Performance, Performance Persistence and Fund Flows: UK Equity Unit Trusts/Open-Ended Investment Companies vs. UK Equity Unit-Linked Personal Pension Funds

Submitted by James Peter Clark, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Finance, February 2013.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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James Peter Clark

Abstract

This thesis analyses and compares the performance, performance persistence and fund flows for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions over the sample period January 1980 to December 2007. Unit-linked personal pension funds are an illiquid investment from the investor's perspective since any invested capital is inaccessible until retirement whereas for unit trusts/OEICs capital invested can be withdrawn at any time. Since decreasing returns to scale from fund flows are the equilibrating mechanism in Berk and Green (2004) that results in no persistence in performance the illiquid nature of unit-linked personal pension funds should ensure more evidence of performance persistence in comparison to unit trusts/OEICs.

I find significant evidence using performance ranked portfolio strategies that underlying portfolios that are only composed of unit-linked personal pension funds have greater performance persistence than unit-linked personal pension funds that have underlying portfolios that also include at least a unit trust/OEIC. This evidence is consistent with Berk and Green (2004) since the illiquid nature of personal pension funds results in an attenuated performance fund flow relationship restricting the equilibrating mechanism. However, there are anomalies in the performance persistence results in relation to Berk and Green (2004) but it could be due to the differential between the number of non-surviving unit trusts/OEICs and non-surviving unit-linked personal pension funds.

I also find that the performance fund flow relationship based on abnormal returns from a Carhart four factor model for both UK equity unit trusts/OEICs and UK unit-linked personal pensions is convex but the performance fund flow relationship is more attenuated for the unit-linked personal pension funds. For the worst performing unit trusts/OEICs there are outflows on average whereas for unit-linked personal pensions there are fund inflows on average. For performance persistence

tests conditional on underlying portfolio fund flows unit trusts/OEICs that have the worst performance but the lowest net fund flows in the ranking period have significantly greater subsequent performance in comparison to the unit trusts/OEICs that have the worst performance but the highest net fund flows in the ranking period. This empirical evidence provides support for Berk and Green (2004) but for the unit-linked personal pension funds the evidence is less convincing.

There is very little evidence that UK equity unit-trusts/OEICs or UK equity unit-linked personal pensions produce abnormal returns. These results are robust across the single index (CAPM) model, the Fama and French three factor model and the Carhart four factor model for both conditional and unconditional models. There is also no evidence that unit trusts/OEICs or unit-linked personal pension funds can time the market. There is a significantly negative timing effect across unconditional factor models which becomes insignificant for the conditional models. There is also no evidence that unit trusts/OEICs have significantly different performance than unit-linked personal pension funds.

To Mum and Dad

In loving memory

Grandad

Nan

Uncle Walter

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List of Abbreviations

ABI	Association of British Insurers
ACD	Authorised Corporate Director
APT	Arbitrage Pricing Theory
AUTIF	Association of Unit Trusts and Investment Funds
CAPM	Capital Asset Pricing Model
CRSP	Center for Research in Security Prices
EMH	Efficient Market Hypothesis
FDR	False discovery rate
FMA	Fund Managers Association
FSA	Financial Services Authority
GP	Group pension
IMA	Investment Management Association
IPP/PP	Individual personal pension/personal pension (unit-linked)
LF	Life fund
LSPD	London Share Price Database
OEIC	Open ended investment company
NAV	Net asset value
PRW	Percentage of repeat winners
UT	Unit trust
SRI	Socially Responsible Investing

Chapter 1

Introduction

The performance fund flow literature generally finds a convex relationship between past performance and subsequent fund flows. Since the performance persistence literature generally finds little evidence of performance persistence, particularly when using the Carhart four factor model, it questions why the empirical evidence suggests investors chase performance when performance does not persist? Berk and Green (2004) try to answer this by creating a rational equilibrium model of active portfolio management, with no moral hazard or asymmetric information, that ensures managers cannot consistently achieve abnormal returns as they are competed away due to decreasing returns to scale from fund flows. In Berk and Green (2004) decreasing returns to scale from fund flows is the equilibrating mechanism that results in no persistence in abnormal returns. The primary motivation of this thesis is to empirically test the Berk and Green (2004) model of mutual fund flows by examining and comparing the performance persistence and associated fund flows for both UK equity unit-linked personal pension funds and UK equity unit trusts/open-ended investment companies (OEICs). The Financial Services Authority (FSA) define an authorised unit trust as:

> "An authorised unit trust is a unit trust scheme that has been autho-

> rised by the Financial Services Authority. It must meet certain conditions concerning its management structure and the type of investments it can hold. Only authorised schemes can be sold to the general public (the retail market)."

In comparison the FSA define an OEIC as:

> "An open-ended investment company (OEIC) is a collective investment scheme that is structured as a company with variable capital and satisfies the property and investment condition in section 236 FSMA. Once authorised by the FSA, it is incorporated as a company under The Open-Ended Investment Companies Regulations 2001 (SI 2001/1228)."

In essence unit trusts and OEICs are both opened ended investment products which means investors buy and sell units/shares directly with the fund manager based on underlying asset values rather than prices based on supply and demand. The main differences between unit trusts and OEICs is of a legal nature with unit trusts set up with a trust structure and OEICs set up with a corporate structure. For the purpose of this research unit trusts/OEICs are treated as similar collective investment schemes where investors have no major restrictions on withdrawing capital invested, although in some cases a back-end load may be charged. Unit-linked personal pension funds share similar features to unit trusts but differ mainly due to their illiquid nature. Money invested in a personal pension fund is inaccessible until retirement although it can be transfered across personal pension funds. Unit-linked personal pensions are a defined contribution scheme which is defined by the Pensions Regulator as:

> "A scheme in which a member's benefits are determined by the value of the pension fund at retirement. The fund, in turn, is determined by the contributions paid into it in respect of that member, and any investment returns."

The Berk and Green (2004) model of mutual fund flows predicts that we will never observe persistence in mutual fund performance because money flows into funds that have performed well and out of funds that have performed badly. Thus Berk and Green (2004) argue that this flow of money into successful funds will lead to difficulties in managing the money successfully due to decreasing returns to scale. Conversely they argue that for funds that have had poor performance, an outflow of money will allow the fund to be managed more efficiently and the poor performance will not persist. Berk and Green (2004) thus argue that performance is not persistent because investors chase good performance and punish bad performance. Since personal pensions have high switching costs and are a long term contractual savings vehicle inaccessible until retirement the flow of funds in personal pensions should not be as responsive to past performance as that of unit trusts/OEICs. Therefore if the Berk and Green (2004) model of mutual fund flows is correct we should find more performance persistence in personal pensions. This is the central theme of the thesis.

A number of recent papers including Berk and Tonks (2007) and Bessler et al. (2010) have examined the performance fund flow relationship with the motivation to empirically test Berk and Green (2004). I will add to this literature by empirically comparing unit trusts/OEICs and unit-linked personal pensions with a view to testing Berk and Green (2004). A key difference in this thesis in comparison to the previous papers empirically testing Berk and Green (2004) is the emphasis on underlying portfolios and flows rather than just concentrating on the funds themselves. The rational for this concentration is the inference that diseconomies of scale faced by fund managers is due to fund flows at the underlying portfolio level. An empirical test of Berk and Green (2004) based on a comparative analysis of the performance persistence and underlying portfolio fund flows for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions is a unique addition to the literature. In addition to analysing the performance persistence and fund

flows for unit trusts/OEICs and unit-linked personal pensions I also compare and contrast the performance of both investment vehicles with a particular emphasis on whether a differential in stock picking and market timing abilities exists between unit trusts/OEICs and unit-linked personal pensions.

Research on UK unit trusts/OEICs and unit-linked personal pension funds is important as the UK fund industry is a vital sector for the UK economy and society. As at 2010 the Investment Management Association (IMA) estimate that UK authorised unit trusts and OEICs have £569 billion of assets under management and the Association of British Insurers (ABI) estimate that insurer-administered individual pensions hold £475 billion in assets. In a US setting Cuthbertson et al. (2010c) highlight that at the end of 2005 approximately 8,500 US mutual funds held $8.9 trillion in assets which represented half of the world's fund assets at the time. Whilst these collective investment vehicles are large in size they are also incredibly important for their investors since they allow an investor to obtain diversification at low cost and the services of active fund managers, albeit at a cost, to provide an expectation of superior returns. For investors in unit-linked personal pension funds their retirement is dependent on the performance of the fund. Their future income in retirement in nominal terms is not guaranteed prior to purchasing an annuity so the performance of unit-linked personal pension funds over the long term is an important area for academics to research to ensure investment practices and structures in the fund industry allow the current working population the best possible chance of ensuring an adequate income in retirement. The empirical evidence in this thesis on the performance, performance persistence and performance fund flow relationship for UK equity unit trusts/OEICs and unit-linked personal pensions will hopefully improve our understanding of the UK collective investment industry.

1.1 Motivation and Contributions

The first contribution of this thesis is to provide evidence on the performance of UK equity unit trusts/OEICs and UK equity unit-linked personal pensions on a risk-adjusted basis using various unconditional and conditional factor models with and without market timing components. The sample period in this thesis extends the empirical evidence on fund performance for unit trusts/OEICs and unit-linked personal pension funds in relation to the existing literature. The thesis also offers empirical evidence on whether the structure of the underlying portfolio impacts on performance. Here, the structure of the underlying portfolio relates to the various investment products the fund manager receives underlying portfolio fund flows through. As discussed in detail in Section 3.2 the underlying portfolio can consist of a combination of unit trusts/OEICs, personal pensions and life funds. In addition, the comparative analysis between the performance of unit trusts/OEICs and unit-linked personal pension funds offers new empirical evidence on whether unit trusts/OEICs significantly out or underperform unit-linked personal pension funds.

The second contribution and the main motivation of this thesis is an empirical test of the Berk and Green (2004) model of mutual fund flows. Unit-linked personal pensions are an illiquid investment from the investors perspective since any capital invested in a unit-linked personal pension fund is inaccessible until retirement. The performance fund flow relationship for unit-linked personal pensions should therefore be more attenuated and in accordance with Berk and Green (2004), where decreasing returns to scale from fund flows is the equilibrating mechanism, we should observe more performance persistence in personal pensions. I provide evidence on the level of performance persistence for unit trusts/OEICs and unit-linked personal pensions using a variety of performance measures and performance persistence tests. I also provide evidence for performance persistence based on the composition of the underlying portfolio using the Morningstar FundID data variable as a proxy for

the underlying fund. Since some personal pension funds share the same underlying portfolio as unit trusts/OEICs the fund flows to these personal pension funds is not restricted to personal pensions. By analysing personal pensions that only have an underlying portfolio that includes personal pension funds with those personal pension funds that have an underlying portfolio that includes at least a unit trust/OEIC I provide empirical evidence from a more stringent test of Berk and Green (2004).

The third contribution of this thesis is to provide evidence on the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions. Since there is very little evidence on the performance fund flow relationship for UK collective investment schemes another motivation of this thesis is to provide new empirical evidence on the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds to fill a gap in the literature. I also provide evidence from another empirical test of Berk and Green (2004) using performance persistence tests conditional on underlying portfolio fund flows.

The final contribution of this thesis is the creation of seven new datasets that I have created to meet the aforementioned objectives of this thesis. They include a survivor-bias free dataset for UK equity unit trusts/OEICs as well as datasets that includes fund flow data for both UK equity unit trusts/OEICs and UK equity unit-linked personal pensions.

1.2 Summary of Empirical Results

There is little evidence that UK equity unit trusts/OEICs and UK equity unit-linked personal pensions produce abnormal returns. Alphas are generally not significantly different from zero and this finding is robust to conditional and unconditional factor models. There is also no evidence that unit trusts/OEICs can successfully time

the market and for unconditional factor models there exists a significantly negative timing effect although it becomes insignificant in the conditional models. There is also no evidence that the structure of the underlying portfolio impacts on performance or that the performance of unit trusts/OEICs is significantly different from the performance of unit-linked personal pension funds.

There is stronger evidence of performance persistence for unit-linked personal pensions that have FundIDs, a proxy for the underlying portfolio, that only contain personal pensions in comparison to unit-linked personal pensions that have FundID's that include at least a unit trust/OEIC. This evidence supports the Berk and Green (2004) model of mutual fund flows since the decreasing returns to scale fund managers face from fund flows is more attenuated in personal pension funds due to their illiquid nature. However, the evidence is conditional on the methodology used with performance ranked portfolio tests offering the strongest evidence. There is contradictory evidence using contingency tables but this potentially is due to winner and loser funds in contingency tables being based on median performance not capturing the differences in the extreme tails of the performance fund flow distribution.

The performance fund flow relationship is convex for both UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds although there is more convexity in the performance fund flow relationship for unit trusts/OEICs. The difference between the performance fund flow relationships for unit trusts/OEICs and unit-linked personal pension funds is mainly concentrated in the extreme tails of the performance fund flow distribution. The worst performing unit-trusts/OEICs experience a subsequent outflow on average whereas the worst performing unit-linked personal pension funds experience subsequent fund inflows on average. Using persistence tests conditional on underlying portfolio fund flows unit trusts/OEICs that have the worst performance but the lowest net fund flows in the ranking period have

significantly greater subsequent performance in comparison to the unit trusts/OEICs that have the worst performance but the highest net fund flows in the ranking period. This empirical evidence provides support for Berk and Green (2004) but for the unit-linked personal pension funds the evidence is less conclusive.

1.3 Organisation of the Thesis

The remainder of this thesis proceeds as follows. Chapter 2 contains a literature survey concentrating on the UK and US markets, methodologies and hypotheses. Chapter 3 concentrates on the institutional features of unit trusts/OEICs, unit-linked personal pensions and fund flows. Chapter 4 details the construction of all the datasets I use within the thesis. Chapter 5 assesses performance, Chapter 6 assesses performance persistence and Chapter 7 assesses fund flows for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds. Chapter 8 concludes and discusses further research.

Chapter 2

Literature Survey and Hypotheses

2.1 Portfolio Diversification and Rationale for Managed Investment Funds

The vast size of the collective investment industry raises the important question, why do investors invest in collective investment funds rather than investing directly in securities themselves? In general two main reasons for the existence and importance of collective investment schemes for investors are

- Diversification at low cost
- Higher expected returns given the risk taken

Diversification is one of the most important concepts of investment and modern portfolio theory. On the assumption that investors are risk averse and mean variance optimisers they will attempt to maximise portfolio expected return given the risk, where risk is measured by the variance/standard deviation of returns. Expected return and variance for any asset/portfolio can be calculated as follows

$$\text{Expected return} = \sum_{i=1}^{n} w_i E\left(r_i\right) \tag{2.1}$$

$$\text{Variance} = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij} \tag{2.2}$$

where w_i is the weight in asset i, $E\left(r_i\right)$ is the expected return on asset i and σ_{ij} is the covariance between the returns of assets i and j. By investing in a large number of assets an investor can reduce the variance of the returns on the portfolio without having to sacrifice expected return. In fact it is possible to reduce the variance of the portfolio's return whilst at the same time increasing expected return. The key to diversification is the covariance term in Equation 2.2. The power of diversification can be seen more clearly if Equation 2.2 is rearranged to separate the variance and covariance terms and a weight of 1/n is invested in each asset.

$$\text{Variance} = \underbrace{\sum_{i=1}^{n} w_i^2 \sigma_i^2}_{\text{n variance terms}} + \underbrace{\sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} w_i w_j \sigma_{ij}}_{\text{n(n}-1\text{) covariance terms}} \tag{2.3}$$

$$\text{Variance} = \underbrace{\frac{1}{n^2} \sum_{i=1}^{n} \sigma_i^2}_{\text{n variance terms}} + \underbrace{\sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} \left(\frac{1}{n^2}\right) \sigma_{ij}}_{\text{n(n}-1\text{) covariance terms}} \tag{2.4}$$

$$\text{Variance} = \frac{1}{n} \underbrace{\left[\frac{1}{n} \sum_{i=1}^{n} \sigma_i^2\right]}_{\text{Average variance}} + \frac{n-1}{n} \underbrace{\left[\frac{1}{n\left(n-1\right)} \sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} \sigma_{ij}\right]}_{\text{Average covariance}} \tag{2.5}$$

$$\text{Variance} = \underbrace{\frac{1}{n}\overline{\sigma_i}}_{\substack{\to 0 \text{ as} \\ \text{n} \to \infty}} + \underbrace{\left(1 - \frac{1}{n}\right)\overline{\sigma_{ij}}}_{\to \overline{\sigma_{ij}} \text{ as n} \to \infty} \tag{2.6}$$

Whilst the 1/n strategy is a naive investment strategy it clearly shows that as the number of assets in a portfolio increases the variance of the returns of the portfolio tend to the average covariance. Firm specific risk, the variance terms of the individual assets, can be diversified away leaving only the undiversifiable market risk represented by the average covariance term. Elton and Gruber (1977) and Statman (1987) amongst others analyse how many stocks are required to achieve a diversified portfolio. The general consensus is around 30 stocks eliminates almost all the firm specific risk relative to a particular benchmark/market portfolio. Adding more stocks has a diminishing impact of reducing what little firm specific risk there is left. Individual investors can diversify themselves but they would need sufficient capital to purchase enough stocks to produce a diversified portfolio such that virtually all firm specific risk is eliminated. Given the cost of buying such a large number of securities and the transaction costs involved one option for investors is to invest through a collective investment scheme. A collective investment fund pools together the capital of many investors allowing a diversified portfolio to be obtained at low cost through economies of scale. This allows investors to invest small amounts of money but still obtain a diversified portfolio.

The second main reason for investing in collective investment funds is more controversial and relates to the role and benefit of active investing by professional fund managers. According to the Efficient Market Hypothesis (EMH) investors, whether individuals or professional fund managers, should not consistently be able to achieve returns higher than predicted given the risk taken. If fund managers cannot earn abnormal returns then it questions the role of active portfolio management and supports passive investment in index funds. Index funds, funds that track a particular

market index, still provide a diversified investment for the investor but have much smaller costs in comparison to active funds as they simply track a benchmark and do not require the same level of resources active managers need to conduct detailed investment analysis. In determining whether active fund managers outperform their benchmark abnormal returns are generally used that account for the risk taken. Earning abnormal returns are dependent on the asset pricing model used and as pointed out by Roll (1977) is always a joint test of the efficiency of the market and the accuracy of the asset pricing model used to calculate expected returns. The question of whether active fund managers on average consistently produce abnormal returns has been a key research area for academics and practitioners. This thesis will extend the literature on abnormal performance of active fund managers by examining and comparing both UK equity unit trusts/OEICs and unit-linked personal pension funds.

2.2 Performance

Fund performance is an important area of research within finance with a central theme questioning the value professional fund managers add especially when considering the compensation they demand. In this thesis I will provide new empirical evidence on fund manager skill from unique largely survivor-bias-free datasets and whether as a group unit trusts/OEICs and/or unit-linked personal pension funds can deliver higher returns than expected given the risk taken. Fund performance and performance persistence tests are also direct tests of the EMH. The EMH in its semi-strong form states that it should not be possible to consistently generate abnormal returns using information from past prices and publicly available fundamental information. Whilst fund managers can earn an abnormal return by chance this should not be possible on average in an informationally efficient market. Tests of performance and performance persistence of collective investment schemes is a

particularly rigorous test of the EMH as if the market were not efficient it would seem rational to assume that it would be professional fund managers who would be likely candidates to be earning the abnormal returns.

Fund performance research in the academic literature saw a surge during the 1990s which then lead to research reexamining the time dynamics of fund performance using a variety of performance persistence tests. The vast majority of the research on fund performance that is relevant has occurred within the past 20 years. This is probably related to advances in computing power over the past two decades increasing the ability of researchers to actually implement the advances in econometrics to large datasets and the availability of survivor-bias free datasets, particularly in the US. Current research in the literature reexamines both performance and performance persistence using alternative econometric techniques such as bootstrapping and false discovery rate. In addition the impact fund flows has on performance persistence is a recent and important topic dominating the current literature. Numerous papers are motivated by performance and performance persistence which is in line with the motivation of this research. I will tackle each element separately, first examining performance, then performance persistence and lastly fund flows and their relationship with performance persistence.

2.2.1 Performance Methodologies and Hypotheses

The performance tests in the literature are generally based on risk adjusted/abnormal returns rather than simple raw returns. If an analysis of fund performance is undertaken with just raw returns the level of performance and persistence in that performance is predominantly determined by the fund's level of risk exposure rather than fund manager skill. For instance, a fund manager that invests in very high risk stocks would on average be expected to produce higher returns than a comparable fund that invests in very low risk stocks particularly over a very long investment

horizon. This does not imply that the fund manager who invested in low risk stocks has no investment skill or investment skill inferior to that of the high risk fund manager, it simply implies that the fund manager who invests in high risk stocks would be expected to be rewarded for taking on the risk in the long term. For these reasons risk adjusted/abnormal returns are invariably used in academic research on fund performance and hence will be the predominant measure I use in this thesis[1].

Factor models - unconditional

The seminal work of Jensen (1968) introduced the standard technique of unconditional alpha used today as a standard in portfolio performance measurement.

$$r_{pt} - r_{ft} = \alpha_p + \beta_p MKT_t + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt} \tag{2.7}$$

Using the technique originally used by Jensen (1968) the excess return of each fund $(r_{pt} - r_{ft})$ at time t, is regressed against the four factors in Equation 2.7, where r_{pt} is the monthly return on fund p at time t and r_{ft} is the monthly return on the risk free asset at time t. The Jensen's alpha, α, for a fund p assesses the fund's level of abnormal performance. The MKT variable is the excess return on the market $(r_{mt} - r_{ft})$ at time t; SMB_t is the size factor at time t, which is the difference between the returns on a portfolio of small companies and the returns on a portfolio of large companies; HML is the book to market factor at time t which is the difference in returns between a portfolio of high book to market companies and low book to market companies and MOM is the one year momentum factor portfolio at time t originally cited in Jegadeesh and Titman (1993). When $\lambda_p = 0$ in Equation 2.7 the Fama and French three factor model is obtained. The CAPM model is obtained from

[1]See Blake and Timmermann (2002) for a detailed justification of the preferred use of risk adjusted/abnormal returns instead of just raw returns in performance and performance persistence tests.

Equation 2.7 when $\gamma_p = 0$, $\delta_p = 0$ and $\lambda_p = 0$. The factor loadings in Equation 2.7 are time invariant. If Jensen's alpha, α, for a fund p is significantly positive it signals evidence for a genuinely skilled fund manager whilst a significantly negative Jensen's alpha signals evidence for a poorly performing fund manager making investment decisions to the detriment of fund value. Hence, investors are looking for positive alpha funds where it infers that fund managers are making positive investment decisions that are adding value to the fund.

The aforementioned standard market model i.e. CAPM, Fama and French (1992) three factor model and Carhart (1997) four factor model are the most common factor models used in the literature. The generally accepted interpretation of the market and Fama and French factor models, particularly based on US data, is that they represent risk factors or proxies to risk factors and their use justifies a risk based interpretation. We can view the Carhart (1997) four factor model either on a risk-adjusted basis or as a mechanical zero investment trading strategy as a benchmark on which to evaluate fund performance. Fund management is a lucrative industry with fund managers extracting large rents for their services so the Carhart (1997) four factor model can be viewed as a strategy that one would expect a fund manager to outperform to justify their compensation. Thus whether we take a risk adjusted standpoint on the factor models or as a mechanical zero investment strategy the aforementioned factor models are viewed as an appropriate method on which to base the analysis of performance and performance persistence between unit trusts/OEICs and unit-linked personal pensions.

Market Timing

The original Jensen technique to calculate alpha, whether from the market model or from multi-factor models, does not distinguish between fund manager skill in security selection and market timing. Skilled fund managers in addition to trying

to select the most under priced stocks given the risk objective of the fund can also increase returns by timing the market based on their expectations of future market movements. Market timing is generally viewed as the ability of the fund manager to profitability move from one asset class to another. Although in this research I limit the investment objective of funds under analysis to equity funds only, fund managers can still exhibit market timing skills by switching into defensive low beta stocks in bear markets and aggressive high beta stocks in bull markets. If fund managers can successfully time the market then returns to the fund will be high in bull markets due to investment in aggressive stocks and still relatively high in bear markets due to switching to defensive stocks.

The two most common tests for market timing used in the literature are those of Treynor and Mazuy (1966) and Henriksson and Merton (1981). The Treynor and Mazuy (1966) test of market timing imposes a quadratic term in the factor model to capture market timing. In the single factor model the quadratic term attempts to capture the non linear relationship between excess fund returns and excess market returns

$$R_{pt} - r_f = \alpha_p + \beta \left(R_{mt} - r_f\right) + \gamma_p \left(R_{mt} - r_f\right)^2 + \varepsilon_{pt} \tag{2.8}$$

If the estimate γ_p is significantly positive then it represents a convex upward sloping regression line and indicates evidence of successful market timing by the fund manager. The original Treynor and Mazuy (1966) tests find no evidence of market timing although the size and scope of the mutual fund industry has developed considerably since the Treynor and Mazuy (1966) study.

The Henriksson and Merton (1981) test for marketing timing uses the following regression

$$R_{pt} - r_f = \alpha_p + \beta \left(R_{mt} - r_f\right) + \delta_p \left(R_{mt} - r_f\right)^+ + \varepsilon_{pt} \tag{2.9}$$

where $\left(R_{mt} - r_f\right)^+ = Max\left(0, R_{mt} - r_f\right)$. If the estimate of δ_p is significantly positive then it indicates evidence of successful market timing by the fund manager. In essence both methods try to capture the non-linearity of fund managers performing better than expected in bull markets and not performing as bad as expected in bear markets.

Factor models - conditional

The factor loadings in the conditional factor models are assumed to be time invariant. Ferson and Schadt (1996) extend the general unconditional factor models to assess the ability of fund managers to add value through private market timing skill. Ferson and Schadt (1996) develop a conditional beta model where a fund's factor betas depend on lagged publicly available information. To distinguish between the private market timing skills of the fund manager and timing skills derived from predictable market or factor movements Ferson and Schadt (1996) create a conditional beta model

$$R_{pt} - r_{ft} = \alpha_p + \beta_{0p} \left(R_{mt} - r_{ft}\right) + \beta'_{1p} \left[Z_{t-1} \left(R_{mt} - r_{ft}\right)\right] + \varepsilon_{pt} \tag{2.10}$$

where Z_{t-1} is a vector of lagged information available at time t. Equation 2.10 can also be modified to include the quadratic term from Treynor and Mazuy (1966) to separate the public and private information used by a fund manager in market timing.

Performance Hypotheses

- Hypothesis 1
  - UK equity unit trusts/OEICs and UK equity unit-linked personal pensions do not on average earn significant abnormal returns or show evidence of successful market timing.

Unit trusts/OEICs and unit-linked personal pension funds both offer investors a diversified portfolio and active investment management. In an efficient market there is no reason a priori to expect fund managers to produce on average abnormal returns. If there is evidence that managers can on average earn abnormal returns then it contradicts the EMH and suggests the market is informationally inefficient. I examine the abnormal performance of unit trusts/OEICs and unit linked personal pensions using both unconditional and conditional models using returns based on bid-bid prices gross of tax to reflect the investment performance due to fund managers investment decisions.

I also use the Treynor and Mazuy (1966) test to decompose unit trust/OEIC and unit-linked personal pension fund manager performance into stock selectivity and market timing components to evaluate their investment skill. I test this hypothesis for robustness by using various factor models including the single (CAPM) model, Fama and French four factor model and the Carhart four factor model across the equity sectors of UK All Companies, UK Equity Income and UK Smaller Companies and across the combined sample of all three equity sectors. If the empirical evidence in this thesis supports Hypothesis 1 then it supports the EMH and questions whether it would be more beneficial for investors to use passive investment schemes particularly as the returns in this thesis are gross of tax and based on bid to bid prices.

- Hypothesis 2

– There is no significant difference between the average abnormal returns of unit trusts/OEICs and unit-linked personal pensions.

Since the investment objectives for both the unit trusts/OEICs and unit-linked personal pension under analysis in this thesis are the same the difference in average abnormal performance between unit trust/OEIC and unit-linked personal pension fund managers is directly comparable. In fact many fund managers manage both a unit trust/OEIC and a unit-linked personal pension fund which further supports Hypothesis 2 which predicts that there should be no significant difference between the average abnormal returns of unit trusts/OEICs and unit-linked personal pensions funds. In addition, when the datasets for the unit trusts/OEICs and unit-linked personal pension funds are based on the underlying FundID, where FundID proxies for the underlying portfolio, the issue of the same fund manager being part of both datasets is less of a problem. Using the UK Equity Unit-linked Personal Pension FundID Database[2] I will also test whether fund managers who only manage unit-linked personal pension funds have significantly different abnormal performance in comparison to fund managers who manage funds that includes both unit-linked personal pension and unit trust/OEICs. A priori there is still no reason to expect a significant difference in average abnormal returns since both unit trusts/OEICs and unit-linked personal pensions are collective investment schemes with professional fund managers in the same investment sectors.

Since this thesis is concentrating on fund manager skill rather than the net return to the investor no differential in abnormal performance between unit trusts/OEICs and unit-linked personal pensions does not imply that an investor should be indifferent between the two investment vehicles. From an investor's perspective, even if there is no differential between fund managers of unit trusts/OEICs and unit-linked personal pensions, investors should in general still use personal pension funds for investing

[2]The databases are discussed in detail in Section 3.2 and Chapter 4 respectively.

for retirement in comparison to unit trust/OEICs as personal pension funds offer tax advantages and the possibility of employer contributions.

2.2.2 Performance Literature Review

The literature review on fund performance is the first of three literature reviews with the other two examining performance persistence and fund flows respectively. This separation of the literature review hopefully aids clarity and allows the focus to be on one particular research area at a time. Numerous papers cover two or more of the aforementioned research areas and they will be critiqued on each area separately in the relevant literature review. Two recent publications closely related to the research in this thesis have been a great source of information. A recent survey paper by Cuthbertson et al. (2010c) provides an in depth comprehensive and technical overview of fund performance, performance persistence and fund flows, the exact same research areas as this thesis. Thus Cuthbertson et al. (2010c) is highly relevant and has been an extremely useful and used resource. In addition, Luckoff (2011) is a newly published book based on the author's doctoral thesis covering both fund performance and performance persistence with particular emphasis on the impact fund flows and managerial change have on fund performance and performance persistence. The concentration in Luckoff (2011) is on US mutual funds but the methods used are of general relevance and the insight and findings from this recent publication are highly relevant to this thesis. Whilst the aforementioned resources have been invaluable the literature reviews that follow attempts to be a concise, personal and unique critique of the literature with particular emphasis on a comparative analysis between UK equity based unit trusts/OEICs and UK based unit-linked personal pensions with the Berk and Green (2004) model of mutual funds flows in view.

The literature reviews concentrate primarily on US and UK studies only. The US

and UK have two of the largest and most developed fund management industries with long enough track records to allow meaningful sample periods to be analysed which in part explains their prevalence in the academic literature. The literature reviews concentrate primarily on the past 20 years which is where the vast majority of the relevant research on this area has been conducted. For a very informative and concise summary in tabular form of the literature on performance and performance persistence in the US and UK see Giles et al. (2002) and Cuthbertson et al. (2010c).

US Studies

Although the literature review primarily concentrates on the past twenty years the seminal work of Jensen (1968) is one of the first major studies on US mutual fund performance. Jensen (1968) incorporates a risk-adjusted measure of performance known as Jensen's alpha on which to evaluate fund managers. Jensen (1968) finds that tests of abnormal performance using the single index model (CAPM)on 115 US mutual funds over the sample period 1945 to 1964 results in no significant abnormal performance. Even before expenses fund managers do not appear to have superior information on which to generate abnormal returns.

Malkiel (1995) analyses US equity mutual funds over the 21 year sample period, 1971 to 1991. Importantly Malkiel (1995) uses a survivor-bias-free dataset of quarterly total returns obtained from Lipper. The inclusion of both non-surviving and surviving funds allows Malkiel (1995) to quantify the impact of survivor-bias on fund returns and question the validity of the conclusions from previous research based on survivor-biased datasets. Malkiel (1995) finds that surviving funds consistently have higher mean returns than non-surviving funds and the difference is statistically significant. Survivor-biased datasets therefore generally overstate the returns to mutual fund investors and emphasises the importance of creating a survivor-bias-free dataset in this thesis. Funds only seem to outperform the market in Malkiel

(1995) on a total return basis when gross of expenses and conditional on surviving funds only. On a risk-adjusted basis using the single index model (CAPM) and only surviving funds Malkiel (1995) finds an average alpha statistically insignificant from zero. Malkiel (1995) also highlights the impact the proxy for the market return can have particularly if an index of large capitalisation stocks is used in a period when smaller stocks perform significantly different to the large stocks.

Ferson and Schadt (1996) extend the fund performance literature by using conditional factor models. Ferson and Schadt (1996) advocate conditional performance evaluation where lagged information variables that are publicly available are incorporated in to the factor model. Ferson and Schadt (1996) argue that a strategy that simply uses publicly available information should not imply superior performance. Using monthly data for 67 mutual funds over the sample period January 1968 to December 1990 Ferson and Schadt (1996) find that their conditional models give improved performance for the stock selection skills and market timing abilities of fund managers in comparison to unconditional models.

The influential paper of Carhart (1997) incorporates the momentum factor of Jegadeesh and Titman (1993) into the Fama and French three factor model. Although the motivation of Carhart (1997) is performance persistence using a survivor-bias-free dataset of 1892 equity funds over the sample period January 1962 to December 1993 Carhart (1997) finds that fund performance is negatively related to the fees charged by the fund and the turnover of the fund.

Almost all of the aforementioned research on performance has been conducted using standard conventional statistical techniques, especially in regards to the calculation of the standard errors. In recent papers Kosowski et al. (2006) and Fama and French (2010) use bootstrap methods to calculate alpha and the t statistic for alpha. The main idea behind the bootstrap is to separate skill from luck as standard statistical techniques do not account for luck persisting or the non normality in

alpha. Kosowski et al. (2006) find that after applying the bootstrap to their 1975 to 2002 equity sample of 2,118 US mutual funds net of returns a sizable minority of fund managers exhibit adequate stock picking skills to cover their costs. In addition Kosowski et al. (2006) find that the significant abnormal performance and persistence in performance is in growth oriented funds.

Scaillet et al. (2010) reexamine performance of US mutual funds over the sample period 1975 to 2006 using a FDR (False Discovery Rate) approach. Applying this new method to performance data Scaillet et al. (2010) they find that approximately 75% of funds exhibit zero alpha based on returns net of expenses with very few funds providing evidence of genuine skill particularly in the most recent part of their sample. The results of Scaillet et al. (2010) are broadly similar to Cuthbertson et al. (2010a) who also apply the FDR approach to evaluate the performance of UK equity unit trusts/OEICs.

In terms of the performance of pension funds in the US the literature is much sparer than for mutual funds. Most of the US literature examining pensions focus on US occupational schemes. Ippolito and Turner (1987) examine 1,526 US pension funds and find and find evidence of under performance by US pension funds relative to their S&P 500 benchmark. Coggin et al. (1993) examine the performance of occupational pension funds from a random sample of 71 US equity funds over the sample period 1983 to 1990 and find some evidence of positive stock selection skills but negative market timing abilities.

UK Studies

The research on performance in the UK over the past 20 years has been sparser in comparison to similar research based in a US setting. A potential reason for this is survivorship bias issues in UK data. In the US academics have access to the CRSP database where mutual fund data is held on both dead and live funds. In

the UK however a complete sample of live and dead funds is difficult to obtain since most database providers are commercial and are biased towards the active investor who only requires data on their current opportunity set of investments. As a result dead funds are generally dropped from such databases at the time of their death causing survivorship bias issues when assessing the cross-sectional performance of funds over time. Due to the difficulty in obtaining survivor-bias-free data few studies on performance have been conducted on UK unit trusts/OEICs in comparison to the US[3].

Fletcher (1995) examines the selectivity and market timing skills of UK unit trust managers in equity sectors. Fletcher (1995) analyses a random selection of 101 unit trusts, under the restriction that each unit trust is required to have at least two years of continuous returns data, over the sample period January 1980 to December 1989. Fletcher (1995) examines fund performance using the methods advocated by Henriksson and Merton (1981) and Chen and Stockum (1986) to decompose fund performance into the stock selection ability and market timing skill of the fund manager. Fletcher (1995) uses the single index (CAPM) model but uses a variety of benchmarks to proxy for the market portfolio to evaluate whether results are conditional on the benchmark used in the single index model. Fletcher (1995) finds that on average UK equity unit trust managers exhibit positive performance in stock selection and negative timing ability but the statistical significance of the results depends on the portfolio benchmark used in the factor model, the selectivity and market timing test used and the investment objectives of the unit trusts. Using the same UK equity unit trust dataset Fletcher (1997) examines the relationship between unit trust performance and their characteristics including their investment objective, size and expenses. Using the arbitrage pricing theory (APT) of Ross (1976), Fletcher (1997) finds no significant evidence that unit trusts outperform

[3]Exceptions to this are Blake and Timmermann (1998), Quigley and Sinquefield (2000), Fletcher and Forbes (2002) and Cuthbertson et al. (2008) whose research are all based on essentially survivor-bias-free samples.

their benchmark and their is little relationship between unit trust performance and investment objective, size and expenses with the results robust to various APT benchmarks.

Leger (1997) extends the literature on timing and selectivity in a UK setting but unlike the vast majority of the literature Leger (1997) analyses UK investment trusts instead of open end investment vehicles. Using a sample of 72 UK investment trusts over the sample period 1973 to December 1993 Leger (1997) finds some evidence of significant positive selectivity and significant negative timing ability using various methods including the Treynor and Mazuy (1966) method based on a single index model.

Blake et al. (1999) analyse UK unit trusts/OEICs performance across all investment objectives with a survivor-bias-free dataset. The unique dataset Blake et al. (1999) use allows them to assess the significance of survivorship bias on fund performance, the performance of non-surviving funds in the period prior to their death, the performance of funds in their first year of existence. The unique database Blake and Timmermann (1998) use consists of monthly returns, provided by Micropal, over a 23 year period from February 1972 to June 1995. The data set is survivor-bias-free and provides returns data on approximately 2300 funds of which 973 had been in existence over the sample period but were not in existence at the end of the sample either through being merged with another fund or through liquidation. The remaining 1402 funds were still in existence at the end of the sample and had either been in existence over the whole sample or in most cases had come into existence at some point during the sample period. Unlike the standard equity focused mutual fund research found in the literature the dataset Blake and Timmermann (1998) analyse is subdivided into 20 unit trust sectors as defined by the Association of Unit Trusts and Investment Funds (AUTIF). Thus, Blake and Timmermann (1998) not only analyse unit trusts with a UK equity focus but also analyse unit trusts where fixed

income, property, commodities and international investing are the primary objectives of the fund. Blake and Timmermann (1998) use their dataset to analyse both the survivor premium and survivor bias inherent in UK unit trusts. They find that across all funds over the sample period the mean survivor premium is 2.4% per year. Blake and Timmermann (1998) also analyse the various sectors within the dataset and find that 16 out of the 20 sectors over the sample period have positive survivor premiums. The 4 sectors where this is not the case only contain a limited number of non-surviving funds. Using an equally weighted portfolio approach based on an unconditional multi factor model Blake and Timmermann (1998) find evidence of under performance by equity and balanced fund managers of around -.15% per month on a risk-adjusted basis although the majority of sectors are not statistically significant at the 5% level.

Quigley and Sinquefield (2000) test whether UK equity unit trust/OEIC managers can outperform the market on a risk-adjusted basis with a strong emphasis on whether this is particularly true for fund managers of small stocks. Whilst Blake and Timmermann (1998) analyse all UK unit trusts Quigley and Sinquefield (2000) concentrate on only UK equity unit trusts. Quigley and Sinquefield (2000) look at monthly returns on 752 UK equity based funds, where 279 of those funds die at some point within their 20 year sample period of January 1978 to December 1997. Quigley and Sinquefield (2000) also obtain their data from Micropal and since it includes non-surviving funds it is survivor-bias-free. Using both the CAPM (single index model) and Fama-French three factor model they find that fund managers net of expenses are unable to outperform the market, a conclusion in line with most US mutual fund studies. Quigley and Sinquefield (2000) also find that funds in the UK small stocks sector, contrary to popular belief, do not consistently beat the market and on a risk-adjusted basis are the worst performers in their sample.

Whilst the majority of the UK literature concentrates on equity funds Gregory

and Whittaker (2007) analyse the performance of UK ethical funds[4]. Funds with objectives of socially responsible investing are relatively new and therefore contain a small set of funds in comparison to the universe of equity funds. Gregory and Whittaker (2007) analyse 32 ethical funds available in the UK over the sample period January 1989 to December 2002. Whilst the SRI funds have a lower raw average return than non SRI funds Gregory and Whittaker (2007) find no significant under performance on a risk adjusted basis using three and four factor models. Interestingly, Gregory and Whittaker (2007) find varying results for the significance of abnormal performance based on whether a static or time-varying model is used.

The majority of the previous studies on performance use standard conventional statistical measures, particularly in regards the measurement of the standard errors, which may be invalid if regressions are run individually for each fund and average alphas calculated. In contrast, Cuthbertson et al. (2008) employ the methodology of Kosowski et al. (2006) where they use a residual bootstrapping technique to account for the non normality in the individual fund alpha distributions to distinguish between skill and luck for fund performance. On a survivor-bias-free sample of 842 non tracker UK equity unit trusts/OEICs over the time period April 1975 to December 2002 Cuthbertson et al. (2008) find that the average alpha of UK equity unit trusts/OEICs is negative but statistically insignificant generally supporting the findings of Blake and Timmermann (1998). These results are relatively robust across three and four factor models including both unconditional and conditional alpha and alpha and beta models. In addition to analyzing cross-sectional averages Cuthbertson et al. (2008) also investigate the extreme tails of the alpha distribution. Cuthbertson et al. (2008) find a relatively small number (between 5 and 10%) of UK funds that have managers with genuine stock picking skills after controlling for luck. They also find that the majority of poorly performing funds is due to bad skill from the fund manager rather that the fund manager simply being unlucky.

[4]Ethical funds are also known as SRI (Socially responsible investing) funds.

Using the same dataset Cuthbertson et al. (2010a) assesses UK equity trust/OEIC performance using the false discovery rate (FDR). This builds on the authors previous work and analyses funds individually rather than focusing on cross-sectional averages and tries to identify how many UK equity unit trusts/OEICs truly have significant abnormal return after adjusting for the FDR. The FDR aims to identify the proportion of funds with significant alphas that would be expected due to luck alone. Cuthbertson et al. (2008) find that approximately 75% of UK equity unit trusts/OEICs do not under or outperform their benchmarks using an unconditional three factor model. Traditional methods find 3% of funds have a significantly positive alpha at a 2.5% significant level but the FDR for these funds is high at 30.4% which suggests only 2% of these significantly positive alpha funds are truly skillful and are not just lucky. Cuthbertson et al. (2008) find a much smaller FDR of 5% at the 2.5% significant level for funds with significantly negative alpha. After accounting for the FDR the evidence at the 2.5% significance level Cuthbertson et al. (2010a) suggest that 17% of UK equity unit trust/OEICs are unskilled. Evidence in both Cuthbertson et al. (2008) and Cuthbertson et al. (2010a) suggests the number of funds with truly negative abnormal performance is much greater than the number of funds with truly positive abnormal performance. Cuthbertson et al. (2010b) also extend the literature on UK equity unit trust performance by focusing on the timing ability of UK unit trusts/OEICs. Instead of using the traditional market timing methods of Treynor and Mazuy (1966) and Henriksson and Merton (1981), Cuthbertson et al. (2010b) employ the nonparametric technique of Jiang (2003). Although Cuthbertson et al. (2010b) use a different method to the previous literature to analyse the market timing skills of unit trusts/OEICs they find little evidence of market timing skills amongst UK unit trusts/OEICs with only a few funds exhibiting positive market timing skills with the which supports the previous findings of Fletcher (1995) and the work of Leger (1997) based on investment trusts.

In comparison to UK unit trusts/OEICs the literature on the performance of UK

pension funds is more limited. Gregory and Tonks (2004) analyse the performance of 506 UK equity based unit-linked personal pensions over the sample period June 1980 to December 2000 using both conditional and unconditional models based on single, three and four factor models. Gregory and Tonks (2004) find that in general average performance of personal pension funds is not significantly different from zero. Gregory and Tonks (2004) use the market timing test of Treynor and Mazuy (1966) and find a negative market timing effect. In general they find that unit-linked personal pensions do not earn significant abnormal returns, a finding relatively consistent with previous fund research.

Clare et al. (2010) analyse the performance of UK pension managers of occupational schemes with a strong emphasis on the market timing ability of the managers. Using a sample of quarterly returns over the period March 1980 to December 2004, consisting of 734 pooled funds including both dead and live funds, Clare et al. (2010) find little evidence of significant positive abnormal performance or any significant market timing.

Blake et al. (2010) analyse the performance of UK occupational defined-benefit funds across a range of investment objectives including equities and bonds, with both domestic and international objectives. Whilst the main motivation of Blake et al. (2010) is to investigate the decentralisation of the investment management industry using pension fund data, they do find some evidence of significant security selection skills for specialist managers.

The general consensus in the literature is that markets are generally informationally efficient and on average fund managers do not consistently earn abnormal returns. Whilst there is some evidence of stock selection ability there is very little evidence that fund managers can time the market.

2.3 Performance Persistence

Whilst the first part of this thesis addresses fund performance I now extend the discussion to address the time dynamics of performance and whether fund performance persists. Carpenter and Lynch (1999) analyse fund persistence tests, particularly in relation to survivorship bias, and classify the methodologies into two types, contingency tables and performance ranked portfolio tests. Both of these type of tests are used extensively in the fund performance literature and I use both in this thesis. The performance persistence tests are in essence a test of the EMH where ex ante data is being used to test whether it provides information to achieve abnormal returns ex post. Whilst the performance persistence results in this thesis also provide evidence on the informational efficiency of the UK equity market the main motivation is an empirical test of the Berk and Green (2004) model of mutual fund flows.

2.3.1 Berk and Green (2004) Model of Mutual Fund Flows

Berk and Green (2004) produce an equilibrium model of fund performance where fund flows are the equilibrating mechanism that results in no persistence in performance. The performance flow relationship is non linear where extremely good fund performance subsequently results in large fund inflows whereas for funds with poor performance there are relatively smaller outflows. The Berk and Green (2004) model of mutual fund flows predicts that we will never observe persistence in mutual fund performance because money flows into funds that have performed well and out of funds that have performed badly. Thus Berk and Green (2004) argue that this flow of money into successful funds will lead to difficulties in managing the money successfully due to decreasing returns to scale. These decreasing returns to scale could be due to higher transaction costs and larger price impact on trades associated with larger inflows or due to spreading information gathering activities

too thinly. Conversely they argue that for funds that have had poor performance, an outflow of money will allow the fund to be managed more efficiently and the poor performance will not persist. Berk and Green (2004) argue that performance is not persistent because investors chase good performance and punish bad performance. The performance flow relationship is convex in the model and is consistent with the general findings in the empirical fund flow literature. Personal pensions can be switched but since they have high switching costs and are a long term contractual savings vehicle inaccessible until retirement the flow of funds in personal pensions should not be as responsive to past performance as that of unit trusts, and hence, if the Berk and Green (2004) model of mutual fund flows is correct we should find more performance persistence in personal pensions.

The idea that fund flows are subject to diminishing returns to scale is at the heart of the Berk and Green (2004) model. It would be tempting to just compare the funds of unit trusts/OEICs and unit-linked personal pensions but this is implicitly assuming that the diseconomies of scale due to fund flows occur at the fund level and are independent from one another. If each fund has its own separate underlying portfolio and fund manager then a direct comparison between the unit trusts/OEICs and unit-linked personal pension funds with a view to test Berk and Green (2004) would be valid. However, diseconomies of scale from fund flows must occur at the underlying portfolio level and it is generally not the case that underlying portfolios of unit trusts/OEICs and unit-linked personal pensions are independent from one another. It is still insightful to compare the performance persistence between unit trusts/OEICs and unit-linked personal pensions to directly compare two different investment vehicles but it cannot be viewed as a rigorous empirical test of the Berk and Green (2004) model. The fund manager of an underlying portfolio may receive fund flows into the underlying portfolio from numerous funds across various investment vehicles. I assess the structure of the underlying portfolios for UK equity open ended investments in Section 3.2 in order to justify the conditions needed for

a valid empirical test of Berk and Green (2004) based on a comparative analysis between unit trusts/OEICs and unit-linked personal pension funds.

2.3.2 Performance Persistence Methodologies and Hypotheses

Contingency Tables

Contingency tables have been used throughout the relevant literature to assess performance persistence in funds[5]. Funds are classified as winners (W) or losers (L) based on the median abnormal return over the relevant ranking period. Over two consecutive time periods a two by two table is formed such that a fund can have one of four outcomes, (WW), (WL), (LW) or (WW) where W represents being above the median abnormal return and a winner and L means being below the median abnormal return and a loser. The following four statistical procedures are the most common found in the literature to be used with contingency tables to test for performance persistence:

1. Cross-product ratio (CP) or Odds Ratio

$$\text{CP} = \frac{(WW \times LL)}{(WL \times LW)} \tag{2.11}$$

The statistical significance of the CP ratio can be tested as $\log(\text{CP})/\sigma_{\log CP}$ has a standard normal distribution where

$$\sigma_{\log CP} = \left[\left(\frac{1}{WW}\right) + \left(\frac{1}{WL}\right) + \left(\frac{1}{LW}\right) + \left(\frac{1}{LL}\right)\right]^{\frac{1}{2}} \tag{2.12}$$

[5]See Brown et al. (1992), Goetzmann and Ibbotson (1994), Brown and Goetzmann (1995), Malkiel (1995) and Fletcher and Forbes (2002) for the application of contingency tables to test for fund performance persistence.

and allows the significance of the deviations of CP ratio from unity to be tested. If the test statistic is significantly positive then it provides evidence of persistence in performance. A significantly negative test statistic provides evidence of reversals in performance.

2. Percentage of repeat winners (PRW), where

$$\text{PRW} = \frac{WW}{\left(\frac{N}{2}\right)} \tag{2.13}$$

The percentage of repeat winners is generally employed in the literate to test the "hot hands" phenomenon found in Grinblatt and Titman (1992), Goetzmann and Ibbotson (1994) and Hendricks et al. (1993). Funds identified as winners in the ranking period would expect on average to be winners in the evaluation period 50% of the time if there is no persistence in performance and funds are independent.

3. Chi-Squared test with 1 d.o.f, where

$$\text{CHI} = \frac{\left(WW - \frac{N}{4}\right)^2 + \left(WL - \frac{N}{4}\right)^2 + \left(LW - \frac{N}{4}\right)^2 + \left(LL - \frac{N}{4}\right)^2}{\left(\frac{N}{4}\right)} \tag{2.14}$$

4. Following Grinblatt and Titman (1992) a regression of evaluation period abnormal returns on ranking period abnormal returns with a t-stat assessing the statistical significance of the slope coefficient. A positive slope coefficient with a statistically significant t-statistic supports the hypothesis that abnormal past performance can be used to predict future abnormal performance.

Performance Ranked Portfolio Strategies

Funds are sorted into portfolios, normally decile or quintile depending on the number of funds in the sample, based on abnormal performance from a factor model over a specified ranking period. The abnormal performance of the top and bottom portfolios is then calculated over a specified evaluation period. These procedures are carried out over the sample period based on overlapping observations. Statistical tests are applied on the difference between the average abnormal returns between the top and bottom portfolios over the evaluation period adjusting for autocorrelation. Carpenter and Lynch (1999) advocate the use of performance ranked portfolio tests where the test statistic based on the difference in the abnormal return between the top and bottom portfolios over the evaluation periods is best specified under a null hypothesis of no performance persistence.

Performance Persistence Hypotheses

- Hypothesis 3
  - There is more performance persistence in UK equity unit-linked personal pension funds in comparison to UK equity unit trusts/OEICs.

The Berk and Green (2004) model implies that fund flows are the equilibrating mechanism that results in no persistence in performance. Money invested in unit-linked personal pension funds is only accessible when the pension holder retires or reaches the minimum age at which the pension can be taken, which in the UK is 55 years of age as at April 2010. Investors can transfer capital across personal pension funds but the level of switching is minimal, Alfon (2002). In comparison, money invested in unit trusts/OEICs can be withdrawn and accessed for other purposes at any time. The performance fund flow relationship should therefore be stronger for unit trust/OEICs due to the highly illiquid nature of personal pension funds. In

the US Del Guercio and Tkac (2002) find evidence of a more attenuated fund flow relationship for pensions in comparison to mutual funds. If the Berk and Green (2004) equilibrating mechanism of fund flows is restricted in unit-linked personal pensions then we should expect more evidence of performance persistence in unit-linked personal pensions. However, as previously mentioned diseconomies of scale from fund flows must be at the underlying portfolio level. Since many unit-linked personal pension funds share an underlying portfolio with a unit trust/OEIC these personal pensions do not have a more attenuated performance fund flow relationship at the underlying portfolio level. Therefore, the direct comparison between unit trust/OEICs and unit-linked personal pensions is insightful but cannot be viewed as a strict empirical test of Berk and Green (2004). However, not all unit linked personal pension share an underlying portfolio with a unit trust/OEIC so potentially we should still expect more performance persistence in unit-linked personal pensions. To conduct a more rigorous empirical test of Berk and Green (2004) I use FundID as a proxy for the underlying portfolio and use the UK Equity Unit-linked Personal Pension FundID Database to test Hypothesis 4.

- Hypothesis 4
  - There is more performance persistence in UK equity unit-linked personal pension funds that have FundIDs that do not include a unit trust/OEIC in comparison to unit-linked personal pension funds that do have FundIDs that include a unit trust/OEIC, where FundID proxies for the underlying portfolio.

Hypothesis 4 concentrates on unit-linked personal pension funds rather than both unit trusts/OEICs and unit-linked personal pensions as the unit trust/OEIC sample contains a large proportion of dead funds. Since I do not have FundID information for dead funds it is not possible to analyse their underlying portfolios, where FundID proxies for the underlying portfolio. It is also not as important to analyse the

underlying portfolios of unit trusts/OEICs as regardless of what other investment vehicles are part of their underlying portfolios the fund flows to the underlying portfolio still contain flows from a unit trust/OEIC. I therefore concentrate Hypothesis 4 on the unit-linked personal pension funds where survivor bias is less of an issue. Hypothesis 4 is tested using the UK Equity Unit-linked Personal Pension FundID Database. The database includes all UK equity unit-linked personal pension funds that have a FundID that only includes unit-linked personal pensions and all UK equity unit-linked personal pension funds that have a FundID that also includes at least a unit trust/OEIC. Due to the illiquid nature of unit-linked personal pension funds that have a FundID that only includes unit-linked personal pensions the performance fund flow relationship should be more attenuated and we should observe more performance persistence since the equilibrating mechanism of fund flows in the Berk and Green (2004) is restricted. For the unit-linked personal pension funds that have FundIDs that include at least a unit trust/OEIC their underlying portfolios also includes fund flows from a unit trust/OEIC and hence the fund flows to the underlying portfolio are not restricted and we should see less persistence in performance.

2.3.3 Performance Persistence Literature Review

US Studies

Grinblatt and Titman (1992) use a survivor-biased dataset of 279 US mutual funds to test for performance persistence over the sample period 1974 to 1984. Grinblatt and Titman (1992) believe survivor bias to be small in their dataset and since non-surviving funds are excluded it should make finding positive persistence more difficult since non-surviving funds are typically funds who are poor performers in sequential periods. Grinblatt and Titman (1992) find statistically significant evidence

of performance persistence by regressing 5 year evaluation period alphas on 5 year ranking period alphas. Grinblatt and Titman (1992) use an eight-portfolio benchmark on which to calculate alpha where the factors in the eight-portfolio benchmark account for size, dividend yields and past returns.

Malkiel (1995) finds significant persistence in US equity mutual fund performance during the 1970s using 2-way contingency tables based on a Z-stat[6] for the percentage of repeat winners with the results robust to the length of the ranking and evaluation periods and the whether performance is measured by total returns or a risk-adjusted alpha. However, during the 1980's the same contingency table tests produce much weaker support of the hot hand phenomenon in Hendricks et al. (1993) with the empirical evidence failing to reject the null hypothesis that performance persists. In fact during the 1980s Malkiel (1995) finds significant evidence of reversals in performance (WL or LW) rather than positive performance persistence.

Brown and Goetzmann (1995) like Malkiel (1995) analyses performance persistence on an essentially survivor-bias-free dataset of equity mutual funds over the sample period 1976 to 1988. Unlike Malkiel (1995) whose dataset is from Lipper Brown and Goetzmann (1995) obtain their data from Weisenberger Investment Companies Service's Mutual Fund Panorama. Brown and Goetzmann (1995) find persistence in poor performers but through their year by year analysis find it is sensitive to the time period under analysis.

An influential study by Carhart (1997) finds that after using his four factor model performance persistence is not present. Using a survivor-bias free sample of 1,892 US equity mutual funds the one anomaly in Carhart (1997) is the relative continual under performance by the worst performing funds. The recent fund flow literature tries to explain the one anomaly in Carhart (1997) by examining the performance

[6] $Z = (Y - np)/(\sqrt{np(1-p)})$ where n is the number of pairs, p equals 0.5 and Y is the number of persistently winning funds. When n is large Z is approximately normally distributed with mean 0 and standard deviation 1.

fund flow relationship in relation to the Berk and Green (2004) model of mutual fund flows.

UK Studies

Whilst the main motivation of Blake and Timmermann (1998) is to analyse fund performance they also assess the level of performance persistence in their 1972 to 1995 sample of 814 UK funds. Blake and Timmermann (1998) apply the recursive portfolio approach based on abnormal returns using a 24 month ranking period with a one month evaluation period and find some evidence of positive performance persistence.

Quigley and Sinquefield (2000) analyse performance persistence on their survivor-bias-free UK equity unit trust sample using both raw and abnormal returns based on the CAPM and Fama and French three factor model. Quigley and Sinquefield (2000) use the recursive portfolio approach and find persistence in performance in raw returns but they emphasise that to exploit this opportunity would require 80% turnover a year eliminating any profits in practice. On a risk-adjusted basis Quigley-Sinquefield-2000 find little evidence of persistence in performance in the top performing funds but some evidence of persistence in the worst performers in line with numerous US based studies.

Fletcher and Forbes (2002) assess performance persistence in UK equity unit trusts using both contingency tables, as previously used by Allen and Tan (1999) for UK investment trusts, and the recursive portfolio approach. Fletcher and Forbes (2002) find significant persistence using contingency tables based on prior year excess returns and no significant evidence of reversals with their results robust to the performance measure used. The performance persistence in the contingency table tests is mainly due to repeat losers. Using the recursive portfolio approach Fletcher and Forbes (2002) find evidence of performance persistence when ranking funds into

quartiles based on prior year excess returns from a single index model. However, using the Carhart (1997) four factor model Fletcher and Forbes (2002) find more reversals in performance and no significant evidence of performance persistence.

Cuthbertson et al. (2008) assess the performance persistence of 675 UK equity funds over the sample period 1975 to 2002. Whilst the main motivation of Cuthbertson et al. (2008) is to assess the performance of UK equity funds using a bootstrap method to distinguish between lucky and skillful fund managers they also briefly analyse performance persistence using a recursive portfolio approach. Funds are ranked into quintiles based on the t statistic of alpha using the previous 60 months of data. Cuthbertson et al. (2008) find no evidence of performance persistence for winners but some evidence of performance persistence for losers with the results robust to rebalancing over 1, 3, 6, 9 and 12 months. The average alpha of the bottom quintile is approximately -2% per year.

For UK pensions the performance persistence literature is much sparer and covers a range of pension products. Brown et al. (1997) and Blake et al. (1999) find no strong evidence of performance persistence. Tonks (2005) examines performance persistence in UK occupational schemes over the sample period March 1983 to December 1997 using both contingency tables and performance ranked portfolio strategies. Tonks (2005) finds stronger evidence of persistence than previous studies at one year horizons and weaker evidence in the long run with the results being generally robust when using both the Fama and French three factor model and the Carhart 4 factor model. Gregory and Tonks (2004) examine the performance and performance persistence in UK personal pensions and find negative persistence at short horizons, but over six months to a year significant positive performance persistence, even when using the Carhart (1997) four factor model.

2.4 Fund Flows

The fund flow literature can be broadly split into two areas based on whether the motivation is to

- Examine the relationship between ex ante performance and ex post fund flows.
- Examine the relationship between the ex ante fund flows and the ex post performance.

The vast majority of the previous literature on fund flows examines the relationship between ex ante performance and ex post fund flows to examine how investors react to past performance through their subsequent investments. The second and more recent motivation examines the relationship between the ex ante fund flows and the ex post performance and has been a focus of interest due to the Berk and Green (2004) model of mutual fund flows. In this thesis I will examine both motivations. I will examine the performance fund flow relationship for both UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds. There is very little previous evidence on the performance fund flow relationship for UK collective investment schemes due to the lack of data availability. I will also perform another empirical test of Berk and Green (2004) using performance ranked portfolio tests conditional on fund flows. It is also important to stress that the empirical test of Berk and Green (2004) is based on fund flows at the underlying portfolio level which is a unique element of this test.

2.4.1 Fund Flow Methodologies and Hypotheses

Fund flows can be calculated on relative or absolute terms. The relative fund flow measure is shown in Equation (7.1). Since it adjusts for the size of the fund it is generally the preferred measure used in the literature, see Sirri and Tufano (1998)

and Chevalier and Ellison (1997). In Equation (2.15) the NAV_{it} is the total NAV (net asset value) i.e. fund size for fund i at time t, NAV_{it-1} is the total NAV at $t-1$ and $(1+r_{it})$ is the realised return on the fund between t and $t-1$ assuming all distributions are reinvested.

$$Flow_{it} \equiv \frac{\text{NAV}_{it} - \text{NAV}_{it-1}(1+r_{it})}{\text{NAV}_{it-1}} \tag{2.15}$$

In this thesis I use a slightly modified version of Equation 2.15 as Berk and Tonks (2007) highlight a potential problem with this measure. If a poorly performing fund in the sample enters liquidation the relative flow of funds measure would expected to be -100%. However, Equation (2.15) will not produce a relative flow of funds measure of -100% in liquidation[7]. To overcome this potential problem, Berk and Tonks (2007) modify the denominator of Equation (2.15) and use Equation (2.16), where now in liquidation a fund's flow in its last period will be equal to -100%. In this research I use Equation (2.16) for the calculation of the relative fund flows although the impact of using either measure should be minimal.

$$Flow_{it} \equiv \frac{\text{NAV}_{it} - \text{NAV}_{it-1}(1+r_{it})}{\text{NAV}_{it-1}(1+r_{it})} \tag{2.16}$$

The absolute fund flow measure is given in Equation (2.17).

$$Flow_{it} \equiv \text{NAV}_{it} - \text{NAV}_{it-1}(1+r_{it}) \tag{2.17}$$

Fund Flow Hypotheses

- Hypothesis 5

[7]Unless, the return over the period is 0 i.e. r_{it} is equal to zero.

  - There is a stronger performance fund flow relationship for UK equity unit trusts/OEICs than for UK unit-linked personal pensions.

Due to the illiquid nature of personal pensions investors in unit-linked personal pension funds should be less responsive to past performance in comparison to unit trust/OEIC investors. Del Guercio and Tkac (2002) provide evidence to support a more convex performance fund flow relationship for US mutual funds in comparison to US pension funds and this thesis will extend the literature to the UK market where there is a lack of empirical evidence. I will also examine whether any differences in the performance fund flow relationship are located in the extreme tails of the performance distribution.

- Hypothesis 6
  - Past winners who have the highest net flows should on average have ex post worse abnormal performance than the past winners who have the lowest net flows.
- Hypothesis 7
  - Past losers who have the lowest net flows should on average have ex post better abnormal performance than the past losers who have the highest net flows.

According to Berk and Green (2004) decreasing returns to scale from fund flows should result in no persistence in fund performance. Using performance ranked portfolio tests conditional on fund flows at the underlying portfolio level we should find more performance persistence in the evaluation period for the worst performing funds with the highest net fund flows in the ranking period in comparison to the worst performing funds with the lowest net fund flows in the ranking period. The best performing funds with the highest net fund flows in the ranking period should provide less evidence of performance persistence in comparison to the best

performing funds with the lowest net fund flows in the ranking period. These general predictions should apply to both unit-trusts/OEICs but it probably depends on the level of convexity in the performance fund flow relationships.

2.4.2 Fund Flows Literature Review

US Studies

Chevalier and Ellison (1997) estimate the performance fund flow relationship for US mutual funds using using growth and income funds over the sample period 1982 to 1992. Chevalier and Ellison (1997) find that the performance fund flow relationship creates incentives for fund managers to risk shift and find empirical evidence that fund managers to risk shift towards the end of the year. Sirri and Tufano (1998) find a convex performance fund flow relationship for 690 US mutual funds over the period 1971 to 1990. In addition to performance Sirri and Tufano (1998) also find that marketing, fees and fund size are important factors in determining fund flows. The convex nature of the performance fund flow relationship for US mutual funds is also found in Del Guercio and Tkac (2002). Evidence in Del Guercio and Tkac (2002) also provides evidence on US mutual funds and generally find a strong relationship between past performance and subsequent fund flows. Del Guercio and Tkac (2002) also examine US pension funds and find that investors in pension funds punish the worst performing funds by withdrawing their capital from the fund. They also have less inclination to switch to winner funds in comparison to mutual fund investors.

Berk and Tonks (2007) empirically test the Berk and Green (2004) model of mutual fund flows. Using a sample of 9,830 US mutual funds over the period 1962 to 2004 they find that the anomaly in Carhart (1997) of performance persistence in the worst funds can potentially be explained by investors being reluctant to withdraw their capital from these poorly performing funds. Bessler et al. (2010) perform similar

tests for performance persistence but conditional on both fund flows and managerial change. Bessler et al. (2010) find that managerial change is at least as important as fund flows in explaining performance persistence in US mutual funds.

UK Studies

There is very little literature on the performance fund flow relationship for UK funds. The main reason is fund size data not being available. The only exception to this is Keswani and Stolin (2008) and their related work. Keswani and Stolin (2008) examine how new cash inflows and outflows impact on future performance. Their sample includes approximately 500 funds and covers the period 1992 to 2000. Their rich dataset find that the performance fund flow relationship is convex for both buying and selling decisions. They are also able to investigate the performance fund flow relationship for retail and institutional investors and find marked differences.

Chapter 3

Institutional Features of Unit Trusts/OEICs, Unit-Linked Personal Pensions and Fund Flows

3.1 Unit Trusts/OEICs and Unit-Linked Personal Pensions

Unit trusts are a collective investment vehicle which allow both individual and institutional investors to invest in a pooled investment fund. The primary benefit of such a collective investment scheme, particularly for individual investors, is a widely diversified portfolio obtainable at relatively low cost. Thus, collective investment schemes with the benefit of economies of scale serve an important function for investors in the financial markets. In addition the average individual investor generally does not have the knowledge, expertise and the required time to conduct investment research and analysis to make well informed investment decisions and manage those decisions over time. By investing in a collective investment vehicle

investors are able to obtain the investment services of professional portfolio managers. The benefit of this professional investment however comes with a price which the investor pays for through various fees[1]. In recent years OEICs, a new collective investment scheme, have seen an emergence into the market place in the UK. OEICs are very similar in nature to unit trusts with the primary difference being that OEICs are legally created as a company whereas unit trusts are created as a trust. Another important difference, particularly for the investor, is that unit trusts are priced on a bid-ask[2] basis whereas OEICs offer single pricing which seems more transparent to the investor. Thus OEICs have a simpler structure and have more transparent pricing than unit trusts which seems more appealing to investors and in part explains OEICs increase in popularity. OEICs, which originated in Europe, comply with EU law and are thus more marketable to european investors as they can be sold across the EU. This is the other main reason for the rise in the popularity and growth of OEICs in the UK over recent years and the trend for unit trusts to convert their funds into an OEIC structure. By converting to an OEIC structure the larger set of potential investors means there are more opportunities for the fund to grow in size through new fund inflows increasing fund manager compensation. To illustrate the size and importance of the industry the Investment Management Association (IMA) estimate that UK authorised unit trusts and OEICs have £569 billion of assets under management as at 2010.

Both unit trusts and OEICs are open-ended investment vehicles where their unit/share price is determined as a function of the underlying asset value and the number of units/shares in existence. New money invested in a unit trust/OEIC creates new units/shares and investors withdrawing money from the unit trust/OEIC results in units/shares being redeemed/canceled directly with the fund manager. Thus the value of unit trusts and OEICs shares are not a function of supply and demand

[1] Fund charges and fess are discussed in detail Section 3.1.1.
[2] Also refereed to as bid-offer.

pressure as in closed end funds e.g. UK investment trusts. In comparison to the US market unit trusts/OEICs can be seen as the UK equivalent to the US mutual fund. Although the terminology is different the fact that unit trusts and OEICs are the equivalent to mutual funds is beneficial as it allows direct comparisons to be made between fund performance in the US and the UK.

In summary, unit trusts and OEICs are similar open ended investment vehicles in that they both allow investors to invest a diversified portfolio at low cost. Unit trusts and OEICs take advantage of economies of scale and offer investors a diversified investment with the additional benefit of having a professional portfolio manager in charge of their capital. The downside for the investor is that managers of unit trusts/OEICs charge investors for their services which reduces the net return to the investor.

The personal pensions I analyse in this research are unit-linked personal pensions and therefore have many similarities with unit trusts/OEICs. Unit-linked personal pensions are a funded pension scheme that pays a pension at retirement on a defined contribution basis[3]. For the pension holder this implies that the value of the pension at retirement is a function of the frequency and amount of the contributions into their pension fund over the accumulation phase as well as the investment performance and fees of the fund manager. To illustrate the size and importance of the personal pension industry the Association of British Insurers (ABI) estimate that insurer-administered individual pensions hold £475 billion in assets as at 2010. The main difference between unit trusts/OEICs and unit-linked personal pensions is that money invested in unit-linked personal pensions is inaccessible until the pension holder retires or reaches the minimum age at which the pension can be taken, which in the UK is 55 years of age as at April 2010. Thus, unit-linked personal pensions are highly illiquid forms of investment from the investor's perspective in

[3]For more information on pensions in the UK see Blake (2003) and Blake (2006).

comparison to unit trusts/OEICs where units/shares can be liquidated with the fund manager at any time. It is precisely this illiquidity in unit-linked personal pensions that should restrict the fund flow performance relationship and result in more performance persistence in unit-linked personal pensions.

3.1.1 Fund Characteristics

The following sections detail specific characteristics of unit trusts/OEICs and unit-linked personal pensions allowing comparisons to be drawn. Tables 3.1 and 3.2 summarise the key features of unit trusts and OEICs in tabular form and supplements the discussion below. The table is taken from the document "Aberdeen Unit Trust Managers Limited Proposed Scheme of Arrangement for the Conversion of Aberdeen UK Growth Unit Trust a UK Authorised Unit Trust into Aberdeen UK Growth Fund a sub-fund of Aberdeen Investment Funds ICVC." Whilst the information is specific to the aforementioned fund it provides a useful general comparison between units trusts and OEICs. Fund characteristics can differ in terms of fund structure, fund sector, fund valuation, fund pricing, fund charges and fund taxation which are all important factors when assessing fund performance from an investors perspective. These sections draw heavily on the work of St Giles et al. (2003) which is one of the few publications that covers these areas in depth and is an indispensable resource on the operations of collective investment schemes. The fund characteristics discussion below is succinct in nature as although informative this research is motivated and focused on assessing fund manager performance through security selection and market timing and not the return to the investor which depends on the fees/charges set by the fund manager and the investor's individual circumstances e.g. tax status.

Table 3.1: Comparison of Unit Trusts and OEICs

Feature	**Authorised Unit Trust**	**OEIC**
Legal Structure	Trust	Open-ended investment company
Fund Structure	Single unit trust or umbrella unit trust	Open-ended investment company with single fund or umbrella company with several sub-funds
Unit/Share Classes	Can have income or accumulation units only	Can have more than one class and type of share
Fund managed by	Manager	Authorised Corporate Director (ACD)
Investments held by	Trustee	Depositar
Meetings	No annual general meeting required	Annual general meeting currently required. It is possible to dispense with the requirement for holding annual general meetings on giving shareholders 60 days notice.
Pricing	Dual or single pricing	Single pricing
Switching Facility	Unitholders in a single unit trust are generally permitted to switch all or part of their units in a trust for units in any other trust managed by the same manager. Similarly, switching may take place between the sub-funds of an umbrella unit trust.	Shares can be switched between classes within a sub-fund and between sub-funds of an umbrella company.
Taxation of Fund	Not liable to UK corporation tax on capital gains arising from disposal of investments.	As for authorised unit trust

Table 3.2: Comparison of Unit Trusts and OEICs Continued

Feature	**Authorised Unit Trust**	**OEIC**
Taxation of Fund	Liable to corporation tax at the lower rate of tax (currently 20%) on income arising from investments after relief for expenses	As for authorised unit trust
	Dividends and distributions received from UK resident companies are received with a notional tax credit and no further tax is payable	As for authorised unit trust
	Dividends and distributions received from UK unit trusts are split between franked investment income and unfranked investment income, the latter is included as taxable income.	As for authorised unit trust
	The Trust is treated as if it was a company resident in the UK, and unitholders are treated as if they were shareholders in the company.	For corporation tax purposes, each separate sub-fund of an OEIC is treated as a company. The OEIC itself is not treated as a UK company.
Ongoing taxation of shareholders	Income distributed by or accumulated in an OEIC is taxed on shareholders in the same way as income distributed by or accumulated in a unit trust. Gains arising on disposal of shares in the OEIC are also taxed on shareholders in the same way as gains arising on disposal of units in an authorised unit trust. Where a shareholder switches between different classes of shares within the same sub-fund, this will not normally constitute a disposal for capital gains tax purposes. The new holding will be treated as if it had been acquired for the same cost and at the same time as the old holding. However, a shareholder switching between different sub-funds of the OEIC will be treated as making a disposal of the old shareholding for capital gains tax purposes.	

The table above has been directly taken from the document "Aberdeen Unit Trust Managers Limited Proposed Scheme of Arrangement for the Conversion of Aberdeen UK Growth Unit Trust a UK Authorised Unit Trust into Aberdeen UK Growth Fund a sub-fund of Aberdeen Investment Funds ICVC."

Fund Structure

Differences between fund structures is generally one of a legal nature and hence can vary across countries due to differing legal systems. In this section the focus is on the structure of the fund from a UK legal perspective with particular emphasis on unit trusts, OEICs and unit-linked personal pensions.

In comparison to unit trusts, OEICs are created and structured as companies rather than as a trust. Unit trusts created under a trust deed are governed by trust law whereas OEICs are governed by company law. OEICs issue shares to investors rather than units and the OEIC can issue different share classes that fulfill the needs of a diverse group of potential investors. Generally, the share classes offered by OEICs can be classified into retail and institutional where the substantial size of the investments made by institutional investors allows OEICs to offer them reduced charges/fees as an incentive for substantial investment. In comparison unit trusts issue units rather than shares that are generally either accumulation units or income units. For income units with an equity focus any dividends paid by the equity shares in the underlying fund are paid out as income to the holders of the unit trust. In comparison the accumulation units reinvest the dividends from the underlying equity shares back into the underlying fund.

As a result of the legal differences between unit trusts and OEICs the unit trust is managed by the fund manager and the investments are held by the trustee. In comparison the OEIC is managed by an authorised corporate director (ACD) and the investments are held by the depositar. Although both fund structures have differences they are mainly from a legal perspective. From an investor's perspective they are both open ended investment vehicles where the sale and redemption of shares/units is directly with the fund manager and their NAV depends on the underlying assets and the investment performance of the fund.

Unit-linked personal pensions are very similar to unit trusts/OEICs. The main difference is the illiquid nature of unit-linked personal pensions from the investor's perspective. Money invested into a personal pensions is inaccessible until retirement. Also since unit-linked personal pensions are a contractual savings device for an individual's provision for retirement they are marketed and sold to individual investors only although employers can contribute to an employee's personal pension.

Scheme Sectors

Funds are classified into sectors based on their investment objectives. This research concentrates on UK equity based funds only which is in line with the vast majority of the existing literature on fund performance and performance persistence. The UK equity focused unit trusts and OEICs are classified into sectors based on their specific equity objectives and for the purpose of this research I use the Investment Management Association's (IMA) classification. Appendix A.1 defines the current definitions as at 2008 for the three IMA UK equity based sectors of UK All Companies, UK Equity Income and UK Smaller Companies. The key criteria across all the UK equity based sectors is that at least 80% of the fund must be held in UK equities. The exact nature of sector classification is not universal and can differ across data providers and through time. For instance Lipper's equivalent classifications for UK All Companies (IMA), UK Equity income (IMA) and UK Smaller Companies (IMA) are Equity UK, Equity UK Income and UK Smaller Companies respectively. The implication of this is that a database of funds in UK equity sectors may have slight variations depending on which sector classifications are used although the variation is not substantial and hence should have a negligible impact on the results.

The unit-linked personal pensions are also classified into sectors based on their specific equity objectives. The UK equity unit-linked personal pensions are divided into UK All Companies, UK Equity Income and UK Smaller Companies but whereas for

unit trusts/OEICs the IMA define the sector definitions for unit-linked personal pensions the Association of British Insurers (ABI) set the sector definitions as shown in Appendix A.2. Comparing the ABI and IMA UK equity sector definitions emphasises that both bodies define the sectors in virtually the same manner. This enables a clear comparison in the analysis of performance, performance persistence and fund flows between UK equity unit trusts/OEICs and UK equity unit-linked personal pensions both at the sector level and for the entire sample.

Although Appendix A.1 and Appendix A.2 define the IMA and ABI UK equity based sector definitions these are the current definitions only as at the beginning of 2008 and it is important to emphasise that this has not always been the classification used. For unit trusts/OEICs the IMA is the trade association for the investment management industry but it only came into existence in its current form in 2002 with the merger of the Association of Unit Trusts and Investment Funds (AUTIF) and the Fund Managers Association (FMA). Prior to 2002 unit trusts and OEICs were classified into sectors by the AUTIF and prior to 1999 the equivalent equity fund sectors were UK Equity Growth, UK Growth and Income, UK Equity Income and UK Smaller Companies. In 1999 the AUTIF merged the two sectors of UK Equity Growth and UK Growth and Income into one sector, UK All Companies, due to there being no significant difference between the two sectors. I classify funds that were in UK Equity Growth and UK Growth and Income prior to 1999 as being in UK All Companies.

Charges

Investors use collective investment schemes to achieve diversification at lower cost due to their economies of scale and to obtain professional portfolio management. However, these services come at a cost to the investor. An investor in a collective investment scheme is subject to charges that can be broadly classified into two

categories as defined in St Giles et al. (2003).

- Charges levied on investors entering or leaving the fund.
- Charges or expenses levied directly on the fund.

Table 3.3 is an edited version from St Giles et al. (2003) describing the various fees and charges incurred by investors and the fund in accordance with the aforementioned classification. The fees that apply to any given fund and investor depend on the fund's legal structure and the management company and should be clearly stated in the fund's prospectus and legal documentation.

Unit trusts use a dual pricing system where investors can buy a unit from the fund manager at a higher price (offer or ask price) than they can sell back a unit to the manager (bid price). The spread incorporates the initial charge/front end load and notional dealing charges depending on whether there is net buying/selling of units. The spread is also used by the fund to cover fund marketing expenses and pay commissions to brokers and financial advisors to compensate them for their business. Not all fund managers have the same charging structure particularly in regards front and back end loads. The majority of funds only have a front end load which is part of the spread initially paid by investors at the point of purchase. However, some funds do not apply a front end load to encourage investors to invest in their unit trust due to the reduce fees. These funds tend therefore to have back end loads which is a fee the investor will occur at the point of sale of the unit trust and is generally on a sliding scale over time. Back end fees encourage long term investment by the investor which is particularly suited to fund managers as they generally are compensated by a percentage of funds under management. The charges imposed by OEICs are similar in nature to unit trusts but since OEICs employ a single pricing methodology the charges are seen as more transparent. Although buyers and sellers transact at the same price with the fund manager investors in OEICs may still have to pay an initial charge but instead of being part of the spread it is an explicit cost

rather than being incorporated into the price. If the OEIC does not apply a front end load it may also use back end loads as with unit trusts.

The annual management fee is generally set as a percentage of total NAV rather than a fixed fee to align the interests of the investors and fund manager. Good fund performance is desired by the investor and since it increases total NAV it increases the fund manager's compensation. In well developed financial markets a typical annual management fee can be anything up to approximately 1.5% but this varies fund to fund as ultimately it is a decision made by fund management.

The annual management fee covers the general costs incurred by the fund manager from running the fund and is generally charged pro rata on a daily basis. The charges of the fund in Table 3.3 can either by paid by the fund manager using the annual management fee or they can be paid directly by the fund. Fund managers and investors will have conflicting views here as paying the expenses from the annual management fee is beneficial to the investor but detrimental to the fund manager whilst paying the charges directly from the fund is beneficial to the fund manager but detrimental from the investors perspective. Since the annual management fee may therefore not adequately reflect the expenses borne by investors regulators are keen on fund managers reporting the total expense ratio. The total expense ratio represents the total costs charged to the fund in a given year expressed as a percentage of the average total NAV over the year. It is therefore a much more informative figure than just the annual management fee for investors as their realised return depends on all fund charges and how they are paid. For OEICs any charges caused by investors entering or leaving the fund can be covered by a dilution levy. This is similar to the notional dealing costs in unit trusts but in OEICs instead of being incorporated into the price the dilution levy is an explicit cost that aids transparency.

Table 3.3: Fund Charges and Expenses

Types of Charges and Expenses	**Definition**
Charges levied upon investors entering or leaving the fund	
Initial charge	Fee paid to the management company upon subscription to an open-ended fund, based on a percentage of NAV per share/unit.
Redemption charge (Also know as back end load and deferred sales charge.	Fee paid to management company upon redemption from an open-ended based on a percentage of NAV per share/unit.
Rounding	Rounding up of a share or unit price to a convenient value for dealing.
Dilution levy	Levy made on either entering or redeeming investors to compensate ongoing investors for dilution that would otherwise be caused, based on NAV per share/unit.
Charges or expenses levied on the fund	
Annual management fee	Fee paid annually to management company for investment management and admin of the fund, based on percentage of average annual total NAV of the fund.
Performance fee	Fee payable to the management company based on out performance of a specified benchmark.
Custodian, depositary or trustee	Fees payable to custodian, depositary or trustee of a fund
Share or unit holder servicing	Costs of registration, admin, payment of dividends, issuance of reports and accounts etc.
Audit	Fees and expenses of the fund audit
Valuer	
Regulatory fees	Authorisation fees payable to the regulator.
Borrowing	Charges and fess payable of fund borrowing.
Taxes and duties	Taxes and duties payable by the fund.
Legal fees	Generally associated with the fund founding documents and their amendment.
Brokerage	Cost of transactions in fund assets.

The above table is an edited version taken from St Giles et al. (2003).

Unit-linked personal pensions have very similar charges to unit trusts. The initial charge is generally up to 5% and the investor in the personal pensions pays an annual management charge of similar magnitude to that of a standard unit trust which covers the administration and management of the pension plan. Since most personal pensions involve the investor making regular payments into the fund over a long period of time generally no charges are levied if the contributions vary over the pensions accumulation phase. Also since personal pensions are a long term investment vehicle inaccessible until retirement investors may want to switch pension providers and fund managers at some point if fund performance is not satisfactory. Investors generally will occur a switching cost in this situation but the level of switching is estimated to be low, see Alfon (2002).

Pricing

Unit trusts and OEICs are open ended investment vehicles and therefore their prices are not determined by demand and supply forces. In addition, an investor liquidates their position by selling the shares/units back to the fund manager rather than in an open market. The price of a unit/share is based on the market value of the net assets of the underlying portfolio divided by the number of units/shares outstanding. However the pricing methods vary and depend on the legal structure of the fund. For unit trusts dual pricing is employed whereas single pricing is used for OEICs. Potential investors who want to purchase a unit pay the offer price and current investors who want to sell a unit back to the fund manager receive the bid price where the offer price is higher than the bid price. Thus a price differential exists between buying and selling units from and to the fund manager at any given point in time. This differential in price is termed the spread and exists to cover the front end load, notional dealing costs when there is net buying/selling and commission to brokers as described in detail in Section 3.1.1 under the heading Charges. The

methodology to determine the maximum ask price, the minimum bid price and hence the maximum bid-ask spread is set by the FSA in the UK. Since the personal pensions I analyse in this thesis are unit-linked they are priced in line with the method for the standard unit trust.

The pricing of OEICs is based on a single price and is seen as more transparent for the investor in comparison to the dual pricing system of the unit trust. The single price is still calculated based on NAV per share as with unit trusts. However, investors do not trade at this single price as ultimately investors of OEICs still incur possible front end loads, exit charges and a dilution levy. A dilution levy is paid by buyers/sellers of the fund when there is significant sales or redemptions and is paid directly into the fund rather than profit for the fund manager. Its purpose is to protect existing investors in the fund from dilution in value due to excessive net sales or net redemptions from new and exiting investors. Since OEICs are single priced based on the middle market price current investors could be worse off if exiting investors receive a higher price that which the fund assets can be sold at in the market. In addition the price does not take into consideration the cost incurred from selling assets. The dilution levy therefore acts to protect current investors from dilution due to excessive net sales or net redemptions. In summary whereas for unit trusts the charges are incorporated into the pricing for OEICs they are explicitly stated to add transparency for the investor.

Taxation

Equity based funds achieve their return through dividends and capital appreciation on their underlying equity investments. Taxation rates are time varying and for the investor is a very important consideration that needs constant monitoring over time. Unit trusts/OEICs receive dividends from their underlying stock net of corporation tax. Investors receive the dividend if paid out by the fund net of corporation tax

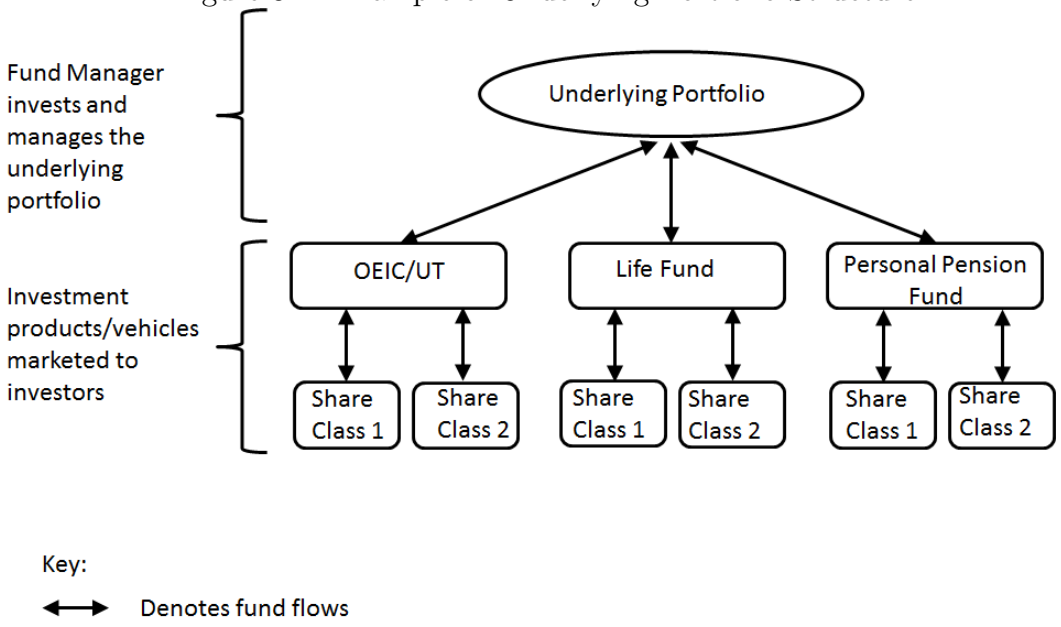
with a 10% tax credit. The tax credit cannot be reclaimed and the individual circumstances of the investor determine whether any more income tax is liable on the dividends received. Prior to 1997 pension funds could have reclaimed the associated tax credit with the dividend. Whilst unit trusts and OEICs themselves are not liable for capital gains tax investors are liable when they sell their units/shares. Since the the emphasis of this thesis is the performance and performance persistence of the fund due to the fund managers investment decisions rather than the return to the investor after taxation an in depth analysis of taxation of funds and its evolution over time is not detailed here. The returns I use in this thesis are gross of taxation and hence meet the objective of concentrating on returns due to the investment decisions of fund managers.

3.2 Structure of the Unit Trust/OEIC and Unit-Linked Personal Pension Industries

The structure of the unit trust/OEIC and unit-linked personal pension industries has important implications for an empirical test of the Berk and Green (2004) model of mutual fund flows. In Berk and Green (2004) fund flows are the equilibrating mechanism that means going forward performance should not persist. In the model the fund manager faces diseconomies of scale as the fund's assets under management increase. Since fund flows are the equilibrating mechanism it is important to clarify what I define as the "fund" and how fund flows should be measured to test Berk and Green (2004). I use the term fund throughout this thesis as a generic term that relates to the unit trust/OEIC and unit-linked personal pension products/funds marketed to and bought by investors. I use the term "underlying portfolio" to represent the total assets under management that the fund manager[4] has to invest

[4]The fund manager (also known as the portfolio manager) manages the underlying portfolio.

Figure 3.1: Example of Underlying Portfolio Structure



and manage. The underlying portfolio's total assets under management are derived from fund flows from its associated investment funds/products. It is important to recognize that an underlying portfolio may include assets that have been accrued through various investment products (or "wrappers") such as unit trusts, personal pensions or life funds. The importance and relevance of these definitions especially in terms of fund flows is best illustrated through an example.

Figure 3.1 represents a potential underlying portfolio structure in the UK where the fund manager invests the underlying portfolio's assets under management. In this example the underlying portfolio collects fund flows from its associated investment vehicles/funds that are marketed and sold to investors, here a unit trust/OEIC, a life product and a personal pension product. For the OEIC as well as the life and pension funds in this example investors have a choice of two products to invest in, share class 1 or share class 2[5]. Investors of share class 1 or 2 in the OEIC both have the same underlying investment, the underlying investment portfolio managed

[5]Share class is the term used for OEICs, unit trusts generally offer investors a choice of income units or accumulation units. The number of share classes offered does not have to be limited to two.

by the fund manager. Typically for OEICs the different share classes just represent different fees applied to the investor due to the different amounts invested i.e. higher fees for retail investors if investing smaller amounts of money in comparison to lower fees for institutional investors investing larger sums of money. Reduced fees for investors who invest larger amounts is rational from the fund manager's perspective as they generally earn compensation through assets under management and want to maximise their compensation by enticing large investors to invest. Offering various share classes/products based on the same fund but with different fee structures is also common for life and pension products.

Since fund flows to the underlying portfolio in Figure 3.1 are a combination of the flows from the personal pension fund, life fund and unit trust/OEIC empirically testing Berk and Green (2004) by comparing the performance, performance persistence and fund flows of unit trusts/OEICs with personal pensions at the fund level in this example could be misleading. The unit trust/OEIC and the personal pension fund both have the same underlying portfolio and their return series would be virtually identical, the main difference only being due to the charges/fees applied. However, the fund flows at the investment product/fund level for the unit trust/OEIC and the personal pension may be very different. To illustrate the point let's assume that the personal pension fund has much smaller fund flows in comparison to the unit trust/OEIC. Using fund flow data at the investment product/fund level we would expect to see greater performance persistence in the personal pension fund in comparison to the unit trust/OEIC. However we know this will not be the case as both the personal pension and the unit trust/OEIC have the same underlying assets as they have the same underlying portfolio and fund manager. Any diseconomies of scale the fund manager experiences will impact the return series of the underlying portfolio and hence the returns on both the personal pension fund and unit trust/OEIC. For unit trusts/OEICs and unit-linked personal pensions who have a structure similar to Figure 3.1 using fund flow data at the investment product level

rather than the underlying portfolio level to test Berk and Green (2004) could lead to erroneous conclusions. Diseconomies of scale fundamentally apply to the fund manager at the underlying portfolio level. In this example the fund manager of the personal pension fund does not have restricted fund flows since the fund manager of the personal pension also has fund flows from a unit trust/OEIC. It is therefore not valid to expect more performance persistence in the personal pension fund in this scenario. We can only expect more performance persistence in those unit-linked personal pensions that do not have a shared underlying portfolio with a unit trust/OEIC.

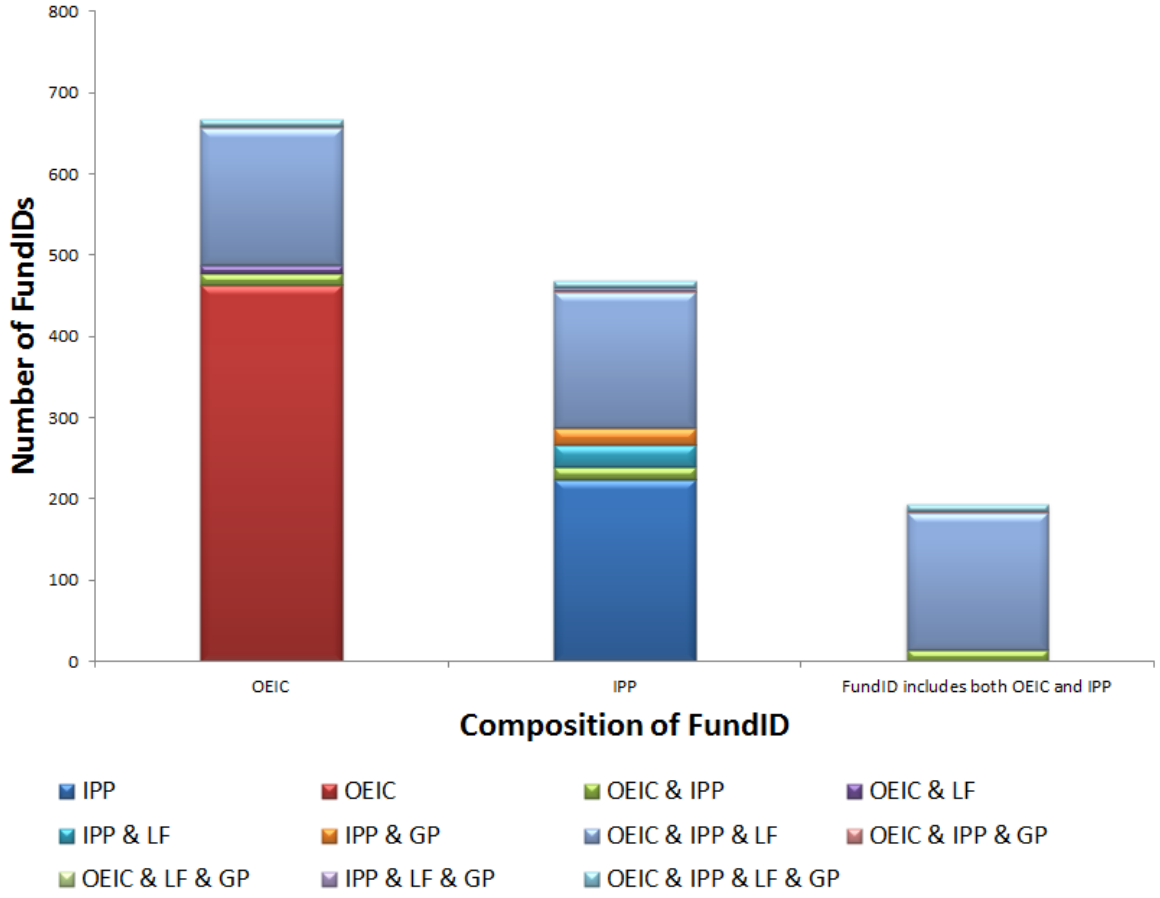
Unfortunately I do not have access to a data variable that identifies underlying portfolios. Potentially the underlying portfolio could be estimated by examining fund manager names, histories and portfolio holdings but I also do not have a comprehensive dataset of this information. I therefore propose a second best alternative to identify underlying portfolios by using the Morningstar FundID variable as a proxy for the underlying portfolio. FundID is a Morningstar Direct data variable that identifies individual sub funds in the Morningstar Direct Database. Morningstar assigns a FundID to all funds in its database and therefore FundID provides a comprehensive dataset for funds at any given point in time. Figure 3.2 is an example of the FundID variable and shows all funds that belong to the FundID FSGR050C3. All funds in Figure 3.2 have the same manager, Mark Lyttleton, and underlying portfolio. The funds in this example that belong to FundID FSGR050C3 include an OEIC, personal pension funds and life funds. The fund manager would have to deal with fund flows and face diseconomies of scale from fund flows from all of the investment products in Figure 3.2. I would not therefore expect more performance persistence in the personal pension fund in this example in comparison to an average unit trust/OEIC as the fund manager also has to deal with the fund flows from the OEIC.

Figure 3.2: FundID Example

Fund Name	ISIN	Sector	Firm	Manager	Fund Size Date	Size	FundID	Fund Type
BlackRock UK Dynamic A Acc	GB0000709062	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
BlackRock UK Dynamic A Inc	GB0000962927	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
BlackRock UK Dynamic D Acc	GB00B583LN52	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
Alico/BlackRock UK Dynamic Gross Pen	GB00B5SKVF88	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton			FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic Pen	GB00B047Z235	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton	28/05/2010	1,331,253.71	FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic RA Pen	GB00B2B0QL53	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton			FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic inet Pen		(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton			FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S2 Pen	GB00B02GC437	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	9,824,636.87	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S3 Pen	GB00B02GCT82	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	958,650.90	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S5 Pen	GB00B02GDD97	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	181,283.55	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S6 Pen	GB00B101SV66	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	34,230,046.77	FSGBR050C3	Ind Pen
AXA/BlackRock UK Dyn Inet Pen		(ABI) UK All Companies (Pen)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	14,534,064.66	FSGBR050C3	Ind Pen
AXA/BlackRock UK Dyn Pen	GB00B142TH80	(ABI) UK All Companies (Pen)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	14,534,064.66	FSGBR050C3	Ind Pen
BlackRock DC UK Dynamic D Pen	GB0031367534	(ABI) UK All Companies (Pen)	BlackRock Pensions	Mark Lyttleton	31/03/2010	3,967,762.88	FSGBR050C3	Ind Pen
CIS/BlackRock UK Dynamic Pen	GB00B11TDK35	(ABI) UK All Companies (Pen)	Co-operative Insurance Society Ltd	Mark Lyttleton			FSGBR050C3	Ind Pen
FP/BLK UK Dynamic Inet Pen		(ABI) UK All Companies (Pen)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton			FSGBR050C3	Ind Pen
FP/BLK UK Dynamic Pen	GB00B0692376	(ABI) UK All Companies (Pen)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	11,262,226.91	FSGBR050C3	Ind Pen
HLL/BlackRock UK Dynamic Pen	GB00B1SRVX91	(ABI) UK All Companies (Pen)	The Hartford	Mark Lyttleton			FSGBR050C3	Ind Pen
L&G/Pen BlackRock UK Dynamic	GB00B0Z1MB28	(ABI) UK All Companies (Pen)	Legal & General	Mark Lyttleton	31/12/2009	10,535,056.92	FSGBR050C3	Ind Pen
LV=/BlackRock UK Dynamic 2 Pen		(ABI) UK All Companies (Pen)	Liverpool Victoria Friendly Society	Mark Lyttleton			FSGBR050C3	Ind Pen
LV=/BlackRock UK Dynamic Pen	GB00B3Z6TV75	(ABI) UK All Companies (Pen)	Liverpool Victoria Friendly Society	Mark Lyttleton	31/10/2009	1,821,446.59	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 6 Pen	GB00B1J0ZG88	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 7 Pen	GB00B1J2R247	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 8 Pen	GB00B1J0ZZ77	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
Scot Eq/BlackRock UK Dyn Pen		(ABI) UK All Companies (Pen)	AEGON Scottish Equitable	Mark Lyttleton	31/05/2010	19,179,075.92	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 1 Pen	GB0030864382	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 2 Pen	GB0030864275	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 4 Pen	GB00B17KPL58	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Skandia/BlackRock UK Dynamic Pen	GB0005000830	(ABI) UK All Companies (Pen)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	47,261,506.88	FSGBR050C3	Ind Pen
Skandia/BlackRock UK Dynamic SP Pen	GB0033364349	(ABI) UK All Companies (Pen)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	47,261,506.88	FSGBR050C3	Ind Pen
SLFC/BlackRock Dynamic Pen	GB00B1W7VM49	(ABI) UK All Companies (Pen)	Sun Life Financial of Canada	Mark Lyttleton			FSGBR050C3	Ind Pen
Stan Life/BlackRock UK Dynamic 3 Pen	GB00B3L4C272	(ABI) UK All Companies (Pen)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Ind Pen
Stan Life/BlackRock UK Dynamic 4 Pen	GB00B3K5WC19	(ABI) UK All Companies (Pen)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Ind Pen
Windsor NM/BlackRock UK Dynamic Pen	GB00B1QH8V81	(ABI) UK All Companies (Pen)	Windsor Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic 3 Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic 4 Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Zurich/BlackRock UK Dynamic ZP Inet Pen		(ABI) UK All Companies (Pen)	Zurich Assurance	Mark Lyttleton			FSGBR050C3	Ind Pen
Zurich/BlackRock UK Dynamic ZP Pen	GB00B0C6J201	(ABI) UK All Companies (Pen)	Zurich Assurance	Mark Lyttleton	30/06/2009	4,840,558.61	FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic Life	GB00B047Z011	(ABI) UK All Companies (Life)	Alico	Mark Lyttleton	28/05/2010	4,284,546.65	FSGBR050C3	Life
Alico/BlackRock UK Dynamic Net Life	GB00B5SFNP75	(ABI) UK All Companies (Life)	Alico	Mark Lyttleton			FSGBR050C3	Life
Aviva/BlackRock UK Dynamic inet Life		(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton			FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S1 Life	GB0031058059	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	2,281,767.73	FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S3 Life	GB0031044265	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	768,607.75	FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S4 Life	GB0032339110	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	31,075,906.59	FSGBR050C3	Life
AXA/BlackRock UK Dyn Inet Life		(ABI) UK All Companies (Life)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	13,992,637.85	FSGBR050C3	Life
AXA/BlackRock UK Dyn Life	GB00B142RT62	(ABI) UK All Companies (Life)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	13,992,637.85	FSGBR050C3	Life
FNW/BlackRock UK Dynamic Life	GB00B3KN8272	(ABI) UK All Companies (Life)	Fidelity FundsNetwork	Mark Lyttleton			FSGBR050C3	Life
FP/BLK UK Dynamic Inet Life		(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton			FSGBR050C3	Life
FP/BLK UK Dynamic ISA Life	GB00B0XBD338	(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	63,497.82	FSGBR050C3	Life
FP/BLK UK Dynamic Life	GB00B059V205	(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	7,032,203.63	FSGBR050C3	Life
HLL/BlackRock UK Dynamic Life	GB00B1SRRK84	(ABI) UK All Companies (Life)	The Hartford	Mark Lyttleton			FSGBR050C3	Life
L&G/Life BlackRock UK Dynamic	GB00B0LMB128	(ABI) UK All Companies (Life)	Legal & General	Mark Lyttleton	31/01/2010	13,714,235.81	FSGBR050C3	Life
MI/BlackRock UK Dynamic 6 Life	GB00B1J0ZH95	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
MI/BlackRock UK Dynamic 7 Life	GB00B1J2R460	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
MI/BlackRock UK Dynamic 8 Life	GB00B1J10110	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
Scot Wid/BlackRock UK Dyn Gr Life	GB0030873458	(ABI) UK All Companies (Life)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	21,888,820.94	FSGBR050C3	Life
Skandia/BlackRock UK Dynamic Life	GB0005000723	(ABI) UK All Companies (Life)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	28,927,851.60	FSGBR050C3	Life
Stan Life/BlackRock UK Dynamic 1 Life	GB00B3BDGH77	(ABI) UK All Companies (Life)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Life
Stan Life/BlackRock UK Dynamic 2 Life	GB00B3BDPG93	(ABI) UK All Companies (Life)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Life
Sterling/BlackRock UK Dynamic 2 Life	GB00B1WTJK45	(ABI) UK All Companies (Life)	Zurich Assurance	Mark Lyttleton			FSGBR050C3	Life
Sterling/BlackRock UK Dynamic Life	GB00B06CPM68	(ABI) UK All Companies (Life)	Zurich Assurance	Mark Lyttleton	30/06/2009	20,409,981.56	FSGBR050C3	Life
Winterthur/BlackRock UK Dynamic Life		(ABI) UK All Companies (Life)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Life

Whilst Figure 3.1 is just an example and Figure 3.2 only represents one FundID, unit trusts/OEICs and unit-linked personal pension funds sharing the same underlying portfolio and fund manager is not unusual. Figure 3.3 shows the cross section of FundIDs in the UK focusing on UK equity unit trusts/OEICs and unit-linked personal pensions as at June 2010. Unfortunately whilst the FundID variable is comprehensive, Morningstar treat the FundID variable as a static data point and hence it is not possible to identify how and if underlying portfolio structures change

Figure 3.3: Composition of FundIDs for Unit-Linked Personal Pension Funds and Unit Trusts/OEICs as at June 2010



IPP = Individual personal pension (unit-linked personal pension); OEIC = Open-ended investment company or unit trust; LF = Life fund; GP = Group pension

over time. Figure 3.3 is also survivor biased as it only reports the underlying portfolio structures of live funds in existence as at June 2010. Despite these limitations Figure 3.3 clearly shows unit-linked personal pensions and unit trust/OEICs sharing the same underlying portfolio and fund manager. Of the 668 FundIDs that include a unit trust/OEIC, 194 also include a unit-linked personal pension fund. This represents approximately 29% of all FundIDs, a proxy for underlying portfolios, for unit trusts/OEICs and 40% of all all underlying portfolios for unit-linked personal pensions within the equity sectors of UK All Companies, UK Equity Income and UK Smaller Companies as at June 2010. For FundIDs that include both a unit trust/OEIC and a unit-linked personal pension the most common underlying structure is where the underlying portfolio also includes a life product. This type of underlying structure was previously shown via the example in Figure 3.1.

In general underlying portfolios for open-ended investment vehicles can consist of a combination of unit-linked personal pensions, unit trusts/OEICs, life funds and group pensions. Using Morningstar Direct's FundID variable as a proxy for the underlying portfolio, the underlying portfolio structure can have one of 15 possible combinations as shown in Table 3.4, although in practice only 13 underlying portfolio structures are found in operation at June 2010. The most common underlying fund structures are the most straightforward. For example, for unit trusts/OEICs the underlying portfolio generates fund flows only from unit trusts/OEICs and for personal pension's the underlying portfolio only generates fund flows from personal pension funds. For underlying portfolios that only contain a unit trust/OEIC there are on average 2.3 classes per underlying portfolio. This supports the notion that unit trusts generally offer income and accumulation units to investors and OEICs offer share classes normally marketed with a retail or institutional emphasis.

For more complex underlying structures where the underlying portfolio contains at least three out of the four different investment vehicles the average number of

classes per underlying portfolio increases dramatically. For example the average number of classes for underlying portfolios that include a unit trust/OEIC, life fund and a unit-linked personal pension fund is 17.3. This large number of classes in part reflects numerous different pension providers marketing their own products to investors but using the same underlying portfolio and fund manager as the other pension providers.

Although complex underlying portfolios for unit trusts/OEICs and personal pensions are common, the most popular structure is the most straightforward where the FundID, a proxy for the underlying portfolio, has fund flows exclusively from a unit trust/OEIC or a unit-linked personal pension fund. In Figure 3.3 approximately 69% of unit trusts/OEICs have a FundID where the assets under management are solely derived from the unit trust/OEIC. Therefore the total fund flows across units/classes for the unit trust/OEIC are also the total fund flows for the fund manager and underlying portfolio. For unit-linked personal pensions approximately 50% have a FundID consisting of only a unit-linked personal pension product/s. For these unit-linked personal pensions the fund flows are restricted to only a personal pension product and are central to testing the Berk and Green (2004) model of mutual fund flows.

To test Berk and Green (2004) I address the problem of unit trusts/OEICs and unit-linked personal pensions sharing the same FundID, a proxy for the underlying portfolio, by creating datasets based on FundID. In addition, whilst testing Berk and Green (2004) is a primary objective of this thesis a general comparative analysis between the performance, performance persistence and fund flows of unit trusts/OEICs is also important. I create seven proprietary datasets in order to meet these objectives throughout the thesis.

- UK Equity Unit Trust/OEIC Survivor-Bias-Free Database
- UK Equity Unit-linked Personal Pension Database

Table 3.4: Underlying Fund Structure based on Morningstar's FundID for UK Equity OEICs/UT's, Individual Personal Pensions (IPP), Life Funds (LF) and Group Pensions (GP) as at June 2010

Fund Structure	No. of FundIDs	FundIDs %	No. of classes	Classes %	Average classes per fund structure
IPP	244	20.2%	582	10.2%	2.4
LF	229	19%	379	6.6%	1.7
GP	16	1.3%	31	0.5%	1.9
OEIC	463	38.3%	1046	18.3%	2.3
OEIC & IPP	15	1.2%	67	1.2%	4.5
OEIC & LF	10	0.8%	37	0.6%	3.7
OEIC & GP					
IPP & LF	28	2.3%	186	3.3%	6.6
IPP & GP	20	1.7%	128	2.2%	6.4
LF & GP					
OEIC & IPP & LF	168	13.9%	2900	50.7%	17.3
OEIC & IPP & GP	2	0.2%	16	0.3%	8
OEIC & LF & GP	1	0.1%	5	0.1%	5
IPP & LF & GP	3	0.2%	107	1.9%	35.7
OEIC & IPP & LF & GP	9	0.7%	238	4.2%	26.4
Total	1208	100%	5722	100%	

- UK Equity Unit-linked Personal Pension FundID Database
- UK Equity Unit Trust/OEIC Fund Size Database
- UK Equity Unit-Linked Personal Pension Fund Size Database
- UK Equity Unit Trust/OEIC FundID Fund Size Database
- UK Equity Unit-Linked Personal Pension FundID Fund Size Database

The UK Equity Unit Trust/OEIC Surviour-Bias-Free and UK Equity Unit-linked Personal Pension datasets restricts each fund in their respective samples to one primary share class/unit and one FundID only. The datasets therefore proxy the underlying portfolios for unit trust/OEICs and unit-linked personal pensions where only one return series per underlying fund is permitted. Details of the construction of these datasets is given in Sections 4.2 and 4.3 respectively.

Although the UK Equity Unit-linked Personal Pension dataset restricts each fund to only one primary share class/unit and one FundID some of the personal pension funds have a shared underlying portfolio with a unit trust/OEIC as previously discussed and emphasised in Figure 3.3. For the UK Equity Unit-linked Personal Pension FundID Database I identify those unit-linked personal pensions that also have a unit trust with the same FundID, a proxy for the underlying portfolio, and those that just have a personal pension in their FundID. In the former the fund flows for those pension funds are not restricted as the underlying portfolio fund manager also has fund flows from a unit trust/OEIC whereas in the latter fund flows should be more restricted as fund flows are only from a personal pension fund. This decomposition of personal pension funds based on FundID, where FundID is a proxy for the underlying portfolio structure, should allow a more rigorous test of Berk and Green (2004). Details for the construction of this dataset is given in Section 4.5.

Whilst the empirical test of Berk and Green (2004) using performance persistence tests is based on assumption that there are restricted fund flows in personal pensions

in comparison to unit trusts/OEICs Chapter 7 directly analyses the performance fund flow relationship for both UK equity unit trusts/OEICs and UK equity unit-linked personal pensions. The UK Equity Unit Trust/OEIC Fund Size Database essentially consists of those funds from the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database which have fund size data available. Likewise, the UK Equity Unit-Linked Personal Pension Fund Size Database consists of those funds from the UK Equity Unit-linked Personal Pension Database which have fund size data available. These datasets allow the performance flow relationship for unit trusts/OEICs and unit-linked personal pensions to be examined.

In addition to the performance persistence tests Chapter 7 proposes another empirical test of Berk and Green (2004) using actual fund flows from the FundID fund size databases. The UK Equity Unit Trust/OEIC FundID Fund Size Database consists of those unit trusts/OEICs where fund size data is available and the FundIDs only contain a unit trust/OEIC with only one unit/share class. In effect the fund size therefore proxies for underlying portfolio size. Likewise, the UK Equity Unit-Linked Personal Pension FundID Fund Size Database consists of those unit-linked personal pension funds where fund size data is available and the FundIDs only contain a unit-linked personal pension with only one unit/share class. More details for the construction and rational of the fund size datasets are given in Section 4.7.

Chapter 4

Data and Database Construction

4.1 Returns Data

I obtain returns data for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions primarily from S&P Micropal[1]. Throughout this thesis the main focus is on the performance of the fund manager through their stock selection and market timing skills and not the actual return to the investor after taxes and fund fees/charges have been deducted. For this reason the returns for unit trusts/OEICs and unit-linked personal pensions are calculated on a monthly basis over the sample period January 1980 to December 2007 based on bid-bid[2] prices gross of tax. The returns therefore proxy the actual return due to the fund manager's investment decisions rather than the net return to an investor which depends on their specific tax situation, fund management fees/charges and bid-ask spreads. The only exception to this is for the dead unit trusts/OEICs where only net returns are available. Whilst this needs to be taken into consideration when directly comparing performance of unit trusts/OEICs and unit-linked personal pensions Keswani and Stolin (2008) highlight the impact using net or gross returns has on performance. Keswani and

[1]For UK equity unit trusts/OEICs I also use other sources as discussed in detail in Section 4.2.
[2]For OEICs where single pricing is employed return calculations are based on mid-mid prices.

Stolin (2008) run their performance tests using both net and gross returns and find that on average the difference in performance from using net returns is only about 5 basis points lower per month than gross returns. Further details for the calculation of returns in S/P Micropal can be found in Quigley and Sinquefield (2000).

4.1.1 Survivorship Bias

Unit Trusts/OEICs

Survivorship bias is a particularly important issue in fund performance studies due to the large number of funds that cease to exist over time either through liquidations or mergers. In the US an important milestone in mutual fund research was the creation of the CRSP Survivor-Bias-Free Mutual Fund Database which was originally developed by Mark Carhart in 1995 for his doctoral dissertation at the University of Chicago. The database has been developed and maintained by CRSP and offers researchers data on the universe of both live and dead US mutual funds. Thus the CRSP Survivor-Bias-Free Mutual Fund Database allows researchers to undertake analysis of fund performance without the problem of survivorship bias and its existence and availability in part explains the prominence of performance and performance persistence studies centered on US mutual funds. In the UK a comparable dataset to the CRSP Survivor-Bias-Free Mutual Fund Database for UK unit trusts/OEICs is not available. Over the past 30 years only a handful of academic studies[3] have been based on UK unit trusts/OEICs due to the problem of accessing a survivor-bias-free dataset. Commercial databases that provide information on UK unit trusts/OEICs generally only provide returns data on funds that are currently in existence, presumably based on the assumption that the primary user will be an active investor who generally only needs information on potential current investments

[3]For example see Quigley and Sinquefield (2000), Blake and Timmermann (1998), Fletcher and Forbes (2002) and Cuthbertson et al. (2008).

for their portfolio. Funds that were once in existence but have died are generally not included in commercial databases as they are not part of the investment opportunity set and this creates a survivorship bias when cross sectionally analysing funds over time.

Unit trusts/OEICs are generally part of a fund family/complex and consistently poorly performing funds are generally merged into a successful fund in the fund complex. This allows the fund family to keep the assets under management from the poorly performing fund whilst at the same time burying its poor performance record. At the extreme, as highlighted by Malkiel (1995), fund families may start a number of new funds at the same time under different fund managers with the view to identify the most successful funds and merge the worst performing funds. This allows the fund complex to aggressively market their funds which have a strong past performance record and bury the past performance record of the worst performing funds that were subsequently merged. If fund families do this on a regular basis datasets based on surviving funds only will tend to have higher performance figures as the excluded non-surviving funds are often the worst performers.

Brown and Goetzmann (1995) estimate the difference in raw returns between an equally weighted sample of all funds and non-surviving funds to be 0.8% a year. Similar estimates are found in Grinblatt and Titman (1992) and Malkiel (1995). When value weighted the difference is much smaller indicating that the main cause of survivor-bias are small funds that perform poorly and cease to exist through a merger or liquidation. I address the important issue of survivor-bias in this thesis by creating a dataset of fund returns for UK equity unit trust/OEICs that is essentially survivor-bias-free. Details of the construction of the dataset are given in Section 4.2.

Unit-Linked Personal Pensions

Whilst the level and importance of survivor-bias in mutual funds is well documented for unit-linked personal pension funds survivor-bias is less of an issue. Due to the long term nature of personal pensions any personal pension funds closed to new investors are in effect still in existence and are still reported in S&P Micropal. Liquidations for unit-linked personal pensions are also negligible as the funds held by unit-linked personal pensions are actually held under trust by a trustee for the benefit and security of the unit holders until retirement. Thus the money invested in the fund is not available to the creditors of the personal pension provider and is not at risk by the provider going into liquidation. Exceptions to this could only be due to illegal financial activities by the pension provider/fund manager. These cases are rare and if they do occur are highly publicised in the media. Since S/P Micropal includes data on personal pensions closed to new investors and liquidations are very rare a large proportion of the survivor-bias in mutual funds is accounted for in the personal pension dataset. However, I have no data on the frequency of mergers between unit-linked personal pension funds across my 28 year sample period. The UK Equity Unit-Linked Personal Pension dataset that I create in this thesis can therefore be viewed as approximately survivor-bias-free with an unmeasurable but estimated small survivor-bias due to potential mergers between personal pension funds.

4.1.2 Investment Objectives

Typically unit trusts/OIECs and unit-linked personal pensions are categorised by their investment objectives, also known as investment sectors. The returns data in this thesis for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions are based on the investment objectives of UK All Companies, UK Equity

Income and UK Smaller Companies[4]. Since I use fund returns data from a commercial database it is biased towards active investors concerned primarily with the current investment opportunity set available to them. This bias towards active investors can be problematic for research requiring historical data as some of the data variables are considered as fixed even when they are time varying. For example fund sector data in S&P Micropal only gives the current fund sector without consideration of whether funds change sectors over time. A current equity fund could have potentially been in another sector such as fixed income but over time changed focus and moved into an equity sector. Using only the current sector information, which would indicate an equity focus, would be misleading since part of the return time series is under a fixed income rather than an equity objective. As S&P Micropal does not record a time series for fund sector history I do not know precisely the extent to which funds change sectors over time. This highlights the need for a comprehensive database available to researchers where all data variables are treated as time varying. From the information I do have available funds changing sector is not viewed as a frequent occurrence although it does happen for a small number of funds. When fund sector changes do occur it is more likely to be within the same asset class rather than changing focus entirely e.g. UK Equity Income (equity sector) to UK All Companies (equity sector). For the analysis I conduct at the entire equity sample level fund sector changes within equity classes are irrelevant. Where fund sector changes are known the time series of returns for the fund are included only in the relevant equity sector/s.

In addition to the issue of funds changing sectors, fund sectors themselves have not been constant over time. Prior to 1999 the UK All Companies sector did not exist. Funds with a similar objective as UK All Companies would have been in either UK Growth or UK Growth and Income before the AUTIF merged these two sectors to form UK All Companies in 1999. I include funds that are classified as UK Growth

[4]See Section 3.1.1 for more information on investment objectives.

and UK Growth and Income prior to 1999 as part of the UK All Companies sector.

4.1.3 Tracker Funds

The UK All Companies sector for both unit trusts/OEICs and unit-linked personal pensions includes index/tracker funds. I exclude passively managed index/tracker funds, where managers simply track and mirror the market's performance, as I am primarily interested in fund manager performance via stock selection ability and market timing skills. Excluding index/tracker funds is standard in the literature for research motivated by analysing active fund management, see Cuthbertson et al. (2008).

I identify index/tracker funds for both unit trusts/OEICs and unit-linked personal pensions using two methods. Initially I use Morningstar Direct to filter the funds as it contains a data variable that indicates whether or not a fund has an index/tracker objective. This method is sufficient to identify most of the index/tracker funds with the main exception being the dead funds not included in the Morningstar Direct database. For the dead funds a second method is employed where I identify index/tracker funds by inspection of the fund name. If the fund name contains the terms 'index' or 'tracker' or any abbreviation used by the database provider of the aforementioned terms such as 'Tracking', 'Trk' or 'Indx' then I drop them from the sample. I test this method for robustness by examining the names of the tracker funds identified by Morningstar Direct, where virtually all funds identified contain within the fund name a term or abbreviated term that indicates that it is an index/tracker fund. Thus, the sample I use for both unit trusts/OEICs and unit-linked personal pensions consists of actively managed funds only. The only potential exceptions are index/tracker funds that died during the sample period, are not part of the Morningstar Direct database and have fund names that do not indicate that it is an index/tracker fund. However, in consideration of the aforementioned process

I use to identify index/tracker funds the probability and significance of a dead fund actually being an index/tracker fund without indicating this in its name is seen as negligible. In addition any fund that changes from being passively to actively managed during the sample would not be identifiable as the index/tracker variable is a static data point in Morningstar Direct. This again highlights the need for a comprehensive database that treats all variables as time varying.

Sections 4.2.1 and 4.3.1 detail the construction of the UK Equity Unit Trust/OEIC Survivor-Bias-Free and the UK Equity Unit-linked Personal Pension databases including the identification of tracker funds. In summary, 72 unit trusts/OEICs and 51 unit-linked personal pensions are identified as index/tracker funds and are excluded from the analysis. There are relatively few index/tracker funds in comparison to the number of non index/tracker funds in the final samples for both UK equity unit trusts/OEICs and UK equity unit-linked personal pensions.

4.2 UK Equity Unit Trust/OEIC Survivor-Bias-Free Database

The initial S&P Micropal list of unit trusts/OEICs restricts each fund to only one unit/share class. Since units/share classes of the same fund have the same underlying portfolio, returns across units/share classes generally only differ marginally due to the different charges/fees applied to the fund and not due to the performance of the underlying portfolio. Allowing all units/share classes to be included would potentially bias the results in favour of those funds with numerous units/share classes and would not represent the underlying performance of the fund managers. US studies generally use a value weighted average of returns across share classes but since I do not have comprehensive fund size data at share class level this preferred option is not feasible. For unit trusts/OEICs the restriction of one share class/unit

per fund also results in each unit trust/OEIC in the list having a unique FundID where I use the FundID variable as a proxy for the underlying portfolio. That is to say once the restriction of one unit/share class is enforced no unit trust/OEIC shares the same FundID with another unit trust/OEIC.

4.2.1 Methodology for Database Construction

The UK Equity Unit Trust/OEIC Survivor-Bias-Free Database covers the period, January 1980 to December 2007. I obtain returns data for live and dead unit trust/OEIC funds from four sources. The returns data for funds that die prior to December 2007 are from three sources. Returns for funds that die before January 1998 are from Quigley and Sinquefield (2000), here after QS1; returns for funds that die between January 1998 and December 2003 are from Lei, Keswani and Stolin, from now on to be known as QS2; and funds that die after December 2003 are from the FSA Customer Outcomes Retailer Investments database. The returns of a dead fund therefore maybe made up of a combination of QS1, QS2 and the FSA Customer Outcomes Retailer Investments database depending on when the fund is created and subsequently dies. The returns data for live funds, as at the end of December 2007, are from S&P Micropal.

The funds that die during the period January 1980 to December 1997 are from QS1. The original QS1 sample from 1978 to 1997 contains 279 dead funds. Of these 279 dead funds, I exclude 4 funds that die before January 1980 as they are not alive at any point during my sample period, January 1980 to December 2007. I also drop 5 index/tracker funds. Thus, I include 270 dead funds from QS1 in the final dataset with all 279 dead funds from QS1 accounted for. The returns for funds that die in the QS2 sample, January 1998 to December 2003, are from one of three possible scenarios. Firstly, 43 funds are born but also die within the QS2 six year sample period. I take their returns directly from QS2. Of the 43 funds, I drop

10 index/tracker funds. Secondly, 13 funds are in existence prior to January 1998 in non equity sectors, hence are not on the QS1 list, but subsequently change into equity sectors during QS2 and then die before the end of the QS2 sample period, December 2003. For these 13 funds I only include the return series when the funds are in equity sectors. Finally, 197 funds are born prior to or in the QS1 sample period and die in the QS2 sample period, January 1998 to December 2003. For these funds the returns cover time periods in both QS1 and QS2 and so are joined together at the December 2003/January 2004 merging point of the QS1 and QS2 datasets. Of these 197 funds, I drop 15 index/tracker funds and one additional fund due to data inconsistencies. In summary, 279 funds die in QS1 and 253 funds die in QS2 of which I include 270 funds from QS1 and 227 funds from QS2 in the final database.

The main issue in the construction of the survivor-bias-free database is matching the live funds as at December 2003 from the QS2 study with the list of live funds as at December 2007 from S&P Micorpal, which I will refer to within this section as QS3 for consistency and simplicity. There are 451 live funds as at December 2003 from the QS2 list and 460 live funds as at December 2007 from the S&P Micropal QS3 list. I use the following procedures to match the aforementioned datasets:

1. I match the funds across the QS2 list as at December 2003 and the QS3 list as at December 2007 through sedol number and then cross check the fund name.

   (a) 150 funds have the same name and the same sedol number. I drop 17 index/tracker funds.

   (b) 156 funds have the same sedol number but a different fund name[5]. In all cases, for robustness I cross check the returns for each of these funds from the QS2 data against the returns from the S&P Micropal December 2007

[5]In some instances the name changes are insignificant, for example the fund name being abbreviated differently over time by S&P Micropal whilst in other cases a fund could have a completely different fund name.

data over the common overlapping time period i.e. prior to January 2004. I drop 7 funds due to the QS1 and QS2 return series being sufficiently different to cause concern. In addition I drop 15 index/tracker funds.

2. I check the remaining funds from the QS3 2007 list for start/inception dates on or after January 2004 as these are new funds that are not in existence as at December 2003 and would not be on the 2003 list.

   (a) 101 funds are created on or after January 2004 and are still alive at December 2007. I drop 2 index/tracker funds and one fund is dropped due to data inconsistencies.

3. I cross check by sedol number the remaining funds on the QS2 2003 list with the FSA Customer Outcomes Retailer Investments database to identify whether any of the funds die during the period January 2004 to December 2007.

   (a) 65 funds die due to a merger. Of these funds I drop 4 index/tracker funds and 1 fund due to inconsistencies between the return series from the FSA Customer Outcomes Retailer Investments database and QS2/QS1 over the overlapping time period i.e. prior to January 2004.

   (b) 23 funds die due to a liquidation. Of these funds I drop 3 index/tracker funds and 1 fund due to inconsistencies between the return series from the FSA Customer Outcomes Retailer Investments database and QS1/QS2 over the overlapping time period.

4. The reasons for the remaining funds on the QS2 2003 list and the QS3 2007 list are more complicated.

   (a) 7 funds on the QS2 2003 list are actually on the QS3 2007 list but change from a unit trust to a OEIC during the period January 2004 to December 2007. This change in legal structure results in a change of sedol number and explains why the two funds could not be initially matched based on

sedol number.

(b) 13 funds on the QS2 2003 list are matched to the QS3 list but the class/unit of fund advertised in the download list by S&P Micropal, which restricts each fund to one advertised class/unit only, changes during the period January 2004 to December 2007. For example, on the QS2 2003 list the income unit may be advertised but in the QS3 2007 list it may change to the accumulation unit. Since different units/classes of the same fund have different sedol numbers matching across sedol numbers is not possible. In these cases I use the returns for the funds on the QS3 list.

(c) 2 funds have both a change in legal structure (unit trust to OEIC) and also a change in class advertised.

(d) 5 funds on the QS2 2003 list are still be in existence at December 2007 but change out of equity sectors during the period January 2004 to December 2007 and hence are not on the QS3 2007 list. I include the returns for these funds up to and including the last full month they are in an equity sector.

(e) 2 funds change sedol numbers over the period January 2004 to December 2007. The reasons for their sedol changes are unknown but I match their returns from QS2 to two funds on QS3 over the overlapping time period i.e. prior to January 2004. I drop 1 index/tracker fund.

5. 4 funds are created after January 2004 and subsequently die before December 2007. Therefore these funds do not show up on either of the QS2 or QS3 lists. I identify these funds from the FSA Customer Outcomes Retailer Investments database.

There are 28 unresolved funds on the QS2 list and 29 funds unresolved on the QS3

list. Although the number of unresolved funds on QS2 and QS3 are very similar I cross check returns and no fund is identified as being the same fund across the remaining QS2 and QS3 lists. The 29 funds from QS3 have start dates prior to January 2004 and therefore if in equity sectors prior to January 2004 should be on the QS2 list. One possible scenario is that these funds are in non equity sectors at the end of the QS2 sample and subsequently transferred into equity sectors during QS2. Since I have no information to confirm this and if true to identify the exact month of sector change I drop these 29 funds from the final database. The 28 unresolved funds from QS2 are assumed to either change sedol and then die in QS3 or change out of equity sectors in QS3 with a resultant change of sedol. This would potentially explain the reason for not being able to track these funds as at December 2007. Therefore I also drop these 28 funds from the final database. Although ideally the final database would contain all funds identified as in existence and in equity sectors during the 28 year sample period, dropping these 57 funds only represents about 5% of the total funds identified. Thus the final unit trust/OEIC database is essentially survivor-bias-free and represents a close approximation to the entire universe of unit trusts/OEICs in existence during the sample period January 1980 to December 2007[6].

To the clarify the outcome of the above process Table 4.1 summarises the final UK Equity Survivor-Bias-Free Unit Trust/OEICs Database. Appendix A.3 summarises the funds from the QS2 2003 list and their relation to the funds on the QS3 2007 list and Appendix A.4 summarises the funds from the QS3 2007 list.

[6]Under the restriction of one unit/share class per fund.

Table 4.1: UK Equity Unit Trust/OEIC Survivor-Bias-Free Database

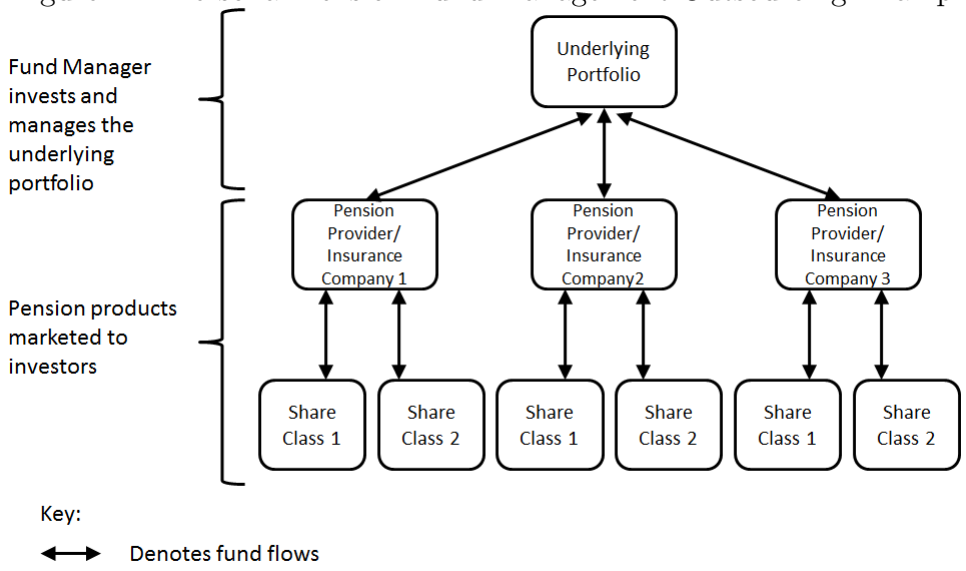
Live Funds			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
150	Same sedol and same fund name	17	133
156	Same sedol but different fund name	22	134
101	Funds born after 31 Dec 2003	3	98
13	Change of fund class advertised		13
7	Change of fund structure: UT to OEIC		7
2	Both change of structure and class advertised		2
2	Unknown reason for change of sedol	1	1
5	Moved out of equity sectors		5
			393
Dead Funds			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
279	Dead funds from QS1	9	270
253	Dead funds from QS2	26	227
92	Dead funds from QS3	9	83
			580
Total **1060**		Total **87**	Total **973**

4.3 UK Equity Unit-Linked Personal Pension Database

Unlike the unit trusts/OEICs the restriction of one unit/share class per fund for unit-linked personal pensions does not result in each fund having a unique FundID. It is not uncommon for numerous personal pension providers, who market and sell their funds separately, to use the same external fund manager to invest and manage the underlying portfolio. For these funds the performance of the fund manager and underlying portfolio are the same. Figure 4.1 illustrates a theoretical though realistic example where even with the restriction of one unit/share class per personal pension fund there still are numerous return series which are from the same underlying portfolio.

In Figure 4.1 three separate personal pension providers/insurance companies market and sell their unit-linked personal pensions separately to the general public but all have the same underlying portfolio and fund manager. This outsourcing of underlying portfolio management seems to have grown in popularity over the past decade. To further illustrate the point consider the name of the following pension,"Stan Life/Baillie Gifford UK Eq 5 Pen". Standard Life is the insurance company that markets the fund and is the pension provider to the investor but it is Baillie Gifford who invest and manage the underlying portfolio. In general it is not uncommon for there to be more insurance companies other than Standard Life who market their own funds but at the same time have the same underlying portfolio managed by Baillie Gifford. Since I am interested in the performance of the underlying portfolio it is rationale to restrict each unit-linked personal pension to 1 FundID only where I use the FundID as a proxy for the underlying portfolio. By ensuring no FundIDs are replicated in the personal pension dataset there should only be one return time series per underlying portfolio. Where various personal pensions have the same FundID I keep the fund with the earliest inception date to maximise the number of observations in the return time series.

Figure 4.1: Personal Pension Fund Management Outsourcing Example



4.3.1 Methodology for Database Construction

1. Under the restriction of 1 unit/share class per fund there are 766 UK equity unit-linked personal pensions from S&P Micropal over the sample period January 1980 to December 2007.

   (a) I drop 51 index/tracker funds from the sample.

   (b) I drop 109 inet funds. Inet stands for indicative net value and relates to a pricing methodology imposed by the ABI since 2005/06 for comparative purposes. Therefore inet funds are used for comparative pricing purposes and are not actually funds that an investor can invest in.

   (c) I drop 4 funds which have duplicated sedol numbers. The sedol number should be unique and hence I drop these funds to err on the side of caution.

   (d) I drop 2 funds with missing sedol numbers.

   (e) I drop 6 funds which have no returns data in S&P Micropal.

I follow the above procedures chronologically so the numbers applying to each category are not definitive e.g. more funds have missing sedol numbers in the data but have already been excluded due to being a tracker fund for example.

2. Using sedol numbers I merge the remaining 594 funds from S&P Micropal with Morningstar Direct FundID data.

   (a) 573 funds merge successfully and have an associated FundID that I use as a proxy to identify the underlying portfolios.

   (b) 21 funds do not merge successfully and without a FundID to identify their underlying portfolio I drop them from the sample.

3. I cross check the 573 funds that contain a FundID to identify any pension funds using the same underlying portfolio. Where more than one personal pension fund uses the same underlying portfolio the fund with the earliest inception date is chosen to maximise the number of observations in the return time series.

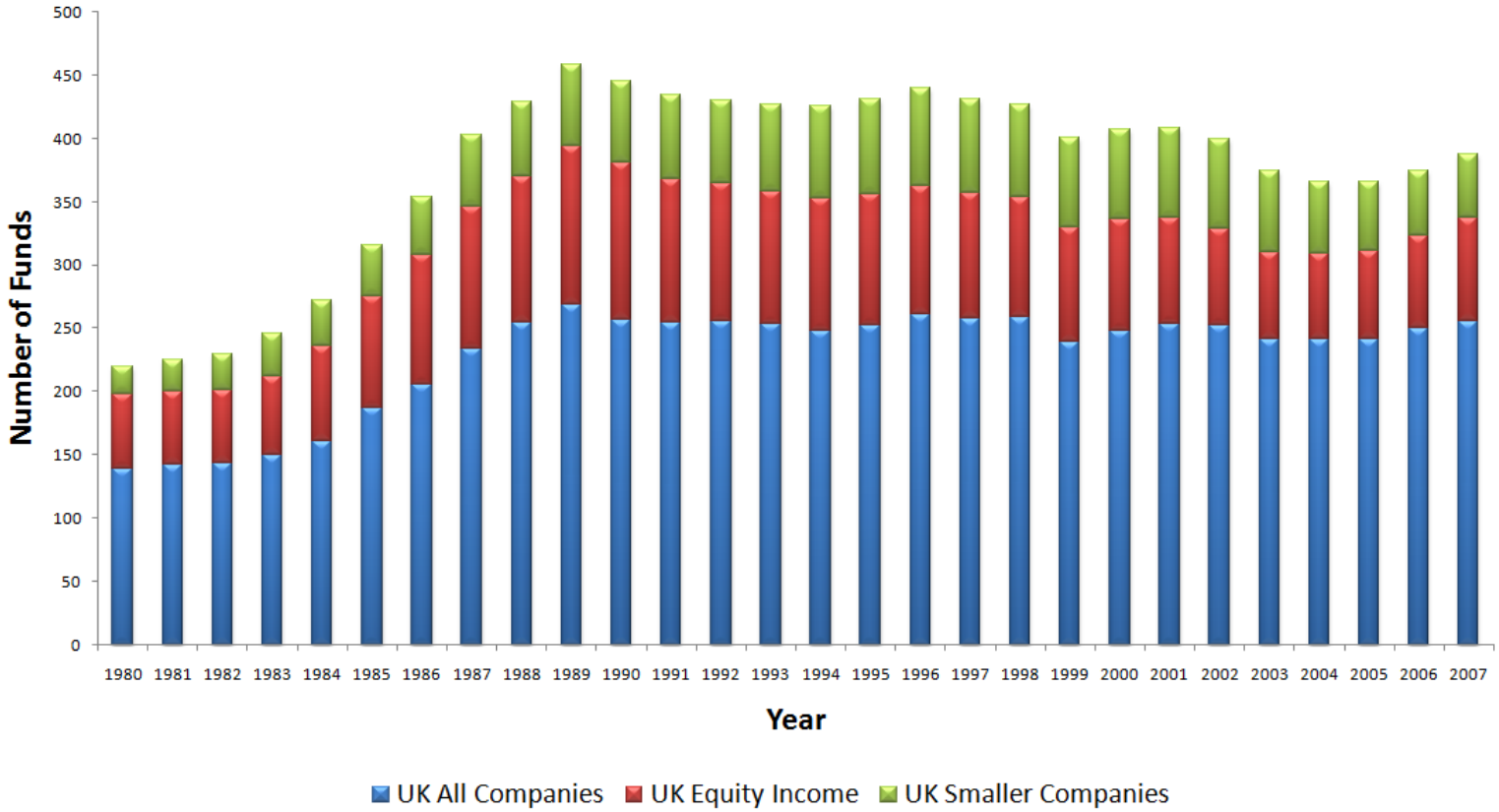
   (a) 280 funds are in the final UK equity unit-linked personal pension dataset after I restrict each pension to 1 FundID only.

Table 4.2 summarises the above process and shows the final UK Equity Unit-Linked Personal Database under the restriction of 1 unit/share class and 1 FundID per personal pension fund. Table 4.2 therefore represents a proxy for the underlying portfolios for UK equity unit-linked personal pensions where only one return series per underlying fund is permitted.

Table 4.2: Database of UK Equity Unit-Linked Personal Pension Funds

Unit-Linked Personal Pension Funds			
Initial Number of Funds	Number of Funds Dropped	Explanation for Dropping Funds	Number of Funds Remaining
766	51	Index/tracker fund	715
715	109	Inet fund	606
606	4	Duplicated Sedol	602
602	2	Missing Sedol	600
600	6	No returns data	594
594	21	No FundID	573
573	293	Only 1 FundID allowed	280
	Total **486**		Final Number **280**

Figure 4.2: Number of Live UK Equity Unit Trusts/OEICs 1980 to 2007



The number of live unit trusts/OEICs is calculated in December each year over the 28 year sample. Figure 4.2 restricts each unit trust/OEIC fund to one unit/share class and one FundID only. This implies that each fund represents a unique FundID and hence the number of funds is a proxy for the number of underlying portfolios for unit trusts/OEICs. Index/tracker funds are excluded.

4.4 Comparison of the UK Equity Unit Trust/OEIC Survivor-Bias-Free and UK Equity Unit-linked Personal Pension Databases

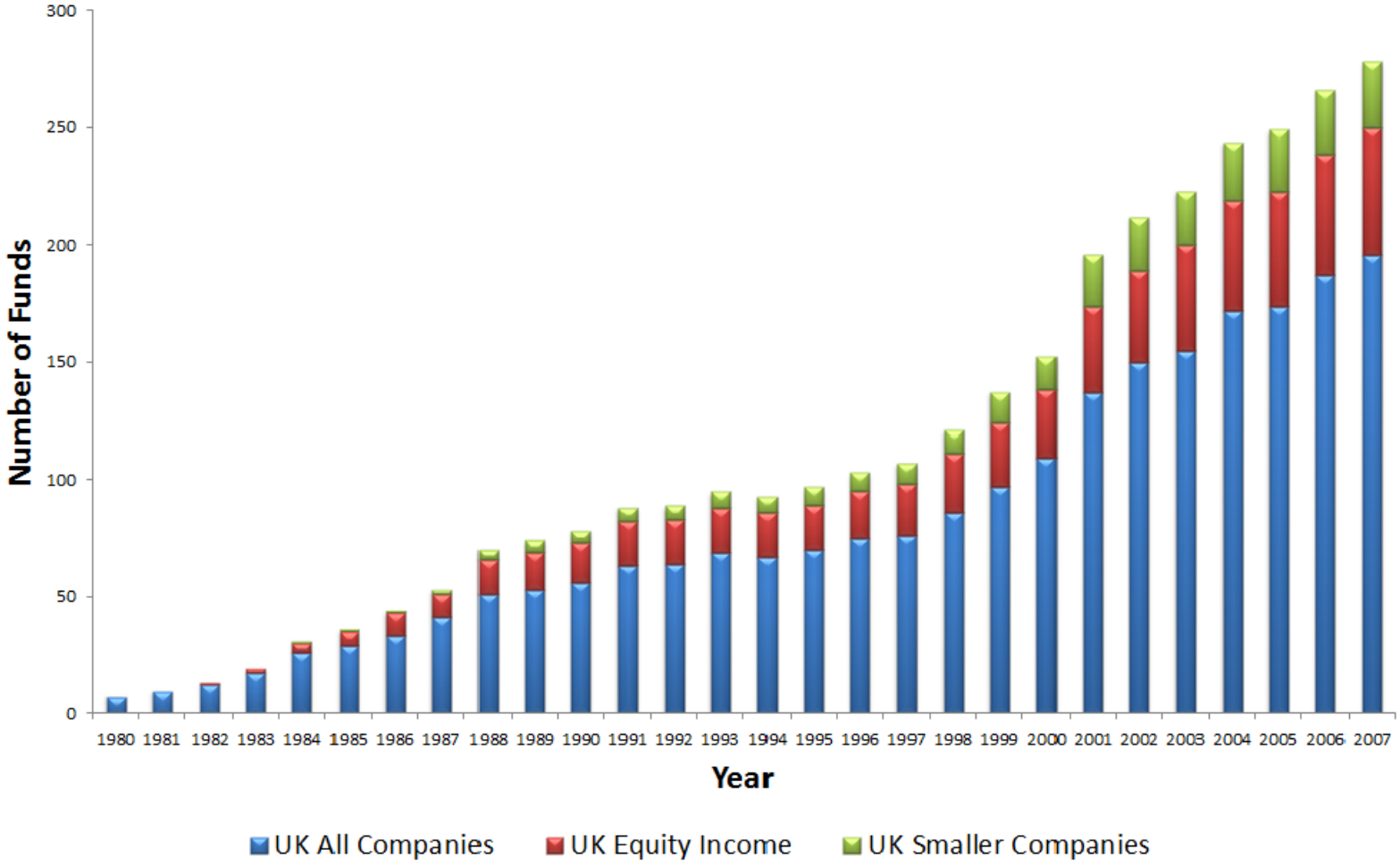
Figure 4.2 shows the number of live unit trusts/OEICs by equity sector in December of each year under the restrictions of one unit/share class and one FundID per fund only over the sample period January 1980 to December 2007. Figure 4.2 therefore represents a proxy to the underlying portfolios for UK equity unit trusts/OEICs rather than the number of all units/share classes in existence in December of each year. Figure 4.2 only shows the number of live funds in December of each year and hence the year on year changes reflect the combined effects of newly created UK equity funds entering the marketplace, funds ceasing to exist due to mergers and liquidations and funds changing sectors. Since dead funds are not explicitly shown in Figure 4.2 the number of funds does not have to increase monotonically over time. The number of unit trusts/OEICs in existence increases substantially over the 1980's. From 1980 to the end of 1989 the number of unit trusts/OEICs more than doubles from just over 200 funds in 1980. From 1990 onwards the variation in the number of unit trusts/OEICs is relatively low with an overall slight downward trend in the number of unit trusts/OEICs from 1990 to 2007. In every year during the sample UK All Companies[7] contains the most funds and always represents more than half of the total number of unit trusts/OEICs. UK Equity Income always has the second most number of funds with UK Smaller Companies always containing the least. The general pattern of unit trusts/OEICs increasing substantially over the 1980's and being relatively stable thereafter is also seen at the sector level. The relative proportions of UK All Companies, UK Equity Income and UK Smaller Companies is fairly consistent over the 28 year sample period.

[7]Prior to 1999 in Figure 4.2 UK Companies proxies for UK Growth and UK Growth and Income, the sectors in place before the AUTIF merged them together to create UK All Companies.

Figure 4.3 shows the number of UK equity unit-linked personal pension funds in December of each year over the 28 year sample period with the restriction of one unit/share class and one FundID per fund only. Figure 4.3 therefore proxies the number of unique underlying portfolios for unit-linked personal pensions. Since S&P Micropal still reports returns for closed unit-linked personal pension schemes, liquidations in personal pension funds are negligible and I have no information on merged funds Figure 4.3 by construction increases monotonically over time as newly created equity funds come into existence during the sample period. The total number of personal pensions in Figure 4.3 at the start of the sample period in 1980 is extremely small indicating the limited role personal pensions held in society at that time. There is a large relative increase in the number of personal pension funds during the 1980's particularly towards the latter part of the decade, although the absolute number of personal pension funds is still relatively small especially in comparison to the number of unit trusts/OEICs during the same period. The large relative increase in personal pension funds since the late 1980's can be linked to the 1986 Social Security Act which on the 1st July 1988 made personal pensions schemes widely available to all members of society. The introduction of personal pensions in 1988 to all members of society replaced the more restrictive retirement annuity plans which were also personal pensions but were only available to the self-employed and individuals who did not have access to an occupational pension scheme. The increase in availability of personal pensions since 1988 explains the relative increase in personal pension funds since the end of the 1980's. Since the turn of millennium the growth of personal pension funds has been large in relative and absolute terms rising from about 150 funds in 2000 to over 250 funds as at December 2007[8]. At the sector level personal pension funds exhibit very similar characteristics to unit trusts/OEICs. In every year during the sample UK All Companies is the dominant

[8]These figures are an underestimate of the true number of funds (underlying portfolios) available to investors since index/tracker funds, funds with duplicated sedol numbers, funds with missing sedol numbers and funds with no returns data in S/P Micropal are excluded.

Figure 4.3: Number of Live UK Equity Unit-Linked Personal Pension Funds 1980 to 2007

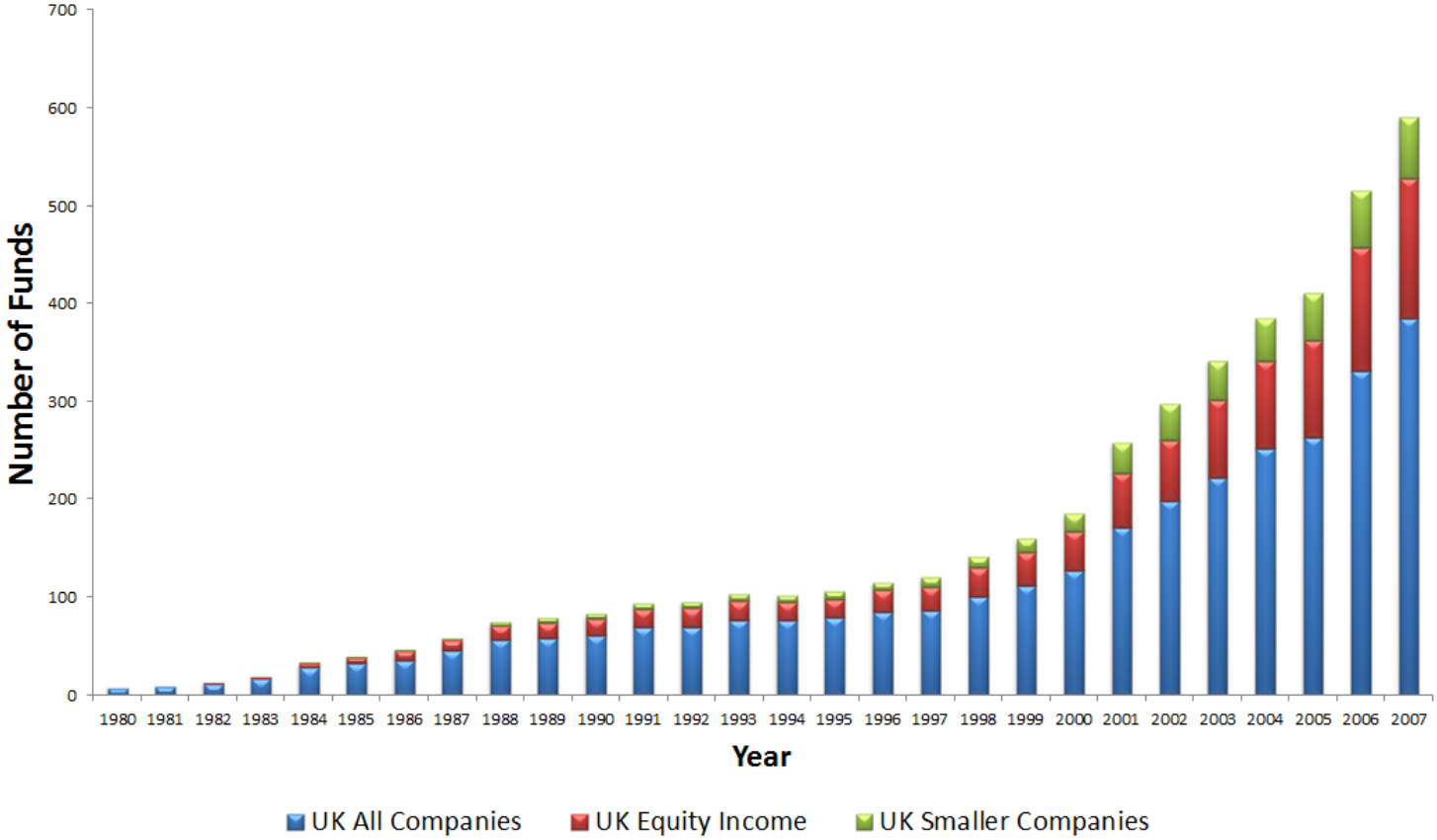


The figure restricts each unit-linked personal pension to one unit/share class. Each personal pension included must also have a unique FundID. The figure therefore proxies the number of unique underlying portfolios for unit-linked personal pensions. Index/tracker funds are excluded.

sector in terms of the number of funds in existence always representing more than half of the total number of personal pension funds, UK Equity Income always has the second most number of funds with UK Smaller Companies always containing the least. However unlike unit trusts/OEICs all of the personal pensions funds at the start of the sample are in the UK All Companies sector. From the early to mid 1980's funds start to appear in the UK Equity Income and UK Smaller sectors as the general population of personal pension funds grows.

Whilst Figure 4.3 emphasises the increase in the number of personal pension funds over the sample period it fails to highlight the fairly recent trend for different personal pension providers to use the same external fund manager and underlying portfolio. To emphasise this point Figure 4.3 is reproduced in Figure 4.4 but without the restriction that each fund has to have a unique FundID and hence a unique underlying portfolio. In Figure 4.4 there are just under 600 personal pension funds at the end of the sample in 2007 whereas in Figure 4.3 there are only around 280 funds. The huge difference between the number of funds in Figures 4.3 and 4.4 at the end of the sample is due to Figure 4.3 restricting each fund to having a unique FundID. It seems a common occurrence from around 2000 onwards for different pension providers, who are generally insurance and life companies, to offer investors personal pension products that use the same underlying portfolio and fund manager as other pension providers. Thus whilst the universe of potential personal pension products since around 2000 has grown rapidly the actual universe of underlying portfolios that investors can invest in through personal pensions has not grown at the same rate. Prior to 2000 the differences between the number of funds in Figures 4.3 and 4.4 are minimal indicating that different personal pension providers using the same external fund manager and underlying portfolio is a fairly recent trend in the industry. For unit trusts/OEICs this is not an issue as each unit trust/OEIC once restricted to one unit/share class per fund has its own underlying portfolio.

Figure 4.4: Number of Live UK Equity Unit-Linked Personal Pensions 1980 to 2007



The figure restricts each unit-linked personal pension to one unit/share class only. Due to the nature/structure of the unit-linked personal pension industry the FundID for each personal pension may not be unique even with the restriction of one unit/share class only per fund. This implies that there are more personal pension funds in the diagram than unique underlying portfolios i.e. some funds, although from different pension providers, have the same underlying portfolio. Figure 4.4 excludes index/tracker funds, inet funds, funds with duplicated sedol numbers, funds with missing sedol numbers and funds with no returns data in S/P Micropal.

Table 4.3: Descriptive Statistics for UK Equity Unit Trusts/OEICs and UK Equity Unit-Linked Personal Pensions 1980 to 2007.

	Entire Sample UT	Entire Sample PP	UT $\geq$ 20 months	PP $\geq$ 20 months	UT 336 months	PP 336 months
Mean	1.05%	0.84%	1.05%	0.85%	1.21%	1.07%
Std. Dev.	4.86%	4.33%	4.86%	4.35%	4.51%	4.44%
Distribution of returns:						
10%	-4.83%	-4.77%	-4.83%	-4.80%	-4.42%	-4.48%
25%	-1.32%	-1.24%	-1.32%	-1.26%	-1.01%	-1.00%
50%	1.41%	1.37%	1.42%	1.40%	1.59%	1.56%
75%	3.79%	3.31%	3.80%	3.33%	3.82%	3.72%
90%	6.41%	5.40%	6.42%	5.42%	6.31%	5.79%
Obs.	123,915	36,705	122,854	36,156	5,040	1,344
No. of schemes	973	280	882	252	15	4

The descriptive statistics are based on the restriction of one unit/share class and one FundID only in each of the respective samples for unit trusts/OEICs and unit-linked personal pensions. The funds therefore represent a proxy for the underlying portfolios. Index/tracker funds are excluded. UT is used in the table to imply both unit trusts and OEICs. UT $\geq$ 20 months and PP $\geq$ 20 months implies that each fund has greater or equal to 20 monthly returns in the dataset.

Table 4.3 shows the raw returns for UK equity unit trusts/OEICs and unit-linked personal pensions over the entire sample period January 1980 to December 2007. The average raw monthly return for unit trusts/OEICs is 1.05% compared to 0.84% for unit-linked personal pension funds. The variation in the returns distribution is also higher for unit trusts/OEICs in comparison to unit-linked personal pensions when comparing the monthly standard deviation of returns and the range in the distribution of returns. Whilst unit trusts/OEICs have on average a higher raw monthly return than unit-linked personal pensions it does not necessarily imply greater skill by unit trust/OEIC managers. It could be that unit trust/OEIC managers on average hold riskier portfolios, where risk is defined by an asset pricing model, and are rewarded with higher average returns for bearing more risk. It is for this exact reason that all tests in this thesis for fund manager performance and performance persistence are based on risk adjusted returns. For an excellent critique of the problems arising from using raw returns rather than risk adjusted returns in fund performance and performance persistence tests see Blake and Timmermann (2002). In addition a larger proportion of the returns for personal pension funds are concentrated in the latter part of the sample period in comparison to unit trusts due to the relatively small number of personal pension funds in existence at the beginning of the sample and the vast number of non-surviving unit trusts/OEICs from the 1980's and 1990's. Since the average raw returns during the 1980's and 1990's is in general higher than the latter part of the sample period the differences in raw returns between unit trusts/OEICs and unit-linked personal pensions is in part due to unit trusts/OEICs having more observations in the more prosperous parts of the sample period.

The average raw monthly return of 1.05% for unit trusts/OEICs is similar but lower than the average raw returns reported by Blake and Timmermann (1998) for the UK equity unit trusts in their 1972 to 1995 sample. Quigley and Sinquefield (2000) also have comparable figures for UK equity unit trusts but like Blake and Timmermann

(1998) the raw returns in their 1978 to 1997 sample are slightly higher than 1.05%. The average raw monthly return of 0.84% for unit-linked personal pension funds is comparable to Gregory and Tonks (2004) who find an average monthly raw return for UK equity unit-linked personal pensions of 1.1% over their sample period 1980 to 2000. For both UK equity unit trusts/OEICs and unit-linked personal pensions the previous literature generally finds higher average raw returns than found in this research. This again suggests that the relatively poor performance of UK equities in the later part of the 1980 to 2007 sample causes the sample average to decrease in comparison to earlier studies.

For the performance and performance persistence tests I require that each fund consists of a minimum of 20 monthly returns to aid statistically meaningful analysis. The descriptive statistics with and without the restriction of a minimum of 20 monthly returns do not deviate significantly from each other as can be seen from Table 4.3. Whilst enforcing a restriction on the minimum number of observations may reduce estimation error it also potentially creates a survivorship bias. However, Kosowski et al. (2006) estimate that the survivor-bias induced by dropping funds with less than 60 observations is only 20 basis points per year. Wermers (1999) also examines the survivor-bias caused by setting a minimum threshold on the number of observations required to be part of the analysis and find similar results to Kosowski et al. (2006). Therefore requiring each fund to have greater than or equal to 20 monthly returns should not have any significant economic consequences.

Both the unit trusts/OEICs and personal pension funds that are in existence throughout the entire 28 year sample have higher average raw monthly returns than for funds who have not been in existence for the entire sample period. Unit trusts/OEICs that have been in existence for all 336 months in the sample have an average raw monthly return of 1.21% and unit-linked personal pensions have an average raw monthly return of 1.07%. As the data used to calculate these raw monthly averages is cotermi-

nous they are directly comparable. Since consistently poorly performing funds face the threat of liquidation or a merger it is not that surprising that funds that have been in existence and survived the entire sample period have higher average raw returns. The unit trusts/OEICs in existence for the entire sample period by definition contains only surviving funds and their superior raw performance is consistent with Blake and Timmermann (1998) who find that surviving funds have an average survivor premium of 20 basis points per points in comparison with non-surviving funds when using coterminous data.

Table 4.4 shows the average raw monthly returns over the entire sample period at the sector level. For both unit trusts/OEICs and unit-linked personal pension funds the UK Equity Income sector has the highest average raw return, UK Smaller Companies has the next highest level of average raw performance with UK All Companies having the smallest average raw monthly return. In all three equity sectors unit trusts/OEICs consistently have higher average raw returns when compared with unit-linked personal pensions. In comparison Blake and Timmermann (1998) find that the UK Smaller Companies sector has the highest average mean monthly return although the difference between the average raw return on the UK Smaller Companies and UK Equity Income is small.

As previously mentioned, when comparing Tables 4.3 and 4.4 we need to be cautious in our conclusions since the returns are raw and not risk adjusted and the returns are not coterminous and may reflect a higher weighting of observations in more economically prosperous times in the UK equities market. In addition comparisons between raw returns in Tables 4.3 and 4.4 need to acknowledge that the underlying portfolio for some of the unit trusts/OEICs and unit-linked personal pensions are the same and hence the performance of the fund manager is the same.

Table 4.4: Descriptive Statistics by Investment Objective for UK Equity Unit Trusts/OEICs and UK Equity Unit-Linked Personal Pensions, 1980 to 2007.

	UT UK All Companies	PP UK All Companies	UT UK Equity Income	PP UK Equity Income	UT UK Smaller Companies	PP UK Smaller Companies
Mean	1.02%	0.84%	1.12%	0.88%	1.04%	0.85%
Std. Dev.	4.76%	4.32%	4.57%	4.02%	5.64%	5.22%
Distribution of returns:						
10%	-4.81%	-4.80%	-4.53%	-4.55%	-5.32%	-5.55%
25%	-1.30%	-1.28%	-1.12%	-0.91%	-1.78%	-1.91%
50%	1.41%	1.41%	1.46%	1.38%	1.36%	1.40%
75%	3.73%	3.33%	3.75%	3.13%	4.18%	4.01%
90%	6.28%	5.37%	6.26%	5.05%	7.28%	6.51%
Obs.	74,567	25,874	29,585	7,125	18,629	3,157
No. of schemes	570	176	193	50	121	26

The descriptive statistics are based on the restriction of one unit/share class and one FundID only in each of the respective samples for unit trusts/OEICs and unit-linked personal pensions. Each fund has ≥ 20 monthly returns. Index/tracker funds are excluded. UT is used here to imply both unit trusts and OEICs. UT's add up to 884 across investment objectives, two more than the 882 for the entire sample, due to funds changing between equity sectors.

4.5 Underlying Portfolio Structure

My empirical test of the Berk and Green (2004) model of mutual fund flows is based on the assumption that the flow of funds in unit-linked personal pension funds is restricted. For unit-linked personal pension funds that have an underlying portfolio which also includes a unit trust/OEIC the flow of funds is not restricted. I therefore construct a secondary dataset of personal pensions based on FundID which I use as a proxy for the composition of the underlying portfolios. Unit-linked personal pensions that have an underlying portfolio composed only of personal pension funds are assumed to have restricted underlying portfolio flows where as personal pensions that have an underlying portfolio that also includes a unit trust/OEIC should have less restricted underlying portfolio flows. Unit trusts/OEICs are assumed to have unrestricted flows as they do not have the long term inaccessible characteristics of personal pensions and so as long as the underlying portfolio has flows from a unit trust/OEIC then the rest of the underlying portfolio's structure is not of concern.

4.5.1 Methodology for Database Construction

I use Morningstar Direct to analyse the composition of the FundIDs, a proxy for the underlying portfolios, for the personal pension funds in order to construct two secondary datasets which combined create the UK Equity Unit-linked Personal Pension FundID Database. The first dataset consists of underlying portfolios that consist of a personal pension/s only. The FundID data variable is a static data variable in Morningstar so I assume that underlying portfolios consisting of personal pensions only, have this underlying portfolio structure throughout their existence. The secondary dataset consists of underlying portfolio that contain a personal pension fund and at least a unit trust/OEIC. The concentration on the personal pension data rather than the unit trust/OEIC data is primarily due to survivorship issues. The UK

Equity Unit Trust/OEIC Survivor-Bias-Free Database consists of a large number of dead funds and Morningstar provides no FundID data for dead unit trusts/OEICs. If the Berk and Green (2004) model is correct I would expect more performance persistence in the underlying portfolios consisting of only personal pension funds where fund flows are assumed restricted in comparison to the underlying personal pension portfolios that also include a unit trust/OEIC. Matching the FundID variable with the UK Equity Unit-linked Personal Pension Database I identify:

1. 100 unit-linked personal pension funds that have a FundID, proxy for the underlying portfolio, that consists of personal pension funds only.

2. 129 unit-linked personal pension funds that also have at least a unit trust/OEIC as part of the underlying portfolio[9].

Table 4.5 summarises the UK Equity Unit-linked Personal Pension FundID Database. Table 4.6 shows the average raw monthly returns for the UK Equity Unit-linked Personal Pension FundID Database. Unit-linked personal pension funds who share their underlying portfolio with at least a unit trust/OEIC have an average monthly raw return of 0.80%. In comparison, unit-linked personal pension funds that do not share their underlying portfolio with any other type of collective investment vehicle apart from personal pension funds have an average raw monthly return of 0.87%. Table 4.6 also again shows little deviation between the raw return figures when a restriction of greater than or equal to 20 monthly observations is enforced.

[9]These underlying portfolio structures include (PP and UT), (PP, UT and GP), (PP, UT and LF) and (PP, UT, GP and LF), where LF is a life fund, PP is a unit-linked personal pension, UT is a unit trust/OEIC and GP is a group pension.

Table 4.5: UK Equity Unit-linked Personal Pension FundID Database

Unit-Linked Personal Pension Funds Categorised by Underlying Portfolio Structure - 1 FundID only	
Underlying Portfolio Structure	Number of funds
PP underlying only	100
PP & at least UT/OEIC underlying	129
	Total **229**

Table 4.6: Descriptive Statistics for UK Equity Unit-linked Personal Pension FundID Database 1980 to 2007

	PP Underlying Only	PP Underlying Only $\geq$ 20 months	PP & at least UT Underlying	PP & at least UT Underlying $\geq$ 20 months
Mean	0.87%	0.87%	0.80%	0.80%
Std. Dev.	4.28%	4.28%	4.40%	4.41%
Distribution of returns:				
10%	-4.67%	-4.67%	-5.00%	-5.02%
25%	-1.25%	-1.25%	-1.29%	-1.30%
50%	1.38%	1.38%	1.44%	1.45%
75%	3.32%	3.32%	3.32%	3.33%
90%	5.44%	5.44%	5.35%	5.37%
Obs.	17,806	17,802	11,703	11,467
No. of schemes	100	99	129	109

The descriptive statistics are based on the restriction of one unit/share class and one FundID only per fund and the composition of the FundID. PP underlying only implies that the FundID is composed of unit-linked personal pensions only. PP & at least UT Underlying implies that the FundID is composed of a unit-linked personal pension and at least a unit trust/OEIC (See Figure 3.4 for relevant underlying portfolio combinations). Index/tracker funds are excluded.

4.6 Factor Data

Factor data for the one, three and four factor models is readily available for US data through Ken French's website[10]. This enables researchers to have easy access to reliable data provided by prominent academic scholars and hence has resulted in numerous research papers using factor models with a US tilt. The factors consist of a market factor, a size factor, a value factor and a momentum factor. In the UK there has been limited research based on UK factor data in comparison to the US due to the lack of a comparable source for UK factor data using the Fama and French methodology. However, a recent working paper by Gregory et al. (2009) has addressed the lack of availability of UK factor data as the authors have constructed a dataset of UK factor data based on the Carhart (1997) four factor model . The factor data for the four factors is freely available for download[11] and I use this factor data for the one, three and four factor models I use throughout this thesis.

4.7 Fund Size Data

Comprehensive fund size data, especially in time series, is notoriously difficult to obtain for UK collective investment schemes. This explains the lack of academic research on fund flows in a UK setting. The exception to this is Keswani and Stolin (2008) and the author's related work on fund flows. This thesis extends the limited research in the UK on fund flows not only for unit trusts/OEICs but also for unit-linked personal pensions.

I obtain fund size data for UK equity unit trusts/OEICs from Morningstar and Defaqto. The fund size data is on a monthly basis from January 2000 to December 2007 but it is only for surviving funds. If the fund size is missing in any given month

[10] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
[11] http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php

Morningstar and Defaqto either report a missing data point or report the previous month's fund size. I therefore drop any repeated fund sizes in both the Morningstar and Defaqto datasets. The problem of repeated fund sizes due to missing data points is much more of a problem in the Defaqto dataset. There are also significantly more missing data points in Defaqto. For these reasons I use the Morningstar fund size data as the primary data series for fund size for unit trusts/OEICs. If fund size is missing in Morningstar but present in Defaqto I merge these data points into the Morningstar fund size time series.

For UK equity unit-linked personal pensions I obtain monthly fund size data from Morningstar, Defaqto and Money Management. As with the unit trust/OEIC fund size data all three data sources report the previous month's fund size if fund size is missing or a missing data point. I therefore delete any repeated fund sizes. The Morningstar fund size data is the most comprehensive but is only from January 2004 to June 2007. The Defaqto fund size data is from January 2000 to December 2007 but is less comprehensive in coverage in comparison to the Morningstar data. I generally only use Money Management as a source to cross reference fund size when needed since Money Management also obtain their fund size data from S&P Micropal and then Morningstar after the purchase of S&P Micropal by Morningstar. Hence, the Money Management data is essentially the same as the Morningstar Data although I do have Money Management data from 2000. Unfortunately Money Management rounds fund size to the nearest million so if there is a repeated fund size it is therefore impossible to distinguish between whether the fund size is missing or is in fact the same as last month's fund size when rounded to the nearest million. Rounding fund size to the nearest million, especially for smaller funds, is problematic as potentially any variation in fund size is unobservable if when rounded it gives the same fund size as the previous month. In addition the Money Management fund size data is only in hard copy and identified by fund name rather than sedol code or an equivalent identifier. For these reasons I use the Morningstar fund size data as the primary

series and merge the Defaqto data with the Morningstar series where Defaqto data is available and Morninstar data is missing. The final fund size time series for unit-linked personal pensions covers the time period January 2000 to December 2007 but the observations are predominantly located in the latter part of the sample period due to the more comprehensive Morningstar data only beginning in 2004.

Using the final fund size data for unit trust/OEICs and unit-linked personal pensions I create four new datasets.

- UK Equity Unit Trust/OEIC Fund Size Database
- UK Equity Unit-Linked Personal Pension Fund Size Database
- UK Equity Unit Trust/OEIC FundID Fund Size Database
- UK Equity Unit-Linked Personal Pension FundID Fund Size Database

I use the first two datasets to examine the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions. I use the last two datasets to perform another empirical test of the Berk and Green (2004) model of mutual fund flows. The aforementioned databases are the basis for Chapter 7 which analyses fund flows for unit trusts/OEICs and unit-linked personal pensions and their relation to Berk and Green (2004).

4.7.1 UK Equity Unit Trust/OEIC Fund Size Database

To create the UK Equity Unit Trust/OEIC Fund Size Database I merge the final unit trust/OEIC fund size time series data with the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database. The final database consists of 291 unit trusts/OEICs. This is considerably less than the number of funds in the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database due to fund size data not being available for dead funds, which is a large proportion of the UK Equity Unit Trust/OEIC Survivor-Bias-Free

Database, and fund size data not covering every fund. In addition both databases cover different time periods with the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database covering 1980 to 2007 and the UK Equity Unit Trust/OEIC Fund Size Database only covering 2000 to 2007. Hence the dead funds pre 2000 in the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database are not relevant for the UK Equity Unit Trust/OEIC Fund Size Database.

Table 4.7 shows the summary statistics for fund size and flows by year for the UK Equity Unit Trust/OEIC Fund Size Database. The fund flow calculations are based on absolute and relative measures. The absolute fund flow calculation is given in Equation 4.1

$$Flow_{it} \equiv \text{NAV}_{it} - \text{NAV}_{it-1}\,(1 + r_{it}) \tag{4.1}$$

where NAV_{it} is the total NAV (net asset value) i.e. fund size, at the time t, NAV_{it-1} is the total NAV at time $t-1$ and $(1 + r_{it})$ is the realised return on the fund between t and $t-1$ assuming all distributions are reinvested. The relative fund flow equation is given in Equation 4.2.

$$Flow_{it} \equiv \frac{\text{NAV}_{it} - \text{NAV}_{it-1}\,(1 + r_{it})}{\text{NAV}_{it-1}\,(1 + r_{it})} \tag{4.2}$$

Table 4.7 shows that the mean monthly fund size across the entire sample for unit trusts/OEICs is £305.65 million. In general the trend for average monthly fund size increases from 2000 to 2007 although the standard deviation is much greater in the 2006 and 2007 periods, presumably due to the build up of the financial crisis. The number of funds in Table 4.7 increases monotonically over time by construction due to the UK Equity Unit Trust/OEIC Fund Size Database only reporting fund

Table 4.7: Fund Size and Flow Summary Statistics for UK Equity Unit Trust/OEIC Fund Size Database

	2000	2001	2002	2003	2004	2005	2006	2007	2000 to 2007
Number of funds	200	216	235	247	264	278	291	291	291
Mean monthly fund size	260.90	249.81	223.78	232.88	271.01	326.38	377.68	420.29	305.65
S.D monthly fund size	346.26	341.75	331.89	379.71	467.16	593.03	719.92	864.21	575.82
10th percentile monthly fund size	17.64	19.40	9.85	9.32	15.55	18.94	18.38	18.13	16.17
Median monthly fund size	124.45	114.47	94.69	90.03	106.67	131.60	139.58	142.21	118.39
90th percentile monthly fund size	677.20	684.90	628.02	605.34	657.87	743.40	833.25	1002.33	740.20
Mean monthly absolute net flow	1.55	1.09	1.47	.76	-.17	2.36	.14	-.56	.74
S.D monthly absolute net flow	29.94	32.69	15.92	13.86	42.62	55.22	59.14	45.95	42.47
10th percentile monthly absolute net flow	-4.41	-7.09	-3.74	-3.42	-4.75	-6.21	-7.46	-10.41	-6.03
Median monthly monthly absolute net flow	.28	.04	.01	-.02	-.10	-.16	-.22	-.42	-.08
90th percentile monthly absolute net flow	9.26	10.00	6.79	5.42	6.14	7.62	8.91	7.52	7.53
Mean monthly relative net flow	1.92%	4.04%	6.14%	4.01%	5.42%	4.27%	1.09%	7.48%	4.37%
S.D monthly relative net flow	25.24%	55.77%	118.76%	82.32%	170.51%	84.31%	25.76%	306.07%	42.47%
10th percentile monthly relative net flow	-2.62%	-4.45%	-2.22%	-2.20%	-2.50%	-2.58%	-2.75%	-3.28%	-6.03%
Median monthly monthly relative net flow	.29%	.06%	.03%	-.03%	-.12%	-.19%	-.29%	-.51%	-.08%
90th percentile monthly relative net flow	6.03%	7.85%	6.00%	5.69%	4.72%	4.71%	3.82%	2.48%	7.53%

Fund sizes and absolute fund flows are in millions of GBP.

size for live funds. The mean monthly absolute fund flow across the entire sample is £.74 million. Over the entire sample some years have a mean monthly outflow whilst others have a mean monthly inflow. The mean monthly relative fund flow over the 8 year sample period is 4.37% and the mean monthly relative fund flow every year during the sample is always positive. Consistently positive mean monthly relative fund flows in conjunction with both positive and negative mean monthly absolute fund flows can be explained by very large funds dominating the absolute flow calculations but not the relative fund flows once absolute fund flow is measured relative to the fund size.

4.7.2 UK Equity Unit-Linked Personal Pension Fund Size Database

To create the UK Equity Unit-Linked Personal Pension Fund Size Database I merge the final unit-linked personal pension fund size data with the UK Equity Unit-linked Personal Pension Database. The UK Equity Unit-Linked Personal Pension Fund Size Database contains 211 funds which is slightly less than the number of funds in the UK Equity Unit-linked Personal Pension Database. This is mainly due to the fund size data not covering every fund. Table 4.8 displays the summary fund size and fund flow statistics by year for the UK Equity Unit-Linked Personal Pension Fund Size Database over the sample period 2000 to 2007.

The mean monthly fund size over the entire sample period is £159.86 million. Over the entire sample period the mean monthly fund size has actually decreased slightly from £204.04 million in 2000 to £179.62 million. In comparison to the unit trusts/OEICs in the UK Equity Unit Trust/OEIC Fund Size Database the average monthly fund size for unit-linked personal pensions is slightly smaller and this deviation increases over the sample period due to the increase in the average unit trust/OEIC fund size and the decrease in the average unit-linked personal pension

Table 4.8: Fund Size and Fund Flow Summary Statistics for UK Equity Unit-Linked Personal Pension Fund Size Database

	2000	2001	2002	2003	2004	2005	2006	2007	2000 to 2007
Number of funds	132	172	189	199	208	211	211	211	211
Mean monthly fund size	204.04	185.18	175.07	174.15	127.95	140.48	162.47	179.62	159.86
S.D monthly fund size	575.57	520.81	463.42	457.35	404.89	454.72	539.94	580.30	498.16
10th percentile monthly fund size	2.20	2.10	1.65	1.66	.53	.92	1.51	1.41	1.11
Median monthly fund size	23.50	17.82	13.71	17.84	7.13	7.81	9.70	13.52	10.34
90th percentile monthly fund size	523.52	451.70	491.80	501.00	276.22	305.00	370.81	420.40	346.00
Mean monthly absolute net flow	2.17	-.20	2.29	1.49	.02	1.39	-.18	.42	.67
S.D monthly absolute net flow	24.41	56.55	18.61	16.89	100.83	45.73	34.78	35.29	53.33
10th percentile monthly absolute net flow	-.66	-.86	-.33	-.47	-.38	-.39	-1.20	-1.68	-.67
Median monthly monthly absolute net flow	.07	.06	.05	.05	.01	.01	.00	-.01	.01
90th percentile monthly absolute net flow	5.20	3.93	4.31	2.63	1.25	1.13	.85	1.57	1.54
Mean monthly relative net flow	1.13%	4.49%	2.66%	41.44%	148.34%	53.40%	14.52%	16.12%	44.61%
S.D monthly relative net flow	8.64%	56.45%	44.43%	596.00%	3781.33%	2056.96%	315.91%	360.99%	1823.74%
10th percentile monthly relative net flow	-2.39%	-2.99%	-2.00%	-1.74%	-2.02%	-1.82%	-2.33%	-2.60%	-2.19%
Median monthly monthly relative net flow	.42%	.33%	.24%	.40%	.19%	.11%	-.05%	-.14%	.09%
90th percentile monthly relative net flow	5.88%	5.38%	5.06%	6.10%	6.44%	5.37%	4.35%	3.74%	5.18%

Fund sizes and absolute fund flows are in millions of GBP.

fund size. The median fund size for unit-linked personal pension is much smaller than the mean fund size indicating that the unit-linked personal pension sample includes many small personal pension funds but also some exceptionally large funds. The mean monthly absolute fund flow over the entire sample for unit-linked personal pensions is £.67 with both positive and negative mean absolute flows across the 8 year sample which is broadly similar to the unit trust/OEIC sample. The mean monthly relative fund flow across the entire sample is 44.61% which is much bigger than the unit trust/OEIC sample. However, by examining the relative fund flow figures year by year it potentially seems that some outliers with extremely large relative fund flows located in the extreme tails of the distribution dominate the mean results.

4.7.3 UK Equity Unit Trust/OEIC Pension FundID Fund Size Database

If diseconomies of scale in the Berk and Green (2004) model of mutual fund flows are at the underlying portfolio level then any empirical test of Berk and Green (2004) needs to use underlying portfolio fund flows or as close a proxy as possible. Fund size data is generally reported at the fund level and not the underlying portfolio level which is problematic for an empirical test of Berk and Green (2004) based on underlying portfolio flows. Using the FundID as a proxy for the underlying portfolio, if a unit trust/OEIC has a FundID that also includes other investment vehicles such as unit-linked personal pensions or life funds then any underlying portfolio fund flow calculation would need to have fund size data for all funds related to the FundID. Since I do not have comprehensive fund size data across all investment vehicles related to each FundID this is not possible. Also, even for FundIDs that only include a unit trust/OEIC fund size would have to be reported in a consistent manner by all fund management companies i.e. all fund sizes reported at the unit/share class

level or all fund sizes reported at the fund size level (the summation of unit/share class sizes across all units/share classes). Figure 4.5 is an example from Morningstar Direct of a FundID and its associated funds and whilst it is a relatively complex FundID in relation to the set of all FundIDs it illustrates well the problem of calculating underlying portfolio size based on FundID.

The FundID in Figure 4.5 includes various different investment vehicles including unit trusts/OEICs, unit-linked personal pension funds and life funds and their related units/share classes. For example the top funds in Figure 4.5 are just different share classes of the same OEIC. For this OEIC the fund sizes across all share classes are reported at the fund size level rather than the share class level i.e. all fund sizes are the same across share classes. The unit-linked personal pension funds in this example show that numerous different insurance companies market and sell their unit-linked personal pension products but use the same fund manager, in this case Mark Lyttleton. For example Aviva have a unit-linked personal pension with various units/share classes but they report each fund size individually i.e. at the unit/share class level. In comparison Scottish Widows report the fund size across their three units/share classes for their pension products as the same figure i.e. the fund size figure (summation of fund sizes across units/classes) rather that the unit/share class figure. In addition, in Figure 4.5 there are lots of missing fund sizes[12]. All of these problems make the calculation of the underlying portfolio size, using FundID as a proxy for the underlying portfolio, impossible. Given the problems with the fund size data on which to calculate underlying portfolio size and fund flows, using FundID as a proxy for the underlying portfolio, I propose a second best alternative to test fund flows at the underlying portfolio level for both UK equity unit trusts/OEICs and UK equity unit-linked personal pensions.

[12]Inet relates to a pricing methodology imposed by the ABI since 2005/06 for comparative purposes. Therefore inet funds are used for comparative pricing purposes and are not actually funds that an investor can invest in and therefore these inet funds in Figure 4.5 should have missing fund size data.

Figure 4.5: FundID and Fund Size Example

Fund Name	ISIN	Sector	Firm	Manager	Fund Size Date	Size	FundID	Fund Type
BlackRock UK Dynamic A Acc	GB0000709062	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
BlackRock UK Dynamic A Inc	GB0000962927	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
BlackRock UK Dynamic D Acc	GB00B583LN52	UK All Companies	BlackRock Fund Managers	Mark Lyttleton	30/04/2010	2,489,929,239.88	FSGBR050C3	OEIC
Alico/BlackRock UK Dynamic Gross Pen	GB00B5SKVF88	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton			FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic Pen	GB00B047Z235	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton	28/05/2010	1,331,253.71	FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic RA Pen	GB00B2B0QL53	(ABI) UK All Companies (Pen)	Alico	Mark Lyttleton			FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic inet Pen		(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton			FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S2 Pen	GB00B02GC437	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	9,824,636.87	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S3 Pen	GB00B02GCT82	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	958,650.90	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S5 Pen	GB00B02GDD97	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	181,283.55	FSGBR050C3	Ind Pen
Aviva/BlackRock UK Dynamic S6 Pen	GB00B101SV66	(ABI) UK All Companies (Pen)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	34,230,046.77	FSGBR050C3	Ind Pen
AXA/BlackRock UK Dyn Inet Pen		(ABI) UK All Companies (Pen)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	14,534,064.66	FSGBR050C3	Ind Pen
AXA/BlackRock UK Dyn Pen	GB00B142TH80	(ABI) UK All Companies (Pen)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	14,534,064.66	FSGBR050C3	Ind Pen
BlackRock DC UK Dynamic D Pen	GB0031367534	(ABI) UK All Companies (Pen)	BlackRock Pensions	Mark Lyttleton	31/03/2010	3,967,762.88	FSGBR050C3	Ind Pen
CIS/BlackRock UK Dynamic Pen	GB00B11TDK35	(ABI) UK All Companies (Pen)	Co-operative Insurance Society Ltd	Mark Lyttleton			FSGBR050C3	Ind Pen
FP/BLK UK Dynamic Inet Pen		(ABI) UK All Companies (Pen)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton			FSGBR050C3	Ind Pen
FP/BLK UK Dynamic Pen	GB00B0692376	(ABI) UK All Companies (Pen)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	11,262,226.91	FSGBR050C3	Ind Pen
HLL/BlackRock UK Dynamic Pen	GB00B1SRVX91	(ABI) UK All Companies (Pen)	The Hartford	Mark Lyttleton			FSGBR050C3	Ind Pen
L&G/Pen BlackRock UK Dynamic	GB00B0Z1MB28	(ABI) UK All Companies (Pen)	Legal & General	Mark Lyttleton	31/12/2009	10,535,056.92	FSGBR050C3	Ind Pen
LV=/BlackRock UK Dynamic 2 Pen		(ABI) UK All Companies (Pen)	Liverpool Victoria Friendly Society	Mark Lyttleton			FSGBR050C3	Ind Pen
LV=/BlackRock UK Dynamic Pen	GB00B3Z6TV75	(ABI) UK All Companies (Pen)	Liverpool Victoria Friendly Society	Mark Lyttleton	31/10/2009	1,821,446.59	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 6 Pen	GB00B1J0ZG88	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 7 Pen	GB00B1J2R247	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
MI/BlackRock UK Dynamic 8 Pen	GB00B1J0ZZ77	(ABI) UK All Companies (Pen)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Ind Pen
Scot Eq/BlackRock UK Dyn Pen		(ABI) UK All Companies (Pen)	AEGON Scottish Equitable	Mark Lyttleton	31/05/2010	19,179,075.92	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 1 Pen	GB0030864382	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 2 Pen	GB0030864275	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Scot Wid/BlackRock UK Dyn Gr 4 Pen	GB00B17KPL58	(ABI) UK All Companies (Pen)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	160,247,584.69	FSGBR050C3	Ind Pen
Skandia/BlackRock UK Dynamic Pen	GB0005000830	(ABI) UK All Companies (Pen)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	47,261,506.88	FSGBR050C3	Ind Pen
Skandia/BlackRock UK Dynamic SP Pen	GB0033364349	(ABI) UK All Companies (Pen)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	47,261,506.88	FSGBR050C3	Ind Pen
SLFC/BlackRock Dynamic Pen	GB00B1W7VM49	(ABI) UK All Companies (Pen)	Sun Life Financial of Canada	Mark Lyttleton			FSGBR050C3	Ind Pen
Stan Life/BlackRock UK Dynamic 3 Pen	GB00B3L4C272	(ABI) UK All Companies (Pen)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Ind Pen
Stan Life/BlackRock UK Dynamic 4 Pen	GB00B3K5WC19	(ABI) UK All Companies (Pen)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Ind Pen
Windsor NM/BlackRock UK Dynamic Pen	GB00B1QH8V81	(ABI) UK All Companies (Pen)	Windsor Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic 3 Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic 4 Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Winterthur/BlackRock UK Dynamic Pen		(ABI) UK All Companies (Pen)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Ind Pen
Zurich/BlackRock UK Dynamic ZP Inet Pen		(ABI) UK All Companies (Pen)	Zurich Assurance	Mark Lyttleton			FSGBR050C3	Ind Pen
Zurich/BlackRock UK Dynamic ZP Pen	GB00B0C6J201	(ABI) UK All Companies (Pen)	Zurich Assurance	Mark Lyttleton	30/06/2009	4,840,558.61	FSGBR050C3	Ind Pen
Alico/BlackRock UK Dynamic Life	GB00B047Z011	(ABI) UK All Companies (Life)	Alico	Mark Lyttleton	28/05/2010	4,284,546.65	FSGBR050C3	Life
Alico/BlackRock UK Dynamic Net Life	GB00B5SFNP75	(ABI) UK All Companies (Life)	Alico	Mark Lyttleton			FSGBR050C3	Life
Aviva/BlackRock UK Dynamic inet Life		(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton			FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S1 Life	GB0031058059	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	2,281,767.73	FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S3 Life	GB0031044265	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	768,607.75	FSGBR050C3	Life
Aviva/BlackRock UK Dynamic S4 Life	GB0032339110	(ABI) UK All Companies (Life)	Aviva Life & Pensions UK Ltd	Mark Lyttleton	30/06/2009	31,075,906.59	FSGBR050C3	Life
AXA/BlackRock UK Dyn Inet Life		(ABI) UK All Companies (Life)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	13,992,637.85	FSGBR050C3	Life
AXA/BlackRock UK Dyn Life	GB00B142RT62	(ABI) UK All Companies (Life)	AXA Sun Life plc.	Mark Lyttleton	31/05/2010	13,992,637.85	FSGBR050C3	Life
FNW/BlackRock UK Dynamic Life	GB00B3KN8272	(ABI) UK All Companies (Life)	Fidelity FundsNetwork	Mark Lyttleton			FSGBR050C3	Life
FP/BLK UK Dynamic Inet Life		(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton			FSGBR050C3	Life
FP/BLK UK Dynamic ISA Life	GB00B0XBD338	(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	63,497.82	FSGBR050C3	Life
FP/BLK UK Dynamic Life	GB00B059V205	(ABI) UK All Companies (Life)	Friends Provident Life and Pensions Ltd.	Mark Lyttleton	28/05/2010	7,032,203.63	FSGBR050C3	Life
HLL/BlackRock UK Dynamic Life	GB00B1SRRK84	(ABI) UK All Companies (Life)	The Hartford	Mark Lyttleton			FSGBR050C3	Life
L&G/Life BlackRock UK Dynamic	GB00B0LMB128	(ABI) UK All Companies (Life)	Legal & General	Mark Lyttleton	31/01/2010	13,714,235.81	FSGBR050C3	Life
MI/BlackRock UK Dynamic 6 Life	GB00B1J0ZH95	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
MI/BlackRock UK Dynamic 7 Life	GB00B1J2R460	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
MI/BlackRock UK Dynamic 8 Life	GB00B1J10110	(ABI) UK All Companies (Life)	Merchant Investors.	Mark Lyttleton	30/04/2010	977,583.73	FSGBR050C3	Life
Scot Wid/BlackRock UK Dyn Gr Life	GB0030873458	(ABI) UK All Companies (Life)	Scottish Widows Plc	Mark Lyttleton	10/06/2010	21,888,820.94	FSGBR050C3	Life
Skandia/BlackRock UK Dynamic Life	GB0005000723	(ABI) UK All Companies (Life)	Skandia/BlackRock	Mark Lyttleton	28/05/2010	28,927,851.60	FSGBR050C3	Life
Stan Life/BlackRock UK Dynamic 1 Life	GB00B3BDGH77	(ABI) UK All Companies (Life)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Life
Stan Life/BlackRock UK Dynamic 2 Life	GB00B3BDPG93	(ABI) UK All Companies (Life)	Standard Life plc	Mark Lyttleton			FSGBR050C3	Life
Sterling/BlackRock UK Dynamic 2 Life	GB00B1WTJK45	(ABI) UK All Companies (Life)	Zurich Assurance	Mark Lyttleton			FSGBR050C3	Life
Sterling/BlackRock UK Dynamic Life	GB00B06CPM68	(ABI) UK All Companies (Life)	Zurich Assurance	Mark Lyttleton	30/06/2009	20,409,981.56	FSGBR050C3	Life
Winterthur/BlackRock UK Dynamic Life		(ABI) UK All Companies (Life)	Winterthur Life	Mark Lyttleton			FSGBR050C3	Life

For unit trusts/OEICs I create the UK Equity Unit Trust/OEIC FundID Fund Size Database where FundID proxies for the underlying portfolio. The UK Equity Unit Trust/OEIC FundID Fund Size Database includes unit trusts/OEICs that only have FundIDs that relate to a unit trust/OEIC and also only have one unit/share class. This restriction implies that fund size data is not only the fund size at the share class level but also the fund size at the fund level since each fund only has one unit/share class. Since each fund is also restricted to only containing a FundID with

a unit trust/OEIC it ensures that the fund size is also the underlying portfolio size, where FundID proxies for the underlying portfolio. Whilst this drastically limits the number of unit trusts/OEICs in the UK Equity Unit Trust/OEIC FundID Fund Size Database it ensures any fund size data on which I test Berk and Green (2004) is based on underlying portfolio size where the FundID proxies for the underlying portfolio.

Table 4.9 shows the summary statistics for the UK Equity Unit Trust/OEIC FundID Fund Size Database. There are 39 funds in the dataset with a mean monthly fund size across the entire sample of £118.55 million. In contrast to the UK Equity Unit Trust/OEIC Fund Size Database there has actually been a decline in the mean fund size across the sample. The mean fund size in 2000 is £198.32 million whereas it is £120.33 million in 2007. The mean monthly absolute fund flow across the entire sample is £.26 million with a large variation with both positive and negative mean absolute fund flows across the years in the sample which is broadly similar to the UK Equity Unit Trust/OEIC FundID Fund Size Database. The mean monthly relative fund flow across the entire sample is 3.26% with a large standard deviation and unlike the UK Equity Unit Trust/OEIC FundID Fund Size Database the mean relative fund flows over the years in the sample have been both positive and negative.

4.7.4 UK Equity Unit-Linked Personal Pension FundID Fund Size Database

For unit-linked personal pensions I create the UK Equity Unit-Linked FundID Fund Size Database where FundID proxies for the underlying portfolio. As with the unit trusts/OEICs the UK Equity Unit-Linked Personal Pension FundID Fund Size Database only includes unit-linked personal pension funds that have FundIDs that relate to personal pensions and also only have one unit/share class. This ensures that the fund size proxies for the the underlying portfolio size. Table 4.10 displays

Table 4.9: Fund Size and Flow Summary Statistics for UK Equity Unit Trust/OEIC FundID Fund Size Database

	2000	2001	2002	2003	2004	2005	2006	2007	2000 to 2007
Number of funds	28	30	33	34	36	38	39	39	39
Mean monthly fund size	198.32	139.00	95.42	79.47	85.30	115.74	142.55	120.33	118.55
S.D monthly fund size	181.62	136.28	99.82	91.03	113.07	221.78	378.99	324.31	233.32
10th percentile monthly fund size	59.67	35.96	3.97	4.88	9.08	13.43	10.58	9.19	11.58
Median monthly fund size	109.10	85.30	58.71	48.66	47.69	53.24	57.62	55.91	62.09
90th percentile monthly fund size	371.40	280.33	229.64	203.42	202.85	277.28	299.65	249.93	270.44
Mean monthly absolute net flow	-.37	-.92	-.70	-.50	.86	4.55	-.29	-1.43	.26
S.D monthly absolute net flow	35.83	16.13	7.12	2.92	20.98	97.36	9.00	15.61	39.88
10th percentile monthly absolute net flow	-5.23	-5.14	-3.27	-1.51	-1.82	-3.02	-2.94	-2.55	-2.95
Median monthly monthly absolute net flow	.03	-.09	-.17	-.15	-.24	-.23	-.27	-.22	-.19
90th percentile monthly absolute net flow	6.76	3.00	1.22	.73	.82	.99	.60	.32	1.16
Mean monthly relative net flow	.69%	-.20%	.50%	.17%	23.78%	1.13%	-.92%	-.84%	3.26%
S.D monthly relative net flow	9.56%	7.54%	12.00%	6.87%	436.28%	28.04%	7.46%	11.57%	161.93%
10th percentile monthly relative net flow	-2.45%	-5.87%	-3.70%	-2.87%	-3.03%	-3.27%	-4.18%	-3.13%	-3.34%
Median monthly monthly relative net flow	.02%	-.10%	-.30%	-.34%	-.42%	-.36%	-.51%	-.56%	-.39%
90th percentile monthly relative net flow	5.28%	4.11%	2.51%	1.74%	2.57%	2.24%	1.19%	1.31%	2.24%

Fund sizes and absolute fund flows are in millions of GBP.

the summery statistics for fund size and fund flows for the UK Equity Unit-Linked Personal Pension FundID Fund Size Database over the sample period January 2000 to December 2007. The dataset includes 34 funds with a mean monthly fund size across the entire sample of £289.10 million. The mean monthly fund size generally increases each year over the sample which contrasts to the UK Equity Unit-Linked Personal Pension FundID Fund Size Database where mean fund size decreases over the sample. The mean monthly absolute fund flow across the entire sample is £.88 million and the mean monthly relative fund flow is .96%.

Table 4.10: Fund Size and Fund Flow Summary Statistics for UK Equity Unit-Linked Personal Pension FundID Fund Size Database

	2000	2001	2002	2003	2004	2005	2006	2007	2000 to 2007
Number of funds	31	31	31	32	34	34	34	34	34
Mean monthly fund size	222.12	218.48	244.94	208.07	252.73	340.11	371.44	366.12	289.10
S.D monthly fund size	388.70	373.93	414.74	398.10	512.70	664.60	744.61	752.95	580.98
10th percentile monthly fund size	3.50	3.65	3.80	3.30	3.90	5.56	5.74	5.96	4.10
Median monthly fund size	89.25	90.25	75.89	66.70	30.03	30.89	28.34	30.59	55.40
90th percentile monthly fund size	736.00	863.45	1060.20	1060.10	1126.28	1654.35	1940.96	2030.11	1164.38
Mean monthly absolute net flow	1.48	3.82	3.21	1.64	-.97	3.39	-1.21	-2.42	.88
S.D monthly absolute net flow	8.45	92.20	9.61	8.25	136.94	101.52	8.81	9.34	74.85
10th percentile monthly absolute net flow	-1.17	-.84	-.62	-.91	-1.26	-2.90	-2.21	-6.02	-1.64
Median monthly monthly absolute net flow	.04	.09	.06	.03	.00	-.02	-.05	-.09	.00
90th percentile monthly absolute net flow	7.54	18.81	9.67	4.16	1.65	1.05	.45	.53	2.63
Mean monthly relative net flow	.58%	3.51%	.73%	.25%	.83%	1.06%	.98%	-.11%	.96%
S.D monthly relative net flow	2.57%	35.77%	2.43%	3.71%	22.06%	20.58%	21.64%	1.94%	18.96%
10th percentile monthly relative net flow	-1.09%	-1.12%	-1.09%	-1.54%	-1.42%	-1.67%	-1.37%	-1.54%	-1.39%
Median monthly monthly relative net flow	.19%	.29%	.13%	.08%	.02%	-.07%	-.14%	-.32%	.00%
90th percentile monthly relative net flow	3.12%	5.74%	2.93%	2.71%	1.93%	2.48%	1.64%	1.88%	2.47%

Fund sizes and absolute fund flows are in millions of GBP.

Chapter 5

Fund Performance

Collective investment schemes are an important investment vehicle for investors as they provide well diversified portfolios at low cost. For actively managed funds they also provide investors with the investment skill of a professional fund manager. However, actively managed funds are compensated by higher fees and therefore a key research theme of the finance literature is whether active fund managers can produce abnormal returns and if so whether the abnormal returns are passed onto the investors. Whilst the latter question is of no less importance, in this chapter I concentrate on whether fund managers of actively managed funds produce abnormal returns from their investment decisions. To empirically investigate whether fund managers produce abnormal returns from their investment decisions I concentrate on actively managed UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds using the UK Equity Unit Trust/OEIC Survivor-Bias-Free and UK Equity Unit-linked Personal Pension databases. I also assess whether there is any significant difference between the performance of UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds.

Since many of the fund managers of the unit-linked personal pension funds will also manage a unit trust/OEIC as part of their underlying portfolio I also anal-

yse the performance of unit-linked personal pension fund managers conditional on the structure of their underlying portfolio using the UK Equity Unit-linked Personal Pension FundID Database. I analyse whether there is any evidence that the performance of unit-linked personal pension fund managers who also manage an underlying portfolio that contains at least a unit trust/OEIC is significantly different from a fund manager who just manages an underlying portfolio that only contains unit-linked personal pensions. The concentration on unit-linked personal pension funds is due to FundID, a proxy for the underlying portfolio, not being available for non-surviving funds which is a large component of the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database. If there is evidence of significantly superior performance by unit trust/OEIC managers then it is important to understand why. Since the returns data are based on bid-bid prices gross of tax they represent the return due to the investment decisions of the fund manager and therefore any difference in performance should be due to a differential skill rather than differences in fees and taxation. Due to the long term nature of personal pensions any small consistent differential in performance could cause large deviations in future pension values. If unit trusts/OEICs do have significantly better performance then the pension industry and regulators need to assess why the better fund managers are attracted to unit trusts/OEICs and/or whether there are any barriers restricting the performance of unit-linked personal pension fund managers. Comparing the different in performance between unit-linked personal pension funds with a FundID that includes only personal pensions with unit-linked personal pension funds that have a FundID that includes at least a unit trust/OEIC will also provide evidence on whether the structure of the underlying portfolio potentially impacts on performance and whether more skillful managers are attracted to more complex fund structures due to the potential of larger fund flows and fund size increasing fund manager compensation.

In a UK setting Blake and Timmermann (2002) and Quigley and Sinquefield (2000) find that abnormal performance of unit trusts is not statistically different from zero.

For the equity and balanced funds in the Blake and Timmermann (2002) sample they find an average monthly alpha of -.15% on a risk adjusted basis which is not significant. Quigley and Sinquefield (2000) find little evidence of equity unit trusts outperforming the market using both a single index model and a UK based Fama and French three factor model. Cuthbertson et al. (2008) also find an average negative alpha for UK equity unit trusts/OEICs but it is not significantly different from zero. In addition to analysing the average performance Cuthbertson et al. (2008) also examine the tails of the performance distribution using a bootstrap and find few funds with positive abnormal performance but much more with negative abnormal performance after accounting for luck. Similar results are also found in Cuthbertson et al. (2010a) using the false discovery rate. Fletcher (1995) finds little evidence of positive market timing skill by unit trust managers which supports the findings of Cuthbertson et al. (2010b)[1]. This chapter will extend the literature on UK fund performance and provide empirical evidence not only the performance of UK equity unit trusts/OEICs and UK equity unit-linked personal pensions but also whether underlying portfolio structure is significant and whether there exists a differential in performance between unit trusts/OEICs and unit-linked personal pension funds.

5.1 Measuring Fund Performance

I measure the performance of unit trusts/OEICs and unit-linked personal pension funds against the single index/CAPM model, the Fama and French three factor model and the Carhart four factor model. The Carhart four factor model is shown in Equation 5.1.

$$R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt} \quad (5.1)$$

[1]For a comprehensive performance literature review see Section 2.2.2

When $\lambda_p = 0$ in Equation (5.1) the Fama and French three factor model is obtained. The CAPM model is obtained from Equation (5.1) when $\gamma_p = 0$, $\delta_p = 0$ and $\lambda_p = 0$. I test for fund performance as in Blake and Timmermann (1998) where an equally weighted portfolio of excess returns in each time period is regressed against the one, three and four factor models as in Equation 5.1. With the equally weighted portfolio method no assumptions are made about the cross-sectional relationship between fund returns. In Equation 5.1 $R_{pt} - r_{ft}$, is regressed against the four factors in Equation (5.1), where R_{pt} is the monthly equally weighted return at time t and r_{ft} is the monthly return on the risk free asset at time t. The Jensen's alpha, α_p, assesses the equally weighted portfolio's level of abnormal performance. The $(R_{mt} - r_{ft})$ variable is the excess return on the market; SMB is the size factor, which is the difference between the returns on a portfolio of small companies and the returns on a portfolio of large companies; HML is the book to market factor which is the difference in returns between a portfolio of high book to market companies and low book to market companies and MOM is the one year momentum factor portfolio originally cited in Jegadeesh and Titman (1993). The factor data I use in this research is obtained from Gregory et al. (2009) and is available to freely download at the Xfi Centre for Finance and Investment's website[2]. The four factors are used as a strategy that is practically implementable as a zero investment portfolio and one that an investor would expect their fund manager to outperform particularly in consideration of the compensation of managers in the fund management industry. Here the four factor model will not be used to infer or critique how appropriate the model is to measure risk factors but I will simply use it as a stringent benchmark against which to assess fund manager performance.

[2]http://xfi.exeter.ac.uk/researchandpublications/portfoliosandfactors/index.php

5.1.1 Market Timing

The factor models in the form of (5.1) primarily test the stock picking skill of the fund manager. Another important aspect of fund manager skill that needs to be considered is their market timing ability. In these tests the emphasis is on whether the fund manager can time the market rather than whether the fund manager can factor tilt their portfolios for the other factors. Although the funds under analysis in this research are confined to UK equity severely restricting the asset allocation decision the manager can still time the market by investing in high beta stocks in bull markets and switching to low beta stocks in bear markets. I test for market timing using the method of Treynor and Mazuy (1966) where a quadratic term is added to the original factor models, to capture the curvature of market timing, as shown in Equation 5.2.

$$R_{pt}-r_{ft} = \alpha_p+\beta_p\left(R_{mt}-r_{ft}\right)+\gamma_p SMB_t+\delta_p HML_t+\lambda_p MOM_t+\eta_p\left(R_{mt}-r_{ft}\right)^2+\varepsilon_{pt} \tag{5.2}$$

A positive and significant γ indicates evidence of market timing by the fund manager. As with the previous tests I use an equally weighted portfolio approach to test for stock selection skills and market timing abilities of the fund managers.

5.1.2 Conditional Beta

Ferson and Schadt (1996) extend the general factor models to assess the ability of fund managers to add value through private market timing skill. Ferson and Schadt (1996) develop a conditional beta model where a fund's factor betas depend on lagged publicly available information. I use conditional beta models across the single, three and four factor models to distinguish between the private market timing

skills of fund managers and timing skills derived from predictable market or factor movements. The conditional beta model based on the single index (CAPM) model is as follows

$$R_{pt} - r_{ft} = \alpha_p + \beta_{0p} \left(R_{mt} - r_{ft} \right) + \beta'_{1p} \left[Z_{t-1} \left(R_{mt} - r_{ft} \right) \right] + \varepsilon_{pt} \tag{5.3}$$

where Z_{t-1} is a vector of lagged information available at time t. For the vector of lagged macroeconomic variables widely available to investors at time $(t-1)$ I use the lagged three month UK treasury bill yield from Datastream, the FTSE All Share dividend yield from LSPD, the lagged term structure (ten year UK gilt yield minus the three month UK treasury bill yield) and a dummy variable for January. In addition to the conditional version of the single index model I also assess fund performance using conditional models for the Fama and French three factor model and the Carhart four factor model. I also test for market timing in the conditional beta model by adding the quadratic term from Treynor and Mazuy (1966) to Equation 5.3 which allows a separation between the public and private information used by a fund manager in market timing. I also test market timing for the conditional three and four factor models. Using the equally weighted portfolio method for conditional factor models with and without a market timing component I test for significant abnormal performance by fund managers of both unit trusts/OEICs and unit-linked personal pension funds.

5.2 Data

The returns data for the performance tests are from the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database, the UK Equity Unit-linked Personal Pension Database and the UK Equity Unit-linked Personal Pension FundID Database. Details of the construction of these datasets are given in Chapter 4. The returns for the funds in

the databases are calculated on a monthly basis over the sample period January 1980 to December 2007 based on bid-to-bid prices gross of tax and therefore represent the return to due to the investment decisions of the fund manager rather than the return of the investors after all fees and expenses have been deducted.

The UK Equity Unit Trust/OEIC Survivor-Bias-Free Database consists of 973 funds, including 393 live and 580 dead funds, and the UK Equity Unit-linked Personal Pension Database consists of 280 funds. Both of these datasets are based on the restriction that only one unit/share class and one FundID per fund is permitted. When the number of observations in the return time series is restricted to greater than or equal to 20 monthly returns to aid statistically meaningful analysis there are 882 unit trust/OEICs and 252 unit-linked personal pension funds in each sample respectively. Index/tracker funds are excluded as I am primarily interested in fund manager performance via stock selection ability and market timing. The datasets are both based on the equity investment sectors of UK All Companies, UK Equity Income and UK Smaller Companies. The datasets represent the underlying portfolios for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds.

Table 5.1 displays the descriptive statistics based on raw monthly returns for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions over the sample period January 1980 to December 2007. Index/tracker funds are excluded and each fund must have at least 20 monthly return observations. The average raw monthly return for unit trusts/OEICs is 1.05% compared to 0.85% for unit-linked personal pension funds. The variation in the returns distribution is also higher for unit trusts/OEICs in comparison to unit-linked personal pensions when comparing the monthly standard deviation of returns and the range in the distribution of returns. Although the number of observations are lower for unit-linked personal

Table 5.1: Descriptive Statistics for UK Equity Unit Trusts/OEICs and UK Equity Unit-Linked Personal Pensions 1980 to 2007.

	Entire Sample Unit Trusts/OEICs	Entire Sample Unit-linked Personal Pensions
Mean	1.05%	0.85%
Std. Dev.	4.86%	4.35%
Distribution of returns:		
10%	-4.83%	-4.80%
25%	-1.32%	-1.26%
50%	1.42%	1.40%
75%	3.80%	3.33%
90%	6.42%	5.42%
Obs.	122,854	36,156
No. of schemes	882	252

pensions a larger proportion of the observations for unit-linked personal pension are located towards the end of the sample where raw returns on average are lower than the 1980's and 1990's. This is a potential reason why the average raw return for unit trusts/OEICs is higher than the unit-linked personal pensions. It could also be due to unit trusts/OEICs holding on average riskier assets than unit-linked personal pension funds.

Table 5.2 displays the summary statistics based on raw returns for the UK Equity Unit-linked Personal Pension FundID Database. In term of raw returns there is little difference between the average raw monthly return and the distribution of returns between unit-linked personal pensions that have FundIDs only associated with personal pensions and those unit-linked personal pensions that have FundIDs associ-

Table 5.2: Descriptive Statistics for UK Equity Unit-Linked Personal Pensions 1980 to 2007 based on the Composition of FundID

	FundID - unit-linked Personal Pension Only	Fund ID - Unit-Linked Personal Pension and at Least a Unit Trust/OEIC
Mean	0.87%	0.80%
Std. Dev.	4.28%	4.41%
Distribution of returns:		
10%	-4.67%	-5.02%
25%	-1.25%	-1.30%
50%	1.38%	1.45%
75%	3.32%	3.33%
90%	5.44%	5.37%
Obs.	17,802	11,467
No. of schemes	99	109

ated with at least a unit trust/OEIC. There is also very little difference between the average raw monthly returns for the entire sample of unit-linked personal pension funds in Table 5.1 and the personal pension funds categorised by the composition of their FundID in Table 5.2.

5.3 Results

Table 5.3 displays the alphas for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds based on unconditional factor models using an equally

weighted portfolio approach as in Blake and Timmermann (1998) over the sample period January 1980 to December 2007. In general, across both unit trusts/OEICs and unit-linked personal pension funds there is very little evidence of significant abnormal performance. Unit trusts/OEICs show evidence of negative average abnormal performance which is robust to the factor model used but in almost all cases it is not statistically significant. The only exception is the significant negative performance at the 5% level by unit trusts/OEICs in the UK All Companies sector. Unit-linked personal pension funds show evidence of both positive and negative abnormal performance but the evidence is not statistically significant. Only the entire sample for unit-linked personal pension funds and the UK Equity Income sector show consistently positive abnormal returns across all factor models although again the evidence is not statistically significant. It is also interesting to highlight that although the average raw return over the entire sample period for unit trusts/OEICs is higher than for unit-linked personal pension funds the reverse is generally true on a risk adjusted basis with unit-linked personal pensions generally having higher alphas. This highlights the importance of adjusting for risk exposure and the need for coterminous data if a comparative analysis is based on raw returns.

Table 5.4 displays the alphas for the unit-linked personal pensions based on the composition of their FundID, where FundID proxies for the underlying portfolio. It also includes the alphas for the entire samples of unit trusts/OEICs and unit-linked personal pension funds from Table 5.3 to aid the comparative analysis. Table 5.4 provides similar evidence to Table 5.3. There is no evidence of abnormal performance when analysing unit-linked personal pension funds based on the composition of their FundID, a proxy for the underlying portfolio. Unit-linked personal pensions that have a FundID that only contains personal pension funds generate a higher alpha and this finding is robust across factor models. However, in general the alpha for unit-linked personal pensions with FundIDs that only contain personal pension funds is negative. Since the alpha for the entire UK equity unit-linked personal

Table 5.3: Equally Weighted Portfolio Performance Evaluation Using Jensen-alphas

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.039%	-.58	.92
	Unit Trust/OEIC	UK All Companies	570	336	-.080%	-1.47	.95
	Unit Trust/OEIC	UK Equity Income	193	264	-.027%	-.37	.92
	Unit Trust/OEIC	UK Smaller Companies	121	336	.177%	.19	.61
	Personal Pension	Entire Sample	252	336	.018%	.25	.92
	Personal Pension	UK All Companies	176	336	-.006%	-.09	.93
	Personal Pension	UK Equity Income	50	305	.105%	1.16	.86
	Personal Pension	UK Smaller Companies	26	283	-.036%	-.17	.52
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.043%	-1.07	.97
	Unit Trust/OEIC	UK All Companies	570	336	-.075%	-1.96*	.98
	Unit Trust/OEIC	UK Equity Income	193	264	-.091%	-1.61	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.116%	1.31	.91
	Personal Pension	Entire Sample	252	336	.022%	.42	.96
	Personal Pension	UK All Companies	176	336	.007%	.13	.96
	Personal Pension	UK Equity Income	50	305	.016%	.19	.90
	Personal Pension	UK Smaller Companies	26	283	.058%	.45	.84
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.065%	-1.53	.97
	Unit Trust/OEIC	UK All Companies	570	366	-.093%	-2.27*	.98
	Unit Trust/OEIC	UK Equity Income	193	264	-.076%	-1.27	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.034%	.38	.91
	Personal Pension	Entire Sample	252	336	.010%	.18	.96
	Personal Pension	UK All Companies	176	336	-.005%	-.08	.96
	Personal Pension	UK Equity Income	50	305	.044%	.47	.90
	Personal Pension	UK Smaller Companies	26	283	-.039%	-.27	.85

The four factor model is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.: $R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt}$. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda_p = 0$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the t stat in the α t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.4: Equally Weighted Portfolio Performance Evaluation Using Jensen-alphas based on the Composition of the Underlying Portfolio's FundID

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.039%	-.58	.92
	Personal Pension	Entire Sample	252	336	.018%	.25	.92
	Personal Pension	FundID - Underlying PP only	99	336	-.007%	-.12	.93
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	-.046%	-.38	.81
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.043%	-1.07	.97
	Personal Pension	Entire Sample	252	336	.022%	.42	.96
	Personal Pension	FundID - Underlying PP only	99	336	0.00%	.00	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	-.043%	-.46	.89
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.065%	-1.53	.97
	Personal Pension	Entire Sample	252	336	.010%	.18	.96
	Personal Pension	FundID - Underlying PP only	99	336	-.016%	-.30	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	-.090%	-.85	.89

The four factor model is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.: $R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt}$. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda_p = 0$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the t stat in the α t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

pension sample is positive across factor models it suggests other compositions of the underlying portfolios, proxied by the FundID, have positive alphas i.e. FundIDs that contain a unit-linked personal pension, no unit trusts/OEICs but another investment vehicle e.g. a life fund.

Tables 5.3 and 5.4 provide evidence that the UK equity market is informationally efficient. However, I only analyse the alpha on the entire sample of funds in question rather than analysing the tails of the performance distribution so we can not say that certain funds do no consistently produce abnormal returns. The evidence in Tables 5.3 and 5.4 is consistent with the findings of Quigley and Sinquefield (2000), Blake and Timmermann (1998), Cuthbertson et al. (2008) for UK unit trusts/OEICs and Gregory and Tonks (2004) for UK equity unit-linked personal pension funds.

Table 5.11 analyses the difference between the performance of unit trusts/OEICs and unit-linked personal pension funds as well as the difference between the performance of unit-linked personal pension funds that have FundIDs associated with only personal pensions and unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC. There is no evidence of differential performance that is statistically significant at the 5% level based on unconditional factor models.

Table 5.5 analyses the market timing component of fund performance using unconditional factor models. Unit trusts/OEICs show significant evidence of negative market timing which is robust across sectors and factor models. The only exception is the UK Equity Income sector where there is no significant evidence of market timing although the market timing coefficient is still negative. Unit-linked personal pension funds also show strong evidence of a negative market timing effect and the results are consistent across all factor models and equity sectors. As shown in Table 5.6 there is again statistically significant evidence of a negative market timing effect for both unit-linked personal pensions that have a FundID that only includes personal pension funds and unit-linked personal pension funds that have a FundID

Table 5.5: Equally Weighted Portfolio Performance Evaluation Using Jensen-alphas with Market Timing

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	η	η t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.047%	.66	-.37	-2.86**	.92
	Unit Trust/OEIC	UK All Companies	570	336	-.002%	-.04	-.33	-3.80**	.95
	Unit Trust/OEIC	UK Equity Income	193	264	-.005%	-.06	-.09	-.66	.92
	Unit Trust/OEIC	UK Smaller Companies	121	336	.278%	1.49	-1.05	-2.78**	.61
	Personal Pension	Entire Sample	252	336	.145%	2.11*	-.55	-5.35**	.92
	Personal Pension	UK All Companies	176	336	.103%	1.63	-.47	-5.05**	.93
	Personal Pension	UK Equity Income	50	305	.220%	2.47*	-.52	-3.76**	.87
	Personal Pension	UK Smaller Companies	26	283	.354%	1.60	-1.77	-4.12**	.54
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.008%	.20	-.23	-2.81**	.97
	Unit Trust/OEIC	UK All Companies	570	336	-.024%	-.60	-.23	-2.97**	.98
	Unit Trust/OEIC	UK Equity Income	193	264	-.056%	-.92	-.14	-1.38	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.244%	2.75**	-.57	-4.26**	.91
	Personal Pension	Entire Sample	252	336	.117%	2.29*	-.42	-4.19**	.96
	Personal Pension	UK All Companies	176	336	.086%	1.71	-.35	-3.96**	.96
	Personal Pension	UK Equity Income	50	305	.129%	1.56	-.53	-3.07**	.90
	Personal Pension	UK Smaller Companies	26	283	.349%	2.88**	-1.36	-5.00**	.86
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.013%	-.29	-.21	-2.62**	.98
	Unit Trust/OEIC	UK All Companies	570	336	-.040%	-.94	-.22	-2.80**	.98
	Unit Trust/OEIC	UK Equity Income	193	264	-.031%	-.48	-.16	-1.55	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.159%	1.81	-.51	-3.83**	.92
	Personal Pension	Entire Sample	252	336	.113%	2.06*	-.42	-4.14**	.96
	Personal Pension	UK All Companies	176	336	.082%	1.53	-.35	-3.90**	.96
	Personal Pension	UK Equity Income	50	305	.173%	1.91	-.56	-3.12**	.90
	Personal Pension	UK Smaller Companies	26	283	.265%	2.13*	-1.31	-4.91**	.86

The four factor model including the Treynor-Mazuy test for market timing is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.:
$R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \eta_p \left(R_{mt} - r_f\right)^2 + \varepsilon_{pt}$. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the η t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.6: Equally Weighted Portfolio Performance Evaluation using Jensen-Alphas with Market Timing based on the Composition of the Underlying Portfolio's FundID

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	η	η t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.047%	.66	-.37	-2.86**	.92
	Personal Pension	Entire Sample	252	336	.145%	2.11*	-.55	-5.35**	.92
	Personal Pension	FundID - Underlying PP only	99	336	.112%	1.79	-.51	-4.95**	.94
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.173%	1.55	-.99	-5.68**	.82
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.008%	.20	-.23	-2.81**	.97
	Personal Pension	Entire Sample	252	336	.117%	2.29*	-.42	-4.19**	.96
	Personal Pension	FundID - Underlying PP only	99	336	.092%	1.86	-.41	-5.13**	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.137%	1.49	-.85	-3.20**	.90
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.013%	-.29	-.21	-2.62**	.98
	Personal Pension	Entire Sample	252	336	.113%	2.06*	-.42	-4.14**	.96
	Personal Pension	FundID - Underlying PP only	99	336	.083%	1.58	-.40	-5.05**	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.100%	1.03	-.82	-3.15**	.90

The four factor model including the Treynor-Mazuy test for market timing is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.:
$R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \eta_p \left(R_{mt} - r_f\right)^2 + \varepsilon_{pt}$. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the η t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

that also contain at least a unit trust/OEIC.

The evidence of significant negative market timing for UK equity unit-trusts/OEICs is consistent with Cuthbertson et al. (2010b) and seems to be robust to the method used to evaluate market timing. For unit-linked personal pensions the evidence in Tables 5.5 and 5.6 is similar to Clare et al. (2010) who find little evidence that professional fund managers add value through market timing strategies. Tables 5.5 and 5.6 provide strong evidence that fund managers for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds cannot time the market. It suggests that investors should be cautious of funds employing market timing strategies although the evidence in Tables 5.5 and 5.6 are based on all funds in their relevant samples rather than the tails of the performance distribution and do not specifically analyse funds that claim to use market timing strategies. However, Cuthbertson et al. (2010b) address the distribution of market timing ability of UK equity unit trusts/OEICs and find that very few funds provide evidence of market timing. If an investor is to invest in an active fund the evidence suggests that they should place the emphasis on the stock picking skills of the fund manager rather than their market timing ability.

Table 5.7 displays the alphas for unit trusts/OEICs and unit-linked personal pensions based on conditional factor models as advocated by Ferson and Schadt (1996). There is very little evidence of significant abnormal performance by unit trusts/OEICs using conditional models based on the single index (CAPM) model, three factor model and four factor model. The UK Smaller Companies sector using a three factor model provides the only evidence of abnormal performance for unit trusts/OEICs with a monthly alpha of .181%. For the three and four factor models all alphas for unit trusts/OEICs are negative apart from the UK Smaller Companies sector. For unit-linked personal pension funds there is also no evidence of abnormal performance but all of the alphas are positive across all sectors and factor models. However, the

difference between the abnormal performance of unit trusts/OEICs and unit-linked personal pension funds is not significantly significant as shown in Table 5.11.

Table 5.8 again finds no evidence of abnormal performance for unit-linked personal pension funds based on the composition of their underlying FundIDs using conditional factor models. Personal pension funds that have FundIDs that include only personal pensions have positive alphas across all conditional factor models but there is no evidence they are statistically significant. The unit-linked personal pensions that have FundIDs that include at least a unit trust/OEIC have consistently lower alphas that is both positive and negative across conditional factor models but there is no evidence they are significantly different from zero. Table 5.11 also provides evidence that the difference between the abnormal return for unit-linked personal pensions that have FundIDs that include only pension funds and unit-linked personal pensions that have FundIDs that include at least a unit trust/OEIC is not significantly different from zero.

Table 5.9 shows the abnormal returns for unit trusts/OEICs and unit-linked personal pensions based on conditional factor models that include a market timing component. The coefficients for the market timing component are generally negative for unit trusts/OEICs but they are not statistically significant. This contrasts with the unconditional factor models with market timing where there is strong statistically significant evidence of a negative market timing effect. There are in fact positive timing coefficients for the entire sample of unit trusts/OEICs using three and four factor models that seems to be driven by the UK Smaller Companies Sector but the timing coefficients are not significantly different from zero. The results for unit-linked personal pension funds based on conditional factor models that include a market timing component are very similar to the unit trusts/OEICs. The market timing coefficient is negative in general but there is no evidence it is significantly different form zero. In Table 5.10 the results for unit-linked personal pension funds

Table 5.7: Equally Weighted Portfolio Performance Evaluation Using Jensen-alphas based on Conditional Models

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.003%	.04	.92
	Unit Trust/OEIC	UK All Companies	570	336	-.039%	-.73	.95
	Unit Trust/OEIC	UK Equity Income	193	336	.017%	.25	.91
	Unit Trust/OEIC	UK Smaller Companies	121	336	.143%	.81	.62
	Personal Pension	Entire Sample	252	336	.077%	1.15	.92
	Personal Pension	UK All Companies	176	336	.051%	.84	.94
	Personal Pension	UK Equity Income	50	305	.149%	1.70	.87
	Personal Pension	UK Smaller Companies	26	283	.120%	.57	.55
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.011%	-.29	.98
	Unit Trust/OEIC	UK All Companies	570	336	-.044%	-1.19	.98
	Unit Trust/OEIC	UK Equity Income	193	336	-.063%	-1.18	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.181%	2.09*	.92
	Personal Pension	Entire Sample	252	336	.068%	1.39	.96
	Personal Pension	UK All Companies	176	336	.051%	1.06	.96
	Personal Pension	UK Equity Income	50	305	.063%	.79	.90
	Personal Pension	UK Smaller Companies	26	336	.152%	1.25	.86
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.029%	-.69	.98
	Unit Trust/OEIC	UK All Companies	570	336	-.059%	-1.48	.98
	Unit Trust/OEIC	UK Equity Income	193	336	-.047%	-.76	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.117%	1.41	.92
	Personal Pension	Entire Sample	252	336	.065%	1.24	.96
	Personal Pension	UK All Companies	176	336	.044%	.88	.96
	Personal Pension	UK Equity Income	50	305	.108%	1.26	.90
	Personal Pension	UK Smaller Companies	26	336	.078%	.61	.86

The four factor model is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.: $R_{pt} - r_f = \alpha_p + \beta_{0p}\left(R_{mt} - r_f\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \beta'_{1p}\left[Z_{t-1}\left(R_{mt} - r_{ft}\right)\right] + \varepsilon_{pt}$ where Z_{t-1} is a vector of lagged information available at time t including the lagged 3-month Treasury bill rate, the lagged divided yield on the FTSE All Share Index, the lagged slope of the term structure (difference between long and short run government yields) and a dummy variable for January. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the *eta* t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.8: Equally Weighted Portfolio Performance Evaluation using Jensen-Alphas based on Conditional Models and the Composition of the Underlying Portfolio's FundID

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.003%	.04	.92
	Personal Pension	Entire Sample	252	336	.077%	1.15	.92
	Personal Pension	FundID - Underlying PP only	99	336	.050%	.84	.94
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.037%	.32	.82
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.011%	-.29	.98
	Personal Pension	Entire Sample	252	336	.068%	1.39	.96
	Personal Pension	FundID - Underlying PP only	99	336	.046%	.95	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.013%	.15	.90
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.029%	-.69	.98
	Personal Pension	Entire Sample	252	336	.065%	1.24	.96
	Personal Pension	FundID - Underlying PP only	99	336	.038%	.76	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	-.014%	-.14	.90

The four factor model is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.: $R_{pt} - r_f = \alpha_p + \beta_{0p}\left(R_{mt} - r_f\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \beta'_{1p}\left[Z_{t-1}\left(R_{mt} - r_{ft}\right)\right] + \varepsilon_{pt}$ where Z_{t-1} is a vector of lagged information available at time t including the lagged 3-month Treasury bill rate, the lagged divided yield on the FTSE All Share Index, the lagged slope of the term structure (difference between long and short run government yields) and a dummy variable for January. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the *eta* t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.9: Equally Weighted Portfolio Performance Evaluation Using Jensen-alphas with Market Timing based on Conditional Models

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	η	η t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.051%	.71	-.28	-1.46	.92
	Unit Trust/OEIC	UK All Companies	570	336	-.002%	-.04	-.21	-1.40	.95
	Unit Trust/OEIC	UK Equity Income	193	336	.055%	.74	-.22	-1.21	.91
	Unit Trust/OEIC	UK Smaller Companies	121	336	.267%	1.42	-.71	-1.34	.62
	Personal Pension	Entire Sample	252	336	.144%	2.10*	-.39	-2.09*	.92
	Personal Pension	UK All Companies	176	336	.098%	1.55	-.27	-1.52	.94
	Personal Pension	UK Equity Income	50	336	.249%	2.69**	-.61	-2.52*	.87
	Personal Pension	UK Smaller Companies	26	283	.332%	1.49	-1.25	-1.93*	.56
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.014%	-.33	.01	.14	.98
	Unit Trust/OEIC	UK All Companies	570	336	-.042%	-1.01	-.01	-.11	.98
	Unit Trust/OEIC	UK Equity Income	193	336	-.059%	-1.04	-.02	-.12	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.172%	1.90	.05	.23	.92
	Personal Pension	Entire Sample	252	336	.094%	1.84	-.149	-1.19	.96
	Personal Pension	UK All Companies	176	336	.063%	1.25	-.07	-.57	.96
	Personal Pension	UK Equity Income	50	305	.121%	1.42	-.34	-1.49	.90
	Personal Pension	UK Smaller Companies	26	283	.271%	2.12*	-.68	-1.65	.86
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.031%	-.70	.16	.15	.98
	Unit Trust/OEIC	UK All Companies	570	336	-.057%	-1.33	-.01	-.10	.98
	Unit Trust/OEIC	UK Equity Income	193	336	-.044%	-.67	-.02	-.13	.95
	Unit Trust/OEIC	UK Smaller Companies	121	336	.107%	1.16	.06	.26	.92
	Personal Pension	Entire Sample	252	336	.091%	1.68	-.15	-1.19	.96
	Personal Pension	UK All Companies	176	336	.056%	1.08	-.07	-.56	.96
	Personal Pension	UK Equity Income	50	305	.170%	1.83	-.35	-1.55	.90
	Personal Pension	UK Smaller Companies	26	283	.196%	1.46	-.66	-1.60	.87

The four factor model including the Treynor-Mazuy test for market timing is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.:
$R_{pt} - r_f = \alpha_p + \beta_{0p}\left(R_{mt} - r_f\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \eta_p\left(R_{mt} - r_f\right)^2 + \beta'_{1p}\left[Z_{t-1}\left(R_{mt} - r_{ft}\right)\right] + \varepsilon_{pt}$ where Z_{t-1} is a vector of lagged information available at time t including the lagged 3-month Treasury bill rate, the lagged divided yield on the FTSE All Share Index, the lagged slope of the term structure (difference between long and short run government yields) and a dummy variable for January. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the *eta* t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.10: Equally Weighted Portfolio Performance Evaluation using Jensen-Alphas with Market Timing based on Conditional Models and the Composition of the Underlying Portfolio's FundID

Factor Model	Investment Vehicle	Sample	No. Funds	No. Obs	α	α t-stat	η	η t-stat	R^2
Single Factor Model	Unit Trust/OEIC	Entire Sample	882	336	.051%	.71	-.28	-1.46	.92
	Personal Pension	Entire Sample	252	336	.144%	2.10*	-.39	-2.09*	.92
	Personal Pension	FundID - Underlying PP only	99	336	.099%	1.56	-.28	-1.53	.94
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.167%	1.45	-.78	-2.53*	.82
Three Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.014%	-.33	.01	.14	.98
	Personal Pension	Entire Sample	252	336	.094%	1.84	-.149	-1.19	.96
	Personal Pension	FundID - Underlying PP only	99	336	.060%	1.19	-.08	-.63	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.092%	1.01	-.45	-1.81	.90
Four Factor Model	Unit Trust/OEIC	Entire Sample	882	336	-.031%	-.70	.16	.15	.98
	Personal Pension	Entire Sample	252	336	.091%	1.68	-.15	-1.19	.96
	Personal Pension	FundID - Underlying PP only	99	336	.053%	1.01	-.08	-.63	.96
	Personal Pension	FundID - Underlying PP & at least a UT/OEIC	109	299	.065%	.68	-.44	-1.77	.90

The four factor model including the Treynor-Mazuy test for market timing is regressed as follows over the sample period, January 1980 to December 2007, where the dependent variable is the equally-weighted monthly excess return on an equally weighted portfolio p of funds at time t.:
$R_{pt} - r_f = \alpha_p + \beta_{0p}\left(R_{mt} - r_f\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \eta_p\left(R_{mt} - r_f\right)^2 + \beta'_{1p}\left[Z_{t-1}\left(R_{mt} - r_{ft}\right)\right] + \varepsilon_{pt}$ where Z_{t-1} is a vector of lagged information available at time t including the lagged 3-month Treasury bill rate, the lagged divided yield on the FTSE All Share Index, the lagged slope of the term structure (difference between long and short run government yields) and a dummy variable for January. Regressions are also made for the three and single factor models where for the three factor model the same equation applies but $\lambda = 0_p$, and for the single factor model $\gamma_p = \delta_p = \lambda_p = 0$. The Jensen-alpha for each sample is calculated and recorded in the α column with the appropriate t stat in the α t-stat column. The market timing parameter is reported in the η column with its relevant t-statistic in the η t-stat column. The R^2 value for the regression in the respective sample is recorded in the final column. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 5.11: Analysing the Difference Between Alphas

	Factor Model	Performance Test	Difference in α	α t-stat
PP Entire Sample - UT/OEIC Entire Sample	Single Factor	Unconditional α	.057%	.59
	Single Factor	Unconditional α with market timing	.098%	1.18
	Single Factor	Conditional α	.074%	.78
	Single Factor	Conditional α with market timing	.094%	.94
	Three Factor	Unconditional α	.065%	.99
	Three Factor	Unconditional α with market timing	.108%	1.65
	Three Factor	Conditional α	.079%	1.26
	Three Factor	Conditional α with market timing	.107%	1.63
	Four Factor	Unconditional α	.075%	1.06
	Four Factor	Unconditional α with market timing	.126%	1.79
	Four Factor	Conditional α	.093%	1.40
	Four Factor	Conditional α with market timing	.122%	1.75
FundID PP Only - FundID PP & at least a UT/OEIC	Single Factor	Unconditional α	-.069%	-.51
	Single Factor	Unconditional α with market timing	.155%	1.21
	Single Factor	Conditional α	.141%	1.10
	Single Factor	Conditional α with market timing	.085%	.65
	Three Factor	Unconditional α	.043%	.40
	Three Factor	Unconditional α with market timing	-.045%	-.43
	Three Factor	Conditional α	.032%	.31
	Three Factor	Conditional α with market timing	-.032%	-.30
	Four Factor	Unconditional α	.074%	.62
	Four Factor	Unconditional α with market timing	-.017%	-.15
	Four Factor	Conditional α	.052%	.48
	Four Factor	Conditional α with market timing	-.012%	-.11

The alphas are obtained from the previous performance tests based on the equally weighted portfolio approach. Statistical significance between alphas at the 5% and 1% levels are denoted by * and ** respectively.

that have FundIDs associated with only personal pensions is very similar to the personal pension funds that have FundID's associated with at least a unit trust/OEIC. The timing coefficients are negative but generally not significant.

5.4 Conclusion

The empirical evidence presented in the performance chapter suggests that the UK equity market is informationally efficient as fund managers of UK equity unit trusts/OEICs and UK unit-linked personal pensions show very little evidence of abnormal performance. These results are robust to the factor model used and whether the model is unconditional or conditional. There is also no evidence that fund managers can successfully time the market. Using unconditional factor models both unit trusts/OEICs and unit-linked personal pension funds show strong evidence of a statistically significant negative market timing effect which becomes insignificant though still negative when using conditional models. Limited evidence of market timing ability based on UK data is consistent with Clare et al. (2010) and Cuthbertson et al. (2010b). Using US monthly holding data Elton et al. (2011b) find that sector rotation with respect to high-tech stocks is a major factor of negative market timing for their US data set. Further research on the timing of UK collective investment schemes could implement the methodology of Elton et al. (2011b) but it requires comprehensive holding data for collective investment schemes. There is also no evidence that the performance of unit trusts/OEICs is significantly different from that of unit-linked personal pension funds. This is perhaps not that surprising as some of the unit trusts/OEICs and unit-linked personal pension funds have the same fund manager and underlying portfolio and therefore performance.

The same general conclusions apply to the unit-linked personal pension funds categorised by FundID. Both the unit-linked personal pension funds that have FundID's

that include only personal pensions and the unit-linked personal pension funds that include at least a unit trust/OEIC provide very little evidence of superior stock picking skills or successful market timing abilities. There is also no significant different between the performance of the two pension fund samples categorised by FundID across all factor models.

With no evidence of differential skill between unit/trust and unit-linked personal pension fund managers it suggests investors saving for retirement should use unit-linked personal pensions rather than unit trust/OEICs since personal pensions have tax advantages and the potential option of contributions from employers. However, since active managers show no evidence of abnormal performance and active unit-linked personal pension funds generally charge higher fees than passive funds it suggests investors investing for retirement purposes would be better off using an index/passive equity fund to maximise their pension value at the end of the accumulation phase. However, these results are based on average alpha and therefore further research is needed to analyse the distribution of returns and whether there are a significant number of active fund managers who produce on average positive abnormal returns and whether they accrue to the investors.

Chapter 6

Fund Performance Persistence

6.1 Introduction

The Berk and Green (2004) model of mutual fund flows predicts that we should not observe persistence in mutual fund performance because money flows into funds that have performed well and out of funds that have performed badly. In Berk and Green (2004) fund managers face diseconomies of scale managing fund flows resulting in fund flows being the equilibrating mechanism that means abnormal performance should not persist. Berk and Green (2004) argue that performance is not persistent because investors chase good performance and punish bad performance. In this chapter I propose an empirical test of Berk and Green (2004) by comparing the performance persistence of UK equity unit trusts/OEICs and UK equity unit-linked personal pensions. Since unit-linked personal pension funds have high switching costs and are a long term contractual savings vehicle inaccessible until retirement the flow of funds in personal pensions should not be as responsive to past performance as that of unit trusts/OEICs. Previous evidence to support the more attenuated fund flow relationship for pensions can be found in Del Guercio and Tkac (2002) and further supporting evidence is given in Chapter 7. If the Berk and Green (2004)

model of mutual fund flows is correct we should find more performance persistence in unit-linked personal pensions where the performance fund flow relationship is more attenuated in comparison to unit trusts/OEICs.

Whilst the previous literature on persistence in fund performance is extensive most studies are motivated by empirically testing the EMH and the value added by active portfolio managers rather than testing the Berk and Green (2004) model of mutual fund flows. This is in part due to Berk and Green (2004) being a relatively recent publication. Fletcher (1997), Blake and Timmermann (1998), Allen and Tan (1999) Quigley and Sinquefield (2000), Fletcher and Forbes (2002), Cuthbertson et al. (2008) and Cuthbertson et al. (2008) assess performance persistence in UK unit trusts/OEICs and find conflicting results. Differences across the studies include varying sample periods, type of funds analysed, risk factor models used, charges incorporated into returns, holding periods and whether the issue of survivorship bias has been assessed. Whether the aforementioned papers find significant performance persistence is divided but the interesting result from Fletcher and Forbes (2002) is that the persistence found in other factor models is eliminated when performance is evaluated to a model similar to Carhart's (1997). Thus, the Carhart (1997) model seems to be the most stringent model across both the US mutual fund data and UK unit trust data when testing for performance persistence and hence I use it to test for performance persistence for both unit-linked personal pensions and unit trusts/OEICs in this research.

The literature on UK pension funds has been more limited in quantity in comparison to unit trusts/OEICs and has been primarily based on occupational pension schemes. Brown et al. (1997) and Blake et al. (1999) find no strong evidence of performance persistence. Tonks (2005) examines performance persistence in UK occupational schemes using both contingency tables and performance ranked portfolio strategies. Tonks (2005) finds stronger evidence of persistence than previous studies at one

year horizons and weaker evidence in the long run. Gregory and Tonks (2004) examine the performance and performance persistence in UK personal pensions and find negative persistence at short horizons, but over six months to a year significant positive performance persistence, even when using the Carhart (1997) four factor model. In this chapter I extend the current literature of performance persistence by empirically testing the Berk and Green (2004) model of mutual fund flows by comparing the performance persistence of UK equity unit trusts/OEICs and UK equity unit-linked personal pensions.

I compare the performance persistence between UK equity unit trusts/OEICs and UK equity unit-linked personal pensions using the UK Equity Unit Trust/OEIC Survivor-Bias-Free and UK Equity Unit-linked Personal Pension databases respectively. In both datasets each fund is restricted to one primary share class/unit and one FundID only. The datasets therefore proxy the underlying portfolios for unit trust/OEICs and unit-linked personal pensions where only one return series per underlying fund is permitted. I use these datasets for a general comparative analysis of the difference in performance persistence between two different investment vehicles as the funds in the UK Equity Unit-linked Personal Pension Database will contain fund managers who also manage unit trusts/OEICs in their underlying portfolio and hence in these cases the fund flow to the fund manager and underlying portfolio are not restricted to only personal pension funds. I would still however expect more performance persistence in the personal pension funds as not all of the personal pension funds will have fund flows from unit trusts/OEICs which will obviously not be the case for the unit trust/OEIC sample. For a more rigorous and meaningful empirical test of Berk and Green (2004) I perform the performance persistence tests using the UK Equity Unit-linked Personal Pension FundID Database. Since the database contains sub samples of unit-linked personal pension funds based on their FundID, a proxy for the underlying portfolio, there should be more performance persistence in the unit-linked personal pension funds that contain FundIDs that only relate to

personal pensions since they are not exposed to fund flows from unit trusts/OEICs.

6.2 Performance Persistence Tests

The performance persistence tests I use in this chapter are based on abnormal performance. I calculate monthly abnormal performance for each fund by comparing the realised monthly return on the fund with the return predicted from an asset pricing model. The asset pricing models I use include the single index (CAPM) model, the Fama and French three factor model and the Carhart four factor model. The Carhart four factor model is shown in Equation 6.1.

$$R_{pt} - r_{ft} = \alpha_p + \beta_p \left(R_{mt} - r_{ft}\right) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt} \qquad (6.1)$$

For each fund, $R_t - r_{ft}$ is regressed against the four factors in Equation (6.1), where R_t is the monthly return at time t on the fund and r_{ft} is the monthly return on the risk free asset at time t. The $(R_{mt} - r_{ft})$ variable is the excess return on the market; SMB is the size factor, which is the difference between the returns on a portfolio of small companies and the returns on a portfolio of large companies; HML is the book to market factor which is the difference in returns between a portfolio of high book to market companies and low book to market companies and MOM is the one year momentum factor portfolio originally cited in Jegadeesh and Titman (1993). When $\lambda_p = 0$ in Equation (7.4) the Fama and French three factor model is obtained. The CAPM model is obtained from Equation (7.4) when $\gamma_p = 0$, $\delta_p = 0$ and $\lambda_p = 0$. The regressions coefficients are based on whole sample regressions and are calculated individually for each fund in order to obtain monthly abnormal returns for unit trusts/OEICs and unit-linked personal pension funds. For

robustness in addition to the unconditional factor models I also calculate abnormal returns for the performance persistence tests using an unconditional Carhart four factor model.

6.2.1 Contingency Tables

The contingency table tests are based on abnormal returns. In each sample I classify funds as winners (W) or losers (L) based on the median abnormal return over the relevant ranking period. Over two consecutive time periods a two by two table is formed such that a fund can have one of four outcomes, (WW), (WL), (LW) or (LL) where W represents being above the median abnormal return and a winner and L means being below the median abnormal return and a loser. I use the following four statistical procedures to test for performance persistence:

1. Cross-product ratio (CP)

$$\text{CP} = \frac{(WW \times LL)}{(WL \times LW)} \tag{6.2}$$

The statistical significance of the CP ratio can be tested as $\log(\text{CP})/\sigma_{\log CP}$ has a standard normal distribution where

$$\sigma_{\log CP} = \left[\left(\frac{1}{WW}\right) + \left(\frac{1}{WL}\right) + \left(\frac{1}{LW}\right) + \left(\frac{1}{LL}\right)\right]^{\frac{1}{2}} \tag{6.3}$$

and allows the significance of the deviations of CP ratio from unity to be tested.

2. Percentage of repeat winners, where

$$\text{PRW} = \frac{WW}{\left(\frac{N}{2}\right)} \tag{6.4}$$

3. Chi-Squared test with 1 d.o.f, where

$$\text{CHI} = \frac{\left(WW - \frac{N}{4}\right)^2 + \left(WL - \frac{N}{4}\right)^2 + \left(LW - \frac{N}{4}\right)^2 + \left(LL - \frac{N}{4}\right)^2}{\left(\frac{N}{4}\right)} \tag{6.5}$$

4. A regression of evaluation period abnormal returns on ranking period abnormal returns with a t-stat assessing the statistical significance of the slope coefficient.

6.2.2 Performance Ranked Portfolio Tests

The performance ranked portfolio persistence tests are performed using abnormal returns based on whole sample regressions using the single (CAPM) index model, Fama and French three factor model and the Carhart four factor model. I sort unit-linked personal pensions and unit trusts/OEICs separately into quintile portfolios based on past abnormal performance in a specified ranking period. Then during the subsequent evaluation period I calculate the average monthly equally weighted portfolio return of the top and bottom quintile portfolios. The ranking and subsequent evaluation periods are calculated with overlapping periods throughout the sample period. I test the difference between the average equally weighted abnormal returns in the top and bottom portfolios using a t-stat where allowance is made for the autocorrelation from overlapping periods. No persistence in performance is signified by a t-stat statistically insignificant from zero. The performance ranked portfolio tests are based on symmetrical ranking and evaluation periods. The ranking and evaluation periods I analyse include 1MR1ME, 3MR3ME, 6MR6ME, 12M12ME and 36MR36ME. For 1MR1ME this notation implies a 1 month ranking period and a subsequent 1 month evaluation period. The same logic in notation applies to the other ranking and evaluation periods. Carpenter and Lynch (1999) advocate the

use of performance ranked portfolio tests and therefore more weight will be placed on the results from the performance ranked portfolio tests.

6.2.3 Rolling Regressions

The aforementioned contingency table and portfolio ranked portfolio tests across the various factor models are all based on factor regression coefficients based on whole sample regressions. This could potentially result in look-ahead bias and does not allow for time varying factor coefficients. I therefore re-estimate the factor coefficients for each fund based on the Carhart four factor model, which is the base case model, and calculate new abnormal returns for each fund using 36 month rolling regressions and test for performance persistence using the aforementioned contingency table and performance ranked portfolio tests.

6.3 Data

The performance persistence tests are based on returns data from the UK Equity Unit Trust/OEIC Survivor-Bias-Free Database, UK Equity Unit-linked Personal Pension Database and the UK Equity Unit-linked Personal Pension FundID Database. The returns for UK equity unit trusts/OEICs and UK equity unit-linked personal pensions are calculated on a monthly basis over the sample period January 1980 to December 2007 based on bid-to-bid prices gross of tax. Details of these datasets including summary statistics and analysis are given in Chapter 4. I use the exact same datasets for the performance persistence tests and the performance tests and thus brief summary statistics and analysis for the raw returns used in the performance persistence tests can also be found in section 5.2. In summary the UK Equity Unit Trust/OEIC Survivor-Bias-Free and UK Equity Unit-linked Personal Pension databases restrict each fund to one primary share class/unit and one Fun-

dID only. The UK Equity Unit-linked Personal Pension FundID Database identifies unit-linked personal pensions in relation to their FundID, a proxy for the underlying portfolio, so underlying portfolios that are only exposed to personal pension funds can be identified in addition to those that have at least a unit trust/OEIC as part of their underlying portfolio. Unit-linked personal pension funds that have an underlying portfolio that only includes personal pension funds should have a more attenuated performance fund flow relationship due to the illiquid nature of personal pensions and therefore in accordance with Berk and Green (2004) more performance persistence.

6.4 Results

Table 6.1 displays the results of the performance ranked portfolio tests based on abnormal returns from the single index (CAPM) model. At the very short horizon, based on a one month ranking and one month evaluation period (1MR1ME), unit trusts/OEICs have significant positive persistence at the 1% significance level whereas the entire sample of unit-linked personal pension funds show reversals in performance, although it is not significantly significant. However, the entire sample of unit-linked personal pension funds only show evidence of reversals in performance at the short term horizon of one month ranking and one month evaluation. At intermediate horizons the entire sample of unit-linked personal pension funds show positive performance persistence though it is only significant at the 6MR6ME and 12MR12ME time horizons. Unit trusts/OEICs however show significant positive performance persistence at all intermediate time horizons up to one year ranking and one year evaluation (12MR12ME). At the shorter term horizons evidence of performance persistence may not be that surprising as to exploit this strategy to earn abnormal returns would require an investor to frequently change the composition of their portfolio. Since the fund returns are based on bid-bid prices gross of

tax an investor would have to factor in the costs associated with constantly entering and exiting different funds in addition to the other costs incurred with investing in actively managed funds. The most significant difference between top and bottom quintiles for the entire unit trust/OEIC sample in Table 6.1 is at the 6MR6MR time horizon where the average monthly difference from holding the top quintile and shorting the bottom quintile is 39 basis points. Over 6 months this is on average just under 2.5% which would not even be sufficient to cover the average cost of a front end load. At the longest horizon of three year ranking and three year evaluation period (36MR36ME) there is no evidence of performance persistence based on single factor abnormal returns for both unit trusts/OEICs and unit-linked personal pension funds.

At the short horizon of 1MR1ME unit-linked personal pension funds that have FundIDs associated with at least a unit trust/OEIC display significant positive performance persistence similar to the entire unit trust/OEIC sample. In comparison the unit-linked personal pension funds that have FundIDs relating only to personal pensions show significant reversals in performance similar to the entire unit-linked personal pension fund sample. At the 6MR6ME horizon unit-linked personal pensions that have a FundID only relating to personal pensions show significant positive performance at the 1% significant level whilst unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC do not show significant performance persistence. This pattern is also seen at the 12MR12ME and 36MR36ME horizons although at the 36MR36ME the performance persistence in the unit-linked personal pension funds that have FundIDs associated only with personal pensions is not significant. These findings based on the composition of the underlying portfolio for unit-linked personal pension funds generally support the Berk and Green (2004) model of mutual fund flows since fund managers of unit-linked personal pension funds that have FundIDs associated with only personal pensions show greater persistence in performance than the unit-linked personal pension funds that have

Table 6.1: Performance Ranked Portfolio Persistence Tests based on Single Factor (CAPM) Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust/OEIC	Entire Sample	335	.0015	-.0017	.0032	2.58**
	Personal Pension	Entire Sample	335	-.0009	.0007	-.0016	-1.19
	FundID -Underlying PP and at least a UT/OEIC	Entire Sample	257	.0034	-.0036	.0070	3.43**
	FundID - PP FundID only	Entire Sample	334	-.0026	.0021	-.0046	-4.14**
3MR3ME	Unit Trust/OEIC	Entire Sample	331	.0014	-.0018	.0031	2.42*
	Personal Pension	Entire Sample	326	.0008	-.0008	.0017	1.52
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	253	.0014	-.0014	.0029	1.35
	FundID - Underlying PP only	Entire Sample	323	.0006	-.0010	.0016	1.80
6MR6ME	Unit Trust/OEIC	Entire Sample	325	.0020	-.0020	.0039	3.50**
	Personal Pension	Entire Sample	321	.0021	-.0013	.0034	3.43**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	246	.0018	-.0014	.0031	1.86
	FundID - Underlying PP only	Entire Sample	315	.0014	-.0020	.0035	3.61**
12MR12ME	Unit Trust/OEIC	Entire Sample	313	.0010	-.0011	.0021	2.18*
	Personal Pension	Entire Sample	307	.0015	-.0007	.0023	2.29*
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	235	-.0002	-.0008	.0006	.38
	FundID - Underlying only	Entire Sample	296	.0012	-.0015	.0027	2.92**
36MR36ME	Unit Trust/OEIC	Entire Sample	265	-.0001	.0004	-.0004	-0.50
	Personal Pension	Entire Sample	254	.0001	-.0008	.0009	1.73
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	178	.0012	.0015	-.0001	-.14
	FundID - Underlying PP only	Entire Sample	246	-.0007	-.0013	.0006	1.16

For performance ranked tests, funds are sorted each year into quintile portfolios based on past abnormal fund performance over the relevant ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period are computed. AV5 and AV1 are the average abnormal returns of the top and bottom portfolios in the evaluation period respectively. There are five different ranking and evaluation periods e.g. 36MR36ME means three-year ranking period and three year evaluation period and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset where DIF is AV5-AV1 and TDIF is a t-statistic on DIF allowing for the autocorrelation induced by using overlapping observations. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 6.2: Contingency Table Persistence Tests based on Single Factor (CAPM) Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust/OEIC	Entire Sample	121,355	.524	1.197	15.64**	245.24**	32.59**
	Personal Pension	Entire Sample	35,708	.498	.949	-2.47*	7.44**	-4.50**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	11,298	.532	1.170	4.18**	21.31**	3.42**
	FundID - Underlying PP only	Entire Sample	17,626	.488	.842	-5.69**	35.24**	-11.29**
3MR3ME	Unit Trust/OEIC	Entire Sample	37,934	.536	1.315	13.31**	178.13**	29.20**
	Personal Pension	Entire Sample	11,306	.520	1.140	3.48**	12.42**	6.90**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	3,555	.549	1.323	4.16**	18.89**	3.45**
	FundID - Underlying PP only	Entire Sample	5,614	.516	1.068	1.22	2.21	5.59**
6MR6ME	Unit Trust/OEIC	Entire Sample	18,140	.536	1.309	9.04**	82.50**	12.25**
	Personal Pension	Entire Sample	5,393	.530	1.256	4.18**	17.50**	3.75**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	1,657	.552	1.313	2.76**	8.73**	1.78
	FundID - Underlying PP only	Entire Sample	2,723	.523	1.153	1.86	3.64	4.39**
12MR12ME	Unit Trust/OEIC	Entire Sample	7,793	.568	1.658	11.07**	125.17**	12.74**
	Personal Pension	Entire Sample	2,380	.561	1.724	6.58	44.00	7.11**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	701	.568	1.591	3.05**	9.60**	.56
	FundID - Underlying PP only	Entire Sample	1,241	.546	1.469	3.37**	11.43**	7.98**
36MR36ME	Unit Trust/OEIC	Entire Sample	1,518	.510	.813	-2.00*	11.98**	-4.61**
	Personal Pension	Entire Sample	449	.517	1.504	2.14*	7.29**	-.31
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	84	.571	1.333	.66	.86	-1.11
	FundID - Underlying PP only	Entire Sample	281	.491	.990	-.04	.61	-2.13*

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(CP)/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns. Significance at the 5% and 1% levels are denoted by * and ** respectively.

FundIDs associated with at least a unit trust/OEIC.

However, it must be acknowledged that FundID is only a proxy for the underlying fund and I am assuming that the performance fund flow sensitivity is weaker for unit-linked personal pensions than for unit trust/OEICs as in Del Guercio and Tkac (2002). Chapter 7 adds to the evidence and supports the idea that unit trust/OEIC flows are more sensitive to past performance although this may only be the case for the extreme performers at both the best and worst ends of the performance distribution. Although unit-linked personal pensions that have FundIDs only associated with personal pensions have more evidence of significant performance persistence than the unit-linked personal pension funds that have FundIDs associated with at least a unit trust/OEIC the two main anomalies in Table 6.1 are why unit trusts/OEICs have significant performance persistence and stronger evidence of performance persistence than the entire sample of unit-linked personal pensions and why unit-linked personal pension funds have significant reversals at the 1MR1ME horizon? A potential reason for the former could be related to the unit trust/OEIC sample being survivor-bias free. Unit trusts/OEICs that have died at some point during the sample period typically would have done so due to being consistently poor performers. These persistently repeating loser unit trusts/OEICs may explain the greater performance persistence in unit trusts/OEICs in comparison to the unit-linked personal pension funds which only contains live funds. However, the only potential survior-bias in the unit-linked personal pensions data is from personal pensions funds that have been merged during the sample period.

Table 6.2 evaluates performance persistence using single index (CAPM) abnormal returns based on contingency tables. At the short term horizon of 1MR1ME the results from the performance ranked portfolio tests and contingency tables are similar. Unit trusts/OEICs display significant positive persistence and the entire sample of unit-linked personal pension funds display significant reversals in performance as shown

by the Z stats and TCS t stats. At the intermediate horizon unit trusts/OEICs generally display significant positive performance persistence. The entire sample of unit-linked personal pensions also show positive performance persistence but not as strong as that of unit trusts/OEICs. This is again broadly similar to the performance ranked portfolio results in Table 6.1. At the long term horizon of three year ranking three year evaluation (36MR36ME) there is evidence of reversals for unit trusts/OEICs and positive performance persistence for the entire sample of unit-linked personal pension funds according to the Z stats. Although significant at the 36MR36ME horizon the general level of performance persistence significance is lower at the long term horizon in comparison to the intermediate horizon.

For the datasets from the UK Equity Unit-linked Personal Pension FundID Database the results are similar at the short horizon to the performance ranked portfolio tests with significant positive persistence in unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC and significant reversals for unit-linked personal pensions that have FundIDs only associated with personal pensions. Interestingly, apart from the 12ME12MR horizon, the results for the intermediate horizon in general show more persistence in performance for unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC in comparison to unit-linked personal pensions that have FundIDs only associated with personal pensions. This contradicts the performance ranked portfolio tests which finds the opposite result. At the long term horizon (36MR36ME) there is little evidence of significant performance persistence for both unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC and unit-linked personal pensions that have FundIDs only associated with personal pensions.

The contradictory evidence between performance ranked portfolio tests and contingency tables could be related to the point of the performance distribution on which winners and losers are determined. Contingency tables use the median whereas the

Table 6.3: Performance Ranked Portfolio Persistence Tests based on Three Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust/OEIC	Entire Sample	335	-.0008	.0008	-.0016	-2.49*
	Personal Pension	Entire Sample	335	-.0021	.0027	-.0049	-5.02**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	257	.0005	.0006	-.0001	-.13
	FundID - Underlying PP only	Entire Sample	334	-.0029	.0033	-.0061	-6.35**
3MR3ME	Unit Trust/OEIC	Entire Sample	331	.0009	-.0014	.0023	5.02**
	Personal Pension	Entire Sample	328	.0008	-.0005	.0013	2.19*
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	253	.0017	-.0006	.0024	2.42*
	FundID - Underlying PP only	Entire Sample	324	.0007	-.0008	.0014	2.12*
6MR6ME	Unit Trust/OEIC	Entire Sample	325	.0013	-.0020	.0033	7.64**
	Personal Pension	Entire Sample	320	.0016	-.0011	.0027	4.36**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	246	.0021	-.0011	.0031	3.08**
	FundID - Underlying PP only	Entire Sample	315	.0014	-.0017	.0031	4.30**
12MR12ME	Unit Trust/OEIC	Entire Sample	313	.0010	-.0016	.0026	6.50**
	Personal Pension	Entire Sample	307	.0014	-.0009	.0023	4.66**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	235	.0011	-.0004	.0015	1.57
	FundID - Underlying PP only	Entire Sample	295	.0013	-.0014	.0027	4.05**
36MR36ME	Unit Trust/OEIC	Entire Sample	265	.0004	-.0008	.0013	3.97**
	Personal Pension	Entire Sample	254	.0002	-.0011	.0014	4.28**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	185	.0021	.0014	.0008	.72
	FundID - Underlying PP only	Entire Sample	246	-.0004	-.0016	.0013	3.26**

For performance ranked tests, funds are sorted each year into quintile portfolios based on past abnormal fund performance over the relevant ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period are computed. AV5 and AV1 are the average abnormal returns of the top and bottom portfolios in the evaluation period respectively. There are five different ranking and evaluation periods e.g. 36MR36ME means three-year ranking period and three year evaluation period and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset where DIF is AV5-AV1 and TDIF is a t-statistic on DIF allowing for the autocorrelation induced by using overlapping observations. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 6.4: Contingency Table Persistence Tests based on Three Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust/OEIC	Entire Sample	121,355	.499	.983	-1.50	2.63	-8.67**
	Personal Pension	Entire Sample	35,708	.478	.813	-9.77**	96.56**	-23.07**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	11,298	.508	.962	-1.03	4.45*	-10.12**
	FundID - Underlying PP only	Entire Sample	17,626	.474	.755	-9.31**	89.48**	-21.16**
3MR3ME	Unit Trust/OEIC	Entire Sample	37,934	.537	1.335	14.04**	197.80**	25.14**
	Personal Pension	Entire Sample	11,306	.524	1.189	4.61**	21.36**	3.24**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	3,555	.548	1.342	4.37**	20.11**	-.42
	FundID - Underlying PP only	Entire Sample	5,614	.528	1.176	3.04**	9.92**	4.8**
6MR6ME	Unit Trust/OEIC	Entire Sample	18,140	.532	1.265	7.90**	63.75**	16.98**
	Personal Pension	Entire Sample	5,393	.537	1.337	5.32**	28.50**	5.33**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	1,657	.543	1.270	2.42*	6.53*	1.31
	FundID - Underlying PP only	Entire Sample	2,723	.535	1.234	2.74**	8.00**	7.21**
12MR12ME	Unit Trust/OEIC	Entire Sample	7,793	.555	1.492	8.79**	81.20**	16.55**
	Personal Pension	Entire Sample	2,380	.553	1.616	5.81**	34.67**	8.01**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	689	.569	1.805	3.83**	14.84**	1.72
	FundID - Underlying PP only	Entire Sample	1,241	.535	1.395	2.92**	8.85**	9.44**
36MR36ME	Unit Trust/OEIC	Entire Sample	1,518	.582	1.568	4.34**	28.49**	1.37
	Personal Pension	Entire Sample	449	.486	1.503	2.13*	11.75**	1.68
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	84	.548	1.332	.65	.48	-.38
	FundID - Underlying PP only	Entire Sample	281	.484	1.210	.79	2.86	0.69

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(CP)/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns. Significance at the 5% and 1% levels are denoted by * and ** respectively.

performance ranked portfolio tests in this thesis use the top and bottom quintiles. Thus, winners and losers are at the more extreme ends of the performance distribution in the performance ranked portfolio tests in comparison to winners and losers from the contingency tables. Why might this be important? Chapter 6 on fund flows provides evidence that the the major difference between the sensitivity of the performance fund flow relationship for unit-linked personal pension funds and unit trusts/OEICs may be at the extreme tails of the performance distribution. The performance ranked portfolio tests are more likely to pick up this effect and therefore greater emphasis is placed on the performance ranked portfolio tests.

Table 6.3 displays the performance ranked portfolio tests based on abnormal returns from the Fama and French three factor model. At the short term horizon 1MR1ME both unit trusts/OEICs and the entire sample of unit-linked personal pensions show significant reversals in performance which for unit trusts/OEIC is the reverse of the result in Table 6.1. At the intermediate time horizons both unit trusts/OEICs and unit-linked personal pensions display significant positive performance persistence with greater persistence in unit trusts/OEICs although the difference diminishes as the time horizon increases. At the long term horizon of 36MR36ME it is surprising to find significant positive persistence in performance for both unit trusts/OEICs and unit-linked personal pensions although there is slighter stronger evidence of persistence for unit-linked personal pensions. Although the results are statistically significant at the 36MR36ME horizon a strategy that is long in the top (winner) quintile and short in the the bottom (loser) quintile generates for unit trusts/OEICs and the unit-linked personal pension funds on average 13 and 14 basis points per month respectively over 36 months. Over three years this approximately implies abnormal returns of under 5% which economically speaking is not significant as this would not be enough to be exploited by investors after investment costs.

For the unit-linked personal pensions datasets based on FundID the results in Ta-

ble 6.3 support the results in Table 6.1. Unit-linked personal pensions that have FundIDs only associated with personal pensions display significant positive performance persistence across all the intermediate and long term time horizons whereas the unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC show less evidence of performance persistence and no significant evidence at the longer term horizons. These results support the Berk and Green (2004) model since the equilibrating mechanism of fund flows is restricted in unit-linked personal pensions that have FundIDs only associated with personal pensions in comparison to unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC. However, the the anomalies from Table 6.1 are still present in Table 6.3. Unit trusts/OEICs show more evidence of performance persistence than the entire sample of unit-linked personal pension funds and for the three factor model the unit trusts/OEICs actually show greater performance persistence than the unit-linked personal pensions that have FundIDs only associated with personal pensions. This evidence is troubling in regards Berk and Green (2004) but as discussed previously it could relate to survivor-bias issues in the pension datasets. Since any survivor-bias that potentially could be present in the personal pension data will be present in both the unit-linked personal pensions that have FundIDs only associated with personal pensions dataset and the unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC dataset greater emphasis is placed on the evidence regarding those datasets for the empirical test of Berk and Green (2004).

Table 6.4 displays the performance persistence results based on the Fama and French three factor model using contingency tables. For unit trusts/OEICs and the entire sample of unit-linked personal pension funds the results mirror the performance ranked portfolio results based on the three factor model. For unit-linked personal pension funds that have FundIDs only associated with personal pensions there is evidence of significant positive performance persistence but at some horizons there is

stronger evidence for performance persistence in unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC. This contradicts what I would have expected in relation to Berk and Green (2004) and contradicts the evidence in the performance ranked portfolio tests. However, as previously discussed this could be due to the difference in fund flows between unit-linked personal pensions and unit trusts/OEICs being predominantly located at the extreme tails of the performance distribution. In addition the TCS column which represents the regression of evaluation period abnormal returns on ranking period abnormal returns is more supportive of the performance ranked portfolio tests with more performance persistence in the unit-linked personal pensions that have FundIDs associated only with personal pensions.

Table 6.5 displays the results from the performance ranked portfolio tests based on abnormal returns from the four factor model which is the standard Fama and French three factor model with the additional of a momentum factor. The results in Tables 6.3 and 6.5 are very similar. There are significant reversals at the short term horizon of 1MR1ME with significant positive performance for both unit trusts/OEICs and the entire sample of unit-linked personal pension funds across the intermediate and long term periods. Initially there is more significant positive persistence in unit trusts/OEICs which diminishes over time until there is slightly stronger evidence of positive performance persistence for the entire sample of unit-linked personal pension funds at the long term horizon of 36MR36ME. For the unit-linked personal pensions dataset based on FundID both the unit-linked personal pensions that have FundIDs associated only with personal pensions and FundIDs associated with at least a unit trust/OEIC show significant positive persistence in performance over the intermediate term with unit-linked personal pensions that have FundIDs only associated with personal pensions having stronger performance persistence in general. At the 36MR36ME horizon the unit-linked personal pensions that have FundIDs only associated with personal pensions have significant positive performance per-

Table 6.5: Performance Ranked Portfolio Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust/OEIC	Entire Sample	335	-.0011	.0006	-.0016	-2.67*
	Personal Pension	Entire Sample	335	-.0023	.0026	-.0049	-5.15**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	257	.0003	.0001	.0002	.20
	FundID - Underlying PP only	Entire Sample	334	-.0028	.0028	-.0056	-6.00**
3MR3ME	Unit Trust/OEIC	Entire Sample	331	.0007	-.0017	.0023	5.21**
	Personal Pension	Entire Sample	328	.0008	-.0006	.0014	2.32*
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	253	.0015	-.0006	.0021	2.07*
	FundID - Underlying PP only	Entire Sample	324	.0007	-.0009	.0015	2.22*
6MR6ME	Unit Trust/OEIC	Entire Sample	325	.0010	-.0022	.0033	7.56**
	Personal Pension	Entire Sample	320	.0015	-.0013	.0029	4.70**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	246	.0018	-.0015	.0033	3.31**
	FundID - Underlying PP only	Entire Sample	315	.0014	-.0018	.0032	4.30**
12MR12ME	Unit Trust/OEIC	Entire Sample	313	.0007	-.0017	.0025	6.04**
	Personal Pension	Entire Sample	307	.0013	-.0010	.0024	4.43**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	235	.0010	-.0009	.0019	2.14*
	FundID - Underlying PP only	Entire Sample	296	.0012	-.0017	.0029	4.23**
36MR36ME	Unit Trust/OEIC	Entire Sample	265	.0002	-.0009	.0011	5.75**
	Personal Pension	Entire Sample	254	.0003	-.0014	.0017	6.00**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	172	.0018	.0009	.0009	1.13
	FundID - Underlying PP only	Entire Sample	246	-.0004	-.0018	.0014	3.26**

For performance ranked tests, funds are sorted each year into quintile portfolios based on past abnormal fund performance over the relevant ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period are computed. AV5 and AV1 are the average abnormal returns of the top and bottom portfolios in the evaluation period respectively. There are five different ranking and evaluation periods e.g. 36MR36ME means three-year ranking period and three year evaluation period and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset where DIF is AV5-AV1 and TDIF is a t-statistic on DIF allowing for the autocorrelation induced by using overlapping observations. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 6.6: Contingency Table Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust/OEIC	Entire Sample	121,355	.498	.977	-2.01*	4.48*	-9.38**
	Personal Pension	Entire Sample	35,708	.479	.821	-9.31**	87.92**	-23.60**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	11,298	.509	.972	-.75	4.21*	-10.78**
	FundID - Underlying PP only	Entire Sample	17,626	.475	.762	-8.98**	83.63**	-21.05**
3MR3ME	Unit Trust/OEIC	Entire Sample	37,934	.539	1.359	14.91**	223.19**	26.12**
	Personal Pension	Entire Sample	11,306	.525	1.194	4.72**	22.51**	4.51**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	3,555	.550	1.363	4.60**	22.21**	0.69
	FundID - Underlying PP only	Entire Sample	5,614	.534	1.228	3.84**	15.56**	5.81**
6MR6ME	Unit Trust/OEIC	Entire Sample	18,140	.534	1.285	8.42**	72.05**	18.30**
	Personal Pension	Entire Sample	5,393	.546	1.428	6.51**	42.64**	6.25**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	1,657	.553	1.339	2.96**	9.72**	1.88
	FundID - Underlying PP only	Entire Sample	2,723	.543	1.297	3.39**	12.21**	8.19**
12MR12ME	Unit Trust/OEIC	Entire Sample	7,793	.563	1.615	10.49**	113.49**	16.08**
	Personal Pension	Entire Sample	2,380	.555	1.644	6.02**	37.17**	8.42**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	701	.588	1.872	4.10**	17.10**	1.79
	FundID - Underlying PP only	Entire Sample	1,241	.543	1.470	3.37**	11.60**	10.02**
36MR36ME	Unit Trust/OEIC	Entire Sample	1,518	.568	1.344	2.86**	19.92**	-.67
	Personal Pension	Entire Sample	449	.512	1.674	2.69**	11.75**	1.39
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	84	.571	1.778	1.30	1.71	-1.48
	FundID - Underlying PP only	Entire Sample	281	.520	1.616	1.99	6.13*	0.98

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(\text{CP})/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns. Significance at the 5% and 1% levels are denoted by * and ** respectively.

sistence whereas the unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC show no significant performance persistence. In the previous literature the Carhart four factor model is generally used as the base model since the addition of a momentum factor, particularly for US data, explains much of the previous performance persistence with the main exception being persistently poor performers. In a UK setting Fletcher and Forbes (2002) find similar evidence with a momentum factor explaining much of the performance persistence in their data. Given these previous findings the level of performance persistence in Table 6.5 using the four factor model is surprising. In comparison to Fletcher and Forbes (2002) different time periods and fund databases possibly explain the differences in results. In addition since the factor data is from different sources and uses slightly different methods it would be interesting to rule out factor data and factor construction influencing the results.

Table 6.8 displays the results for the contingency table tests based on the four factor model. Again both unit trusts/OEICs and the entire sample of unit-linked personal pensions show significant evidence of reversals at the short term horizon of 1MR1ME and significant positive performance across both intermediate and long terms. As with the previous contingency table tests there is more evidence of performance persistence in the unit trust/OEICs.

The unit-linked personal pension funds that have FundIDs associated only with personal pensions show stronger evidence of reversals at the 1ME1MR horizon in comparison to those person pension funds that also include at least a unit-trust in their FundID. At intermediate horizons there is generally slightly more evidence of positive performance persistence for unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC. However, there is again stronger evidence of positive performance persistence for unit-linked personal pension funds that have FundIDs associated only with personal pensions in comparison to unit-linked

Table 6.7: Performance Ranked Portfolio Persistence Tests based on Conditional Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust/OEIC	Entire Sample	335	-.0003	.0007	-.0011	-1.89
	Personal Pension	Entire Sample	335	-.0016	.0023	-.0039	-4.29**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	257	.0009	.0015	-.0006	-.54
	FundID - Underlying PP only	Entire Sample	334	-.0022	.0028	-.0051	-5.54**
3MR3ME	Unit Trust/OEIC	Entire Sample	331	.0013	-.0014	.0027	9.32**
	Personal Pension	Entire Sample	327	.0016	-.0003	.0019	3.27**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	253	.0024	.0000	.0024	2.53*
	FundID - Underlying PP only	Entire Sample	325	.0013	-.0005	.0018	2.63**
6MR6ME	Unit Trust/OEIC	Entire Sample	325	.0016	-.0019	.0035	8.69**
	Personal Pension	Entire Sample	319	.0020	-.0010	.0030	5.02**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	247	.0023	-.0010	.0034	3.44**
	FundID - Underlying PP only	Entire Sample	313	.0018	-.0014	.0033	4.12**
12MR12ME	Unit Trust/OEIC	Entire Sample	313	.0013	-.0015	.0027	7.42**
	Personal Pension	Entire Sample	301	.0016	-.0007	.0025	4.52**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	235	.0016	-.0004	.0020	2.29*
	FundID - Underlying PP only	Entire Sample	296	.0014	-.0014	.0028	4.12**
36MR36ME	Unit Trust/OEIC	Entire Sample	265	.0006	-.0007	.0013	7.00**
	Personal Pension	Entire Sample	254	.0007	-.0009	.0016	6.41**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	169	.0018	.0012	.0008	.81
	FundID - Underlying PP only	Entire Sample	246	-.0001	-.0014	.0013	3.38**

For performance ranked tests, funds are sorted each year into quintile portfolios based on past abnormal fund performance over the relevant ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period are computed. AV5 and AV1 are the average abnormal returns of the top and bottom portfolios in the evaluation period respectively. There are five different ranking and evaluation periods e.g. 36MR36ME means three-year ranking period and three year evaluation period and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset where DIF is AV5-AV1 and TDIF is a t-statistic on DIF allowing for the autocorrelation induced by using overlapping observations. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 6.8: Contingency Table Persistence Tests based on Conditional Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust/OEIC	Entire Sample	121,355	.499	.982	-1.59	2.30	-3.67**
	Personal Pension	Entire Sample	35,708	.482	.840	-8.23**	68.83**	-19.52**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	11,298	.509	.972	-.75	4.61*	-9.36**
	FundID - Underlying PP only	Entire Sample	17,626	.479	.787	-7.93**	65.46**	-17.99**
3MR3ME	Unit Trust/OEIC	Entire Sample	10,269	.541	1.385	15.80**	250.69**	28.04**
	Personal Pension	Entire Sample	11,306	.537	1.317	7.31**	53.67**	8.04**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	3,555	.552	1.385	4.83**	24.51**	3.27**
	FundID - Underlying PP only	Entire Sample	5,614	.538	1.282	4.64**	22.13**	7.75**
6MR6ME	Unit Trust/OEIC	Entire Sample	18,140	.539	1.350	10.08**	103.26**	18.80**
	Personal Pension	Entire Sample	5,393	.544	1.430	6.54**	43.12**	6.29**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	1,657	.547	1.353	3.07**	9.78**	1.37
	FundID - Underlying PP only	Entire Sample	2,723	.544	1.316	3.58**	13.37**	8.59**
12MR12ME	Unit Trust/OEIC	Entire Sample	7,793	.561	1.632	10.73**	118.96**	16.40**
	Personal Pension	Entire Sample	2,380	.564	1.779	6.95**	49.82**	8.67**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	701	.593	1.987	4.48**	20.53**	2.76**
	FundID - Underlying PP only	Entire Sample	1,241	.551	1.499	3.54**	12.75**	8.97**
36MR36ME	Unit Trust/OEIC	Entire Sample	1,518	.568	1.417	3.37**	20.61**	.60
	Personal Pension	Entire Sample	449	.508	1.584	2.41*	9.91**	1.67
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	84	.595	1.618	1.09	1.62	-1.68
	FundID - Underlying PP only	Entire Sample	281	.548	1.982	2.81**	9.78**	1.37

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(CP)/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns. Significance at the 5% and 1% levels are denoted by * and ** respectively.

personal pensions that have FundIDs associated with at least a unit trust/OEIC when using the regression of evaluation period abnormal returns on ranking period abnormal returns.

Whilst the previous performance persistence results are based on abnormal returns derived from unconditional factor models Tables 6.7 and 6.8 show the performance persistence results based on abnormal returns from a four factor conditional model (Equation 5.3) as previously used in the performance tests. Using a conditional model does not alter the general conclusions drawn from the unconditional performance persistence tests. Evidence of reversals is still seen at the short horizon of 1MR1ME as well as significant positive performance persistence across the intermediate and long term horizons for both unit trusts/OEICs and the entire sample of unit-linked personal pension funds. There is stronger evidence of performance persistence for unit trusts/OEICs but the difference diminishes as the ranking and evaluation horizon increases. The unit-linked personal pensions that have FundIDs associated only with personal pensions show evidence of positive performance persistence over the intermediate to long horizon. In comparison the unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC also show evidence of significant positive performance persistence but the evidence is not as strong and there is no evidence of performance persistence at the long term horizon of 36MR36ME.

Tables 6.9 and 6.10 show the performance persistence results based on abnormal returns from the four factor model but allowing the factor loadings to vary over time. Look-ahead bias as discussed in Carhart (1997) could be a potential problem since all the previous unconditional models use factor loadings that are estimated over the entire twenty eight year sample period. However, the results for performance persistence using time varying factor loadings are generally the same as the time invariant factor models.

Table 6.9: Performance Ranked Portfolio Persistence Tests based on Four Factor Rolling Coefficients Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust/OEIC	Entire Sample	300	-.0002	-.0003	.0002	0.30
	Personal Pension	Entire Sample	300	-.0010	.0012	-.0021	-2.60**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	221	-.0012	-.0001	-.0013	-1.04
	FundID - Underlying PP only	Entire Sample	300	-.0016	.0005	-.0021	-2.49*
3MR3ME	Unit Trust/OEIC	Entire Sample	296	.0013	-.0019	.0032	5.67**
	Personal Pension	Entire Sample	296	.0014	-.0019	.0033	4.87**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	218	.0008	-.0017	.0025	2.92**
	FundID - Underlying PP only	Entire Sample	296	.0014	-.0021	.0034	4.60**
6MR6ME	Unit Trust/OEIC	Entire Sample	290	.0015	-.0023	.0038	8.07**
	Personal Pension	Entire Sample	289	.0015	-.0023	.0038	5.56**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	209	.0007	-.0017	.0022	2.97**
	FundID - Underlying PP only	Entire Sample	290	.0014	-.0025	.0039	4.75**
12MR12ME	Unit Trust/OEIC	Entire Sample	278	.0013	-.0020	.0034	7.15**
	Personal Pension	Entire Sample	275	.0012	-.0023	.0034	3.97**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	194	.0016	-.0009	.0024	2.52*
	FundID - Underlying PP only	Entire Sample	277	.0006	-.0023	.0030	2.61**
36MR36ME	Unit Trust/OEIC	Entire Sample	230	.0000	-.0007	.0007	2.28*
	Personal Pension	Entire Sample	222	-.0004	-.0020	.0015	2.00
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	140	.0006	.0014	-.0007	-.86
	FundID - Underlying PP only	Entire Sample	222	-.0010	-.0022	.0012	1.40

For performance ranked tests, funds are sorted each year into quintile portfolios based on past abnormal fund performance over the relevant ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period are computed. AV5 and AV1 are the average abnormal returns of the top and bottom portfolios in the evaluation period respectively. There are five different ranking and evaluation periods e.g. 36MR36ME means three-year ranking period and three year evaluation period and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset where DIF is AV5-AV1 and TDIF is a t-statistic on DIF allowing for the autocorrelation induced by using overlapping observations. Significance at the 5% and 1% levels are denoted by * and ** respectively.

Table 6.10: Contingency Table Persistence Tests based on Four Factor Rolling Coefficients Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sample	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust/OEIC	Entire Sample	91,796	.503	1.011	.818	1.173	1.98*
	Personal Pension	Entire Sample	27,123	.481	.823	-8.02**	65.76**	-16.53**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	7,568	.503	.894	-2.44*	10.23**	-7.06**
	FundID - Underlying PP only	Entire Sample	14,265	.486	.825	-5.75**	35.88**	-13.85**
3MR3ME	Unit Trust/OEIC	Entire Sample	28,674	.542	1.384	13.70**	188.41**	31.67**
	Personal Pension	Entire Sample	8,603	.527	1.208	4.39**	19.50**	7.14**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	2,368	.549	1.257	2.77**	9.76**	1.65
	FundID - Underlying PP only	Entire Sample	4,566	.531	1.198	3.04**	9.93**	8.51**
6MR6ME	Unit Trust/OEIC	Entire Sample	13,694	.553	1.488	11.57**	134.96**	19.59**
	Personal Pension	Entire Sample	4,079	.548	1.401	5.36**	29.31**	7.93**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	1,087	.554	1.258	1.89	5.00*	-.19
	FundID - Underlying PP only	Entire Sample	2,210	.546	1.381	3.78	14.64**	11.75**
12MR12ME	Unit Trust/OEIC	Entire Sample	6,030	.583	1.901	12.31**	153.74**	18.47**
	Personal Pension	Entire Sample	1,806	.545	1.447	3.91**	15.80**	10.47**
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	446	.565	1.57	2.36*	5.70*	3.26**
	FundID - Underlying PP only	Entire Sample	1,022	.544	1.402	2.69**	7.44**	10.27**
36MR36ME	Unit Trust/OEIC	Entire Sample	1,151	.566	1.423	2.97**	14.48**	-1.09
	Personal Pension	Entire Sample	351	.507	1.220	.93	1.99	1.66
	FundID - Underlying PP and at least a UT/OEIC	Entire Sample	57	.456	.710	-.64	.75	-1.04
	FundID - Underlying PP only	Entire Sample	228	.500	1.288	.95	2.35	2.36*

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(CP)/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns. Significance at the 5% and 1% levels are denoted by * and ** respectively.

6.5 Conclusion

The evidence for performance persistence using the UK Equity Unit-linked Personal Pension FundID Database with performance ranked portfolio tests generally supports the Berk and Green (2004) model of mutual fund flows. Unit-linked personal pension funds that have a FundID, a proxy for the underlying portfolio, only associated with personal pensions show significant positive performance at intermediate to long horizons. In comparison the unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC show weaker evidence of performance persistence particularly at longer horizons where there is no significant evidence of performance persistence[1]. The illiquid nature of unit-linked personal pension funds from an investor's perspective is the central reason why in accordance to Berk and Green (2004) we should observe more performance persistence in unit-linked personal pensions that have FundIDs associated with only personal pension funds. The underlying portfolios for these funds will only receive fund flows from personal pensions and due to the illiquid nature of personal pensions the attenuated fund flow relationship should restrict the equilibrating mechanism in Berk and Green (2004). For unit-linked personal pensions that have FundIDs associated with at least a unit trust/OEIC their underlying portfolios and fund managers do not have fund flows restricted to personal pension funds.

The evidence supporting Berk and Green (2004) is much stronger in the performance ranked portfolio tests in comparison to the contingency tables. A potential explanation for the contradictory evidence could be related to the point of the performance distribution on which winners and losers are determined. The evidence in Chapter 7 suggests unit trusts/OEICs have a greater performance fund flow relationship in comparison to unit-linked personal pensions in the extreme tails of performance distribution. The contingency table tests determine winners and losers based on

[1]These results are relatively robust to the sample period analysed. See Appendix A.9 to A.12.

the median abnormal return and hence do not concentrate on the extreme tails of the performance distribution. The performance ranked portfolio tests however use quintiles and hence winner funds are located in the top 20% and loser funds in the bottom 20% of the performance distribution. The concentration on the more extreme tails of the distribution may explain the variation in results across methodologies particularly given the evidence on the performance fund flow relationship given in Chapter 6. A potential line of further research is to examine the compare unit trusts/OEICs and unit-linked personal pensions using performance ranked portfolio tests but based on deciles or higher but this requires having a sufficient amount of funds.

For the entire samples of unit trusts/OEICs and unit-linked personal pensions the results are surprising. I find more evidence of performance persistence for unit trusts/OEICs in comparison to the entire sample of unit-linked personal pension funds. Although the entire sample of unit-linked personal pensions will include some underlying portfolios that also include a unit trust/OEIC this is not the case for all the unit-linked personal pensions. In contrast all unit trusts/OEICs will obviously have fund flows from a unit trust/OEIC. Even more concerning is that the evidence of persistence for unit trusts/OEICs is greater than for the unit-linked personal pensions that have FundIDs associated with only personal pension funds. A potential reason for this could be that the unit trust/OEIC database is survivor-bias free whereas the UK Equity Unit-linked Personal Pension Database has a unknown but assumed small level of survivor-bias due to no data being available on merged pension funds. Non surviving funds typically cease to exist due to be being consistently poor performers and hence any excluded dead funds would presumably reduce the level of performance persistence. Also since liquidations are negligible for personal pension funds the higher level of non-surviving funds in the UK Equity Unit Trust/OEIC Database could be a major influence on performance persistence results. However, Appendix A.6 to A.8 displays the percentage of repeat loser funds

from the contingency table tests across factor models and losers funds do not seem to overly dominate the results. Further research is needed to assess the level of merged funds in personal pensions and also to try and explain the reason for significant reversals at the short term horizon of 1ME1MR. However, there are some promising results from the performance persistence tests in regards the Berk and Green (2004) model of mutual fund flows that warrants further research.

The performance persistence results for both unit trusts/OEICs and unit-linked personal pensions generally show greater evidence of performance persistence at medium term horizons in comparison to longer term horizons. As discussed in Elton et al. (2011a) a potential reason for this in relation to the Berk and Green (2004) model of mutual fund flows could be due to either investors taking time to reallocate funds or due to investors taking time to receive and process the relevant data. If this is the case then it could potentially explain why there is minimal persistence in performance at the longer term horizons but stronger evidence at medium term horizons.

From an investor's perspective the evidence suggests that active fund managers can produce persistence in performance but decreasing returns to scale from fund flows reduces performance persistence over the longer term. Since this research is based on the performance of the fund due to the investment decisions of fund managers further research needs to examine the net performance of the fund after taxes and charges to assess whether any persistence in abnormal performance accrues to the investor. At present the lack of availability of comprehensive datasets for expense ratios, fees etc for collective investment schemes limits the possibility of this future valuable research for UK investors and society in general.

Chapter 7

Fund Flows

Previous research based on US data by Chevalier and Ellison (1997), Sirri and Tufano (1998) and Del Guercio and Tkac (2002) find a strong relationship between past performance and subsequent fund flows for US mutual funds. The seminal work of Carhart (1997) concludes that after taking into consideration his four-factor model there is little evidence of performance persistence which raises the question of why fund flows respond to past performance when performance is not persistent? Berk and Green (2004) try to answer this question by producing a rational equilibrium model of active portfolio management that ensures managers cannot consistently achieve abnormal returns as they are competed away due to decreasing returns to scale. Berk and Tonks (2007) test the Berk and Green model of mutual fund flows, using US mutual fund data from 1962 to 2004, by primarily examining the one anomaly in Carhart (1997), the relative continual under performance by the worst performing funds. Berk and Tonks (2007) find that the continual under performance by the worst performing funds can be attributed to an attenuated performance flow of funds relationship which supports the Berk and Green (2004) model of mutual fund flows. In this chapter I examine the performance fund flow relationship for UK equity unit-linked personal pension funds and UK equity unit trusts/OEICs. I also

propose another empirical test of Berk and Green (2004) by analysing UK equity unit trusts/OEICs and unit-linked personal pension funds but based on underlying portfolio flows using actual fund/underlying portfolio size data.

7.1 Methodology

7.1.1 Fund Flows

The previous literature generally uses two measures to calculate fund flows. The relative fund flow measure, as shown in Equation (7.1), is typically the most frequently used measure in the literature. In Equation (7.1) the NAV_{it} is the total NAV (net asset value) i.e. fund size for fund i at time t, NAV_{it-1} is the total NAV at $t-1$ and $(1+r_{it})$ is the realised return on the fund between t and $t-1$ assuming all distributions are reinvested.

$$Flow_{it} \equiv \frac{\text{NAV}_{it} - \text{NAV}_{it-1}\,(1+r_{it})}{\text{NAV}_{it-1}} \tag{7.1}$$

Berk and Tonks (2007) highlight a potential problem with this measure. If a poorly performing fund in the sample enters liquidation the relative flow of funds measure would expected to be -100%. However, Equation (7.1) will not produce a relative flow of funds measure of -100% in liquidation[1]. To overcome this potential problem, Berk and Tonks (2007) modify the denominator of Equation (7.1) and use Equation (7.2), where now in liquidation a fund's flow in its last period will be equal to -100%. The implication of using either formula should be minimal since they only differ by a factor of $1/(1+r_{it})$. In this research I use Equation (7.2) for the calculation of the relative fund flow for the aforementioned reason.

[1]Unless, the return over the period is 0 i.e. r_{it} is equal to zero.

$$Flow_{it} \equiv \frac{\text{NAV}_{it} - \text{NAV}_{it-1}(1 + r_{it})}{\text{NAV}_{it-1}(1 + r_{it})} \tag{7.2}$$

For robustness, in addition to using the relative fund flow measure, I also use the absolute fund flow measure which I calculate using Equation (7.3).

$$Flow_{it} \equiv \text{NAV}_{it} - \text{NAV}_{it-1}(1 + r_{it}) \tag{7.3}$$

7.1.2 Abnormal Returns

To examine the performance fund flow relationship I primary use risk adjusted returns for the performance measure. I calculate monthly abnormal performance for each fund by comparing the realised monthly return on the fund with the return predicted from the Carhart four factor model. The Carhart four factor model is shown in Equation (7.4).

$$R_{pt} - r_{ft} = \alpha_p + \beta_p (R_{mt} - r_{ft}) + \gamma_p SMB_t + \delta_p HML_t + \lambda_p MOM_t + \varepsilon_{pt} \tag{7.4}$$

For each fund, $R_t - r_{ft}$ is regressed against the four factors in Equation (7.4), where R_t is the monthly return at time t on the fund and r_{ft} is the monthly return on the risk free asset at time t. The $(R_{mt} - r_{ft})$ variable is the excess return on the market, SMB is the size factor, HML is the book to market factor and MOM is the one year momentum factor. The regression coefficients are based on whole sample regressions and are calculated individually for each fund in order to obtain monthly abnormal returns for each unit trust/OEIC and unit-linked personal pension fund.

7.1.3 Performance Fund Flow Relationship

The empirical test of Berk and Green (2004) in Chapter 6 assumes that unit-linked personal pension funds have a more attenuated performance fund flow relationship in comparison to unit trusts/OEICs due to the illiquid nature of personal pensions. Whilst Del Guercio and Tkac (2002) offer evidence in a US setting, in this chapter I extend the evidence to UK equity unit-linked personal pension funds and UK equity unit trusts/OEICs. I examine the performance fund flow relationship following the method of Sirri and Tufano (1998). I rank funds based on their previous 1 year abnormal return, where abnormal returns are calculated from a Carhart four factor model. The funds are ranked into 4 equal bins based on past performance over the ranking period and I then calculate the subsequent one year relative fund flow (growth rate). This procedure is followed for overlapping time periods throughout the sample. As highlighted by Berk and Tonks (2007) a problem with using the relative flow measure is the recent growth in the number of small funds[2]. The result of having a disproportionately large number of small funds is that the relative flows can be abnormally large and these outliers can dominate the results. Also, mergers between funds can cause extreme relative fund flow outliers which dominate the performance fund flow results. To account for these outliers I analyse the performance fund flow relationship for unit trusts/OEICs and unit-linked personal pensions based on the relative fund flow data between the fifth and ninety fifth percentiles. I then calculate the average relative fund flow for each bin, where bin 1 contains the funds with the lowest abnormal returns in the performance ranking period and bin 4 contains the funds with the highest abnormal returns in the performance ranking period. I then graph the performance fund flow relationship based on the average relative fund flow to each bin. I apply this method separately to both unit trusts/OEICs and unit-linked personal pension funds to enable a comparative

[2]Berk and Tonks (2007) find a large number of small funds in the last 10 year of their 1962 to 2004 US sample.

analysis to be made. I also examine the performance fund flow relationship using 10 and 20 bins in the performance ranking period. This provides evidence of whether the fund flow relationship varies at the extreme tails of the performance fund flow distribution for unit trusts/OEICs and unit-linked personal pensions which potentially otherwise would not be captured using only 4 bins. For robustness I also examine the performance fund flow relationship using raw returns in the one year ranking period although I focus the main analysis on the abnormal returns since they are risk adjusted.

7.1.4 Empirical Test of Berk and Green (2004)

The empirical test of Berk and Green (2004) in Chapter 6 predicts greater performance persistence in unit-linked personal pension funds that have a FundID, a proxy for the underlying portfolio, only associated with personal pensions in comparison to unit trusts/OEICs and unit-linked personal pension funds that have a FundID associated with at least a unit trust/OEIC. The illiquid nature of personal pensions should imply an attenuated fund flow relationship and thus for unit-linked personal pension funds that have an underlying portfolio that only contains fund flows from personal pensions we should see more more performance persistence since the equilibrating mechanism of fund flows in Berk and Green (2004) is restricted. The motivation for the empirical test of Berk and Green (2004) in Chapter 6 is part driven by the lack of available fund size data for UK funds, the lack of consistency in how fund size is reported and the problem of calculating accurate underlying portfolio sizes and portfolio flows. However, the empirical test of Berk and Green (2004) in Chapter 6 has the advantage that we can look at a large sample of unit trusts/OEICs and unit-linked personal pension funds without actually having fund size data. It does however rely on the assumption of a more attenuated performance fund flow relationship for unit-linked personal pensions in comparison to

unit trusts/OEICs. Previous evidence in the academic literature to support this assumption can be found in Del Guercio and Tkac (2002) in addition to the new evidence for the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds presented in this chapter.

Given the assumption of a more attenuated fund flow relationship for unit-linked personal pensions in comparison to unit trusts/OEICs I propose another empirical test of Berk and Green (2004) using actual fund flow data. Since I imply that the diseconomies of scale fund managers face in Berk and Green (2004) are at the underlying portfolio level I empirically test Berk and Green (2004) using funds flows at the underlying portfolio level, where I use FundID as a proxy for the underlying portfolio. Since I do not have comprehensive fund size data it is impossible to compute underlying portfolio sizes across all funds. My second best alternative involves using the UK Equity Unit Trust/OEIC FundID Fund Size Database and the UK Equity Unit-Linked Personal Pension FundID Fund Size Database to empirically test Berk and Green (2004) using fund flows at the underlying portfolio level. The aforementioned databases are discussed in detail in Section 7.2. In short, each fund has an underlying FundID, a proxy for the underlying portfolio, only composed of a unit trust/OEIC for the unit trust/OEIC database and a unit-linked personal pension for the personal pension database that consists of only one unit/share class. Due to these aforementioned restrictions the fund sizes in the aforementioned databases are also the underlying portfolio sizes. Therefore fund flows calculated from these databases can therefore be considered as the underlying portfolio flows. The main disadvantage of this restriction to create underlying portfolio flows is the small number of funds in the UK Equity Unit Trust/OEIC FundID Fund Size Database and the UK Equity Unit-Linked Personal Pension FundID Fund Size Database since most underlying portfolios contain more than one investment vehicle and more than one unit/share class.

To perform the empirical test I rank funds into quartiles based on their previous 1 year performance, where performance is measured by abnormal returns from the Carhart four factor model. The funds in the top quartile are then sorted into into two groups based on the past 1 year median relative fund flow across all funds. This double sorting results in two portfolios, TQTH and TQBH, where TQTH stands for the portfolio which contains funds in the top quartile based on past 1 year performance and the top half based on past 1 year relative fund flows. Likewise TQBH represents the portfolio of funds that are in the top quartile based on past 1 year performance and the bottom half based on past 1 year relative fund flows. I follow the same procedure for the bottom quartile based on past 1 year performance. BQTH represents the portfolio of funds that are in the bottom quartile based on past 1 year performance ranking period and are in the top half in the past 1 year relative fund flow ranking. Likewise, BQBH represents the portfolio of funds that are in the bottom quartile based on past 1 year performance ranking period and are in the bottom half in the past 1 year relative fund flow ranking. For the funds in the portfolios that represent TQTH, TQBH, BQTH and BQBH the subsequent post formation 1 year abnormal return from the Carhart 4 factor model is calculated. This procedure is followed using overlapping time periods throughout the sample. I then calculate the average abnormal return for each portfolio along with its t stat where the t stat has been calculated to allow for the autocorrelation from using overlapping periods. I also analyse spread portfolios using the same procedure. I apply the aforementioned procedures separately to unit trusts/OEICs and unit-linked personal pensions. For robustness I also apply the methodology using absolute fund flows.

Bessler et al. (2010) employ a similar methodology to empirically examine Berk and Green (2004) but it is not clear whether the fund flows in Bessler et al. (2010) are a close approximation to the underlying portfolio flows a fund manager would face diseconomies of scale investing. In addition Bessler et al. (2010) use deciles

for the past 1 year performance ranking and also deciles for the past 1 year fund flow ranking. Bessler et al. (2010) can employ deciles in both the past performance ranking and fund flow ranking due to examining US data where the number of funds with comprehensive fund size data is much greater. However, their deciles for the past 1 year fund flow are past performance decile specific. For example the top decile with the past performance winners are sorted into past fund flow deciles based on fund flow data for funds only in the top decile not all funds across all performance deciles. Since they have enough data to use deciles in both performance and fund flow rankings the difference in fund flows between the past performance winner decile with the highest fund flows and the past performance winner decile with the lowest fund flows can still be significantly difference. Since I am using such a small number of funds using deciles is not feasible. For the past 1 year flow ranking I split the funds into two groups based on the median fund flow. However unlike Bessler et al. (2010) this is not specific to the past 1 year performance quartile but is measured across all funds. Since I have so few funds ranking the past 1 year fund flows across all funds should capture extremes in the fund flows across performance quartiles.

The Bessler et al. (2010) methodology has the advantage that each portfolio based on past performance and fund flows at any given point in time will always contain funds. For the methodology I employ this may not be the case. For instance, the funds in the top quartile based on past 1 year performance at a given point in time may all belong to the top half of funds when split by the median past fund flow across all funds. This would imply that no funds would be part of the top quartile based on past 1 year performance and bottom half based on past 1 year relative fund flows i.e. no funds in TQBH. This would not be the case if the past 1 year fund flow ranking was quartile specific. However, this is just a extreme example for a given point in time during the sample. Since the ranking based on past 1 year performance and relative fund flows is based on overlapping periods each portfolio i.e. TQTH, TQBH, BQTH and BQBH, has sufficient data to empirically examine

Berk and Green (2004).

7.2 Data

I analyse the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds using the using data from the UK Equity Unit Trust/OEIC Fund Size and the UK Equity Unit-Linked Personal Pension Fund Size databases. For the emprical test of Berk and Green (2004) using fund size data I use the UK Equity Unit Trust/OEIC FundID Fund Size and the UK Equity Unit-Linked Personal Pension FundID Fund Size databases. All the aforementioned databases have a sample period of January 2000 to December 2007 and include monthly returns based on bid-bid prices and monthly fund size data. Details of the construction of these databases has previously been discussed at length in Section 4.7.

In summary the UK Equity Unit Trust/OEIC Fund Size Database includes all UK equity unit trusts/OEICs where both returns and fund size data are available. Likewise, the UK Equity Unit-Linked Personal Pension Fund Size Database includes all UK equity unit-linked personal pension funds where both returns and fund size data are available. I use these datasets to examine the performance fund flow relationship. The UK Equity Unit Trust/OEIC FundID Fund Size Database contains those UK equity unit trusts/OEICs that have an underlying FundID, a proxy for the underlying portfolio, only composed of a unit trust/OEIC that only has one unit/share class. Likewise, the UK Equity Unit-Linked Personal Pension FundID Fund Size Database contains those UK equity unit-linked personal pension funds that have an underlying FundID composed only of a unit-linked personal pension that only has one unit/share class. The fund sizes in these two databases therefore proxy for the underlying portfolio size for each fund and hence any fund flow cal-

Table 7.1: Fund Size and Flow Summary Statistics for Fund Size Databases - 2000 to 2007

	UK Equity Unit Trust/OEIC Fund Size Database	UK Equity Unit-Linked Personal Pension Fund Size Database	UK Equity Unit Trust/OEIC FundID Fund Size Database	UK Equity Unit-Linked Personal Pension FundID Fund Size Database
Number of funds	291	211	39	34
Mean monthly fund size	305.65	159.86	118.55	289.10
S.D monthly fund size	575.82	498.16	233.32	580.98
10th percentile monthly fund size	16.17	1.11	11.58	4.10
Median monthly fund size	118.39	10.34	62.09	55.40
90th percentile monthly fund size	740.20	346.00	270.44	1164.38
Mean monthly absolute net flow	.74	.67	.26	.88
S.D monthly absolute net flow	42.47	53.33	39.88	74.85
10th percentile monthly absolute net flow	-6.03	-.67	-2.95	-1.64
Median monthly monthly absolute net flow	-.08	.01	-.19	.00
90th percentile monthly absolute net flow	7.53	1.54	1.16	2.63
Mean monthly relative net flow	4.37%	44.61%	3.26%	.96%
S.D monthly relative net flow	42.47%	1823.74%	161.93%	18.96%
10th percentile monthly relative net flow	-6.03%	-2.19%	-3.34%	-1.39%
Median monthly monthly relative net flow	-.08%	.09%	-.39%	.00%
90th percentile monthly relative net flow	7.53%	5.18%	2.24%	2.47%

Fund sizes are in millions of GBP.

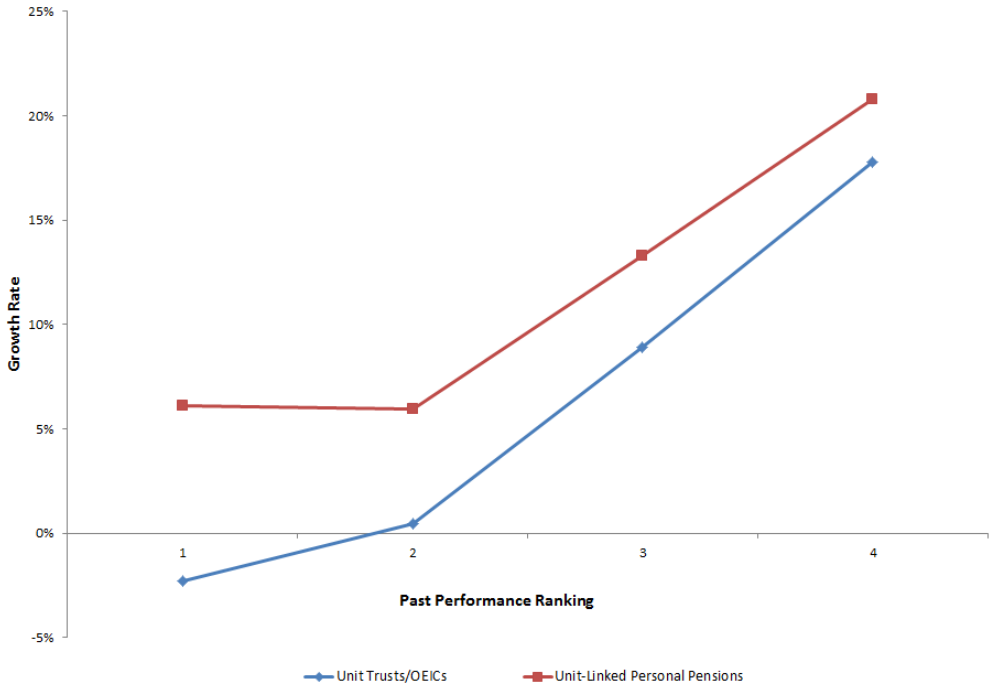
culations will proxy the underlying portfolio flows. I therefore use these last two aforementioned datasets to perform an empirical test of the Berk and Green (2004) model of mutual fund flows based on underlying portfolio flows, where the FundID is a proxy for the underlying portfolio.

Table 7.1 summaries the four databases I use in Chapter 7. There are relatively few funds in the UK Equity Unit Trust/OEIC FundID Fund Size Database and the UK Equity Unit-Linked Personal Pension FundID Fund Size Database since these databases restrict funds to having an underlying FundID that only contains a unit trust/OEIC or a unit-linked personal pension that only has one unit/share class. Although these databases have a limited number of funds they allow the fund size and flow figures to proxy for the underlying portfolio sizes and flows. For the UK Equity Unit Trust/OEIC Fund Size Database and the UK Equity Unit-Linked Personal Pension Fund Size Database the flows in general do not represent the underlying portfolio size and underlying portfolio flows. The flows in Table 7.1 for the UK Equity Unit Trust/OEIC Fund Size and the UK Equity Unit-Linked Personal Pension Fund Size databases are susceptible to outliers due to exceptionally large relative fund flows from mergers between funds and relatively small funds experiencing large growth. This potentially explains the large variation in fund flows Table 7.1. The performance fund flow relationship is examined based on the fund flows between the fifth to ninety fifth percentiles to eliminate outliers dominating the results.

7.3 Results

Figure 7.1 displays the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds over the sample period January 2000 to December 2007 based on ranking performance into 4 bins.

Figure 7.1: Abnormal Performance Fund Flow Relationship Based on Four Performance Bins



Funds are ranked based on their one year abnormal returns from the Carhart four factor model at time t and divided equally into four bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

The relative flow (growth rate) is always larger for unit-linked personal pensions in comparison to unit trust/OEICs. For bin 4, the winners in the past 1 year abnormal performance ranking period, this is particularly surprising as it suggests that the performance fund flow relationship for unit-linked personal pension funds is stronger than that of unit trusts/OEICs. Does this imply that the set of unit-linked personal pension fund investors are more responsive and sensitive to past performance for winners in term of investing new money than unit trust/OEIC investors? We have to be careful with our interpretation of Figure 7.1 as whilst Figure 7.1 shows the average relative fund flows it does not necessarily result from investors investing in response to past performance. In particular the fund flows for unit-linked personal pensions are a complex mixture of flows from various channels. Some of these chan-

nels may have a highly sensitive performance fund flow relationship. Other channels may have a less sensitive performance fund flow relationship. An approximate classification of fund flows for unit-linked personal pensions is as follows.

- Outflows due to investors in unit-linked personal funds retiring and entering the deccumulation phase and converting their accumulated money in the personal pension fund into an annuity or an annuity and a lump sum.
- Current investors in a unit-linked personal pension fund continuing to contribute through regular i.e. monthly, contributions.
- Current investors in a unit-linked personal pension changing their contribution level whether through an increase or decrease in contributions.
- Current investors in the unit-linked personal pension funds switching funds.
- New investors investing into a unit-linked personal pension for the first time.
- Mergers between unit-linked personal pension funds.

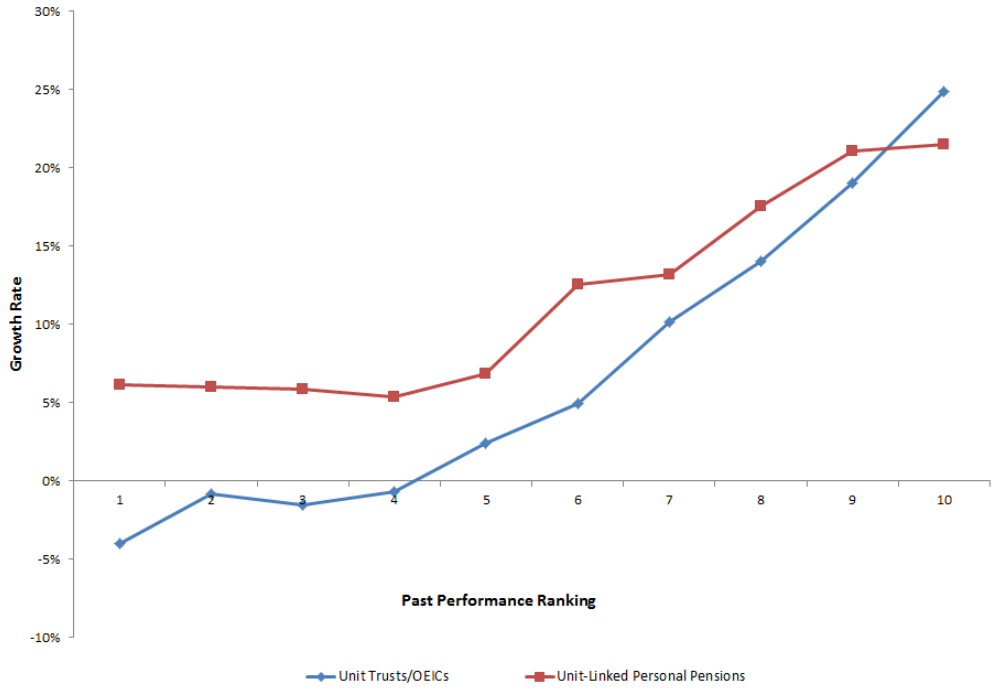
For two or perhaps three of these fund flow channels it seems highly unlikely that the past 1 year abnormal return would be the cause of the subsequent 1 year relative flow. In particular outflows from the fund through unit-linked personal pension investors retiring and converting their accumulated money into an annuity or an annuity and lump sum is likely to be much less sensitive to the past performance of the fund since retirements are generally predetermined long before the event.

In addition any fund flows from mergers are not a direct result of investors investing in response to past performance. In the month the fund size data records the merged fund size the fund flow calculations produce abnormally large figures that potentially bias the performance fund flow results. Figure 7.1 should already have excluded most mergers as it only analyses fund flow data between the fifth and ninety fifth percentiles. Also, most individual investors do not have the sufficient

available capital to invest a one off lump sum into a unit-linked personal pension to generate enough income for retirement. Most individual investors will invest into their pension through monthly contributions. Whilst this perhaps may be sensitive to past performance of the fund i.e. for consistently poorly performing personal pension funds investors may stop contributing, in general investors have to continue to contribute to accumulate enough money in their pension to fund their retirement. Investors who stop contributing to a personal pension still incur management fees each year and cannot directly access their funds. They can switch into another personal pension but investors generally will occur a switching cost and the level of switching is estimated to be low in the UK, Alfon (2002). Hence the continual contributions of exiting unit-linked personal pension holders is generally expected to persist and be less sensitive to past performance than new personal pension investors or investors in general in unit trusts/OEICs.

In addition to the higher relative fund flows for unit-linked personal pension funds in all bins in comparison to unit trusts/OEICs, unit-linked personal pension funds do not have an average outflow in the bottom bin i.e. the bin that contains the poorest abnormal performers from the ranking period. Although the classification of channels for fund flows for unit-linked personal pensions is complex a potential explanation for this relates to the fund flows from existing unit-linked personal pension holders continuing to make monthly pre-determined contributions far exceeding the outflows due to current unit-linked personal holders retiring. It must be stressed that these potential explanations are only suggestions as without detailed fund flow data based on the above classification we have no direct evidence. From Berk and Green (2004) we would expect an outflow from the worst preforming funds to result in the fund being managed more efficiently. Hence, poor performers continuing to perform poorly would be more likely on average for unit-linked personal pension funds in comparison to unit trusts/OEICs.

Figure 7.2: Abnormal Performance Fund Flow Relationship Based on Ten Performance Bins

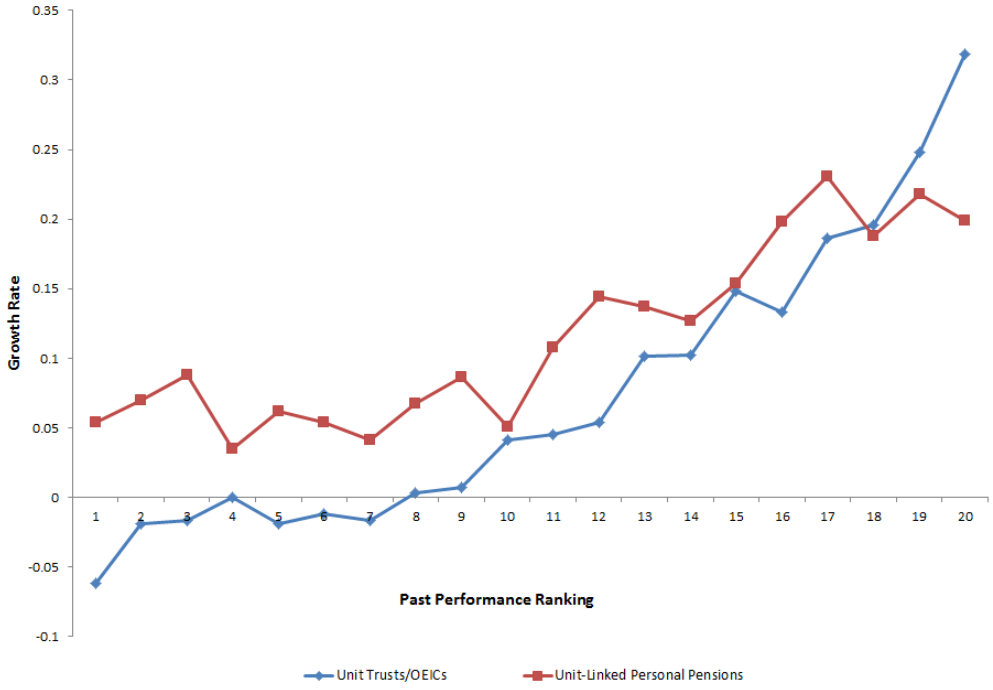


Funds are ranked based on their one year abnormal returns from the Carhart four factor model at time t and divided equally into ten bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

Whilst the higher general level of fund flows for unit-linked personal pension funds can be potentially explained by the majority of current unit-linked personal pension investors continuing to make regular pre agreed contributions to their personal pension fund it does not explain the general similarities of the relative sensitivities of investors to different levels of past performance for both unit trusts/OEICs and unit-linked personal pensions. Figure 7.1 suggests that the sensitivities of unit trust/OEIC investors and unit-linked personal pension fund investors to past performance is not significantly different which is surprising given the highly illiquid nature of unit-linked personal pension funds. The gradients of fund performance fund flow lines for both the unit trust/OEIC and unit-linked personal pension funds is virtually identical between bins 2, 3 and 4. This evidence is puzzling but poten-

tially suggests that the difference in the fund flow performance relationship between unit trusts/OEICs and unit-linked personal pensions, due to the illiquid nature of personal pensions, could be concentrated in the extreme tails of the distribution which is not captured when performance is only divided into 4 bins.

Figure 7.3: Abnormal Performance Fund Flow Relationship Based on Twenty Performance Bins



Funds are ranked based on their one year abnormal returns from the Carhart four factor model at time t and divided equally into twenty bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

Figure 7.2 displays the performance fund flow relationship between unit trusts/OEICs and unit-linked personal pensions based on ranking funds into 10 equal bins based on their previous one year abnormal returns from the Carhart four factor model. The rationale to increase the number of bins in the ranking period is to expose the extreme tails of the performance fund flow relationship. Figure 7.2 shares some similar characteristics with Figure 7.1. The average relative fund flow (growth rate) for unit-linked personal pensions is positive for all bins and is generally always greater

than the average relative fund flow of unit trusts/OEICs. The one exception to this is bin 10 which contains the funds with the highest abnormal returns in the ranking period. Figure 7.2 also displays a more convex performance fund flow relationship for unit trusts/OEICs in comparison to unit-linked personal pensions when using 10 bins. This difference in the performance fund flow relationship is not captured when only using 4 bins. The range between the average relative fund flow for the top and bottom bins is much greater for unit trusts/OEICs in comparison to unit-linked personal pensions. It seems that the the main differences between the performance fund flow relationship for unit trusts/OEICs and unit-linked personal pensions is at the extreme tails of the distribution. Any test of Berk and Green (2004) based on a comparative analysis of personal pensions and unit trusts/OEICs would potentially produce stronger results by using methodologies that focus on the extreme tails of the performance fund flow distribution.

Figure 7.3 displays the performance fund flow relationship between unit trusts/OEICs and unit-linked personal pensions based on ranking funds into 20 equal bins based on their previous one year abnormal returns from the Carhart four factor model. The performance fund flow relationship is less smooth than the 10 bin case but this is probably due to having an insufficient number of funds in the sample to use 20 bins. In all other regards Figure 7.3 is very similar to Figure 7.2. The general shape of the performance fund flow relationship for unit trusts/OEICs is very similar to the performance fund flow relationship for US mutual funds in Sirri and Tufano (1998). Unit trusts/OEICs have a steeper performance fund flow relationship in comparison to unit-linked personal pension funds. The response to past performance is also much larger in the top bin for unit trusts/OEICs. The results for the performance fund flow relationship based on 4, 10 and 20 bins is fairly robust to the performance measure used. If the 1 year past performance ranking is based on raw returns[3] the

[3]Appendices A.13, A.14 and A.15 display the performance fund flow relationships for unit trusts/OEICs and unit-linked personal pensions based on using raw returns in the performance ranking.

Table 7.2: Performance of Funds Based on Past 1 Year Performance and 1 Year Absolute Fund Flow

Ranking Period	Investment Vehicle	Fund Flow Measurement	Ranking	Evaluation Period Mean Return	t stat
	Unit trust/OEIC		All Funds	-.007	-.61
	Unit trust/OEIC	Absolute	TQTH	-.011	-.68
	Unit trust/OEIC	Absolute	TQBH	-.015	-.96
1 Year Ranking (Abnormal)	Unit trust/OEIC	Absolute	BQTH	-.065	-2.29*
	Unit trust/OEIC	Absolute	BQBH	-.029	-2.07*
	Unit trust/OEIC	Absolute	TQTH - TQBH	.011	.75
	Unit trust/OEIC	Absolute	BQTH - BQBH	-.041	-2.49*
	Unit trust/OEIC	Absolute	TQTH - BQBH	.019	1.64
	Unit trust/OEIC	Absolute	TQBH - BQBH	.044	1.78
	Personal Pension		All Funds	-.006	-1.50
	Personal Pension	Absolute	TQTH	.004	.40
	Personal Pension	Absolute	TQBH	-.001	-.22
1 Year Ranking (Abnormal)	Personal Pension	Absolute	BQTH	-.007	-1.14
	Personal Pension	Absolute	BQBH	-.016	-2.63**
	Personal Pension	Absolute	TQTH - TQBH	.006	.64
	Personal Pension	Absolute	BQTH - BQBH	.011	1.65
	Personal Pension	Absolute	TQTH - BQBH	.022	2.19*
	Personal Pension	Absolute	TQBH - BQBH	.004	.78

Funds are ranked into quartiles based on their past 1 year abnormal return from the Carhart 4 factor model. The funds in the top quartile are then sorted into two groups based on the past 1 year median absolute fund flow across all funds. The same procedure is applied to the funds in the bottom quartile. TQTH stands for top quartile top half where the quartile represents the past 1 year performance ranking and the half represents the past 1 year absolute fund flow. Likewise, BQBH stands for bottom quartile bottom half where the quartile represents the past 1 year performance ranking and the half represents the past 1 year absolute fund flow. Following this convention TQBH stands for top quartile bottom half and BQTH stands for bottom quartile top half. For the portfolios that represent TQTH, TQBH, BQTH and BQBH the subsequent post formation 1 year abnormal return from the Carhart 4 factor model is calculated. This procedure is followed using overlapping time periods throughout the sample. I then calculate the average abnormal return for each portfolio along with its t stat where the t stat has been calculated to allow for the autocorrelation. I follow the same procedure for the spread portfolios.

Table 7.3: Performance of Funds Based on Past 1 Year Performance and 1 Year Relative Fund Flow

Ranking Period	Investment Vehicle	Fund Flow Measurement	Ranking	Evaluation Period Mean Return	t stat
	Unit trust/OEIC		All Funds	-.007	-.61
	Unit trust/OEIC	Relative	TQTH	-.016	-1.02
	Unit trust/OEIC	Relative	TQBH	-.006	-.35
1 Year Ranking (Abnormal)	Unit trust/OEIC	Relative	BQTH	-.075	-2.78**
	Unit trust/OEIC	Relative	BQBH	-.028	-1.77
	Unit trust/OEIC	Relative	TQTH - TQBH	.000	-.02
	Unit trust/OEIC	Relative	BQTH - BQBH	-.052	-2.78**
	Unit trust/OEIC	Relative	TQTH - BQBH	.012	.76
	Unit trust/OEIC	Relative	TQBH - BQBH	.068	2.68**
	Personal Pension		All Funds	-.006	-1.50
	Personal Pension	Relative	TQTH	.006	.55
	Personal Pension	Relative	TQBH	.003	.62
1 Year Ranking (Abnormal)	Personal Pension	Relative	BQTH	-.004	-.74
	Personal Pension	Relative	BQBH	-.022	-3.32**
	Personal Pension	Relative	TQTH - TQBH	.004	.37
	Personal Pension	Relative	BQTH - BQBH	.021	2.97**
	Personal Pension	Relative	TQTH - BQBH	.032	2.37**
	Personal Pension	Relative	TQBH - BQBH	.006	1.25

Funds are ranked into quartiles based on their past 1 year abnormal return from the Carhart 4 factor model. The funds in the top quartile are then sorted into two groups based on the past 1 year median relative fund flow across all funds. The same procedure is applied to the funds in the bottom quartile. TQTH stands for top quartile top half where the quartile represents the past 1 year performance ranking and the half represents the past 1 year relative fund flow. Likewise, BQBH stands for bottom quartile bottom half where the quartile represents the past 1 year performance ranking and the half represents the past 1 year relative fund flow. Following this convention TQBH stands for top quartile bottom half and BQTH stands for bottom quartile top half. For the portfolios that represent TQTH, TQBH, BQTH and BQBH the subsequent post formation 1 year abnormal return from the Carhart 4 factor model is calculated. This procedure is followed using overlapping time periods throughout the sample. I then calculate the average abnormal return for each portfolio along with its t stat where the t stat has been calculated to allow for the autocorrelation. I follow the same procedure for the spread portfolios.

same general findings are observed particularly for the worst performers where unit trusts/OEICs on average have fund outflows whereas unit-linked personal pensions have on average inflows. The evidence of the performance fund flow relationship for the best performers based on raw returns is less supportive of a more attenuated performance fund flow relationship for personal pension funds in comparison to risk adjusted returns.

Tables 7.2 and 7.3 display the results for the empirical test of Berk and Green (2004) based on underlying portfolio flows. Table 7.3 based on relative fund flows offers the slightly stronger results in favour of Berk and Green (2004) although the general conclusions from Table 7.3 also apply to the results based on absolute fund flows in Table 7.2. For unit trusts/OEICs the BQTH portfolio shows evidence of significance average under performance. The BQTH portfolio contains the unit trusts/OEICs that have the worst performance but are in the half with the highest fund flows in the ranking period. Berk and Green (2004) suggest an outflow for the worst performing funds would allow the funds to be managed more efficiently and poor performance will not persist. For the funds in the BQTH this is not the case as they experience on average high inflows and the significantly negative performance of the BQTH portfolio in the evaluation period is supportive of Berk and Green (2004). For funds in the BQBH their evaluation period mean return is negative but not significantly different from zero. As shown in the performance fund flow graphs unit trusts/OEICs with the worst performance on average experience the greatest subsequent fund outflows which according to Berk and Green (2004) would allow the fund to be managed more efficiently. Since the BQBH funds do have greater average performance than the BQTH portfolio it provides empirical support for Berk and Green (2004). In addition the spread portfolios of TQBH-BQBTH and BQTH-BQBH are both significant at the 1% level. This suggests profitable strategies are potentially possible although the evidence does not include transactions costs and fees. It also suggest that is the worst performing unit trusts/OEICs with the

largest inflows that drive the results. The fund managers of the winner funds in terms of performance with the highest inflows would face the highest diseconomies of scale and hence we would expect in accordance in Berk and Green (2004) worse performance in the TQTH portfolio in comparison to the TQBH portfolio. For the top performing unit trusts/OEICs in the ranking period in Table 7.3 the TQBH portfolio displays a greater mean return in the evaluation period in comparison to the TQTH portfolio which supports Berk and Green (2004). However the spread portfolio of TQTH-TQBH is not significantly different form zero. This is perhaps surprising as the best performers in the ranking period who subsequently have the smallest net flows would be expected to have persistence in performance since the fund manager would not have to deal with decreasing returns to scale from large inflows.

For unit-linked personal pension funds the performance fund flow relationship is less convex and sensitive to past performance particularly in the extreme tails of the performance distribution. Due to the illiquid nature of personal pensions investors do not respond to past performance as much as unit trust/OEIC investors particularly in the extreme tails. Also, for the worst performing unit-linked personal pension funds the performance fund flow relationship still results in inflows on average rather than outflows. This is not that surprising as the illiquid nature of personal pensions means that investors can only exit the fund by switching funds incurring large costs and they cannot withdraw and access their money until retirement. Given these two features a spread portfolio of long TQBH and short BQTH would be the likely candidate to produce significant abnormal returns. However the mean return on the spread portfolio is not significantly different from zero. However the spread portfolio of TQTH-BQBH is significant at the 1% level. Taken in isolation this makes economic sense in regards Berk and Green (2004) since the performance fund flow relationship for the best performing unit-linked personal pensions is less convex and the worst performing funds are likely to continue to under perform since

on average there are inflows rather than outflows. However, it does not explain why the TQTH-BQBH spread portfolio is significant and TQBH-BQTH spread portfolio is not significantly different from zero. The driver of these results if the BQBH portfolio which is significantly negative at the 1% level. This anomaly is also present in Table 7.2 based on abnormal flows but the evidence is not as statistically strong in comparison to the relative flow. Further research and investigation is required to understand and explain this anomaly but a potential explanation is due to separating fund flows on the median and performance on quartiles. Using deciles or higher for ranking both performance and fund flows would capture the extremes in fund flows but is dependent on a large and comprehensive dataset being available which is currently not the case for UK funds.

7.4 Conclusion

The empirical evidence of a convex performance fund flow relationship for unit trusts/OEICs and unit-linked personal pension funds is consistent with the evidence based on US data in Del Guercio and Tkac (2002) and Sirri and Tufano (1998). The convex nature of the performance fund flow relationship suggests investors chase future out performance but do not punish under performance by the same margin. For the worst performing unit-linked personal pension funds the subsequent fund flows are actually inflows on average. The evidence in Figures 7.1, 7.2, and 7.3 suggests that the performance fund flow relationships for unit trusts/OEICs and unit-linked personal pension funds are only significantly different at the extreme tails of the performance distribution. Investors in unit trusts/OEICs respond to extreme fund performance more than unit-linked personal pension fund investors. For the worst performing unit trust/OEIC investors withdraw capital on average producing fund outflows whereas the worse performing unit-linked personal pension funds still experience fund inflows on average. For the best performing unit trusts/OEICs the

performance fund flow relationship is stronger than unit-linked personal pensions but only in the extreme tail of the performance distribution. The empirical evidence on the performance fund flow relationship for unit trusts/OEICs and unit-linked personal pension funds suggests performance persistence tests that concentrate on the extreme tails of the performance distribution will provide stronger evidence in favour of Berk and Green (2004).

The performance ranked portfolio tests based on underlying portfolios and flows offers some evidence in support of the Berk and Green (2004) model of mutual fund flows but most of the evidence comes from the unit trust/OEIC sample. The worst performing unit trusts/OEICs in the ranking period who also have the highest net fund flows have much worse performance in the evaluation period than the worst performing unit trusts/OEICs who have the smallest net fund flows. This empirical evidence which is robust to relative and absolute measures supports Berk and Green (2004) where fund managers face diseconomies of scale investing fund flows. The evidence presented here for unit trusts/OEIC is broadly similar to the evidence in Bessler et al. (2010) based on single sorting on fund flows for US mutual funds. However, the evidence from the unit-linked personal pension fund sample is more difficult to interpret and in general offers little support for Berk and Green (2004). Since the performance fund flow relationship for unit-linked personal pension funds is less convex using only quartiles to rank performance and the median to rank fund flows may not pick up the difference between the extreme in the performance and fund flow distributions.

Empirically testing Berk and Green (2004) based on underlying portfolio flows is a unique feature of this research. Unfortunately the lack of fund size data that is reliable and comprehensive has forced the focus to be on underlying portfolios that hold only a unit trust/OEIC or a unit-linked personal pension fund which consist of only one unit/share class. Whilst this second best approach allows underlying flows to be

approximated funds who meet this requirement are only a very small subset of the entire population of UK equity unit trusts/OEICs and unit-linked personal pension funds. Future research needs to extend the evidence between performance and underlying portfolio fund flows ideally using a comprehensive and reliable survivor-bias free database.

Chapter 8

Conclusion and Future Research

8.1 Conclusion

This thesis examines the performance, performance persistence and the performance fund flow relationship for UK equity unit trusts/OEICs and UK equity unit-linked personal pension funds. The main motivation for the comparative analysis is to empirically test the Berk and Green (2004) model of mutual fund flows. In addition to the empirical test of Berk and Green (2004) another unique feature of this research is the emphasis on underlying portfolio fund flows since I infer that fund managers face diseconomies of scale investing fund flows at the underlying portfolio level rather than the fund level.

I find stronger evidence of performance persistence for UK equity unit-linked personal pension funds that have FundIDs, a proxy for the underlying portfolio, that only contain personal pensions in comparison to UK equity unit-linked personal pensions that have FundID's that include at least a unit trust/OEIC. Due to the highly illiquid nature of personal pensions and their attenuated performance fund flow relationship underlying portfolios that only have fund flows from personal pensions exhibit more evidence of performance persistence than the underlying portfolios of

personal pensions that also include at least a unit trust/OEIC. The empirical performance persistence evidence using performance ranked portfolio strategies based on the composition of the underlying portfolio for personal pension funds offers support for the Berk and Green (2004) model. The performance tests do provide anomalies. However, the large differential between non-surviving funds in the unit trust/OEIC and unit-linked personal pension fund samples could potentially explain the performance persistence anomalies.

The performance fund flow relationship is more attenuated for unit-linked personal pension funds in comparison to unit trusts/OEICs with the main differences located at the extreme tails of the performance distribution. These empirical findings are consistent with Del Guercio and Tkac (2002). The performance ranked portfolio tests conditional on the underlying portfolio fund flows for unit trusts/OEICs provides more evidence in support of the Berk and Green (2004) model. Unit trusts/OEICs in the bottom performance quartile with the highest net fund flows in the ranking period have significantly worse performance in the evaluation period than the unit trusts/OEICs in the bottom performance quartile with the lowest net fund flows. These empirical results are consistent with Berk and Green (2004) where fund managers face decreasing returns to scale from fund flows. However, the evidence for the unit-linked personal pensions is less convincing.

There is little evidence that UK equity unit trusts/OEICs and UK equity unit-linked-personal pensions produce significantly positive alphas with these findings robust across conditional and unconditional factor models. In addition there is little evidence that unit trusts/OEICs can successfully time the market with the results robust across unconditional and conditional factor models. There is evidence of a significantly negative timing effect in the unconditional factor models but it becomes insignificant in the conditional models.

From a fund manager's perspective the evidence suggests that they should concen-

trate on stock picking rather than market timing. However, a more rigorous test of market timing would be to select only those fund managers who claim in their investment mandate to be able to time the market and this is a potential line for future research. There is also no evidence that the performance of unit trusts/OEICs is significantly different from the performance of unit-linked personal pension funds or that the underlying portfolio structure influences fund performance. The empirical performance evidence suggests that the UK equity market is informationally efficient.

In addition to the empirical evidence this thesis also highlights the lack of a comprehensive survivor-bias-free UK collective investment database with an academic bias. An academic bias implies that fund data for non-surviving fund is not deleted and every variable is treated as a time series in comparison to commercial databases that treat most data variables as time invariant and if the data does change over time they simply just change the data point in the database. This process loses vast amounts of important data and potentially biases any studies based on analysing cross sectional data over time. Whilst I have created numerous databases in this thesis, they have been built with a particular research motivation in mind rather than to provide a database for general use. Also, unless a database is continually updated it becomes outdated as soon as it is finished. Of particular importance is the fund size data variable. The fund flow literature has become an increasingly important research area since the Berk and Green (2004) paper which infers that decreasing returns to scale from fund flows are the equilibrating mechanism that results in no performance persistence. Hence, any empirical research on fund flows is dependent on the availability and quality of the fund size data. The reporting of fund size needs to be consistent across the fund industry, needs to be accurate and needs to be enforced by regulation if the fund size data in the UK is to become comprehensive and error free. In addition, the evidence in this thesis and the related literature emphasises that fund size as a data variable needs to be viewed by the

investment community with the same level of importance as a fund's return.

From a policy perspective fund research in a UK setting lacks that of the US mainly due to a suitable database not existing. Numerous studies that would be highly beneficial to UK investors, particularly in regards to personal pensions where new research could provide evidence and proposals to increase the returns and value of pensions in the accumulation phase, are not possible due to insufficient UK data or data of poor quality. Since investment management companies have no real incentive to provide data comprehensively over time with exact precision the only way the creation of a comprehensive UK collective investment database seems viable is for the regulatory authority (FSA) to undertake this project with the aim of maintaining an updated database over time. Until a comprehensive UK collective investment database is available cutting edge research on fund performance and fund flows will be directed towards other markets and economies where reliable data is available which is to the detriment of the UK's economy and society.

8.2 Further Research

A potential avenue for further research is to apply the comparative analysis of personal pension funds and mutual funds to the US market. The US data has comprehensive fund size data and a large set of funds to study. This would allow the extreme tails of the performance fund flow distribution to be analysed using deciles or higher with a much larger number of funds than in the UK. It would however require an analysis of the US fund industry to ascertain whether I can identify underlying portfolios and calculate their flows to empirically test Berk and Green (2004). It again points to the issue that academics tend towards a US bias in empirical fund research due to the ease in which comprehensive and reliable data is available which is to the detriment of the UK fund industry and the investors it serves.

Another avenue for further research is to investigate the increasing popularity of different personal pension providers to use the same fund manager and underlying portfolio. It would be interesting to analyse individually the performance fund flow relationship for these personal pension funds since ultimately all funds will have the same performance before fees and charges. All personal pensions across providers sharing the same underlying portfolio would be advertising the same past performance record and hence any differential in the performance fund flow relationships is not be due to the performance of the underlying portfolio. If there are large differentials the key factors driving the differential in fund flows needs to be determined. It could be that investors are responding to differences in fees across pension providers or perhaps due to different levels of marketing. It would be interesting to analyse the variation in the fee structure for the various pension providers as ceteris paribus a rational investor in Berk and Green (2004) who infers managerial skill from past performance would only invest in the fund with the lowest fees.

This thesis and future related research will hopefully build on the Berk and Green (2004) model of mutual fund flows with the aim to improve our understanding of performance and fund flows for collective investment schemes. From a pensions perspective hopefully research focused on the Berk and Green (2004) model of mutual fund flows will improve our understanding of the fund industry to ensure investments in unit-linked personal pension funds maximise future pension values to ensure future retirees have sufficient income in retirement.

Appendix A

A.1 IMA Sector Definitions

UK All Companies

Funds which invest at least 80% of their assets in UK equities which have a primary objective of achieving capital growth.

UK Equity Income

Funds which invest at least 80% of their assets in UK equities and which aim to have a yield which is in excess of 110% of the yield of the FT All Share Index.

UK Smaller Companies

Funds which invest at least 80% of their assets in UK equities of companies which form part of the Hoare Govett Smaller Companies Index or have an equivalent or lower market capitalisation.

A.2 ABI Sector Definitions

UK All Companies

Funds which invest at least 80% of their assets in equities quoted on the UK stock market. Funds have the primary objective of achieving capital growth or total return.

UK Equity Income

Funds which invest at least 80% of their assets in equities quoted on the UK stock market. Net of tax yield on the underlying portfolio of at least 110% of the FTSE All Share yield.

UK Smaller Companies

Funds which invest at least 80% of their assets in equities quoted on the UK stock market which form the bottom 10% by market capitalisation.

A.3 QS2 December 2003 Unit Trusts/OEICs

Table A.1: Destination of QS2 2003 Funds in Relation to the S&P Micropal QS3 2007 List.

Funds still alive			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
150	Same sedol and same fund name	17	133
156	Same sedol but different fund name	22	134
13	Change of fund class advertised		13
7	Change of fund structure: UT to OEIC		7
2	Both change of structure and class advertised		2
2	Unknown reason for change of sedol	1	1
5	Moved out of equity sectors		5
Funds that died			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
23	Liquidated	4	19
65	Merged	5	60
Unresolved funds			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
28	Fund could not be located in QS3.	28	
Total **451**		Total **77**	Total **374**

The 253 dead funds from QS2 combined with the 451 funds in A.1 account for all 704 funds in QS2.

A.4 QS3 S&P Micropal December 2007 Unit Trusts/OEICs

Table A.2: QS3 2007 list

Funds still alive			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
150	Same sedol and same fund name	17	133
156	Same sedol but different fund name	22	134
101	Funds born after 31 Dec 2003	3	98
13	Change of fund class advertised		13
7	Change of fund structure: UT to OEIC		7
2	Both change of structure and class advertised		2
2	Unknown reason for change of sedol	1	1
Unresolved funds			
Initial Number of funds	Explanation for fund	Number of dropped funds	Final Number of funds
29	Funds born prior to Jan 2004 not on QS2 list	29	
Total **460**		Total **72**	Total **388**

A.5 Descriptive Statistics for Unit-Linked Personal Pensions

Table A.3: Descriptive Statistics for UK Equity Unit-Linked Personal Pensions 1980 to 2007

	PP Entire Sample	PP UK All Companies	PP UK Equity Income	PP UK Smaller Companies
Mean	0.85%	0.83%	0.90%	0.84%
Std. Dev.	4.22%	4.20%	3.78%	5.16%
Distribution of returns:				
10%	-4.62%	-4.67%	-4.07%	-5.36%
25%	-1.18%	-1.24%	-0.77%	-1.76%
50%	1.42%	1.40%	1.46%	1.47%
75%	3.28%	3.29%	3.04%	3.96%
90%	5.19%	5.19%	4.67%	6.37%
Obs.	50,056	34,415	10,875	4,766
No. of schemes	594	388	143	63

The table restricts each unit-linked personal pension to one unit/share class only. Due to the nature/structure of the unit-linked personal pension industry the FundID for each personal pension may not be unique even with the restriction of one unit/share class only per fund. This implies that there are more personal pension funds in the diagram than unique underlying portfolios i.e. some funds, although from different pension providers, have the same underlying portfolio. Table A.3 excludes index/tracker funds, inet funds, funds with duplicated sedol numbers, funds with missing sedol numbers and funds with no returns data in S/P Micropal.

A.6 Contingency Table Summary based on the Single Factor (CAPM) Model

Table A.4: Contingency Table Summary based on Single Factor (CAPM) Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	N	WW	LL	WL	LW
1MR1ME	Unit Trust	Entire Sample	121,355	31,772 *(26.18%)*	31,631 *(26.06%)*	29,007 *(23.90%)*	28,945 *(23.85%)*
	Personal Pension	Entire Sample	35,708	8,888 *(24.89%)*	8,733 *(24.46%)*	9,051 *(25.35%)*	9,036 *(25.31%)*
	Underlying - PP and at least a UT	Entire Sample	11,298	3,008 *(26.62%)*	2,864 *(25.35%)*	2,720 *(24.08%)*	2,706 *(23.95%)*
	Underlying - PP only	Entire Sample	17,626	4,299 *(24.39%)*	4,137 *(23.47%)*	4,598 *(26.09%)*	4,592 *(26.05%)*
3MR3ME	Unit Trust	Entire Sample	37,934	10,157 *(26.78%)*	10,107 *(26.64%)*	8,889 *(23.43%)*	8,781 *(23.15%)*
	Personal Pension	Entire Sample	11,306	2,940 *(26.00%)*	2,898 *(25.63%)*	2,736 *(24.20%)*	2,732 *(24.16%)*
	Underlying - PP and at least a UT	Entire Sample	3,555	976 *(27.45%)*	926 *(26.05%)*	831 *(23.38%)*	822 *(23.12%)*
	Underlying - PP only	Entire Sample	5,614	1,448 *(25.79%)*	1,405 *(25.03%)*	1,386 *(24.69%)*	1,375 *(24.49%)*
6MR6ME	Unit Trust	Entire Sample	18,140	4,857 *(26.78%)*	4,822 *(26.58%)*	4,267 *(23.52%)*	4,194 *(23.12%)*
	Personal Pension	Entire Sample	5,393	1,428 *(26.48%)*	1,422 *(26.37%)*	1,274 *(23.62%)*	1,269 *(23.53%)*
	Underlying - PP and at least a UT	Entire Sample	1,657	457 *(27.58%)*	428 *(25.83%)*	385 *(23.23%)*	387 *(23.36%)*
	Underlying - PP only	Entire Sample	2,723	712 *(26.15%)*	698 *(25.63%)*	660 *(24.24%)*	653 *(23.98%)*
12MR12ME	Unit Trust	Entire Sample	7,793	2,213 *(28.40%)*	2,173 *(27.88%)*	1,745 *(22.39%)*	1,662 *(21.33%)*
	Personal Pension	Entire Sample	2,380	668 *(28.07%)*	683 *(28.70%)*	523 *(21.97%)*	506 *(21.26%)*
	Underlying - PP and at least a UT	Entire Sample	701	199 *(28.39%)*	192 *(27.39%)*	158 *(22.54%)*	152*(21.68%)*
	Underlying - PP only	Entire Sample	1,241	339 *(27.32%)*	341 *(27.48%)*	282 *(22.72%)*	279 *(22.48%)*
36MR36ME	Unit Trust	Entire Sample	1,518	387 *(25.49%)*	333 *(21.94%)*	427 *(28.13%)*	371 *(24.44%)*
	Personal Pension	Entire Sample	449	116 *(25.84%)*	131 *(29.18%)*	111 *(24.72%)*	91 *(20.27%)*
	Underlying - PP and at least a UT	Entire Sample	84	24 *(28.57%)*	21 *(25.00%)*	18 *(21.43%)*	21 *(25.00%)*
	Underlying - PP only	Entire Sample	281	69 *(24.56%)*	71 *(25.27%)*	75 *(26.69%)*	66 *(23.49%)*

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. N is the number of pairs.

A.7 Contingency Table Summary based on the Three Factor Model

Table A.5: Contingency Table Summary based on Three Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	N	WW	LL	WL	LW
1MR1ME	Unit Trust	Entire Sample	121,355	30,280 *(24.95%)*	30,137 *(24.83%)*	30,497 *(25.13%)*	30,441 *(25.08%)*
	Personal Pension	Entire Sample	35,708	8,536 *(23.91%)*	8,395 *(23.51%)*	9,396 *(26.31%)*	9,381 *(26.27%)*
	Underlying - PP and at least a UT	Entire Sample	11,298	2,867 *(25.38%)*	2,728 *(24.15%)*	2,852 *(25.24%)*	2,851 *(25.23%)*
	Underlying - PP only	Entire Sample	17,626	4,176 *(23.69%)*	4,019 *(22.80%)*	4,721 *(26.78%)*	4,710 *(26.72%)*
3MR3ME	Unit Trust	Entire Sample	37,934	10,187 *(26.85%)*	10,148 *(26.75%)*	8,842 *(23.31%)*	8,757 *(23.08%)*
	Personal Pension	Entire Sample	11,306	2,962 *(26.20%)*	2,936 *(25.97%)*	2,707 *(23.94%)*	2,701 *(23.89%)*
	Underlying - PP and at least a UT	Entire Sample	3,555	974 *(27.40%)*	934 *(26.27%)*	828 *(23.29%)*	819 *(23.04%)*
	Underlying - PP only	Entire Sample	5,614	1,482 *(26.40%)*	1,439 *(25.63%)*	1,347 *(23.99%)*	1,346 *(23.98%)*
6MR6ME	Unit Trust	Entire Sample	18,140	4,822 *(26.58%)*	4,780 *(26.35%)*	4,320 *(23.81%)*	4,218 *(23.25%)*
	Personal Pension	Entire Sample	5,393	1,449 *(26.87%)*	1,443 *(26.76%)*	1,260 *(23.36%)*	1,241 *(23.01%)*
	Underlying - PP and at least a UT	Entire Sample	1,657	450 *(27.16%)*	428 *(25.83%)*	392 *(23.66%)*	387 *(23.36%)*
	Underlying - PP only	Entire Sample	2,723	728 *(26.74%)*	705 *(25.89%)*	651 *(23.91%)*	639 *(23.47%)*
12MR12ME	Unit Trust	Entire Sample	7793	2,161 *(27.73%)*	2,123*(27.24%)*	1,815*(23.29%)*	1,694 *(21.74%)*
	Personal Pension	Entire Sample	2,380	658 *(27.65%)*	674 *(28.32%)*	537 *(22.56%)*	511 *(21.47%)*
	Underlying - PP and at least a UT	Entire Sample	701	208 *(29.67%)*	202 *(28.82%)*	149 *(21.26%)*	142 *(20.26%)*
	Underlying - PP only	Entire Sample	1,241	332 *(26.75%)*	340 *(27.40%)*	290 *(23.37%)*	279 *(22.48%)*
36MR36ME	Unit Trust	Entire Sample	1,518	442 *(29.11%)*	400 *(26.35%)*	377 *(24.84%)*	299 *(19.69%)*
	Personal Pension	Entire Sample	449	109 *(24.28%)*	138 *(30.73%)*	115 *(25.61%)*	87 *(19.38%)*
	Underlying - PP and at least a UT	Entire Sample	84	23 *(27.38%)*	22 *(26.19%)*	20 *(23.81%)*	19 *(22.62%)*
	Underlying - PP only	Entire Sample	281	68 *(24.20%)*	79 *(28.11%)*	74 *(26.33%)*	60 *(21.35%)*

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. N is the number of pairs.

A.8 Contingency Table Summary based on the Four Factor Model

Table A.6: Contingency Table Summary based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	N	WW	LL	WL	LW
1MR1ME	Unit Trust	Entire Sample	121,355	30,240 *(24.92%)*	30,088 *(24.79%)*	30,547 *(25.17%)*	30,480 *(25.12%)*
	Personal Pension	Entire Sample	35,708	8,559 *(23.97%)*	8,415 *(23.57%)*	9,374 *(26.25%)*	9,360 *(26.21%)*
	Underlying - PP and at least a UT	Entire Sample	11,298	2,877 *(25.46%)*	2,733*(24.19%)*	2,844 *(25.17%)*	2,844 *(25.17%)*
	Underlying - PP only	Entire Sample	17,626	4,190 *(23.77%)*	4,027 *(22.85%)*	4,705 *(26.69%)*	4,704 *(26.69%)*
3MR3ME	Unit Trust	Entire Sample	37,934	10,230 *(26.97%)*	10,190 *(26.86%)*	8,805 *(23.21%)*	8,709 *(22.96%)*
	Personal Pension	Entire Sample	11,306	2,969 *(26.26%)*	2,935 *(25.96%)*	2,706 *(23.93%)*	2,696 *(23.85%)*
	Underlying - PP and at least a UT	Entire Sample	3,555	977 *(27.48%)*	938 *(26.39%)*	826 *(23.23%)*	977 *(27.48%)*
	Underlying - PP only	Entire Sample	5,614	1,499 *(26.70%)*	1,452 *(25.86%)*	1,333 *(23.74%)*	1,330 *(23.69%)*
6MR6ME	Unit Trust	Entire Sample	18,140	4,840 *(26.68%)*	4,797 *(26.44%)*	4,298 *(23.69%)*	4,205 *(23.18%)*
	Personal Pension	Entire Sample	5,393	1,473 *(27.31%)*	1,463 *(27.13%)*	1,235 *(22.90%)*	1,222 *(22.66%)*
	Underlying - PP and at least a UT	Entire Sample	1,657	458 *(27.64%)*	431 *(26.01%)*	383 *(23.11%)*	385 *(23.23%)*
	Underlying - PP only	Entire Sample	2,723	739 *(27.14%)*	711 *(26.11%)*	643 *(23.61%)*	630 *(23.14%)*
12MR12ME	Unit Trust	Entire Sample	7,793	2,193*(28.14%)*	2,167 *(27.81%)*	1,771 *(22.73%)*	1,662 *(21.33%)*
	Personal Pension	Entire Sample	2,380	660 *(27.73%)*	677 *(28.45%)*	535 *(22.48%)*	508 *(21.34%)*
	Underlying - PP and at least a UT	Entire Sample	701	206 *(29.39%)*	199 *(28.39%)*	149 *(21.26%)*	147 *(20.97%)*
	Underlying - PP only	Entire Sample	1,241	337 *(27.16%)*	343 *(27.64%)*	285 *(22.97%)*	276 *(22.24%)*
36MR36ME	Unit Trust	Entire Sample	1,518	431 *(28.39%)*	382 *(25.16%)*	394 *(25.96%)*	311 *(20.49%)*
	Personal Pension	Entire Sample	449	115 *(25.61%)*	138 *(30.73%)*	109 *(24.28%)*	87 *(19.38%)*
	Underlying - PP and at least a UT	Entire Sample	84	24 *(28.57%)*	24 *(28.57%)*	18 *(21.43%)*	18 *(21.43%)*
	Underlying - PP only	Entire Sample	281	73 *(25.98%)*	84 *(29.89%)*	69 *(24.56%)*	55 *(19.57%)*

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. N is the number of pairs..

A.9 Performance Ranked Portfolio Persistence Tests based on the Four Factor Model - Jan 1980 to Dec 1999

Table A.7: Performance Ranked Portfolio Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust	Entire Sample	239	-.0022	.0010	-0.0032	-4.82**
	Personal Pension	Entire Sample	239	-.0029	.0029	-.0058	-4.69**
	Underlying - PP and at least a UT	Entire Sample	161	-.0001	-.0012	.0010	0.69
	Underlying - PP only	Entire Sample	238	-.0028	.0036	-.0064	-5.19**
3MR3ME	Unit Trust	Entire Sample	235	.0001	-.0020	.0021	4.84**
	Personal Pension	Entire Sample	212	.0014	-.0013	.0026	3.79**
	Underlying - PP and at least a UT	Entire Sample	157	.0012	-.0016	.0028	2.06*
	Underlying - PP only	Entire Sample	212	.0015	-.0013	.0027	3.02**
6MR6ME	Unit Trust	Entire Sample	229	.0004	-.0024	.0028	6.46**
	Personal Pension	Entire Sample	207	.0019	-.0013	.0032	3.86**
	Underlying - PP and at least a UT	Entire Sample	112	.0024	-.0023	.0048	2.83**
	Underlying - PP only	Entire Sample	207	.0023	-.0018	.0041	3.74**
12MR12ME	Unit Trust	Entire Sample	217	.0002	-.0019	.0021	5.05**
	Personal Pension	Entire Sample	203	.0018	-.0010	.0028	4.13**
	Underlying - PP and at least a UT	Entire Sample	139	.0007	-.0016	.0023	1.86
	Underlying - PP only	Entire Sample	198	.0019	-.0017	.0037	3.97**

For performance ranked tests, funds are sorted each year into quintile portfolios based on past performance of the funds - abnormal returns of each fund over the ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period is computed; AV5 and AV1 are the abnormal returns of the top and bottom portfolios in the evaluation period, averaged over all time periods in the sample. There are four different ranking and evaluation periods: 36MR36ME means three-year ranking period and three year evaluation period, and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset, and DIF is AV5-AV1, and TDIF is a t-statistic on DIF, allowing for the autocorrelation induced by using overlapping observations.

A.10 Performance Ranked Portfolio Persistence Tests based on the Four Factor Model - Jan 2000 to Dec 2007

Table A.8: Performance Ranked Portfolio Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	No. periods	AV5	AV1	DIF	TDIF
1MR1ME	Unit Trust	Entire Sample	95	.0013	-.0006	.0020	1.71
	Personal Pension	Entire Sample	95	-.0010	.0017	-.0028	-2.31*
	Underlying - PP and at least a UT	Entire Sample	95	.0007	.0021	-.0014	-.91
	Underlying - PP only	Entire Sample	95	-.0028	.0011	-.0040	-3.29**
3MR3ME	Unit Trust	Entire Sample	91	.0013	-.0016	.0029	2.56*
	Personal Pension	Entire Sample	91	.0007	-.0004	.0011	1.00
	Underlying - PP and at least a UT	Entire Sample	91	.0012	.0001	0.0011	0.85
	Underlying - PP only	Entire Sample	91	-.0007	-.0011	.0003	0.39
6MR6ME	Unit Trust	Entire Sample	85	.0011	-.0022	.0034	6.88**
	Personal Pension	Entire Sample	85	.0011	-.0016	.0027	5.28**
	Underlying - PP and at least a UT	Entire Sample	85	.0013	-.0011	.0024	4.38**
	Underlying - PP only	Entire Sample	85	-.0001	-.0020	.0019	4.47**
12MR12ME	Unit Trust	Entire Sample	73	.0012	-.0020	.0032	3.01**
	Personal Pension	Entire Sample	73	.0011	-.0016	.0027	3.54**
	Underlying - PP and at least a UT	Entire Sample	73	.0013	-.0011	.0025	2.13*
	Underlying - PP only	Entire Sample	73	-.0001	-.0021	.0020	3.77**

For performance ranked tests, funds are sorted each year into quintile portfolios based on past performance of the funds - abnormal returns of each fund over the ranking period. The equally weighted average portfolio abnormal returns of the top and bottom portfolios over the subsequent evaluation period is computed; AV5 and AV1 are the abnormal returns of the top and bottom portfolios in the evaluation period, averaged over all time periods in the sample. There are four different ranking and evaluation periods: 36MR36ME means three-year ranking period and three year evaluation period, and 1MR1ME means a one month ranking period and one month evaluation period. This procedure is followed for overlapping periods throughout the full period of the dataset, and DIF is AV5-AV1, and TDIF is a t-statistic on DIF, allowing for the autocorrelation induced by using overlapping observations.

A.11 Contingency Table Persistence Tests based on the Four Factor Model - Jan 1980 to Dec 1999

Table A.9: Contingency Table Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust	Entire Sample	85,362	.493	.937	-4.76**	22.91**	-19.26**
	Personal Pension	Entire Sample	15,323	.483	.823	-6.01**	37.47**	-17.46**
	Underlying - PP and at least a UT	Entire Sample	2,900	.548	1.144	1.81	8.80**	-6.52**
	Underlying - PP only	Entire Sample	9,281	.476	.755	-6.74**	47.72**	-14.56**
3MR3ME	Unit Trust	Entire Sample	26,267	.536	1.325	11.36**	129.82**	17.98**
	Personal Pension	Entire Sample	4,757	.543	1.328	4.88**	24.45**	9.25**
	Underlying - PP and at least a UT	Entire Sample	886	.609	1.765	4.18**	20.56**	2.58**
	Underlying - PP only	Entire Sample	2,905	.539	1.241	2.90**	9.33**	8.69**
6MR6ME	Unit Trust	Entire Sample	12,554	.529	1.232	5.82**	35.12**	13.81**
	Personal Pension	Entire Sample	2,286	.522	1.146	1.63	2.96	6.05**
	Underlying - PP and at least a UT	Entire Sample	414	.570	1.180	.84	2.73	.12
	Underlying - PP only	Entire Sample	1,414	.525	1.094	.845	1.30	7.96**
12MR12ME	Unit Trust	Entire Sample	5,236	.554	1.503	7.33**	56.17**	10.65**
	Personal Pension	Entire Sample	987	.549	1.448	2.89**	8.54**	6.75**
	Underlying - PP and at least a UT	Entire Sample	165	.630	1.486	1.258	3.99*	-.23
	Underlying - PP only	Entire Sample	631	.536	1.366	1.95	3.97*	8.47**
36MR36ME	Unit Trust	Entire Sample	868	.576	1.550	3.19	15.55**	2.12*
	Personal Pension	Entire Sample	166	.542	1.913	2.05*	5.71*	1.30
	Underlying - PP and at least a UT	Entire Sample	20	.800	6	1.76	4*	-.43
	Underlying - PP only	Entire Sample	113	.566	2.530	2.38**	7.11**	.54

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where log(CP)/$\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns.

A.12 Contingency Table Persistence Tests based on Four Factor Model - Jan 2000 to Dec 2007

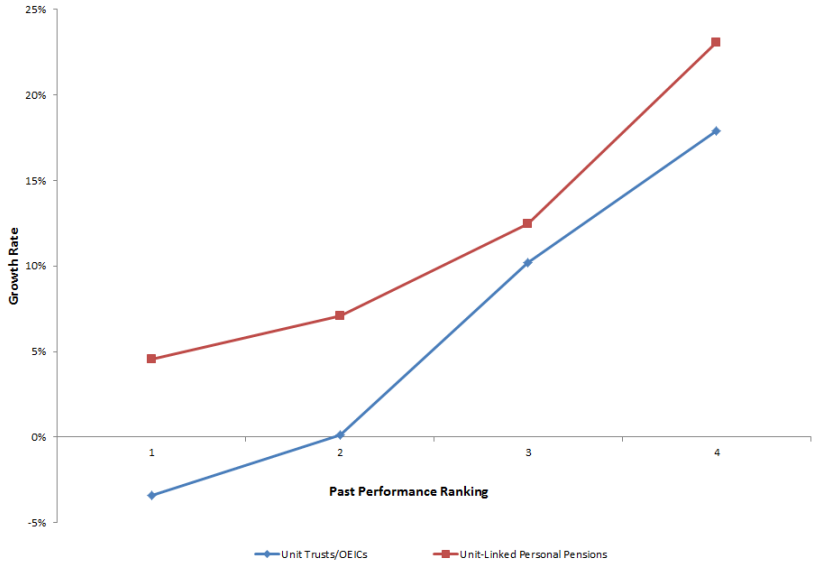
Table A.10: Contingency Table Persistence Tests based on Four Factor Abnormal Returns of Fund Performance

Ranking and Evaluation Period	Investment Vehicle	Sector	N	PRW	CP	Z Stat	CHI	TCS
1MR1ME	Unit Trust	Entire Sample	35,599	.510	1.066	3.04**	9.54**	10.81**
	Personal Pension	Entire Sample	20,248	.477	.818	-7.14**	51.14**	-17.28**
	Underlying - PP and at least a UT	Entire Sample	8,356	.495	.914	-2.06*	4.98*	-10.04**
	Underlying - PP only	Entire Sample	8,274	.475	.774	-5.81**	34.54**	-16.57**
3MR3ME	Unit Trust	Entire Sample	11,289	.546	1.427	9.41**	88.84**	12.07**
	Personal Pension	Entire Sample	6,423	.514	1.121	2.28*	5.23*	-4.39**
	Underlying - PP and at least a UT	Entire Sample	2,631	.529	1.247	2.83**	8.04**	-3.16**
	Underlying - PP only	Entire Sample	2,644	.532	1.244	2.80**	7.96**	-4.17**
6MR6ME	Unit Trust	Entire Sample	5,231	.545	1.415	6.26**	39.30**	7.86**
	Personal Pension	Entire Sample	2,988	.569	1.766	7.69**	59.62**	3.15**
	Underlying - PP and at least a UT	Entire Sample	1,210	.547	1.412	2.99**	9.02**	1.82**
	Underlying - PP only	Entire Sample	1,246	.568	1.644	4.35**	19.16**	2.27**
12MR12ME	Unit Trust	Entire Sample	2,222	.580	1.889	7.40**	55.65**	6.32**
	Personal Pension	Entire Sample	1,285	.559	1.832	5.36**	30.07**	5.66**
	Underlying - PP and at least a UT	Entire Sample	508	.571	2.05	3.97**	16.30**	1.53**
	Underlying - PP only	Entire Sample	551	.555	1.606	2.76**	7.69**	5.16**
36MR36ME	Unit Trust	Entire Sample	215	.567	1.087	.30	1.69	-.46
	Personal Pension	Entire Sample	126	.524	1.663	1.41	2.57	1.58
	Underlying - PP and at least a UT	Entire Sample	35	.571	1.429	.52	.54	-.49
	Underlying - PP only	Entire Sample	68	.529	1.425	.73	.59	0.95

Funds are classified as winners or losers based on abnormal returns in each of two consecutive time periods, and the numbers of winner-winner (WW), winner-loser (WL), loser winner (LW) and loser-loser (LL) are counted. The following statistics are computed: a) Percentage of repeat winners, PRW = WW/(N/2); b) Cross-product ratio CP = (WW x LL)/(WL x LW); where $\log(CP)/\sigma_{\log(CP)}$ has a standard normal distribution, and $\sigma_{\log(CP)} = [(1/WW) + (1/WL) + (1/LW) + (1/LL)]^{1/2}$; c) Chi-Squared test with 1 d.o.f. where CHI = (WW - N/4)^2 + (WL - N/4)^2 + (LW - N/4)^2 (LL - N/4)^2/N/4, and N is the number of pairs; and d) TCS is the t-statistic for the slope coefficient in the pooled cross-section OLS regression of evaluation period abnormal returns on ranking period abnormal returns.

A.13 Raw Performance Fund Flow Relationship Based on Four Performance Bins

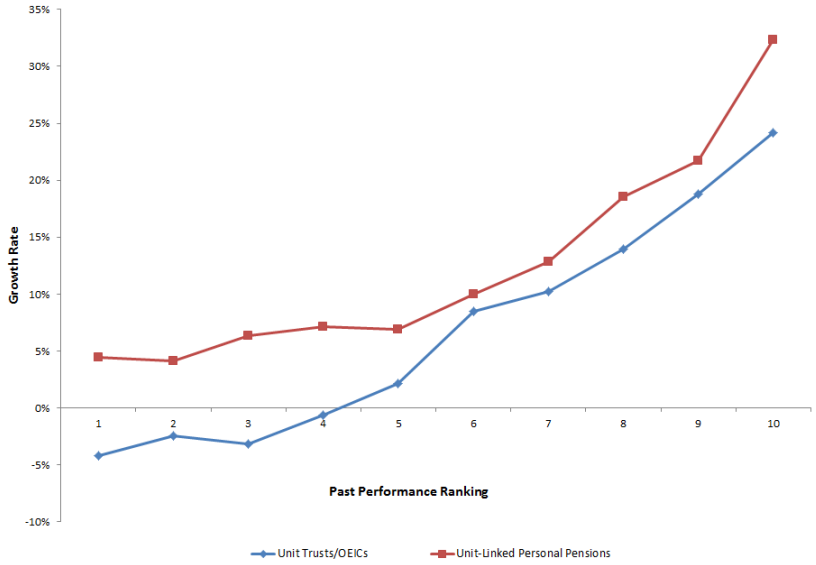
Figure A.1: Raw Performance Fund Flow Relationship Based on Four Performance Bins



Funds are ranked based on their one year raw returns at time t and divided equally into four bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

A.14 Raw Performance Fund Flow Relationship Based on Ten Performance Bins

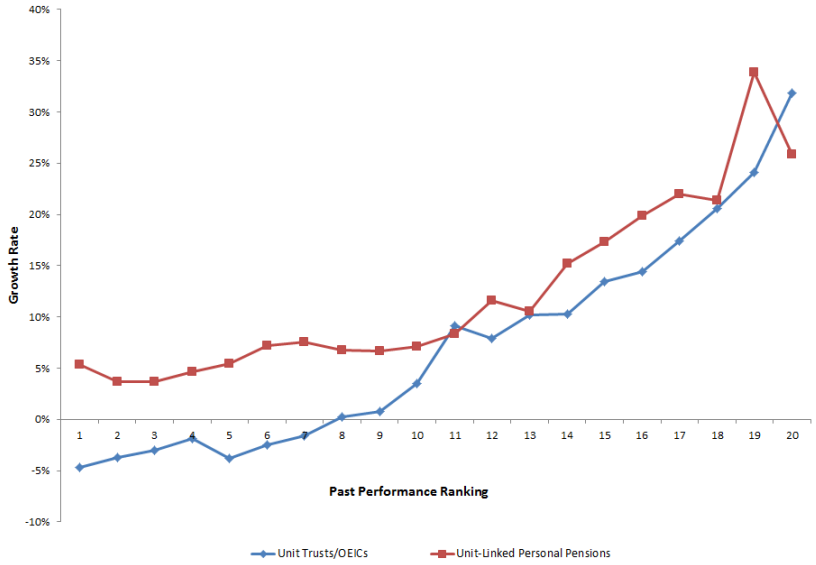
Figure A.2: Raw Performance Fund Flow Relationship Based on Ten Performance Bins



Funds are ranked based on their one year raw returns at time t and divided equally into ten bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

A.15 Raw Performance Fund Flow Relationship Based on Twenty Performance Bins

Figure A.3: Raw Performance Fund Flow Relationship Based on Twenty Performance Bins



Funds are ranked based on their one year raw returns at time t and divided equally into twenty bins where the highest bin signals the best performers and lowest bin signals the worst performers. The average equally weighted one year growth rate (relative fund flow) at time $t+1$ year is then calculated for each bin. This procedure is followed for overlapping time periods throughout the sample to allow the entire sample mean growth rate for each bin to be calculated.

Bibliography

Alfon, I., 2002. To switch or not to switch, that's the question. an analysis of the potential gains from switching pension provider. FSA occasional paper, FSA.

Allen, D., Tan, M., June/July 1999. A test of the persistence in the performance of UK managed funds. Journal of Business Finance and Accounting 26 (5 & 6), 559–593.

Berk, J. B., Green, R. C., 2004. Mutual fund flows and performance in rational markets. Journal of Political Economy 112, 1269–1295.

Berk, J. B., Tonks, I., Apr. 2007. Return persistence and fund flows in the worst performing mutual funds. NBER working papers, National Bureau of Economic Research, Inc.

Bessler, W., Blake, D., Luckoff, P., Tonks, I., Mar. 2010. Why does mutual fund performance not persist? The impact and interaction of fund flows and manager changes. MPRA Paper 34185, University Library of Munich, Germany.

Blake, D., 2003. Pension Schemes and Pension Funds in the United Kingdom. Oxford University Press.

Blake, D., 2006. Pension Finance. John-Wiley & Sons.

Blake, D., Lehmann, B. N., Timmermann, A., October 1999. Asset allocation dynamics and pension fund performance. Journal of Business 72 (4), 429–61.

Blake, D., Timmermann, A., 1998. Mutual fund performance: Evidence from the UK. European Finance Review 2, 57–77.

Blake, D., Timmermann, A., 2002. Performance persistence in mutual funds: An independant assessment of the studies by charles river associates for the investment management association. Tech. rep., FSA.

Blake, D., Timmermann, A. G., Tonks, I., Wermers, R., Feb. 2010. Decentralized investment management: Evidence from the pension fund industry. CEPR Discussion Papers 7679, C.E.P.R. Discussion Papers.

Brown, G., Draper, P., McKenzie, E., 1997. Consistency of UK pension fund investment performance. Journal of Business Finance & Accounting 24 (2), 155–178.

Brown, S., Goetzmann, W., Ibbotson, G., Ross, S., 1992. Survivorship bias in performance studies. Review of Financial Studies 5 (4), 553–580.

Brown, S. J., Goetzmann, W. N., June 1995. Performance persistence. Journal of Finance 50 (2), 679–98.

Carhart, M. M., March 1997. On persistence in mutual fund performance. Journal of Finance 52 (1), 57–82.

Carpenter, J. N., Lynch, A. W., December 1999. Survivorship bias and attrition effects in measures of performance persistence. Journal of Financial Economics 54 (3), 337–374.

Chen, C., Stockum, S., 1986. Selectivity, market timing and random behaviour of mutual funds: A generalized model. Journal of Financial Research.

Chevalier, J., Ellison, G., December 1997. Risk taking by mutual funds as a response to incentives. Journal of Political Economy 105 (6), 1167–1200.

Clare, A., Nitzsche, D., Cuthbertson, K., October 2010. An empirical investigation into the performance of uk pension fund managers. Journal of Pension Economics and Finance 9 (04), 533–547.

Coggin, T. D., Fabozzi, F. J., Rahman, S., July 1993. The investment performance of U.S. equity pension fund managers: An empirical investigation. Journal of Finance 48 (3), 1039–55.

Cuthbertson, K., Nitzsche, D., O'Sullivan, N., 2008. UK mutual fund performance: Skill or luck? Journal of Empirical Finance 15 (4), 613–634.

Cuthbertson, K., Nitzsche, D., O'Sullivan, N., 2010a. False discoveries in UK mutual fund performance.

Cuthbertson, K., Nitzsche, D., O'Sullivan, N., 2010b. The market timing ability of UK mutual funds. Journal of Business Finance & Accounting 37 (1-2), 270–289.

Cuthbertson, K., Nitzsche, D., O'Sullivan, N., May 2010c. Mutual fund performance: Measurement and evidence. Financial Markets, Institutions & Instruments Vol. 19 (2), 95–187.

Del Guercio, D., Tkac, P. A., December 2002. The determinants of the flow of funds of managed portfolios: Mutual funds vs. pension funds. Journal of Financial and Quantitative Analysis 37 (04), 523–557.

Elton, E. J., Gruber, M. J., October 1977. Risk reduction and portfolio size: An analytical solution. The Journal of Business 50 (4), 415–37.

Elton, E. J., Gruber, M. J., Blake, C. R., 2011a. Does size matter? The relationship between size and performance. Review of Finance.

Elton, E. J., Gruber, M. J., Blake, C. R., 2011b. An examination of mutual fund timing ability using monthly holdings data. Review of Finance.

Fama, E. F., French, K. R., June 1992. The cross-section of expected stock returns. Journal of Finance 47 (2), 427–65.

Fama, E. F., French, K. R., October 2010. Luck versus skill in the cross-section of mutual fund returns. Journal of Finance 65 (5), 1915–1947.

Ferson, W. E., Schadt, R. W., June 1996. Measuring fund strategy and performance in changing economic conditions. Journal of Finance 51 (2), 425–61.

Fletcher, J., January 1995. An examination of the selectivity and market timing of UK unit trusts. Journal of Business Finance & Accounting 22 (1), 143–156.

Fletcher, J., 1997. An examination of UK unit trust performance within the arbitrage pricing theory framework. Review of Quantitative Finance and Accounting.

Fletcher, J., Forbes, D., December 2002. An exploration of the persistence of UK unit trust performance. Journal of Empirical Finance 9 (5), 475–493.

Giles, T., Wilsdon, T., Worboys, T., 2002. Performance persistence in UK equity funds: A literature review. Report no. d03374-00, Charles River Associates.

Goetzmann, W., Ibbotson, R., 1994. Do winners repeat? Patterns in mutual fund behavior. The Journal of Portfolio Management.

Gregory, A., Tharyan, R., Huang, A., 2009. The fama-french and momentum portfolios and factors in the UK. Xfi Centre for Finance and Investment Paper No. 09/05.

Gregory, A., Tonks, I., Mar. 2004. (UBS Pensions series 22) performance of personal pension schemes in the UK. Fmg discussion papers, Financial Markets Group.

Gregory, A., Whittaker, J., 2007. Performance and performance persistence of 'ethical' unit trusts in the UK. Journal of Business Finance & Accounting 34 (7-8), 1327–1344.

Grinblatt, M., Titman, S., December 1992. The persistence of mutual fund performance. Journal of Finance 47 (5), 1977–84.

Hendricks, D., Patel, J., Zeckhauser, R., March 1993. Hot hands in mutual funds: Short-run persistence of relative performance, 1974-1988. Journal of Finance 48 (1), 93–130.

Henriksson, R. D., Merton, R. C., October 1981. On market timing and investment performance. ii. statistical procedures for evaluating forecasting skills. Journal of Business 54 (4), 513–33.

Ippolito, R., Turner, J., 1987. Turnover, fees and pension plan performance. Financial Analysts Journal 43, 16–26.

Jegadeesh, N., Titman, S., 1993. Returns to buying winners and selling losers: implications for stock market efficiency. Journal of Finance 48, 65–91.

Jensen, M. C., 1968. The performance of mutual funds in the period 1945-1964. Journal of Finance 23, 389–416.

Jiang, W., September 2003. A nonparametric test of market timing. Journal of Empirical Finance 10 (4), 399–425.

Keswani, A., Stolin, D., 02 2008. Which money is smart? mutual fund buys and sells of individual and institutional investors. Journal of Finance 63 (1), 85–118.

Kosowski, R., Timmermann, A., Wermers, R., White, H., December 2006. Can mutual fund "stars" really pick stocks? new evidence from a bootstrap analysis. Journal of Finance 61 (6), 2551–2595.

Leger, L., 1997. Uk investment trusts: performance, timing and selectivity. Applied Economic Letters.

Luckoff, P., 2011. Mutual Fund Performance and Performance Persistence. Gabler Verlag - Springer.

Malkiel, B. G., June 1995. Returns from investing in equity mutual funds 1971 to 1991. Journal of Finance 50 (2), 549–72.

Quigley, G., Sinquefield, R., 2000. Performance of uk equity unit trusts. Journal of Asset Management 1(1), 72–79.

Roll, R., March 1977. A critique of the asset pricing theory's tests part I: On past and potential testability of the theory. Journal of Financial Economics 4 (2), 129–176.

Ross, S., 1976. The arbitrage theory of capital asset pricing. Journal of Economic Theory.

Scaillet, O., Barras, L., Wermers, R. R., 2010. False discoveries in mutual fund performance: Measuring luck in estimated alphas. Journal of Finance (1), 179–216.

Sirri, E. R., Tufano, P., October 1998. Costly search and mutual fund flows. Journal of Finance 53 (5), 1589–1622.

St Giles, M., ALexeeva, E., Buxton, S., 2003. Managing Collective Investment Funds. Wiley.

Statman, M., September 1987. How many stocks make a diversified portfolio? Journal of Financial and Quantitative Analysis 22 (03), 353–363.

Tonks, I., September 2005. Performance persistence of pension-fund managers. The Journal of Business 78 (5), 1917–1942.

Treynor, J. L., Mazuy, K. K., July-August 1966. Can mutual funds outguess the market. Harvard Business Review 44 (4), 131–136.

Wermers, R., 04 1999. Mutual fund herding and the impact on stock prices. Journal of Finance 54 (2), 581–622.