CHAPTER 23

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PENSION FUND MANAGEMENT AND INVESTMENT PERFORMANCE

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1 INTRODUCTION

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Pension schemes may be unfunded or funded, and the detailed working of these is discussed elsewhere in this *Handbook*. In an unfunded pay-as-you-go scheme, the pension represents a transfer made between the current working population and the current retired population. In a funded scheme the working population makes contributions into a pension fund which, during the accumulation phase, grows in value up to retirement. After retirement, the fund enters the decumulation phase and pays out a pension to the retired pensioners for the remainder of their lives. The management of investment funds in these pension schemes is the topic of this chapter.

During the accumulation phase, the pension fund will tend to increase in value because of additional contributions made into the fund, and also due to the investment returns generated by the assets in the fund. For example, in a pension scheme that requires annual contributions of $1,000 over 40 years, the fund's assets would build up to $120,800 in value at retirement if the return on cumulated funds was 5 percent per year; but the same contributions over the same period if the rate

of return was 6 percent would grow to $154,800. This simple numerical example illustrates that small changes in the return on assets can have a dramatic impact on the size of the pension fund at retirement, and hence on the pension that can be paid from this accumulated fund. In practice the returns on pension fund investments will vary every period, hence introducing some risk into the size of the pension fund at retirement, and types of pension schemes differ according to who bears this investment risk.

Private pension schemes can be classified by type in two dimensions: whether the pension is paid on a defined contribution or a defined benefit basis, and whether the pension scheme is constituted on an individual or a group basis. Individual pension schemes are always *funded* and pay a pension at retirement on a *defined contribution* basis. This means that the individual receives a pension which depends on the accumulated assets in the fund. Personal pensions in the UK and 401(k) pension plans or individual retirement accounts in the United States are examples of such schemes, and individuals may have some choice over the type of investments in the fund. Under any defined contribution scheme, the pensioner bears the risk of fund underperformance. Group pension schemes are arranged for more than one individual, and there may be some sharing across generations of the accumulated assets in the pension fund. In most countries occupational schemes provided by an employer are examples of group pension schemes, and may pay on a defined benefit or a defined contribution basis. Papke *et al.* (1996) note the shift in the United States from defined benefit to defined contribution pension schemes and particularly 401(k) plans. Similarly in the UK there has been a substantial growth in UK individual defined contribution schemes over the last 20 years. According to the Sandler Report (2002) between 1988 and 1995 the share of total pensions assets represented by personal pensions increased from 12 to over 20 percent.

The return earned by assets in the pension fund depends upon the investment strategy and asset allocation decisions of the pension fund. These investment decisions can be made by individual pension contributors, or delegated to professional fund managers. The purpose of this chapter is to analyze the investment management process of funds invested in pension schemes.[1] The chapter focuses particularly on measuring the performance of investment returns earned by pension funds. Although investment performance is considered within a global context, in fact only a small number of countries have sizeable funded pension schemes. Table 23.1 shows the stock of pension assets for major developed countries in 1996. The United States, UK, and Netherlands have large amounts of pension fund assets relative to GDP in their economies, reflecting the importance of funded schemes in these countries.[2] In contrast major economies such as Japan, France, and Germany have a relatively small percentage of pension fund assets, reflecting the fact that these economies' pension schemes are predominantly unfunded pay-as-you-go systems.

Table 23.1 Private pension funding in major developed countries, 1996

	US $bn	% of GDP
Belgium	11	4
Canada	213	45
Denmark	38	22
Finland	18	14
France	69	5
Germany	137	6
Ireland	32	43
Italy	32	3
Japan	943	22
Netherlands	349	89
Spain	22	4
Sweden	38	33
UK	966	76
USA	4,763	62
EU total	1,730	21

Source: Davis (1998).

The next section discusses the investment management industry in general, and explains how it relates to the pensions management industry. Section 3 explains the measurement of investment returns; Section 4 introduces a number of risk-adjusted performance measures, and Section 5 discusses some problems with these measures. Sections 6 and 7 report the results of empirical evidence of pension fund investment performance. Section 8 concludes.

2 THE PENSIONS MANAGEMENT INDUSTRY

Pension fund management is only one part of the very large global investment management industry, which represents the management of investment portfolios by professional fund managers.[3] Such delegated portfolio management also in-

cludes unit trusts (mutual funds), investment trusts (closed-end funds), invest-
ment policies (life assurance, endowment policies). Franks *et al.* (2003) report that
it is estimated that the extent of global assets under external management during
1999 was of the order of €33 trillion. Table 23.2 shows the assets under management
in seven European countries and the United States. Franks *et al.* report that in all of
these countries the amount of assets managed has increased substantially through-
out the 1990s. In the UK, United States, France, Germany, the Netherlands over the
period 1994–9 the amount of assets managed more than doubled; net assets of
Spanish institutional investors trebled over the same period; and assets under
management in Italy in 1999 were six times greater than in 1994. Davis and Steil
(2001) produce similar estimates, and suggest that the recent increase is part of a
longer trend of institutionalization of the savings markets around the world. In
1970 the total financial claims of the financial sector were 4 percent of GDP for the
G-7 countries. By 1998 this figure had almost doubled to 7.91 percent.

Pension assets are a significant part of the global investment management
industry: pension funds, mutual funds, and insurance funds account for roughly
equal shares of total assets, though both mutual funds and insurance funds will
include some pension savings. Pension funds are relatively important in the UK
and the United States, and we can see from Table 23.2 that in the United States
mutual funds are also important institutional investors, which is not the case for
the UK. Table 23.3 shows the percentage of UK corporate equity owned by
institutional investors, and shows that pension funds are major investors in the

Table 23.2 Assets under management for eight countries, 1999 (billion euro)

Country	Pension funds	Insurance companies	Mutual funds
France	66	830	705
Germany	129	673	515
Ireland	47	32	150
Italy	65	169	412
Netherlands	397	220	83
Spain	32	62	219
UK	1,270	1,266	345
Total Euro-7	2,006	3,252	2,429
USA	7225	2,403	6,388

Source: Franks *et al.* (2003).

Table 23.3 Institutionalization of the UK equity market to 1999

	End year (%)					
	1963	1975	1981	1989	1994	1999
Pension funds	6.4	16.8	26.7	30.6	27.8	19.6
Insurance companies	10.0	15.9	20.5	18.6	21.9	21.6
Unit and investment trusts and other	12.6	14.6	10.4	8.6	10.1	9.7
Banks	1.3	0.7	0.3	0.7	0.4	1.0
Total UK Institutions	30.3	48.0	57.9	58.5	60.2	51.9
Individuals	54.0	37.5	28.2	20.6	20.3	15.3
Other personal sector	2.1	2.3	2.2	2.3	1.3	1.3
Public sector	1.5	3.6	3.0	2.0	0.8	0.1
Industrial and Commercial Companies	5.1	3.0	5.1	3.8	1.1	2.2
Overseas	7.0	5.6	3.6	12.8	16.3	29.3
Total	100	100	100	100	100	100

Source: Myners (2001), based on ONS 'Share Ownership: A Report on the Ownership of Shares at 31/12/99', 8.

equity markets, owning about 40 percent of the UK's equity sector. Table 23.2 also shows that although France and Germany do not have large funded pension schemes, they have relatively large insurance and mutual fund sectors. It is important to recognize that individuals in different countries may be making provisions for their retirement through other savings vehicles. UCITS (Undertaking for Collective Investment in Transferable Securities) are important savings vehicles in France and Germany (Franks *et al.* 2003).

The difference between pension schemes and other saving vehicles is the long-term nature of the scheme under which the savings cannot be accessed until retirement. Del Guercio and Tkac (2002) find that the flow of funds into pension funds is less sensitive to past performance than for mutual funds and suggest that this is because of the long-term nature of pension schemes.

A fund manager is an individual (or company) that performs a range of activities centered around a core service of investing clients' assets, in particular managing an investment portfolio. The client–manager relationship is an example of the principal–agent framework where the client employs a fund manager to invest the client's assets in order to maximize returns for a given level of risk or obtain the lowest level of risk to achieve a targeted return. In terms of mean-variance analysis, the objective of the fund manger is to locate the client's portfolio on the efficiency frontier or in the case of active fund management to generate abnormal returns

above some benchmark, that is, to do better than the efficiency frontier. With respect to occupational pension funds, Lakonishock *et al.* (1992) refer to a 'double agency' problem, since the employee, who will eventually become the recipient of the pension, is also principal, and delegates pension fund decisions to the company, which in turn delegates the investment allocation decisions to a fund manager.

Why does the client delegate investment management to the fund manager? There are two reasons: first the fund manager may have superior investment skills, through information-processing abilities. The second reason is due to economies of scale in the fund management process: buying and selling securities may be expensive for a small fund, and pooling these funds under the jurisdiction of a single fund manager may be efficient. Of course the disadvantage of delegated portfolio management is that the client needs to monitor the fund manager. Bhattacharya and Pfleiderer (1985) and Stoughton (1993) discuss the structure of fund manager contracts within the context of delegated portfolio management.

There are two basic types of delegated investment management: bespoke and pooled fund management. In a bespoke vehicle the client hires a fund manager to make the investment decisions on its behalf according to some specified mandate and specific return expectation. The fund manager acts as the custodian of the investor's capital, and will typically report back to the client in a personal capacity on a regular basis on the performance of the fund. In a pooled vehicle, the client simply purchases units of a diversified investment from a financial institution, such as an insurance company or a unit trust, and this approach involves the commingling of investment capital from many clients. The fund manager will again report back to the client, but in a less personal manner. Not surprisingly the costs of

Table 23.4 Fund management fees charged in different countries for a £100 million mandate

| | Basis points per annum | | | | | | | |
| | Canada | | UK | | Australia | | USA | |
	Equities	Fixed interest	Equities	Fixed interest	Equities	Fixed interest	Equities	Fixed interest
Upper quartile fee	28	22	48	23	47	22	50	30
Median fee	24	18	40	18	44	19	42	26
Lower quartile fee	21	16	30	17	40	18	33	23

Source: Frank Russell quoted in Myners (2001).

running a bespoke service will be more than the pooled vehicle, and for that reason the bespoke vehicle is only likely to be used by clients with large amounts of funds to be managed. Typical fees charged by fund managers for managing a segregated fund across a number of countries are given in Table 23.4. The median fee for managing an equity portfolio is about 50 basis points or 0.5 percent per year of the funds under management.

The fund manager manages the client's investment portfolio, with an appropriate mix of asset classes/select assets, with the typical objective of maximizing returns subject to a specified level of risk, and will adjust the portfolio through time, as expectations of returns change. Under pooled fund management, the fund manager sets the long-term policy of the fund, and then investors such as pension funds can choose to purchase shares in this investment vehicle. Under bespoke asset management, the fund manager will agree a long-term policy or strategy with the pension fund, and this will involve specifying a relevant benchmark against which the portfolio performance will be judged. Traditionally fund managers were assessed by relation to a peer-group benchmark such as outperforming the median performance of similar funds. However Myners (2001) reports a long-run trend away from peer-group benchmark to customized benchmarks. This trend reflects trustees increasingly taking asset-allocation decisions on the basis of advice from consultants, and then allocating management of a class of assets to a specific fund manager. The customized benchmark for that manager might then be the relevant index for that asset class. The bespoke investment management process is seen as dynamic, with the mandate evolving over time as the performance of the fund or asset class varies, and expectations of future returns change.

Individual pension schemes that have delegated investment management will typically be constituted on a pooled basis, unless the individual is particularly wealthy. The type of fund management chosen for occupational pension schemes will depend in part on the advice given by consultant actuaries who assess the financial viability of the occupational pension scheme. Under an insured scheme contributions are made into a pooled vehicle which guarantees to pay a pre-defined benefit at a pre-defined time. The risk of a funding shortfall (ignoring default risk) is borne by the fund manager (typically an insurance company), and not the individual or the corporation.

Most small schemes will be run as insured fund management. Under a self-administered scheme, where the pension fund sponsors have some control over the investment management, fund management may be outsourced to one or more external managers, or managed in-house. If the performance objectives are met, the pension scheme should meet all actuarially defined future liabilities. The risks of a contribution shortfall are thus borne by both the sponsoring company and by the external fund manager (to the extent that a failure to meet the benchmark will result in a loss of assets under management). A self-administered scheme may either opt to join a pooled investment fund, which typically offers a lower fee

structure though no mandate flexibility. Alternatively the fund may be managed on a segregated basis, offering greater mandate flexibility but at a higher price. If the scheme is managed on a segregated basis, the pension fund employs one or more fund managers, who are given a mandate to manage assets against a pre-determined benchmark. This method may be discretionary, whereby the asset composition is left up to the fund manager, or non-discretionary, whereby the trustees decide upon the asset allocation. In the non-discretionary case the pension fund sponsors would typically rely on the advice of consultants (actuaries) on the appropriate asset allocation, and then employ specialist fund managers in different sectors.

Very large pension schemes are typically managed by a team of in-house professionals. This allows the fund complete flexibility in terms of asset/liability matching. However the risk of a contribution shortfall lies solely with the scheme sponsor. Tonks (2005) reports on the distribution of fund managers (external and internal) across 2,175 UK occupational pension funds from 1984–97 (see Table 23.5), and provides evidence on the concentration of pension fund management.

The top-ranked fund manager (1RMan) manages 10.8 percent of observations in the sample, the second-ranked manages 5.6 percent and the third manages 4.8

Table 23.5 Distribution of managers across pension funds by category of manager

Fman category	Overall		Between Funds		Within Funds
	Freq.	%	Freq.	%	%
Multi-manager	17,299	29.07	659	30.3	78.10
1RMan	6,410	10.77	244	11.22	81.04
2RMan	3,318	5.58	184	8.46	59.55
3RMan	2,881	4.84	116	5.33	73.40
4RMan–17RMan[#]	13,758	23.14	681	31.31	68.16
18RMan–188RMan	15,595	26.22	965	44.65	58.84
ΔMan	248	0.42	225	10.34	2.64
Total	59,509	100.0	3,074 (n = 2,175)	141.33	63.43

Notes: Sample consists of 2,175 pension funds 1984–97 with 59,509 quarterly observations, with 190 categories of fund manager. Total within = (659 * 78.1 + 244 * 81.04 + …) /3,074; Multi-manager denotes a multiple manager mandate for the pension fund, where more than one manager is employed by the pension fund; n RMan denotes nth Ranked Manager by frequency of observations. For example, 1RMan denotes the first-ranked fund manager, and 188RMan is the 188th-ranked fund manager. ΔMan denotes a change of fund category, when the identity of the fund manager for that quarter is unclear, because the pension fund is changing fund managers during the quarter.[#] denotes that each of these fund managers had greater than 1% of the overall frequency.
Source: Tonks (2005).

percent, and another 14 fund managers (4RMan–18RMan) manage a total of 23.14 percent of observations. 1RMan manages across 244 funds, and 81.04 percent of these funds' observations are using 1RMan. There is also a multi-manager category and a change of manager category (ΔMan). Most funds use a single fund manager in any quarter, but 659 funds have multiple fund managers at some time, and 29.07 percent of all observations have multiple fund managers. Only 85 funds use the same fund manager over the fund's life.

There are a number of different fund management styles. The traditional mandate given to a fund manager is a balanced mandate under which the fund manager manages across all asset classes, and then selects securities within each asset class. The asset allocation decision has a strategic component, in which the global mix of asset classes are based on long-term expectations of expected returns and global macroeconomic factors. In the short term, fund managers may make tactical asset allocation decisions, moving away from the strategic asset allocation decision, to take advantage of short-term fluctuations in asset returns.

Within each asset class a fund manager will make security selection decisions. This may involve active fund management, based on better information or the better investment skills of the fund manager, in order to earn a return above the efficiency frontier. As distinct from balanced fund management, the pension fund may employ specialist managers or apply specialist mandates to specific sectors, having made the asset allocation decision separately. An alternative to active management is passive fund management, whereby the fund manager adopts a stock selection strategy that tracks the market portfolio, proxied by an appropriate index. Pension funds may also employ specialist fund managers who apply quantitative investment management techniques, such as programme trading, or using hedge funds.

3 Return Calculations Methods and Benchmarks

Investors such as pension funds who have delegated their portfolio to a portfolio manager will want to assess the portfolio's performance in terms of its realized risk and returns characteristics. The return to a pension fund's investments over a period *(t, t + 1),* provided there are no net cash inflows into the pension fund during the period is defined as

$$r_i = \frac{mv_{i,t+1} + divs_{i,t} - mv_{i,t}}{mv_{i,t}}$$

where r_i is the return on the pension fund over the period, $divs_{i,t}$ are the dividends received by the pension fund from its investments at the end of the period, $mv_{i,t}$ is the market value of the fund at time t. However suppose that there arenet inflows $NI_{i,t}$ representing cash coming into the fund through contributions, and cash going out in the form of pensions. A mature pension fund, with a high percentage of pensioners to active members, is likely to have negative net inflows. We need to allow for these cash flows in the return calculation, since they do not reflect the investment performance of the fund manager.

$$r_i = \frac{mv_{i,t+1} + divs_{i,t} - NI_{i,t} - mv_{i,t}}{mv_{i,t}}$$

There are two methods for allowing for within-period cash flows: time-weighted return (TWR), and money-weighted return (MWR). TWR calculates the return achieved from a time point immediately after each cash flow until the next cash flow and compounds the returns to get the total return. MWR treats the investment as a project with positive and negative cash flows, and calculates the internal rate of return (IRR) of these cash flows. The IRR is called the MWR when applied in this manner. In general TWR and MWR differ because TWR is a pure percentage return, taking no account of the size of the actual cash value on which the percentage is based.

The Chartered Financial Analysts (CFA) Institute (formerly the Association of lnvestment Management Research (AIMR)) has developed a comprehensive set of Global Investment Performance Standards (GIPS) in order to promote a common set of guidelines for portfolio performance measurement: these standards recommend the use of TWR in performance calculations. There may, however, be times when the portfolio assessment would like to take account of the amount of funds under management, in which case the MWR would be more appropriate. So the moral is that in calculating returns ensure that cash inflows and outflows are appropriately allowed for, and then use either TWR or MWR consistently to compute returns.

Table 23.6 reports the average return on the median UK pension fund over the period 1994–2003 as 6.1 percent per annum. Part of the investment return will be due to movements on the stock market as a whole. In order to isolate the performance of the fund manager, the performance of the investment portfolio may be separated from the return on an appropriate benchmark portfolio. One candidate benchmark is a stock market index such as the S&P500, or the FTSE100. However this may be a poor proxy for the asset allocation of the whole pension fund, if the fund is invested in a variety of asset classes. Tables 23.7 and 23.8 illustrate the asset allocation of UK pension funds from 1993–2003, and of the pension funds

Table 23.6 Average annual returns on median UK pension fund by asset class, 1994–2003

	Median pension fund return (%) 1994–2003	Index return (%) 1994–2003	Index definition
UK equities	6.3	6.1	FTSE All-Share
Overseas equities	3.4	5.3	FTSE All-World Ex-UK
UK gilts	7.1	7	FTSE A All Stocks Gilts
Overseas bonds	4.9	4.7	JP Morgan (Global Ex-UK) Traded
UK index-linked	6.5	6.5	FTSE A ILG
property	11.2	9.8	CAPS Property
Total fund	6.1		

Source: RussellMellonCAPS Fund Returns (2004) (not listed in refs.).

of a number of major economies in 2003. Table 23.8 suggests that the asset allocation of pension funds is similar across countries: approximately 50 percent in equities, 25 percent in bonds, and the remainder in cash, property, and other assets. There are some differences in the split between foreign and domestic equities and bonds, but Table 23.7 shows how the median UK pension

Table 23.7 Average asset allocation across UK pension funds, 1993–2003

As at 31 December (%)	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
UK equities	57.3	56.0	54.9	54.7	54.3	52.0	53.6	51.0	47.4	43.4	41.5
Overseas equities	24.4	23.0	22.0	21.0	18.6	18.9	22.8	22.5	25.0	25.1	26.7
UK bonds	4.8	6.1	7.4	7.9	9.4	11.3	10.3	12.8	14.8	18.2	19.4
Overseas bonds	4.7	4.6	4.9	3.7	4.0	4.6	3.9	3.7	2.9	2.1	1.1
Index-linked bonds	3.0	3.8	3.8	3.9	4.1	4.0	4.0	5.0	5.7	7.1	7.5
Cash	3.5	3.7	4.6	6.6	7.5	7.2	3.5	3.2	2.3	2.0	1.6
Property	1.9	2.5	2.1	2.0	1.9	1.9	1.7	1.7	1.8	2.0	2.0
Other	0.4	0.3	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.2
Total fund	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: RussellMellonCAPS (2004) (not listed in refs.).

Table 23.8 Average asset allocation of occupational pension funds in major markets, 2003

(%)	Australia	Japan	Netherlands	Sweden	Switzerland	UK	USA	Average
Domestic equities	31	27	7	21	12	39	48	26
Overseas equities	22	17	36	16	13	28	14	21
Domestic bonds	17	32	8	29	30	12	33	23
Overseas bonds	5	13	32	26	16	3	1	14
Cash	6	5	4	2	10	3	1	4
Property	12	1	5	6	15	6	2	7
Other	7	5	8	0	4	9	1	5
Total fund	100	100	100	100	100	100	100	100

Source: UBS Pension Fund Indicators (2004) (not listed in refs.).

fund has moved toward its recent asset allocation: a substantial reduction in UK equities, partially offset by an increase in overseas equities, and a substantial increase in bonds.

Therefore in order to assess performance of the portfolio, we could use a market index appropriate to the particular asset class, such as in the second column of Table 23.6. However market indices still suffer from a number of problems. The sector market index may exhibit survivorship bias from assets that have been removed due to poor performance, so that returns on the index will be upward biased. It would not be possible to generate the returns on an index by continuously replicating the exact asset composition of the index without incurring substantial trading costs. Bailey *et al.* (1990) point out that pension funds may hire fund managers with specific investment mandates which are related to the liabilities of the pension fund. The market index may not reflect the divergent style of the managers. Other alternative benchmarks are the median return of a sample of fund managers in a similar asset class, or a normal portfolio. Bailey (1992) makes a number of criticisms of median managers including: the subjective selection of the sample; the different risks and styles between managers; the lack of transparency in such a benchmark; and the difficulty in replicating the same investment strategy. Normal portfolios are customized benchmarks designed to reflect the style of an individual manager, but these may be difficult to implement, and are subject to manipulation from an underperforming fund manager. Blake (1998) and Blake and Timmermann (2002) suggest the use of liability-driven benchmarks. However

this raises the issue of the valuation of pension liabilities, and it is unclear how to obtain the appropriate discount rate for valuing pension liabilities.[4]

4 RISK-ADJUSTED PORTFOLIO PERFORMANCE MEASURMENT MEASURES

In making the comparison in terms of realized returns it is important to make an adjustment for the risk of the portfolio. What is the appropriate measure of risk? If the portfolio is the only portfolio held by the pension fund then the total risk of the portfolio would be the measure of risk. If the portfolio is held along with a number of other portfolios, then the non-diversifiable risk of the portfolio will be the appropriate measure.

4.1 Sharpe Measure: Excess Return to Variability

To assess the portfolio returns Sharpe (1966, 1994) proposed computing S for the portfolio under consideration and also for the benchmark portfolio.

$$S = (r_p - r_f)/\sigma_p$$

where r_p is the return on the portfolio, r_f is the risk-free rate, and σ_p is the standard deviation of the returns on the portfolio. The Sharpe measure uses the Capital Market Line as a benchmark and is appropriate for a pension fund that has invested its wealth in the one portfolio under consideration. Lo (2002) has examined the properties of the Sharpe ratio taking account of estimation risk.

4.2 Excess Return to Beta: Treynor Measure

Treynor (1965) proposed using the Security Market Line as a benchmark and T is appropriate for funds that have invested their wealth in a number of portfolios.

$$T = (r_p - r_f)/\beta_p$$

where β_p is the beta of the portfolio. Again to assess the performance of a portfolio, T is computed for both the portfolio and a benchmark.

4.3 Jensen Differential Performance Index

Jensen (1968) proposed measuring the performance of a portfolio by its abnormal return above the Security Market Line.

$$\alpha_p - \{r_p - \{r_f + \beta_p(Er_m - r_f)\}$$

where Er_m is the expected return (sample average) on the market portfolio, and α_p is the Jensen-alpha measure of outperformance. Alternatively we may regress the excess return $(r_p - r_f)$ of a portfolio against the excess return on the market and interpret the intercept as the Jensen measure. The Jensen-alpha specifically evaluates the active fund management by the portfolio manager, as opposed to the passive fund management of investing in the risk-free asset and the market portfolio.

Although both the the Treynor and Jensen measures are based on the Security Market Line, when comparing two portfolios, they can give conflicting assessments of performance. This is because the Treynor measure evaluates a portfolio based on the excess return per unit of risk, measured by the portfolio beta. In contrast the Jensen-alpha measures the absolute excess return for the level of risk adopted by the portfolio. These three measures of portfolio performance can be interpreted as investment returns, in the following way. The Sharpe measure S shows the return per unit of volatility to the zero investment portfolio formed by borrowing \$1 and investing it in the portfolio. The Treynor measure T shows the return per unit of beta-risk to the zero investment portfolio formed by borrowing \$1 and investing it in the portfolio. The Jensen-alpha shows the return earned by the zero investment portfolio formed by selling short β_P dollars in the market portfolio and $(1 - \beta_P)$ dollars in the risk-free asset and investing \$1 in the portfolio.

The Jensen-alpha measure has the advantage that it can easily be extended to alternative asset-pricing models, such as the Arbitrage Pricing Theory. The multi-factor Jensen-alpha with n factors can be written as

$$\alpha_p = r_p - r_f - b_{p1}F_1 - b_{p2}F_2 - \ldots - b_{pn}F_n$$

where F_k is the risk premium on the nth factor.

4.4 Information Ratio

The information ratio is similar to the Sharpe ratio but compares the performance of a portfolio to its benchmark

$$I = (r_p - r_b)/\sigma_{ER}$$

where r_p is the average return for portfolio p over some period, r_b is the average return on a benchmark portfolio over the same period, so that $(r_p - r_b)$ is the excess return on the portfolio over the benchmark; σ_{ER} is called the tracking error, and is the standard deviation of the excess returns during the period. The information ratio compares the return over the benchmark with the 'risk' taken—where risk is the tracking error, defined as the deviation from the benchmark.

5   Problems with Performance Measurement

5.1   The Market Index

A potential problem with the risk-adjusted performance measures outlined above is that the benchmark used for comparison may be inappropriate. For example it is an unresolved question whether the CAPM is the correct asset pricing model that can explain the cross-sectional distribution of asset prices in an economy (Fama and French 1996). Even if the correct asset pricing model is specified, Roll (1978) points out that the chosen index may not represent the entire universe of securities: in fact it is likely that equity indices such as the S&P 500 will have a large capitalization bias. In this case the performance measure may be comparing the performance of the fund with a benchmark that itself is inefficient. Grinblatt and Titman (1993) suggest a method of assessing portfolio performance without requiring a benchmark. This involves comparing the performance of the selected assets in the portfolio with a reference period when these same assets were not in the portfolio.

5.2   Market Timing

The original Jensen technique made no allowance for the market-timing abilities of fund managers when fund managers change the composition of their portfolio on the basis of expected market movements. When portfolio managers expect the market portfolio to rise in value, they may switch from bonds into equities and/or they may invest in more high beta stocks. When they expect the market to fall they will undertake the reverse strategy: sell high beta stocks and move into 'defensive'

stocks. If managers successfully engage in market timing, then returns to the fund will be high when the market is high, and also relatively high when the market is low.

If there were no market timing, then a regression of $r_i - r_f$ against $r_m - r_f$ would produce points scattered around the solid line in Figure 23.1. If there is market timing, then the correct model specification will be a different dotted line in the good and bad market conditions. A simple Jensen-alpha intercept will conclude that there is negative performance. If managers successfully market time, then a quadratic plot would prove a better fit (Treynor–Mazuy test (Treynor and Mazuy 1966)). So a test of market timing is a significant value of γ_p in the following regression, for the single factor model.

$$R_{pt} - r_f = \alpha_p + \beta_p(R_{mt} - r_f) + \gamma_p (R_{mt} - r_f)^2 + \varepsilon_{pt}$$

An alternative test of market timing for the single factor model suggested by Henriksson and Merton (1981) is

$$R_{pt} - r_f = \alpha_p + \beta_p(R_{mt} - r_f) + \delta_p(R_{mt} - r_f)+ + \eta_{pt}$$

where $(R_{mt} - r_f)+ = Max(0, R_{mt} - r_f)$. The market timing test is easily extended to a multi-factor framework, assessing the timing on each of the style components.
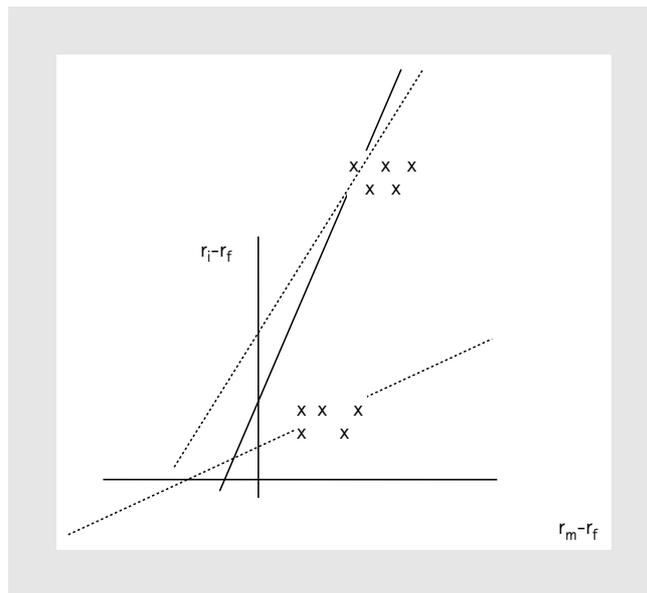

Fig. 23.1 Illustrating the problem of market timing

5.3 Conditional Performance Evaluation

In order to distinguish fund managers' skills from simply taking advantage of predictable market or factor movements, Ferson and Schadt (1996) advocate allowing for the benchmark parameters to be conditioned on economic conditions. Allowing the market parameters to be time-varying, the Jensen regression becomes

$$R_{it} - r_{ft} = \alpha_i + \beta_i(Z_{t-1}) \ (R_{mt} - r_{ft}) + \gamma_i F_t + \varepsilon_{it}$$

where Z_{t-1} is a vector of instruments for the information available at time t (and is therefore specified as $t-1$) and $\beta_{i*}(Z_t)$ are time-conditional betas, and their functional form is specified as linear:

$$\beta_i(Z_t) = b_o + B'z_{t-1}$$

where $z_{t-1} = Z_{t-1} - E(Z)$ is a vector of deviations of the Zs from their unconditional means. Implementing this approach involves creating interaction terms between the market returns and the instruments. Typical instruments used are: lagged Treasury bill rate, dividend yield, default premium (difference between low and high quality corporate bonds), slope of the term structure (difference between long-and short-run government bond yields).

5.4 Style-Adjusted Performance

The benchmark portfolio can be a single index or because investment style is important, a 'customized' benchmark can be developed specifically for the portfolio in question (Daniel *et al.* 1997). For example, if the portfolio holds on average 20 percent US government bonds and 80 percent US equities, we may form a customized benchmark as $0.8 \times$ S&P500 + $0.2 \times$ Merrill Lynch Government Bond Index. Usually the customized benchmark is based on an effective mix style analysis (Sharpe 1992). This is achieved by performing an 'effective mix' style analysis on the fund and finding the style exposures. For example, suppose a regression is run on the portfolio returns against various factors, and suppose the following factor-loadings are estimated: 0.4 for large value stock portfolio; 0.2 for growth stock portfolio; 0.3 for small capitalization portfolio; and 0.1 for government bond. Then we can form a customized benchmark for the fund as 0.4 * Large + 0.2 * growth + 0.3 * Small cap + 0.1 * Bonds.

6 EVIDENCE ON INVESTMENT PERFORMANCE

The early evidence on the performance of mutual funds in the United States found that simple tests of abnormal performance did not yield significant returns. Jensen (1968) examined the performance of 115 mutual funds over the period 1955–64, using the Security Market Line as the basis for comparison. Jensen's technique is to regress the excess returns on the individual fund (above the risk-free rate) against the excess return on the market ($R_{mt} - r_{ft}$)

$$R_{it} - r_{ft} = \alpha_i + \beta_i(R_{mt} - r_{ft}) + \varepsilon_{it}$$

for each fund i over the t data periods, and save the coefficients α_i and β_i. Under the null hypothesis of no-abnormal performance the α coefficient should be equal to zero. For each fund we may test the significance of α as a measure of that fund's abnormal performance. In addition we may test for overall fund performance by testing the significance of the mean α.

$$\bar{\alpha} = \frac{1}{N} \sum_{i=1}^{N} \alpha_i$$

The appropriate t-statistic is

$$t = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{\alpha_i}{SE(\alpha_i)}$$

Jensen examined the abnormal return for each fund net of expenses, and found that the average abnormal return was approximately 1 percent per annum: if expenses were added back into the gross return, average abnormal return was approximately zero. Hence Jensen's conclusions were that market professionals do not appear to be able to beat the market.

Applying this same methodology to the average performance of pension funds, Ippolito and Turner (1987) examined returns on 1,526 US pension funds and find underperformance relative to the S&P 500 Index. Lakonishok *et al.* (1992) provide evidence on the structure and performance of the money management industry in the United States in general, but focus on the role of pension funds, examining 769 pension funds, with total assets of $129 billion at the end of 1989. They find the equity performance of funds underperformed the S&P 500 by 1.3 percent per year throughout the 1980s. They emphasize that although there is a long literature on the underperformance of mutual funds, pension funds also underperform relative to mutual funds on average. Coggin *et al.* (1993) investigate the investment performance of a random sample of 71 US equity pension fund managers for the

Table 23.9 Performance evaluation of UK pension funds, 1983–1997

	No. funds	α	α t-stat.	δ (Market timing)	δ t-stat.
Panel A: CAPM benchmark					
Average values	1,714	0.00017	0.966		
No. coeffs > 0		898			
No. of signif. coeffs.			165		
Treynor–Mazuy					
Average values	1,714	0.0008	11.055	−0.0013	−21.152
Merton–Henriksson					
Average values	1,714	0.0018	19.412	−0.0493	−27.14
Panel B: three-factor benchmark					
Average values	1,714	0.0001	4.526		
No. coeffs > 0		940			
No. of signif. coeffs.			142		

Source: Thomas and Tonks (2001) and Tonks (2002).

period January 1983 through December 1990, and find that the average selectivity measure is positive and average timing ability is negative, though both selectivity and timing are sensitive to the choice of benchmark when management style is taken into consideration. For example, they find that funds that target value strategies yielded outperformance of 2.1 percent per annum, but funds that adopted growth strategies underperformed by −0.96 percent.

Table 23.10 Performance of UK personal pensions 1980–2000

	No. funds	α	α t-stat.	δ (Market timing)	δ t-stat.
Panel A: CAPM benchmark					
Average values	399	−0.00013	−6.43		
Average values	399	0.00033	−1.07	−0.1538	−14.12
Panel B: three-factor benchmark					
Average values	399	0.00029	−1.68		
Average values	399	0.00030	0.68	0.1081	−7.75

Source: Gregory and Tonks (2004).

In the UK, Blake *et al.* (1999) examine the asset allocations of a sample of 364 UK pension funds that retained the same fund manager over the period 1986–94. Following the methods suggested by Brinson *et al.* (1986), they find that the total return is dominated by asset allocation. Average return from stock selection is negative, and average return to market timing very negative. In one asset class, UK equity managers are comparatively good at selecting equities, but only 16 percent of the sample beat the peer group average. Thomas and Tonks (2001) investigate the performance of the UK equity portfolios of 2,175 segregated UK pension funds over the period 1984–97, and the results are presented in Table 23.9. They find that over the whole period and across all funds average outperformance was not very different from zero, and there were negative returns to market timing, though the significance of selectivity increased with the addition of the market timing variable. The distribution of the Jensen-alphas across funds is given in Figure 23.2. Gregory and Tonks (2004) examine the performance of individual personal pensions (exempt unit trusts) in the UK from 1980–2000. They examine those personal pension schemes that invest predominantly in UK equities, and in Table 23.10 report that average performance is not significantly different from zero.
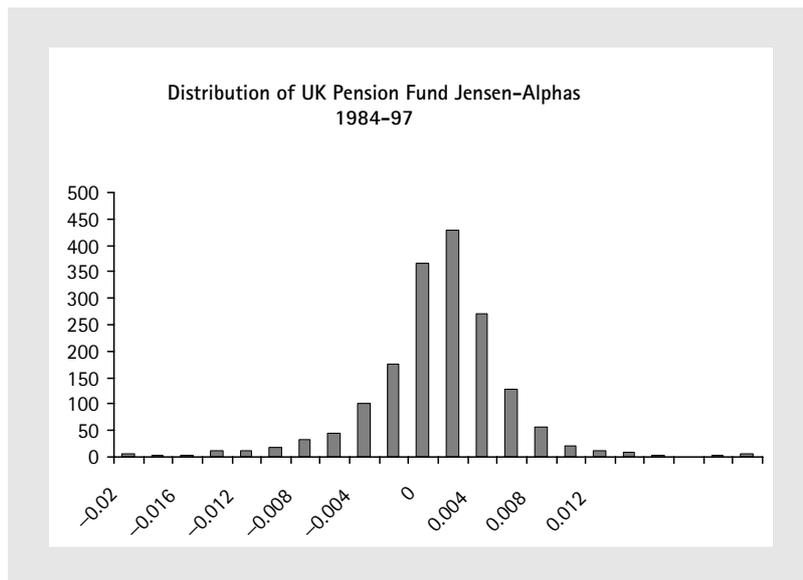

Fig. 23.2 Evidence on performance of pension funds

Source: Thomas and Tonks (2001).

7 PERSISTENCE IN INVESTMENT PERFORMANCE

Although on average fund managers do not outperform, in any sample there is a distribution to the performance as shown in Figure 23.2, and more recently research on performance measurement has investigated whether the outperformers in the sample continue to outperform in the future. Grinblatt and Titman (1992) find that differences in mutual fund performance between funds persist over five-year time horizons and this persistence is consistent with the ability of fund managers to earn abnormal returns. Carhart (1997) demonstrates that common factors in stock returns (including a momentum factor) and investment expenses explain persistence in equity mutual funds' mean and risk-adjusted returns. The only significant persistence not explained is concentrated in strong underperformance by the worst return mutual funds. His results do not support the existence of skilled or informed mutual fund portfolio managers. There are a number of tests for persistence, and recently Carpenter and Lynch (1999) have assessed the power of these difference tests particularly in the presence of different types of survivorship bias. Carpenter and Lynch classify persistence tests into two types: performance-ranked portfolio strategies, and contingency tables.

Performance-ranked portfolio tests sort fund managers each year into portfolios based on past performance, and then form portfolios of the top and bottom managers (by decile or quintile). The equally weighted average portfolio abnormal return of the top and bottom portfolios over the subsequent evaluation period is then evaluated. These procedures are followed for overlapping periods throughout the full period of the data set, and the difference between the average abnormal return on the series of top and bottom portfolios is computed. From their simulations Carpenter and Lynch find that the persistence test based on a *t*-statistic of the difference between the performance of the top and bottom portfolio managers is the best specified under the hypothesis of no persistence, and the most powerful against the alternatives considered. These persistence tests can be computed on the basis of alternative ranking and evaluation time periods, since it may be the case that persistency is only apparent at particular time intervals.

Contingency tables classify funds as winners or losers in each of two consecutive time periods, and examine the distribution of winner–loser combinations. Lakonishok *et al.* (1992), in their study of 769 all equity pension funds, undertake a contingency analysis with funds divided into quartiles, and conclude that evidence of persistence is weak since there is only a 26 percent probability of repeat top quartile performance. In the UK, Brown *et al.* (1997) and Blake *et al.* (1999) have examined consistency in UK occupational pension fund performance. Both studies find only weak evidence of persistence in performance. In constructing their data

samples, both the Brown *et al.* (1997) and Blake *et al.* (1999) studies of UK pension funds specify that the pension fund have the same single fund manager over the length of their respective samples. Tonks (2005) argues that this specification of the data set may have induced survivorship bias in these data samples, since Grinblatt and Titman (1992) and Hendricks *et al.* (1993) have argued that if fund survival depends on average performance over several periods, then survivorship induces spurious reversals: first-period losers must subsequently win in order to survive, and this biases persistence downwards. Tonks (2005) examines persistence in pension fund manager performance using data on UK occupational pension funds irrespective of whether they change manager. He finds strong evidence of persistence in abnormal returns generated by fund managers over one-year time horizons. He found that the returns on a zero investment portfolio of a long position in a portfolio of fund managers that performed well over the previous 12 months and a short position in a portfolio of fund managers that performed poorly, would have yielded an annualized abnormal return of 1.56 percent. He then compares his sample with a restricted sample that imposes the Brown *et al.* (1997), and Blake *et al.* (1999) criteria that specify that the pension fund has the same fund manager over the length of their respective samples. With the restricted sample he finds that the evidence on persistence is weaker. Gregory and Tonks (2004) in their study of personal pension funds also examine persistence in performance of these pension schemes and identify negative persistence at short horizons, but at time intervals of six months to one year they find significant positive persistence, though this positive persistence weakens at longer time intervals.

8 Conclusions

This chapter has provided a survey of pension fund management industry and how it relates and interacts with individual and occupational private pension funds. We have focused on the performance of pension funds whose assets are managed by fund managers. In a funded scheme the pension paid to a retired person will depend on the accumulated value of the assets in the pension fund at retirement. This is clearly the case for a defined contribution scheme where the relationship between the value of the fund and the pension is explicit. But this same annuitization is implicit in a defined benefit scheme, since although there may be some risk-sharing across generations, ultimately the defined benefit scheme is only able to pay out a pension that is a proportion of the value of the assets in the scheme.

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The value of the pension fund will increase over time due to contributions and the investment returns on the fund. These investment returns depend on the asset allocation and portfolio decisions of fund managers. Small changes in the investment returns compound up to large changes in the value of the pension fund at retirement. The evidence on fund manager performance is that on average they do not add very much value over and above a passive strategy of investing in the market index. However this average disguises the fact that some fund managers perform well, and others perform poorly. Identifying and understanding the persistence of the poor performance of some fund managers is an important issue in the pensions area, and one in which further research would be worthwhile.

Notes

1. Blake (2003) provides a detailed description of the development of funded pensions in the UK, and a discussion of recent policy initiatives.
2. Palacios and Pallares-Miralles (2000) identify these three countries plus Australia, South Africa, Switzerland, and Iceland as being the only countries in the world with private pension fund assets greater than 50 percent of GDP. A combination of generous tax allowances on pension contributions (Dilnot and Johnson 1993) and a liberal regulatory regime for pension investments (Davis 1995) probably explains the dominance of funded pensions in these countries.
3. Investment management is also referred to as fund management, asset management, portfolio management, and money management.
4. Speed *et al.* (2003) and Hill (2003) discuss the use of liability-based benchmarks in the context of pension fund returns.

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