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ABSTRACT

Decentralized Investment Management: Evidence from the Pension Fund Industry

The past few decades have seen a major shift from centralized to decentralized investment management by pension fund sponsors, despite the increased coordination problems that this brings. Using a unique, proprietary dataset of pension sponsors and managers, we identify two secular decentralization trends: sponsors switched (i) from generalist (balanced) to specialist managers across asset classes and (ii) from single to multiple competing managers within each asset class. We study the effect of decentralization on the risk and performance of pension funds, and find evidence supporting some predictions of recent theory on this subject. Specifically, the switch from balanced to specialist managers is motivated by the superior performance of specialists, and the switch from single to multiple managers is driven by sponsors properly anticipating diseconomies-of-scale (as funds grow larger) and adding managers with different strategies before performance deteriorates. Interestingly, competition between multiple specialist managers also improves performance, after controlling for size of assets and fund management company-level skill effects. We also study changes in risk-taking when moving to decentralized management. Here, we find that sponsors appear to rationally anticipate the difficulty of coordinating multiple managers by allocating reduced risk budgets to each manager, which helps to compensate for the suboptimal diversification that results; sponsors also benefit from alpha diversification when employing multiple fund managers. Overall, our results provide support for pension fund sponsors, at least on average, rationally choosing their delegation structure.

JEL Classification: G11 and G23
Keywords: asset management, decentralized management, pension funds and principal agent problems

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Pension funds hold a significant share of the market portfolio. During 2005, worldwide pension fund assets exceeded \$18 trillion, or more than 88% of OECD GDP; by comparison, worldwide mutual fund assets during 2005 amounted to about \$17 trillion.[1] While a great deal of research has focused on the performance and structure of mutual fund markets, such as Carhart (1997) and Chen et al (2004), surprisingly little research has been conducted on pension funds. While this omission is likely driven by the scarce availability of data on pension funds, the large differences in the structures of pension versus mutual fund markets makes pension funds a fertile ground for study.

Specifically, mutual fund investors assign their monies to a fund manager with a designated investment style, and these investments are pooled with other investor assets. Typically, each investor has a very small share of total mutual fund assets, so the portfolio manager is not motivated much by the threat of the individual withdrawing her money from the fund. By contrast, sponsors of defined benefit pension plans typically employ fund managers to oversee their sizable pools of assets in separate accounts with an arrangement known as delegated portfolio management. These sponsors are allowed to directly monitor fund management, as well as having a large influence on the strategy and structure of fund offerings. At one extreme, a pension fund sponsor may employ a single fund manager with a "balanced mandate" across all asset classes, while, at the other extreme, the pension fund might employ multiple managers, each with a "specialist mandate," within every asset class.

The practice of using multiple managers, referred to as "decentralized investment management" by Sharpe (1981), might at first appear surprising. Specifically, as modeled by van Binsbergen et al (2008), the unconstrained solution to the mean-variance optimization problem for a sponsor is usually different from the optimal linear combination of mean-variance efficient portfolios chosen by the individual managers employed by the sponsor. Thus, multiple managers usually lead to a "diversification loss," since individual managers do not account for the correlation of their own portfolio returns with the returns of other managers in the fund. This coordination problem can be reduced through well-designed managerial incentive contracts, but cannot be eliminated entirely. Moreover, employing separate fund managers to oversee investments in individual asset classes, rather than hiring a single manager to oversee

[1] See oecd.org/daf/pensions/gps for pension fund statistics and ici.org/stats/mf for mutual fund statistics.

all asset classes, shifts the responsibility for tactical asset allocation (e.g., market timing) away from fund managers and onto the sponsor.

However, there are many potential benefits from employing multiple managers, especially as funds grow larger. For example, pension funds can diversify (across managers) the strategies used to generate alpha to exploit the skills of specialist active managers with superior knowledge of a particular asset class (Sharpe, 1981; van Binsbergen et al, 2009). They might also employ multiple managers to induce yardstick competition and benefit from the resulting higher effort levels exerted by these managers (Shleifer, 1985). Such benefits of using multiple managers can be particularly important for a sponsor with a large fund, given the significant diseconomies-of-scale in pre-fee returns in asset management.

In this paper, we investigate whether pension fund sponsors have rationally moved toward decentralized management, given the greater coordination problem and higher fees that decentralization brings. Alternatively, it is possible that the increasing prevalence of specialized fund managers is simply due to successful new marketing strategies by fund families to generate higher asset management fees.

The few existing studies of pension funds (e.g., Lakonishok et al, 1992) do not examine the effect of the delegation arrangement on performance and risk-taking, due to the nonavailability of data on specific fund mandates.[2] Our paper, by contrast, studies a dataset on UK pension funds between 1984 and 2004 which uniquely contains, in addition to quarterly returns and total assets under management (AUM), information on the type of mandate (balanced, specialist or multi-asset) followed by each pension fund sponsor/manager pairing at each point in time. For instance, we know the investment mandate type of, say, fund manager A for UK equities for each pension fund sponsor during each quarter, which allows us to test for differences in the performance of manager A in UK equities when the firm acts as a specialist versus balanced manager, as predicted in the specialization hypothesis of Sharpe (1981). As

[2]Lakonishok et al (1992) note that up to the early 1980s, most U.S. pension fund managers operated under balanced mandates, with very few specialists. Brinson, et al (1986) report that, by 1985, this situation had changed, with most U.S. pension funds employing multiple specialist managers, similar to the UK two decades later. Lakonishok et al (1992) consider the performance of specialist managers grouped by styles (growth, value, and yield) but do not have data on specialist versus balanced or multi-asset managers.

another example, we are able to see whether manager A differs in its risk-taking in UK equities when it is the sole specialist, compared with when it competes with other specialists. This allows us to test whether sponsors limit the risk-taking of multiple competing managers, due to the coordination problem of van Binsbergen et al (2008). Thus, our data allows us to determine whether particular types of mandates lead to differential performance and/or risk-taking, controlling for asset class and manager characteristics.[3]

First, we investigate whether sponsors employ specialist managers, a form of decentralization, in preference to balanced managers because specialists have superior skills. Our results show that specialist managers indeed display significant security-selection skills, while balanced fund managers fail to exhibit any security-selection or market-timing skills, but compete through lower fees. Specifically, the pre-fee performance of balanced managers is less than that of specialist managers, which is consistent with the higher management fees charged by specialists.[4] Further, the performance of specialists persists, particularly in the case of UK equities, the most significant asset class held by UK pension funds over our sample period.[5]

Second, we examine the dynamics of the switch from balanced to specialist managers. We find that this switch is more likely to occur when balanced managers underperform their benchmarks, which occurs, at least in part, because of diseconomies-of-scale that arise with

[3]It is noteworthy that van Binsbergen et al (2008) assume that all managers have equal skills. Therefore, in their setting, the decision to decentralize fund management (which is made outside of their model) always produces suboptimal outcomes. Our setting makes no such assumptions; we study performance and risk-taking in a unified empirical framework, where managers may have differential skills. As such, besides studying the decentralization issues highlighted by van Binsbergen et al (2008), we also study the rationality of the decentralization decision itself.

[4]Our dataset does not contain information on the fees charged by the individual fund managers, although we know from industry surveys that the fees of specialists are higher than those of balanced managers, so we may infer that specialists capture at least some of the rents from their superior skill or greater effort. This result is consistent with the predictions of Berk and Green (2004).

[5]These findings are consistent with hidden-action (or hidden-ability) principal-agent relationships, such as in our pension fund sponsor/manager setting, where the principal offers a menu of contracts to different types of agents to induce them to self-select into particular contracts in a separating equilibrium. In our setting, specialist and balanced fund managers (the agents) self-select into their preferred contractual arrangements: specialist managers choose to emphasize security-selection skills, while balanced managers choose to emphasize lower fees through the management of larger pools of assets across several asset classes.

increasing fund size. However, even controlling for this size effect, sponsors switch to specialists to improve performance.

Third, we investigate why the employment of multiple fund managers, another form of decentralization, is more common in large funds. Sponsors of large funds tend to use multiple fund managers to reduce diseconomies-of-scale (a benefit of decentralization), but are then faced with higher fees, as well as the problem of coordinating diversification across multiple managers.[6] We find that sponsors react to this coordination problem by controlling risk levels, as predicted by van Binsbergen et al (2008). Specifically, fund sponsors appear to reduce the risk budgets of their managers, such that total pension fund risk is lower under decentralized investment management (a cost of decentralization). Overall, the benefits and costs of decentralization produce a Sharpe ratio that is comparable with that of funds that have not decentralized. This implies that decentralization actually improves performance sufficiently to compensate for the suboptimal total risk level that results. The shift to decentralized management can, therefore, be interpreted as rational, since it offers funds with growing AUM a strategy for reducing the effects of diseconomies-of-scale. Indeed, had funds not decentralized in order to split assets between a number of fund managers, Sharpe ratios would have fallen, since, over most of the sample period, the median sponsor's AUM grow rapidly.

Finally, we find evidence that sponsors employ multiple managers to introduce competitive incentives for managers to perform well, similar to the incentives for outsourced mutual fund management documented by Chen et al (2006). Specifically, we find negative abnormal returns during the four quarters prior to a switch from a single to multiple managers, followed by significantly improved performance during the following four quarters. We show that most of this performance improvement can be traced to the incumbent manager, consistent with the incumbent responding sharply to the threat of a new competing manager in the same asset class.[7] The absolute size of the underperformance prior to the switch averaged only 53

[6]We also find that the dispersion of alphas of pension funds employing multiple managers is lower than funds employing single managers, which is another benefit.

[7]During our sample period, funds switched much more frequently from a single manager to multiple managers than the reverse. This should not be surprising, as it is likely that funds begin with a single fund manager, then switch to multiple managers for a couple of reasons: either they become dissatisfied with the performance of their fund manager or the fund becomes too large to be managed by a single manager and

bps/year, however, indicating that sponsors react promptly and switch to multiple managers before the performance of their single manager deteriorates significantly.

Overall, our paper provides support for rationality in the choice of pension fund mandate. Decentralization from balanced to specialist managers is chosen when balanced managers underperform, while decentralization from single to multiple managers is chosen when the single manager underperforms – which is often a consequence of the increased size of a fund. Further, sponsors appear to understand the costs of decentralization, as shown by their tendency to reduce the risk budgets of managers when the sponsors move to decentralization.

The remainder of the paper is organized as follows. In section I, we explain the different types of investment mandates and set out the hypotheses we wish to test. Section II describes the data. Section III analyzes the relationship between pension fund performance and mandate type, distinguishing between specialist and balanced mandates, as well as studying the dynamics of the change from balanced to specialist managers. Section IV explores the effect on the return and risk characteristics of the pension funds from employing multiple managers compared with single managers, as well as studying the dynamics of the shift from single to multiple managers. Section V concludes.

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the sponsor may employ several managers without incurring huge fees. Poor pre-fee investment performance during the periods prior to a switch is consistent with either explanation.

I. Decentralized Investment Management: Theory and Empirical Predictions

Following the decision to outsource the investment management of a pension fund, plan sponsors must decide on the optimal investment delegation arrangement.[8,9] In general, sponsors can choose centralized or decentralized fund management. There are two important dimensions through which the centralization/decentralization decision might be made.

First, the sponsor must decide whether to employ generalist managers, under a "balanced mandate" or a "multi-asset mandate"; or specialist managers, under a "specialist mandate". Under a balanced mandate, the fund manager is responsible for investing across the full range of assets permitted by the sponsor, such as UK equities, UK bonds, and international equities. The sponsor chooses the strategic asset allocation (SAA), i.e., the longer-term target asset mix, usually with the guidance of an actuarial or investment consultant, but the balanced manager can make both market timing ("tactical asset allocation") and security selection decisions. Under a specialist mandate, the manager is allowed to make security selection decisions within a subclass of assets, and only limited market timing decisions. Under a multi-asset mandate, a manager can invest in more than a single asset category, but in less than the full range available to the balanced manager; the manager can also engage in more sophisticated market timing strategies than the specialist manager. As in the case of balanced management, the sponsor chooses the SAA under the specialist and multi-asset mandates.

Second, the sponsor might decentralize by using multiple balanced managers (rather than a single balanced manager), each of whom invests across all asset classes, or by using multiple

[8] In the UK, a pension plan operates under "trust law" (see, e.g., Blake, 2003). This means that a pension plan is run by independent trustees in the best interests of the plan members. The plan sponsor appoints the trustees, although up to one third can, if the members choose, be elected by them. Legally, all decisions are made by the trustees, although they generally delegate investment decisions to investment professionals, and have a duty to take into account the views of the sponsor. We do not have information on the governance structure of different pension funds (such as information on the trustees). Therefore, for simplicity, we refer to the "sponsor" as being the decision-maker, even though, legally, this role is held by the trustees.

[9] Our study assumes that the decision to outsource has already been made by the fund sponsor. Although this decision is also interesting, our dataset does not include information on internally managed funds.

specialist managers (rather than a single specialist manager) within a given asset class. Even more complex arrangements can occur. For example, a sponsor might employ balanced, multiple-asset, and specialist managers simultaneously, as well as employing a single manager within some asset classes and multiple managers within others. Therefore, it is crucial to analyze the results of decentralization for a sponsor within each asset class as well as across asset classes to assess the performance and risk effects of decentralization.

I.A. Balanced, multi-asset, and specialist mandates

Figure 1 shows the evolution in the proportion of UK equity mandates in our sample that follow a balanced, multi-asset or specialist strategy; these proportions are separately depicted for each of these types, and further separated into proportions of each type that are in single- or multiple-managed mandates.[10] The figure illustrates the secular move by UK pension funds away from balanced managers towards multi-asset and specialist managers during the period March 1984 to March 2004. Roughly 99% of portfolios were allocated to balanced mandates during 1984, but only about 12% by 2004 – at which time 63% of mandates were multi-asset and 25% were specialist. To facilitate the interpretation of our results, it is of interest to know whether multi-asset managers are more like balanced managers or more like specialist managers. Appendix A shows that they are more like balanced managers, although there are sufficient differences not to merge them with balanced managers in our study.

The first dimension of the decentralization decision is whether to employ a single balanced manager across all asset classes, or to employ a specialist manager within each asset class. Sharpe (1981) argues that specialists might have superior private information on securities

[10]To compute these percentages, we count the number of sponsor asset classes managed under each type of arrangement. For instance, a pension fund with a single balanced manager across all seven asset classes would count as having seven balanced manager accounts, while a pension fund with a single balanced manager and seven specialists (one in each asset class) would count as having seven balanced and seven specialist manager contracts. Also, in the first case, the balanced manager would count as seven single management contracts, while, in the second case, the mandates would count as seven multiple balanced manager contracts and seven multiple specialist contracts, reflecting the fact that they are part of a system of competitive managers within individual asset classes. A virtually identical figure results if proportions by value are used in place of proportions by number.

within a given asset class, giving them better performance than generalists. However, van Binsbergen et al (2008) argue that the use of specialist managers will result in less efficient portfolio diversification; they show that a sponsor can minimize the loss of diversification through a well-designed benchmark choice for each asset class, but that it is not possible to completely eliminate the negative externality imposed by each individual manager's optimal portfolio choice.

In our context, if the movement toward specialist managers is rational, then specialist managers should deliver better pre-fee performance (as per Sharpe, 1981) than balanced managers to compensate for the diversification loss (as per van Binsbergen et al, 2008) as well as the higher fees charged by specialists.[11] On the other hand, balanced fund managers market themselves as providers of SAA services across the full range of assets available and are in a position to take advantage of market timing and security selection opportunities across all asset classes.[12,13] These predictions are summarized in our first hypothesis:

Hypothesis 1: The Specialization of Investment Skills: *The measured performance and per-*

[11] We do not have information on fees in our data set, but Mercer (2006) surveys global investment management fees, and reports that, in 2006, the median annual fee for a balanced mandate is 57 bps/year (of AUM), whereas specialist mandates command fees from 60 to 100 bps/year, depending on the asset class. Further, McKinsey (2006) reports, from its survey of US institutional asset managers, that, in 2005, the average asset management fee for a balanced mandate was 50 bps/year, while it was 54 bps/year for large-cap equity specialist funds and 64 bps/year for mid-cap equity specialist funds.

[12] For example, see Myners (2001, p.75). Although balanced managers sell themselves as providers of SAA services to all clients – they have more than pension funds as clients – the SAA decision in the case of pension funds is actually made by the actuarial consultant to the funds' sponsor who is also employed to value the pension liabilities. The consultant typically refuses to share with prospective managers any information on the maturity structure of the liabilities that would help the balanced manager determine an appropriate SAA. Balanced managers are therefore reduced to the subsidiary roles of market timing and security selection, much to their chagrin. Balanced managers are generally able to make short-term market timing deviations from the SAA within boundaries set by the sponsor.

[13] Obviously, all fund managers would prefer to maximize their fee income, and, therefore, might claim to have security-selection skills. Therefore, the higher pre-fee performance of specialists depends on pension fund sponsors offering contracts to balanced and specialist managers that provide incentives to maximize their abnormal performance (for a given risk budget). Under such a separating contract, fund managers with better market-timing skills (but worse selectivity skills) will choose to emphasize market-timing performance.

formance persistence (before fees) of fund managers depends on mandate type: (i) specialist fund managers will exhibit better security-selection skills; (ii) balanced fund managers will exhibit better market-timing skills; (iii) given that there is a diversification loss with the use of specialists and because of their higher fees, the total performance of specialist managers will exceed that of balanced managers to compensate; and (iv) the performance of multi-asset managers will be greater than balanced, but less than specialist managers' performance. Further, (v) the persistence in performance of specialist managers will be greater than that of balanced managers, with that of multi-asset managers lying between.

Since moving to a specialist mandate is costly in terms of diversification loss and higher fees, we hypothesize that a sponsor would expect better performance, adjusting for all other fund characteristics, when moving to specialists:

Hypothesis 2: The Dynamics of Mandate Switching: *(i) The switch from a balanced to a specialist mandate will follow poor pre-fee performance of the balanced manager and (ii) pre-fee performance after the switch should significantly improve.*

I.B. Single versus multiple managers

The second dimension of the decentralization decision is whether to employ a single or multiple managers within an asset class. For instance, a sponsor can choose either one or more balanced managers, each managing across all asset categories. Similarly, a sponsor who wishes to employ a specialist strategy might hire either one or more specialist managers within each asset class. Either approach is really a choice between centralization and decentralization.

Figure 1 also shows the trend toward multiple-managed asset classes during our sample period for balanced, multi-asset, and specialist mandates. Although the use of multiple balanced mandates within a pension fund has decreased over time, it has increased as a proportion of all balanced mandates. The proportion of multiple manager mandates has similarly increased among multi-asset and specialist managers. Clearly, pension funds have moved over the sample period toward decentralization, even within asset classes.

Why might pension fund sponsors consider employing multiple managers? According to standard principal-agent theory (e.g., Holmstrom, 1982), a principal employs multiple agents for two reasons: (i) to take advantage of a technology only available to a particular agent, and (ii) to provide information to induce incentive effects. Under the first explanation, the principal requires multiple tasks to be performed, and a single agent is unable to perform all these tasks effectively, particularly when specialist knowledge is required, so the principal employs multiple agents each with skills in a specific task. In our context, a "value" manager and a "growth" manager would be examples of specialists within the UK equity class. Since Chen et al (2004) report evidence of strong diseconomies-of-scale in fund management (before fees) and Berk and Green (2004) demonstrate that fund diseconomies result from growth in AUM for successful funds, we would expect that sponsors would be especially keen to switch to multiple managers when their funds have grown too large for a single manager to maintain acceptable performance.[14]

With respect to incentive effects, hiring multiple managers induces an internal yardstick competition (Shleifer, 1985), allowing the principal to assess the managers' comparative performance and helping to overcome the problems of shirking and hidden actions. Mookherjee (1984) shows that, with multiple agents, relative performance evaluation when agents' outputs are correlated enables the principal to obtain first-best outcomes.[15]

However, hiring multiple managers again introduces a coordination problem – this time within an asset class – in addition to the cross-asset-class coordination problem discussed in

[14] Further, if fund trustees do not know the manager's true skills, they may want to employ multiple managers as a way to diversify the alpha risk. Indeed, Sharpe (1981) distinguishes between diversification of style (where funds employ multiple managers with different investment approaches) and diversification of judgment (where multiple managers are employed to analyze the same subset of securities). The latter is related to uncertainty about the true level of each manager's alpha. If fund managers have specialist skills that are not perfectly known by the sponsor, Kapur and Timmermann (2005) show that pension funds will employ multiple managers to diversify the risk of employing a low-skill fund manager. If this effect is important, we would expect to find a tighter distribution of alphas among multiple-managed funds than among single-managed funds. Also, we would expect sponsors to be especially concerned about alpha risk as a fund grows larger, due to the higher penalty from underperformance.

[15] Mitigating this effect somewhat is the manager's desire to avoid *relative* underperformance in a yardstick competition due to career concerns, which may result in the construction of conservative portfolios that herd around that of the median fund manager (Blake et al, 1999). However, this is likely a second-order effect.

the last section.[16] Van Binsbergen et al (2008), in their analysis of optimal decentralized investment decisions, argue that the sponsor will contract with each fund manager in a way that induces the manager to optimally choose a lower risk portfolio than would be chosen without the coordination problem. This risk reduction is a way to compensate for the diversification loss arising from the suboptimal coordination between different managers' portfolio decisions. The resulting total asset class risk level for a given sponsor is also predicted to be lower with multiple-manager structures, compared with single-manager structures.

Thus, sponsors should trade-off higher performance with suboptimal risk-taking when deciding on a multiple-manager arrangement. In addition, the use of multiple managers results in higher fee levels, since managers offer substantial economies-of-scale in fees. Our next hypothesis formalizes these predictions:

Hypothesis 3: The Coordination of Fund Managers: *The decision to employ multiple managers affects both fund performance and fund risk. Compared with single-managed funds, multiple-managed funds will have (i) higher pre-fee performance, (ii) lower risk, and (iii) lower dispersion of performance to compensate for the decrease in diversification and the higher fee levels that result from the use of multiple managers.*

Fund sponsors might switch to multiple managers within an asset class for a number of reasons. First, a sponsor might anticipate its single fund manager underperforming in the future, due to the increasing size of AUM and the corresponding diseconomies-of-scale in pre-fee fund management. In this case, we would expect the sponsor to hire additional fund managers, each specializing in a particular sector (e.g., large-capitalization growth). Second, the sponsor might wish to set up a competition between managers to improve performance. In this case, we would expect managers to cover the same universe of stocks, but to use different strategies. Poor investment performance in the period prior to a switch, followed by average

[16] The diversification loss can be reduced, however, by lowering the correlation between returns on the portfolios of individual managers. One way to accomplish this is to let different managers control separate asset classes (e.g., equities, bonds, cash and property) which are likely to be far more weakly correlated than, say, different strategies within UK equities. Alternatively, within an asset class, multiple managers may be employed to cover different sectors or styles, such as transportation vs. technology stocks or large-capitalization value vs. small-capitalization growth stocks. Indeed, the vast majority of multiple-manager arrangements in our dataset involve specialists rather than balanced managers (see Figure 1).

performance would provide evidence supporting the first explanation, while above-average investment performance after the switch would provide evidence for the second.

Hypothesis 4: The Dynamics of Manager Switching: *(i) The switch from a single to multiple managers will follow the underperformance of the single manager and will result in significantly improved performance. Moreover, sponsors rationally anticipating the effects of diseconomies-of-scale will switch to multiple managers (ii) before abnormal returns deteriorate significantly and (iii) in response to a growth in fund assets.*

II. Data

The dataset used in this study was provided by BNY Mellon Asset Servicing (formerly Russell-Mellon-CAPS – commonly known as "CAPS") and consists of quarterly returns on the investment portfolios of 2,385 UK pension funds that had their performance monitored by CAPS at some stage between March 1984 and March 2004. These pension funds hold the assets of occupational defined-benefit – principally final salary – pension plans. The investment portfolios of each pension fund are allocated across seven asset classes: UK equities, UK bonds, international equities, international bonds, index-linked bonds, cash, and property. In addition, for each unique fund/quarter, the coded identity of the fund manager (or managers) and the size (asset value) of the investment mandate under management are provided. All the pension funds in this particular CAPS dataset have "segregated" (i.e., bespoke) as distinct from "pooled" (i.e., co-mingled) investment mandates. The assets of these pension funds were managed by 364 different fund management companies (FMCs), including external and in-house management teams.[17]

Panel A of Table 1 shows the total size of pension fund assets, in constant 2004 pounds, and the aggregate asset allocation at three evenly spaced dates over the sample period. Our CAPS dataset covers about half (by value) of all pension funds in the UK. There is one other major provider of pension fund performance measurement services in the UK, and that

[17]The CAPS dataset has coded information on the FMC that operates the investment mandate. We use the terms fund manager and FMC interchangeably in the paper, even though we have no information on the specific individuals from the FMC who manage the assets of a specific fund.

organization monitors the other half of the sample. Tonks (2005) argues that there will not be any serious selection biases in our dataset since any switching between these two measurement services will be symmetric. Although pension funds may exit the CAPS database because of poor performance, they will be replaced by poor performers from the alternative measurement service. The real value of pension fund assets in our sample grew by 262% between 1984 and 1994, and fell by 23% between 1994 and 2004. This contraction over the second half of the period reflects a combination of the closure of some defined benefit pension plans to new members (and, in some cases, to further accruals by existing members) and low investment returns over the period 2000-2003.

The most striking feature of the asset allocation shown in Table 1 is the increased allocation to UK equities during the first half of the period, followed by a rapid reduction during the second half. Apart from the fact that the UK equity market in 2000 fell by more than other equity markets, the reduced allocation to UK equities is the result of the increased maturity of pension plan liabilities over the second half of the sample period – making volatile equities a less suitable matching asset – together with a change in the tax rules in 1997 that ended UK pension funds' right to reclaim the tax paid on UK dividends. There was some substitution to international equities over the whole period, so that the total allocation to equities (UK plus international), by 2004, was almost the same as during 1984. There is a corresponding inverse pattern in the allocation to UK bonds, with the weighting first falling, then returning to its original level by the end of the sample period. Again reflecting the increasing maturity of pension liabilities – a significant proportion of which are inflation indexed – the allocation to index-linked bonds has increased steadily. Of the remaining asset categories, there is little discernible pattern, except for a steadily declining weight to property. The three most important asset classes are UK equities, UK bonds and international equities, which together account for more than 85% of the total asset value. Therefore, we focus on these three asset classes in the remainder of our paper.

Panel B of Table 1 shows the number of pension funds and fund manager mandates across the different asset classes for three different time periods. UK equities is the only asset class in which every pension fund in the sample invests. The table reveals that both the number of funds and the number of managers have contracted over time. This is partly explained by the closure of funds and the merger or closure of FMCs, but also by possible switches to CAPS's rival performance measurement service.

We have already seen in Figure 1 that there has been a switch from balanced to specialist and multi-asset mandates, and an increased use of multiple-manager mandates in a given asset class over the sample period. As well as showing the coded identity of the fund manager employed by the pension fund during any quarter, the CAPS dataset also reports the investment mandate under which the fund manager is operating. Table 2 provides further information on the use of multiple-manager mandates and the move to specialist mandates. Panel A shows the average size of a fund manager mandate by number of fund managers employed across asset categories at three different dates. Panel B shows the distribution of funds and the number of fund managers employed for each of the investment mandates, again across asset classes and at the three different dates.

From Panel A, it can be seen that, during 1984, over 80% of contracts in each asset class were for a single fund manager – as part of a balanced mandate. The remaining contracts employed two or more managers – as part of competing balanced mandates. The size of the mandate was approximately constant within most asset classes, regardless of the number of managers employed. Panel A also shows that, in asset classes such as UK equities, almost half of all mandates involved multiple managers by 2004. However, in other asset classes, such as property and the various bond categories, the preferred delegation arrangement remained single-manager mandates.

Panel B shows that the dominant investment mandate in 1984 was balanced.[18] Even during 1984, property was sometimes recognized as a specialist asset category, and our classification of balanced mandates includes those mandates that were balanced-excluding-property (BXP), with any property holdings managed by specialist managers. In UK equities, the average number of fund managers per balanced mandate was 1.26. There were negligible (non-property) specialist mandates operating in 1984.

Over time, there has been an increase in the use of multiple-manager balanced mandates (as

[18] Note that the number of funds in each asset class is not the same. Although fund managers may have been operating under a balanced mandate, they might have chosen not to invest in certain asset classes, and therefore the CAPS data would not include these funds as reporting returns in those assets classes.

Figure 1 shows): by 1994, 35% of mandates were multiple-balanced. However, the proportion of balanced mandates has fallen throughout the remaining period to around 15% of total mandates by 2004, as pension funds increasingly turned to specialist and multi-asset mandates. By 1994, for UK equities, international bonds, and international equities, the picture of a single fund manager operating a balanced mandate was changing, with an increased use of two or more managers per asset class. Balanced and BXP mandates had fallen to around 75% of the total; although they were still the dominant mandate-type, they were being replaced by active multi-asset mandates and specialist equity mandates. Pension funds were becoming aware that a single FMC might not have sufficient expertise across all asset classes. Some FMCs claimed superior skills in managing equities, while others claimed skills in managing bonds.

By the end of our sample period, balanced mandates had largely been replaced by a mix of active multi-asset, specialist UK equity and specialist international equity mandates. Specialist equity mandates accounted for 7.5% of the total, covering such specialities as small, medium, and large cap stocks, global and pan-regional equities, as well as a small number of passive mandates.[19] Similar switches had taken place in the other key asset classes. The mean size of mandates employing multiple managers, relative to the size of single-manager funds, had also increased. This implies that it was the larger pension funds that were increasingly decentralizing their investment management through the use of multiple managers. For example, in international equities in 2004, the mean size of the mandate of funds employing a single manager in that asset class was £35.96 million, whereas, for funds employing three or more managers, the mean fund size was £62.35 million.

[19] A text descriptor provided information about the many different types of investment mandate. The "specialist" category comprises a variety of non-balanced, and non-multi-asset mandates, including some mandates listed as passive, i.e. 6-8 percent of the UK bond and international equity mandates and 12 percent of the UK equity mandates. We may therefore slightly under-estimate the skills of the active managers.

III. Empirical Evidence on Balanced vs. Specialist Managers

III.A. Methodology

We now turn to our empirical results, concentrating on the three main asset classes, UK equities, UK bonds and international equities. The first two components of Hypothesis 1, namely that specialist fund managers possess security-selection skills, while balanced fund managers possess market-timing skills, can be assessed as follows.

To test for security selection skills in UK equities, we estimate a four-factor model and save the intercept coefficients as a measure of the Jensen-alpha in the regression:

$$r_{ift} = \alpha_{if} + \beta_{1if} r_{mt} + \beta_{2if} SMB_t + \beta_{3if} HML_t + \beta_{4if} MOM_t + \varepsilon_{ift}, \tag{1}$$

where r_{ift} is the pre-fee excess return (over a T-bill rate) by fund manager i at pension fund f during quarter t, r_{mt} is the period$-t$ excess return on the benchmark UK equity portfolio, SMB_t, HML_t and MOM_t are the Fama-French (1993) size and value common risk factors augmented by the Carhart (1997) momentum factor.[20] Under the null hypothesis of no-abnormal performance, α_{if} should be equal to zero. We can test for abnormal performance across, for example, all specialist pension fund mandates, by testing for the significance of the average, $\bar{\alpha}$, when there are F funds and M fund managers in the sample:

$$\bar{\alpha} = \frac{1}{F} \sum_{f=1}^{F} \frac{1}{M} \sum_{i=1}^{M} \alpha_{if}. \tag{2}$$

To conduct inference about the statistical significance of this mean alpha estimate, we use the residual-resampling bootstrap procedure prescribed by Kosowski et al (2006). For each bootstrap iteration, we sample with replacement from the fund manager-specific error terms of Equation (1). Using these innovations, we generate bootstrapped returns using (1), while imposing $\alpha_{if} = 0$ to reflect the null of no abnormal performance. We then re-estimate the

[20] CAPS use the total return on the FTSE All-Share Index as the benchmark for UK equities. We take the excess return of this index over the UK Treasury bill rate. SMB_t, HML_t and MOM_t are UK versions of these factors supplied by Professor Alan Gregory of Exeter University.

model and obtain a fitted value for each fund-manager alpha for that bootstrap. These are averaged cross-sectionally to form an average bootstrapped alpha. Repeating this across B bootstraps, we obtain a bootstrapped distribution of the average alpha estimate, which can be used to compute the p-value for the average alpha estimate obtained using the actual data. This procedure preserves cross-sectional differences in sample lengths across fund/manager relationships, and, so, replicates the variability in the α-estimates due to heterogeneity in fund-manager tenures.

To separate selectivity from timing skills, we apply the Treynor-Mazuy (1966) test, using the four-factor model, augmented by a quadratic term on the excess return on the market:

$$r_{ift} = \alpha_{if} + \beta_{1if} r_{mt} + \beta_{2if} SMB_t + \beta_{3if} HML_t + \beta_{4if} MOM_t + \beta_{5if} r_{mt}^2 + \varepsilon_{ift}. \tag{3}$$

We test for the significance of the average market-timing term, $\bar{\beta}_5$, using a bootstrap procedure similar to the one described above. Then, following Grinblatt and Titman (1994), the Treynor-Mazuy total performance measure (TM) for each pension fund manager is defined as:

$$TM_{if} = \alpha_{if} + \beta_{5if} Var(r_m), \tag{4}$$

where α_{if} and β_{5if} are the coefficients in (3) and $Var(r_m)$ is the variance of the excess returns on the market.

To test for selection skills in UK bonds, we estimate a two-factor model consisting of the excess returns on the FTSE-A All-Gilts ($GOVB$) and UK government consol (i.e., perpetual) bonds ($CONS$) portfolios, again measured relative to the UK T-bill rate:

$$r_{ift} = \alpha_{if} + \beta_{1if} GOVB_t + \beta_{2if} CONS_t + \varepsilon_{ift}. \tag{5}$$

The market-timing and TM performance measures are then based on the following estimates:

$$r_{ift} = \alpha_{if} + \beta_{1if} GOVB r_{mt} + \beta_{2if} CONS_t + \beta_{3if} GOVB_t^2 + \beta_{4if} CONS_t^2 + \varepsilon_{ift}, \tag{6}$$

$$TM_{if} = \alpha_{if} + \beta_{3if} Var(GOVB_t) + \beta_{4if} Var(CONS_t). \tag{7}$$

For international equities, we use a four-factor model that includes sterling-denominated excess returns on the North American (NA) and Europe Australasia Far Eastern Ex UK

($EAFEX$) stock market portfolios, plus global SMB and HML factors:[21]

$$r_{ift} = \alpha_{if} + \beta_{1if} NA_t + \beta_{2if} EAFEX_t + \beta_{3if} SMB_t + \beta_{4if} HML_t + \varepsilon_{ift}. \tag{8}$$

We separate the global equity return into North American and EAFE components because of the evidence in Timmermann and Blake (2005), who show that UK pension fund weights on North America differed significantly from their corresponding market capitalization weights over the sample period studied here. Finally, estimates of the market-timing and TM performance measures are based on the following equations:

$$\begin{aligned} r_{ift} &= \alpha_{if} + \beta_{1if} NA_t + \beta_{2if} EAFEX_t + \beta_{3if} SMB_t \\ &\quad + \beta_{4if} HML_t + \beta_{5if} NA_t^2 + \beta_{6if} EAFEX_t^2 + \varepsilon_{ift}, \qquad (9) \\ TM_{if} &= \alpha_{if} + \beta_{5if} Var(NA_t) + \beta_{6if} Var(EAFEX_t). \qquad (10) \end{aligned}$$

III.B. The specialization of investment skills: Performance and mandate type

Table 3 presents percentiles of the distribution of pre-fee return performance for the three key asset classes. Panel A reports the distribution of mean pre-fee returns measured across funds. All returns are annualized and are measured in percent per annum. We can see that the mean of the distribution, as well as the risk, is highest for the UK equity portion of sponsor portfolios, next highest for international equities, and lowest for UK bonds. Panels B and C report the distribution of the alpha and beta estimates. The mean annual pre-fee alpha for UK equities is -7 basis points, while, for UK bonds and international equities, it is 67 and 30 basis points, respectively. As we will see shortly, these results change when we condition on the investment mandate. The mean beta results suggest that the models for UK and international equities are appropriate, while the model for UK bonds is marginally less satisfactory, since the mean beta estimate is not quite centered on unity.[22]

Table 4 presents the results of the security selection and market-timing measures of performance for each mandate type, with bootstrapped p-values. The results show that specialist

[21] As the value factor, we use the sterling return on the World ex UK Standard Value Index (MSCI Barra). As the growth factor, we use the sterling return on the World ex UK Standard Growth Index (MSCI Barra).

[22] Neverthless, this was the best equation for bond returns we could find after extensive experimentation.

managers outperform balanced managers in UK equities under the selectivity measure based on the alpha from the model that accounts for market-timing skills, (3), and the corresponding measures for managers investing in UK bonds and international equities, (6) and (9). Specifically, for UK equities, the average pre-fee selectivity alpha for specialist mandates is a significant 67 basis points per year. The results for the multi-asset mandates typically lie between the specialist and balanced mandates: multi-asset mandates also display significant selectivity skills, particularly in international equities, where they exhibit an average pre-fee alpha of 1.91% per year. These results confirm parts *(i)* and *(iii)* of Hypothesis 1: specialist fund managers display significant security selection abilities, and their pre-fee total performance exceeds that of balanced managers. Part *(iv)* is also supported, as the performance of the managers operating under a multi-asset mandate falls between that of the specialist and balanced managers. However, the results for market timing beta fail to confirm part *(ii)* of Hypothesis 1, since we do not find systematic evidence that balanced mandates are associated with positive returns from market timing.[23] These results on performance measures contrast with the results in Table 3, and show that splitting the data according to investment mandate allows us to identify evidence of outperformance in a way that is not possible when the data are in an aggregated form.

Previous studies of pension fund performance, including Beebower and Bergstrom (1977), Brinson et al (1986), Ippolito and Turner (1987), Lakonishok et al (1992), Coggin et al (1993), Christopherson et al (1998), and Bauer et al (2007) for the US, and Blake et al (1999) for the UK, have typically found little evidence of either security selection or market timing skills by pension fund managers.[24] However, these studies did not allow for the differing objectives of pension fund managers, and whether they were operating under balanced or specialist mandates. We have shown that it is important for balanced managers to be assessed for market timing skills and specialists to be assessed for selectivity skills.

Figure 2 presents the outcome of a non-parametric bootstrap for the cross-sectional dis-

[23]The same holds for specialist and multi-asset mandates. This shows that fund managers, whatever their mandate type, do not possess skills in market timing, consistent with the research on mutual fund managers.

[24]However, a recent study by Busse et al (2006) did find evidence of persistence in the performance of 1,475 U.S. institutional investment managers in domestic equities and international bonds between 1991 and 2004.

tribution of the TM total performance measure (selectivity plus market timing) by the three mandate types, specialist, multi-asset, and balanced, in the three main asset classes. For each mandate type, we show the percentage of funds that generated a TM performance estimate greater than expected, as represented by the 45-degree line tracking significance levels between 1% and 10%. For example, in UK equities, we find that 8.5% of the specialists generated superior performance in excess of the 95th percentile of the bootstrapped distribution (which is computed under the null that managers have no skills), compared with only 6.4% and 6.1% for the multi-asset and balanced managers, respectively. In general, the top specialists and multi-asset managers deliver superior performance across all three asset classes, with specialists almost always performing the best. In contrast, there is much less evidence of superior performance for the balanced managers, regardless of the asset class.

An alternative approach to testing Hypothesis 1*(i)* is to follow Grinblatt and Titman (1993) and use the portfolio change measure for selectivity, denoted SEL_i. For each manager, i, over the life, T_i, of the fund that they manage, we compute SEL_i across the J asset classes:

$$SEL_i = \frac{1}{T_i} \sum_{t=1}^{T_i} \sum_{j=1}^{J} w_{ijt}(r_{ijt} - r_{jt}^{Index}), \tag{11}$$

where w_{ijt} is the weight in the ith manager's fund of asset class j at the beginning of time t, r_{ijt} is the return produced by manager i in asset class j during period t, and r_{jt}^{Index} is the benchmark return on asset class j during period t. We then compute SEL_i for each manager over the life, T_i, of the fund that they manage. Using this measure, we find that the average SEL_i is positive and significant for specialist managers (0.63% per year), insignificant for multi-asset managers, and significantly negative for balanced managers (-0.21% per year) – qualitatively similar to our regression-based results in Table 4. Further, roughly three times the number of specialist managers generate a significantly positive SEL_i estimate (at the 5% significance level) compared with the balanced managers. These results confirm that specialist managers are more skilled at selecting securities, especially relative to balanced managers.

To summarize the results from this section, we find evidence largely consistent with Hypothesis 1. That is, specialist managers and multi-asset managers outperform balanced managers, before fees, and their outperformance is due to their security-selection skills. As we have previously noted, the higher fees charged for specialist mandates (Mercer, 2006, and

McKinsey, 2006) will dissipate some of this outperformance. We find no systematic evidence of market timing skills, however, even among managers operating under balanced mandates. The results, therefore, go some way toward explaining the systematic switch away from balanced mandates over the sample period, despite the diversification loss highlighted by van Binsbergen et al (2008).

III.C. The specialization of investment skills: Persistence in performance and mandate type

There is little consensus about persistence in pension fund performance. To take some recent studies, Tonks (2005) finds evidence of persistence in a sample of UK pension funds at the one-year horizon, whereas Bauer et al (2007) fail to establish persistence for a sample of US pension plans. Whether persistence might be related to mandate type has not, however, been explored before. One might expect that the ability to repeat strong performance is highest among specialist managers, if they are truly the most skilled. Another reason to expect this outcome is that specialists are more highly compensated than, say, balanced managers. If fund sponsors were unable to differentiate between over- and under-performing specialists, they would be less likely to pay them higher fees.

To test for persistence in the performance of a given fund/manager pairing, we divide the data into non-overlapping three-year periods. For each period, we first run the performance regressions, (3), (6) and (9), and obtain the estimates of performance, $\hat{\alpha}_{if}$ and $\hat{\beta}_{5if}$, as well as TM from (4), (7) and (10). In a second step, we test whether the value of the performance estimate obtained during one three-year period predicts its value during the subsequent three-year period.

In particular, to explore if a fund's prior ability to generate above-median alpha performance in a previous period increases the likelihood that it will generate above-median alpha performance in the current period, we estimate the following regression in the second step:

$$I_{\{\widehat{\alpha}_{if}>\bar{\alpha}\}} = \lambda_0 + \lambda_1 I_{\{\widehat{\alpha}_{if,-1}>\bar{\alpha}_{-1}\}} + \eta, \tag{12}$$

where $I_{\{\widehat{\alpha}_{if}>\bar{\alpha}\}}$ is a zero-one indicator variable that equals one when $\hat{\alpha}_{if} > \bar{\alpha}$ (the median $\hat{\alpha}$ across all mandates), and the subscript "-1" indicates the alphas estimated during the previous three-year period. We split the funds into above- and below-median performance groups due to the small number of observations, particularly for the managers operating under specialist mandates. Identical procedures are followed for the market-timing betas and TM measures.

The estimated coefficients in (12) represent the following probabilities:

$$\begin{aligned} p\lim(\widehat{\lambda}_0) &= Pr(\hat{\alpha}_{if} > \bar{\alpha} | \hat{\alpha}_{if,-1} \leq \bar{\alpha}_{-1}) \\ p\lim(\widehat{\lambda}_1) &= Pr(\hat{\alpha}_{if} > \bar{\alpha} | \hat{\alpha}_{if,-1} > \bar{\alpha}_{-1}) - Pr(\hat{\alpha}_{if} > \bar{\alpha} | \hat{\alpha}_{if,-1} \leq \bar{\alpha}_{-1}), \end{aligned}$$

so λ_1 measures the probability of future above-median performance for managers with a good track record (i.e., with previous above-median performance) compared with managers with a poor track record (i.e., with previous below-median performance). A positive value of λ_1 is indicative of performance persistence, while a negative value of λ_1 suggests reversion toward the mean. Similarly,

$$p\lim(\lambda_0) + p\lim(\lambda_1) = Pr(\hat{\alpha}_{if} > \bar{\alpha} | \hat{\alpha}_{if,-1} > \bar{\alpha}_{-1}),$$

is a measure of managers' overall persistence. We would expect this to exceed one-half if performance persists.

Table 5 shows the results from this analysis. In each panel, the first column shows $\widehat{\lambda}_0 + \widehat{\lambda}_1$, while subsequent columns show the persistence estimates, $\widehat{\lambda}_1$, along with standard errors and t-statistics. The Jensen alphas in Panel A show that specialists exhibit persistent (and statistically significant) UK equity alphas: 66.7% of specialist UK equity managers with above-median alphas during a three-year period generate above-median alphas during the following three years ($\widehat{\lambda}_0 + \widehat{\lambda}_1 = 0.667$). This far exceeds the expected value of 0.5 under the null of no persistence. There is also some evidence of persistence by multi-asset managers in UK bonds, but not by other types of multi-asset managers or by balanced managers.

The market-timing measure (Panel B) shows no statistically significant evidence of persistence in any asset class for any type of mandate. However, for the TM measure (Panel C), we do find much stronger evidence of persistence for specialist fund managers managing UK equities than for any other mandate/asset-class pairing. Table 5 thus provides evidence supporting Hypothesis 1*(v)*. In doing so, it again helps to explain (i) the switch to specialists over the sample period, since UK equities comprise the most important asset class for the

UK pension fund industry during our sample period, (ii) the switch to multi-asset managers (particularly in UK bonds), and (iii) the switch away from balanced managers who show no evidence of either security selection or market timing skills.

III.D. The dynamics of mandate switching

To look further into the motivation behind mandate changes by sponsors, we conduct an event study. Each mandate switch by a sponsor is included as an observation, so long as there is no reverse switch during the event window (which is defined as four quarters before and four quarters after the switch).

Table 6 reports the results of the performance of the fund around the switch from a balanced to a specialist mandate for the three major asset classes and for the total portfolio. In particular, we consider the simple benchmark-adjusted returns during the four quarters preceding the switch, as well as during the following four quarters.[25] The table shows that, for both UK equities and the total portfolio, the average benchmark-adjusted return is negative before the switch, at -36 and -17 basis points per year, respectively. It is positive for both UK bonds and international equities. This suggests that it is the poor relative performance in the dominant asset class of UK equities (which is also sufficiently large to affect the return on the total portfolio), rather than in any other asset category, that persuades sponsors to switch away from balanced towards specialist mandates. The switch is justified, on average, since there is a statistically significant improvement in performance after the switch in both UK equities and the total portfolio of 89 and 72 basis points, respectively. There is a smaller improvement of 55 basis points per year in the UK bond portfolio, while the post-switch performance of the international equities portfolio deteriorates, although the deterioration is not statistically significant.

These results confirm Hypothesis 2. An interesting observation is that the pre-switch underperformance is fairly modest. This suggests that sponsors are concerned that the underperformance will worsen and switch mandates to avoid this. Balanced managers are penalized

[25] For UK and International equities, the benchmarks are the FTSE All-Share and the MSCI world ex-UK index, respectively, while, for UK bonds, this is the ten year government bond total return index. These are also the benchmark indexes used by the data provider.

severely for even modest underperformance.

IV. Empirical Evidence on Single vs. Multiple Managers

IV.A. The coordination of fund managers: Competition and manager performance

Do managers perform differently when they compete with other managers? Shleifer (1985) argues that hiring multiple managers induces an internal yardstick competition, allowing the principal to assess the managers' comparative performance and helping to overcome the problems of shirking and hidden actions. Our dataset allows us to address this question in a unique manner, since we have data on the same manager, both when acting alone and when competing against one or more other managers in the same asset class. For example, we have pre-fee UK equity returns for each fund manager across many different sponsors during the same time periods. Some sponsors employ a particular fund manager in a multiple-manager setting within UK equities, while others employ the same fund manager as their sole UK equity manager. Our data allow us to control for the unique skill of each manager using a manager fixed-effects framework. Differences in performance as a result of manager competition can then be addressed, by considering whether managers perform better or worse in a multiple-manager setting.

To this end, we conduct, for a given asset class (e.g., UK equities), the following experiment. Let r_{ift} be the excess return for manager i operating in a particular asset class for fund f during quarter t, and let $\mathbf{r}_{bt}$ be the vector of risk factor excess returns (as described at the beginning of the previous section). In the first stage, we run the regression:

$$r_{ift} = \alpha_{if} + \boldsymbol{\beta}'_{if}\mathbf{r}_{bt} + \varepsilon_{ift}. \tag{13}$$

This model allows us to compute the risk-adjusted performance for manager i at fund f, denoted $r^{adj}_{ift} = \widehat{\alpha}_{if} + \widehat{\varepsilon}_{ift}$. We can also compute the average risk-adjusted performance of manager i, $\bar{\alpha}_i$, across all funds, f, managed, where $\bar{\alpha}_i = \frac{1}{F_i}\sum_{i=1}^{F_i} \hat{\alpha}_{if}$ and F_i equals the number of funds that manager i works for over the course of his career, in a given asset class. In the second stage, we run a pooled regression across all funds managed by all managers across all time periods, for the given asset class:

$$r_{ift}^{adj} - \bar{\alpha}_i = \delta \log(REL\_SIZE_{ift}) + \gamma NMAN_{ft} + \nu_{ift}, \quad (14)$$

where REL_SIZE_{ift} equals the total net assets at the end of quarter t for manager i at fund f in a particular asset class (e.g., UK equities) divided by the average fund size in that asset class during that quarter (across all managers), and $NMAN_{ft}$ equals the total number of managers in the asset class at fund f during quarter t.[26] This specification captures any diseconomies-of-scale at the fund level, controlling for the intrinsic skill of a particular manager – which we would expect to be common across all funds managed by the same manager – as measured by $\bar{\alpha}_i$. Note that we use relative fund size (REL_SIZE), as we would expect fund-level diseconomies-of-scale, principally caused by market impact costs, to be driven by fund size relative to the size of capital markets.[27]

Panel A of Table 7 shows the outcome of this analysis, separated by mandate type (specialist, multi-asset, or balanced). First, note that there is strong evidence of pre-fee diseconomies-of-scale at the fund level, as the regression coefficient, δ, is negative for seven of nine fund types.[28] Second, the results of Panel A show that there is no evidence that a larger number of managers results in increased pre-fee performance, as indicated by the regression coefficient, γ.

This would appear to indicate that Hypothesis 3*(i)* is rejected. However, the model in (14) might not be capturing fund management company (FMC) scale-economies. Specifically, we might expect there to be scale-economies at the FMC level, even though there are scale-diseconomies at the pension fund level, similar to the findings of Chen et al (2004) among mutual funds. At the FMC level, economies might be due to spreading fixed costs (e.g., a large

[26] Note that we suppress the intercept in the second stage, since all variation in $r_{i,f,t}^{adj} - \bar{\alpha}_i$ should be related to REL_SIZE or $NMAN$, or should be zero-mean noise.

[27] We do not have data on the total capitalization of each market for each period, therefore, we use median fund size in a given quarter as a proxy.

[28] This finding is consistent with the next subsection, where we will show that large size is a strong predictor of a switch to multiple managers.

research team of security analysts) among a greater number of funds; further, large FMCs are able to recruit and retain the best – and correspondingly most expensive – fund managers.[29]

Accordingly, we employ another specification that uses the same first-stage regression as the above model, but uses a second-stage regression that captures the size of the FMC in a particular asset class (e.g., the aggregate of all UK equity funds managed by the fund manager):

$$r_{ift}^{adj} = c + \delta \log(TOT\_SIZE_{it}) + \gamma NMAN_{ft} + \nu_{ift}, \tag{15}$$

where $TOT\_SIZE_{it} = \sum_{f=1}^{F_i} SIZE_{ift}$ measures the aggregate assets (in a particular asset class) operated by manager i at the end of quarter t across all funds.

The results for this specification are shown in Panel B of Table 7. Here, we find strong evidence of economies-of-scale at the FMC level, since five out of nine coefficients, δ, are positive and significant at the 1% confidence level. This suggests that large FMCs do provide better performance. We also find that there is now some evidence of a positive competition effect among specialists, as the coefficient, γ, is positive for each asset class, and is highly significant in the case of UK bonds. However, there is no consistent positive competition effect among multiple managers operating under either multi-asset or balanced mandates.[30] Therefore, we conclude that Hypothesis 3*(i)*, namely that there is better performance in multiple-managed funds compared with single-managed funds, is accepted in the case of multiple managers operating under specialist mandates, but not in the case of those with either multi-asset or balanced mandates.

[29] Another possibility is that a particular manager uses a similar strategy across many funds that are managed in a given asset class. For instance, we would not expect the same FMC to employ a significantly different strategy in managing UK equities for two different sponsors. Even if the FMC offers different strategies within UK equities (e.g., growth vs. value), we would expect each of these strategies to be managed in a consistent way and reflect the house view of the FMC, e.g., with respect to GDP or inflation forecasts.

[30] The above two specifications assume that differential performance is linearly related to the number of managers within an asset class of a particular sponsor, $NMAN_{ft}$. In unreported tests, we find similar results when we use a dummy variable indicating more than one manager, and when we use separate dummy variables indicating the presence of two, three, or four managers within an asset class of a given sponsor. When we included both fund and fund manager scale-economies by combining both (14) and (15) into a single equation, the evidence in support of a positive competition effect is somewhat weaker, except for specialists in U.K. equities.

IV.B. The dynamics of manager switching

Table 8 explores the dynamics of the switch from single to multiple managers. Specifically, we run the following pooled logit regression for each asset class:

$$I_{ft} = \kappa + \delta \log(REL\_SIZE_{ft}) + \gamma \; PERF_{ft} + \upsilon_{ft},$$

where I_{ft} is an indicator variable that takes the value one if fund f switches from a single manager to multiple managers during quarter t in a particular asset class, REL_SIZE_{ft} is the size of fund f, relative to the average fund size (in that asset class) at the end of quarter t, and $PERF_{ft}$ is the average return in excess of the benchmark for fund f over the four quarters prior to t. Note, in Table 8, that δ is positive for all asset classes (and statistically significant for two out of the three), confirming that diseconomies-of-scale are an important driver of the move from single to multiple managers. A UK equity fund ten times the average size has an 18% higher chance of incurring a switch than the average fund, while the corresponding numbers are 48% and 25% for UK bonds and international equities, respectively.

Note, also, that the switch is (weakly) driven by poor previous four-quarter performance (γ), although this result is not consistent across all asset classes and is not statistically significant in any asset class. Again, this confirms our above finding of (weakly) negative abnormal returns prior to the switch from single to multiple managers within an asset class. This indicates that fund sponsors react quickly to decreasing performance that is due to increasing fund size, before fund performance deteriorates substantially.

As a further test, within each asset class we examine the distribution of fund sizes during the quarter of a switch from a single manager to multiple managers (in an asset class). To control for the upward trend in asset class sizes over our period of study, we measure the quarterly size as the log of the fund size relative to the average fund size across all funds at the end of that quarter. The results are presented in Figure 3. They show that funds that switch from a single manager (in an asset class) to multiple managers are, on average, much larger (during the switch quarter) than single-managed funds, but a little smaller than other multiple-managed funds. This again indicates that sponsors switch in response to anticipated diseconomies-of-scale. Within both single-managed and multiple-managed funds, there are fairly tight distributions of fund sizes, supporting the idea that there is a clientele effect linking fund size and the number of fund managers appointed.

The results of this section are consistent with parts *(ii)* and *(iii)* of Hypothesis 4: switching from single to multiple managers appears to be driven mainly by diseconomies-of-scale at the fund level, and sponsors appear to properly anticipate and make the switch before there is significant deterioration in pre-fee performance caused by diminishing scale-economies at the fund level.

However, it remains possible that our results reflect a selection bias. Specifically, a given fund manager ABC might allocate more talent and effort to some pension fund sponsors, relative to others. If true, sponsors with poor relative performance might introduce competition to encourage ABC to improve its performance, with the result that ABC's performance might end up being similar under both single- and multiple-manager arrangements.

To further control for this potential selection bias, we perform an event study that focuses on the returns during the eight quarters surrounding the switch from a single- to a multiple-manager mandate.[31] The first six columns of Panel A of Table 9 examine the performance during the periods before and after a switch within the three main asset classes. Specifically, the table shows, for each asset class where a sponsor made a switch, mean benchmark-adjusted returns, during the four quarters prior to and following the switch quarter. Here, benchmark-adjusted returns are value-weighted during the period after the switch across all managers (both incumbent – i.e., not fired – and new managers).[32] The results show some evidence of underperformance during the four quarters prior to the switch among UK equity and international equity funds, followed by significantly improved performance during the four quarters following the switch in the case of UK equities. Although the improvement in performance is not especially large economically (62 bps/year for UK equities) and only brings funds up to an average level of performance, fund sponsors once again severely discipline underperforming managers – in this case, by splitting assets among a larger number of fund managers.

[31] There are 150-200 switches in each asset class during our sample period. During the sample period, many funds switched from having a single manager to having multiple managers within an asset class, while a few funds made the opposite switch.

[32] Since benchmark-adjusted returns are measured at the asset-class level, we value-weight the corresponding manager abnormal returns within that asset class. In addition, a sponsor may appear in more than one column of the table, if the sponsor switched from single to multiple managers in more than one asset class.

We might expect the competition effect would be especially strong in motivating an incumbent manager who is *not* fired to improve his performance. In panel B, we conduct the event study only across funds that moved from a single manager to a multiple-manager mandate, but also retained the previous single manager. We report the pre- and post-switch average benchmark-adjusted returns for the incumbent manager. We find stronger evidence of a competition effect among UK equity and international equity managers: performance improves slightly more across the switch, relative to the results of panel A, with the effect being statistically significant in the case of UK equities.

We look further into this issue by examining the impact on the total portfolio, redefining a "switch" as one that occurs in *any* asset class of a given sponsor. We define the event this way because it is possible that sponsors hire additional managers in one asset class (e.g., UK equities) hoping that their managers in other asset classes (e.g., UK bonds) interpret this as a threat that they might be subject to similar discipline, i.e., that the sponsor plans to exhibit effective governance across the full range of assets held. Here, we measure benchmark-adjusted returns, value-weighted across all the asset classes held by each sponsor. Average total portfolio performance is presented in the final two columns of panels A and B of Table 9.[33] There does not appear to be a strong cross-asset-class competition effect, as the evidence of negative abnormal returns before a switch at the fund level is weak. Thus, it appears that managers interpret competitive effects to be segmented, and not common across different asset classes – perhaps due to the difficulty of comparing manager skill across asset classes that have differing levels of market efficiency.

We note that the asset-class underperformance levels in Table 9 are relatively small, consistent with sponsors anticipating a decrease in performance due to a growing asset base, with the corresponding diseconomies-of-scale, and moving to a multiple-manager mandate before performance degrades significantly. Thus, the secular movement from single- to multiple-managers appears to be driven by sponsors wishing to avoid underperformance, rather than trying to improve mediocre performance.[34] We, therefore, find evidence supporting Hypoth-

[33] For example, a sponsor who switches from one to two UK equity managers would be included, even if the sponsor used a single manager in all other asset classes.

[34] In unreported tests, we examine the pre-fee returns surrounding switches from multiple to single managers.

esis 4*(i),* namely that there is higher pre-fee performance when there are multiple managers, at least for UK equity funds. However, this superior pre-fee performance is likely to be offset, at least partly, by the higher fees associated with employing more managers, each having smaller AUM. Further, we do find some evidence of pre-fee economies-of-scale at the FMC level, but, presumably, the FMC captures much, if not most, of this surplus through higher fees. Unfortunately, our dataset does not allow an analysis of fees.

We now have a motive for why sponsors move to a multiple manager structure. There is a fairly complex trade-off between competition, specialization, and fees. Small pension funds can only afford one manager in order to maximize scale-economies in fees. As the fund grows larger, the sponsor is able to employ a larger pool of managers to benefit (weakly) from competition or (especially) specialization and to avoid scale-diseconomies at the fund level. However, the sponsor very likely pays higher total fees when employing larger numbers of fund managers.

IV.C. The coordination of fund managers: Competition and manager risk

The appointment of multiple managers can result in significant diversification losses, since each manager will not necessarily hold a portfolio that optimally diversifies risk with other managers. In response, as predicted by the model of van Binsbergen et al (2008), the sponsor should optimally reduce the risk budget of each fund manager to achieve the desired overall level of risk.

To explore whether pension fund sponsors adjust the risk of their funds when they increase the number of fund managers employed, we decompose fund risk according to the number of managers employed by the fund. For each fund, we compute the value-weighted average returns across all managers within a given asset class. We then perform a 3×3 double sort, in which we divide the funds into terciles according to their *SIZE* (small, medium, large) and

Here, there was no statistically significant underperformance prior to the switch, and there was no superior performance after the switch. This indicates that the switch was prompted by a different explanation, such as a desire to reduce fund management costs (including monitoring costs), although the number of switches from multiple to single is too small to draw reliable conclusions.

the number of fund managers, *NMAN* (1, 2, 3 or more). We subdivide by fund size, since portfolio return volatility is highly negatively correlated with fund size (since smaller funds are generally less diversified than large funds).

For each period, we compute the cross-sectional sample variance in portfolio returns for each size/manager tercile. We then average this over time to get a summary measure of the time-series average cross-sectional return variance across funds included in each of these nine terciles. Hence, our analysis is based on the following measure of the variance (within an asset class):

$$\overline{\sigma}^2_{SIZE,NMAN} = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{1}{NMAN_t - 1}\sum_{i=1}^{NMAN_t}(r_{it} - \overline{r}_t)^2\right), \quad (16)$$

where $\overline{r}_t$ is the (cross-sectional) average return within a given size/manager tercile, $NMAN_t$ is the number of managers in the same size/manager tercile, and $T = 81$ is the total number of quarters in the dataset.[35]

Empirical results are shown in Table 10. They reveal a clear pattern relating fund size, the number of fund managers employed, and the portfolio risk for the total pension fund portfolio. Specifically, the larger the fund, and the greater the number of managers, the lower the dispersion of portfolio returns.

The results are strongest for the total portfolio and for UK equities, but also hold for the largest UK bond and international equity funds. However, the results are statistically significant only for the total portfolio and for UK equities, as the following test results show. To test formally if portfolio risk is declining in the number of managers, the size of the fund or both, we adopt the monotonic relationship (*MR*) test recently proposed by Patton and Timmermann (2009). The null of this test is that there is no particular pattern in the variance of the portfolios as a function of, say the number of managers, while the alternative is that the variance is a declining function of the number of managers, regardless of fund size. For example, if return variance is monotonically decreasing in the number of managers, the variance of returns on funds with two managers should be smaller than that of single-managed funds and the variance of funds with three or more managers should be lower than that of

[35] To motivate this equation, notice that in a setting with homogeneity in funds' exposures to multiple risk factors, this measure effectively extracts the average idiosyncratic variance across funds.

funds with two managers. This must hold separately for small, medium and large funds, giving rise to six inequalities that are jointly tested. By analogy, we can also test whether return variance declines as a function of fund size and is jointly decreasing in both fund size and the number of managers. We report p-values for this test in Table 10. Small p-values indicate that fund return variance is decreasing as a function of the sorting variable(s). For UK equities and the total portfolio, we find statistically significant evidence that return variance declines both in the number of managers and in the size of the fund, whereas for UK bonds and international equities, the relationships are generally not statistically significant.

As a second test, we compute the average time-series variance of returns for single- and multiple-managed funds for the full sample, as well as four sub-samples. For each quarter, we group funds according to whether they are single- or multiple-managed. For each fund, i, we then compute its time-series variance of returns over the sample period, τ_i, for which we have quarterly return observations for that fund. Only funds with a minimum of 20 quarterly observations are included in the analysis, and funds that switch from being single-managed to becoming multiple-managed (or vice versa) are categorized as separate samples, according to their status during a particular period, in the computation.[36] The average variance measure is:

$$\overline{\sigma}_f^2 = \frac{1}{F_f} \sum_{i=1}^{F_f} \left(\frac{1}{\tau_i - 1} \sum_{t=1}^{\tau_i} (r_{it} - \overline{r}_i)^2 \right), \tag{17}$$

where $f \in (SINGLE, MULTI)$ represents the single- or multiple-manager sample and F_f is the number of funds in the corresponding sample. The results are shown in Table 11. Clearly, multiple-managed funds have, on average, a lower volatility than single-managed funds. Moreover, these findings are not just a result of multiple-managed funds becoming more prevalent in the latter part of the sample, since the multiple-managed funds have statistically significantly lower variance than the single-managed funds in two of three sub-samples.

These results confirm Hypothesis 3*(ii),* namely that an increasing number of managers being employed by a fund lowers the volatility of the fund's returns. Since multiple managers are more likely to manage different security types, or employ different strategies, sponsors appear to be especially sophisticated in setting reduced risk budgets so that the overall risk

[36] The quarter of the switch is omitted from this analysis.

is controlled properly.

Earlier, we found weak evidence supporting Hypothesis 3*(i),* namely that performance is positively influenced by the number of fund managers. Thus, while we find that the reduced risk budget under decentralized management does indeed lead to a reduction in risk, there is no corresponding decrease in performance because of the competition and/or specialization effects from having multiple managers. Both effects help reduce the impact of diseconomies-of-scale which would otherwise tend to worsen performance as funds grow larger (see Table 2). Overall, Sharpe ratios (not reported here) of single- and multiple-managed funds are therefore very similar (although we cannot observe the post-fee effect with our dataset).

Fund sponsors also face the risk associated with not knowing the true skill of fund managers. An important question that arises from this is whether hiring multiple managers can help diversify the risk relating to manager alphas. To address this, we estimate the alphas for both single- and multiple-managed funds using the earlier factor specifications for the three asset classes in equations (3), (6), and (9). Table 12 provides insights into the distribution of the estimated alphas along with the standard deviation of these alpha estimates across the single- and multiple-managed funds. Consistent with Hypothesis 3*(iii)* that hiring multiple managers can reduce alpha risk, there is a clear tendency for alpha estimates to be far more widely dispersed for single-managed funds than for multiple-managed funds across all three asset classes and across all mandate types. This suggests that alpha-diversification is an important reason why funds employ multiple managers.

Another way to illustrate this effect is to study the volatility at the manager level and compare this with the fund-level volatility within a given asset class. For single-managed funds, these two measures will be identical. However, for multiple-managed funds, the fund-level volatility might be lower due to diversification effects. We confirm this conjecture. The average multiple-managed UK equity volatility at the manager level is 18.40% per annum, compared with only 17.92% at the fund level. The corresponding figures for UK bonds (8.04% versus 7.90%) and international equity (20.42% versus 19.90%) show a similar diversification effect. Moreover, the fund-level volatility for multiple-managed portfolios tends to be lower than the corresponding volatility for single-managed funds (namely, 18.24%, 8.58% and 19.86% for the three asset classes). This suggests that although individual fund managers that operate as part of a multiple-managed portfolio might have more generous risk budgets than those of single-managed funds, diversification effects operating across managers results in a lower overall risk for the multiple-managed portfolios. Again, this provides evidence supporting Hypothesis 3*(iii)*.

V. Conclusions

Decentralized investment management is widespread throughout the institutional investment industry and, in particular, the pension fund industry. Yet, despite the huge economic importance of this practice, very little is known about the economic motivation for decentralizing or about how fund performance and risk-taking behavior are affected by decentralization.

This paper used a proprietary dataset to study decentralization in investment management in the UK pension fund industry from 1984 to 2004. Over this time period, most pension fund sponsors shifted from employing balanced managers, who invest across all asset classes, to specialist managers, who specialize mostly within a single asset class; and from a single manager (either balanced or specialist) to competing multiple managers (balanced, specialist, multi-asset or combinations thereof) within each asset class. This secular shift from single balanced managers to multiple specialist managers carries significant decentralization costs. As modeled by van Binsbergen et al (2008), decentralization involves suboptimal risk-taking at the portfolio level, due to the problem of coordinating different managers through incentive contracts. The hiring of multiple managers also increases total fees, which usually exhibit economies-of-scale.

We have investigated whether these shifts have been rational; that is, whether fund sponsors have experienced increased performance to compensate for the suboptimal diversification. We first examined whether the performance of specialist mandates is better than that of balanced mandates. We found that, after conditioning on fund manager mandates, specialist managers do display significant security-selection skills, whereas balanced fund managers fail to display any significant security-selection or market-timing skills; there was also evidence of persistence in performance by specialists, especially in UK equities, the most important asset class held by UK pension funds. We further examined the effects on performance and risk from employing multiple managers. We found mild evidence to support the conjectures that competition between multiple managers produces better performance – but this held only in the case of competing specialist managers in UK equities – and that pension fund sponsors react to the coordination problem by controlling risk levels: total pension fund risk (and, in particular, alpha risk) is lower under decentralized investment management. We also found that the switch from balanced to specialist mandates and the switch from single to multiple managers were preceded by poor performance; in the latter case, part of the poor performance was due to the fund becoming too large for a single manager to manage.

Overall, our findings help to explain both the shift from balanced to specialist managers over the sample period – pension funds benefited from superior performance as a result of the shift – and the shift from single to multiple managers – pension funds benefited from risk reduction, via alpha diversification, and from avoiding fund-level diseconomies-of-scale by employing multiple managers. We interpret these shifts as being rational by pension fund sponsors, despite the greater coordination problems and diversification loss associated with increased decentralization.

We note that, following the end of our sample period in 2004, further specialization of skills in pension fund management has occurred. One example is the emergence of diversified growth funds which, in addition to the standard asset classes considered in our paper, offer investments in such "alternatives" as private equity, hedge funds, commodities, infrastructure, currencies and emerging market debt. While the objective of such funds is to generate stable absolute returns over an investment cycle with lower volatility than an all-equity fund, it is clear that the trend documented in this paper of pension funds employing multiple asset managers with specialist knowledge appears to be continuing.

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Appendix: Analysis of Multi-Asset Managers

This Appendix investigates whether multi-asset managers are closer to specialist managers or to balanced managers. Under one possible scenario, specialists were first used by large funds because they became disappointed with the performance of their balanced manager. Smaller funds could not afford seven specialists, so they used lower cost multi-asset managers. These would be specialists in related asset categories (such as UK and international equities, or UK and international bonds). If this is true, multi-asset managers are really specialists for smaller funds.

Another scenario is that balanced managers fought back against the rise of specialists by setting up mini-balanced managers called multi-asset managers. If this is true, there would be no particular link between fund size and the use of multi-asset managers and no particular link between asset categories offered by the multi-asset managers.

We investigate these possibilities in two ways. We first measure the number of asset classes multi-asset managers are generally active in and we then try to understand in what asset classes multi-asset managers are active. The same analysis is conducted for specialist and balanced managers. The six columns of Table A contain the following information respectively:

1. The number of observations, which provides the number of "manager/fund/date" triples. We use this because the number of asset classes in a given "manager/fund/date" triple varies over time.
2. The cross-sectional and time-series average number of asset classes contained in the portfolios.
3. The cross-sectional and time-series standard deviation of the number of asset classes contained in the portfolios.
4. The percentage of portfolios active in both UK equities (UKE) and UK bonds (UKB).
5. The percentage of portfolios active in both UK equities and international equities (INT.E).
6. The percentage of portfolios active in UK equities, UK bonds and international equities.

It is clear from the table that multi-asset managers are quite similar to balanced managers, yet typically manage fewer asset classes.

Table A. Mandates Description

	Obs.	Mean	S.D.	UKE & UKB	UKE & INT.E	UKE & UKB & INT.E
Specialist	33944	1.75	0.80	0.89%	21.13%	0.66%
Multi-Asset	18394	4.18	1.34	72.10%	82.73%	65.42%
Balanced	82115	4.89	1.21	78.99%	94.09%	76.25%

Table 1. Summary Statistics for Funds and Fund Managers

Panel A: Fund Size and Asset Allocation

Asset	Jan 1984		Jan 1994		Jan 2004	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
UK Equities	64.4	50.7	266.3	57.9	150.8	42.7
UK Bonds	23.0	18.1	9.7	2.1	59.6	16.9
Int. Equities	21.4	16.9	121.3	26.4	94.7	26.8
Int. Bonds	0.2	0.1	15.9	3.5	3.7	1.0
Index-Linked	1.8	1.4	10.8	2.4	32.1	9.1
Cash	2.8	2.2	21.8	4.7	5.4	1.5
Property	13.3	10.5	14.0	3.0	7.0	2.0
Total	126.9	100.0	459.7	100.0	353.3	100.0

Panel B: Number of Funds and Fund Managers by Asset Class

Asset	Jan 1984		Jan 1994		Jan 2004		In Existence	
	Funds	Managers	Funds	Managers	Funds	Managers	Funds	Managers
UK Equities	955	113	1044	112	630	82	2385	280
UK Bonds	943	109	652	96	612	61	2319	247
Int. Equities	911	108	1019	118	627	89	2350	279
Int. Bonds	74	22	761	75	210	41	1603	181
Index-Linked	545	75	513	76	412	48	2044	205
Cash	779	108	816	113	463	75	2351	304
Property	718	93	543	86	232	43	1657	184

Note: This table reports summary statistics for the funds and fund managers in our data set. For each of the seven asset classes, Panel A shows the total size of funds under management in real billions of pounds sterling (using the 2004 consumer price index as the base-year deflator) along with the portfolio allocation to each asset class. Panel B reports the number of funds and the number of managers by asset class. Also shown is the total number of different funds and managers in existence at some point during our sample from 1984-2004.

Table 2. Distribution of Funds

Panel A: Distribution of Funds by Number of Managers

# of managers		Jan 1984 Mean Size	Jan 1984 Percentage	Jan 1994 Mean Size	Jan 1994 Percentage	Jan 2004 Mean Size	Jan 2004 Percentage
UK Equities	1	30.87	80.42%	72.06	72.99%	42.44	56.83%
	2	32.01	14.76%	62.25	19.83%	45.76	26.19%
	3 or more	38.06	4.82%	129.13	7.18%	71.51	16.98%
UK Bonds	1	12.33	82.18%	8.66	87.27%	35.45	72.55%
	2	11.98	13.47%	7.80	11.35%	46.05	21.41%
	3 or more	14.64	4.35%	24.01	1.38%	51.51	6.05%
Int. Equities	1	9.83	81.34%	29.19	75.37%	35.96	64.27%
	2	13.10	14.05%	27.03	17.76%	33.01	23.92%
	3 or more	13.58	4.61%	56.69	6.87%	62.35	11.80%
Int. Bonds	1	2.49	98.65%	5.03	77.27%	6.13	79.52%
	2	1.77	1.35%	8.89	18.79%	13.42	17.62%
	3 or more	-	-	26.96	3.94%	12.37	2.86%
Index-Linked	1	2.23	87.89%	9.31	88.30%	33.40	75.97%
	2	2.88	10.46%	19.98	11.11%	34.45	19.90%
	3 or more	1.01	1.65%	21.11	0.58%	47.69	4.13%
Cash	1	1.84	82.67%	4.63	79.04%	2.03	68.25%
	2	1.22	13.35%	4.79	14.46%	3.13	21.17%
	3 or more	2.73	3.98%	9.05	6.50%	4.72	10.58%
Property	1	16.03	86.21%	14.88	90.79%	26.09	88.36%
	2	5.43	11.56%	7.89	8.66%	13.62	10.34%
	3 or more	6.38	2.23%	2.63	0.55%	12.78	1.29%

Panel B: Distribution of Funds by Mandate Type

Mandate		Jan 1984 Funds	Jan 1984 Managers	Jan 1994 Funds	Jan 1994 Managers	Jan 2004 Funds	Jan 2004 Managers
UK Equities	Specialist	12	2.33	119	2.03	284	2.17
	Multi-Asset	2	2.00	173	1.36	384	1.67
	Balanced	952	1.26	821	1.36	83	1.46
UK Bonds	Specialist	10	1.80	46	1.35	203	1.56
	Multi-Asset	2	2.00	103	1.19	399	1.37
	Balanced	938	1.24	516	1.14	76	1.34
Int. Equities	Specialist	10	2.00	98	1.90	275	1.89
	Multi-Asset	2	2.00	157	1.31	365	1.57
	Balanced	907	1.25	815	1.34	81	1.36
Int. Bonds	Specialist	3	1.00	25	1.48	63	1.22
	Multi-Asset	0	0.00	71	1.15	90	1.22
	Balanced	71	1.01	676	1.29	64	1.36
Index-Linked	Specialist	6	1.33	30	1.37	139	1.47
	Multi-Asset	2	1.50	112	1.12	286	1.32
	Balanced	540	1.14	378	1.12	24	1.29
Cash	Specialist	26	1.92	129	2.09	236	1.80
	Multi-Asset	2	1.50	122	1.20	204	1.37
	Balanced	766	1.23	631	1.29	63	1.43
Property	Specialist	30	1.27	87	1.21	83	1.13
	Multi-Asset	1	1.00	66	1.12	98	1.19
	Balanced	692	1.17	402	1.10	53	1.06

Note: Panel A sorts the funds according to the number of managers they employ, i.e., a single manager, two managers, or three managers or more. For each of these categories, we report the average size of the funds in real millions of pounds sterling (using the 2004 consumer price index as the base-year deflator). We also show the percentage of all funds in a given asset class that employ one, two or three or more managers. Panel B sorts the funds according to the manager's mandate type: specialist, multi-asset (more than one asset class, but fewer than all asset classes) and balanced (all asset classes). We report the number of funds as well as the average number of managers operating under each mandate type.

Table 3. Return Performance by Asset Class

Panel A: Mean Returns

Asset Class	1%	5%	10%	25%	50%	75%	90%	95%	99%	mean
UK Equities	-4.39%	1.45%	6.75%	10.96%	14.18%	17.81%	21.88%	24.49%	30.13%	14.15%
UK Bonds	4.78%	6.37%	7.93%	9.42%	10.59%	11.57%	12.71%	13.39%	15.88%	10.43%
International Equities	-6.11%	2.11%	5.27%	8.67%	11.22%	14.13%	17.29%	19.65%	23.95%	11.10%

Panel B: Alpha Estimates

Asset Class	1%	5%	10%	25%	50%	75%	90%	95%	99%	mean
UK Equities	-6.31%	-3.30%	-2.32%	-1.00%	-0.01%	0.90%	2.09%	3.10%	5.47%	-0.07%
UK Bonds	-2.56%	-1.05%	-0.55%	0.08%	0.63%	1.20%	1.78%	2.32%	3.90%	0.67%
International Equities	-12.39%	-7.57%	-4.65%	-1.15%	0.60%	2.27%	4.25%	6.05%	13.22%	0.30%

Panel C: Beta Estimates

Asset Class	1%	5%	10%	25%	50%	75%	90%	95%	99%	mean
UK Equities	0.82	0.91	0.94	0.98	1.01	1.05	1.09	1.12	1.23	1.02
UK Bonds	0.44	0.82	0.93	1.07	1.15	1.23	1.30	1.34	1.50	1.13
International Equities	0.46	0.71	0.81	0.89	0.94	1.01	1.11	1.20	1.45	0.95

Note: This table presents the raw return performance as well as the risk-adjusted return performance for the three main asset classes held by the pension funds, namely UK equities, UK bonds and international equities. All results are based on quarterly data over the period from 1984-2004. Panel A reports percentiles for the distribution of mean returns measured across funds. Panels B and C present alpha and beta estimates. For UK equities, we use a four-factor model that includes the return on a broad market portfolio, a size factor, a value factor and a momentum factor. For UK bonds, we use a two-factor model that includes the returns on a broad market portfolio of UK government bonds and on UK government perpetual bonds (consols). Finally, for international equities, we use a four-factor model based on return indices for North America and the Europe Australasia Far Eastern Ex UK (EAFEX) area, augmented by a size and a small cap factor. All returns are measured in percent per annum.

Table 4. Measures of Security Selection and Market Timing Skills by Mandate Type

UK Equities

Specialist Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	0.67%	0.014
Market Timing Beta	0.093	0.066
TM Total Performance	0.91%	0.005

Multi-Asset Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	0.46%	0.006
Market Timing Beta	-0.005	0.545
TM Total Performance	0.43%	0.004

Balanced Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	-0.24%	0.857
Market Timing Beta	0.091	0.000
TM Total Performance	0.09%	0.876

UK Bonds

Specialist Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	1.17%	0.000
Market Timing Beta	-0.206	0.598
TM Total Performance	0.98%	0.000

Multi-Asset Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	0.81%	0.002
Market Timing Beta	0.767	0.080
TM Total Performance	0.55%	0.007

Balanced Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	0.62%	0.057
Market Timing Beta	-0.253	0.889
TM Total Performance	0.65%	0.031

International Equities

Specialist Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	2.26%	0.002
Market Timing Beta	-0.138	0.834
TM Total Performance	1.55%	0.019

Multi-Asset Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	1.91%	0.007
Beta (Market Timing)	-0.331	0.998
TM Total Performance	1.04%	0.065

Balanced Mandates

	Avg. Coefficient	P-Value
Jensen's Alpha	0.48%	0.313
Market Timing Beta	-0.563	0.999
TM Total Performance	-1.85%	0.966

Note: This table reports evidence of security selection and market timing skills for three types of manager, namely specialists, multi-asset managers (managing more than one asset class, but fewer than all asset classes) and balanced managers (managing all asset classes). For each mandate type, we show the average estimates of Jensen's alpha from the factor models for each asset class described in the note to Table 3, augmented to include the squared excess return on the associated market portfolio. Finally, we report the beta coefficient on the market-timing term along with the Treynor-Mazuy (TM) total performance measure. P-values are based on a non-parametric bootstrap that uses a one-sided test for the ability of funds to generate alphas, betas or TM measures in excess of the mean values estimated using the actual data sample. Jensen's alphas and the TM measures are reported in percent per annum.

Table 5. Persistence in Performance by Mandate Type

	Panel A: Jensen's Alpha					Panel B: β_5 (Market Timing)					Panel C: TM				
Specialist Mandates	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2
UK Equities	0.667	0.246	0.105	2.340	0.060	0.596	0.167	0.106	1.579	0.028	0.732	0.278	0.106	2.615	0.077
UK Bonds	0.882	0.282	0.180	1.566	0.108	0.722	0.278	0.204	1.361	0.074	0.810	-0.024	0.181	-0.131	0.001
Int. Equities	0.324	-0.143	0.104	-1.376	0.019	0.492	0.079	0.112	0.703	0.005	0.372	-0.098	0.103	-0.959	0.010
Multi-Asset Mandates	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2
UK Equities	0.456	0.166	0.086	1.926	0.030	0.491	-0.088	0.090	-0.987	0.008	0.510	0.173	0.090	1.913	0.029
UK Bonds	0.805	0.224	0.110	2.045	0.060	0.689	0.133	0.120	1.115	0.018	0.783	0.129	0.113	1.140	0.020
Int. Equities	0.298	-0.049	0.088	-0.561	0.003	0.400	-0.069	0.093	-0.746	0.005	0.313	-0.088	0.089	-0.987	0.008
Balanced Mandates	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2	$\hat{\lambda}_0+\hat{\lambda}_1$	$\hat{\lambda}_1$	S.E. $\hat{\lambda}_1$	t-stat	R^2
UK Equities	0.516	0.002	0.023	0.096	0.000	0.523	0.030	0.023	1.285	0.001	0.523	0.005	0.023	0.195	0.000
UK Bonds	0.493	0.008	0.036	0.226	0.000	0.504	0.045	0.035	1.268	0.002	0.492	0.071	0.035	1.998	0.005
Int. Equities	0.502	-0.037	0.025	-1.509	0.001	0.507	0.015	0.025	0.591	0.000	0.467	-0.084	0.025	-3.424	0.007

Note: This table reports the results from a regression of an indicator tracking above-median performance (estimated over a three-year period) for a particular fund/manager pairing on a constant and the fund/manager pairing's prior performance (estimated over the previous three-year period). The performance is based on the following equation (in the case of UK equities):

$$r_{ift} = \alpha_{if} + \beta_{1if} r_{mt} + \beta_{2if} SMB_t + \beta_{3if} HML_t + \beta_{4if} MOM_t + \beta_{5if} r_{mt}^2 + \epsilon_{ift}$$

There are similar equations described in the text for UK bonds and international equities. We estimate the following:

$$I_{\{\hat{\alpha}_{if} > \bar{\alpha}\}} = \lambda_0 + \lambda_1 I_{\{\hat{\alpha}_{if,-1} > \bar{\alpha}_{-1}\}} + \eta$$

A positive and significant estimate of λ_1 indicates persistence in performance. Panel A tests for persistence in the manager's alpha α_{if}. Panel B tests for persistence in the manager's market timing coefficient β_{5if}; finally, panel C tests for persistence in the manager's TM performance measure, i.e. $\alpha_{if} + \beta_{5if} \cdot Var(r_m)$.

Table 6. Return Performance around Switches from Balanced to Specialist Mandates

Quarters Before/ After Switch	UK Equities Returns	UK Equities t-stat	UK Bonds Returns	UK Bonds t-stat	Int. Equities Returns	Int. Equities t-stat	Total Portfolio Returns	Total Portfolio t-stat
-4	-0.23%	-0.52	0.21%	0.49	2.87%	1.92	0.02%	0.04
-3	-0.79%	-1.57	0.63%	1.37	2.00%	1.37	0.05%	0.14
-2	-1.08%	-2.67	0.17%	0.33	0.62%	0.46	-0.52%	-1.46
-1	0.59%	0.90	0.08%	0.15	2.08%	1.38	-0.22%	-0.65
1	1.00%	1.73	0.61%	1.20	0.29%	0.20	0.62%	1.42
2	0.81%	1.93	1.60%	3.51	2.24%	1.77	0.48%	1.37
3	0.56%	1.06	0.84%	1.82	3.57%	2.48	0.83%	2.12
4	-0.34%	-0.87	0.18%	0.36	-1.50%	-1.12	0.24%	0.58
Performance Before	-0.36%		0.27%		1.89%		-0.17%	
Performance After	0.53%		0.82%		1.16%		0.55%	
P-value	0.0060		0.0544		0.7664		0.0040	

Note: This table shows the mean returns in excess of the benchmark, and the associated t-statistics, around the quarters where a fund switches from balanced to specialist mandates. Returns are value-weighted and computed at the portfolio level, i.e. across all managers employed. In the first six columns, the analysis is conducted for the three asset classes UK equities, UK bonds and international equities. In the last two columns, the analysis is conducted at the total portfolio level. The last three rows of the table report the average performance before and after the switch and the p-value for a difference-in-mean test for the null of equal average returns against the alternative that the performance in the year following the switch from a balanced to a specialist mandate is better than the one over the year before the switch. All numbers are in percent per annum and are based on the full sample from 1984-2004.

Table 7. Performance, Fund Size and the Number of Managers

Panel A: Scale-Economies at Fund Level

Specialist

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	0.0002648	1.81	0.0001358	0.98	11017
UK Bonds	0.0001032	1.07	0.0000964	0.73	4066
Int. Equities	-0.0009035	-3.81	-0.0000473	-0.21	8731

Multi-Asset

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	-0.0001081	-1.35	-0.0000974	-1.18	13338
UK Bonds	-0.0000242	-0.42	-0.0000424	-0.67	10488
Int. Equities	-0.0001358	-0.83	-0.0001523	-0.88	12302

Balanced

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	-0.0001768	-5.14	-0.0001818	-4.75	73045
UK Bonds	-0.0000452	-1.61	-0.0000203	-0.55	56889
Int. Equities	-0.0001441	-2.00	-0.0000886	-1.09	69958

Panel B: Scale-Economies at Manager Level

Specialist

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	0.00000	-0.03	0.00033	1.19	11017
UK Bonds	0.00050	7.08	0.00131	3.27	4066
Int. Equities	0.00071	3.40	0.00080	1.82	8731

Multi-Asset

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	0.00024	4.22	-0.00004	-0.23	13338
UK Bonds	0.00008	1.82	-0.00015	-1.08	10488
Int. Equities	-0.00026	-2.25	-0.00005	-0.12	12302

Balanced

	δ	t-test δ	γ	t-test γ	Obs.
UK Equities	0.00049	16.20	-0.00043	-5.82	73045
UK Bonds	-0.00013	-5.01	0.00012	1.69	56889
Int. Equities	0.00085	13.38	-0.00010	-0.63	69958

Note: This table presents the results from a two-stage procedure capturing the effect of fund size and number of managers on fund performance. First, we compute risk-adjusted returns using the factor models for each asset class described in the note to Table 3. In Panel A, we present a measure of risk-adjusted returns that controls for managers' ability across funds and we regress this measure on the log fund-size relative to the average fund size and a variable indicating the number of managers active in each asset class, without including a constant. In Panel B, we regress risk-adjusted returns on a constant, the log size of the manager across all funds and a variable indicating the number of managers active in each asset class. The coefficient for the size variable is δ, while the one for the number of managers is γ.

Table 8. The Probability of Switching from Single to Multiple Managers: The Effect of Fund Size and Past Performance

	δ	**t-test(δ)**	γ	**t-test(γ)**
UK Equities	0.08	1.57	-13.93	-1.58
UK Bonds	0.21	3.24	6.35	0.48
Int. Equities	0.11	1.94	-3.96	-1.30

Note: This table reports the results of a logit model of a fund's probability of switching from employing a single to multiple managers in a given asset class as a function of the fund's size (δ) and past performance (γ). Size is measured as the log fund size relative to the average fund size across all funds in existence at time t. Performance is measured as the average annual return in excess of the benchmark for each fund over the course of the previous year.

Table 9. Return Performance around Switches from Single to Multiple Managers

Panel A: Fund Performance

Quarters Before/ After Switch	UK Equities Returns	UK Equities t-stat	UK Bonds Returns	UK Bonds t-stat	Int. Equities Returns	Int. Equities t-stat	Total Portfolio Returns	Total Portfolio t-stat
-4	-0.57%	-1.18	-0.63%	-1.52	-1.55%	-1.10	-0.69%	-1.42
-3	-0.59%	-1.10	-0.02%	-0.05	1.90%	1.44	0.39%	0.83
-2	-1.24%	-2.59	-0.81%	-1.68	-0.65%	-0.48	-0.28%	-0.58
-1	0.22%	0.33	1.18%	2.04	-1.74%	-1.25	0.08%	0.13
1	0.28%	0.74	0.09%	0.21	-0.40%	-0.28	-0.26%	-0.70
2	0.54%	1.78	0.20%	0.50	0.08%	0.06	0.22%	0.65
3	-0.61%	-1.43	0.53%	1.27	-0.63%	-0.53	-0.51%	-1.30
4	0.11%	0.24	-0.45%	-1.09	-0.24%	-0.17	0.44%	0.81
Performance Before	-0.53%		-0.04%		-0.54%		-0.11%	
Performance After	0.09%		0.10%		-0.30%		-0.03%	
P-value	0.0345		0.3329		0.4028		0.4039	

Panel B: Performance of the Incumbent Manager

Quarters Before/ After Switch	UK Equities Returns	UK Equities t-stat	UK Bonds Returns	UK Bonds t-stat	Int. Equities Returns	Int. Equities t-stat	Total Portfolio Returns	Total Portfolio t-stat
-4	-1.09%	-1.77	-0.89%	-1.47	-3.93%	-2.04	0.44%	0.62
-3	0.31%	0.53	0.33%	0.56	2.06%	1.13	0.38%	0.73
-2	-1.13%	-2.23	-0.83%	-1.07	-0.43%	-0.26	-0.32%	-0.52
-1	-0.16%	-0.25	1.04%	1.76	-1.65%	-0.93	-0.03%	-0.04
1	0.23%	0.37	-0.48%	-0.75	-1.06%	-0.50	0.71%	0.99
2	1.51%	2.01	0.91%	1.32	-0.83%	-0.45	-0.13%	-0.16
3	-0.30%	-0.49	0.21%	0.36	-0.54%	-0.34	0.88%	1.07
4	-0.34%	-0.55	-0.95%	-1.57	0.63%	0.31	0.20%	0.33
Performance Before	-0.51%		-0.06%		-0.99%		0.11%	
Performance After	0.28%		-0.07%		-0.46%		0.41%	
P-value	0.0374		0.5064		0.3452		0.2716	

Note: This table shows the mean returns in excess of the benchmark, and the associated t-statistics, around the quarters where a fund switches from employing a single to employing multiple managers. In Panel A, returns are value-weighted and computed at the portfolio level, i.e., across all managers employed. The analysis is conducted for the three asset classes UK equities, UK bonds and international equities and for the the total portfolio. In Panel B, returns are value-weighted and computed for the incumbent managers: the managers that are already employed when the second manager is hired. The analysis is conducted for the three asset classes UK equities, UK bonds and international equities and for the the total portfolio. The last three rows of each panel report the average performance before and after the switch and the p-value for a difference-in-mean test for the null of equal average returns against the alternative that the performance in the year following the switch from single to multiple managers is better than the one over the year before the switch. All numbers are in percent per annum and are based on the full sample from 1984-2004.

Table 10. Portfolio Variance Sorted by Number of Fund Managers and by Fund Size

Total Portfolio

Managers	Small	Medium	Large
	Size tercile		
1	0.471	0.335	0.310
2	0.393	0.255	0.224
3 or more	0.240	0.221	0.189
	Size	0.054	
MR test	**Managers**	0.000	
	Joint	0.015	

UK Equities

Managers	Small	Medium	Large
	Size tercile		
1	0.344	0.270	0.208
2	0.318	0.188	0.161
3 or more	0.279	0.187	0.127
	Size	0.000	
MR test	**Managers**	0.016	
	Joint	0.000	

UK Bonds

Managers	Small	Medium	Large
	Size tercile		
1	0.184	0.107	0.119
2	0.128	0.133	0.083
3 or more	0.441	0.121	0.085
	Size	0.883	
MR test	**Managers**	0.902	
	Joint	0.907	

International Equities

Managers	Small	Medium	Large
	Size tercile		
1	0.853	0.615	0.622
2	0.847	0.422	0.379
3 or more	1.301	0.514	0.378
	Size	0.005	
MR test	**Managers**	0.484	
	Joint	0.283	

Note: This table shows the average return variance for funds sorted by the number of managers (one, two, or three or more), and by size terciles (small, medium and large) and computes a monotonic relationship (MR) test. Each quarter, we sort the funds into nine categories according to the number of funds employed and the size of the fund's portfolio. We then compute the cross-sectional variance of fund returns for each category and finally calculate the time-series mean of this number. The null of the MR test is that there is no systematic relationship between the portfolio variance and size, number of managers or both, while the alternative is that the portfolio variance declines monotonically as a function of size or number of managers or both variables together. The numbers reported are p-values. All variances are annualized before being multiplied by one thousand and are based on the full sample from 1984-2004.

Table 11. Return Variances for Single- and Multiple-Managed Funds

Panel A: Full Sample Results

	Mean of Variances of Returns	Funds	t-test
Single-Managed Funds	5.54	1473	4.18
Multiple-Managed Funds	5.01	655	

Panel B: Sub-Sample Results

1984-1990

	Mean of Variances of Returns	Funds	t-test
Single-Managed Funds	8.30	848	0.07
Multiple-Managed Funds	8.28	281	

1990-1997

	Mean of Variances of Returns	Funds	t-test
Single-Managed Funds	2.29	756	3.69
Multiple-Managed Funds	2.10	338	

1997-2004

	Mean of Variances of Returns	Funds	t-test
Single-Managed Funds	5.63	538	4.65
Multiple-Managed Funds	5.01	407	

Note: This table presents the average variance of returns for single- and multiple-managed funds for the full sample (1984-2004) as well as for three sub-samples. Each quarter, we group funds according to whether they are single- or multiple-managed. Only funds with a minimum of 12 quarterly observations are included in the analysis. Funds that switch from being single-managed to becoming multiple-managed (or vice versa) are categorized as separate funds. Average variances are annualized before being multiplied by one thousand.

Table 12. Risk and the Number of Managers

Specialist Mandates

		S.D. α	$\alpha < -4$	$-4 < \alpha < -2$	$-2 < \alpha < 0$	$0 < \alpha < 2$	$2 < \alpha < 4$	$4 < \alpha$	P-value
UK Equities	**Single-Managed**	4.14	3.78%	5.88%	27.31%	40.76%	11.76%	10.50%	0.0000
	Multiple-Managed	3.33	0.00%	0.00%	26.92%	61.54%	7.69%	3.85%	
UK Bonds	**Single-Managed**	1.45	0.67%	2.01%	17.45%	59.73%	19.46%	0.67%	0.3242
	Multiple-Managed	1.31	0.00%	0.00%	10.53%	57.89%	26.32%	5.26%	
Int. Equities	**Single-Managed**	6.66	5.14%	6.54%	16.82%	27.10%	19.63%	24.77%	0.0000
	Multiple-Managed	3.46	4.48%	1.49%	13.43%	32.84%	23.88%	23.88%	

Multi-Asset Mandates

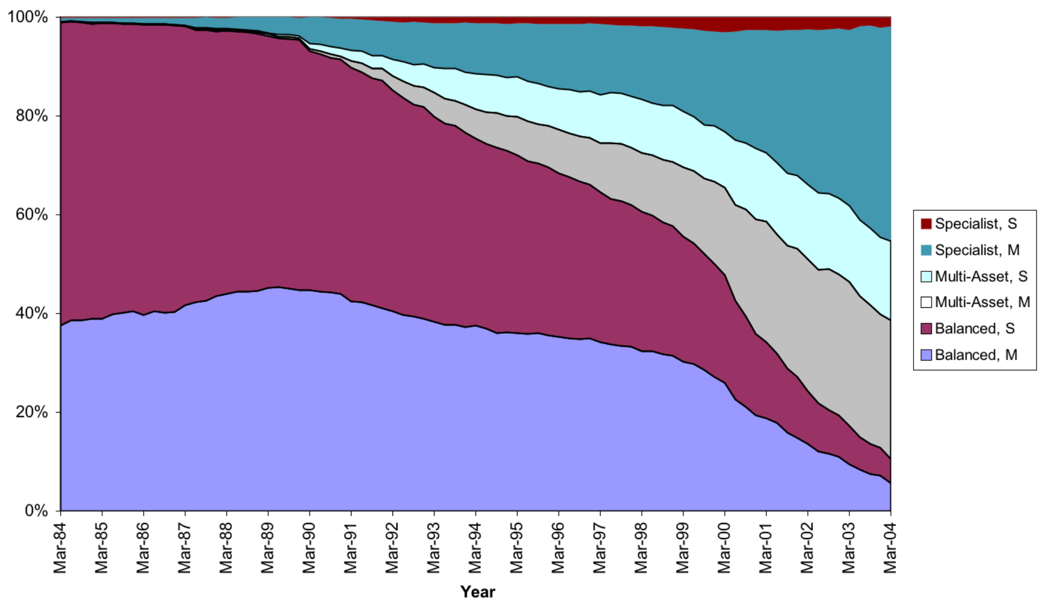
		S.D. α	$\alpha < -4$	$-4 < \alpha < -2$	$-2 < \alpha < 0$	$0 < \alpha < 2$	$2 < \alpha < 4$	$4 < \alpha$	P-value
UK Equities	**Single-Managed**	1.82	0.75%	3.51%	33.33%	47.87%	10.28%	4.26%	0.0002
	Multiple-Managed	1.31	1.15%	4.60%	22.99%	65.52%	5.75%	0.00%	
UK Bonds	**Single-Managed**	1.48	0.28%	0.28%	19.94%	66.10%	11.40%	1.99%	0.0000
	Multiple-Managed	0.93	0.00%	0.00%	20.00%	67.14%	12.86%	0.00%	
Int. Equities	**Single-Managed**	3.14	2.61%	5.22%	19.58%	30.55%	27.94%	14.10%	0.0000
	Multiple-Managed	2.10	0.00%	1.30%	15.58%	45.45%	25.97%	11.69%	

Balanced Mandates

		S.D. α	$\alpha < -4$	$-4 < \alpha < -2$	$-2 < \alpha < 0$	$0 < \alpha < 2$	$2 < \alpha < 4$	$4 < \alpha$	P-value
UK Equities	**Single-Managed**	2.57	4.77%	11.48%	36.32%	35.38%	8.52%	3.54%	0.0000
	Multiple-Managed	1.66	2.93%	5.61%	47.56%	40.24%	2.44%	1.22%	
UK Bonds	**Single-Managed**	1.37	0.37%	2.93%	24.74%	62.96%	8.42%	0.59%	0.0000
	Multiple-Managed	1.04	0.29%	0.29%	14.29%	80.47%	4.08%	0.58%	
Int. Equities	**Single-Managed**	4.78	14.83%	7.82%	19.41%	28.71%	15.13%	14.10%	0.0000
	Multiple-Managed	4.07	10.83%	9.57%	20.91%	28.21%	19.90%	10.58%	

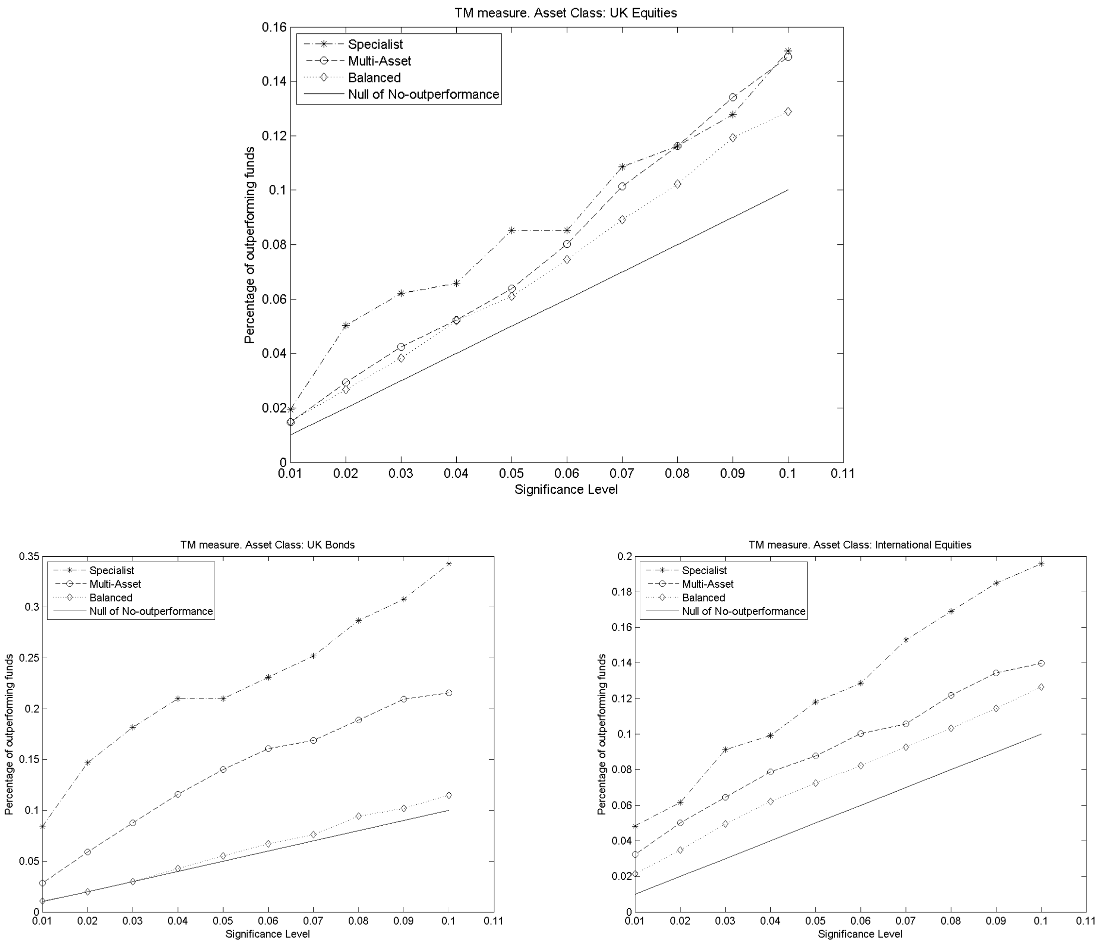
Note: This table compares the distribution of annualized alpha estimates for single- and multiple-managed funds. The alphas are obtained using the factor models for each asset class described in the note to Table 3. Each column reports the proportion of funds with a given annualized alpha, while the last column reports the p-value for a variance test of the null of equal variances against the alternative that the variance of single-managed funds is greater than that for multiple-managed funds.

Figure 1: Distribution of UK Equity Mandates by Mandate Type and by Number of Managers: 1984-2004



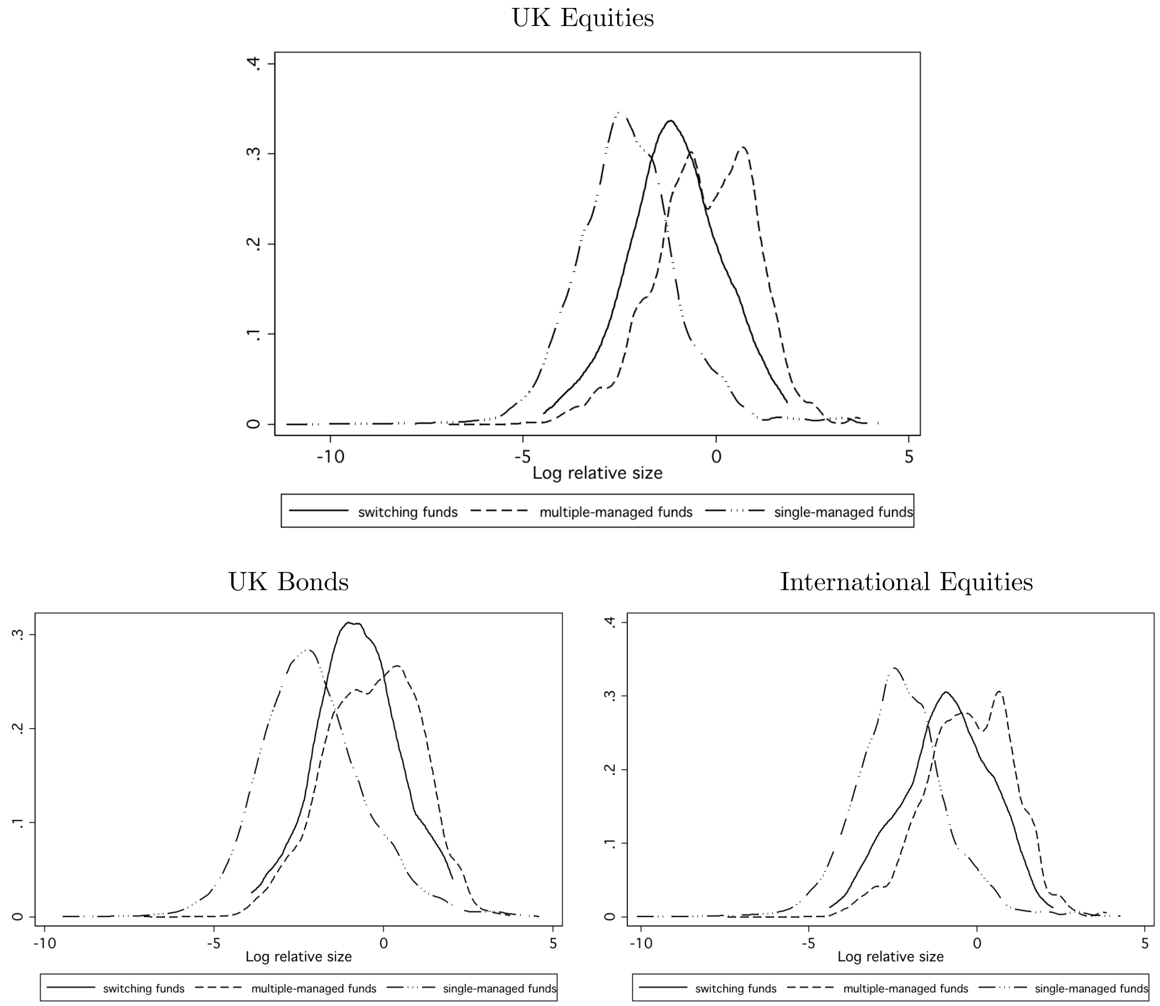
Note: This figure shows the evolution through time in the percentages of types of UK equity manager mandates, namely specialists, multi-asset managers (who manage more than one asset class, but fewer than all asset classes) and balanced managers (who manage across all asset classes), and whether these mandates were managed within the UK equity asset class by a single (S) or by multiple (M) fund managers.

Figure 2: Percentage of Outperforming Funds by Mandate Type



Note: These figures show the outcome of a non-parametric bootstrap test for the cross-sectional distribution of performance measures by three types of managers, namely specialists, multi-asset managers (who manage more than one asset class, but fewer than all asset classes) and balanced managers (who manage across all asset classes). For each mandate, we show the percentage of funds that generated a performance estimate greater than expected, as represented by the "Null of No-outperformance" line. We use the TM measure of performance as it controls for both market timing and security selection. The analysis is conducted separately for the three asset classes UK equities, UK bonds and international equities.

Figure 3: Distribution of Relative Fund-Size for Single- and Multiple-Managed Funds



Note: These figures present kernel density estimates of the distribution of size for single-managed funds, multiple-managed funds and funds that switch from a single manager to multiple managers in the following quarter. Size is measured as the log fund size relative to the average fund size across all funds in existence at a given point in time. The analysis is conducted separately for the three asset classes UK equities, UK bonds and international equities.