How Good are the Investment Options Provided by Defined Contribution Plan Sponsors?

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Abstract

We investigate the quality of the investment choices that sponsors of defined contribution plans offer to plan participants for their retirement portfolios. Using a unique database of over 30,000 plans, we calculate the performance of equity-oriented investment options that were included in plans compared to a sample of funds that were not. On average, plan options produce annualized risk-adjusted returns exceeding those of non-plan options by as much as 120 basis points, an outcome that is relatively insensitive to factor model specifications, time period, or investment style classification. This performance advantage is largely due to actively managed plan options and privately managed institutional funds do not appear to enjoy any incremental performance advantage relative to public mutual funds. We conclude that plan sponsors do appear to possess superior selection skills when designing the set of investment options offered to plan participants.

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1. Introduction and Summary

One of the more notable trends to emerge in the management of retirement assets over the past two decades is the rapid ascent of defined contribution plans as a primary vehicle by which retirement portfolio savings are accumulated. For example, the Investment Company Institute reports that between 1994 and the second quarter of 2011, the assets invested 401(k), 403(b), and 457 plans—the three leading types of defined contribution plans—in the United States rose from $1.4 trillion to $4.7 trillion, outpacing the percentage increase in the assets managed by the entire U.S. retirement market (i.e., $5.9 to $18.2 trillion). By contrast, assets under management in private defined benefit plans over this period only increased from $1.3 to $2.5 trillion, a far more modest rate of expansion. In fact, by 2011, defined contribution plans were matched in importance only by government pension plans ($4.5 trillion) and individual retirement accounts ($4.9 trillion) as a source of retirement funds.

Given their popularity as a retirement savings alternative, it is not surprising that defined contribution plans have begun to receive considerable scrutiny from researchers. To date, the vast majority of this literature appears to be concerned with the way that plan participants choose the funds in which they invest as well as with the subsequent investment performance of those funds. Several stylized facts summarize these findings, which have concentrated on 401(k) plans. First, investors are typically either under- or over-allocated toward equity in their asset allocation decision and tend to trade or rebalance their portfolios on an infrequent basis (Agnew, Balduzzi, and Sunden (2003)). Second, when offered the choice, 401(k) participants also tend to invest too heavily in the stock of the company sponsoring the plan, which Huberman (2001) calls the "familiarity breeds investment" effect. Finally, Huberman and Jiang (2006) document that plan participants tend to allocate their contributions evenly across the funds they select—the so-called "1/N" strategy—a portfolio formation decision that can be justified on a both an

analytical (DeMiguel, Garlappi, and Uppal (2007)) and behavioral (Benartzi and Thaler (2001)) basis.[1]

On the other hand, far less is known about the motivations and decision-making abilities of the institutions that sponsor defined contribution plans. This is somewhat puzzling given Elton, Gruber, and Blake's (2006) observation that the portfolio choices made by participants in these plans are themselves a function of the fund choices offered by the plan sponsors. Thus, if the options made available to participants are either insufficient or lacking in some other way, it may be impossible for them to allocate their assets in an optimal manner. Indeed, in their study focusing on the 401(k) market, those authors concluded that just over half of the plans they examined offered an adequate set of mutual fund choices, which they defined as one capable of spanning the space delineated by eight asset- and style-class indexes.

Further, although the extant evidence is quite limited, it is not clear that the choices that 401(k) sponsors do offer to investors are superior to those that they do not. Elton, Gruber, and Blake (2007) looked at the risk-adjusted performance of the publicly traded mutual funds selected by a small sample (i.e., 43) of plan sponsors over the period from 1994 to 1999 and provided mixed evidence regarding how these plan options fared relative to a set of passively and actively managed alternatives. Specifically, they found that the funds offered to plan participants outperformed a randomly selected set of style-matched funds, but produced negative alphas relative to the passive benchmark portfolios.[2] By contrast, in a related study from the defined benefit plan literature, Goyal and Wahal (2008) demonstrated that the decisions made by plan sponsors when hiring or firing active portfolio managers did not subsequently lead to superior performance. Further, Cohen and Schmidt (2009) have suggested that mutual fund companies appear to overweight the stock of plan sponsor companies in their family of portfolios in order to attract potential defined contribution business, a policy that could erode the overall performance to their non-plan investors.

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[1] Other examples of this literature include Madrian and Shea (2001), Poterba (2003), Choi, Laibson, Madrian, and Metrick (2006), and Huberman, Iyengar, and Jiang (2007). See also Brown, Liang and Weisbenner (2006, 2007).

[2] Elton, Gruber, and Blake (2007) also documented that plan funds outperformed non-plan, non-index funds by roughly the amount of the fee differential (1.9 basis points) that existed between the two samples. This raises the possibility that the "skill" that plan sponsors possess simply amounts to selecting lower-cost funds.

Although the preceding findings are suggestive, they offer an incomplete picture of the design and investment performance of the menu of investment choices offered to participants in a defined contribution plan. In particular, a substantial amount of assets in these plans are *not* invested in publicly traded mutual funds. For instance, the Investment Company Institute (2011) reported that in 2010 only 56.0% of plan assets were held in mutual funds, with the majority of what remained invested in privately managed institutional portfolios or the sponsoring company's own stock. As a consequence, it is difficult to judge the quality of the retirement portfolio choices the sponsors provide to participants without examining the performance of these privately managed alternatives. Additionally, given the legal mandate that sponsors face to provide a diversified collection of alternatives to participants in the plans, it is likely that both the selection and composition of the active and passive management options differs from that found in a less restrictive environment.[3] In fact, the additional explicit and implicit constraints faced by sponsors with regard to the choices they offer represent a contracting challenge that can potentially have a material impact on investment performance, along the lines of Almazan, Brown, Carlson, and Chapman (2004).

In this paper, we extend the literature on the role played by the plan sponsor in the investment performance of a defined contribution plan in a number of ways. Our investigation is based on a unique dataset maintained by the largest plan administrator in the industry and consists of the investment options offered by more than 27,000 sponsors of over 30,000 plans during the period from January 2000 to June 2007. These investment options are delineated along several lines (e.g., equity investment style, passive vs. active management, private vs. public fund) that permit a number of new questions to be addressed. To facilitate this analysis, we also develop a sample of otherwise comparable investment vehicles that sponsors chose *not* to select as plan options. The investment returns generated by these non-plan options serve as an indirect assessment of the *opportunity cost* of the sponsors' selection skills inasmuch as they proxy for the next-best collection of investment choices that could have been offered to plan participants. Thus, in addition to examining the overall level of plan performance relative to expectations, this methodological design also allows us to assess the ability of

[3] Many of the legal restrictions imposed on the plan sponsor in its role as a fiduciary are discussed in more detail in the next section.

plan sponsors to create a superior menu of plan options from which the participants' retirement portfolio decisions are made.

Focusing on the equity-oriented funds that were either included or not included in a defined contribution plan, we develop and test four different hypotheses regarding the selection skills of plan sponsors. First, we posit that the investment options that sponsors offer to plan participants produce superior risk-adjusted returns relative to those options that are not selected for the plan. Second, we consider the possibility that it is the set of actively managed (i.e., non-index fund) options that determine any measurable performance differential between plan and non-plan options. Third, as a complement to the previous conjecture, we argue that passively managed plan options may outperform passively managed non-plan options. Finally, within the set of actively managed plan options, we examine whether funds managed in private accounts outperform public mutual funds on a risk-adjusted basis, perhaps due to differences in the operating costs and investment restrictions faced by private and public managers.

To control for the possibility of model and time period misspecification, we calculate risk-adjusted performance statistics (i.e., alphas) for our plan and non-plan investment option samples using three different variations of a multi-factor risk model and over three different sub-periods of the entire 90-month sample period. Our findings, which remain invariant to the myriad modeling adjustments, indicate that, on average, plan options significantly outperform non-plan options after controlling for risk and expenses. The mean alpha differential over the entire sample period was about 10 basis points per month, which compounds to more than 120 basis points per annum, net of fees. Based on substantial analysis designed to test the robustness of this result with respect to how alphas are measured and aggregated both within an annual cross section as well as over time, we find that the outcome holds, to slightly different degrees, across all equity style classes and sub-intervals of the overall sample period.

Further, we demonstrate that the set of actively managed investment funds is almost exclusively responsible for this performance differential; the difference in active plan and non-plan alphas was especially strong (i.e., about 20 basis points per month) during the weak equity market of 2000-2002. On the other hand, non-plan index funds produce slightly larger alphas than passively managed plan funds, particularly in the earliest sample sub-period. Finally, among the collection of actively managed products offered

within the plan sample, there appears to be little difference in risk-adjusted performance between privately and publicly managed options when the funds are pooled on an equally weighted basis. However, when these alpha measures are calculated on a participant- or plan asset-weighted basis, the preponderance of the evidence points to a slight tendency for public mutual funds to produce superior returns relative to private institutional accounts. This is a surprising outcome given the a priori advantages that private account managers appear to enjoy in terms of lower expenses and more predictable cash flows. Overall, on the basis of the strength and consistency of these findings, we conclude that the sponsors of defined contribution plans possess legitimate selections skills that allow them to discriminate between potential portfolio options in a meaningful way.

The remainder of the paper is organized as follows. In the next section, we discuss how a typical defined contribution plan is organized in terms of the number of investment alternatives offered to participants and provide descriptive statistics on how the industry has evolved in recent years. In Section 3, we describe the data we use in the empirical analysis, while in the fourth and fifth sections we develop and test the hypotheses regarding plan sponsor behavior. Section 6 provides a more detailed analysis of the cross-sectional differences in the actively managed portion of the plan option sample and Section 7 concludes the study.

2. Defined Contribution Plan Organization and the Plan Sponsor's Decision

As provided for by the United States Congress in the Employee Retirement Income Security Act (ERISA) of 1974 and subsequent amendments (e.g., the Tax Reform Act of 1978, Pension Protection Act of 2006), defined contribution retirement plans represent multi-faceted arrangements between at least four economic agents: the plan participant, the plan sponsor, the plan administrator/service provider, and the plan investment managers. In a typical plan, a portion of an employee's (i.e., the plan participant) salary is deducted on a pre-tax basis by the employer (i.e., the plan sponsor) and earmarked for investment in the plan portfolio. Depending on the specific nature of the plan, these deductions are usually made on a voluntary basis by the participant and may be matched by additional contributions from the sponsor. These funds are then turned over to a third-party (i.e., the plan administrator/service provider), who provides an array of services to both the participant and the sponsor. The most important of these services are (i) the

investment of the earmarked funds in a pre-selected set of alternative investment vehicles (i.e., the plan investment managers), (ii) the administration (e.g., record-keeping, statement creation, check processing) of the plan for the sponsor on behalf of the participant, and (iii) assisting the sponsor in providing financial information and investment guidance to the participant.[4] Figure 1 illustrates the nature of the various relationships linking the agents involved in a retirement plan.

A critical aspect of this network of relationships is that the plan participant is ultimately responsible for deciding how the plan assets are to be invested among the available investment alternatives. In fact, shifting the risk of the portfolio investment outcome to the participant is perhaps the main reason why the defined contribution form of retirement investing has become popular among plan sponsors. Still, as the party responsible for selecting the menu of investment options available to plan participants, the plan sponsor is a fiduciary under the plan.[5] In order to limit the plan sponsor's fiduciary responsibility to just this selection of investment options—and not to the participant's ultimate investment among them—ERISA Section 404(c), as interpreted by regulations issued by the Department of Labor, generally requires the sponsor to diversify the set of plan choices by offering "…a participant or beneficiary an opportunity to choose, from a broad range of investment alternatives, the manner in which some or all of the assets in his account are invested (p. 490)." Over time, this requirement has come to be interpreted as an obligation to provide at least three investment choices that are (i) diversified and have materially different risk-return characteristics, and (ii) allow the participant to create an appropriate range of risk-return outcomes when used in combination with one another to form a retirement savings portfolio. In practice, this

[4] The preceding description is an abbreviated overview of an extremely complex subject and is merely intended to focus the discussion on the specific issue at hand. For a more complete treatment of the organizational design of a defined contribution retirement plan, see Baker, Logue, and Rader (2005).

[5] Formally, a fiduciary in this context is any entity that has control over the management of an employee benefit plan or its assets. This definition is broad enough to include the plan sponsor. In fact, it is so broad that, but for the exception provided by Section 404(c) of ERISA, the plan sponsor would even be responsible for the ultimate investment decisions of the plan participants (i.e., choosing one investment option over another available one). It is therefore critical that plan sponsors comply with Section 404(c) and, even if they do, they still have fiduciary responsibility for selecting the menu of available plan options. Further, under ERISA, all actions taken by a fiduciary must be for the exclusive benefit of plan participants and beneficiaries and fiduciaries must exercise the care, skill, and diligence that would be used by a reasonably prudent person familiar with such matters. See McGill, Brown, Haley, and Schieber (2005) for a more detailed discussion of both the responsibilities of fiduciaries and the rights of participants in the pension plan market.

interpretation suggests that equities, fixed-income, and cash equivalents be the three asset classes included in the minimum set of alternatives.

Designing a defined contribution plan that simultaneously satisfies the fiduciary obligations of the sponsor while meeting the needs of the participants and controlling expenses is obviously a challenging task. For this reason, sponsors quite frequently engage an outside administrator/service provider to assist with this process, along with consultants that have no direct control over the management or administration of the assets. Drawn from a wide spectrum of the investment management industry (e.g., Fidelity Employer Services Company, Vanguard, TIAA-CREF, AIG-Valic, Charles Schwab, ING, Nationwide Financial, T. Rowe Price Group), these service providers are typically better equipped to assist the sponsor in creating a menu of investment alternatives that will address the range of financial situations faced by participants in the plan. Depending on the scope of the service provider's operations, the portfolios defining these investment choices can be managed by the internal staff of an affiliated division, by external managers and sub-advisors, or by some combination of the two. While the gamut of design features that fall within the plan administrator's influence is subject to negotiation with the sponsor, it often includes the number of plan investment choices, the asset classes covered by the choices, the specific investment vehicles representing the designated asset classes, and whether those investment vehicles are available from public (i.e., mutual fund) or private account managers. Thus, one of the principal criteria a plan sponsor will use to judge the performance of a service provider is the investment performance of any plan investment options that are managed by the service provider or its affiliates.[6]

A recent survey of plan sponsors and service providers conducted by *Plansponsor* magazine reveals several interesting aspects of the organizational structure of the defined contribution industry.[7] For the 5,973 defined contribution plan sponsors surveyed, roughly two-thirds of the plans (64.0%) had fewer than 500 participants and, on average, 73.8% of the eligible employees choose to participate. The plans also tended to be small

[6] As the portfolio distortion findings of Cohen and Schmidt (2009) indicate, the nature of the relationship between the plan sponsor and service provider can create potential conflicts of interest. In this regard, Davis and Kim (2007) also document that mutual fund companies that derive a large portion of their income as plan administrators are more likely to vote with management in proxy contests.

[7] The results of the survey were published in the November 2008 issue of the magazine and are available on their public website at www.plansponsor.com. The Investment Company Institute (2011) also provides a useful analysis of the economic motivations and statistical trends in this industry.

in scale; 71.8% of them had fewer than $50 million in total assets under management. Further, the mean (median) number of investment options offered by the plans was 18.8 (16.0), but the mean (median) number of options held by participants was just 5.2 (4.2). Interestingly, only 9.5% of the plans offered the sponsor's company stock as an investment option, while the most popular option was in the "target date fund" category (39.9%). Finally, when asked to rank on a 1-7 scale the importance of various factors associated with the performance of a service provider, plan sponsors indicated the strongest preferences for service and investment performance factors (Quality of Service to Participants: 6.65; Quality of Service to Sponsor: 6.50; Investment Performance: 6.38), milder preferences for choice and fee factors (Variety of Investment Options: 6.17; Reasonableness of Fees: 6.16), and relatively low preferences for reputation and recognition factors (Reputation of Service Provider: 5.76; and Recognizable "Brand Name" Fund Options: 5.36).

3. Data Description

3.1 Plan Administrator Data Sample

The primary source of the information used in this study comes from the proprietary database of defined contribution plans maintained by Fidelity Employer Services Company LLC, the largest work-place pension plan administrator and service provider in the world.[8] The data consist of the relevant characteristics describing all of the defined contribution plans for which the company served as record-keeper for the period from January 2000 to June 2007. In particular, for each plan we obtained the following records at various points during the overall sample period: (i) the number of participants involved, (ii) the total assets under management, (iii) the total number, identities, and investment attributes (e.g., public vs. private fund, equity vs. fixed-income) of the investment options held by participants, and (iv) monthly net-of-fee returns to all of the available investment options.

Table 1 summarizes several of the salient characteristics of this defined contribution plan sample. In Panel A, we list year-end statistics regarding the number of sponsors, plans, participants, and assets under management in the sample, as well as the

[8] Fidelity Employers Services Company operates as a subsidiary of Fidelity Investments Institutional Services Company Inc. In its role as a provider of retirement, benefits and human resources services, it is completely separate and distinct from Fidelity Management & Research Company, the investment management and advisory subsidiary of Fidelity Investments.

distribution of available plan options offered by the sponsors. By any measure, the collection is a large one, comprising over 27,000 plan sponsors, over 30,000 plans, 12.5 million participants, and total assets of almost $900 billion.[9] Further, the size of the plans in terms of both the average number of participants per plan and the average assets under management per plan increased over the sample period, allowing for the equity market downturn that ended in 2002. Of more importance for the present analysis, however, is the fact that sponsors appear to offer plan participants a sizeable number of investment options. Across the entire sample, there were 635,215 total options (i.e., the sum of the number of investment alternatives across all plans) offered by the last reporting date, which corresponds to an average of 23.22 options per plan. Notice also that the mean number of options per plan increased steadily during the sample period from a starting point of fewer than 15 products.[10] Finally, the reported ranges of the minimum (one) and maximum (696) number of investment options that were actually held by participants within a plan suggest that there is a considerable degree of heterogeneity within the sample.[11]

Panel B of Table 1 provides a more detailed breakdown on the nature of the plan options that sponsors offer. Percentage allocation statistics are listed for three main divisions of the plan option sample according to (i) asset classes, (ii) whether the plan option was managed privately in an institutional account or in a public mutual fund, and

[9] Due to corporate restructuring events such as mergers or acquisitions, some plan sponsors in the sample are affiliated with multiple retirement plans (e.g., Verizon is affiliated with several different plans as a result of the company's merger activity).

[10] It is not universally accepted that more is better than fewer when it comes to the number of investment alternatives included in a retirement plan. Cronqvist and Thaler (2004) suggest that having to select among a large number of options can make an already complex portfolio choice problem unduly complicated for many unsophisticated participants. The "libertarian paternalism" approach to plan design promoted by Thaler and Sunstein (2008, Ch. 7 and 9) would recommend that sponsors offer such investors a pre-packaged set of diversified funds as a default condition; see also Thaler and Sunstein (2003).

[11] At this point, it is worth recalling that the plan administrator performs a separate and very different function than the plan investment managers, who may or may not have any direct affiliation with the service provider's parent organization. Thus, although the reported data are provided by a single service provider (i.e., Fidelity Employer Services Company), they represent the combined efforts of scores of different money management institutions. In fact, portfolio managers *not* employed by Fidelity Management & Research Company control 74.04% of all the plan options contained in the sample—both public funds and private accounts—a figure consistent with that organization's market share in the money management industry as a whole. Nevertheless, to insure that no implicit conflict of interests exist in our sample, we have replicated the entire empirical analysis described below with the subset of plan options created by *removing* all funds associated with Fidelity Investments. This adjustment had no material impact on the findings or conclusions; these supplementary results are available upon request.

(iii) whether the plan option followed a passive or active investment mandate.[12] Further, these allocation percentages are tabulated by (i) the number of plan options available, (ii) the percentage of plan participants selecting that option type, and (iii) the percentage of total plan assets held in that option type. For instance, 58.93% of plan options in the sample are U.S. Domestic equity funds, which represented 65.82% of the investment positions held by the average plan participant and 65.19% of the total assets invested across the plan sample. There are three things of particular note about these statistics. First, U.S. Domestic equity represents the dominant asset class, easily exceeding the combined allocations to the other alternatives. Second, while there is a significant representation of both privately and publicly managed funds in the plan option sample, the latter appear to represent the largest portion of the available investment choices by a ratio of about two to one (e.g., 57.17% to 27.84%). Finally, the vast majority of plan assets offered and invested in fall within the active management classification, but a larger proportion of privately managed funds are passively invested.

3.2 Defining the Plan Investment Option Sample

For the purpose of analyzing the comparative performance of plan and non-plan investment options, the most vital pieces of information contained in our data base are the identity of the fund choices offered to plan participants, as well as the performance of those options over time. While we have monthly returns for all funds, the composition of each plan was available less frequently. Specifically, given the constraints imposed by size and complexity of the data involved, we were able to obtain this information on four distinct occasions: namely, at the beginning of January 2000; July 2002; January 2005; and July 2007. This pattern of observations leads naturally to dividing the full 90-month sample period (i.e., January 2000-June 2007) into three non-overlapping 30-month sub-periods: (i) January 2000-June 2002, (ii) July 2002-December 2004, and (iii) January 2005-June 2007.

[12] More formally, an institutionally managed (i.e., private) account is defined as any plan option that is not available to retail investors in the form of a public mutual fund or closed-end fund. While investment managers can provide both private and public versions of the same portfolio strategy, the management of these options may differ in material ways, such as portfolio turnover and rebalancing policies. However, the institutionally managed account will typically have lower fees due to the economies of scale related to a larger investment position and relationship with the plan sponsor in a single account rather than in large numbers of retail accounts. In addition, it is seldom the case that a plan sponsor will include as options in the same plan the public and private version of the same portfolio for a given manager.

The descriptive information summarized in Table 1 showed that the defined contribution pension industry grew substantially during the overall sample period. Of course, with this growth the nature and quality of the options offered to plan participants may have changed as well. Accordingly, we created three distinct plan option samples to coincide with each of the 30-month sub-periods. Notice that for any of the sub-periods, we are able to identify which plan options were available both at the beginning and at the end of the investment horizon (e.g., for the January 2000-June 2002 period, we know the funds offered to plan participants on January 1, 2000 and June 30, 2002). Thus, it is possible to establish each plan option sub-sample using either the beginning-of-period or end-of-period collection of funds.

Each approach has advantages and disadvantages. The end-of-period method allows for an evaluation of funds that sponsors may have added as investable options during the interval, but also ignores the possibility that poor performing funds available from the outset were dropped prior to the ending date. Unfortunately, this creates a potential look-ahead bias in two ways: (i) funds added to a plan option roster after a period of superior performance will not be included in the non-plan sample; and (ii) funds initially available to plan participants but then removed after a period of inferior performance will not be included in the plan option sample. Alternatively, defining the plan option sample based on the beginning-of-period approach avoids the look-ahead bias problem, but potentially misstates the selection skills of sponsors by ignoring the additions and deletions they make during the interval.

In the empirical analysis described below, we calculate performance metrics for plan option samples defined using both approaches, a procedure that allows for an explicit evaluation of the extent to which a look-ahead bias problem exists. However, to be the most conservative in our judgments about plan sponsor selection skills, we adopt the beginning-of-period definition as our primary method for forming the plan option sample. Thus, unless otherwise noted, throughout the remainder of the paper we report findings based on this approach.

3.3 Defining the Non-Plan Investment Option Sample

In order to compare the quality of the plan option decisions made by our sponsor sample, we also constructed a collection of non-plan options. That is, at the beginning of each sub-period (i.e., January 2000, July 2002 and January 2005), we constructed a

representative set of investment alternatives that sponsors *could have* included in their plans, but *chose not to*. Since we did not have access to information concerning all of the private management options that sponsors may have considered before rejecting them, our non-plan option sample consists exclusively of publicly available mutual funds that were not included in any of the defined contribution plans for which Fidelity Employer Services Company served as a fiduciary during the sample period. Further, to help manage the scope of the analysis, we only considered mutual funds with a U.S. equity-oriented objective.

To accomplish these objectives, on each selection date, we screened the entire mutual fund database maintained by Morningstar, Inc., an independent provider of investment research services, for all U.S. domestic equity funds that were available for purchase by retail customers. To insure that each potential non-plan fund truly followed an equity investment mandate, we imposed the additional inclusion criteria that it produced a coefficient of determination of at least 75% when its returns were evaluated by a multi-risk factor model. (The various forms of this return-generating model are described in the next section.) We then isolated those funds that did not also show up on the list of plan options available in the sponsor sample. Only those funds that did not appear on the beginning-of-period plan option list for a given performance measurement horizon were included in the final non-plan option sample.[13,14] Morningstar also provided monthly net-of-fee returns for these funds, along with various other data concerning the funds' relevant characteristics (e.g., investment objective, style class).

4. The Quality of Plan Option Selections: Testable Hypotheses and Methodology

4.1 Testable Hypotheses

The underlying motivation for this study is to investigate formally the quality of the investment options that sponsors offer to participants in defined contribution plans.

[13] It is entirely possible that some of the funds included in our non-plan option sample were available choices in other defined contribution plans for which Fidelity Employer Services Company was not the record-keeper. However, this possibility does not conflict with the fact these funds were *not selected* as options by the sponsors that we actually investigate. Consequently, there is no overlap between the investment options we placed in our plan and non-plan samples.

[14] When the plan option sample is alternatively defined by the end-of-period approach, the non-plan option sample consists of those publicly available mutual funds in the Morningstar database that did not show up as a plan choice *at any point* during the sub-period in question. Again, this procedure creates a possible look-ahead bias by not allowing funds that were either added or removed as plan options during the sub-period to enter the non-plan option sample.

Specifically, we propose to analyze whether the choices that sponsors do select are superior to those that they do not. The literature provides some evidence on both sides of the question of whether fiduciaries in this broadly defined institutional environment do possess meaningful manager selection skills. On one hand, Parwada and Faff (2005) studied investment management mandates in the defined benefit pension market and found that those mandates were substantially more likely to be awarded to managers exhibiting superior past performance relative to their peers. Thus, given the tendency for asset manager performance to persist in the mutual fund industry (e.g., Grinblatt and Titman (1992), Brown and Goetzmann (1995)), it is reasonable to expect that the options provided to plan participants might represent a superior set of investment choices. On the other hand, Goyal and Wahal (2008) showed that defined benefit plan sponsors who follow a "return chasing" strategy of hiring (terminating) investment managers following periods of abnormally good (poor) performance do not deliver superior excess returns subsequently. Additionally, Carhart (1997) showed that apparent persistence in mutual fund performance is likely to be an artifact of a misspecified model of return expectations. What is unclear, however, is which side of this argument best describes the nature of the defined contribution pension industry. Accordingly, the debate frames the following testable hypothesis:

Hypothesis 1: The investment options that defined contribution plan sponsors offer to participants produce superior risk-adjusted returns relative to otherwise comparable options that are not selected for the plan.

As described in the previous section, defined contribution plan sponsors offer participants options that are managed on both a passive (i.e., indexed) and active basis. While the we do not address the "passive vs. active" management debate directly—see, for instance, Bogle (1998)—it is relevant to consider whether the actively managed options offered in a plan have superior investment characteristics relative to those active funds the sponsor did not select. Since there is substantial evidence that active fund managers exhibit genuine proficiency in security selection (e.g., Chen, Jegadeesh, and Wermers (2000), Baker, Litov, Wachter, and Wurgler (2010)), the question becomes whether plan sponsors are able to identify and select those skillful managers (and avoid those that are not) when creating the menu of plan options. Similarly, although both the

nature of the investment problem and the tighter fee structures make it less likely that indexed products will exhibit significant differences from one another (e.g., Guedj and Huang (2009)), it is still interesting to consider whether passively managed plan options outperform comparable non-plan ones. Thus, two additional hypotheses that we test are:

Hypothesis 2: The *actively managed* investment options that plan sponsors offer to participants produce superior risk-adjusted returns relative to otherwise comparable actively managed options that are not selected for the plan.

Hypothesis 3: The *passively managed* investment options that plan sponsors offer to participants produce superior risk-adjusted returns relative to otherwise comparable passively managed options that are not selected for the plan.

Finally, the statistics presented in Table 1 also indicated that a number of the options that plan sponsors offer are managed in private investment vehicles as opposed to publicly available funds. Although there is limited extant evidence on the topic, studies such as Coggin, Fabozzi, and Rahman (1993) and Christopherson, Ferson, and Glassman (1998) provide mixed findings on whether private defined benefit pension managers are able to produce superior investment performance. Nevertheless, there are several a priori reasons to expect that there might be differences in the returns generate by private managers and public funds operating in otherwise identical investment environments. In particular, the Pension and Welfare Benefits Administration (1998) notes that private managers typically charge measurably lower fees (e.g., a difference of 50 basis points per annum), owing largely to the lower account servicing expenses they incur by managing the assets of a single client rather the voluminous number of commingled accounts that describe the typical public mutual fund. Further, it is also likely that managers of privately negotiated accounts will have more predictable fund inflows from participant salary contributions, which in turn could lead to lower liquidity costs (i.e., "cash drag") in the on-going management of the invested capital. Finally, it is possible that private managers face a markedly different set of investment restrictions than those imposed on managers in the public fund market and that these differences could affect investment performance (e.g., Almazan, Brown, Carlson, and Chapman (2004)). The net effect of these discrepancies leads to the following prediction:

Hypothesis 4: The privately managed investment options that plan sponsors offer to participants produce superior risk-adjusted returns relative to otherwise comparable publicly managed options.

4.2 Measuring Abnormal Investment Performance

To compare the relative investment performance for our samples of plan and non-plan options, we estimate several versions of the following four-factor risk model adapted from Fama and French (1993) and Carhart (1997):

$$(R_{jt}\text{-}RF_t) = \alpha_j + b_{j1}(R_{mt}\text{-}RF_t) + b_{j2}SMB_t + b_{j3}HML_t + b_{j4}MOM_t + \varepsilon_{jt} \quad (1)$$

where, for each month t, $(R_{jt}\text{-}RF_t)$ and $(R_{mt}\text{-}RF_t)$ are the excess returns to the j-th investment option and the market portfolio, respectively; SMB is the difference in returns between portfolios of small and large capitalization firms; HML is the difference in returns between portfolios of stocks with the highest and lowest book-to-market ratios; and MOM is the difference between the returns to portfolios of stocks with the largest and smallest returns during the previous 11 months (see Jegadeesh and Titman (1993) for the motivation for including price momentum effects).[15] Specifically, within a given time horizon, we estimate three different α (i.e., alpha) coefficients for each plan and non-plan investment alternative using: (i) a one-factor version of equation (1) with $(R_{mt}\text{-}RF_t)$ as the independent variable; (ii) a three-factor version with $(R_{mt}\text{-}RF_t)$, SMB, and HML; and (iii) the full four-factor version. Consistent with our sample formation process, we calculated risk-adjusted performance statistics over the January 2000-June 2002, July 2002-December 2004, and January 2005-June 2007 sub-periods. The first of these intervals is particularly notable in that it almost exactly coincides with the timing of a significant downturn in global equity markets. We also examine behavior over the complete January 2000-June 2007 period by combining the respective risk-adjusted performance measures from the three sub-periods into a single comprehensive sample.

Finally, we imposed two additional conditions on the empirical analysis. First, given the nature of the risk model and the non-plan option sample we employ, we only

[15] The factor return data required for the estimation of equation (1) were obtained from Ken French and Eugene Fama via the website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. This website also contains a more detailed description of how the R_m, SMB, HML, and MOM variables were constructed.

calculated alphas for those plan options that followed a U.S. domestic equity mandate. Thus, we do not address in the study the quality of the fixed-income or cash-equivalent options that plan sponsors chose. Second, in order to generate equivalent sample sizes for each of the three forms of the risk factor model used to calculate alphas, the R^2 inclusion rule described earlier for building the non-plan option comparison sample was based on the three-factor version only.[16]

5. The Quality of Plan Option Selections: Empirical Results

5.1 Full Sample Results

In assessing the quality of the plan options that sponsors offer to their defined contribution plan participants, there are two questions that need to be addressed. First, does the total set of potential plan options from which sponsors make their ultimate menu selections produce returns that meet or exceed expectations? Second, do the funds that sponsors actually include in their plans outperform funds that were not selected? While answering the second question is the primary focus of this investigation, it is also useful to consider whether plan participants are being well served on an absolute basis as well as a relative one, allowing for plan fees.

5.1.1 In-Sample Alpha Difference Tests

The first two panels of Table 2 list three different investment performance summary statistics for various parts of the full sample of potential equity-oriented plan options: (i) the mean alpha, (ii) the median alpha, and (iii) the percentage of positive alphas within the respective sample stratification. Alphas are tabulated separately for each form of the factor model discussed above and differences in the performance statistics between plan and non-plan options, as well as p-values indicating the statistical significance of those differentials, are also reported.[17] (Notice in this display that we refer to these performance statistics as "in-sample" alphas, which highlights the fact they are measured over the same time period used to estimate the risk parameters themselves; the distinction

[16] We have also produced a full set of the findings discussed in the next section using the three different non-plan option samples that result from applying the "$R^2 \geq 0.75$" inclusion rule independently to each of the three versions of equation (1). Although this procedure generated slightly different non-plan sample sizes, it had no appreciable impact on the reported outcomes; these findings are available upon request.

[17] The mean alpha differential test was conducted as a standard difference-in-means t-test, adjusting for the unequal sizes of the plan and non-plan sub-samples. The median alpha differential tests were conducted using the Mann-Whitney procedure. The (% Pos.) differential test was conducted as a chi-squared test on the difference in proportions in two samples.

between *in-sample* and *out-of-sample* performance measures will be clear in the next section.) Panel A analyzes sponsor selection skill over the full 90-month sample period while Panel B provides a breakdown of performance during each 30-month sub-period.

The mean alpha statistics for the total sample of potential plan options shown in Panel A suggest that factor model selection does appear to matter. In particular, there is a sizeable gap between the average monthly alphas generated by the one-factor market model (i.e., -2.75 basis points) and the three- and four-factors versions of the Fama-French model (i.e., -11.32 and -10.91 basis points, respectively). Comparable gaps exist for the other two alpha summary statistics, suggesting that the one-factor risk model may be setting return expectations too low relative to the true level of risk that exists within the set of equity funds from which plan sponsors could choose. Regardless of the model specification, however, both the mean and median alpha statistics are negative and that the proportion of potential plans producing a positive alpha never exceeds 40%. This implies that the overall set of potential plan options generated returns that fell short of expectations, but it is interesting to note that the level of annualized shortfall is within the range of the funds' expense ratios, which the Pension and Welfare Benefits Administration (1998) showed could range as high as 133 basis points per year for defined contribution plan options. Further, these findings are also consistent with the percentage of *all* retail mutual funds that are capable of producing positive alphas relative to a multi-factor risk model (see, for instance, Harlow and Brown (2006)).

Putting concerns about the quality of the potential investable universe aside, the more relevant issue involves examining the *difference* in the alphas generated by the set of alternatives that sponsors chose compared to those they did not. In this regard, the evidence in Panel A appears to be quite persuasive. For each factor model, plan sponsors consistently selected funds that produced, on average, the largest risk-adjusted returns. For example, using the three-factor model to describe return expectations, the mean monthly in-sample alpha for the set of actual plan options was 9.61 basis points higher than that for the non-plan sample, which translates into a compounded annual advantage of 1.22%. This outcome was confirmed by the other factor model variations—particularly the four-factor model that accounts for return momentum effects—and, to a modestly reduced extent, by the median alpha differential statistics. Additionally, the significant difference in the (% Pos.) measure (e.g., 44.36% vs. 34.78% for the three-factor model)

indicates that this mean alpha advantage is not being driven by a few outliers. Consequently, these data represent an initial indication that plan sponsors may possess selection skills that allow them to discriminate among the best set of available investment options when determining the menu of choices from which their participants will invest.

The sub-period breakdown shown in Panel B of Table 2 produces a similar picture. In all three 30-month intervals, the plan option sample outperforms the non-plan sample on a risk-adjusted basis irrespective of which metric is used. This performance advantage is particularly strong during the general equity market decline that occurred in the first sub-interval (i.e., January 2000-June 2002), which suggests that plan sponsors may be especially good at selecting funds that control downside risk on a relative basis. This notion is corroborated by the fact that more than three out five of the plan options during this period beat expectations (i.e., (% Pos.) coefficients ranging from 59.72% to 65.39%), whereas no more than about 50% of the non-plan funds were able to do the same. However, given that the mean and median alpha differentials were significantly positive in the other sub-periods, it also appears that sponsors were capable of selecting funds that outperformed in rising markets as well. Collectively, then, these findings provide considerable support for our first hypothesis.[18]

5.1.2 Alternative Aggregation & Out-of-Sample Alpha Tests

The preceding analysis strongly suggests the relative outperformance of the plan option sample, but it is possible that the experimental design influenced that outcome. In particular, there are two initial areas of possible concern. First, our method of aggregating alpha statistics across the entire sample period is but one of several techniques that could have been employed. Second, as noted, these risk-adjusted performance statistics were estimated simultaneously with the factor model on which

[18] Recall that, to avoid a look-ahead bias, a fund was only included in the plan option sample if it was available to participants from the beginning of the sample period. This inclusion procedure has the potential of understating the advantage of plan options over non-plan options if plan sponsors are skillful in adjusting the set of options offered during the investment horizon. To evaluate this possibility, we replicated the results of the entire study with an end-of-period inclusion criterion. This adjustment had a material effect on the sizes of the plan option and non-plan option samples, but did not change any of the findings at a qualitative level. For instance, with respect to the findings reported in Panel A of Table 2 for the overall sample period, the end-of-period plan option sample had 2,028 observations (compared to 1,488 using the beginning-of-period criterion). Further, the difference in the mean alpha reported for the one-, three- and four-factor models were 0.0684, 0.1058 and 0.1099, respectively, all of which are statistically significant and larger than their beginning-of-sample counterparts. Thus, while the skill level exhibited by plan sponsors is apparent even with the more conservative beginning-of-period specification, their true prowess in selecting plan options might be somewhat larger still.

they were based. To address these issues in a separate robustness test, we implemented an alternative methodological approach designed to produce out-of-sample estimates of abnormal performance and then aggregate the cross section of those statistics in a different manner. Specifically, we employed the following procedure, which can be viewed as a modified form of the Fama-MacBeth (1973) two-stage approach:

1. For each plan and non-plan option j, we estimated the set of factor loadings $\{b_{jkt}\}$ for various forms of equation (1) as of month t using the most recent 30 months of return data (e.g., in June 2002, model parameters were estimated using data from January 2000-June 2002);
2. These estimated loadings were used in conjunction with the actual factor returns in month t+1 to create an estimate for the expected return to the j-th option in month t+1 (i.e., $E(R_{jt+1})$);
3. The out-of-sample estimate of abnormal performance for option j in month t+1 was then calculated by differing that option's actual and expected returns, or $\hat{\alpha}_{jt+1} = R_{jt+1} - E(R_{jt+1})$;
4. The first three steps were repeated for each month between July 2002 (i.e., the first month for which $\hat{\alpha}_j$ can be estimated) and June 2007 by rolling the 30-month estimation window forward one month at a time. For each available plan and non-plan option, this procedure created as many as 60 separate monthly $\hat{\alpha}_j$ forecasts, depending on data availability;
5. For both the plan and non-plan option samples, separate month T forecasts of the aggregate abnormal performance—call them $\hat{\alpha}_{PT}$ and $\hat{\alpha}_{NPT}$—were created as equally weighted portfolios of the available options in each respective sample. The month T difference between the aggregated out-of-sample alpha forecasts in the plan and non-plan samples (i.e., $[\hat{\alpha}_{PT} - \hat{\alpha}_{NPT}]$) was computed for each of the 60 months between July 2002-June 2007; and
6. We then tested for the statistical significance of the mean, median, and proportion of positive values in the set of 60 monthly values for $[\hat{\alpha}_{PT} - \hat{\alpha}_{NPT}]$.[19]

[19] To minimize the impact of outliers in this relatively small set of observations, we Winsorized the data distribution at the 90% level (i.e., the bottom (top) three observations in the rank-ordered distribution were set equal to the fourth-from-bottom (-top) observation) before performing the mean value significance test.

Panel C of Table 2 summarizes the results, which are once again reported separately for the one-, three- and four-factor versions of the underlying risk model. In general, these aggregated findings corroborate the conclusion that the investment options chosen by plan sponsors produce superior net-of-expense, risk-adjusted returns. The overall mean of the 60 cross-sectional values of $[\hat{\alpha}_{PT} - \hat{\alpha}_{NPT}]$ ranged from 6.40 basis points per month (for the three-factor model) to 6.53 basis points (for the one-factor model), with all three average out-of-sample alpha differential estimates being highly statistically reliable. Additionally, the median values of these alpha differential distributions tell a similar, if somewhat attenuated, story in terms of both the directional effect and significance.

Perhaps an even more telling indication of the performance advantage enjoyed by the plan option sample over the non-plan option sample is the percentage of the 60 aggregated alpha differentials that were positive. Specifically, regardless of which form of equation (1) was used to forecast risk-adjusted performance, the portfolio of investment options chosen by plan sponsors produced a larger alpha value than the comparable non-plan alpha in roughly seven out of 10 cases. Further, the reported p-values indicate that each of these (% Pos.) alpha differential statistics exceeds its null hypothesis level of 50% by a reliable margin. Thus, the findings in Panel C make it unlikely that those in Panels A and B are a spurious artifact of how risk-adjusted performance was calculated or accumulated over time.

5.2 Factor-Matching Tests

While the difference tests in Table 2 summarize several aspects of how the typical plan and non-plan funds performed over the sample period, there may be other important cross-sectional differences in these samples that are "averaged out" by the empirical design. For instance, despite the fact that all of the plan and non-plan returns were risk-adjusted using the same multi-factor model, there is a chance that the two samples load differently on the various risk factors. If this is indeed the case, any imprecision in measuring either the factor betas for a particular investment option or the overall levels of the factors themselves could manifest as an unintended difference in the reported alphas.

To guard against this possibility, we performed two additional robustness tests comparing the performance of the plan and non-plan samples using a more precise method of matching investment options by their factor exposures. First, we sort all of the

plan options (1,488 observations) and non-plan options (9,048 observations) into risk factor "bins" and assess the relative performance of each subgroup. In the second test, we match each plan option with a specific non-plan "nearest neighbor" according the similarity of their respective factor exposures and then calculate the risk-adjusted return differentials of those matched pairs. Each of these robustness tests was conducted using the in-sample performance statistics described earlier.

5.2.1 Factor Bin Sorts

We placed every investment option in each sample division into one of 16 distinct factor-matched bins according to whether its beta exposures from the four-factor version of equation (1) fell above or below the median value for the entire sample. For example, an option included in a plan having an above-median (R_m-RF) beta, below-median SMB beta, below-median HML beta, and above-median MOM beta would be placed in the [High (R_m-RF), Low SMB, Low HML, High MOM] factor-matched bin within the plan option sample.[20] After filling each bin in this manner for both investment option types, we then calculated the bin-specific mean alpha, median alpha, and (% Pos. Alpha) performance statistics, as well as the differences in those respective values between the plan and non-plan samples. For the purpose of this sorting procedure, factor betas were measured over the entire 90-month sample period.

Panel A of Table 3 lists the frequencies and risk-adjusted performance differentials for each of the sixteen factor-match bins. Notice that the plan and non-plan options appear to sort in a roughly similar manner. This can be seen in the seventh column of the display, which reports the ratio of the number of plan options to the number of non-plan options that occur in a particular bin. Using the total sample ratio of 16.59% (i.e., 1,488 ÷ 9,048) as the expected frequency in each bin, the chi-square statistic testing for bin uniformity is 11.22, which has an associated p-value of only 0.7369. Still, the bin frequency range of 10.57% to 23.86% indicates some amount of dispersion in how the extreme observations in these samples are divided. For the four bins with the largest relative concentrations of plan options, three have low SMB exposures, three have low

[20] Due to correlation among the factor loadings, it is unlikely that this sorting procedure will ever produce bins of equal size in any given sample. That is, if low-SMB beta options in the non-plan sample also tend to have low MOM factor exposures, the [Low SMB, Low MOM] bins will be more heavily populated than the [High SMB, High MOM] bins. Thus, this sorting method controls for differences that may exist in the factor loading patterns of the plan and non-plan samples.

HML exposures, and three have high MOM exposures. However, the broad nature of the sorting routine we employ makes it impossible to infer if these strategic outcomes were an intentional part of the sponsors' selection process or merely a statistical consequence.

Whether using the mean or median, the alpha difference statistics show a remarkable degree of consistency across the 16 factor-matched bins. In fact, all but one of the bin-specific differentials for both performance measures are positive, and they are statistically significant at the 5% level in nine (mean alpha) and 13 (median alpha) cases, respectively. (The mean alpha differential in the [High, High, High, Low] bin is insignificantly negative.) Further, notice that the respective sample-wide weighted averages for these statistics match of exceed the 8.0 - 9.5 basis point values reported for their in-sample, equally weighted counterparts using the four-factor risk model in Table 2. Additionally, the next-to-last column of Table 3 shows that the plan option sample produced a higher percentage of positive alphas than the non-plan sample in 13 of the 16 bins. Taken together, these factor-matched findings once again provide strong confirmation regarding the investment superiority of the plan option sample and allow us to state more confidently that the selection skills demonstrated by plan sponsors are not confined to—or driven by—a limited number of factor-related investment strategies.

5.2.2 Matched-Pair Analysis

A different way of performing this factor-matching comparison is to pair each plan option with its single most comparable alternative in the non-plan sample, where these "nearest neighbors" are defined by the proximity of their respective risk exposures. An advantage of this refinement is that it offers a better measure of the potential opportunity cost imposed on the plan participant by the sponsor's selection process. That is, for a participant who has committed to investing a portion of his retirement portfolio assets into an equity fund with a given set of risk characteristics, the cost of the being limited to the options provided by the sponsor is the incremental return foregone by *not* being able to invest in the non-plan option with the most similar factor profile. Accordingly, our analysis focuses on the risk-adjusted return differentials produced across the entire matched pair sample.

To accomplish this, we matched all plan options in the sample with a specific non-plan option as follows. Starting with a randomly selected plan option, we searched the

non-plan option sample for the fund that minimized the sum of the absolute values of the differences in the factor loadings computed by equation (1). That is, the nearest neighbor was the non-plan option that satisfied:

$$\min \sum_{i=1}^{4} \left| (b_{i,plan} - b_{i,non\text{-}plan}) \right| . \qquad (2)$$

Repeating this process for all 1,488 plan options—which entailed approximately 13.5 million (i.e., 1,488 x 9,048) comparisons —yielded the final collection of factor-matched pairs.[21] For each pairing, a risk-adjusted return differential was then computed by subtracting the estimated in-sample alpha for the non-plan neighbor from its counterpart in the plan option sample.

Panel B of Table 3 reports several statistics associated with these matched-pair return differentials, including the mean value, the percentage of positive differences (i.e., $\alpha_{j.plan} > \alpha_{j,non\text{-}plan\ neighbor}$), and various values defining the frequency distribution. Separate findings are shown for the entire sample period as well as each of the three sub-periods. Overall, the findings once again confirm that the investment options selected by plan sponsors produced returns that were superior to those generated by otherwise comparable funds that were not chosen. Both the mean and median alpha differentials are positive in all of the various time horizons (e.g., 7.26 and 2.35 basis points per month, respectively, for the January 2000-June 2002 sub-period). While these reported alpha differential values are somewhat reduced relative to when the plan option sample was compared to the entire non-option sample, this more severe way of controlling for risk still produces statistically and economically significant levels of outperformance.

Further, the fact that the mean alpha differential exceeds the median value in each period implies that the matched-pair return distribution is positively skewed, suggesting that sponsors were able to include a disproportionate share of big "winners"—or avoid the inclusion of big "losers"—among their plan option menus. This skewness is also indicated by alpha differentials at each percentile break above the median exceeding (in absolute terms) their corresponding values below the median to differing degrees (e.g.,

[21] Two other details of this matching process are worth noting. First, the sequential selection of nearest neighbors from the non-plan option sample was done with replacement, which eliminated the possibility that the results could be influenced by where the selection procedure started in the plan option sample. Second, we also repeated the entire matching process using a variation of equation (2) that minimized the sum of the squared deviations in plan and non-plan factor loadings. This alternative procedure produced no material difference in the findings relative to those reported in Panel B of Table 3.

for the entire sample period, the respective observations at the 75th and 25th percentiles are 12.95 and -5.50 basis points, whereas the absolute gap between 33.52 and -23.64 basis points at the 90th and 10th percentiles is considerably wider). Finally, and perhaps most telling, more than three in five (e.g., 61.76% in the full sample period) of the plan options generated higher risk-adjusted returns than their factor-matched nearest neighbors in the non-plan sample. This is a strong indication that plan sponsors were consistently able to select plan options that "covered" their net-of-fee opportunity costs, as measured by the return produced by their matched pairs. The reported p-values in the last column of the display, which are calculated relative to an expected value of 50%, indicate that these comparisons are statistically meaningful across all three sub-periods as well in the overall time frame.

5.3 Active vs. Passive Management Results

To help establish the source of the apparent return differential enjoyed by plan funds, Table 4 refines the analysis of the preceding section by focusing on the set of *actively* managed funds maintained within the total investable option universe. As in Table 2, Panels A and B of this new exhibit examines in-sample risk-adjusted returns during the entire period and three sub-periods, respectively, while Panel C reports findings for the modified Fama-MacBeth aggregation procedure using out-of-sample alpha forecasts. Notice once again that the vast majority of the funds in both the total universe (10,368 of 10,536) and plan option (1,350 of 1,488) samples are indeed actively managed. Thus, it is not surprising that the differences in mean and median alphas generated by active plan and non-plan options are quite similar to those reported for the entire sample. Despite this fact, it does appear to be the case that those differentials are slightly larger in the active sample than for the corresponding measures in the overall sample. For instance, the mean three-factor monthly alpha differences for the active and total samples were 9.86 and 9.61 basis points, respectively. Further, the ability of plan sponsors to discriminate among funds able to beat return expectations appears to be greater as well; the difference in the (% Pos.) statistic between the plan and non-plan options using the three-factor model is 11.14% for active funds versus 9.58% for all funds. This pattern is reflected across all factor model variations, as well as in each of the shorter intervals included in the sub-period analysis shown in Panel B. Further, the out-of-sample alpha analysis in Panel C confirms the pattern of plan option superiority for the 60 monthly

cross sections. Thus, consistent with our second hypothesis, we conclude that the actively managed funds that sponsors select for their plans do outperform the set of non-plan options, after controlling for both risk and fees.

It is also possible that the passively managed investment alternatives offered to plan participants outperform those that sponsors considered but rejected. While quite mixed, the findings reported in Table 5 ultimately suggest that this is *not* likely to be true. However, considerable caution is warranted when drawing any definitive conclusions due to the substantially smaller sample sizes—particularly for the non-plan index fund sample—involved in the analysis. For the entire sample period (Panel A), the difference in mean in-sample alphas between plan and non-plan passively managed funds is actually negative for the three- and four-factor models (i.e., -3.42 and -3.11 basis points, respectively) although neither differential was meaningfully different from zero. The sub-period results listed in Panel B confirm the insignificance of these performance differentials over time. Further, index funds included as plan options were typically able to produce returns that meet or exceed expectations about 25% of the time. If nothing else, this underscores the effect that expenses have on investment products that follow a passive mandate. On the other hand, the out-of-sample alpha differential findings in Panel C vary greatly by factor model they do suggest a positive and meaningful separation in performance between plan and non-plan passive funds that favors the former when the multi-factor return-generating models are used.

The overall inference that can be drawn from the combined results listed in Table 4 and Table 5 is that sponsors do appear to be adept at selecting actively managed funds to offer to participants in their defined contribution plans, but that they show no consistently demonstrable skills when choosing among the set of available index fund alternatives. Accordingly, in addition to finding support for our second hypothesis, we also reject our third proposition that the passively managed plan funds produce better risk-adjusted returns than otherwise comparable non-plan index funds. This might not be an unexpected outcome: the potential value added to the plan participant in having sponsors spend their time analyzing active funds rather than passive ones is undoubtedly greater.[22] Based on this evidence, we can therefore narrow our earlier conclusion regarding the

[22] This view is also consistent with the model of the money management industry developed in Berk and Green (2004), who demonstrate the benefits that obtain to rational active portfolio managers who possess superior information gathering and assessment skills.

superior fund selection skills of the sponsors in our sample to include just those potential plan options that have an active management mandate.

6. The Plan Option Sample: Cross-Sectional Differences

Given the advantage in risk-adjusted performance documented for the subset of actively managed plan options, it is useful to consider some possible determinants of this result. One potentially important structural difference that exists within the plan option sample is that some of the funds are managed in private institutional accounts while others are run as public mutual funds. Other potential factors that might be associated with this performance differential include the total market value of participant assets invested in the option, the number of plans that offer a particular option, and the number of participants that hold a particular investment option in their portfolios.

6.1 Public vs. Privately Managed Plan Options

Hypothesis 4 stated that managers of privately held accounts would generate superior risk-adjusted returns relative to otherwise comparable public funds, due to the ex ante advantages they enjoy (e.g., lower expenses, more predictable cash inflows). To test this supposition formally, Table 6 reports statistics summarizing the alpha differentials between the privately and publicly managed funds constituting the set of actively managed plan options. For the sake of brevity, the display only lists findings for the entire sample period, but pools the risk-adjusted performance statistics in three different ways: (i) equally weighted abnormal returns, (ii) participant-weighted abnormal returns, and (iii) plan asset-weighted abnormal returns. As before, both in-sample alphas and out-of-sample aggregated alpha differentials are calculated for the public and private active plan option subsamples.[23]

Panel A shows the set of performance measures pooled on an equally weighted basis. This portfolio formation method implicitly assigns the same level of importance to each plan option regardless of the degree to which participants actually invest in it or the size of the plan in which it is included. The in-sample alpha results (Panel A.1) indicate little

[23] For the out-of-sample alpha differentials, the three ways of pooling risk-adjusted performance affected the way in which the monthly cross-sectional portfolios were formed (i.e., Step 5 of the modified Fama-MacBeth procedure in Section 5.1.2 was replicated using participant-weighted and asset-weighted portfolios in addition to equally weighted ones.)

difference in performance between actively managed private and public funds. In fact, the three- and four-factor versions of equation (1) lead to insignificant average performance differentials of approximately minus one basis point per month, with only modest differences in the (% Pos.) variable. Conversely, the one-factor model produces a slightly positive (although insignificant) performance advantage for the public funds over private managers. The out-of-sample aggregated alpha differential results (Panel A.2)—particularly the mean and (% Pos.) statistics—do indicate a slight positive performance increment generated by privately managed accounts. However, most of these alpha differentials remain statistically insignificant. Thus, the evidence in Panel A does not provide strong support for an investment advantage enjoyed by either management type and, as such, fails to support the final hypothesis we investigate regarding the superiority of privately managed accounts.

In fact, if the performance statistics are tabulated on the basis of how the typical plan participant actually allocates within the plan (Panel B) or how the total plan assets are allocated across the entire sample (Panel C), the preponderance of the evidence appears to be more consistent with the alternative story that mutual fund managers produce slightly better risk-adjusted returns than private managers. For example, when either multi-factor version of the risk model is employed to calculate in-sample alphas (Panels B.1 and C.1), the median performance differential in favor of mutual funds is about seven basis points per month. Further, more than half of the public managers produced positive alphas, while more than half of the private managers failed to do so (e.g., 58.64% positive alphas in mutual funds vs. 42.24% in institutional accounts using the three-factor model in the asset-weighted sample).

Additionally, both the mean and median out-of-sample alpha differentials (Panels B.2 and C.2) from the multi-factor versions of equation (1) are positive—with a single exception—although at far more modest and insignificant levels. Generally, slightly more than half of these performance differentials are positive (e.g., 56.67% of the participant-weighted out-of-sample differentials exceed zero, using the three- and four-factor models). Consequently, compared to the mixed evidence generated by the equally weighted sample, the participant- and asset-weighted findings suggest that plan participants are able to identify the better funds when deciding where they should actually invest their money. Thus, not only do the earlier results indicate that plan

sponsors exhibit positive manager selection skills when choosing their plan option menus, but it may also be the case the investors who use those menus to allocate their retirement savings exhibit positive selection skills of their own.

It is tempting on the basis of the findings in the bottom two panels of Table 6 to conclude that the typical manager of a public plan fund possesses somewhat elevated security skills relative to the typical private plan fund manager. However, while this might be true, there are at least two reasons that argue against that judgment. First, the statistical evidence is not especially strong; in fact, the alpha differentials from the one-factor model actually contradict that conclusion.[24] Further, even if these performance statistics capture legitimate return differentials, it is possible that they merely reflect disparities in the operating conditions or investment restrictions imposed on public and private accounts, rather than disparate levels of investment prowess. Although our data do not permit us to differentiate between those possibilities directly, it is nonetheless true that defined contribution plan participants do not appear to be incrementally benefited by their selection of private fund managers, in contrast to the prediction of Hypothesis 4.

6.2 Other Potential Cross-Sectional Influences

In addition to dissimilarities in the way their assets are managed, the performance differentials established for the collection of active plan options might also be associated with differences in the way plans are organized. Three specific factors that define the defined contribution universe in our sample are (i) the total market value of participant holdings in a particular option across all plans (MKTVAL), (ii) the number of distinct plans offering a particular option to their participants (PLANFRQ), and (iii) the number of participants across all plans who select a particular option (PARTFRQ). Given the previous findings, it is conceivable that, as a group, sponsors are good at selecting fund managers who are able to produce larger risk-adjusted returns. If so, we would expect a greater number of plans to offer the highest-alpha funds to their participants. Alternatively, if plan participants are good at determining the best options from the set of choices they are offered, we would also expect the better-performing funds to attract more assets and more investors.

[24] Because the participant- and asset-based pooling methods in Panels B.1 and C.1 represent weighted averages, notice that it is only possible to calculate p-values for the mean in-sample alpha difference tests, which have been appropriately adjusted for each weighting scheme.

To examine these possibilities, we consider the extent to which the in-sample risk-adjusted performance measures (ALPHA) for each of the 1,350 actively managed plan options are linked to MKTVAL, PLANFRQ, and PARTFRQ. In particular, we perform two final statistical tests. First, we calculate the Spearman rank correlation coefficients between the various combinations of variables. Second, in order to evaluate the temporal stability of the relationships between performance and the three plan organization determinants, we divide the sample into terciles by the size of the plan option's ALPHA coefficient and calculate the means for each variable within those cohorts. We perform these analyses over both the entire sample period as well as the three non-overlapping 30-month sub-periods. These results are summarized in Table 7.[25]

As shown in Panel A, none of the three plan-specific variables is particularly highly correlated with plan option performance, although the relationships between ALPHA and MKTVAL (0.1078) as well as PLANFRQ (0.0886) are positive and statistically reliable at conventional levels over the entire sample period. For MKTVAL, this relationship appears to be reasonably stable with positive coefficients occurring in all three sub-periods, the most recent two of which are also strongly significant. This suggests that, across the entire plan universe, participants tend to put their investment capital into those funds producing the best performance. This conclusion is substantiated by the relationship between ALPHA and PARTFRQ, which is consistently positive—indicating that more participants tend to invest in the best-performing options—and statistically meaningful in the last sub-period. Conversely, the correlation between ALPHA and PLANFRQ is actually negative (although highly insignificant) in the second sub-period, so that the strength of the overall relationship is being driven by the most recent 30-month interval. Thus, while a greater number of plan sponsors do offer options with the largest risk-adjusted returns, this tendency has not been established for as long.[26]

The cohort evidence in Panel B confirms both the overall direction of these connections as well as the relative lack of strength that underlies them. Specifically,

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[25] The findings listed in Table 7 are based on risk-adjusted returns defined relative to the four-factor version of equation (1). We have also replicated these tests using alphas from the one- and three-factor versions of the risk model and they do not differ in any material way from those reported in the exhibit.

[26] Although not shown in Table 7, we also computed the Spearman rank correlations between MKTVAL, PLANFRQ, and PARTFRQ. Not surprisingly, the two participant-oriented measures were quite highly correlated (i.e., ρ(MKTVAL,PARTFRQ) = 0.9491). The relationship between the sponsor-oriented measure and the other two were also significantly positive, although at somewhat more modest levels (i.e., ρ(PLANFRQ,MKTVAL) = 0.4170 and ρ(PLANFRQ,PARTFRQ) = 0.4879).

viewed across the entire period, the mean ALPHA in the lowest tercile of the sample (i.e., -0.3350, or -33.50 basis points per month) is associated with the lowest mean levels for all of the other variables: $418.412 (MKTVAL), 512.00 (PLANFRQ), and 28,360 (PARTFRQ). However, the reported values for these three characteristics are not monotonic across the performance terciles. In fact, only in the most recent 30-month interval is it the case that the largest number of sponsors and participants are associated with the best-performing investment options, indicating that in this sub-period sponsors selected the best funds as options in their plans and participants picked the best funds from among those that they were offered. On the other hand, the largest concentration of sponsor and participant activity *never* falls in the lowest-alpha terciles, suggesting that the vast majority of both groups demonstrate the consistent ability to avoid selecting the worst performing funds.

7. Concluding Comments

Although the size and scope of the market for retirement assets has fostered a considerable amount of research, the vast majority of that literature has been concentrated on the portfolio choices that investors make as well as the investment performance associated with those decisions. Of course, the choices that participants make are a direct function of the set of alternatives they are offered, but far less is known about the motivation and performance of the sponsors who provide those choices. To help address this need, in this paper we posit and test several hypotheses concerning the quality of the investment options that sponsors made available to their participants compared to those that they did not. Using a comprehensive and proprietary database maintained by the largest service provider in the defined contribution industry, we demonstrate that the investment options included in plans outperform an otherwise comparable set of non-plan alternatives by an average of 1.22% on an annualized basis, an incremental amount that is both net of fees and adjusted for risk. This performance advantage is (i) spread fairly uniformly across equity style classes, (ii) is not particularly sensitive to the nature of the risk-adjustment process, and (iii) was present, albeit in different degrees, across all sub-intervals of the overall sample period. Further, we show that the sources of this outperformance are the actively managed funds that sponsors select and, to a far lesser extent, the public fund products they choose, despite the apparent advantages that

privately managed accounts appear to enjoy. We conclude that plan sponsors possess genuine selection skills with regard to the menu of investment options they offer to their participants.

Our analysis also suggests some potentially fruitful directions for future research. We have concentrated on the equity fund selections made by plan sponsors, which is likely to be the asset class for which there is the largest possible benefit in deploying superior selection skills. Even so, the same set of hypotheses that we test in this study could be applied to fixed-income, cash-equivalent, or even life-cycle and tactical asset allocation funds. Further, it would be interesting to consider how frequently sponsors feel compelled to adjust the set of available plan options and what the economic and behavioral determinants underlying that decision might be.

Beyond that, it is possible that cross-sectional variations in the set of plan options offered by sponsoring firms are related to differences in any of several dimensions summarizing their corporate profiles (e.g., industry affiliation, market capitalization, employee base). Said differently, do General Electric, Microsoft, and Whole Foods Market face comparable decisions when designing their defined contribution plans? In this context, it may be the case the need to hedge labor income risk influences the selection process. Finally, it is likely that managers in the defined contribution market are subject to the same sort of agency problems of the type identified by Brown, Harlow, and Starks (1996) and Chevalier and Ellison (1997) and it would be useful to consider how those incentives might impact performance, particularly with regard to differences between funds available to the general public and those accounts that are privately managed. However, inasmuch as all of these issues are well beyond the scope of the present investigation, they will be left for future consideration.

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Table 1

Summary of Defined Contribution Plan Characteristics

This display summarizes various characteristics describing the sample of defined contribution plans for which Fidelity Employer Services Company acted as a service provider for the period from January 2000 to June 2007. Panel A lists year-end statistics regarding the number of sponsors, plans, participants, and assets under management in the sample, as well as the distribution of available plan options offered by the sponsors. Panel B lists percentage allocation statistics involving the asset classes and the nature of the fund management (i.e., active vs. passive, private vs. public).

Panel A: Number of Sponsors, Participants, and Investment Options

Year Ending	Number of Sponsors	Number of Plans	Total Participants	Avg Participants Per Plan	Total Assets ($ mil)	Avg Assets Per Plan ($ mil)	Total Plan Options	Avg Options Per Plan	Max (Min) # of Plan Options Utilized
2000	21,460	23,973	8,394,395	350.16	494,754	20.64	315,752	14.71	305 (1)
2001	22,946	25,653	9,109,671	355.11	493,938	19.25	370,902	16.16	430 (1)
2002	23,707	26,421	9,581,385	362.64	455,194	17.23	413,818	17.46	471 (1)
2003	24,053	26,805	9,798,152	365.53	575,574	21.47	448,814	18.66	534 (1)
2004	24,882	27,764	10,326,808	371.95	661,042	23.81	500,650	20.12	583 (1)
2005	25,955	29,035	11,212,918	386.19	733,546	25.26	567,111	21.85	656 (1)
2006	27,359	30,634	12,464,411	406.88	877,412	28.64	635,215	23.22	696 (1)

Table 1 (cont.)

Summary of Defined Contribution Plan Characteristics

Panel B: Investment Profile of Plan Options				
		Plan Options (%)	Plan Participants (%)	Plan Assets (%)
Asset Allocation:				
Cash		14.99	14.21	17.88
Fixed Income		13.78	7.94	5.83
U.S. Domestic Stock		58.93	65.82	65.19
Global Stock-ex U.S.		12.29	12.03	11.10
Public vs. Private Management:				
Cash		14.99	14.21	17.88
Mutual (Public) Funds		57.17	77.14	69.53
Institutional (Private) Funds		27.84	8.64	12.59
Cash		14.99	14.21	17.88
Fixed Income	Public	7.88	6.60	4.27
	Private	5.90	1.34	1.56
U.S. Domestic Stock	Public	40.41	59.44	55.06
	Private	18.52	6.38	10.13
Global Stock-ex U.S.	Public	8.88	11.11	10.20
	Private	3.42	0.92	0.90
Active vs. Passive Management:				
Actively Managed		92.61	95.55	95.00
Passively Managed		7.39	4.45	5.00
Cash		14.99	14.21	17.88
Mutual Funds	Active	56.06	74.71	67.71
	Passive	1.10	2.44	1.81
Institutional Funds	Active	21.61	6.63	9.41
	Passive	6.02	2.01	3.18

Table 2

Risk-Adjusted Performance of Plan and Non-Plan Investment Options: Full Sample Results

In-sample risk-adjusted performance (i.e., alpha) statistics are reported for the complete collection of plan and non-plan investment options over the period January 2000-June 2007 (Panel A) and three sub-periods: (i) January 2000-June 2002; (ii) July 2002-December 2004; and (iii) January 2005-June 2007 (Panel B). Alphas were calculated relative to three versions of the factor model in (1): (i) a one-factor model using (R_m-RF); (ii) a three-factor model using (R_m-RF), SMB, and HML; and (iii) a four-factor model using (R_m-RF), SMB, HML, and MOM. Statistics indicating the difference in performance between plan and non-plan options and the associated p-values are reported in the last two rows for each sample period. Panel C reports mean, median, and (% Positive) statistics for the differences between plan and non-plan option alphas estimated out-of-sample using a modified version of the Fama-MacBeth two-stage technique and aggregated over the 60 monthly cross-sections from July 2002-June 2007.

		One-Factor Model				Three-Factor Model				Four-Factor Model		
Option Description	Obs.	Mean	Median	% Pos.		Mean	Median	% Pos.		Mean	Median	% Pos.
Panel A. In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: All Options	10536	-0.0275	-0.0794	39.76		-0.1132	-0.0928	36.13		-0.1091	-0.0913	36.33
Alpha: Plan Options	1488	-0.0130	-0.0382	43.78		-0.0307	-0.0268	44.36		-0.0271	-0.0245	44.49
Alpha: Non-Plan Options	9048	-0.0299	-0.0900	39.10		-0.1268	-0.1072	34.78		-0.1225	-0.1046	34.99
Difference		0.0169	0.0518	4.68		0.0961	0.0804	9.58		0.0954	.0801	9.50
p-value		*0.2692*	*0.0001*	*0.0006*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
Panel B. In-Sample Alphas; Three Sub-Periods												
(i) January 2000-June 2002												
Alpha: Plan Options	216	0.3875	0.2089	65.39		0.0993	0.1261	61.57		0.0995	0.1147	59.72
Alpha: Non-Plan Options	2928	0.1539	0.0155	51.08		-0.0944	-0.0151	48.36		-0.0911	-0.0282	47.47
Difference		0.2336	0.1934	14.31		0.1937	0.1412	13.21		0.1906	0.1429	12.25
p-value		*0.0001*	*0.0002*	*0.0001*		*0.0001*	*0.0001*	*0.0002*		*0.0001*	*0.0004*	*0.0005*
(ii) July 2002-December 2004												
Alpha: Plan Options	535	-0.0310	-0.0356	46.36		-0.1272	-0.0873	34.02		-0.1277	-0.0902	33.46
Alpha: Non-Plan Options	3706	-0.1022	-0.1334	35.20		-0.2042	-0.1925	23.45		-0.2026	-0.1909	23.45
Difference		0.0712	0.0978	11.16		0.0770	0.1052	10.57		0.0749	0.1007	10.01
p-value		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
(iii) January 2005-June 2007												
Alpha: Plan Options	737	-0.1129	-0.0585	35.82		0.0013	-0.0143	46.81		0.0088	-0.0079	48.03
Alpha: Non-Plan Options	2414	-0.1412	-0.0977	30.61		-0.0471	-0.0576	35.71		-0.0377	-0.0514	37.57
Difference		0.0283	0.0392	5.21		0.0484	0.0433	11.10		0.0465	0.0435	10.46
p-value		*0.0173*	*0.0001*	*0.0079*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
Panel C. Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Diff: [Plan - Non-Plan]	60	0.0653	0.0315	65.00		0.0640	0.0449	71.67		0.0643	0.0418	71.67
p-value		*0.0006*	*0.1228*	*0.0201*		*0.0004*	*0.0444*	*0.0008*		*0.0008*	*0.0286*	*0.0008*

Table 3

Factor-Matched Performance Comparison of Plan and Non-Plan Investment Options

In-sample risk-adjusted performance (i.e., alpha) statistics are reported for the full collection of plan options and non-plan investment options over the period January 2000-June 2007. In Panel A, both the entire plan and non-plan samples are sorted into 16 bins according to whether their beta exposures from the four-factor version of equation (1) fall above or below the sample median for a given risk factor. Differences in (i) mean alpha, (iii) median alpha, and (iii) percentage of positive alphas are listed for each factor-matched bin along with the p-values indicating the statistical significance of those differentials. In Panel B, each plan option is compared with its "nearest neighbor" non-plan option, defined as the alternative whose factor beta estimates most closely match those of the respective plan option. The display lists the risk-adjusted return differentials (i.e., plan option minus non-plan neighbor) that fall at various breakpoints of the frequency distribution, as well as the mean value and percentage of positive differentials. Matched-pair frequency distributions are also shown for the three sub-periods of the full sample.

Panel A: Factor-Sorted Bins of Plan and Non-Plan Option Samples

Factor-Sort Bin							Mean Alpha		Median Alpha		% Pos. Alpha	
(Rm-RF)	SMB	HML	MOM	Plan Obs.	Non-Plan Obs.	% (Plan / Non-Plan) Obs.	Diff.	*p-value*	Diff.	*p-value*	Diff.	*p-value*
Low	Low	Low	Low	96	623	15.41	0.0444	*0.0866*	0.0256	*0.0274*	8.66	*0.1141*
Low	Low	Low	High	110	540	20.37	0.0711	*0.0012*	0.0618	*0.0001*	19.28	*0.0002*
High	Low	Low	Low	136	570	23.86	0.0335	*0.2596*	0.0265	*0.0001*	-10.16	*0.0078*
High	Low	Low	High	77	558	13.80	0.0711	*0.0431*	0.0991	*0.0023*	9.71	*0.0408*
Low	Low	High	Low	154	1010	15.25	0.0822	*0.0008*	0.0659	*0.0003*	15.34	*0.0004*
Low	Low	High	High	73	364	20.06	0.0612	*0.1312*	0.0273	*0.0013*	3.18	*0.6129*
High	Low	High	Low	61	577	10.57	0.0963	*0.0214*	0.0577	*0.0047*	0.51	*0.9251*
High	Low	High	High	36	283	12.72	0.0047	*0.9203*	0.0547	*0.0740*	-6.56	*0.3239*
Low	High	Low	Low	31	174	17.82	0.2035	*0.0295*	0.1910	*0.0032*	26.59	*0.0058*
Low	High	Low	High	126	588	21.43	0.1993	*0.0001*	0.1255	*0.0001*	21.09	*0.0001*
High	High	Low	Low	55	397	13.85	0.1412	*0.1424*	0.1493	*0.4724*	9.18	*0.1876*
High	High	Low	High	163	1024	15.92	0.1142	*0.0160*	0.1458	*0.0140*	11.87	*0.0039*
Low	High	High	Low	93	676	13.76	0.1383	*0.0069*	0.1191	*0.0003*	15.89	*0.0033*
Low	High	High	High	81	529	15.31	0.2211	*0.0015*	0.1353	*0.0123*	18.67	*0.0010*
High	High	High	Low	91	524	17.37	-0.0658	*0.2923*	0.0173	*0.7209*	-14.09	*0.0089*
High	High	High	High	105	611	17.86	0.0963	*0.0870*	0.1035	*0.0005*	12.13	*0.0170*
				1,488	9,048							
					Average:	16.59	0.0945		0.0878		8.83	

Table 3 (cont.)

Factor-Matched Performance Comparison of Plan and Non-Plan Investment Options

Panel B: Risk-Adjusted Return Differentials for Plan Option and "Nearest Neighbor" Non-Plan Options

		Return Differential Frequency Distribution										
Sample Period	Obs.	Min	5%	10%	25%	50%	75%	90%	95%	Max	Mean	% Positive Differentials
Jan 2000-Jun 2007	1488	-3.6742	-0.4234	-0.2364	-0.0550	0.0219	0.1295	0.3352	0.5448	3.2493	0.0397	61.76
p-value											*0.0001*	*0.0001*
(i) Jan 2000-Jun 2002	216	-2.5222	-0.9991	-0.6051	-0.1614	0.0235	0.2767	0.8247	1.2311	3.2493	0.0726	58.80
p-value											*0.1057*	*0.0097*
(ii) Jul 2002-Dec 2004	535	-3.6742	-0.3803	-0.2266	-0.0624	0.0217	0.1507	0.3350	0.4879	1.3568	0.0364	59.81
p-value											*0.0077*	*0.0001*
(iii) Jan 2005-Jun 2007	737	-1.0263	-0.3113	-0.1738	-0.0402	0.0218	0.0984	0.2550	0.3890	1.2964	0.0324	64.04
p-value											*0.0001*	*0.0001*

Table 4

Risk-Adjusted Performance of Plan and Non-Plan Investment Options: Actively Managed Options

In-sample risk-adjusted performance (i.e., alpha) statistics are reported for the complete collection of plan and non-plan investment options that were *actively managed* over the period January 2000-June 2007 (Panel A) and three sub-periods: (i) January 2000-June 2002; (ii) July 2002-December 2004; and (iii) January 2005-June 2007 (Panel B). Alphas were calculated relative to three versions of the factor model in (1): (i) a one-factor model using (R_m-RF); (ii) a three-factor model using (R_m-RF), SMB, and HML; and (iii) a four-factor model using (R_m-RF), SMB, HML, and MOM. Statistics indicating the difference in performance between plan and non-plan options and the associated p-values are reported in the last two rows for each sample period. Panel C reports mean, median, and (% Positive) statistics for the differences between plan and non-plan option alphas estimated out-of-sample using a modified version of the Fama-MacBeth two-stage technique and aggregated over the 60 monthly cross-sections from July 2002-June 2007.

		One-Factor Model				Three-Factor Model				Four-Factor Model		
Option Description	Obs.	Mean	Median	% Pos.		Mean	Median	% Pos.		Mean	Median	% Pos.
Panel A. In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: All Options	10368	-0.0272	-0.0797	39.97		-0.1143	-0.0942	36.24		-0.1101	-0.0921	36.44
Alpha: Plan Options	1350	-0.0051	-0.0269	45.68		-0.0285	-0.0193	45.93		-0.0246	-0.0153	46.07
Alpha: Non-Plan Options	9018	-0.0305	-0.0901	39.12		-0.1271	-0.1074	34.79		-0.1229	-0.1048	35.00
Difference		0.0254	0.0632	6.56		0.0986	0.0881	11.14		0.0983	0.0895	11.07
p-value		*0.1145*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
Panel B. In-Sample Alphas; Three Sub-Periods												
(i) January 2000-June 2002												
Alpha: Plan Options	209	0.3925	0.2269	66.67		0.0979	0.1259	61.72		0.0982	0.1187	59.81
Alpha: Non-Plan Options	2918	0.1524	0.0155	51.08		-0.0952	-0.0158	48.25		-0.0919	-0.0288	47.36
Difference		0.2401	0.2114	15.59		0.1931	0.1417	13.47		0.1901	0.1475	12.45
p-value		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0003*	*0.0002*		*0.0001*	*0.0008*	*0.0005*
(ii) July 2002-Decemer 2004												
Alpha: Plan Options	485	-0.0285	-0.0288	47.01		-0.1303	-0.0873	35.05		-0.1307	-0.0902	34.43
Alpha: Non-Plan Options	3695	-0.1023	-0.1334	35.19		-0.2045	-0.1934	23.49		-0.2029	-0.1915	23.49
Difference		0.0738	0.1046	11.82		0.0742	0.1061	11.56		0.0722	0.1013	10.94
p-value		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
(iii) January 2005-June 2007												
Alpha: Plan Options	656	-0.1097	-0.0491	38.26		0.0065	-0.0082	48.93		0.0148	0.0010	50.31
Alpha: Non-Plan Options	2405	-0.1413	-0.0907	30.68		-0.0470	-0.0574	35.80		-0.0376	-0.0510	37.67
Difference		0.0316	0.0416	7.58		0.0535	0.0492	13.13		0.0524	0.0520	12.64
p-value		*0.0117*	*0.0001*	*0.0002*		*0.0001*	*0.0001*	*0.0001*		*0.0001*	*0.0001*	*0.0001*
Panel C. Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Diff: [Plan - Non-Plan]	60	0.0639	0.0446	66.67		0.0625	0.0500	68.33		0.0634	0.0503	71.67
p-value		*0.0005*	*0.2097*	*0.0098*		*0.0005*	*0.0237*	*0.0043*		*0.0015*	*0.0382*	*0.0008*

Table 5

Risk-Adjusted Performance of Plan and Non-Plan Investment Options: Passively Managed Options

In-sample risk-adjusted performance (i.e., alpha) statistics are reported for the complete collection of plan and non-plan investment options that were *passively managed* over the period January 2000-June 2007 (Panel A) and three sub-periods: (i) January 2000-June 2002; (ii) July 2002-December 2004; and (iii) January 2005-June 2007 (Panel B). Alphas were calculated relative to three versions of the factor model in (1): (i) a one-factor model using (R_m-RF); (ii) a three-factor model using (R_m-RF), SMB, and HML; and (iii) a four-factor model using (R_m-RF), SMB, HML, and MOM. Statistics indicating the difference in performance between plan and non-plan options and the associated p-values are reported in the last two rows for each sample period. Panel C reports mean, median, and (% Positive) statistics for the differences between plan and non-plan option alphas estimated out-of-sample using a modified version of the Fama-MacBeth two-stage technique and aggregated over the 60 monthly cross-sections from July 2002-June 2007.

		One-Factor Model				Three-Factor Model				Four-Factor Model		
Option Description	Obs.	Mean	Median	% Pos.		Mean	Median	% Pos.		Mean	Median	% Pos.
Panel A. In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: All Options	168	-0.0491	-0.0718	26.79		-0.0458	-0.0772	29.76		-0.0465	-0.0794	29.76
Alpha: Plan Options	138	-0.0894	-0.0685	25.36		-0.0519	-0.0766	28.99		-0.0520	-0.0794	28.99
Alpha: Non-Plan Options	30	0.1362	-0.0886	33.33		-0.0177	-0.0892	33.33		-0.0209	-0.0795	33.33
Difference		0.0468	0.0201	-7.97		-0.0342	0.0126	-4.34		-0.0311	0.0001	-4.34
p-value		*0.0022*	*0.4218*	*0.3730*		*0.3283*	*0.6879*	*0.6379*		*0.3715*	*1.000*	*0.6379*
Panel B. In-Sample Alphas; Three Sub-Periods												
(i) January 2000-June 2002												
Alpha: Plan Options	7	0.2440	-0.0590	28.57		0.1436	0.1419	57.14		0.1387	0.1120	57.14
Alpha: Non-Plan Options	10	0.6101	0.3166	50.00		0.1345	0.1266	80.00		0.1261	0.1004	80.00
Difference		-0.3661	-0.3756	-21.43		0.0091	0.0153	-22.86		0.0126	0.0116	-22.86
p-value		*0.3941*	*0.7782*	*0.3914*		*0.9519*	*0.4990*	*0.3234*		*0.9307*	*0.4990*	*0.3234*
(ii) July 2002-Decemer 2004												
Alpha: Plan Options	50	-0.0556	-0.1312	40.00		-0.0970	-0.0897	24.00		-0.0986	-0.0899	24.00
Alpha: Non-Plan Options	11	-0.0773	-0.1624	36.36		-0.1160	-0.1093	9.09		-0.1145	-0.1103	9.09
Difference		0.0217	0.0312	3.64		0.0190	0.0196	14.91		0.0159	0.0204	14.91
p-value		*0.7392*	*0.7866*	*0.8246*		*0.7567*	*0.1114*	*0.2783*		*0.7978*	*0.1114*	*0.2783*
(iii) January 2005-June 2007												
Alpha: Plan Options	81	-0.1391	-0.0680	16.05		-0.0410	-0.0711	29.63		-0.0397	-0.0773	29.63
Alpha: Non-Plan Options	9	-0.1294	-0.0821	11.11		-0.0668	-0.1056	11.11		-0.0697	-0.1084	11.11
Difference		-0.0097	0.0141	4.94		0.0258	0.0345	18.52		0.0300	0.0311	18.52
p-value		*0.8978*	*0.2945*	*0.6998*		*0.4712*	*0.7268*	*0.2419*		*0.4190*	*0.7268*	*0.2419*
Panel C. Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Diff: [Plan - Non-Plan]	60	0.0448	-0.0032	48.33		0.0905	0.0479	61.67		0.1158	0.1025	65.00
p-value		*0.5257*	*0.3502*	*0.7963*		*0.0216*	*0.3061*	*0.0707*		*0.0068*	*0.2591*	*0.0201*

Table 6

Risk-Adjusted Performance of Actively Managed Plan Options: Public vs. Private Funds

Risk-adjusted performance (i.e., alpha) statistics are reported for the sample of actively managed plan investment options according to whether the fund was (i) privately managed in an institutional account; or (ii) managed in a public fund. In-sample alphas were computed over the full period from January 2000-June 2007 while out-of sample alphas were generated using a modified version of the Fama-MacBeth two-stage technique and aggregated over the 60 monthly cross sections from July 2002-June 2007. All alphas were calculated relative to three versions of the factor model in (1): (i) a one-factor model using (R_m-RF); (ii) a three-factor model using (R_m-RF), SMB, and HML; and (iii) a four-factor model using (R_m-RF), SMB, HML, and MOM. Summary performance measures were pooled in three ways: (i) equally weighted (Panel A); (ii) participant-weighted (Panel B); and (iii) plan asset-weighted (Panel C). Mean, median, and (% Positive) statistics indicating the difference in performance between public and private active plan options and the associated p-values are reported in the last two rows for the in-sample alphas; similar statistics are reported for the out-of-sample alpha differential between public and private active funds.

		One-Factor Model				Three-Factor Model				Four-Factor Model		
Option Description	Obs.	Mean	Median	% Pos.		Mean	Median	% Pos.		Mean	Median	% Pos.
Panel A. Equal-Weighted Averages												
A.1 In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: All Active Options	1350	-0.0051	-0.0269	45.68		-0.0285	-0.0193	45.93		-0.0246	-0.0153	46.07
Alpha: Active Public	1003	-0.0022	-0.0432	43.42		-0.0308	-0.0225	46.76		-0.0274	-0.0230	46.26
Alpha: Active Private	347	-0.0137	0.0070	52.16		-0.0220	-0.0161	43.52		-0.0165	-0.0116	45.53
Difference		0.0115	-0.0502	-8.74		-0.0088	-0.0064	3.24		-0.0109	-0.0114	0.73
p-value		*0.6756*	*0.0034*	*0.0049*		*0.6817*	*0.4935*	*0.2961*		*0.6077*	*0.1522*	*0.8146*
A.2 Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Differential: [Active Public – Active Private]	60	-0.0815	-0.0621	40.00		-0.0505	-0.0444	45.00		-0.0476	-0.0268	41.67
p-value		0.1041	0.0484	0.1213		0.1876	0.1757	0.4386		0.2223	0.1306	0.1967

Table 6 (cont.)

Risk-Adjusted Performance of Actively Managed Plan Options: Public vs. Private Funds

Option Description	Obs.	One-Factor Model				Three-Factor Model				Four-Factor Model		
		Mean	Median	% Pos.		Mean	Median	% Pos.		Mean	Median	% Pos.
Panel B. Participant-Weighted Averages												
B.1 In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: Active Public	1003	-0.0125	-0.0662	44.53		0.0102	0.0515	58.50		0.0168	0.0568	58.15
Alpha: Active Private	347	-0.0048	-0.0195	47.17		-0.0089	-0.0160	43.81		-0.0032	-0.0098	46.36
Difference		-0.0077	-0.0467	-2.64		0.1101	0.0675	14.69		0.0200	0.0666	11.79
p-value		*0.8773*	---	---		*0.6420*	---	---		*0.6146*	---	---
B.2 Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Differential: [Active Public – Active Private]	60	-0.0356	-0.0295	48.33		0.0208	0.0324	56.67		0.0227	0.0282	56.67
p-value		0.3310	0.1774	0.7963		0.5214	0.4311	0.3017		0.5076	0.6989	0.3017
Panel C. Plan Asset-Weighted Averages												
C.1 In-Sample Alphas; Full Period (January 2000-June 2007)												
Alpha: Active Public	1003	-0.0070	-0.0507	45.87		0.0184	0.0515	58.64		0.0256	0.0529	58.27
Alpha: Active Private	347	0.0179	0.0133	53.31		-0.0150	-0.0216	42.24		-0.0094	-0.0145	43.66
Difference		-0.0249	-0.0640	-7.44		0.0334	0.0731	16.40		0.0350	0.0674	14.61
p-value		*0.4681*	---	---		*0.1927*	---	---		*0.1623*	---	---
C.2 Out-of-Sample Aggregated Alphas; Truncated Full Period (January 2002-June 2007)												
Alpha Differential: [Active Public – Active Private]	60	-0.0395	-0.0640	36.67		0.0245	0.0057	51.67		0.0161	-0.0108	48.33
p-value		0.3221	0.0842	0.0389		0.4946	0.8974	0.7963		0.6667	0.8974	0.7963

Table 7

Risk-Adjusted Performance of Actively Managed Plan Options: Plan-Specific Determinants

Panel A reports Spearman rank correlation coefficients between in-sample alphas for actively managed plan options (ALPHA) and three different variables: (i) the total value of participant holdings in a particular option (MKTVAL), (ii) the number of distinct plans offering a particular option (PLANFRQ), and (iii) the number of participants holding a particular option (PARTFRQ). Alphas were computed using the four-factor version of equation (1) and p-values are reported beneath each correlation coefficient. Panel B reports mean values for ALPHA, MKTVAL, PLANFRQ, and PARTFRQ within sample terciles sorted by the plan's in-sample risk-adjusted performance statistic. Results are reported for the entire sample period as well as three non-overlapping 30-month sub-periods.

Panel A: Spearman Rank Correlation with Plan Option Risk-Adjusted Performance (ALPHA)

Period	Obs.	MKTVAL	PLANFRQ	PARTFRQ	
January 2000-June 2007	1350	0.1078	0.0886	0.0533	
p-value		*0.0001*	*0.0011*	*0.0505*	
January 2000-June 2002	209	0.0798	0.0505	0.0800	
p-value		*0.2506*	*0.4674*	*0.2498*	
July 2002-December 2004	485	0.1062	-0.0404	0.0746	
p-value		*0.0193*	*0.3749*	*0.1006*	
January 2005-June 2007	656	0.1148	0.1405	0.0947	
p-value		*0.0032*	*0.0003*	*0.0153*	

Panel B: Mean Values of Variables in ALPHA-Sorted Terciles

Period	Tercile (Obs)	ALPHA	MKTVAL ($ Mil)	PLANFRQ	PARTFRQ (Thousands)
January 2000-June 2007	Low (448)	-0.3350	418.412	512.00	28.360
	Mid (451)	-0.0215	757.402	657.33	49.470
	High (451)	0.2808	645.596	849.52	41.489
(i) January 2000-June 2002	Low (69)	-0.4603	535.462	917.36	49.824
	Mid (70)	0.0852	1,614.997	1,362.44	126.918
	High (70)	0.6616	419.419	900.07	37.280
(ii) July 2002-December 2004	Low (161)	-0.4636	218.572	417.20	18.542
	Mid (162)	-0.0999	886.718	801.65	55.485
	High (162)	0.1693	597.133	654.47	37.781
(iii) January 2005-June 2007	Low (218)	-0.2005	528.952	453.70	28.819
	Mid (219)	0.0024	387.626	325.19	20.266
	High (219)	0.2415	753.739	977.65	45.577

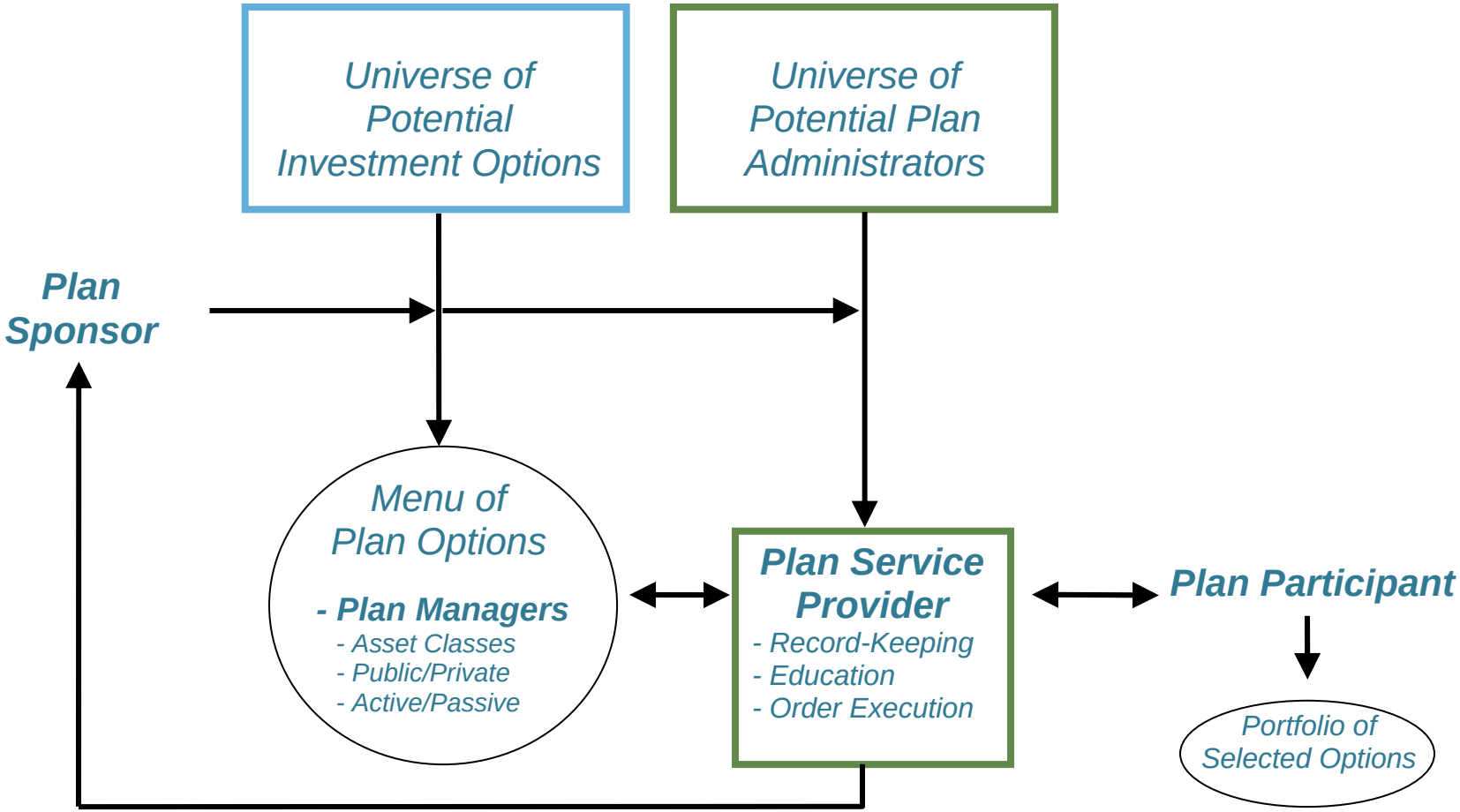

Figure 1. Organizational Structure of a Defined Contribution Retirement Plan. This figure summarizes the various relationships that exist between the four primary economic agents involved in a defined contribution retirement plan: the plan participant, the plan sponsor, the plan administrator/service provider, and the plan investment managers. The main feature of this structure is that plan sponsor has the fiduciary duty to create the menu of available plan investment options, but the plan participant is responsible for choosing the specific options that constitute the invested portfolio.