Offering vs. Choice in Retirement Plans:

A Cross Sectional Analysis of Investment Menus with Traditional and Life-Cycle Mutual Funds

by

Tai Kam,[1] Robert L. McDonald,[2] David P Richardson[1] and Thomas A. Rietz[3]

September 2016
DRAFT

Abstract

Defined contribution retirement plan investment menus have substantially changed over the past 20 years. Today, a typical plan offers many more investment options than in the past. And auto-diversified life-cycle funds have become a ubiquitous option and increasingly popular participant choice. Using a cross section of over 600,000 TIAA participants, we study how participants allocate contributions given the new and growing plan choices. Typically, participants invest in fewer than five funds. Younger participants typically allocate more to equity than older workers and men allocate more to equity than women. There are significant plan menu effects. Participants tend to invest in more funds when there are more funds available. Further, when equity funds constitute a higher proportion of available funds, participants invest more in equity. Many participants now invest exclusively in life-cycle funds; typically younger, lower income and less wealthy participants. Life-cycle fund participants invest significantly more in equity overall, decrease equity exposure faster with age, and appear less affected by the number and mix of funds available. Overall, we find the structure of the investment menu significantly affects how participants tend to allocate their retirement plan contributions.

[1] TIAA Institute, 8625 Andrew Carnegie Boulevard, Charlotte, NC 28262
[2] Department of Finance, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, Illinois 60208
[3] Department of Finance, Henry B. Tippie College of Business, University of Iowa, Iowa City, Iowa 52242.

"One of the most important decisions many people face is the choice of a portfolio of assets for retirement savings." --Campbell and Viceira **(2002)**

I. Introduction

Defined Contribution (DC) plans have become the primary retirement plan for the majority of American workers.[4] Participants in DC plans typically bear the burden of investment decisions: they are offered access to a plan that has a menu of investment alternatives and must decide whether to participate, how much to contribute, how to allocation contributions among investment options, and when and how to take retirement distributions. Sponsors of DC plans have fiduciary responsibilities to participants and, as a result, face legal risks. Changes in DC plan regulation and design—intended to assist participants and reduce fiduciary risk exposure—have included revised rules about default investments and larger numbers of funds available for investment choices.

In this paper, we use cross-sectional data to examine participant fund choices in this new environment. We find that participants who allocate contributions only to life-cycle funds—single choice, auto-diversified funds-of-funds that reduce the equity component of the fund over time—invest more in equity than participants who customize their investment allocations. In contrast to prior research (e.g., Huberman and Jiang (2006)), we find statistically significant correlations between available the number of choices and allocations. There are small but measurable effects in which participants invest in a greater number of funds when more funds are offered. We find that participants use one additional fund for every thirty additional funds available. There are also measurable effects from the underlying mix of investment offerings. We find that offering a greater percentage of equity funds choices is associated with slightly larger average equity holdings.[5]

[4] For private ERISA plans, see the Department of Labor's Abstract of 2012 Form 5500 Annual Reports (U.S. Department of Labor (2015)). Also see the National Compensation Survey (http://www.bls.gov/ncs/, access 9/19/15).

[5] We note that, because the data are cross-sectional, we document these effects but are unable to speak to causality.

Our findings follow research over the past fifteen years that highlights the importance of plan design in framing and influencing participant decisions. Three changes in recent years have affected plan characteristics and potentially affected participant choices.

1. There has been widespread adoption of default "auto-enrollment" provisions, in which the plan specifies a default contribution percent and default investment fund for new participants who otherwise make no active choice. The importance of auto-enrollment was first highlighted by Madrian and Shea (2001), who compared plan participation before and after an employer adopted a default participation provision. Employee participation increased significantly when the default choice was "participate" instead of "not participate."
2. The Pension Protection Act of 2006 (PPA) codified Qualified Default Investment Alternatives (QDIAs). A QDIA is intended to be "a single investment capable of meeting a worker's long-term retirement savings needs."[6] Prior to the PPA, money-market funds were a common default investment. Following the adoption of the PPA, life-cycle funds have been widely adopted as a default.[7] The purpose of QDIAs was to provide employees with economically reasonable default investments that would also satisfy fiduciary obligations of plan sponsors.
3. Finally, a number of plans have adopted open architecture investment menus, which allow participants to select funds from multiple fund providers. By increasing the range of investment options for participants, this potentially provides protection for fiduciaries at the cost of increased complexity for participants. The large number of alternatives has led to concerns that participants may cope by using behavioral rules of thumb such as investing equally in many funds (the "1/N" rule, see Benartzi and Thaler (2001)).

Our goal is to understand how participants choose investments in this new environment in which the PPA and open architecture have substantially changed the investment choice set for many retirement plan

[6] See http://www.dol.gov/ebsa/newsroom/fsqdia.html, accessed 3/30/16.

[7] In 2012, the two most common QDIAs in the TIAA-CREF system were money market and life-cycle funds. Richardson and Bissette (2014) show that life-cycle funds became increasingly popular among TIAA-CREF system participants following the passage of the PPA, recently accounting for almost 30 cents of every dollar contributed.

participants. We examine participant choices using administrative data from the TIAA system. Our 2012 cross-sectional data covers more than 600,000 participants across 98 of the largest institutions within the TIAA system. The administrative data includes information on plan rules, participant demographics and participant choices. The plan rules data includes the structure of the investment menu at each institution, default provisions, contribution rules and vesting rules. The participant data includes basic demographic information, contribution allocations, asset holdings, and personal rates of return. The data allow us to analyze contribution and asset allocation choices given the choice sets available to participants.

Our findings relate to existing research on participant behavior in retirement plans, specifically work that studies participant responses to the number of funds offered. Basic principles of portfolio theory imply that plan participants should structure their portfolios' risk-return profiles independently of the number of fund options in their plan investment menu. However, behavioral factors may interfere with optimal choices. The evidence on these effects is mixed.

An important question is how participants make effective choices when offered a large number of investment options. One concern is that expanded investment menus can be counterproductive. Iyengar and Lepper (2000) contend that too many choices in general may create confusion and distraction, resulting in poorly-informed consumer decisions. Iyengar, Huberman and Jiang (2004), in the context of retirement investing, find that "choice overload" reduces participation rates. Using a 2001 cross-section of participants from 649 DC plans, they find that participation dropped 2% for every 10 additional funds on an investment menu. While most of the plans examined have 10-30 options, participation rates are highest for those with 10 or fewer options. Benartzi and Thaler (2001) suggest that many plan participants cope with large investment menus by following a naïve portfolio diversification strategy: investing $1/N^{th}$ of their assets in each of the N funds available on the investment menu (i.e., the "1/N" rule).

On the other side, Huberman and Jiang (2006) explore participant investment choices using the same data as Iyengar, Huberman and Jiang (2004). Although choice overload leads to reduce participation, they find little evidence that the menu significantly affected the investment choices of those who do participate. They find that "the number of funds used, typically between three and four, is not sensitive to the number of funds

offered by the plans, which ranges from four to 59. A participant's propensity to allocate contributions to equity funds is not very sensitive to the fraction of equity funds among offered funds." In particular they find that "Once plans offer an abundance of choices (more than 10 funds), there is no correlation between equity allocation and exposure." Huberman and Jiang (2004) conclude that, if the plan investment menu provides adequate choices among asset classes, then plan sponsors should not have fiduciary concerns over the number of options on the investment menu. By contrast, Choi, Laibson and Madrian (2010) show that, even when choosing among different S&P 500 index funds, educated and informed participants can make errors in selecting the optimal investment, specifically picking the high fee funds.

Beyond the mixed results of research on menu options and participant behavior, no study has yet examined how participants make decisions when the investment menu contains a set of auto-diversified investment choices - life-cycle funds. We contribute to the evidence on plan design and compare and contrast effective choices for participants who choose life-cycle funds for all or part of their retirement portfolios. In addition, our data allow us to capture other plan design innovations, including auto-rebalancing and increased access to plan resources through the internet.

We begin by conducting analysis similar to Huberman and Jiang (2006) using the 2012 cross-section of TIAA participant administrative data. We extend the analysis to include the effects of having life-cycle funds on the investment menu.[8] To date, our results focus on contribution allocations for participants of different ages who have different plan options. We separately analyze participants who choose no life-cycle funds from those who either (1) choose life-cycle funds as part of their portfolios or (2) those who choose life-cycle funds exclusively. With one exception, all classes of active participants (men and women, at various ages, with various life-cycle fund holding patterns) allocate the majority of their contributions to equity.[9] Across all classes, older participants allocate less to equity than younger participants.

Plan attributes also have significant effects on the equity exposures of participants. Participants in plans that have a larger percentage of equity funds hold significantly more equity unless they invest in

[8] With analysis of automatic rebalancing and other factors yet to be completed.

[9] The exception, on average, is women in 60+ age ranges.

life-cycle funds. Participants in plans with more choices tend to hold more equity as well. Participants with higher contributions (and higher income) and who live in wealthier areas also hold more equity. Older participants and women tend to hold less equity. Finally, investors who choose life-cycle funds hold significantly more equity, though the proportion of equity falls faster across the investor's lifetime.

Participants who hold life-cycle funds exclusively behave quite differently from participants who hold a portfolio of non-life-cycle funds or those who hold life-cycle funds as part of a larger portfolio. Usually, participants who invest exclusively in life-cycle funds hold a single fund and they have more equity exposures than participants who hold portfolios of funds with no or only some life-cycle funds. While there are significant differences in equity exposure between men and women who do not use life-cycle funds, using life-cycle funds exclusively eliminates this difference.

The plan of the paper is as follows. In Section II we describe the 2012 cross-sectional set of participant and plan rule data. Section III discusses our analytic techniques and presents our results and findings. Section IV offers concluding thoughts and an overview of our future research direction.

II. Data

A. Description

The data consist of a 2012 cross section of participant asset holdings, contribution allocations and plan characteristics. In total, the data covers 645,197 participants at one of 98 large employers covered by the TIAA system and includes information on1,073 DC plans. The set of plans includes 401 (a), (h) and (k); 403(b) and 457 (b) and (f) plans (the designation corresponds to the relevant section of the IRS code that allows for the plans). Table 1 shows the number of plans of each type and the number of participants in each plan type. The number of active participants in a plan range from 1 to 26,615 with an average of 825. The median plan has 53 active participants. In many cases, participants can participate in more than one plan (e.g., a "main" retirement plan and a supplemental plan). There are 2,361 unique plan combinations actively used by participants. The number of active participants in a plan combination range from 1 to 18,448 with an average of 273. The median plan combination has 7 active participants.

The data are similar in nature to that of Huberman and Jiang (2006), who used a cross section of 647 defined contribution (mostly 401k) plans from Vanguard in 2001.

The advent and ensuing popularity of life-cycle funds creates major differences on our data and results compared to Huberman and Jiang (2006). We have data on both holdings of and allocations to investment funds by all plan participants. However, here, we focus primarily on allocations.[10] This creates an information advantage over the data used in Huberman and Jiang (2006) because their allocation data was by asset class and not fund-by-fund.[11] We also have more individual data for some variables.

We study active participants, that is, those who contributed to the plan in the year. Participants who allocate exclusively to life-cycle funds behave quite differently from participants who customize their portfolio by allocating contributions to non-life-cycle funds or those who use life-cycle funds as part of a larger portfolio. Therefore, in addition to analyzing overall participants, we analyze behaviors of "no life-cycle," "some life-cycle" and "life-cycle only" investors separately in much of our analysis. This allows us to understand better the effects of the advent and popularity of auto-diversified life-cycle funds on lifetime financial security.

The variables we use include the number of funds chosen by each participant for allocations (NCHOSEN) with allocation amounts and total contributions (CONTRIBUTION). We also count the number of funds that account for 95% of the participant's allocation (NCHOSEN95). %EQ is the proportion of current-year contributions that a participant invests in equity funds where balanced funds count as ½ equity (following Huberman and Jiang (2006)) and life-cycle funds are given a weight in proportion to the classification of funds held in the life-cycle fund. We have the number of choices (funds) offered by the participant's plan (NCHOICE) and the proportion of equity funds out of all funds offered by a plan (%EQOffered). We have the participant's annual compensation (COMP), total

[10] Similar analysis of holdings data yields similar results.

[11] Huberman and Jiang (2006, p. 769) say Vanguard breaks allocations down across seven categories "money market funds, bond funds, balanced funds, active stock funds, indexed stock funds, company stock funds, and other (mainly insurance policies and nonmarketable securities, which represent less than 0.1 % of the total balance)."

investable assets in the retirement plan (PASSETS) and average wealth in the nine digit zip code of the participant (WEALTH) as a proxy for the participant's total wealth. We have each participant's age (AGE), cumulative time contributing to the plan (TENURE) and gender (FEMALE is a dummy variable that takes on the value of 1 if the participant is female). We have the ratio of the employer's contribution to the participant's contribution (MATCHRATE, Huberman and Jiang (2006) use the average match rate in the plan). We know whether a participant has signed up for web access to his or her accounts (WEB, web access has increased dramatically since 2001). Finally, we have the number of active participants in the plan (Huberman and Jiang (2006) use number of employees to proxy for size).

B. Summary Statistics

Table 2 shows overall summary statistics for our data; summary statistics for no life-cycle, some life-cycle and life-cycle only participants; and, where applicable, similar statistics from Huberman and Jiang (2006). Table 3 gives univariate difference in means t-test statistics between overall participants and subsets of participants based on life-cycle fund holdings. Where applicable it also lists test statistics for differences between overall TIAA participants and those of Huberman and Jiang (2006). Because the sample sizes are large, even small differences in means create statistically significant differences. However, there are many differences that are both economically meaningful and statistically significant.

There are differences in plans between TIAA in 2012 and Vanguard in 2001. The number of choices available to the average investor increased dramatically, nearly tripling. The percentage of participants who have web access has also increased dramatically, more than doubling overall. We note that participants who invest exclusively in life-cycle funds have the lowest rate of web access among TIAA participants. As a percentage of offered funds, equity funds constitute about two-thirds of the funds, on average, in both TIAA and Vanguard plans. Participants who choose life-cycle funds tend to be in plans with higher numbers of funds available and participants who choose life cycle funds exclusively tend to be in plans with a greater percentage of equity funds offered.

There are differences in participants. TIAA participants are more likely to be women and tend to be older than those with Vanguard. Women and younger participants are significantly more likely to invest in life-cycle funds exclusively. Similarly, participants with lower compensation, lower contribution levels and fewer plan assets (PWEALTH) in the plan are more likely to invest in life-cycle funds exclusively. So are investors who live in lower wealth zip codes (ZWEALTH). The contribution rate is significantly higher overall in the TIAA data (average contribution = 10.5% of average compensation) than Vanguard (5.2%). However, among TIAA participants, the contribution rate is significantly lower for participants who use life-cycle funds exclusively (7.6% of compensation). This observation is likely due to life-cycle only participants contributing only at the default rate.

At first, choices seem similar. Overall relative to Vanguard, TIAA participants choose roughly the same number of funds on average (3.4 to 3.5), investing a similar amount in equity (a little over two-thirds on average). However, TIAA participants who do not use life-cycle funds exclusively invest in more funds on average (4.1 to 5.5). Participants who invest only in life-cycle funds typically choose a single fund. However, through this investment, they tend to invest much more heavily in equity than other participants.

III. Results

A. Number of Funds Chosen by Individuals

Figure 1 shows the number plans offering different numbers of investment options. Panel A shows analysis at the plan level. Panel B shows analysis at the plan combination level. The difference arises because participants may participate in more than one plan (e.g., a "primary" retirement plan and a supplemental plan at an institution that may have different numbers of options available). Overall, 32.7% of participants (210,796) participated in more than one plan. The distributions differ dramatically from Huberman and Jiang (2006). First, several standardized plans stand out: 152 plans offer 10 investment options, 202 offer 29 options and 102 offer 49 options. These tend to be small plans, with an average of 166, 235 and 183 participants per plan, respectively. The range is high: 5 plans offer only 1 fund

(accounting for 402 participants) and 4 offer 84 investment options (accounting for 5,131 participants). Plan combinations cover the same range of options. The average plan offering is 32 options and the median plan participant is offered 36 options. The average plan combination offering is 36 options and median plan combination participant is offered 36 options. By contrast, Huberman and Jiang (2006, p. 770), found "relatively few participants are offered more than 22 funds."

Figure 2 shows the number of investment options chosen by participants for their allocations. The distributions differ dramatically from Huberman and Jiang (2006) because of a spike at one fund. Some of this spike is driven by participants who choose a single life-cycle fund. However, even for participants who choose no life-cycle funds, there is a spike at one fund. This implies that, in addition to participants who choose only a life-cycle fund, many participants choose only a single non-life-cycle fund such as TIAA Traditional or TIAA Real Estate.

Figure 3 shows how the distribution of the number of investment options chosen by participants varies by the number of options offered. Panel A shows all participants. The light grey shading shows the range between the 10^{th} percentile and the 90^{th} percentile of participants who are offered each number of options. The dark grey region shows the range between the 25^{th} to the 75^{th} percentile. The black line shows the median allocations. Panel B shows participants who do not invest in any life cycle funds. Panel C shows participants who invest exclusively in life-cycle funds. Panel D shows new participants (those who started contributing to the retirement plan in the past year.) The overall pattern is similar to Huberman and Jiang (2006), but with a bias toward investors who invest in a single fund. This holds across all investors and those who do not invest in life cycle funds. Both new investors and those who invest exclusively in life-cycle funds tend strongly to hold a single fund.[12]

Table 4 shows determinants of the number of funds chosen in the allocations of participants. It is similar to Huberman and Jiang's (2006) Table II except that they use holdings as an approximation for allocations, while we can use allocations directly. We use the same specification as Huberman and Jiang:

[12] Results are similar when analyzing the number of options that constitute 95% of allocations in the plan for each participant.

$$\mathbf{NChosen}_{i,j} = \gamma \mathbf{NChoice}_j + \boldsymbol{\beta} \mathbf{Controls}_{i,j} + \boldsymbol{\varepsilon}_{i,j} \quad (1)$$

where $NChosen_{i,j}$ is the number of funds used in allocations or holdings by individual *i* in plan *j*, $Controls_{i,j}$ is a vector of control variables and $\varepsilon_{i,j}$ is a residual error. The error structure allows for plan-level random effects. Our control variables differ slightly from Huberman and Jiang's (2006) because of differences in the dataset. Individual attributes are CONTRIBUTION, ZWEALTH, FEMALE, AGE, and TENURE (with the plan, not academic tenure).[13] The plan attributes (beyond NChoices) we include are MATCHRATE (the individual match rate instead of the plan average) and NPARTICIPANTS (the number of plan participants as a proxy for plan size).[14] We also include a vector of plan averages of individual participant attributes.

Our results differ markedly from Huberman and Jiang (2006). Overall, we find that more investment options in a plan increases the number of funds used in allocations at the rate of about 1 additional fund used for every 30 additional funds available. This is driven by participants who do not invest exclusively in life-cycle funds. While the increase in allocations is far less than the "1/N" rule would imply, coefficients are significantly positive. Participants with higher contributions (and higher income) choose more funds. Overall, women tend to choose more funds.[15] However, the effect either disappears or reverses for women who invest in life-cycle funds and who are new to their plans. Among participants who do not invest exclusively in life-cycle funds, older participants tend to choose fewer funds. Having web access increases the number of funds in a participant's allocation by nearly 1.

The subset of participants that stands out is participants who invest only in life-cycle funds. These participants typically allocate to one or two funds (investing in more than one life-cycle fund) and may allocate to more funds if they contribute more. Little else seems to matter much (either in terms of statistical significance or size of coefficient relative to the average holdings).

[13] We do not use compensation because it is highly correlated with contributions.
[14] COMPSTK doesn't make sense in context and we do not know whether there was an alternative defined benefit plan.
[15] The later result is consistent with field (Sunden and Surette 1998) and experimental (McDonald and Rietz 2015) evidence that women diversify more in the sense that they tend to invest in more options.

B. Plan level number of funds used

Individual investors typically choose a relatively small number of funds. The number of funds offered has some effect on the number of funds used by participants. At the plan level, this effect may be much larger if different investors choose different sets of funds. Figure 4 shows the average number of funds that account for 75% and 90% of plan assets relative to the number of funds offered. Figure 4 also displays the number of funds that account for 75% and 90% of the individual participants (as opposed to total assets) relative to the number of funds offered (referred to as "participant hits"). There are statistically significant upward trends. However, the trends fall far that implied by a plan level 1/N rule. Across the range of number of funds offered in their data, results are similar to Huberman and Jiang's (2006). In our data, the results extend across a much larger range of number of funds offered.

Figure 5 presents a different view of the trends. It shows the results (asset balances and participants hits) for the top fund and top three funds out of the total. If 1/N rule holds, then the top funds should account for a declining percentage of assets held. Figure 5 shows a small, but statistically significant downward trend. It is lower than a strict 1/N rule would imply but still meaningful. Using each plan as an observation, we run the following weighted least squares regression:

$$\ln(Top1\%_i) = a + b \times \ln(n_i) + \epsilon_i \quad (2)$$

where $Top1\%_i$ is the percentage of plan assets in the fund with the most assets in plan combination i,n_i is the number of choices available in plan combination i and the weighting is by the number of participants in the plan combination. We run a similar regression for the percentage of plan assets in the largest three funds using $\ln(n_i/3)$ as the independent variable. A "1/N null hypothesis" would be a=0 and b=-1 for both regressions. In both cases, the coefficient on the independent variable is significantly negative (-0.1029, t-stat.=-10.59 and -0.1274, t-stat.=-19.21), indicating that the percent invested in the top funds declines with the number of funds offered. However, in both cases, the coefficient is significantly higher than -1 (t-stat. = 92.29 and 131.62), indicating that the decline is far less than implied by a plan level 1/N rule.

C. Allocations across Chosen Funds

Even if participants do not allocate investments evenly across all available choices, they may allocate investments evenly across the funds that they do choose, i.e., use a "conditional 1/N" rule. We look at two measures of whether participants allocate evenly across chosen funds: a normalized Herfindahl index and a measure we develop to measure the uniqueness of contribution levels to funds.

The normalized Herfindahl index is computed as:

$$H = \frac{\left(\sum_{i=1}^{n} s_i^2\right) - \frac{1}{n}}{1 - \frac{1}{n}}, \tag{3}$$

where *i* indexes the *n* funds chosen by a participant and s_i is the fraction of the participant's total allocation that is invested in fund *i*. H is defined to be 1 for a single fund chosen. The normalized Herfindahl index ranges from 0 to 1. If a participant spreads allocations evenly across the chosen funds, the normalized Herfindahl is 0. If a participant allocates an incremental amount to *n*-1 out of *n* funds, then the normalized Herfindahl would approach 1.

Table 5 shows average normalized Herfindahl indices for participants who choose between 1 and 10 funds where the indices are computed based upon the amounts in the most recent allocation. Overall, the average investor who chooses 2 funds has a normalized Herfindahl index of 0.160. This corresponds to 70.0% allocated to one investment fund and 30.0% allocated to the other. The split corresponding to the average Herfindahl index for participants who hold no life-cycle funds is 68.4% to the larger fund. It is 75.6% for participants who mix life-cycle and non-life-cycle funds; 71.1% for participants who hold two life-cycle funds and 78.6% for new participants.

For participants who hold 3 funds, the overall average normalized Herfindahl index is 0.156. What does this mean? How close to a "conditional 1/N" rule can a participant be while holding 3 funds with a normalized Herfindahl index of 0.156? Consider a participant who allocates 1/3 to one fund. The participant would have to allocate 49.5% to the largest fund allocation and 17.2% to the smallest allocation to achieve a normalized Herfindahl index of 0.156. Alternatively, suppose the participant allocated the same amount to two out of the three funds. The participant's allocations would have to be 52.0%, 24.0% and 24.0% to the three funds. Neither is anywhere close to a "conditional 1/N" allocation.

While the results from the normalized Herfindahl indices show that participants do not use a "conditional 1/N" rule, they do decline as participants invest in more funds. Figure 6 shows average normalized Herfindahl indices for participants who hold 1 through 10 funds.[16] The drop indicates that, while participants are not allocating evenly across chosen funds, they are allocating more than incremental amounts to each fund as they choose more funds.

To present a different view of what participants are doing, we ask how many unique allocation levels a participant uses across funds chosen for allocations. A participant who follows a conditional "1/N" rule will have only one unique allocation level: Each fund will be allocated the total times 1/N. A participant who allocates a different amount to each fund chosen will have N unique allocations. To control for rounding errors and the way that participants select percentage allocations through TIAA, we define allocation levels to two funds as the same if their absolute difference is within 1.5% of the total allocation. Table 5 shows the average number of unique allocation levels for participants who choose 1 to 10 funds based on the most recent allocation. Figure 7 plots these numbers.[17] Generally, the number of unique allocation levels increases rapidly as the number of funds chosen increases. Overall, increasing the number of funds held by 1 increases the number of unique allocations, on average, by 0.44 according to a linear fit. This suggests that typical investors choose new allocations when they add funds, in contrast to a conditional "1/N" rule.

Finally, Table 5 shows the percentage of participants who actually allocate $1/N^{th}$ of their allocation to each fund chosen and thereby utilize a conditional "1/N" rule (within a 1.5% rounding error). Figure 8 plots this data.[18] A significant fraction of participants who allocate to two funds split the allocation evenly. Some participants who allocate to 4 funds do so as well. Beyond 5 funds, incrementally small numbers of participants follow a conditional "1/N" rule, with a small bounce at 10 funds.

[16] We suppress data points where the mean is the average of less than 10 observations.
[17] We suppress data points where the mean is the average of less than 10 observations.
[18] We suppress data points where the mean is the average of less than 10 observations.

D. Equity Exposure, Age, Gender and Life-Cycle Fund Effects on Equity Allocations

Even if participants tend to choose a small number of funds and do not spread allocations evenly across chosen funds, the composition of funds offered by a plan may influence the composition of funds in participants' allocations. Participants in plans with a higher equity exposure[19] may allocate more to equity than participants in plans with lower equity exposure.[20] Figure 9 shows a histogram of plans and participants with various levels of equity exposure along with the median equity allocation at each level. We find there is a small, but significant effect: plans with higher equity exposure are associated with higher equity allocations.

The results so far suggest that participants who choose life cycle funds behave differently from those who do not. Does this change their allocations to equity? Prior research suggests that age and gender also may influence equity allocations. Are there significant effects in our data? Figure 10 shows the average equity percentage allocations of participants in different age groups broken down by gender and how the participants use life-cycle funds. Table 6 presents regressions results showing the significance of differences shown in Figure 10 using Powell's (1984) Censored Least Absolute Deviation regression (with censoring limits at 0% and 100%) using bootstrapped standard errors with plan combination level sampling units (to allow for differential variance between versus within plan combinations). The regression separates life-cycle only investors from other participants with a dummy variable configuration. It also shows whether the equity exposure of participants (percentage of equity funds in a plan's offering) affects equity allocations.

Life-cycle only investors have overall higher equity allocations. While participants in plans with higher equity exposure tend to invest more in equity, using life-cycle funds exclusively offsets this tendency.

---

[19] Equity exposure is measured by the percentage of equity funds offered by the plan with balanced funds counted as ½ equity and life-cycle funds counted according the classification of funds held by the life-cycle fund.

[20] This may arise for several reasons. Participants who want higher equity exposure may gravitate to employers whose plans offer more equity funds or may lobby their employer to add more equity.. Participants may believe that the structure of plan offerings represent the allocations that should be made to different asset classes. Participants may also choose randomly several funds from the many available. If so, a larger percentage of equity funds could lead to larger equity allocations by chance.

Women tend to allocate significantly less to equity than men. In the younger age categories, women who don't use life-cycle funds or those who use life-cycle funds as part of a larger portfolio tend to hold the least equity (65% and 66% in the 25-30 age group, respectively). Next are men who choose no or some life-cycle funds (68% and 69% in the 25-30 age group, respectively). Again, using life-cycle funds exclusively offsets this tendency. Women who use life-cycle funds exclusively have the same equity allocations as men who use life-cycle funds exclusively.

Younger participants who invest exclusively in life cycle funds have much higher equity exposures (88% in the 25-30 age group for both men and women). The equity allocations of all types of participants decline significantly with age. If participants invest exclusively in life cycle funds, equity allocations drop with age at a significantly faster rate. This result is likely due to life-cycle only participants being on an automatic "glide-path" that reduces relative equity holdings while other participants must request these changes be made.

E. Equity Exposure, Demographics and Plan Rule Effects on Equity Allocations of Participants

In Table 7, we investigate equity exposure effects on equity allocation controlling for a range of demographic, income, wealth and plan information again using Powell's (1984) Censored Least Absolute Deviation regression, bootstrapped standard errors and plan combination level sampling units. The dependent variable is the percentage of each participant's allocation that is invested in equity funds. The independent variable of interest is the percentage of funds in the participant's plan menu that are equity funds.

For participants who do not choose life-cycle funds, more equity exposure leads to larger equity allocations. Overall, participants with higher Zip+4 wealth and contribute more invest more in equities and older participants who have been with the plan longer invest less (though there appears to be some interaction between age and tenure). Women invest less in equity unless they invest exclusively in life-cycle funds. Life-cycle only investors' equity allocations are unaffected by equity exposure. Older life-cycle only participants who have been with the plan longer invest less in equity (this follows naturally

from the design of the life-cycle funds). Higher contributions are associated with higher equity allocations, but Zip+4 wealth goes in the opposite direction. Notably: women who invest exclusively in life-cycle funds have the same equity exposure as men who invest exclusively in life-cycle funds. After controlling for other factors, all classes of participants appear to decrease equity exposure at similar rates. Thus, while life-cycle funds "hard wire" falling equity exposure with age, non-life-cycle investors follow a similar, albeit customized "do it yourself," pattern.

IV. Who Chooses Life-Cycle Funds?

Given the impact of life-cycle funds on equity exposure, it is natural to ask what characteristic makes a participant more likely to choose them. Table 2 shows univariate differences and seems to indicate the participants who only choose life cycle funds tend to be younger, and have lower income, contributions and wealth. Women tend to be more likely to allocate to life-cycle funds than men. Table 8 presents a multivariate analysis using logistic regressions to explain the choice of allocating only to life-cycle funds or allocating to any life-cycle funds. The data are restricted to primary plans where life-cycle funds are available in the plan. Dependent variables include demographic and plan level variables used in prior regressions plus a dummy variable for whether a life-cycle fund is the plan default. On average, about 31% of participants allocate ONLY to life cycle funds within their primary plan while 37.5% allocate some to life-cycle funds. Many of the variables are statistically significant and a few have a large effect on the probability of choosing only or any life-cycle funds. Women are about 0.6 to 1.2 percentage points more likely to only choose life-cycle funds than men. Older participants are 1/3 to a little more than 1/2 a percentage point a year less likely to choose life cycle funds. The longer a participant has been with a plan, the less likely he or she is to choose life cycle funds at the rate of 2.4 to 2.8 percentage points per year. However, the overwhelmingly dominant factor in determining whether a participant chooses life cycle funds is whether a life cycle fund is the default. A participant in a plan with a life-cycle default is around 20 to 23 percentage points more likely to allocate ONLY to life cycle funds than a participant who

is not in a plan with a life-cycle default. This is about 4.5 times as likely to allocate only to life-cycle funds.

V. Discussion

Options for investment differ considerably between current (2012) TIAA investment plans and prior analysis of Vanguard plans in 2001. There are now many more choices in a typical plan and participants are much more likely to have web access to their accounts. Life-cycle funds have become very popular, particularly among women, younger and less well-off investors. We observe relatively high (but adequate) savings rates of around 10% of income annually.

While the number of options increased significantly, typical participants still only invest in a handful of funds. Average equity allocations remain around 2/3rds of allocations but do tend to decline with age. Most participants do not appear to be using naïve diversification. However, we document some significant plan menu effects. First, participants in plans with more investment options tend to use more funds. The result is significant but small; with an average increase of 1 for every 30 additional funds offered.. Second, participants in plans with a larger share of equity funds available tend to invest more in equity funds. Again, the result is significant but small, with an increase of 10% in equity exposure resulting in an increase of X% of equity allocation. Finally, life cycle fund participation results in dramatically higher equity exposure, especially for younger participants. However, life cycle funds decrease equity exposure with age at a faster rate than observed for non-life-cycle investors.

VI. References

Benartzi, Shlomo, and Richard Thaler. 2001. "Naive diversification strategies in defined contribution savings plans." *American Economic Review* 91 (1): 79-98.

Campbell, John Y., and Luis M. Viceira. 2002. "Strategic Asset Allocation: Portfolio Choice for Long-Term Investors." *Oxford Scholarship Online.* Oxford University Press. 01 03. Accessed 09 17, 2015. http://www.oxfordscholarship.com/view/10.1093/0198296940.001.0001/acprof-9780198296942.

Choi, James J., David Laibson, and Brigitte C. Madrian. 2010. "Why Does the Law of One Price Fail? An Experiment on Index Mutual Funds." *The Review of Financial Studies* 23 (4): 1405-1432.

Huberman, Gur, and Wei Jiang. 2006. "Offering versus Choice in 401(k) Plans: Equity Exposure and Number of Funds." *The Journal of Finance* 61 (2): 763-801.

Iyengar, Sheena S., and Mark R. Lepper. 2000. "When choice is demotivating: Can one desire too much of a good thing?" *Journal of personality and social psychology* 79 (6): 995-1006.

Iyengar, Sheena S., Gur Huberman, and Wei Jiang. 2004. "How much choice is too much?: Contributions to 401(k) retirement plans." In *(ed) Pension design and structure: New lessons from behavioral finance*, by Utkus S. Mitchell, 83–96. Oxford, UK: Oxford University Press.

Madrian, Brigitte C., and Dennis F. Shea. 2001. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *The Quarterly Journal of Economics* 116 (4): 1149-1187.

McDonald, Robert L., and Thomas A. Rietz. 2015. *Ratings and Asset Allocation: An Experimental Analysis.* Working Paper, University of Iowa.

Powell, James L. 1984. "Least Absolute Deviations Estimation for the Censored Regression Model." *Journal of Econometrics* 25 (3): 303–325.

Richardson, Davod P., and Benjamin Bissette. 2014. "Trends in Premium and Asset Allocation by TIAA-CREF Participants: 2005-2011." *TIAA-CREF Research Dialogue* 112.

Sunden, Annika E., and Brian J. Surette. 1998. "Gender differences in the allocation of assets in retirement savings plans." *American Economic Review* 88 (2): 207-711.

U.S. Department of Labor, Employee Benefits Security Administration. 2015. *Private Pension Plan Bulletin: Abstract of 2012 Form 5500 Annual Reports.* Washington, DC: U.S. Department of Labor. Accessed 9 20, 2015. http://www.dol.gov/ebsa/pdf/2012pensionplanbulletin.pdf.

VII. Figures

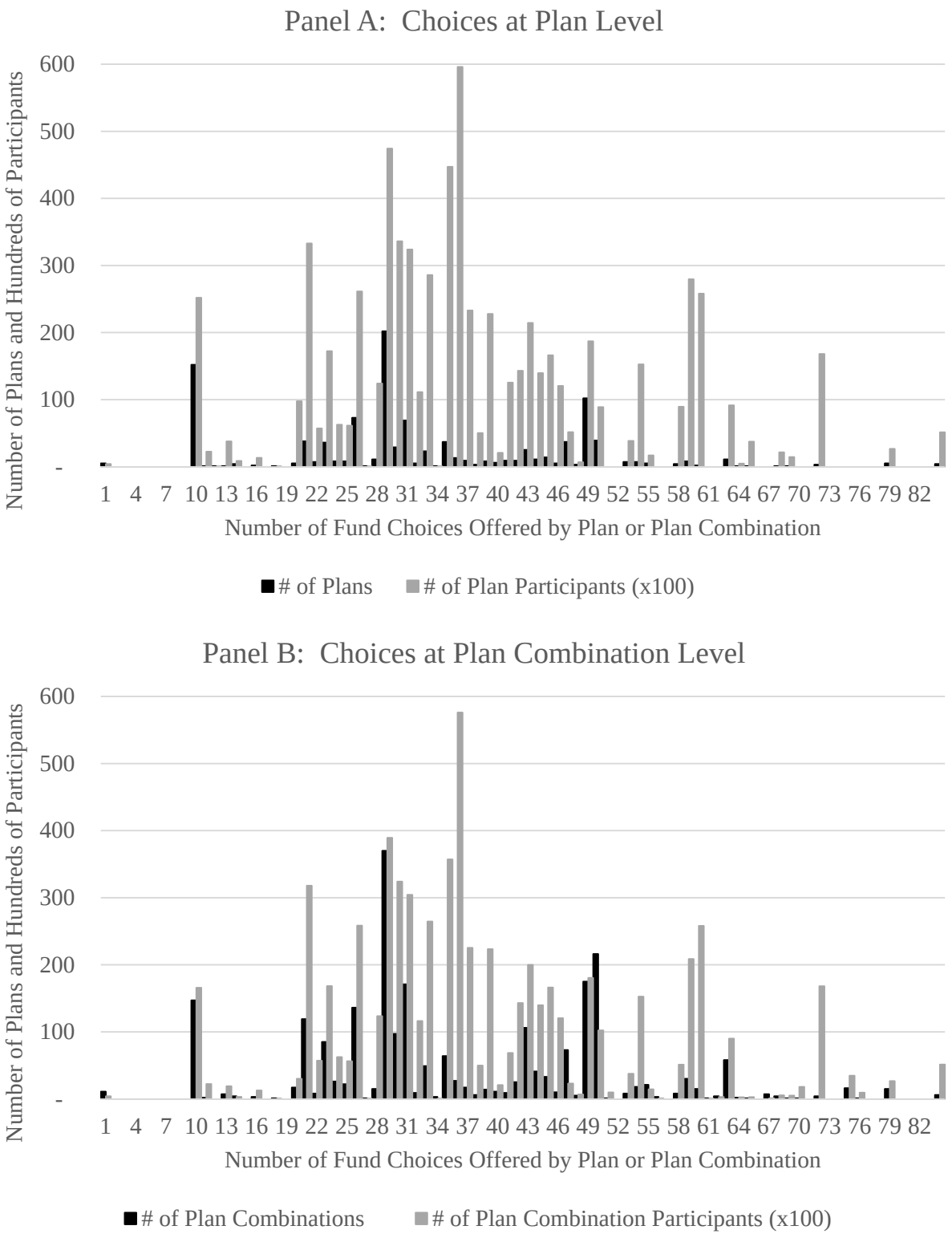

Figure 1: Distribution of the plans offering different numbers of funds and the number of participants offered different numbers of funds in their plans

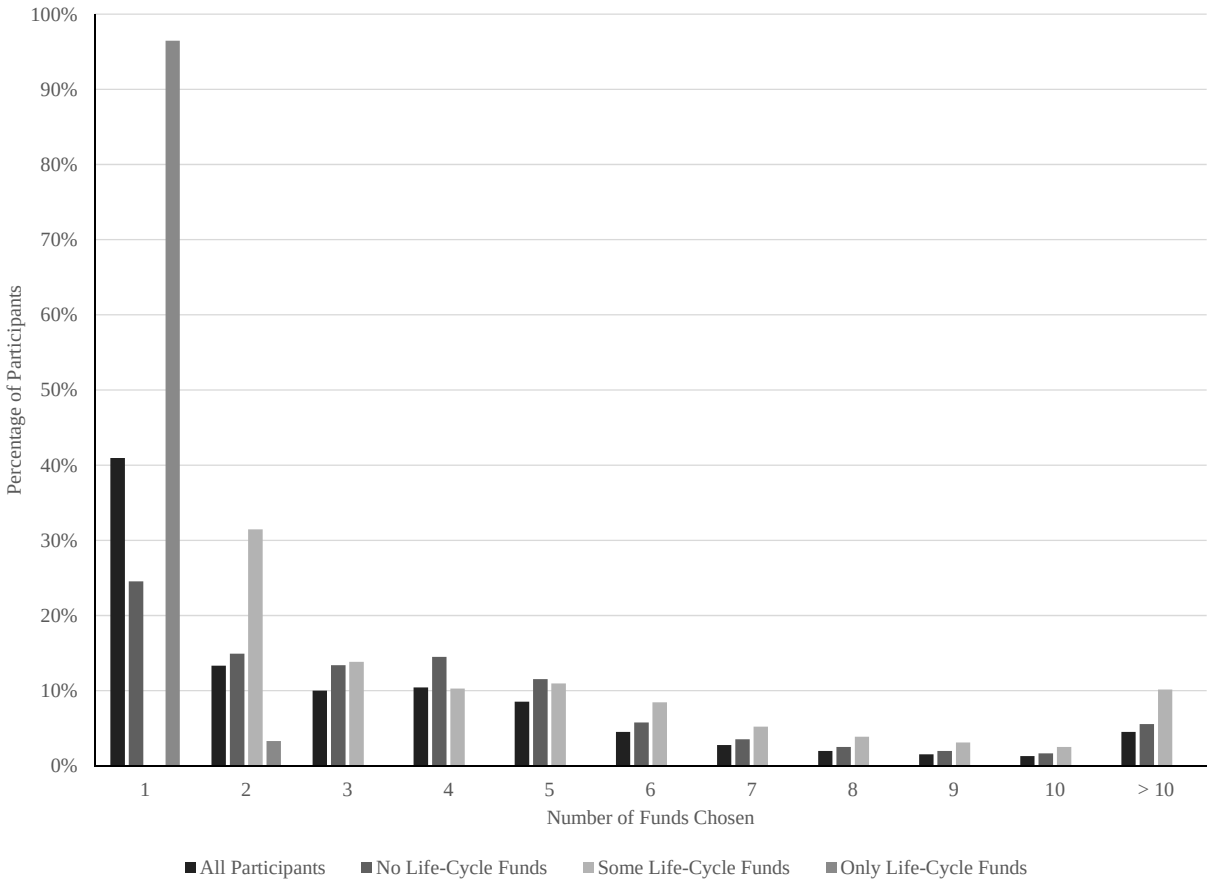

Figure 2: Histogram of Numbers of Funds Chosen by Participants

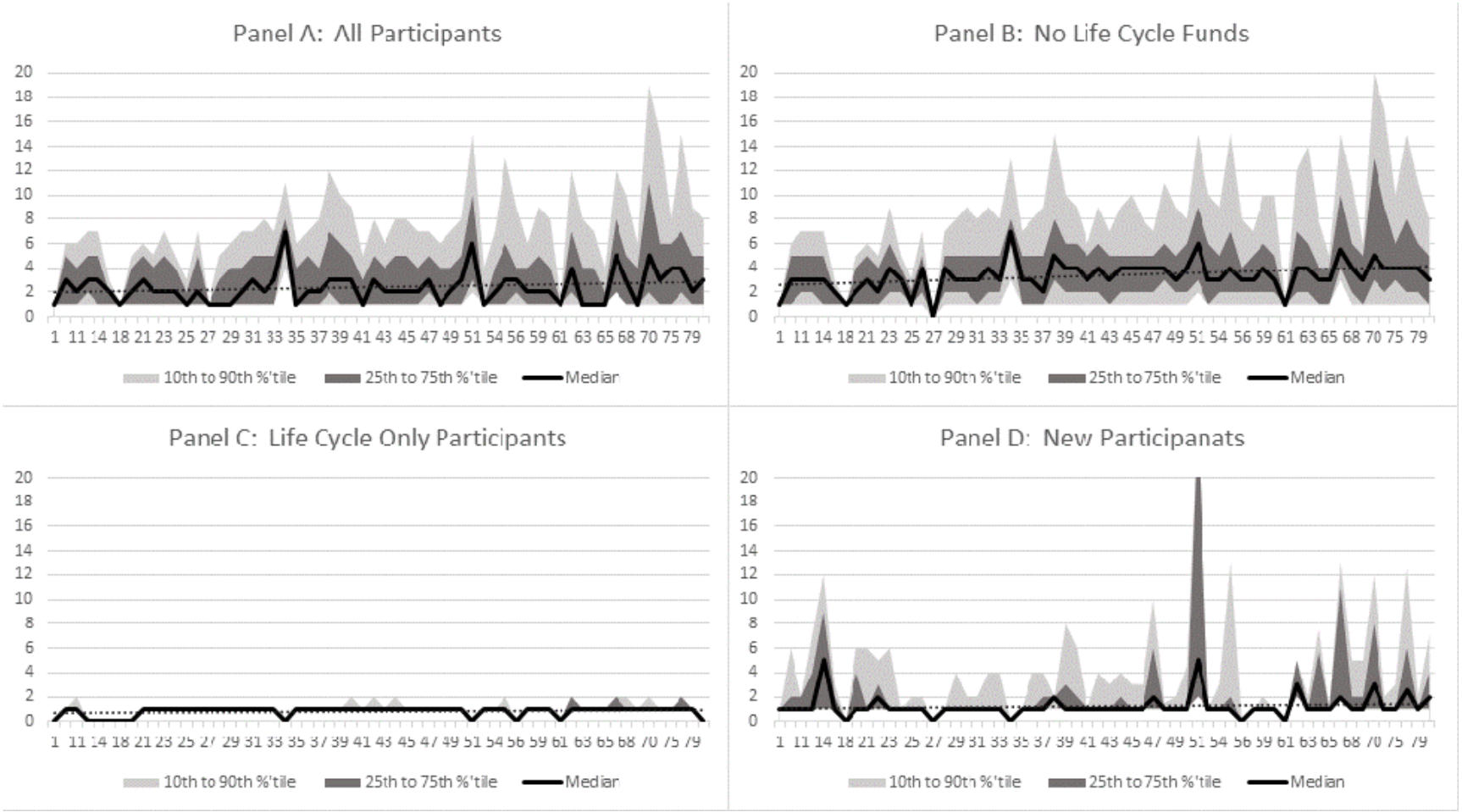

Figure 3: Distributions of the investment options used for allocations by the number of options offered by plans. The light grey shows the range between the 10th and 90th percentile, the dark grey between the 25th and 75th, the black line show the median for each subgroup and the dotted line is the linear trend for the median.

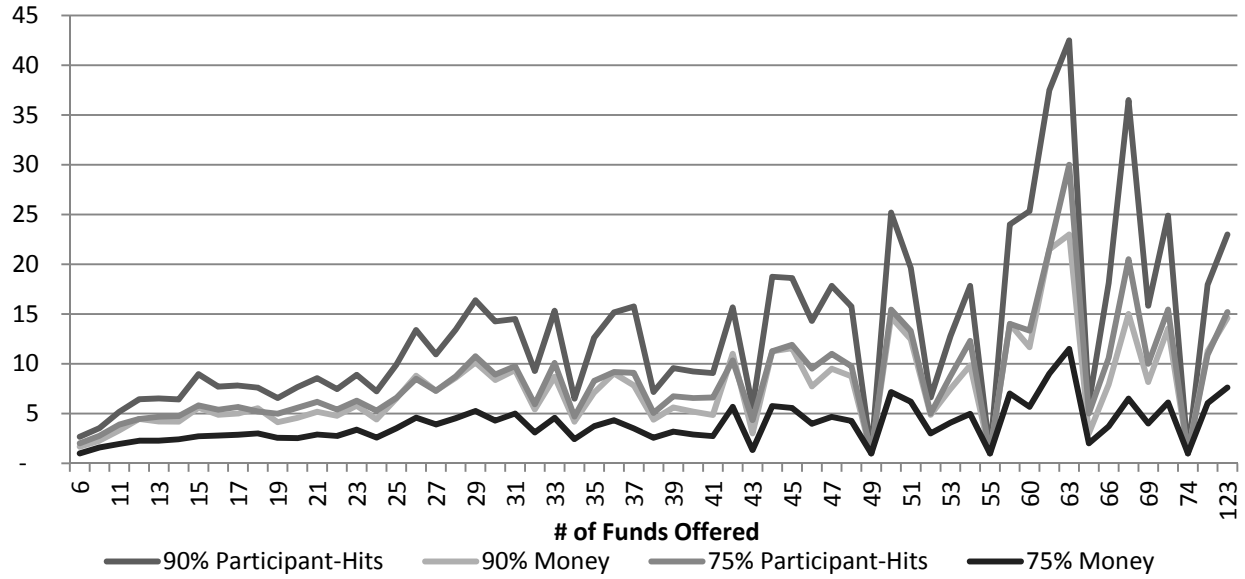

Figure 4: The number of funds used by plans versus number of funds offered. For each level of number of funds offered, the number of funds needed to hold 90% and 75% of the plan-level balances and total participant hits, where each participant record counts as a hit.

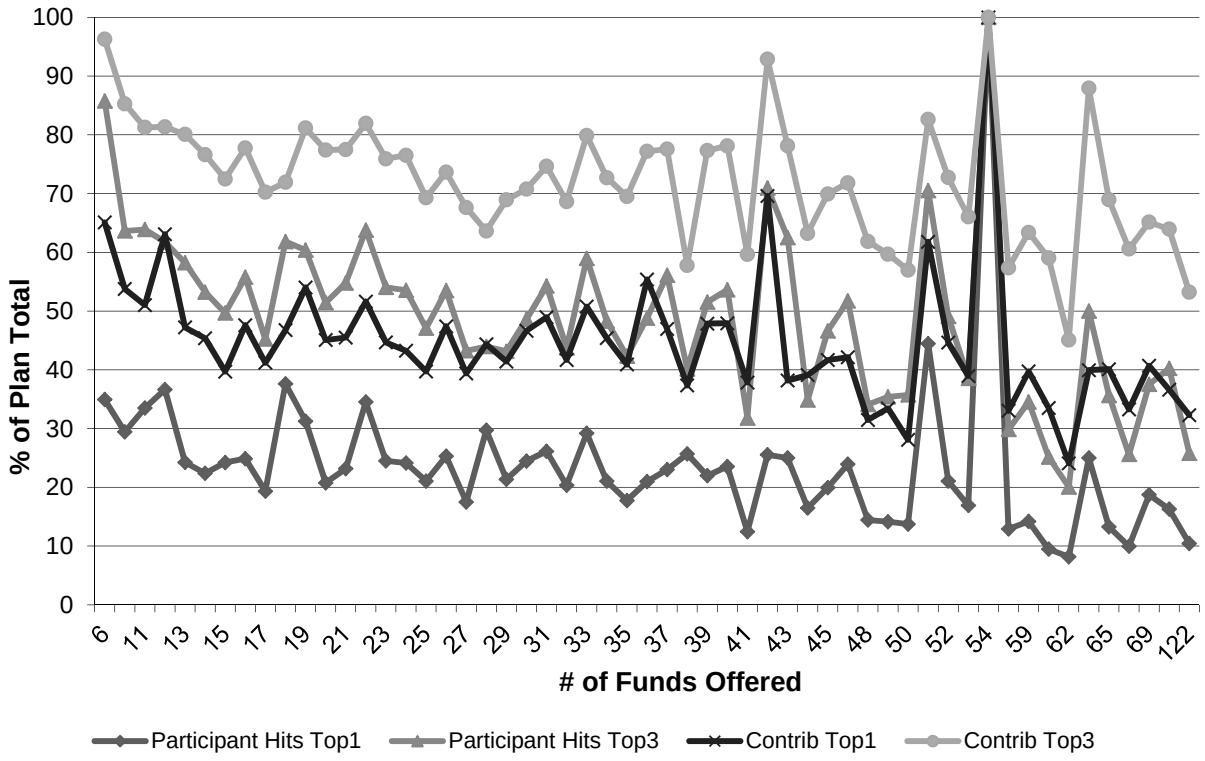

Figure 5: Concentration of plan assets and participants versus number of funds offered. The proportion of plan assets and participant hits concentrated in the top one and three funds.

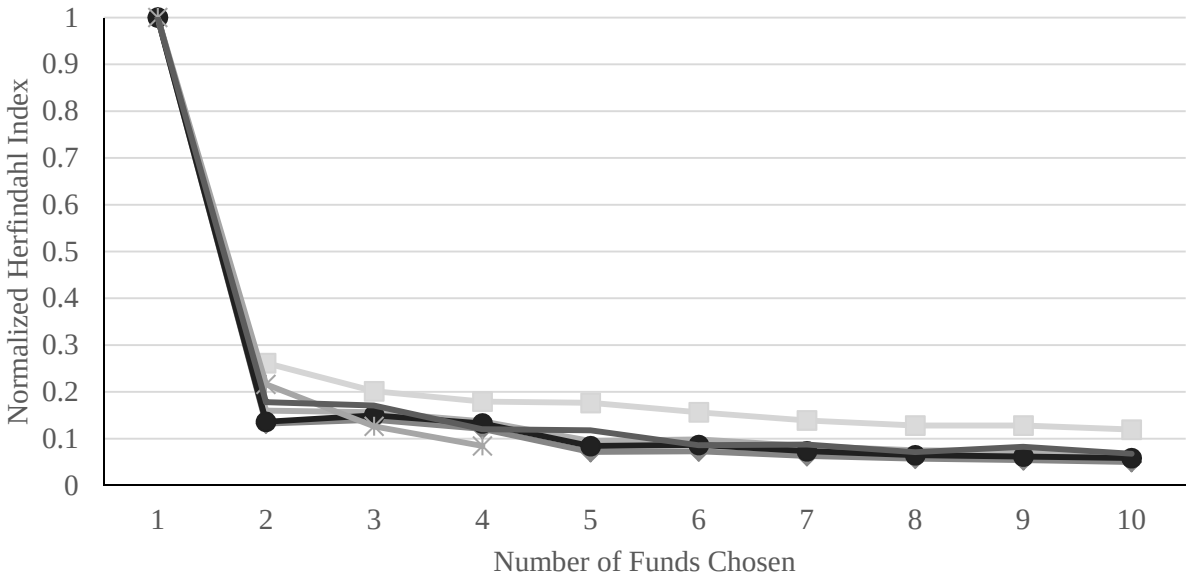

Figure 6: Normalized Herfindahl Indices for Participants who allocate to between 1 to 10 Funds
*Means are suppressed for 5 or more funds chosen for participants who choose only life cycle funds because 13 or fewer participants held 5 through 10 funds.

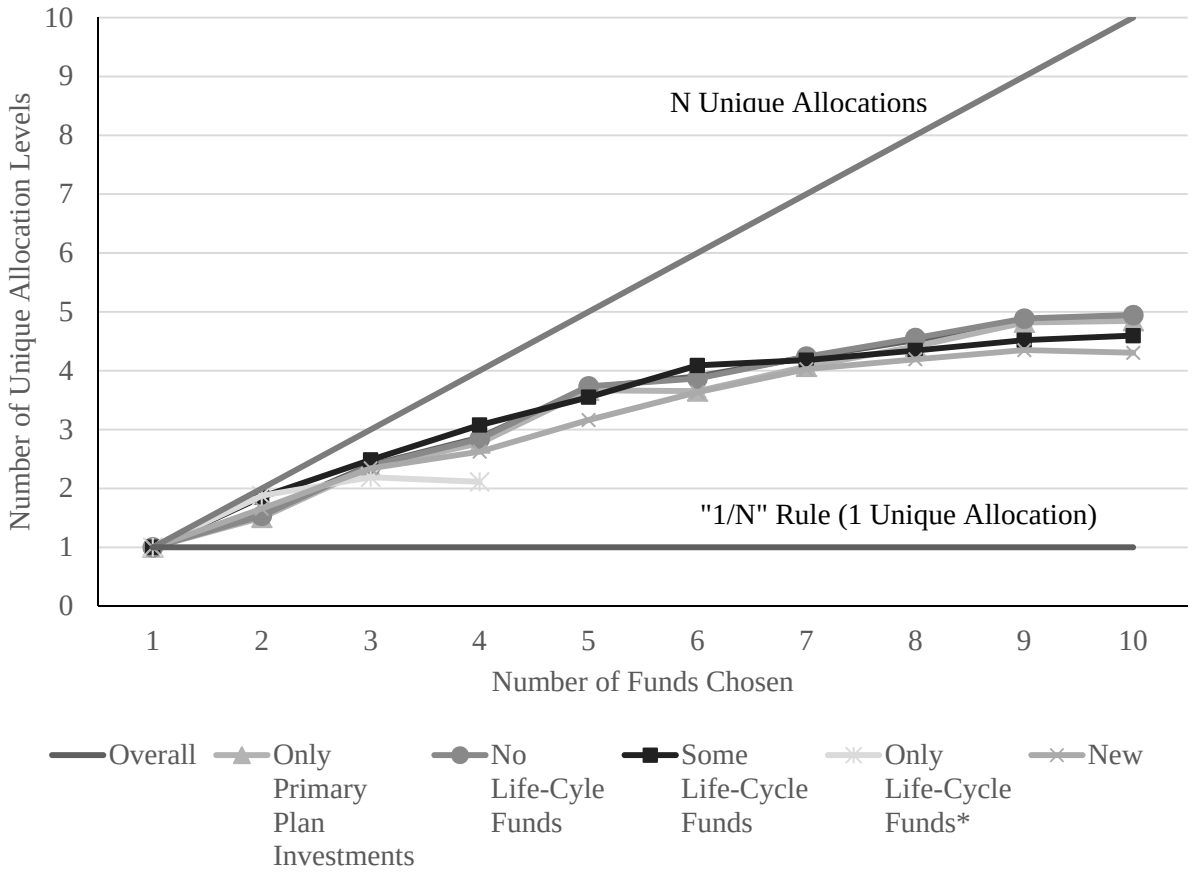

Figure 7: Average Number of Unique Allocation Levels for Participants who Hold 1 to 10 Funds
*Means are suppressed for 5 or more funds chosen for participants who hold only life cycle funds because 10 or fewer participants held 5 through 10 funds.

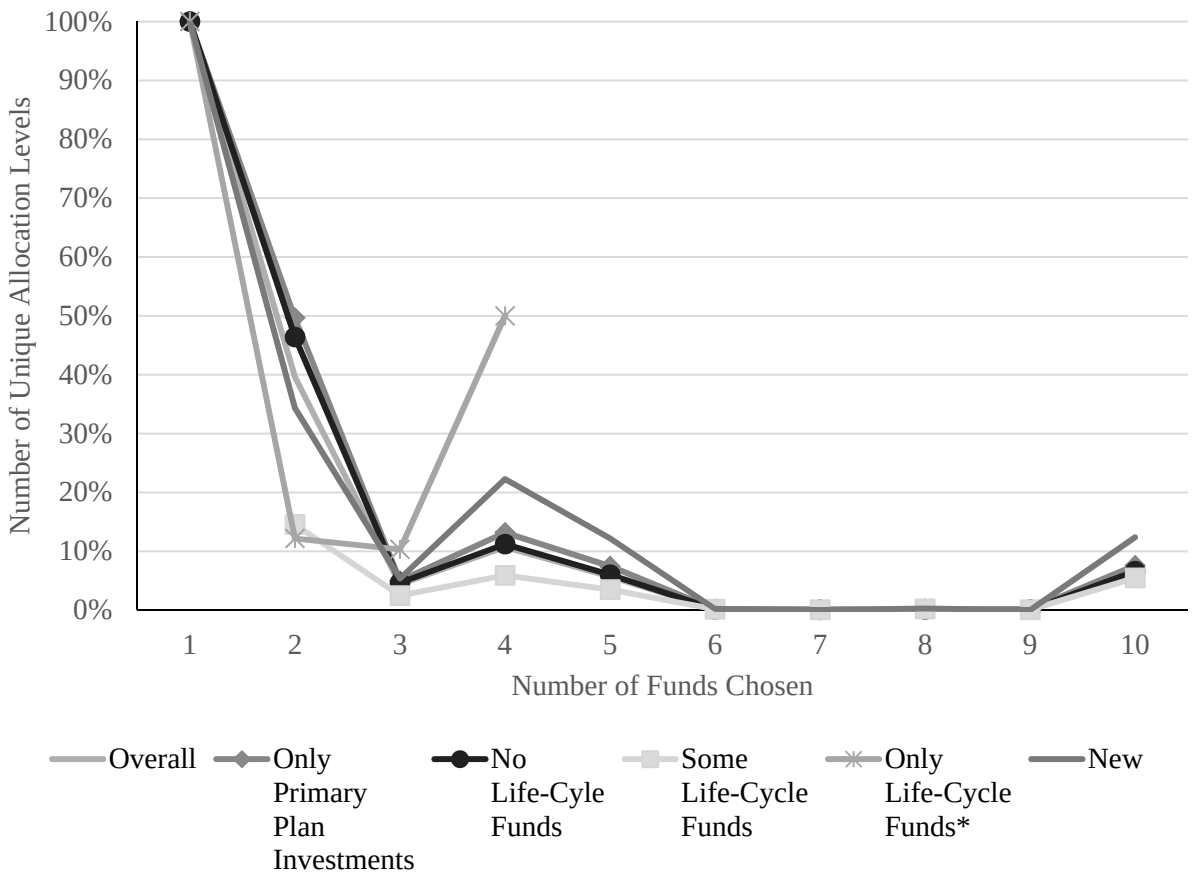

Figure 8: Percentage of Participants Who Follow a Strict "1/N" Rule and Allocate to 1 to 10 Funds
*Means are suppressed for 5 or more funds chosen for participants who allocate only to life cycle funds because 10 or fewer participants held 5 through 10 funds.

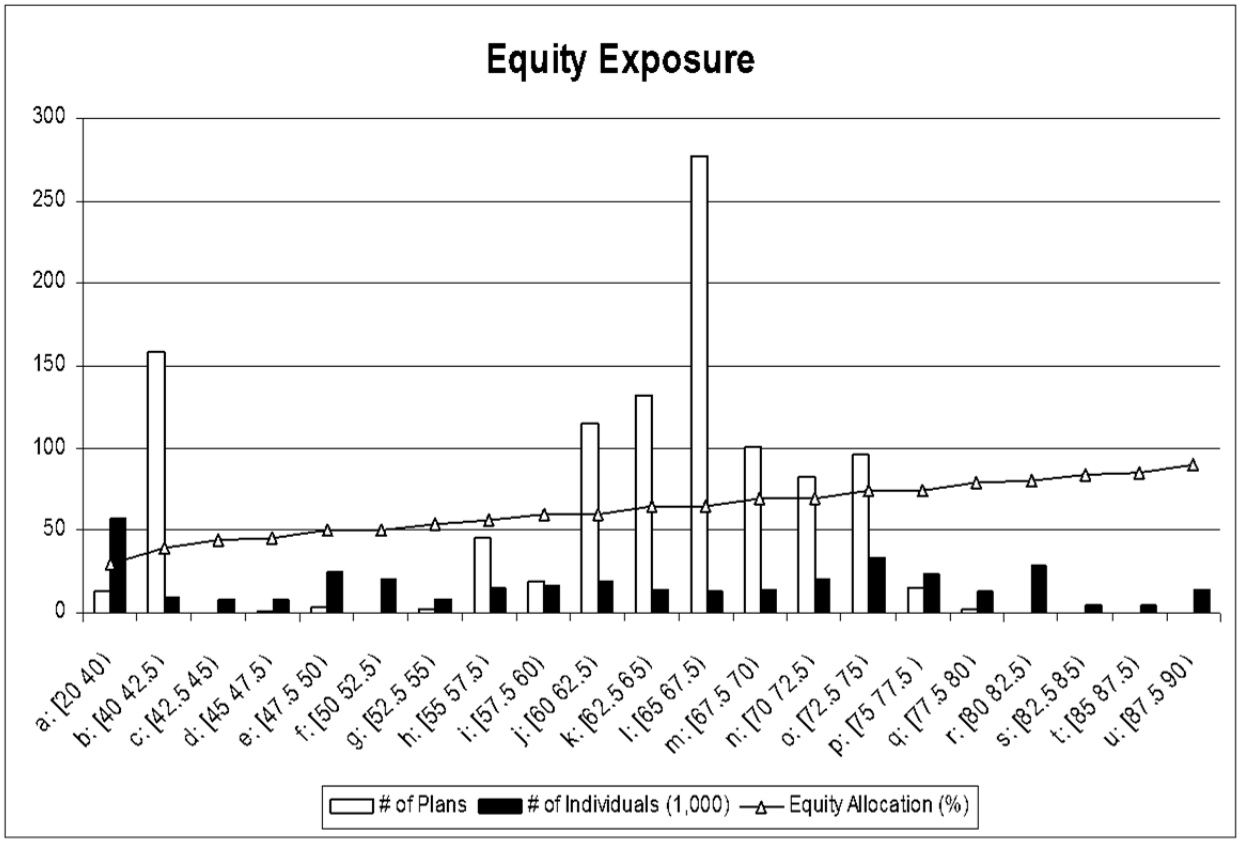

Figure 9: Histogram of numbers of plans, histogram of numbers of participants and median equity exposures of participants in plans with various ranges of equity exposure (percentage of fund choices that are equity funds).

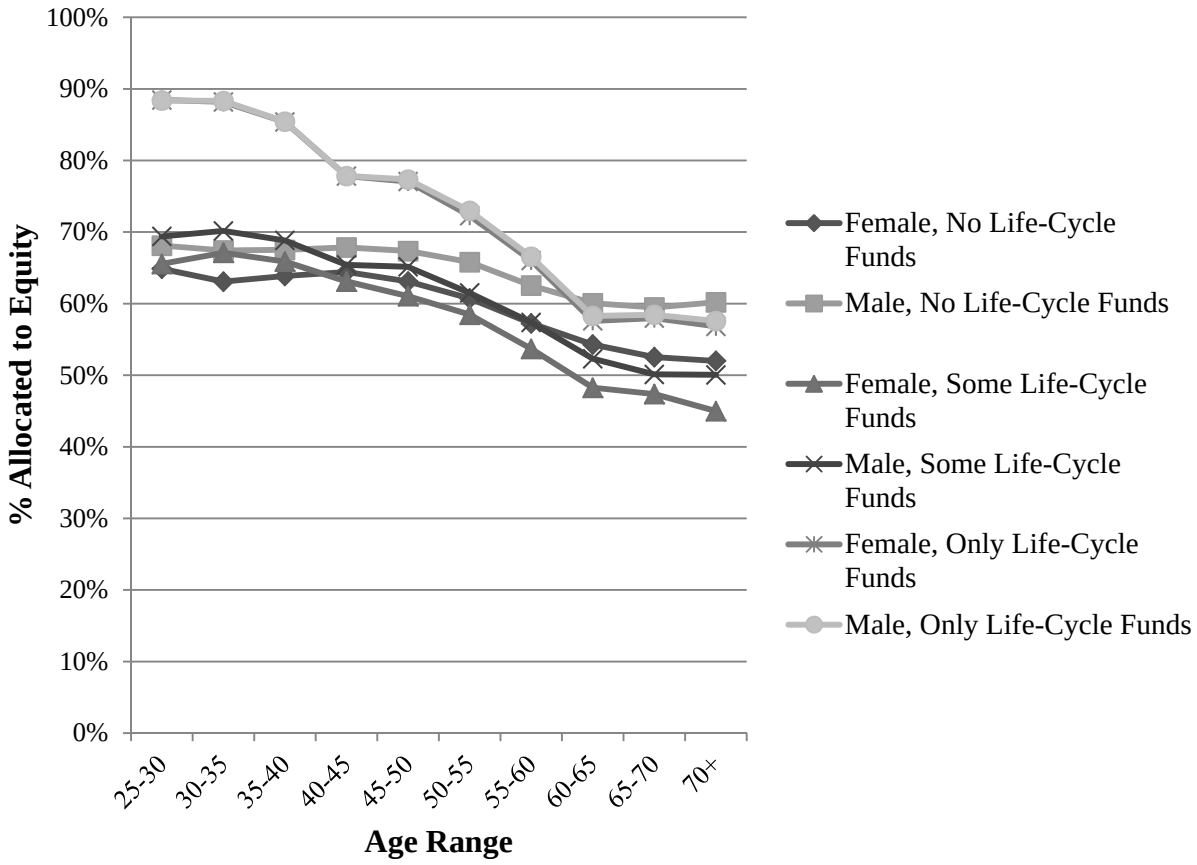

Figure 10: Age, Gender and Life-Cycle Fund Effects on Equity Allocations

VIII. Tables

Table 1: Number of Plans and Number of Participants Participating in each Plan Type

Plan Type	Number of Plans	Number of Participants		
		Mean	Median	Total
401(a)	133	759	51	101013
401(a)/414(h)(2)	253	801	25	202718
401(k)	3	3402	1521	10206
403(b) DC	210	1641	222	344622
403(b) TDA	291	720	87	209531
457(b)	96	134	12.5	12828
457(b) Private	53	78	43	4157
457(f)	34	19	2	648
Overall	1073	825	53	885723

*There are 645,197 unique participants, but many participate in more than one plan, creating multiple observation. For analysis, we either aggregate across plans for a given participant or use only the participant's primary plan (the plan with the most assets).

Table **2**: Summary Statistics

Summary statistics and comparison to Huberman and Jiang (2006). Variables include: NCHOSEN is the number of funds in which a participant chooses to invest all of his or her contribution; NCHOSEN95 is the number of funds in which a participant chooses to invest at least 95% of his or her contribution; %EQ is the proportion of current-year contributions that a participant invests in equity funds; %EQOffered is the proportion of equity funds out of all funds offered by a plan; CONTRIBUTION is the dollar amount that a participant contributed to his or her defined contribution plan in the year; COMP is a participant's annual compensation; PWEALTH is average total investable assets in the plan (Huberman and Jiang use average wealth by zip code); FEMALE is the gender dummy variable; AGE and TENURE stand for a participant's age and his tenure with the current employer or plan; MATCHRATE is the ratio of the employer contribution to the employee contribution for the year (Huberman and Jiang use the average match rate in the plan); NCHOICE is the number of funds available to the plan participants; WEB is the proportion of participants who register for web access to their DC accounts in a plan; and NPARTICIPANTS in the number of active plan participants (Huberman and Jiang use number of employees).

			TIAA-CREF Data					
Variable	**Units**	**Statistic**	**Overall**	**Only Primary Plan Investments**	**No Life-Cycle Funds**	**Some Life-Cycle Funds**	**Only Life-Cycle Funds**	**Huberman and Jiang**
NCHOSEN	1	Mean	3.37	3.16	4.13	5.48	1.07	3.48
		Median	2.00	2.00	3.00	4.00	1.00	3.00
		Std.Dev	3.34	3.10	3.43	4.07	0.28	1.99
		Obs.	645,197	582,342	397,693	60,514	186,990	572,157
NCHOSEN95	1	Mean	3.09	2.96	3.79	4.74	1.07	3.12
		Median	2.00	2.00	3.00	4.00	1.00	3.00
		Std.Dev	2.75	2.64	2.81	3.16	0.27	1.69
		Obs.	645,197	582,341	397,693	60,514	186,990	572,157
%EQ	1%	Mean	68.00	69.09	62.04	60.61	80.45	66.84
		Median	72.50	74.00	60.00	63.67	80.40	78.94
		Std.Dev	23.08	22.70	25.21	22.58	11.54	35.40
		Obs.	563,539	508,254	316,035	60,514	186,990	572,157
%EQOffered	1%	Mean	66.80	66.83	66.56	66.34	67.46	66.42
		Median	66.78	66.78	66.90	66.70	66.78	68.18
		Std.Dev	6.15	6.25	6.74	5.14	5.00	7.73
		Obs.	644,797	581,986	397,293	60,514	186,990	572,157
CONTRI-BUTION	$ 1,000	Mean	10.64	8.74	12.50	13.68	5.69	4.32
		Median	7.12	6.73	8.88	9.31	3.63	3.34
		Std.Dev	11.33	8.03	11.84	13.52	7.11	3.38
		Obs.	645,197	582,342	397,693	60,514	186,990	572,157
COMP	$10,000	Mean	6.67	6.69	7.34	7.47	4.75	6.44
		Median	5.59	5.63	6.34	6.19	3.88	5.25
		Std.Dev	5.07	5.09	5.09	5.76	4.16	6.67
		Obs.	247,743	245,439	155,517	26,607	65,619	572,157
PWEALTH	$10,000	Mean	18.72	19.88	25.53	18.56	4.12	N/A
		Median	6.55	7.23	11.52	8.60	1.30	
		Std.Dev	35.68	36.84	41.50	30.08	10.66	
		Obs.	638,595	576,630	394,994	60,182	183,419	
ZWEALTH[§]	$10,000	Mean	46.96	47.55	56.28	45.49	27.04	6.06
		Median	11.57	11.65	15.67	13.00	5.70	1.64
		Std.Dev	125.14	126.80	139.15	117.12	87.25	17.84
		Obs.	618,171	558,055	384,107	58,705	175,359	572,157
FEMALE	0-1	Mean	0.54	0.53	0.52	0.54	0.58	0.38
		Median	1.00	1.00	1.00	1.00	1.00	-
		Std.Dev	0.50	0.50	0.50	0.50	0.49	0.46
		Obs.	641,978	579,985	396,717	60,298	184,963	572,157
AGE	Years	Mean	48.40	48.27	52.13	48.31	40.50	43.36
		Median	49.01	48.77	52.93	48.70	38.48	44.00
		Std.Dev	12.33	12.35	11.09	10.98	11.48	9.75
		Obs.	645,082	582,247	397,665	60,503	186,914	572,157

Table 2 (Continued)

TENURE	Years	Mean	12.73	13.03	15.94	12.86	5.45	11.06
		Median	10.70	11.10	14.20	11.30	3.40	9.08
		Std.Dev	9.96	10.08	9.73	9.01	6.29	9.25
		Obs.	625,283	564,814	392,506	58,859	173,918	572,157
MATCHRATE	1%	Mean	183.42	184.12	187.26	192.79	169.76	N/A
		Median	160.00	160.00	160.00	121.56	133.33	
		Std.Dev	279.26	280.30	296.13	339.86	195.63	
		Obs.	343,185	340,354	228,125	30,222	84,838	
NCHOICE	1	Mean	38.45	37.64	37.47	39.63	40.16	13.66
		Median	36.00	35.00	36.00	36.00	36.00	13.00
		Std.Dev	14.40	14.19	14.88	13.69	13.35	5.75
		Obs.	645,197	582,342	397,693	60,514	186,990	572,157
WEB	1%	Mean	62.57	62.90	68.95	76.24	44.57	28.68
		Median	100.00	100.00	100.00	100.00	-	26.21
		Std.Dev	48.39	48.31	46.27	42.56	49.70	11.73
		Obs.	645,197	582,342	397,693	60,514	186,990	572,157
NPARTICIPANTS	1	Mean	273.39	587.63	213.93	46.37	148.40	N/A
		Median	7.00	7.00	9.00	3.00	7.00	
		Std.Dev	1,075.10	2,044.86	830.67	179.61	496.16	
		Obs.	2,360	991	1,859	1,305	1,260	

[§]The Huberman and Jiang Zip+4 Wealth measure differs from ours because the institutions covered in the IXI wealth measures have changed dramatically since 2001

Table 3: Difference in Means Test Statistics on Summary Variables

Difference in Means t-Test Statistics between Data Sets in Table 1

Variable	Stastic	Overall vs Primary Plan Investments	Overall vs No Life-Cycle	Overall vs Some Life-Cycle	Overall vs All Life-Cycle	Overall vs Huberman and Jiang
NCHOSEN	Difference	-0.21***	0.76***	2.11***	-2.30***	0.11***
	t-statistic	-35.868	111.156	123.928	-547.559	22.421
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000
NCHOSEN95	Difference	-0.13***	0.70***	1.65***	-2.02***	0.03***
	t-statistic	-27.437	124.761	123.896	-581.544	7.428
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000
%EQ	Difference	1.10***	-5.95***	-7.38***	12.45***	-1.16**
	t-statistic	24.787	-109.518	-76.285	305.930	-20.650
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000
%EQOffered	Difference	0.03**	-0.24***	-0.46***	0.66***	-0.38***
	t-statistic	2.374	-18.222	-20.793	47.470	-29.978
	p-value	0.0176	0.0000	0.0000	0.0000	0.0000
CONTRI-BUTION	Difference	-1.89***	1.86***	3.05***	-4.95***	-6.32***
	t-statistic	-107.604	79.325	53.718	-228.331	-426.922
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000
COMP	Difference	0.02*	0.67***	0.80***	-1.92***	-0.23***
	t-statistic	1.648	40.920	21.812	-100.107	-17.108
	p-value	0.0993	0.0000	0.0000	0.0000	0.0000
PWEALTH	Difference	1.16***	6.81***	-0.16	-14.60***	
	t-statistic	17.526	85.372	-1.226	-285.682	N/A
	p-value	0.6306	0.0000	0.2203	0.0000	
ZWEALTH	Difference	0.59**	9.32***	-1.47***	-19.92***	
	t-statistic	2.549	33.866	-2.888	-75.989	N/A[§]
	p-value	0.6306	0.0000	0.2203	0.0000	
FEMALE	Difference	-0.01***	-0.02***	0.00	0.04***	-0.16***
	t-statistic	-8.977	-19.476	-0.584	32.571	-180.892
	p-value	0.7493	0.0000	05594	0.0000	0.0000
AGE	Difference	-0.12***	3.73***	-0.09*	-7.90***	-5.04***
	t-statistic	-5.594	159.634	-1.870	-257.643	-251.388
	p-value	0.0000	0.0000	0.0615	0.0000	0.0000
TENURE	Difference	0.30***	3.21***	0.13***	-7.28***	-1.67***
	t-statistic	16.428	160.392	3.316	-370.517	-95.215
	p-value	0.8790	0.0000	0.0000	0.0000	0.0000
MATCHRATE	Difference	0.70	3.84***	9.37***	-13.66***	
	t-statistic	1.036	4.909	4.657	-16.587	N/A
	p-value	0.3003	0.0000	0.0000	0.0000	
NCHOICE	Difference	-0.81***	-0.98***	1.17***	1.71***	-24.79***
	t-statistic	-31.343	-33.199	20.082	47.957	-1273.208
	p-value	0.0000	0.0000	0.0000	0.0000	0.0000
WEB	Difference	0.33***	6.38***	13.67***	-18.00***	-33.89***
	t-statistic	3.804	67.249	74.623	-138.720	-544.759
	p-value	0.0001	0.0000	0.0000	0.0000	0.0000
NPARTICIPANTS	Difference	314.24***	-59.46	-227.02***	-124.98***	
	t-statistic	4.579	-2.026	-10.009	-4.775	N/A
	p-value	0.0000	0.1127	0.0002	0.0050	

"***," "**" and "*" denote significance at the 99%, 95% and 90% levels of confidence, respectively.

[§]While Huberman and Jiang have a zip-+4 wealth variable, the institutions covered in the IXI wealth measures have changed dramatically since 2001.

Table 4: Determinants of Number of Funds Used for Allocations

NCHOSEN is the number of funds in which a participant chooses to invest all of his or her allocation. NCHOICE is the number of fund options available to employees of the plan combination. Definitions of control variables are the same as those in Table I. The coefficients and standard errors are multiplied by 100. The first column uses all participant records. The rest use only participants who (1) choose no life-cycle funds, (2) choose some life-cycle funds and some other finds, (3) choose only life-cycle funds and (4) are new (i.e., started contributing to the plan in the past year). The wealth variables enters as a log. Standard errors adjust for both heteroskedasticity and arbitrary correlation of error disturbances clustered at the plan combination level with plan level random effects. The effective sample size for the coefficients on individual (plan) attributes is of the order of the number of individuals (plans). "*," "**" and "***" indicate that the coefficient differs from 0 at the 90%, 95% and 99% level of confidence, respectively.

	All	No Life-cycle Funds Chosen	Some Life-cycle Funds Chosen	Only Life-cycle Funds Chosen	New
NCHOICE	3.38***	4.05***	3.84***	0.08*	0.61
	(0.29)	(0.31)	(0.41)	(0.05)	(0.37)
CONTRIBUTION	2.11***	1.90***	1.81***	0.12***	2.35***
	(0.24)	(0.25)	(0.28)	(0.04)	(0.64)
LN(ZWEALTH)	-0.98**	-0.12	-0.78	-0.20*	1.03*
	(0.40)	(0.57)	(0.85)	(0.12)	(0.60)
FEMALE	12.38***	15.58***	-7.91**	0.82	-8.32***
	(1.51)	(1.76)	(3.61)	(0.74)	(2.61)
AGE	-0.76***	-3.15***	-2.93***	-0.07*	-0.40**
	(0.15)	(0.14)	(0.27)	(0.04)	(0.17)
TENURE	2.68***	-1.62***	0.34	0.12	-8.04
	(0.33)	(0.22)	(0.37)	(0.10)	(6.48)
MATCHRATE	0.01**	0.00	0.00	0.01	0.02
	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)
WEB	91.35***	81.53***	98.61***	0.44	87.69***
	(3.79)	(4.31)	(5.29)	(0.44)	(9.39)
Avg(FEMALE)	31.57	25.72	-32.94	-7.73	26.94
	(19.77)	(21.67)	(35.64)	(6.56)	(43.00)
Avg(AGE)	0.45	-1.73**	-2.06	-0.26	0.09
	(0.73)	(0.83)	(1.43)	(0.27)	(1.23)
Avg(TENURE)	4.17***	8.68***	5.33***	0.60**	5.79***
	(1.02)	(1.10)	(1.56)	(0.25)	(1.88)
Avg(LN(ZWEALTH))	-2.07	-13.17***	-9.69	0.40	19.70***
	(3.67)	(4.19)	(6.82)	(1.46)	(6.03)
NPARTICIPANTS	0.00**	0.00*	0.00	0.00***	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Intercept	57.33*	366.72***	510.03***	118.75***	44.27
	(34.39)	(39.28)	(60.46)	(9.65)	(48.77)
N	593,130	375,964	56,542	160,624	40,037
R2	9.28%	8.19%	6.47%	0.24%	7.86%

Table 5: Allocation Concentration, Number of Unique Allocations and Fraction of Participants who Follow a Conditional "1/N" Rule

H is the average Normalized Herfindahl Index for participants who choose a given number of funds. NoA is the average number of unique allocation amounts for participants who choose a given number of funds. % "1/N" is the percentage of participants who follow a conditional "1/N" rule for the chosen number of funds. Obs. is the number of participants who choose a given number of funds.

Number of Funds Chosen	Statistic	Overall	Only Primary Plan Investments	No Life-Cycle Funds	Some Life-Cycle Funds	Only Life-Cycle Funds	New
1	H	1.000	1.000	1.000	#N/A	1.000	1.000
	NoA	1.000	1.000	1.000	#N/A	1.000	1.000
	% "1/N"	100%	100%	100%	#N/A	100%	100%
	Obs.	252,360	240,556	84,578	#N/A	167,782	34,479
2	H	0.160	0.132	0.136	0.262	0.216	0.178
	NoA	1.60357	1.50348	1.53592	1.85439	1.87831	1.6566
	% "1/N"	40%	50%	46%	15%	12%	34%
	Obs.	66,832	57,969	52,915	10,178	3,739	1,424
3	H	0.156	0.140	0.150	0.201	0.126	0.171
	NoA	2.396	2.359	2.385	2.484	2.190	2.343
	% "1/N"	4%	5%	5%	2%	10%	5%
	Obs.	56,246	51,047	49,169	6,951	126	799
4	H	0.137	0.121	0.133	0.179	0.084	0.120
	NoA	2.864	2.768	2.841	3.076	2.111	2.625
	% "1/N"	11%	13%	11%	6%	50%	22%
	Obs.	58,902	52,105	52,959	5,907	36	768
5	H	0.095	0.071	0.084	0.176	0.240	0.118
	NoA	3.713	3.665	3.735	3.549	3.000	3.162
	% "1/N"	6%	7%	6%	4%	22%	12%
	Obs.	47,223	40,005	41,534	5,680	9	673
6	H	0.098	0.073	0.086	0.156	0.117	0.086
	NoA	3.904	3.652	3.867	4.089	3.400	3.636
	% "1/N"	0%	0%	0%	0%	0%	0%
	Obs.	23,067	17,245	19,245	3,817	5	516
7	H	0.084	0.063	0.073	0.139	0.055	0.087
	NoA	4.229	4.070	4.240	4.179	2.000	4.026
	% "1/N"	0%	0%	0%	0%	0%	0%
	Obs.	14,292	11,221	11,893	2,397	2	422
8	H	0.075	0.057	0.065	0.128	0.017	0.071
	NoA	4.520	4.412	4.555	4.343	2.000	4.194
	% "1/N"	0%	0%	0%	0%	0%	0%
	Obs.	10,594	8,817	8,854	1,739	1	403
9	H	0.072	0.054	0.062	0.128	0.010	0.082
	NoA	4.825	4.819	4.885	4.519	2.000	4.350
	% "1/N"	0%	0%	0%	0%	0%	0%
	Obs.	8,160	7,397	6,824	1,335	1	274
10	H	0.067	0.050	0.058	0.119	0.000	0.068
	NoA	4.895	4.846	4.946	4.595	1.000	4.304
	% "1/N"	6%	8%	7%	5%	100%	12%
	Obs.	7,058	6,573	6,055	1,002	1	194

Table 6: Age, Gender and Life-Cycle Fund Effects on Equity Allocations of Participants

The independent variable is, % Equity, is the percentage of current-year contributions that are allocated to equity funds where balanced funds are counted as 1/2 and life-cycle funds are counted as the weighted averages of funds held by the life cycle fund. % Equity Offered, is the percentage of equity funds out of all funds offered by the participant's plan combination, counting the same way. Independent variables are the participant's age and dummy variables for gender and life-cycle-only investors, and interactions among these variables. Estimates are obtained through censored median regression (Powell (1984)) to account for the constraint that %EQ falls within [0,100%]. Bootstrapped standard errors are sampled by plan combination sampling units to adjust for both hetreoskedasticity and differences between variances within plans. ** indicates that the coefficient is different from 0 at the 5% significance level under the normal approximation confidence intervals.

Variable	Overall
Constant	0.5534**
	(0.1029)
Life-Cycle Only (1/0)	0.4954**
	(0.1175)
% Equity Offered	0.4755**
	(0.1445)
Life-Cycle Only	-0.3770**
x % Equity Offered	(0.1638)
Female (1/0)	-0.0554**
	(0.0127)
Life-Cycle Only	0.0486**
x Female	(0.0132)
Age	-0.0056**
	(0.0004)
Life-Cycle Only	-0.0017**
x Age	(0.0004)
Age x Female	0.0001
	(0.0002)
Life-Cycle Only	0.0000
x Age x Female	(0.0002)
Final sample size	645,082
Pseudo R2	20.12%

Table 7: Determinants of the Equity Allocations of Participants

The independent variable, % Equity, is the percentage of current-year dollar contributions by a participant that are allocated to equity, where equity funds are classified as 100% equity, balanced funds are classified as 1/2 equity and life-cycle funds are classified according to the weighted average of classifications of funds held by the life cycle fund. % Equity Offered, is the number of equity funds divided by the number of funds offered by the participant's plan combination. (Balanced and life-cycles funds are counted fractionally, classified as above.) Control variables are: (1) individual attributes: total annual contribution (in thousands) , the log of the zip+4 wealth level (in ten thousands), gender, age, tenure with the plan, the individual match rate and whether the participant is registered for web access; and (2) the number of funds offered by the participant's plan; (3) plan average of individual attributes. Estimates are obtained through censored median regression (Powell (1984)) to account for the constraint that %EQ falls within [0,100%]. Bootstrapped standard errors are sampled by plan combination sampling units to adjust for both hetreoskedasticity and differences between variances within plans. ** indicates that the coefficient is different from 0 at the 5% significance level under the normal approximation confidence intervals.

Variable	Overall	No Life-Cycle Funds	Some Life-Cycle Funds	Only Life-Cycle Funds
Constant	1.0731**	0.6737**	0.9723**	1.0231**
	(0.1161)	(0.1196)	(0.1020)	(0.0554)
% Equity Offered	0.3233**	0.3517**	-0.0174	0.0691
	(0.0960)	(0.1321)	(0.1053)	(0.0685)
Contribution	0.0007**	0.0014**	0.0002	0.0004**
	(0.0002)	(0.0003)	(0.0002)	(0.0001)
Log(Wealth)	0.0054**	0.0146**	0.0080**	-0.0005**
	(0.0006)	(0.0008)	(0.0010)	(0.0002)
Female (1/0)	-0.0204**	-0.0322**	-0.0210**	-0.0016
	(0.0016)	(0.0027)	(0.0034)	(0.0009)
Age	-0.0091**	-0.0081**	-0.0078**	-0.0075**
	(0.0001)	(0.0003)	(0.0002)	(0.0001)
Web Access (1/0)	0.0019	0.0577	0.0307**	0.0035**
	(0.0025)	(0.0100)	(0.0070)	(0.0008)
Tenure	-0.0025**	0.0029**	0.0011**	-0.0002**
	(0.0003)	(0.0005)	(0.0003)	(0.0001)
# of Funds on Menu	0.0010**	0.0010**	0.0011**	0.0001
	(0.0003)	(0.0004)	(0.0003)	(0.0001)
Matchrate	0.0000	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Avg Female	-0.0665	-0.1345**	-0.0808**	-0.0035
	(0.0395)	(0.0557)	(0.0341)	(0.0223)
Avg Age	-0.0033	-0.0041	-0.0016	0.0008
	(0.0022)	(0.0027)	(0.0019)	(0.0010)
Avg Web	-0.0078	0.2727**	0.1159**	0.0276
	(0.0375)	(0.0865)	(0.0405)	(0.0265)
Avg Tenure	0.0036	0.0072**	0.0021	0.0000
	(0.0023)	(0.0030)	(0.0017)	(0.0010)
Avg Contrib	0.0007	-0.0015	-0.0007	-0.0002
	(0.0008)	(0.0008)	(0.0004)	(0.0004)
Avg Ln Wealth	-0.0243**	-0.0412**	-0.0037	-0.0006
	(0.0084)	(0.0105)	(0.0099)	(0.0027)
Final sample size	593,128	375,934	56,542	160,624
Pseudo R2	13.26%	4.19%	7.58%	48.68%

Table 8: Logit Models for Whether Participants Hold Life-Cycle Funds

The independent variable is 1 if the participant allocates only to life-cycle funds (Models 1 and 2) or at all to life-cycle funds (Models 3 and 4) in his or her primary plan. Independent variables are the number of choices offered by the participant's primary plan, the participant's total annual contribution (in thousands) , the log of the participant's zip+4 wealth level (in ten thousands), gender, age, whether a life-cycle fund is the plan default, tenure with the plan, a life-cycle default/tenure interaction, the individual match rate and the log of the number of participants in the plan. When plan level controls are used (Models 2 and 4), the controls are the plan averages of gender, age, tenure and wealth. Robust standard errors are clustered at the plan level. "***," "**," and "*" indicates that the coefficient is different from 0 at the 99%, 95% and 90% levels of confidence, respectively.

Parameter	Statistic	Model 1: Only Life-Cycle Funds Used	Model 2: Only Life-Cycle Funds Used	Model 3: Any Life-Cycle Funds Used	Model 4: Any Life-Cycle Funds Used
Intercept	Coef.	1.4700***	4.4122***	1.2476*	4.5426***
	(Std. Err.)	(0.5080)	(1.0374)	(0.7273)	(1.0211)
Number of Choices	Coef.	-0.0054	-0.0079	-0.0129**	-0.0156**
	(Std. Err.)	(0.0056)	(0.0058)	(0.0063)	(0.0067)
	d(Pr)/d(x)	-0.0833%	-0.1229%	-0.2672%	-0.3261%
Contribution (x$1,000)	Coef.	-0.0435***	-0.0354***	-0.0295***	-0.0233***
	(Std. Err.)	(0.0079)	(0.0066)	(0.0090)	(0.0076)
	d(Pr)/d(x)	-0.6680%	-0.5493%	-0.6112%	-0.4859%
ln(Zip Code Wealth (x$10,000))	Coef.	0.0022	0.0070	0.0059	0.0114**
	(Std. Err.)	(0.0078)	(0.0052)	(0.0077)	(0.0047)
	d(Pr)/d(x)	0.0338%	0.1093%	0.1227%	0.2369%
Female	Coef.	0.0768**	0.0405**	0.0539	0.0215
	(Std. Err.)	(0.0346)	(0.0188)	(0.0345)	(0.0186)
	d(Pr)/d(x)	1.1791%	0.6287%	1.1180%	0.4475%
Age	Coef.	-0.0248***	-0.0226***	-0.0280***	-0.0255***
	(Std. Err.)	(0.0022)	(0.0016)	(0.0021)	(0.0017)
	d(Pr)/d(x)	-0.3811%	-0.3498%	-0.5801%	-0.5310%
Life-Cycle Default	Coef.	1.5055***	1.2649***	1.6125***	1.4159***
	(Std. Err.)	(0.3447)	(0.3381)	(0.3081)	(0.2968)
	d(Pr)/d(x)	23.1246%	19.6165%	33.4649%	29.5256%
Tenure	Coef.	-0.1555***	-0.1593***	-0.1298***	-0.1342***
	(Std. Err.)	(0.0187)	(0.0179)	(0.0147)	(0.0140)
	d(Pr)/d(x)	-2.3887%	-2.4696%	-2.6947%	-2.7976%
Life-Cycle Default x Tenure	Coef.	-0.0007	0.0033	0.0117	0.0146
	(Std. Err.)	(0.0230)	(0.0225)	(0.0201)	(0.0195)
	d(Pr)/d(x)	-0.0112%	0.0517%	0.2427%	0.3053%
Match Rate	Coef.	-0.0004	-0.0004	-0.0003	-0.0003
	(Std. Err.)	(0.0003)	(0.0003)	(0.0002)	(0.0002)
	d(Pr)/d(x)	-0.0065%	-0.0058%	-0.0069%	-0.0065%
ln(Plan Participants)	Coef.	-0.0489	-0.0879	0.0143	-0.0300
	(Std. Err.)	(0.0623)	(0.0637)	(0.0942)	(0.0870)
	d(Pr)/d(x)	-0.7516%	-1.3628%	0.2966%	-0.6256%
Plan Level Controls?		No	Yes	No	Yes
Obs.		488,475	488,475	488,475	488,475
Psuedo R2		30.29%	30.94%	25.66%	26.27%
Percent = 1		31.24%	31.24%	37.50%	37.50%
Percent Correctly Classified		82.44%	82.46%	78.30%	78.43%