Alphabeticity Bias in 401(k) Investing*

Thomas W. Doellman
John Cook School of Business
Saint Louis University
3674 Lindell Blvd.
St. Louis, MO 63108
tdoellma@slu.edu

Jennifer Itzkowitz
Stillman School of Business
Seton Hall University
400 South Orange Ave
South Orange, NJ 07079
jennifer.itzkowitz@shu.edu

Jesse Itzkowitz
Ipsos Behavioral Science Center
360 Park Avenue South,17th Floor
New York, NY 10010
jesse.itzkowitz@ipsos.com

Sabuhi H. Sardarli
College of Business Administration
Kansas State University
2097 BB, 1301 Lovers Lane
Manhattan, KS 66506
ssardarli@ksu.edu

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Abstract

Structural factors which cause irrational investment in defined contribution savings plans are of great concern. Using a proprietary database of 401(k) plans we show that alphabeticity – the order that fund names appear when listed in alphabetical order – significantly biases participants' investment allocation decisions. While we show a larger impact as the number of funds in the plan increases, this bias is strong even when relatively few funds are available in the plan menu. Importantly, our findings suggest that a more strategic ordering of funds could result in favorable outcomes for participants.

JEL Classification: G10, G11, G20, G21, G23

1. Introduction

Investments in 401(k) and other defined contribution (DC) plans constitute a significant proportion of Americans' retirement savings. According to the Investment Company Institute (2017), as of year-end 2016, $7.6 trillion in assets were held in DC plans, accounting for 28% of all retirement assets in the U.S. As DC plans have grown in prevalence, so have individuals' responsibility over their financial futures. Thus, it is critical to understand the factors that shape individuals' investment decisions in these plans. Prior work shows that several factors can preclude DC plan participants from investing rationally: bias, behavioral inertia, framing, and a lack of financial literacy.[1] We consider a new behavioral bias – alphabeticity – in the context of 401(k) investing and examine its potential effects on participants' investment decisions.

Alphabeticity bias is the phenomena in which early alphabet options are chosen more frequently than others. Two psychological processes contribute to alphabeticity bias: status quo bias and satisficing. Investment options within 401(k) and other DC plans are often listed in alphabetical order. While many investors can access their plans online and may be able to re-order their list of fund choices, individuals generally rely on the default (status quo) list given to them (Kahneman, Knetsch, and Thaler, 1991; Samuelson and Zechkauser, 1988). Thus, because funds are initially listed in alphabetical order, they remain in alphabetical order when participants make fund allocation decisions within the plan.

Reliance on the status quo interacts with individuals' tendency to satisfice resulting in alphabeticity bias. When choosing between multiple alternatives, each possessing different

[1] A few examples of this literature include Agnew, Balduzzi, and Sunden, (2003), Benartzi and Thaler (2001, 2007), Duflo and Saez (2002), Finke, Howe, and Huston (2017), Huberman and Jiang (2006), Lusardi and Mitchell (2007), and Madrian and Shea (2001).

attributes, individuals typically satisfice, where their search ceases after the first "acceptable" option is found, even if continued searching could yield a better result (Caplin et al., 2011; Payne, 1976; Simon, 1956). Thus, when a participant searches through her plan's menu of investment options, she may be more likely to choose the funds appearing towards the beginning of the list. Since 401(k) fund choices with early alphabet names appear at the beginning of the list, they will be chosen more often than later alphabet named funds.

While alphabeticity bias is shown to affect other types of decision making, including stock choice,[2] differences between stock market investing and investing in 401(k) plans may mitigate the likelihood of alphabeticity bias affecting investment choice in 401(k) plans. Stock market investors have thousands of investment options to choose from, each with an overwhelming amount of information available for investors to sift through, making it impossible to consider every option. In contrast, 401(k) investors typically choose from a relatively small number of funds making it more manageable for investors to consider every option.[3] Because alphabeticity bias relies on investors' truncated search, the bias may not affect fund choice in 401(k) plans like it does stock choice.

[2] Research in other disciplines shows that alphabeticity influences many different decision processes. Politicians with early alphabet names are more likely to be elected than their competitors (Edwards, 2015). Scholars with last names that begin early in the alphabet are invited to review papers more often than those with last names that start with letters later in the alphabet (Richardson, 2010). And, because they are solicited more often, alumni with early alphabet names donate more than those with later alphabet names (Meer and Rosen, 2011). Stocks beginning with early alphabet letters have been found to have higher turnover, liquidity, and valuation than later alphabet stocks (Itzkowitz, Itzkowitz, and Rothbort, 2015; Itzkowitz and Itzkowitz, 2016; Jacobs and Hillert, 2016).

[3] Plans in our sample contain an average of 20 funds. The plan with the most funds has 129 options.

We find that alphabeticity bias indeed affects investment allocation decisions in DC plans. Consider a 401(k) plan that offers the following 13 funds options (which are listed in alphabetical order in the plan offering): Brandywine, Columbia Acorn, Dodge & Cox Stock, Fidelity Contrafund, Fidelity Freedom Income, Fidelity Puritan, Forward Small To Mid Cap, Harbor Capital Appreciation, Pimco All Asset All Authority, Pimco Commodity Real Return Strategy, Royce Pennsylvania Mutual, T. Rowe Price Blue Chip Growth, Vanguard 500 Index. We find that if the Royce fund changed its name to American Royce Pennsylvania Mutual (a 10-position increase, moving it to the top position when listed in alphabetical order), investment in the fund would increase by roughly 20%, all else equal. This represents an additional allocation of $653,000 to the Royce fund in the average plan with $32.5 million in assets.

Next, we recognize that a fund's position on the plan menu is more important than a fund's relative location in the alphabet. For example, if a 401(k) plan offers only Vanguard funds (each starting with the word Vanguard), then the Vanguard 500 Index fund is likely to be listed first. However, if a 401(k) plan offers Vanguard funds as well as funds from other families, then the Vanguard 500 Index fund is likely to appear towards the end of the list. We exploit the unique size and cross-sectional nature of our dataset to examine this more closely. We find that the same fund appearing in multiple plans in the sample receives a significantly higher allocation when it is listed closer to the top of the plan menu. This result offers further support of our main hypothesis that the alphabeticity bias significantly affects investment allocation decisions in 401(k) plans.

Having established a significant relation between alphabeticity and participants' investment allocation decisions, we then analyze how plan features exacerbate or moderate the influence of alphabeticity bias on these allocation decisions. First, we investigate how plan complexity affects the magnitude of the bias. Because individuals exposed to more complex

options are more likely to rely on heuristics when making choices (Ülkümen, Chakravarti, and Morowitz 2010), more fund choices and a more diverse offering may exacerbate the alphabeticity bias. The results support this hypothesis. However, while plans that offer more funds exhibit greater bias, the bias exists even in plans with fewer than 10 fund choices.

Next, we consider the impact of participant and plan sophistication proxies on alphabeticity bias in 401(k) investing. Specifically, we use business profession as a proxy for participant expertise, or sophistication. Expertise may protect professionals from making biased investment decisions. Professionals have training and experience at performing complex analytical tasks – skills that may allow them to better manage their attention and effort (Alba and Hutchinson, 1987). Alternatively, similar to the widespread failure of financial education to affect workers' investment decisions, all workers may, on average, display equal bias when it comes to investing in their personal 401(k) plans.[4] Additionally, we use plan size and third-party plan administrator (TPA) prestige as measures of plan sophistication.[5] Larger plans typically reside at larger companies. Larger companies and top TPAs may provide additional resources to help participants in the decision-making process, moderating the alphabeticity bias. Our results support the hypothesis that all participants, on average, display the bias equally. Interestingly, this is even true for professionals employed in the financial sector.

[4] Prior research shows that the push for widespread financial education to improve investment outcomes in 401(k) investing in the workplace proves to be fruitless regardless of profession or expertise (Fernandes, Lynch, and Netemeyer, 2014).

[5] A TPA is a financial institution hired by the plan sponsor to provide the administrative functions of the plan. TPAs are often influential in plan menu design, including the specific funds to be included in the plan menu.

For completeness, we consider and rule out the alternative behavioral explanation for our results – memorability. It is possible that 401(k) investors perform thorough searches of the fund options available in their plan offerings, but due to characteristics inherent to memory, investors are better able to recall (and thus select) early list items. Previous work in psychology shows that serial-position, or list order, affects memory. When individuals learn lists, the best memory is for the items at the beginning (primacy effect) and end (recency effect) of the list (Murdock, 1962). While our main result is consistent with both satisficing and serial-position hypotheses, additional tests rule out serial-position as the psychological process responsible for the bias. Our analyses show relatively higher investment in funds listed towards the top of the list and no rebound in investment in funds listed towards the end of the list. In fact, we find that investment in funds listed later in the plan menu is significantly less than in all other funds in the menu. This implies that, rather than the bias being an artifact of memory because of the serial-position effect, it is due to search cessation prior to full information evaluation, consistent with our original hypothesis related to alphabeticity bias.

Finally, we confirm that the results are robust to several alternative factors. First, we recognize that Fidelity orders funds within plan menus slightly differently than we initially assume (by asset class first, then alphabetically) in the analysis. After modifying the order of funds in Fidelity's plan menus in our analysis to be consistent with their actual ordering, the results support the hypothesis that participants default to the status quo ordering and then satisfice by choosing options closer to the top of the menu. Next, because not all plans separate funds by asset class as we assume in our main analysis, we include all funds in the sample and find that the main result still holds. We then confirm that the results are not biased by the composition of the sample. Outliers in the distribution of our main independent variable of interest do not influence the results.

Additionally, the results are not driven by recently added funds with low balances predominantly inhabiting the bottom of plan menus. In every case, regardless of the sample or subsample used, the results are robust, consistent with the original findings, and support our main hypothesis.

Our findings broaden our understanding of the factors that shape 401(k) investment choice. While literature shows that behavioral biases affect underinvestment and plan participation (Benartzi and Thaler, 2007; Choi, Laibson, and Madrian, 2005; Choi, Laibson, and Metrick, 2002), diversification strategies (Benartzi and Thaler, 2001; Huberman and Jiang, 2006), and the effect of "recommendations" from peers, companies, and plan authorities (Doellman and Sardarli, 2016; Mitchell and Utkus, 2004; Duflo and Saez, 2002), there is little focus on how the informational environment of the investor affects these biases.[6] We show that the presentation of choices offered to participants can bias their investment allocation decisions in their 401(k) plan.

This finding is particularly significant in the context of Huberman and Jiang's (2006) study which finds no significant relation between fund investment allocation decisions in 401(k) plans and plan menu design. In contrast, our results show that alphabeticity (a plan design feature) significantly affects participants' allocation decisions. Thus, rather than having funds arbitrarily listed in alphabetical order, plan sponsors could request that TPAs strategically order funds so the effect of alphabeticity bias results in a favorable outcome for participants. For instance, if funds were listed in ascending order by expense ratio rather than alphabetically, then the plan design feature would help reduce investment fees paid by plan participants affected by alphabeticity bias. Prior literature shows that expense ratio is a more reliable predictor of future return performance than past performance, with expense ratio and performance being negatively correlated (Elton,

[6] Iyengar, Huberman, and Jiang. (2004) and Iyengar and Kamenica (2010) provide notable exceptions.

Gruber, and Blake, 1996; Carhart, 1997). Alternatively, low volatility funds could be placed at the top of the plan menu given significant evidence in the literature that low volatility portfolios have outperformed higher volatility portfolios over the past several decades (Baker, Bradley, and Wurgler, 2011; Karceski, 2012). Ultimately, the desired outcome could be decided by the plan sponsor and TPA using the knowledge that plan participants are, on average, biased toward picking funds at the top of plan menu lists.

We also contribute to the behavioral finance literature by extending the nascent literature examining the influence of name on choice. Prior work shows that name fluency (Green and Jame, 2013; Head, Smith, and Wilson, 2009; Alter and Oppenheimer, 2006), name memorability (Grullon, Kanatas, and Weston, 2004), and alphabeticity (Itzkowitz and Itzkowitz, 2016; Itzkowitz, Itzkowitz, and Rothbort, 2015) affect stock selection. In work that most seemingly relates to ours, Jacobs and Hillert (2016) test the implications of alphabeticity bias on mutual fund flows. After omitting index funds and small mutual funds, they find that alphabeticity bias only affects the smaller mutual funds remaining in their sample. While they observe aggregate fund flows as the result of all market participants' investment decisions (more similar to the stock market), our study is the first to show that names influence individuals' fund allocation decisions in the limited choice set of 401(k) plan menus. Importantly, to this point, alphabeticity bias has been found in the presence of a large choice set, such as stock investing (Itzkowitz, Itzkowitz and Rothbort ; Itzkowitz and Itzkowitz,) and mutual fund investing (Jacobs and Hillert). Alphabeticity bias effects in a relatively small mutual fund choice set where the cost of search is significantly lower, such as in 401(k) investment menus, had been an important yet unexplored issue in the extant literature.

2. Data and sample selection

2.1. Sample Description

The proprietary database of defined contribution plan information was provided by Brightscope, Inc. It consists of a cross-sectional database of 6,807 unique plans with plan information collected from ERISA Form 5500 filings for the 2007 reporting year. Data items pertinent to our analysis include plan net assets, identification of investment funds in the plan menu, investment fund balances, investment fund expense ratios, and plan sponsor and TPA identification. Several prior studies utilize SEC Form 11-k filings which provide DC plan information of large publicly traded companies that typically hire large mutual fund families as the plan's TPA.[7] Our database is more representative of the overall retirement plan industry and the average plan participant because it includes plans of private and publicly traded companies of all sizes and the plans are administered by over 400 unique TPAs. These features of the database allow us the unique ability to adequately analyze the important research question addressed in this study.

We supplement the data provided by Brightscope, Inc. with data retrieved from CRSP Mutual Fund Database and Morningstar Direct. We use both CRSP and Morningstar to obtain net returns of funds in our database. We use Morningstar Direct to identify funds in our sample that had a five-star rating as of the beginning of 2007. Finally, due to many private companies in the database, we use manual internet searches to identify the industry in which the plan sponsor operates. Based on this search, we identify whether a plan sponsor operates in a "blue-collar" or "professional" industry. Examples of professional industries include: technology, engineering,

[7] See for example, Brown, Liang, and Weisbenner, (2007), Cohen and Schmidt (2009), Huberman and Sengmueller (2004), and Pool, Sialm, and Stefanescu (2016).

accounting, marketing, consulting, law, and healthcare (including pharmaceutical firms). Within the professional industries, we further identify plan sponsors as financial or non-financial firms.

2.2. Descriptive statistics

Panel A of Table 1 provides descriptive statistics at the plan level. The average plan in the sample has roughly $32.5 million in net assets (Plan Assets). The Employee Benefit Research Institute (EBRI) reports information for almost 50% of all 401(k) plan assets and it reports a mean plan size of $25.3 million for its 2007 dataset. Thus, while the size of the average plan in our sample is small compared to that in a sample of 11-k filers, it is quite similar to that reported by the EBRI. While representing plans of all sizes, our sample also represents plan sponsors of all types. We broadly categorize these plan sponsors into those operating in blue-collar and professional industries. Professional is a dummy variable equal to one if the plan sponsor operates in a professional industry. A value of zero would indicate the plan sponsor operates in a blue-collar industry. Within the group of plan sponsors operating in professional industries, we separately identify plan sponsors operating in the financial sector with the dummy variable, Finance. In our sample, 40% of plan sponsors operate in a professional industry while 7% operate in the financial sector.

[Insert Table 1 here]

In terms of fund investments, the average plan contains 19.8 total funds (Number of Funds). A plan menu frequently lists funds in submenus by asset class. These submenus typically include some combination of domestic equity, international, fixed income, multi-asset (i.e. target date or lifecycle funds), stable value or guaranteed investment contracts, and money market. The average plan in our sample includes 10.1 domestic equity funds, 1.9 international funds, 1.8 fixed income funds, 3.8 multi-asset funds, 1.6 money market funds, and 0.7 stable value or guaranteed

investment contract funds (Number of Other Funds). Plan complexity will be important to analysis later in the paper. Naturally, as the number of fund options in the plan menu increases, the more complex the allocation decisions become. The number of unique Morningstar fund categories reflected in the plan offering represents another layer of complexity. As Number of Morningstar Categories increases, not only do participants have more fund options to choose from, but they have greater fund variety from which to choose. On average, plans' fund offerings reflect 14 unique Morningstar categories.

As the relatively short menus of non-equity funds in the typical plan would make it difficult to study the effect of alphabeticity bias on allocation decisions in these submenus, the primary analysis in this study focuses only on the equity funds within the plan menu. This is reasonable because even though most of the plans in our sample provide more than one type of investment, equity funds account for the largest proportion of not only fund options available but also participant allocations. In our sample, the average plan has roughly 60% of total assets invested in equity funds. While this percentage might seem low, the adoption of automatic enrollment and qualified default investment options has led a growing proportion of participants to contribute completely to target date funds. Of the investment not allocated to target date funds, allocations to equity funds constitute 75% of plan assets, on average. Therefore, we focus our analysis on equity funds only, though we consider the entire plan menu in robustness tests.

Panel B of Table 1 provides descriptive statistics at the plan-fund level for equity funds in the sample.[8] We define Fund Balance as participants' aggregate investment allocation to an equity

[8] The statistics are reported at the plan-fund level so that they represent what the average investor has available to him/her in a plan menu in the sample. In other words, if the same fund appears in five different plans, it will be counted five times in the statistics reported.

fund relative to the aggregate investment balance of all equity funds within the plan. An equity fund in the sample accounts for, on average, 9.90% of total investment in a plan's equity submenu.

Ultimately, we are interested in how Fund Balance is affected by Alph Order – the integer value of an equity fund's alphabetical position in the plan menu of equity fund options. However, simply comparing Fund Balance across plans ignores the fact that plans have different numbers of funds available in the plan menu, which naturally affects Fund Balance. In other words, even in the absence of the alphabeticity bias, one cannot expect investment allocations across plan menu positions to be, on average, similar across plans in the sample. Consider the average investment across two plans – one with 4 funds and one with 10 funds. If each of the funds in the plan with 4 options contained 25% of the fund balance and likewise, each of the funds in the plan with 10 options contained 10%, then averaging Fund Balance by plan menu position across the two plans would make it appear as though the top four funds have an abnormal amount of investment. To mitigate this bias, we create the variable Fund Excess Ratio which is defined as the ratio of *actual* Fund Balance to *expected* Fund Balance as a percentage, where expected Fund Balance is simply 1/n with n representing the number of equity funds in the plan.[9] Therefore, a Fund Excess Ratio greater than 100% indicates a higher allocation than 1/n and a Fund Excess Ratio less than 100% indicates a lower allocation than 1/n. Fund Excess Ratio is our dependent variable of interest throughout the analysis, while Alph Order is our main independent variable of interest.

As we show in Table 1, Panel B, the mean of Fund Excess Ratio is 100%, as expected. However, the observations of Fund Excess Ratio include a few large outliers as can be seen from

[9] Our choice of 1/n for expected Fund Balance is motivated by the fact that this naïve diversification strategy has been well documented by Benartzi and Thaler (2001), Iyengar, Huberman, and Jiang (2004), and Iyengar and Kamenica (2010).

the maximum value of 2,161%. This value suggests that there exists a plan-fund observation with a Fund Balance that is roughly 22 times the value of 1/n. In this plan, there are 57 equity funds offered with one fund receiving 37.91% of the plan's total investment allocation to equity funds relative to a 1/n value of 1.75%. The most likely explanation for this outlier is that many funds had been recently added to the plan menu. Such outliers could impact our results if recently added funds happen to inhabit the bottom of plan menus. Incidentally, the fund referenced above is listed fifteenth in the plan menu. Tests later in the paper confirm our main results are robust to omitting such outliers from the sample.

Continuing with the other plan-fund level variables in Panel B of Table 1, the average fund has an annual expense ratio of 89 basis points and experienced a net return of 7.09% in the prior year. In addition, 7.40% of all plan-fund observations had a five-star Morningstar rating as of the beginning of 2007. Proprietary Fund is a dummy variable equal to one if the fund is a proprietary fund of the TPA (e.g. Fidelity administers the plan and the plan's menu includes Fidelity's mutual funds) and suggests that 42% of the total plan-fund observations in the sample are proprietary funds of the TPA. Fund Frequency is the number of times a fund appears in the sample of plans. Since many of the largest, most well-known funds appear frequently across plans, their presence causes significant variation in this variable. VFA is a dummy variable equal to one if the fund belongs to the Vanguard, Fidelity, or American Funds mutual fund family. As these are the three largest (in terms of assets under management), most well-known families in the overall mutual fund marketplace, and three of the most prominent TPAs in the 401(k) industry specifically, it is not surprising that 48% of the sample's plan-fund observations belong to these families. Finally, Index Fund is a dummy variable equal to one if the fund's objective is to track the performance of

the S&P 500 Index.[10] These funds represent roughly 7% of plan-fund observations, similar to what would be expected if each plan had roughly one such fund in the plan menu.

Since the analysis is done at the plan-fund level, Panel C of Table 1 provides the correlation matrix for the variables from Panel B. First, Fund Excess Ratio and Alph Order are negatively correlated, suggesting smaller allocations to funds listed further down (i.e. funds with a higher Alph Order) the plan menu. This provides initial evidence that alphabeticity impacts participants' allocation decisions. Next, to highlight a few additional implications from Panel C in Table 1, Fund Excess Ratio is negatively correlated with Expense Ratio and positively correlated with recent performance. It is also positively related to our measures of fund salience (i.e. Fund Frequency, VFA, Index Fund, and Age). Thus, Panel C in Table 1 provides support for these variables to serve as important controls in the analysis.

Finally, our main hypothesis is that the alphabeticity bias significantly affects investment allocation decisions in 401(k) plans. Since alphabetical sorting is arguably arbitrary, we would expect early and late alphabet funds to be similar. However, if characteristics of funds in the top half of plan menus are more attractive than those in the bottom half, then this might provide a rational explanation for participants' preference for funds at the top of the menu. Panel D of Table 1 reports descriptive statistics for funds in the top half and the bottom half of plan menu lists along with difference-in-means tests.

Consistent with the correlation matrix from Panel C in Table 1, the mean of Fund Excess Ratio for funds in the top half of plan menus is significantly larger, both statistically and

[10] We specify S&P 500 Index funds because other types of index funds had only recently become common in 401(k) plan menus. Therefore, other types of index funds in the sample tend to have low balances which affects the variable when including them in the definition of Index Fund.

economically. However, while most of the differences in means of the fund characteristic variables are statistically significant, there is little evidence of economically significant differences in top half and bottom half funds (suggesting statistical significance is being driven mostly by sample size). Fund fees and performance are arguably the most important characteristics to participants. Expense Ratio is almost identical across the two groups. And while the average lagged one-year return for top half funds is 1.51 percentage points higher, the average lagged three-year returns are almost identical across fund positions, and the average lagged five-year return for bottom half funds is higher. When forward three-year and five-year returns are considered, bottom half funds outperform top half funds.

Regarding the other variables, proprietary funds of TPAs and index funds are four percent more likely to appear in the bottom half of plan menus, while funds with a five-star Morningstar rating are one percent more likely to appear in the top half of plan menus. Fund age is almost identical across the two groups. Overall, the results from Panel D in Table 1 make it difficult to reasonably conclude that systematic differences in fund characteristics between the top half and the bottom half of plan menus can explain any preference participants might have for early alphabet funds.

3. Empirical Results

Our main hypothesis is that the alphabeticity bias significantly affects investment allocation decisions in 401(k) plans. As discussed earlier, we test our hypothesis using only the equity funds of the plan menu; thus, Fund Balance is a domestic equity fund's balance as a proportion of total investment in only the equity funds of the plan menu. Fund Excess Ratio (expressed as a percentage) is Fund Balance divided by 1/n, where n is the number of equity funds

available in the plan menu. We focus only on equity funds because most plan menus separate funds into lists by asset class (e.g. equity, bond, balanced, etc.). Our test is a conservative one. If there exists plan menus in our sample where funds are not listed by asset class, or if there exists plan menus where funds are not listed alphabetically, the presence of these plans in our analysis would bias the results against finding evidence of alphabeticity bias in the sample.

Figure 1 provides simple univariate evidence of alphabeticity bias in the sample. We compare Fund Excess Ratio across the different positions where a fund can appear in the plan menu when listed alphabetically. On average, each of the top four funds contain 10% more investment allocation relative to a 1/n allocation, while funds five through ten each contain 5% less investment allocation. Each fund appearing after the tenth position contains 10% less investment allocation. Thus, this simple figure provides initial evidence that funds closer to the top of plans menus receive greater investment allocations than funds closer to the bottom of plan menus.

[Insert Figure I here]

3.1. Main multivariate results

Univariate tests suggest that alphabeticity bias affects fund investment. We now use multivariate tests to further explore this result. Specifically, we use the following OLS model with plan fixed effects to test for alphabeticity:

$$\text{Fund Excess Ratio}_i = \alpha + \beta_1 * \text{AlphOrder}_i + \sum \beta_j X_i^j + \sum \beta_k Z_i^k + \varepsilon_i. \quad (1)$$

Fund Excess Ratio$_i$ is Fund Balance for equity fund i divided by 1/n, where n is the number of equity funds within the plan menu. Alph Order$_i$ is the integer value of a fund's alphabetical position in the plan menu of equity fund options. If the predicted effect of Alph Order holds, then β_1 will be negative and statistically significant. In other words, funds listed later in the alphabet (i.e. a

larger value for Alph Order), and therefore further down the plan menu, will receive less investment allocations. X is a vector of control variables discussed earlier and Z is a vector of plan dummy variables that accounts for plan fixed effects. Finally, correlation in residuals across plans could result from different plans having similar plan menus. This is most likely the case for plans administered by the same TPA. Thus, standard errors are clustered at the TPA level.[11]

The fixed effects model has two primary advantages in the context of our analysis. First, if the coefficient of Alph Order occurs as the result of an omitted plan-specific factor, then including plan fixed effects would mitigate its influence on Alph Order. Next, the fixed effects model only compares fund balances within each plan, further alleviating the concern that plans offer different numbers of fund choices.

Table 2 displays the results of our initial tests. In Column 1 of Table 2, we simply regress Alph Order, our main variable of interest, against Fund Excess Ratio while including plan fixed effects and its coefficient is negative and statistically significant. Thus, there is a decrease in allocations to a fund when a fund's name causes it to be listed later in the plan menu. The effect is also economically significant. Simply moving a fund up the plan menu list by one position would increase allocations to that fund by 2.23%.

[Insert Table 2 here]

Of course, not all plan participants are going to simply choose funds near the top of the plan menu. Our initial result simply suggests that, on average, plan participants are biased towards choosing these funds. But, other fund characteristics are also likely to affect investment allocations, on average. In Column 2, we initially control for several of these other potentially important fund characteristics and find that the effect of Alph Order is still statistically and

[11] Results are similar when clustering standard errors at the plan or fund level.

economically significant. The average plan has 10 equity funds in the plan menu (from Table 1 Panel A). Thus, after controlling for these other factors in Column 2, moving a fund from the bottom of the average plan menu to the top leads to an 18.01% (-2.011 × -9) increase in allocation to that fund. For the average fund, this increases the percentage of plan assets to the fund from 9.9% to 11.68% (9.9% × 1.1801). As the typical plan has $32.5 million in assets, the effect would be a $578,500 increase in investment allocation to the fund.

It is important to consider the other control variables in Column 2 as they too significantly impact participants' allocation decisions. First, we find that the fee charged by the fund significantly influences fund allocations. Fund fees are captured by the expense ratio of the fund (Expense Ratio). Unsurprisingly, higher fees deter allocations to the fund. Performance is captured by the fund's previous year raw return performance (Lag 1yr Return); and, better performance attracts greater allocations.

Another factor that may influence participants' fund allocations is a certification effect from the TPA. To control for this, we include a dummy variable (Proprietary Fund) that indicates whether the fund in question contains the name of the TPA. While not all TPAs have proprietary investment products to include in the plan menu, roughly 57% of the plan menus in the sample include TPA proprietary funds. Since the TPA administers the plan and provides participants with such resources as educational material, the TPA is likely viewed as an expert by participants. Thus, because a fund choice containing the TPA's name could be seen as an implicit endorsement, or certification, of that fund, investors could perceive these funds to be of higher quality.

There is also evidence that some TPAs give subtle cues to participants to invest in their funds rather than competing funds from other families in the plan menu. For instance, a Government Accountability Office report (2011) found evidence that some TPAs highlight their

own funds in educational material which may be seen by participants as an endorsement of that fund by the TPA, who is a perceived subject matter expert. So, whether externally influenced or not, it is quite possible participants will allocate greater amounts to the TPA's proprietary funds due to a certification effect. We find that the coefficient for Proprietary Fund is positive and significant. All else equal, proprietary funds have a 15.4% higher investment allocation, on average.

Aside from using the information in the plan offering, it is possible that individuals seek outside recommendations to evaluate fund quality. To control for this, we include a dummy variable (5 Star Morningstar) to indicate whether a fund is rated as a five-star fund by the Morningstar Corporation. We specifically control for Morningstar rating as it is ubiquitous in fund prospectuses and general fund information provided to plan participants. Thus, without much effort, plan participants can determine a fund's "quality" based on this measure. Not surprisingly, these ratings matter. We find that funds with a five-star rating receive a greater proportion of investment.

Next, index funds have grown in popularity over the past 10 to 15 years, in large part due to significantly lower fees when compared to actively managed mutual funds. We control for index funds by including an indicator variable (Index Fund) that is equal to one if the stated Lipper Objective of the fund is to mimic the S&P 500 Index. While the coefficient on Index Fund is not quite statistically significant at conventional levels (possibly due to its strong, negative correlation with Expense Ratio), the effect is positive and economically significant.

Overall, the findings in Column 2 of Table 2 suggest that, as we had expected, other fund characteristics impact participants' allocation decisions, on average. However, our main result,

that alphabetical order affects fund allocations, holds even after controlling for these important fund characteristics.

Next, it is possible that early alphabet funds are more memorable or salient for reasons unrelated to their position in the alphabet. In Columns 3-5 of Table 2, we test a variety of fund characteristics as proxies for a fund's inherent "memorability". In other words, certain fund characteristics might be correlated with that fund's likelihood of being recognized by plan participants and, therefore, may increase the allocations to such a fund. However unlikely, if funds with these specific characteristics happen to be frequently listed towards the top of plan menus (i.e., happen to have lower alphabet names), then fund salience could help to explain our main results related to alphabeticity bias. Specifically, we test for whether our results still hold when controlling for fund family, fund "popularity", and fund age.

First, we consider that fund salience may also be the result of a fund's family. According to Morningstar, American Funds, Fidelity Investments, and The Vanguard Group are the top three open-end mutual fund companies in terms of assets under management. As the largest and most well-known mutual fund families, their funds may be recognizable to even the most unsophisticated investors. While Vanguard funds will often be positioned at the end of an alphabetized list of funds, Fidelity funds would be listed closer to the top of the list and American funds would most often be listed at the top of the list. With more than one-third of plan-fund observations represented by American and Fidelity funds, it is especially important to confirm that our results are not driven by the salience of American Funds or Fidelity Investments.

To control for fund salience, in Column 3 of Table 2, we include an indicator variable (VFA) that is equal to one if a fund's name begins with Vanguard, Fidelity or American Funds.[12] We see that a fund starting with the name Vanguard, Fidelity or American Funds receives a statistically and economically significant 17.1% higher investment allocation, all else equal; but, the effect of alphabeticity still holds. The results confirm that alphabeticity bias influences allocation decisions even after considering the salience of a fund's family.

Next, as an alternative measure of fund salience, we create Fund Frequency which counts the number of plans in the sample that offer the fund. Funds that appear across the most plans are likely "popular" funds that may be more familiar to investors, making them more likely to be chosen. The results presented in Column 4 of Table 2 indicate that Fund Frequency has a positive and significant effect on Fund Excess Ratio; however, even after controlling for this factor, we find that alphabeticity bias significantly affects fund allocations. As a final measure of fund salience, in Column 5 of Table 2 we control for the number of years a fund has been in existence (Age) with the idea that funds that have survived for many years are more likely to be familiar to plan participants. Even after controlling for Age, the results once again confirm that alphabeticity bias significantly affects investment allocations.

After careful analysis, we base the remainder of the tests on the specification provided in Column 3 of Table 2. As can be seen in Panel C of Table 1, the variables used to measure fund salience (VFA, Fund Frequency, and Age) highly correlate not only with each other, but also with Expense Ratio, which precludes the use of combinations of fund salience controls.

[12] Of the 1,662 unique funds available in the sample, 264 have names that begin with Fidelity, Vanguard, or American Funds.

Finally, in untabulated tests, we confirm the efficacy of the results presented above. We begin by omitting any *plan* from the regression that has even a single fund offered by American Funds. Then, we omit plans including Fidelity's funds. Finally, we omit plans with either an American or Fidelity fund. Again, we choose American Funds and Fidelity Investments because not only are their funds salient, they are also more likely to be listed towards the top of plan menus and, thus, more likely to influence the results in favor of finding evidence of alphabeticity bias. In each regression, regardless of the sample, the main results are not affected. Next, rather than controlling for a fund's frequency in the sample, we omit the 10 most frequently offered funds from the plan listings.[13] Similarly, in another test, we eliminate any fund that has been in existence for at least 50 years (roughly the 95th percentile of Age). Finally, we omit index funds from the plan menus. Even after changing the sample composition, our results hold and the effect of Alph Order on Fund Excess Ratio is similar in magnitude to previous specifications in our analysis.

3.2. Variation in fund position across plan menu lists

Another interesting test of alphabeticity bias is examining changes to a fund's allocation following a name change that significantly moves the fund up or down plan menu lists. Unfortunately, the nature of our data does not allow for such an analysis. However, we can take advantage of the unique size and cross-sectional nature of our data set to examine this question a different way. By using fund fixed effects rather than plan fixed effects, we can observe how a fund's allocation is affected when the same fund appears in different positions across plan menus

[13] There are 1,662 distinct funds offered across all plans. The 10 funds which are offered most frequently in descending order are as follows: American Funds Growth Fund of America, Fidelity Freedom Income, Fidelity Spartan 500 Index, Vanguard 500 Index, Fidelity Contrafund, Fidelity Low-Priced Stock, Fidelity Value, Davis New York Venture, American Funds American Balanced, Fidelity Mid Cap Stock.

in the sample. After all, a fund's position on a plan menu is more important than a fund's relative location in the alphabet. For example, if all the funds offered in a 401(k) plan are proprietary Vanguard funds (each starting with the word Vanguard), then the Vanguard 500 Index fund is likely to be listed first. However, in other plans where Vanguard funds, as well as funds from other families are offered, the Vanguard 500 Index fund is likely to appear towards the end of the list.

Table 3 provides the coefficients of cross-sectional regressions with fund fixed effects. Because fund-fixed effects are used, we omit all fund-level control variables that are fixed across plans from the model. In addition, we include the Number of Equity Funds to control for differences in plan menu size across the sample. An additional benefit of this model is that the fund fixed effects control for fund-level variables omitted from our previous tests that may impact investor allocation decisions.

We must also consider that Alph Order captures an incremental movement up or down the list regardless of a fund's position in the list. For example, the impact on Fund Excess Ratio of an incremental movement up the list for a fund in the middle or at the bottom of a list of 20 funds may be quite different than that of a fund in a list of 7 funds. Ultimately, we are interested in the impact to allocation at the very top of the plan menus. Therefore, in Table 3 we introduce a new, standardized measure of the independent variable to examine this question. Specifically, in contrast to Alph Order, we focus on Top 4 which is a dummy variable that indicates if a fund is one of the first four listed funds alphabetically in a plan's equity fund submenu. We base our analysis on the first four funds in the list because there is evidence that plan participants typically allocate their wealth across roughly four funds when investing in 401(k) plans (Huberman and Jiang, 2006).

The coefficient of Top 4 in Column 1 of Table 3 provides additional support for alphabeticity bias in 401(k) investing. Across plans, the same fund experiences significantly more investment when it appears higher on a plan menu list. However, a lack of variation in plan position across the sample for many funds weakens the results. Therefore, in Column 2 of Table 3, we run the same regression but only include the 50 most frequently offered funds in the sample. On average, these funds appear in 549 different plans, likely creating more variation in fund positioning on menus across the sample. In Column 3 of Table 3, we examine only the 10 most frequently offered funds, which appear in 1,102 different plans on average. As expected, fund position has a stronger influence on fund allocation among more frequently occurring funds. The same fund receives significantly more allocation in plans when it is listed closer to the top of the plan menu.

[Insert Table 3 here]

Finally, as mentioned above, Vanguard represents a particularly unique case for this analysis. On the one hand, its funds are common within the sample and are likely to experience significant variation in plan menu position. This is because Vanguard-administered plans tend to have mostly, if not all, Vanguard funds in the plan menu. So, some Vanguard funds will naturally be at the very top of the plan menu. However, plans administered by other TPAs that include Vanguard funds in the plan menu often include other families' funds in the plan menu as well. In these plans, Vanguard funds will naturally be concentrated at the end of the plan menu. On the other hand, when Vanguard funds appear towards the end of plan menus, allocations to Vanguard funds may not be significantly impacted, given its familiarity to even the most uneducated investors. Given these factors, it is particularly interesting to analyze whether allocations to Vanguard funds are impacted by changes in its funds' positioning across plan menus in the sample.

Column 4 of Table 3 provides the results using fund fixed effects for just Vanguard funds in the sample. The coefficient on Top 4 is large, positive, and statistically significant. This suggests that, even given its positive reputation in the industry, Vanguard benefits from its funds being listed at the top of plan menus. Overall, the results in Table 3 provide additional evidence of a strong alphabeticity bias in 401(k) investing.

3.3. Moderating factors

So far, the results support our hypothesis that alphabeticity bias significantly affects investors' investment allocations. Next, we consider how other plan characteristics, such as plan complexity and plan sophistication, may exacerbate or mitigate the strength of the bias.

3.3.1. Plan complexity

We hypothesize that plan complexity will exacerbate the strength of the alphabeticity bias. Individuals who encounter a more complex set of options are more likely to use heuristics (Ülkümen, Chakravarti, and Morowitz, 2010) and are more reliant upon the status quo (Baumeister, Bratslavsky, Muraven, and Tice., 1998; Dean, 2008). We measure and test plan complexity by considering variation in the number of equity funds offered, the number of unique Morningstar categories represented by funds in the plan menu, and the number of non-equity funds offered.

Specifically, we hypothesize that as the number of funds offered increases, participants will make more biased decisions. In fact, our finding may even be driven by larger plans in the sample. Although, even the largest plan menus in our sample provide a far smaller choice set than in other settings studied in the prior literature (e.g., investing in the stock market or in the overall mutual fund marketplace).

Given we are studying the impact of the number of funds in the plan on the effect of alphabeticity bias, and this is a plan-level variable, we must use a simple OLS model rather than the plan fixed effects model. As in Table 3, because we are comparing across plans of different sizes, we use the independent variable Top 4. The controls are the same as in the base model provided in Table 2 Column 3.

Next, we introduce dummy variables to the analysis which indicate whether the plan has more than a particular number of equity funds available in the plan menu. The variable, More 9, indicates whether the plan has more than 9 equity funds (the 25th percentile when considering only equity funds), More 13 indicates whether the plan has more than 13 equity funds (the 75th percentile), and More 18 indicates whether the plan has more than 18 equity funds (the 90th percentile). Depending on the specification and when plan participants have a larger choice set from which to choose, the new dummy variable interacts with Top 4 to determine the marginal impact on allocations to the first four listed funds alphabetically.

Because of the presence of More 9 in Column 1 of Table 4, Top 4 represents the effect of being one of the first four listed funds alphabetically when there are less than 10 equity funds to choose from in the plan menu. Interestingly, allocation to each of these funds is, on average, 13.4% higher. Given this effect is both economically and statistically significant, it suggests that even in relatively small choice sets participants' allocation decisions in our sample are significantly affected by alphabeticity bias. As expected, the bias is even stronger as the number of funds in the choice set expands. The coefficient on the interaction between Top 4 and More 9 suggests that, compared to plans with less than 10 equity funds available, the allocations to each of the first four listed funds alphabetically is higher by an additional 3.66% when there are more than nine funds

available in the choice set. Column 2 of Table 4 shows that the marginal effect of the alphabeticity bias is more than twice as large (8.1%) when there are more than 13 funds in the plan.

[Insert Table 4 here]

Finally, in Column 3 of Table 4, the marginal effect (the coefficient on the interaction between Top 4 and More 18) of the alphabeticity bias on allocation to the top four funds when there are more than 18 equity funds in the plan menu is also statistically and economically significant. However, this marginal effect is smaller in magnitude than the marginal effect in Column 2. This is not surprising as the comparison group (Top 4) for the specification in Column 3 is now plans with less than 19 funds, rather than less than 14 funds in Column 2 or less than 10 funds in Column 1. In Column 4 of Table 4, we control for plans with between 9 and 19 funds to test whether the alphabeticity effect is strongest in plans with the most funds available. Indeed, the coefficient for the interaction between Top 4 and More 18 is statistically significant and larger than that for the interaction between Top 4 and Between 9 and 19.

So far, the results in Table 4 show that as the number of funds in a plan increases, the strength of the bias increases as well. Unique to this study, and possibly most interestingly, alphabeticity bias is also shown to be present among the smallest plans in the sample. In the extant literature, alphabeticity bias has only been studied in very large choice sets where such a bias would be most expected to exist. Our finding in the context of 401(k) investing is unique and speaks to a previously unexplored yet important issue when it comes to the impact of alphabeticity bias on investment decisions in small choice sets.

Next, we turn to other measures of choice complexity. First, we create an indicator variable (MS Cat 18) that is equal to one if Number of Morningstar Categories is greater than 18 (the 75th percentile of the variable's sample distribution). Beyond just the number of fund options in the

plan menu, Morningstar categories offer an additional level of choice, and thus complexity, within the plan menu. Because of the presence of MS Cat 18 in Column 5 of Table 4, Top 4 represents the effect of being one of the first four listed funds alphabetically when there are relatively fewer Morningstar categories from which to choose in the plan menu. Compared to plans with fewer category options available, the coefficient on the interaction between Top 4 and MS Cat 18 suggests that the allocations to each of the first four listed funds alphabetically is higher by an additional 9.63% when there are more category choices.

Next, we include an indicator variable, Non-equity 12, that is equal to one if the number of non-equity funds in the plan is greater than 12 (the 75th percentile of the variable's sample distribution). Although we continue to look only at the decision among equity funds, we recognize that more non-equity fund options are likely to influence allocations to equity funds. A greater number of non-equity funds increases the complexity of the plan menu, potentially increasing reliance on heuristics. Again, we see that for more complex plans, participants are more likely to choose from the top of the equity fund submenu. These results are consistent with the theory that as participants are exposed to more choices, or more complex decisions in general, they are more likely to rely on heuristics and default to the status quo, resulting in a fund choice from the top of the list.

3.3.2. Plan sophistication

We examine the role that plan sophistication has on the strength of alphabeticity bias in 401(k) fund selection. More sophisticated participants may be less susceptible to the effect of the alphabeticity bias. Similarly, larger plans and plans administered by the top TPA's may provide the resources necessary to help plan participants overcome behavioral biases and make more informed decisions.

Specifically, it is possible that a participant's profession (and expertise) affects their susceptibility (or immunity) to the bias. Professionals have learned and practiced analytical skills within their domain and, thus, are better able to manage their attention and effort – factors that can shield them from behavioral biases when searching and deciding among choices (Alba and Hutchinson, 1987). According to the expertise theory, we expect professional workers to be less influenced by alphabeticity bias on average.

Another consideration is that financial education in the workplace to improve investment decision making in retirement plans has proven ineffective for even professional or high-income individuals (Fernandes, Lynch, and Netemeyer, 2014). Investing is a complex and unique skill such that general expertise is seemingly insufficient in helping individuals avoid behavioral biases which can affect investment allocation decisions. Thus, to adequately test the expertise hypothesis in the context of alphabeticity, we may need to focus on professionals in the financial industry.

We examine whether participants' expertise and profession influence the effect of alphabeticity bias on investment allocation decisions in Table 5. Columns 1 and 2 of Table 5 display the results of our investigation in to how working at a company in a professional industry and the finance industry, respectively, influences the alphabeticity bias. Interestingly, regardless of the industry in which the participants are employed, workers display similar effects of the alphabeticity bias on allocation decisions. The coefficients on the interactions between Top 4 and Professional in Column 1 of Table 5 and between Top 4 and Finance in Column 2 of Table 5 are neither statistically nor economically significant. This supports the hypothesis that all workers' decisions indeed display alphabeticity bias on average.

Next, we investigate whether greater resources help plan participants overcome the alphabeticity bias. Typically, larger companies have greater average plan assets. And, as both

company and plan size increases, economies of scale may allow the companies and plan administrators to offer plan participants more resources to improve decision making. Similarly, the largest TPAs may be able to offer resources and advice to participants that improve rational decision making. We test these hypotheses in Columns 3 and 4 of Table 5, respectively. In Column 3 we introduce an indicator variable, Large Plan, which is equal to one if the plan's total net assets place it above the 75th percentile ($20 million) of the sample's distribution and interact it with Top 4. In Column 4 of Table 5, we introduce an indicator variable, Top TPA, which is equal to one if the plan is administered by Vanguard, Fidelity, or American Funds and interact it with Top 4. We find that the alphabeticity bias is not statistically different among larger plans or plans administered by top TPAs. Thus, there is no evidence to support the hypothesis that plan sophistication moderates the effect of the alphabeticity bias.

[Insert Table 5 here]

3.4. Robustness tests

Our finding that alphabeticity bias significantly impacts fund allocation decisions in 401(k) investing has held up to a battery of tests in the prior analysis. In this section, we consider several robustness tests to further confirm this finding. First, we consider and rule out an alternative explanation for our results. Then we examine the effect on our results for plans that are known to have slight variation in the plan design compared to our previous assumptions. Next, we explore the sensitivity of our previous findings to extreme values of the dependent variable, Fund Excess Ratio. Finally, we examine potential biases due to the composition of our sample.

3.4.1. Serial-position effects as an alternative explanation

We argue that our results are consistent with alphabeticity bias significantly affecting participant allocation decisions. We posit that alphabeticity bias occurs as a joint product of the

status quo bias and satisficing. Next, we provide robustness tests to rule out an alternative behavioral bias related to memorability, specifically a serial-position effect.

Rather than being a function of investors' search processes, it is possible that our results are driven by memorability related to a fund's position on the plan menu. The effects of serial order on memorability are well documented. Due to attention and memory decay processes, people best remember the items that begin a list (primacy) and the items that conclude a list (recency), with recency being a stronger predictor of recall than primacy (Murdock, 1962). Thus, if our findings are the result of a memory based bias, there should be greater investment in not only early alphabet funds, but also in later alphabet funds, with the effect of the bias being greatest for the later alphabet funds. However, if our findings are in fact a result of satisficing, then relatively high allocations to fund options should only exist for early alphabet funds.

To conduct this test, we introduce an indicator variable, Bottom 4, which is equal to one if a fund is one of the last four funds when listed alphabetically in the plan menu. Column 1 of Table 6 shows the coefficient for Bottom 4 is negative and statistically significant, suggesting that later alphabet funds receive less allocation than other funds in the plan menu. And given the positive and statistically significant coefficient for Top 4, the bottom four listed funds in the plan menu receive even less investment than the top four listed funds. This is the opposite of a recency-based memory effect. As in Table 4, we also consider that plans with more funds offered may reveal more extreme effects for Top 4 and Bottom 4. Columns 2 and 3 of Table 6 display results when we consider plans containing less than ten equity fund options and those with more than nine (More 9) equity fund options, respectively. Consistent with the results in Table 4, the coefficient of Top 4, when there are more than 10 fund options available, is considerably larger; however, the coefficient on Bottom 4 is similar regardless of the specification. Overall, the results in Table 6 do

not support the presence of recency effects predicted by the serial-position memory based theory and instead provide additional evidence for the satisficing theory.

[Insert Table 6 here]

3.4.2. Alternative fund ordering

Next, we recognize that TPAs create plan menus on a business-by-business basis. Thus, while it is customary to present funds by asset class (separating equity funds from bond funds, for example) and then in alphabetical order[14], as we assume in our analysis, this may not always be the case. This variation between actual fund ordering and our assumed fund ordering for some plans in the sample would mitigate the likelihood of finding any effect of alphabeticity bias in our analysis. However, we investigate further to confirm the robustness of our results.[15]

We find that the fund ordering utilized by Fidelity, the largest TPA by 401(k) AUM, represents one notable, yet slight, exception to our assumptions in the analysis regarding fund ordering. When the fund options are presented to participants, Fidelity lists funds by asset class and then by alphabetical order as we assume, but funds are also divided into sub-classes (e.g. large-cap, mid-cap, and small-cap within the equity fund list) creating a subtle difference from our assumption. Because alphabeticity bias relies on the confluence of satisficing and the status quo bias, variation in the default (or status quo) plan menu order should bias the data away from our

[14] Anecdotal evidence supports our characterization of plans listing funds by asset class and then alphabetically. For instance, TIAA-CREF, the second largest TPA in terms of 401(k) assets under management (AUM), alphabetizes asset class lists (equity, fixed income, guaranteed, money market, multi-asset, and real estate) and the funds within these lists are also alphabetized, consistent with what we assume in our analysis. Vanguard, the third largest TPA by 401(k) AUM, also lists funds by asset class and then alphabetically on its web-based platform.

[15] The order of the data provided to us by Brightscope is not the same as the order that the funds are presented to participants.

main finding. Further, we should expect stronger results if the tests are based on the exact default ordering presented to participants. We confirm that this is indeed the case.

In Column 1 of Panel A in Table 7 we present our base model (Column 3 in Table 2) for non-Fidelity administered plans only. In Column 2 of Panel A in Table 7, we present our base model for only plans administered by Fidelity.[16] In both instances, we use our base assumption that funds are listed by asset class and then in alphabetical order. The coefficient on Alph Order for Fidelity administered plans is significantly smaller than that for the rest of the sample. This finding is consistent with either the alphabeticity bias being smaller in Fidelity administered plans, our original test assumptions not accurately reflecting Fidelity's plan design, or both. In Column 3 of Panel A in Table 7 we reorder the menus of plans administered by Fidelity to be consistent with Fidelity's design (ordering the funds first by asset sub-classes and then in alphabetical order with-in these sub-classes). The coefficient on Alph Order in Column 3 is significantly larger compared to that in Column 2 when funds are ordered based on our original assumption (by asset class and then in alphabetical order) (-1.962 vs. -1.165). In fact, the coefficient is larger than that for the rest of the sample in Column 1 of Panel A in Table 7. Overall, these results provide further support for the underlying influences of status quo bias and satisficing which contribute to alphabeticity bias in 401(k) investing.

[Insert Table 7 here]

3.4.3. Controlling for outliers in fund excess ratio

Descriptive statistics in Table 1 suggest some extreme values for Fund Excess Ratio. The large outliers are the result of the concentration of investment in a few funds in plans with

[16] We do not include VFA as a control in Column 2 because of the prevalence of Fidelity funds in Fidelity administered plans.

numerous equity funds available. As described by Agnew, Balduzzi, and Sunden, (2003), fund investment is sticky with investors making changes to their account only every four years on average. This suggests new funds may have a disproportionately smaller amount of investment regardless of alphabetical placement. Thus, large outliers are most likely the result of the small balances of recently added funds in the plan menu. Assuming a newly added fund's positioning in a plan menu is random, the noise in the analysis caused by outliers may simply "cancel out" or, if anything, work against finding a result. However, if these funds naturally cluster near the middle or end of plan menus, then a sample bias would exist that favors finding our result.

To mitigate the effect of outliers on our results, in Table 7 Panel B we re-run the specifications from Table 2 omitting any *plan* that contains a plan-fund observation that falls below the first percentile or above the ninety-ninth percentile of Fund Excess Ratio. This test identifies 1,375 unique plan-fund outliers and results in 13,374 plan-fund observations being eliminated from the analysis. In each of the models, the effect of alphabeticity bias on Fund Excess Ratio is still statistically significant, and the magnitude of the effect is almost identical to that in Table 2 for each specification. In untabulated results, we also omit just those funds in plan menus with an allocation of less than one percent of total equity fund investment and re-run our main tests. The coefficient for Alph Order remains negative and statistically significant. In terms of magnitude, consistent with newly added funds adding noise to our analysis, we do see that the coefficients on Alph Order are larger than in previous analysis. The effects of all other explanatory variables are also consistent with prior results.

Lastly, we consider two alternative measures (in untabulated tests) for the dependent variable to further confirm the robustness of our results. First, we use simple Fund Balance and find that the results are qualitatively and statistically similar to those when using Fund Excess

Ratio. Second, we create a dummy variable that is equal to one if Fund Excess Ratio is greater than 100%. Again, the results are qualitatively unchanged. That is, as funds appear further down the plan menu list they are less likely to have a Fund Excess Ratio greater than 100%, further supporting our main findings.

3.4.4. Sample bias

We realize that 401(k) investors have other fund type choices besides equity funds. Prior analyses omit non-equity funds (e.g., bond, balanced, money market, etc.) because alternative investment choices are generally listed separately by asset class within a plan offering. Therefore, the existence of these funds in the plan menu should not change the impact of alphabetical order on equity fund choice because they are not on the same lists. There are structural reasons why these other funds were not included as well. As the descriptive statistics show, equity funds dominate plan menus. Other asset categories typically have few fund choices for participants to select from, making it difficult to run our models on these small subsets of funds. Even though it works against our finding a result if funds are not listed alphabetically and by asset class, we re-run our tests considering all funds in the plan menu for completeness and a truly conservative test of our result. In untabulated results we find that while the coefficients on Alph Order are smaller in magnitude, the coefficient is still negative and statistically and economically significant. While this is partially a function of equity funds dominating plan menus, it also speaks to the strength of the effect of alphabeticity bias in 401(k) plan investing.

4. Conclusion

We show that alphabeticity bias affects participants' fund allocation decisions in 401(k) plans. That is, funds listed at the beginning of plan menus receive significantly greater allocations

compared to funds listed towards the end of plan menus. This finding is a function of funds being listed alphabetically in plan menus and behavioral biases that lead individuals to truncate search processes when choosing from a list of options.

In the extant investments literature, alphabeticity bias has only been found in large choice sets, such as aggregate investments in the stock and mutual fund markets (Itzkowitz, Itzkowitz, and Rothbort, 2015; Itzkowitz and Itzkowitz, 2016; Jacobs and Hillert, 2016). This is not surprising, as individuals who encounter greater numbers of choice options are more likely to use heuristics when making decisions (Ülkümen, Chakravarti, and Morowitz, 2010). Our paper is the first to show that alphabeticity bias affects investment decisions even in small choice sets, such is the case with 401(k) investing. Though we do find that the bias grows as the number of funds in the plan offering increases, even the largest plan offerings in our sample are extremely limited in the context of the overall stock market or mutual fund marketplace. Further, we show that the bias exists in larger (in terms of net assets) plans, plans administered by the top third-party plan administrators in the 401(k) industry, and plans of companies in professional industries, including the financial industry.

These findings have simple, yet important, policy implications. While prior work shows evidence of behavioral biases in 401(k) investing, this study importantly shows that design features of the plan menu contribute to behavioral biases that affect participants' investment decisions. This is particularly important because prior work shows that while behavioral interventions have limited effect (Fernandes, Lynch, and Netemeyer, 2014), changing the informational environment can remedy irrational investment (Bernartzi and Thaler, 1999). As alphabetical sorting is arguably random, it is not surprising that we find the characteristics of funds in the top and bottom half of plan menus to be quite similar. Thus, while plan participants affected by alphabeticity bias are not

necessarily harmed by alphabetical sorting of plan menus, other sorting mechanisms could arguably result in more desirable outcomes for plan participants. We found that TPAs are beginning to offer plan sponsors the flexibility to customize how plan menus are presented to employees, making the results from our analysis especially pertinent to plan sponsors.

One alternative sorting strategy might be listing fund options in ascending order based on expense ratio. This simple change could have considerable impact. Assuming an alphabetized list of plan menu options, the average expense ratio of the top four equity funds in plan menus of our sample is 90 basis points. But, if we order equity funds in ascending order based on expense ratio, the average expense ratio of the top four funds is 62 basis points. This difference in fees is economically significant. Assuming $5,000 annual contributions and a fixed 7% annual gross rate of return over a 30-year period, this difference in fees, all else equal, costs an investor $20,440 in investment income – a loss equivalent to over four years' worth of contributions. Alternatively, plan sponsors could employ other strategies to benefit plan participants, such as listing low volatility funds first as low volatility portfolios have been shown to outperform higher volatility portfolios over the past several decades (Baker, Bradley, and Wurgler, 2011; Karceski, 2012).

Simply put, for those who are prone to alphabeticity bias, the same factors that biased their allocation decisions could lead them to select fund options that improve their overall investment outcomes. Importantly, this change would not impact plan participants that are unaffected by alphabeticity bias. We show that some investors in the sample are attracted to lower fee funds for instance. Thus, expense ratio based ordering would simply allow these participants to more quickly and easily find these cheaper fund options. Nudging investors towards selecting lower expense ratio funds could also motivate mutual fund companies to include cheaper funds in 401(k) plan

menus knowing their more expensive funds will receive less investment because of being listed later in the plan menu.

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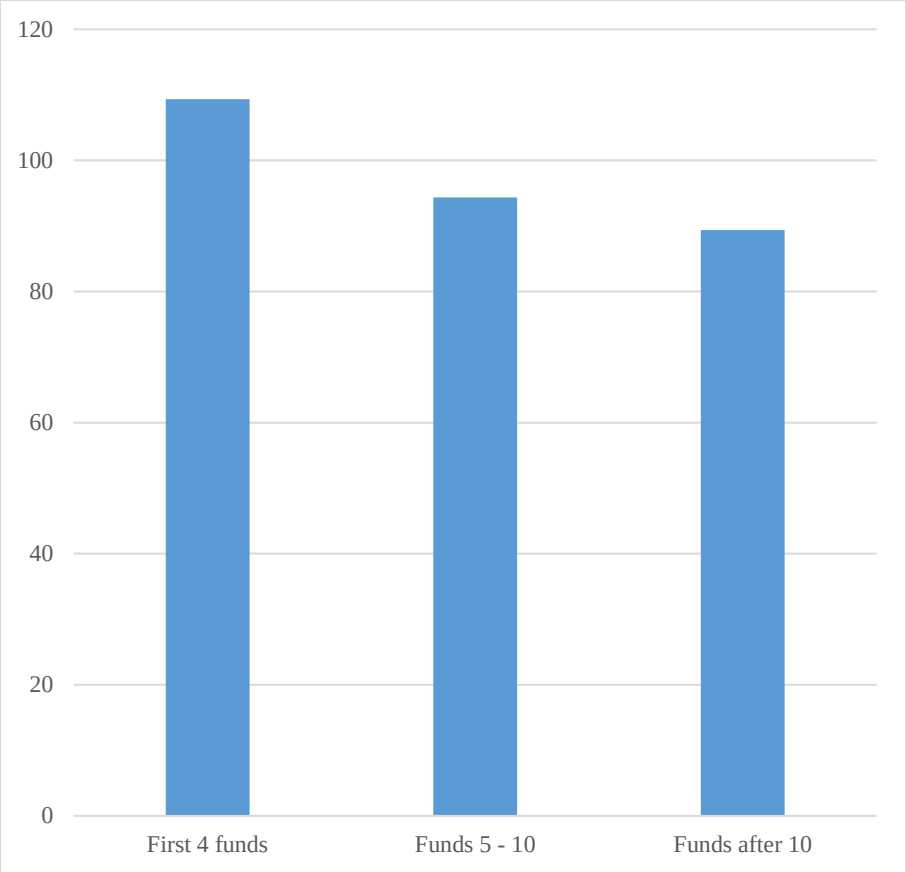

Figure 1

Fund excess ratio by position

Notes: This figure provides univariate evidence of alphabeticity bias in the sample. Average Fund Excess Ratio is reported for different positions in the plan menus.

Table 1

Descriptive statistics

This table reports descriptive statistics for the main variables in the sample at the plan level (Panel A) and at the plan-fund level (Panel B). Plan Assets is the net assets of the plan according to Brightscope. Professional (Finance) is an indicator variable equal to one if the plan sponsor operates primarily in a professional (financial) industry. Top TPA identifies plans administered by the three largest third-party plan administrators in our sample: American Funds, Fidelity, and Vanguard. Number of Morningstar Categories reports the number of distinct Morningstar categories represented in plans. The remaining information in Panel A reports the statistics on the type of funds offered in plans. In Panel B, Fund Balance is the amount of investment in an equity fund divided by the total plan investment in equity funds. Fund Excess Ratio is Fund Balance divided by 1/n, where n is the number of equity funds in the plan menu. Alph Order is the integer value of an equity fund's alphabetical position in the plan menu of equity fund options. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. 5 Star Morningstar is an indicator variable equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name, identifying the proprietary funds of the TPA. Fund Frequency counts the number of times a fund is offered across all plans in the sample. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. Index Fund is an indicator variable equal to one if the fund's Lipper Objective is to mirror the S&P 500 Index. Age is the difference between the current year and the fund's inception year. Panel C reports pairwise correlation coefficients for plan-fund level variables along with p-values for the coefficients. Panel D reports descriptive statistics for characteristics of funds in the top half versus the bottom half of plan menu lists.

Panel A: Plan Level Variables

	Mean	Std Dev	Min	25th	Median	75th	Max
Plan Assets (millions)	32.47	149.99	0.14	3.89	8.35	20.00	7,200
Professional (1/0)	0.40	0.49	0	0	0	1	1
Finance (1/0)	0.07	0.26	0	0	0	0	1
Top TPA (1/0)	0.40	0.49	0	0	0	1	1
Number of Funds	19.79	8.09	2	14	18	25	129
Number of Equity Funds	10.10	4.66	2	9	11	13	75
Number of International Funds	1.93	1.58	0	1	2	2	23
Number of Fixed Income Funds	1.77	1.16	0	1	2	2	17
Number of Multi-Asset Funds	3.79	4.40	0	0	0	9	14
Number of Money Market Funds	1.55	0.75	0	1	2	2	7
Number of Other Funds	0.66	0.61	0	0	1	1	6
Number of Morningstar Categories	13.97	5.39	1	10	13	18	53
N = 6,807							

Panel B: Plan-fund Level Variables

	Mean	Std Dev	Min	25th	Median	75th	Max
Fund Balance (%)	9.90	10.26	0.00	2.42	6.85	14.19	100.00
Fund Excess Ratio (%)	100.00	99.59	0	28.48	73.81	141.21	2,160.72
Alph Order	6.53	5.22	1	3	6	9	75
Expense Ratio (%)	0.89	0.41	0.03	0.64	0.92	1.19	5.17
Lag 1yr Ret (%)	7.09	8.71	-38.0	3.00	6.00	11.00	88.00
5 Star Morningstar (1/0)	0.07	0.26	0	0	0	0	1
Proprietary Fund (1/0)	0.42	0.49	0	0	0	1	1
Fund Frequency	507.75	715.26	1	94	246	660	3,680
VFA (1/0)	0.48	0.50	0	0	0	1	1
Index Fund (1/0)	0.07	0.25	0	0	0	0	1
Age	20.46	15.17	0	11	16	24	83
N = 68,782							

Panel C: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Fund Excess Ratio									
(2) Alph Order	-0.068								
	(0.000)								
(3) Expense Ratio	-0.118	-0.025							
	(0.000)	(0.000)							
(4) Lag 1yr Ret	0.147	-0.058	0.075						
	(0.000)	(0.000)	(0.000)						
(5) 5 Star Morningstar	0.108	0.021	-0.018	0.170					
	(0.000)	(0.000)	(0.000)	(0.000)					
(6) Proprietary Fund	0.049	0.161	-0.247	0.070	0.192				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
(7) Fund Frequency	0.188	-0.172	-0.313	0.064	0.023	0.057			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
(8) VFA	0.106	0.072	-0.483	0.112	0.201	0.581	0.471		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
(9) Index Fund	0.095	0.011	-0.426	-0.053	-0.076	0.031	0.139	0.046	
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
(10) Age	0.175	-0.045	-0.205	0.066	0.149	0.028	0.124	0.208	0.116
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)

Panel D: Top Half vs. Bottom Half Funds

	Top Half		Bottom Half		Top - Bottom	
	Mean	Std Dev	Mean	Std Dev	Diff	t-stat
Fund Excess Ratio (%)	108.47	34.67	92.33	30.63	16.14	28.76
Expense Ratio (%)	0.89	0.27	0.88	0.32	0.01	1.59
Lag 1yr Ret (%)	7.79	3.75	6.28	3.87	1.51	23.04
Lag 3yr Ret (%)	32.07	7.18	31.90	7.48	0.18	1.40
Lag 5yr Ret (%)	101.14	20.73	105.82	21.57	-4.68	-12.89
Forward 3yr Ret (%)	-3.60	5.98	-0.96	5.46	-2.64	-26.88
Forward 5yr Ret (%)	8.79	7.49	11.90	7.18	-3.11	-24.74
Proprietary Fund (1/0)	0.37	0.42	0.41	0.42	-0.04	-5.47
Index Fund (1/0)	0.05	0.11	0.09	0.11	-0.04	-22.71
5 Star Morningstar (1/0)	0.07	0.13	0.06	0.11	0.01	6.09
Age	21.03	9.03	20.30	8.25	0.73	4.87
N=6,807						

Table 2

The effect of alphabeticity on 401(k) investment allocations

This table reports the coefficients of OLS regressions with plan fixed-effects for our main tests of the effect of alphabeticity on participants' investment allocations in 401(k) plans. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Alph Order is the integer value of an equity fund's alphabetical position in the plan menu of equity fund options. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. 5 Star Morningstar is an indicator variable equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Index Fund is an indicator variable equal to one if the fund's Lipper Objective is to mirror the S&P 500 Index. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. Fund Frequency counts the number of times a fund is offered across all plans in the sample. Age is the difference between the current year and the fund's inception year. The *t*-statistics are reported in parentheses using clustered standard errors at the plan administrator level.

	(1)	(2)	(3)	(4)	(5)
Alph Order	-2.232***	-2.011***	-1.894***	-1.299***	-1.321***
	(-10.830)	(-12.035)	(-12.418)	(-5.279)	(-8.830)
Expense Ratio		-43.550***	-34.995***	-27.365***	-16.420*
		(-4.036)	(-3.361)	(-3.121)	(-1.692)
Lag 1yr Ret		161.086***	154.044***	148.680***	135.620***
		(16.637)	(15.049)	(9.740)	(11.176)
Proprietary Fund		15.414***	7.813*	15.941***	25.001***
		(3.176)	(1.743)	(4.720)	(5.606)
5 Star Morningstar		40.152***	38.649***	39.825***	33.343***
		(4.759)	(4.476)	(6.038)	(12.612)
Index Fund		18.382	22.375*	19.012**	37.949***
		(1.625)	(1.949)	(2.201)	(3.838)
VFA			17.060***		
			(4.763)		
Fund Frequency				0.022***	
				(11.250)	
Age					1.127***
					(10.686)
Intercept		129.765***	116.760***	100.206***	71.616***
		(9.539)	(9.555)	(10.590)	(5.437)
N	68,782	68,782	68,782	68,782	61,480
R^2	0.005	0.068	0.071	0.086	0.087

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3

The effect of variation infFund position across plan menu lists

This table reports the coefficients of OLS regressions with fund fixed-effects that test whether variation in fund position across plan menu lists impacts participants' investment allocations. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Top 4 is an indicator variable equal to one if the fund is one of the first four listed funds alphabetically in a plan offering. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. Number of Equity Funds counts the number of equity funds offered in the plan. The *t*-statistics are reported in parentheses.

	All funds	Most frequent 50 funds only	Most frequent 10 funds only	Vanguard Funds only
	(1)	(2)	(3)	(4)
Top 4	2.629***	7.210***	9.562***	10.271***
	(2.605)	(4.209)	(3.341)	(3.222)
Proprietary Fund	13.770***	20.362***	26.091***	12.198***
	(11.508)	(10.575)	(7.758)	(4.875)
Number of Equity Funds	0.952***	2.211***	3.564***	1.716***
	(15.822)	(20.956)	(18.524)	(8.057)
Intercept	81.673***	80.123***	73.811***	75.582***
	(76.582)	(39.315)	(21.447)	(26.943)
N	68,782	27,468	11,021	6,665
R^2	0.006	0.020	0.036	0.018

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4

The influence of plan complexity on alphabeticity

This table reports the coefficients of OLS regressions that test whether plan complexity exacerbates the alphabeticity bias. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Top 4 is an indicator variable equal to one if the fund is one of the first four listed funds alphabetically in a plan offering. More 9 (More 13) (More 18) is an indicator variable equal to one if the plan contains more than 9 (13) (18) equity funds. Between 9 & 19 is an indicator variable equal to one if the plan contains more than 9 equity funds but less than 19 equity funds. MS Cat 18 is an indicator variable equal to one if the plan contains funds that belong to more than 18 (75th percentile in the sample) distinct Morningstar categories. Non-equity 12 is an indicator variable equal to one if the plan contains more than 12 (75th percentile in the sample) non-equity funds. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. 5 Star Morningstar is an indicator equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Index Fund is an indicator variable equal to one if the fund's Lipper Objective is to mirror the S&P 500 Index. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. The *t*-statistics are reported in parentheses using clustered standard errors at the plan administrator level.

	(1)	(2)	(3)	(4)	(5)	(6)
Top 4	13.437***	13.566***	14.248***	13.416***	11.065***	12.591***
	(8.992)	(9.720)	(8.623)	(9.043)	(7.660)	(7.817)
More 9	2.439					
	(1.151)					
Top 4 × More 9	3.659*					
	(1.821)					
More 13		-0.266				
		(-0.111)				
Top 4 × More 13		8.077**				
		(2.359)				
More 18			-3.488*	-1.194		
			(-1.739)	(-0.396)		
Top 4 × More 18			6.317**	7.136**		
			(2.428)	(2.180)		
Between 9 & 19				3.054*		
				(1.686)		
Top 4 × Between 9 & 19				3.021*		
				(1.683)		
MS Cat 18					-8.912***	
					(-6.186)	
Top 4 × MS Cat 18					9.629***	
					(5.805)	
Non-equity 12						-9.650***
						(-5.785)
Top 4 × Non-equity 12						5.758***

						(3.729)
Expense Ratio	-19.336***	-19.015***	-18.880***	-19.302***	-18.558***	-18.333***
	(-2.842)	(-2.800)	(-2.804)	(-2.852)	(-2.671)	(-2.636)
Lag 1yr Ret	152.681***	152.745***	152.954***	152.658***	152.204***	152.305***
	(13.963)	(14.276)	(14.457)	(14.054)	(14.719)	(14.761)
Proprietary Fund	-2.408	-2.176	-1.920	-2.143	-0.542	0.057
	(-1.062)	(-0.959)	(-0.829)	(-0.920)	(-0.222)	(0.023)
5 Star Morningstar	31.306***	31.398***	31.586***	31.451***	31.227***	31.593***
	(3.551)	(3.554)	(3.544)	(3.530)	(3.602)	(3.661)
Index Fund	30.862***	30.768***	30.471***	30.617***	30.282***	30.557***
	(2.889)	(2.863)	(2.817)	(2.844)	(2.775)	(2.782)
VFA	7.765**	7.844***	8.144***	8.012***	9.618***	9.926***
	(2.559)	(2.578)	(2.723)	(2.635)	(3.268)	(3.558)
Intercept	91.695***	93.151***	93.107***	91.499***	94.836***	93.957***
	(9.564)	(9.154)	(8.938)	(9.545)	(9.378)	(9.278)
N	68,782	68,782	68,782	68,782	68,782	68,782
R^2	0.055	0.055	0.055	0.055	0.055	0.056

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5

The influence of plan sophistication on alphabeticity

This table reports the coefficients of OLS regressions that test whether plan sophistication helps to moderate the effect of alphabeticity bias. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Top 4 is an indicator variable equal to one if the fund is one of the first four listed funds alphabetically in a plan offering. Professional (Finance) is an indicator variable equal to one if the plan sponsor operates primarily in a professional (financial) industry. Large Plan is an indicator variable equal to one if plan size is larger than $20 million (75th percentile in the sample). Top TPA identifies plans administered by the three largest third-party plan administrators in our sample: American Funds, Fidelity, and Vanguard. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. 5 Star Morningstar is an indicator variable equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Index Fund is an indicator variable equal to one if the funds Lipper Objective is to mirror the S&P 500 Index. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. Number of Equity Funds counts the number of equity funds offered in the plan. The *t*-statistics are reported in parentheses using clustered standard errors at the plan administrator level.

	(1)	(2)	(3)	(4)
Top 4	13.968***	14.933***	15.103***	14.195***
	(6.471)	(8.617)	(11.829)	(9.218)
Professional	-1.934*			
	(-1.741)			
Top 4 × Professional	2.468			
	(1.308)			
Finance		0.194		
		(0.168)		
Top 4 × Finance		0.928		
		(0.372)		
Large Plan			-4.447**	
			(-2.340)	
Top 4 × Large Plan			-0.280	
			(-0.097)	
Top TPA				-19.519***
				(-13.133)
Top 4 × Top TPA				2.846
				(0.854)
Expense Ratio	-19.070***	-18.993***	-20.407***	-17.737***
	(-2.802)	(-2.792)	(-2.848)	(-2.649)
Lag 1yr Ret	152.926***	152.968***	152.871***	149.496***
	(14.088)	(14.144)	(14.111)	(13.938)
Proprietary Fund	-2.259	-2.269	-2.063	6.336***
	(-0.984)	(-0.986)	(-0.915)	(3.078)
5 Star Morningstar	31.455***	31.464***	31.670***	32.125***

	(3.543)	(3.549)	(3.617)	(3.817)
Index Fund	30.788***	30.842***	30.257***	30.583***
	(2.875)	(2.872)	(2.845)	(2.961)
VFA	7.813***	7.787**	7.293**	13.423***
	(2.587)	(2.567)	(2.322)	(5.423)
Number of Equity Funds	0.099	0.087	0.099	0.231
	(0.775)	(0.718)	(0.750)	(1.511)
Intercept	92.697***	91.929***	94.370***	91.445***
	(9.205)	(9.329)	(9.024)	(12.418)
N	68,782	68,782	68,782	68,782
R^2	0.061	0.061	0.061	0.059

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6

Ruling out serial-position effects as an alternative explanation

This table reports the coefficients of OLS regressions with plan fixed-effects that test whether serial-position effects are an alternative explanation to alphabeticity bias. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Top 4 is an indicator variable that is equal to one if the fund is one of the first four listed funds alphabetically in a plan offering. Bottom 4 is an indicator variable equal to one if the fund is one of the last four funds listed alphabetically in a plan offering. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. 5 Star Morningstar is an indicator variable equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Index Fund is an indicator variable equal to one if the fund's Lipper Objective is to mirror the S&P 500 Index. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. Column 2 (3) only considers plans with less than 10 (more than 9) equity funds available in the plan menu. The *t*-statistics are reported in parentheses using clustered standard errors at the plan administrator level.

	(1)	(2)	(3)
Top 4	13.929***	11.579***	18.850***
	(5.905)	(9.558)	(3.267)
Bottom 4	-4.424*	-4.859***	-5.500*
	(-1.947)	(-2.925)	(-1.665)
Expense Ratio	-34.533***	-34.515***	-34.502***
	(-3.242)	(-3.018)	(-3.478)
Lag 1yr Ret	155.270***	175.054***	128.424***
	(14.463)	(6.077)	(13.187)
Proprietary Fund	10.102**	8.494**	12.662
	(2.432)	(2.154)	(1.469)
5 Star Morningstar	38.082***	39.089***	36.868***
	(4.659)	(3.511)	(7.430)
Index Fund	23.045**	18.234	41.834***
	(2.041)	(1.597)	(3.432)
VFA	16.356***	13.786***	22.383***
	(4.549)	(4.415)	(3.596)
Intercept	99.526***	102.132***	93.752***
	(7.261)	(7.417)	(6.777)
N	68,782	46,644	22,138
R^2	0.071	0.083	0.060

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7

Robustness tests of alternative fund ordering and outliers in fund excess ratio

This table reports the coefficients of OLS regressions with plan fixed-effects that test the robustness of our results to alternative fund ordering by Fidelity plans and outliers in Fund Excess Ratio. In Columns 1 and 2 in Panel A we re-run our main tests from Table 2 for plans not administered by Fidelity and for plans administered by Fidelity, respectively. In Column 3 we reorder the menus of Fidelity administered plans to be consistent with their actual design and re-run our main tests. In Panel B we omit any plan that contains a plan-fund observation that falls below the first percentile or the ninety-ninth percentile of Fund Excess Ratio and re-run our main tests from Table 2. The dependent variable is Fund Excess Ratio, measured as the ratio of Fund Balance (the amount of investment in an equity fund divided by the total plan investment in equity funds) to 1/n, where n is the number of equity funds in the plan menu. Alph Order is the integer value of an equity fund's alphabetical position in the plan menu of equity fund options. VFA is an indicator variable equal to one if the first word(s) of the fund name is Vanguard, Fidelity, or American Funds. Expense Ratio is the fund's expense ratio. Lag 1yr Ret is a fund's prior year net return. Proprietary Fund is an indicator variable equal to one if the fund's name contains the TPA's name. 5 Star Morningstar is an indicator variable equal to one if the fund had a Morningstar five-star rating as of the beginning of 2007. Index Fund is an indicator variable that is equal to one if the fund's Lipper Objective is to mirror the S&P 500 Index. Fund Frequency counts the number of times a fund is offered in the sample. Age is the difference between the current year and fund inception year. The *t*-statistics are reported in parentheses. Standard errors are clustered at the plan administrator level, except in Panel A models (2) and (3).

Panel A: Alternative Fund Ordering in Fidelity Administered Plans

Alphabetical ordering of:	All Equity Funds		Equity Funds by Asset Sub-Classes
Plans included:	Non-Fidelity Plans	Fidelity Plans	Fidelity Plans
	(1)	(2)	(3)
Alph Order	-1.697***	-1.165***	-1.962***
	(-5.056)	(-8.606)	(-11.14)
VFA	12.073***		
	(4.049)		
Expense Ratio	-52.175***	-31.074***	-32.582***
	(-8.831)	(-10.283)	(-10.787)
Lag 1yr Ret	138.019***	175.253***	158.028***
	(15.205)	(17.954)	(15.794)
Proprietary Fund	13.229*	37.045***	35.628***
	(1.954)	(18.019)	(17.292)
5 Star Morningstar	5.372	32.504***	32.460***
	(1.049)	(15.463)	(15.460)
Index Fund	9.271	-2.438	-2.073
	(0.627)	(-0.699)	(-0.595)
Intercept	140.149***	88.460***	96.563***
	(16.517)	(23.687)	(24.724)
N	46,813	21,969	21,969
R^2	0.069	0.088	0.090

Panel B Controlling for Outliers in Fund Excess Ratio

	(1)	(2)	(3)	(4)
Alph Order	-1.997***	-1.841***	-1.118***	-1.093***
	(-8.367)	(-7.935)	(-4.665)	(-8.282)
Expense Ratio	-39.136***	-30.300***	-24.019***	-12.596
	(-3.631)	(-2.792)	(-2.840)	(-1.234)
Lag 1yr Ret	161.809***	154.394***	149.606***	137.368***
	(11.378)	(10.662)	(7.517)	(8.519)
Proprietary Fund	12.561**	5.363	12.703***	20.754***
	(2.487)	(1.482)	(4.110)	(4.058)
5 Star Morningstar	31.268***	29.693***	31.433***	25.590***
	(4.750)	(4.440)	(6.255)	(14.753)
Index Fund	14.290	18.310*	15.411**	33.534***
	(1.410)	(1.768)	(1.969)	(3.734)
VFA		17.036***		
		(4.706)		
Fund Frequency			0.020***	
			(8.810)	
Age				1.040***
				(11.801)
Intercept	126.966***	113.530***	98.770***	70.740***
	(8.974)	(8.444)	(10.553)	(4.945)
N	55,408	55,408	55,408	49,214
R^2	0.075	0.078	0.096	0.097

***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.