

**INVESTING FOR RETIREMENT:
THE MODERATING EFFECT OF FUND ASSORTMENT SIZE ON THE 1/N HEURISTIC**

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*INVESTING FOR RETIREMENT:**THE MODERATING EFFECT OF FUND ASSORTMENT SIZE ON THE 1/N HEURISTIC*

Does the number of funds offered in your defined contribution plan affect how many funds you choose to invest in or how you spread dollars across the funds you choose? Across three experiments and the analysis of defined contribution plan data, we explore these issues by examining investors' tendency to engage in the $1/n$ heuristic – allocating their dollars evenly across all available investment options (Benartzi and Thaler 2001). We decompose this heuristic into its two underlying behavioral dimensions: the tendency to invest in all available funds (which we label $1/n_{\#}$) and the tendency to spread the invested dollars evenly across chosen funds (which we label $1/n_{\$}$). We argue that choosing from larger fund assortments taxes investors' cognitive resources, which leads to more simplified diversification strategies. We find that increasing the fund assortment size *decreases* the tendency to invest in all available funds ($1/n_{\#}$), but *increases* the tendency to spread the invested dollars evenly among the chosen alternatives ($1/n_{\$}$) – provided that the number of funds chosen for investment allows for easy equal dollar allocations. We integrate our results with prior research regarding asset choice and allocation heuristics.

Keywords: retirement, investment decisions, 401k, asset allocation, $1/n$ heuristic, diversification

Historically, traditional defined benefit pensions were the primary form of retirement plan offered in the U.S. However, in the 1990s defined contribution plans such as 401(k)s became the primary form (Estreicher and Gold 2007). The reasons for this shift are many, including a reduction in financial risks for the employer and the need to accommodate the fact that few employees remain with one firm for their working lifetimes. As individuals take on more responsibility for their retirement assets, concerns arise regarding the ability and motivation of individuals to make these decisions. These decisions are becoming more daunting as employers increase the number of mutual funds they offer for investment in their defined contribution plans. Some employers are now even offering brokerage accounts in their plans (Rosato 2003), effectively increasing the choice set to include hundreds or even thousands of investment options.

Managers of financial services are faced with a dilemma. On the one hand, they wish to offer retirement plan participants larger assortments from which to choose in order to maximize satisfaction. On the other hand, they don't want to overwhelm or intimidate investors by creating plans that result in more difficult or biased decisions. This dilemma leads us to study how the assortment of mutual funds offered in retirement plans impacts the use of simplified diversification strategies by plan participants.

While researchers in marketing have considerable potential to increase our understanding of financial investment decision making, research in this important domain is only recently beginning to emerge. For example, recent research has examined the use of credit (e.g., Prelec and Loewenstein 1998; Prelec and Simester 2001; Soman 2001; Soman and Cheema 2002) and customers' preferences for financial products (Zhou and Pham 2004). Researchers have begun to examine decision simplification strategies and heuristics, such as the susceptibility to contextual and presentation biases in investment decisions (Nenkov et al. 2009), and the disposition effect, or the tendency to sell "winners" (stocks that have appreciated in value) sooner than "losers" (those that

have declined in value; e.g., Dhar and Zhu 2006; Kumar and Lim 2008; Lee et al. 2008; Shefrin and Statman 1985).

We seek to contribute to this nascent body of research by examining the use of decision simplification strategies as a function of fund assortment. In the present research, we show that choosing from a larger fund assortment reduces the tendency to invest in all available funds, but increases the absolute number of funds invested in. Importantly, choosing from a larger assortment also increases the tendency to allocate the invested dollars evenly across the chosen funds, provided the investor chooses a number of funds that makes it easy to perform an even allocation. We argue that choosing from larger assortments taxes investors' cognitive resources, which results in greater reliance on simplified diversification strategies. Our work builds on the ideas that reducing available cognitive resources leads to the increased use of heuristics (e.g., Chaiken and Trope 1999; De Neys 2006; Evans and Curtis-Holmes 2005), and engaging in an initial difficult choice task makes decision makers rely on less effortful and deliberative decision strategies in a subsequent choice task (Pocheptsova, Amir, Dhar, and Baumeister 2009).

Our findings replicate, extend, and explicate recent findings by Huberman and Jiang (2006). We provide a process explanation for several of their results and address an issue largely unexplored in their work – the tendency to spread invested dollars evenly across chosen funds as a function of assortment size and the number of funds chosen for investment. This question is quite important, because the level of diversification in a retirement investment portfolio can significantly impact an investor's expected income stream in retirement (Markowitz 1952). Unfortunately, investors often do not adequately diversify their retirement plans (Morgenson 2003), holding just one or two funds in their 401(k) plans (Wang 2004), overinvesting in an employer's stock (Meulbroek 2005), concentrating their portfolios in particular fund “styles” (Statman 2004) or “pseudodiversifying” by choosing investments whose returns are highly correlated (Ayal and Zakay

2009; Hedesstrom, Svedsater, and Garling 2004; Shefrin and Statman 2000).

ASSORTMENT SIZE

Research suggests that, when asked directly, consumers say they prefer choosing from larger assortments (for a review see Broniarczyk 2008). Large assortments should increase the probability that consumers will find their ideal products (Baumol and Ide 1956) and may offer more decision flexibility (Kahn and Lehmann 1991). However, some of the negative psychological effects of choosing from larger product assortments have gained attention in recent years (Gourville and Soman 2005; Mick, Broniarczyk, and Haidt 2004; Schwartz 2004). Choosing from larger assortments requires extra effort to evaluate the attractiveness of each of the alternatives in the assortment, leading to increased demand on an individual's cognitive resources (Chernev 2003). Such limited-resource decision making results in greater reliance on decision simplification strategies (Chaiken and Trope 1999; De Neys 2006; Evans and Curtis-Holmes 2005; Epley and Gilovich 2006; Levav, Kivetz, and Cho 2010; Pocheptsova et al. 2009) to reduce the effort expended on decision making (e.g., Shah and Oppenheimer 2008).

Much of the prior work on assortments has been conducted in contexts where the consequences of a wrong decision are minimal (e.g., choosing the wrong brand of jam, chocolate, or other grocery item). However, there has been some recent seminal work on more consequential decision making such as that involved in investing for retirement. Huberman, Iyengar, and Jiang (2007) investigate the impact of assortment size on consumers' participation in retirement plans and find that every ten funds added to a 401(k) plan lead to a 1.5% to 2.0% drop in participation rates. Such decision deferrals are likely the result of the increased complexity of the choice task. While recent research has suggested ways to increase employee participation in 401(k) plans (Madrian and Shea 2001; Thaler and Benartzi 2004), little research has examined the impact of fund assortment size on individual investors' allocation or diversification strategies.

DECOMPOSING THE 1/n HEURISTIC

We focus on a specific type of diversification strategy simplification - the tendency to evenly allocate the dollar contributions among all of the options offered. Investing perfectly evenly in all available funds has been termed the "1/n heuristic" (Benartzi and Thaler 2001). While allocating investment dollars evenly among all available options is not a suboptimal strategy per se, a critical downside of engaging in the 1/n heuristic is that an investor's allocations become subject to menu effects, such that retirement plans offering a larger (smaller) proportion of stock funds will result in greater (lesser) equity exposure. These initial diversification decisions in a retirement portfolio are particularly important because investors commonly exhibit decision inertia after their initial allocation decisions (Samuelson and Zeckhauser 1988).

Recent research by Huberman and Jiang (2006) suggests that relatively few investors actually engage in the strict definition of the 1/n heuristic – they report that less than 1% of investors invest evenly in all available funds. Notably, their work was based on a dataset whose mean fund set size was about double that of the data set used by Benartzi and Thaler, who found a higher incidence of the 1/n heuristic (2001; 13.7 versus 6.8 mean number of funds offered, respectively). Recognizing that the experiments in their research were restricted to small fund assortment sizes, typically from two to five funds in total, Benartzi and Thaler (2001) explicitly called for research testing boundary conditions for the 1/n heuristic using larger fund assortment sizes. This is one of the objectives of our research.

The core conclusions of Huberman and Jiang (2006) are that strict adherence to the 1/n heuristic is rare, and that the tendency to engage in weaker forms of this heuristic is not subject to the number of funds offered in retirement plans. However, a careful reading of their work suggests that investors' allocation tendencies may in fact differ according to fund assortment size. They report that the vast majority of individual investors prefer to invest in just a handful of funds (i.e.,

three to five funds) and that investors' choices are largely impervious to fund assortment size. However, when analyzed at the plan level, they note that plans offering more funds resulted in a greater mean number of funds invested in. For example when 10 [30] funds were offered in a plan, 75% of the dollars invested was allocated across 5 [11] funds.

Importantly, Huberman and Jiang (2006) did not examine investors' allocations across chosen funds as a function of assortment size. Their results (Table III, p. 780) suggest that investors are more likely to evenly divide their dollars when allocating across a chosen number of funds that make it easy to do so (e.g., it is easy to evenly divide dollars across two or three funds, but not across seven or eight funds). However, they are silent on the issue of whether or not the tendency to divvy up one's dollars evenly increases as a function of number of funds offered for investment.

Our research specifically explores the moderating effect of mutual fund assortment size on the use of the $1/n$ heuristic by decomposing the heuristic into its two underlying behavioral dimensions: 1) choosing the funds from among those offered in which to invest, and 2) deciding how to allocate investment dollars across the set of chosen funds. We propose that the $1/n$ heuristic reflects the confluence of two decision simplification strategies: fund choice and dollar allocation. In the fund choice component, the $1/n$ heuristic involves choosing every available option. We refer to this as the $1/n_{\#}$ heuristic. In the dollar allocation component, the $1/n$ heuristic involves allocating an equivalent amount to each chosen option. We refer to this as the $1/n_{\$}$ heuristic. Clearly, the $1/n$ heuristic fails to obtain if the investor departs from either the $1/n_{\#}$ heuristic or the $1/n_{\$}$ heuristic.

We argue that the two behavioral tendencies operate differently as a function of fund assortment size. We expect that the $1/n_{\#}$ heuristic is more likely to occur when investors choose from a small fund assortment size. As mentioned earlier, recent investigations (Huberman and Jiang 2006) indicate that most 401(k) participants tend to invest in just a handful of funds (typically three to five). Thus, when the fund size assortment is very small, individuals who believe they must

invest in several different funds to achieve sufficient diversification are likely to invest in all available funds – even if the set of investment options does not perfectly match their preferences. If this is the case, the need to invest in *all* offered funds should abate as fund assortment size increases. Because Benartzi and Thaler (2001) examined relatively small fund assortment sizes, their findings may reflect, in part, a ceiling effect caused by an inadequate fund assortment. We therefore expect that the tendency to invest in all available (or a larger proportion of) funds will *decline* as fund assortment size increases.

Further, as fund assortment size increases, the complexity of the choice task increases, creating a cognitively taxing context for the investor. Dual-process theories of judgment and decision making (e.g., Chaiken and Trope 1999; Evans 2006; Kahneman and Frederick 2005) argue that decision makers can engage in either intuitive, heuristic, and simplified System 1 decision processes, or in slower, more analytic, deliberative, and reflective System 2 processes (see Evans 2008 for a review). Importantly, the System 2 process requires access to sufficient cognitive resources, and recent research suggests that decision makers will default to System 1 processes when under time pressure (Evans and Curtis-Holmes 2005), cognitive load (De Neys 2006), or after having just completed a cognitively exhausting choice task (Pocheptsova et al. 2009).

Choosing from a larger assortment entails making a larger number of tradeoffs, which reduces the availability of cognitive resources (Schmeichel and Baumesiter 2004; Vohs et al. 2008). Although we posit that choosing from a larger assortment will reduce the tendency to invest in *all* available funds, we do expect that the average number of funds invested in will increase, demonstrating a weaker menu effect in accord with the theorizing of Benartzi and Thaler (2001). The larger fund assortment represents a more cognitively taxing decision context (Chernev 2003; Huffman and Kahn 1998), which should increase investors' reliance on simplified decision strategies. One such diversification strategy will consist of investing in more funds. Investing in

more funds allows investors to construct what they may perceive to be a more diversified portfolio without having to carefully evaluate and compare the attractiveness of each of the available funds. Thus, we expect that, as the number of funds offered for investment increases, the proportion of funds invested in will decline, but the sheer number of funds invested in will rise.

We also predict that another simplified diversification strategy will manifest when investors choose from larger fund assortments, a phenomenon largely uninvestigated in prior research. Specifically, we expect that if an investor has chosen a number of funds to invest in that makes it cognitively easy to evenly allocate their dollars across those funds (i.e., has chosen to invest in 1, 2, 3, 4, 5, or 10 funds), then the tendency to evenly allocate the invested dollars among chosen funds (the $1/n$ heuristic) will be greater if choosing from a larger fund assortment.

If an employer offers only a handful of funds to choose from (e.g., from 1 to 5 funds), the number of funds chosen by investors will always represent a number that renders it cognitively easy to divide the dollars evenly across the chosen number of funds. When choosing from a larger fund assortment, some investors will choose a number of funds that makes it difficult to evenly divide their dollars – for example, choosing to invest in 7, 8, or 9 funds. We predict that among those choosing a number of funds to invest in that provides an easy divisor for equal allocations, the tendency to evenly allocate dollars should be significantly greater when choosing from a larger versus smaller fund assortment, as a response to the cognitively taxing choice task. Finding such a pattern of results would help to resolve differences in the observed incidence of the $1/n$ heuristic (Benartzi and Thaler 2001; Huberman and Jiang 2006) and extend prior findings regarding the tendency to evenly allocate dollars as a function of choosing an easy divisor number of funds for investment (Huberman and Jiang 2006).

To test our propositions, we present the results of four studies. In Studies 1a and 1b, we manipulate 401(k) plan structure (i.e., fund assortment size) in decision simulations and assess the

effects on investor behavior. In Study 2 we also manipulate cognitive load in order to explore the underlying process. In Study 3, which assesses actual 401(k) investment decisions, we examine plan participants' initial defined contribution plan allocations when choosing from a small versus large fund assortment size. The experimental work was supported by a grant from the FINRA (formerly NASD) Investor Education Foundation.

For the first three studies, we had to choose how many funds to offer for investment in the decision scenarios. Research suggests that as of 2001, the majority of 401(k) plans offered from 3 to 9 options for investment (Elton, Gruber, and Blake, 2006), so we wanted to encompass at least this range. In Benartzi and Thaler's (2001) analysis of a database containing 1.56 million 401(k) investors, they reported the average number of funds offered in the 401(k) plans as 6.8, with a range from 1 to 21 funds offered. Huberman and Jiang (2006) report a range of plans offering from 4 to 59 funds, with the vast majority offering 22 or fewer. Given this backdrop, Study 1a investigates the effect of offering 3 versus 15 funds for investment, Study 1b offers 5 versus 25 funds for investment, and Study 2 offers 6 versus 18 funds for investment. Study 3 examines real investors' allocations when choosing from either 10 or 19 funds.

STUDY 1a

Method

Sample. For Study 1a, a nationally representative sample of U.S. households was obtained from a list seller for a mailing to 5,000 households. A dollar bill was enclosed to encourage response; 344 responses were received for a response rate of 6.7%. Since 84 respondents said they would choose not to participate in the plan, the analyses are based on a sample of 260 (Mean age = 45; 36.9% female).

Design. Study 1a consists of a single factor (fund assortment size: small, large) between-

subjects design. Assortment size was manipulated such that the 401(k) plan offered 3 or 15 mutual funds for investment (i.e., a small or large fund assortment; see web Appendix). The funds were listed in alphabetical order. We maintained an equal split among the proportion of stock funds (1/3 of total), bond funds (1/3 of total), and money market funds (1/3 of total) offered. In the small assortment condition, there was one stock fund, one bond fund, and one money market fund. In the large assortment condition, there were five stock funds, five bond funds, and five money market funds.

Procedure. Each participant received a booklet that asked him/her to imagine that s/he was an employee of a firm that offered the opportunity to invest in a 401(k) plan. Participants were exposed to information describing the plan, including descriptions about each of the funds offered. Participants then decided how much money to invest by filling in the amount, and decided how they would allocate their monies across the mutual fund options by writing in amounts next to names of each of the funds they chose to invest in. They were allowed to enter either the dollar amount or the percent of total dollars for each fund, and they were instructed that the total had to equal their chosen total dollar amount (or 100%). They were informed about the maximum annual dollar investment they could make (\$14,000), and that this maximum was set by the Federal government.

The fund descriptions were based on actual funds available at Vanguard, although Vanguard-specific brand-identifying information was removed from the stimuli. After the investment decision was completed, respondents answered several questions on 7-point Likert items (from 1 = Strongly Disagree to 7 = Strongly Agree) and provided demographic information. Further, following the investment decision task, 108 respondents completed a thought-listing task (explained in more detail below).

Measures. We report the tendency to invest in all available funds (1/n#), an outcome of the first stage of the investment decision process, as well as the proportion of available funds invested

in, and the mean number of funds chosen. We then report the proportion of investors choosing an “easy divisor” number of funds and the proportion of investors who evenly allocate dollars across the funds chosen for investment ($1/n_s$).¹ We classify those who spread their dollars across just one fund as evenly (versus unevenly) allocating their dollars, along with those who spread their dollars evenly across more than one fund. We report the proportion of investors choosing one fund, the proportion choosing 2, 3, 4, 5, or 10 funds, and the proportion choosing some other number of funds in Table 1.

For a randomly selected one third of the households mailed, we included an open-ended question immediately after they completed the investment task. We asked them to tell us in their own words how they made their decisions. We calculated the number of thoughts listed and used this measure as an indication of cognitive resource availability. We expected people in the large assortment condition, whose cognitive resource availability is more limited due to increased cognitive effort, would generate fewer thoughts (e.g., Fennis, Janssen, and Vohs 2008; Shiv and Fedorikhin 1999).

Results

Our focal interest is how mutual fund assortment size affects the likelihood that subjects exhibit each of the two underlying dimensions of the $1/n$ heuristic. In this study and all subsequently reported studies, we define an easy divisor number of funds as 1, 2, 3, 4, 5, or 10 mutual funds having been chosen for investment. Unless otherwise noted, the linear and logistic regressions for this study and all subsequently reported studies were conducted with fund assortment size coded as a dummy variable. In addition, for the analyses in the first three studies, covariates were included

¹We also report in Tables 1 and 2, the Herfindahl index, the sum of squared proportions of dollars invested across chosen funds, in accord Huberman and Jiang (2006). A smaller Herfindahl index indicates a more even allocation of dollars. Note that this index is limited in the current context, however, as its value is correlated with the number of funds chosen for investment. We also conducted our analyses with an entropy measure (Mitchell, Kahn and Knasko 1995) and the results are consistent with those based on the Herfindahl index.

for the respondent's gender, age, household income, employment status, possession of a 401(k) plan, and dollars invested in the plan. Means (covariate-adjusted) from this study and all subsequent studies are shown in Table 1. To ease readability, for all studies we report the model tests and statistical results for the mean comparisons in Table 2, rather than in the body of the paper.

Insert Tables 1 and 2 about here.

1/n. Only 1.9% of respondents chose to allocate their investment dollars evenly across all the funds available (i.e., engaged in the strict definition of 1/n), and the propensity to do so did not differ in the small (3.0%) versus large (0.8%) assortment conditions ($p > .15$). This low overall incidence rate is in accord with that of Huberman and Jiang (2006). We next examine the impact of fund assortment size on the two underlying dimensions of the 1/n heuristic.

1/n#. A larger proportion of participants invested in all available funds when choosing from the small versus large assortment (43.7% versus 0.8%, respectively, $p < .01$), in support of our thesis. The proportion of available funds invested in also decreased as fund assortment size increased: from 74.6% in the 3 fund assortment condition to 24.7% in the 15 fund assortment condition ($p < .01$). Also, as predicted, the larger fund assortment resulted in a larger absolute number of funds chosen for investment. Investors included an average of 2.25 funds when choosing from a 3 fund assortment, compared to 3.68 funds when choosing from a 15 fund assortment ($p < .01$).

1/n\$. We next examined the tendency to invest dollars evenly across chosen funds. The proportion of investors who divided their dollars evenly among their chosen funds did not differ as a function of assortment size (35.6% in the small versus 39.2% in the large assortment condition, $p > .20$). The proportion of investors who chose to invest in an easy divisor number of funds (i.e., 1, 2, 3, 4, 5, or 10 funds) decreased from the small (100.0%) to large (84.0%) assortment condition ($p < .01$). Conditional upon choosing an easy divisor number of funds, the tendency to evenly allocate dollars was significantly higher in the large (45.7%) versus small (35.6%, $p < .05$) assortment condition, as

predicted. These results provide evidence of an increased reliance on the even allocation heuristic ($1/n_s$) when choosing from a larger fund assortment, conditional on having chosen a number of funds that provides an easy divisor.

Thoughts. We examined the thoughts listed in response to the open-ended question posed immediately after completion of the investment task (to the random sample of respondents as mentioned earlier, $n = 108$). Investors listed 1.70 thoughts on average when choosing from a small fund assortment, compared to 0.98 thoughts when choosing from the large fund assortment ($p < .05$). This 42% reduction in thoughts supports our argument that investors had fewer cognitive resources available when choosing from the larger assortment.

Discussion

We show that the two underlying dimensions of the $1/n$ heuristic respond quite differently to increasing fund assortment sizes, and that it is necessary to analyze each tendency separately to clearly understand the drivers of the $1/n$ phenomenon. In this study we find support for our prediction that the tendency to invest in all available funds abates when choosing from a larger fund assortment. Thus, this aspect of the $1/n$ heuristic may reflect a ceiling effect of too small an assortment size in prior research (Benartzi and Thaler 2001). However, we find support for a weaker form of this aspect of the $1/n$ heuristic, in that the absolute number of funds invested in increased when choosing from a larger assortment. Further, we find that among investors who have chosen an easy divisor number of funds to invest in, the tendency to invest their dollars evenly across chosen funds is greater when choosing from a larger fund assortment. We argue that this tendency is a response to the cognitively taxing effect of considering a larger number of funds for investment. The more complex task limits the cognitive resources available to the decision maker, who then chooses to simplify the portfolio construction task by evenly allocating dollars across chosen funds. Our thought listing findings provide corroborating process level support for our

theoretical framework.

We next present the results of a study conducted in a different medium, an online panel, which provides an alternative process measure, time taken to complete the task, as a proxy for limited resource availability. We also alter the plan structure offerings such that the small fund assortment is larger (5 funds offered rather than 3), and both of the fund assortments offer a majority of stock funds for investment, as is more common in defined contribution plan offerings.

STUDY 1b

Method

Sample. In this study, a nationally representative sample of U.S. adults was obtained from a commercial market research firm via an online panel. A total of 363 participants completed the questionnaire and chose to participate in the plan (Mean age = 47; 64.9% female).

Design. This study consisted of a single factor (fund assortment size: small, large) between-subjects design. Assortment size was manipulated such that the 401(k) plan offered 5 or 25 mutual funds for investment (see web Appendix). The funds were listed in alphabetical order. In the small assortment condition there were 3 stock funds, 1 bond fund, and 1 money market fund offered for investment, while in the large assortment condition there were 15 stock funds, 5 bond funds, and 5 money market funds offered. Thus, this study differs from the previous study in that the small assortment condition contained a larger set from which to choose. In addition, the proportion of funds offered in each of the three asset categories more closely matches that offered by many fiduciaries, with a significantly larger proportion of stock funds offered compared to bond or money market funds.

Procedure. The procedure in this study was similar to that of Study 1a. Because this study was conducted online, investors viewed the fund descriptions, then a) selected the total amount they

wanted to invest from a drop-down list (\$0, \$500, \$1,000, \$2,000, \$3,000...\$15,000), and b) entered a percentage amount next to each fund to indicate the percent of their investment they wanted to allocate to each. The software alerted them if their total percentages did not equal 100%.

Results

1/n. Only 2.2% of participants chose to allocate their investment dollars evenly across all the funds available. This low incidence mirrors the results of Study 1a. Also, the tendency to engage in the strict definition of the 1/n heuristic was higher in the small (6.0%) versus large (0.0%) fund assortment condition ($p < .01$). We now turn to separate analyses of the two underlying dimensions of the 1/n heuristic.

1/n_#. A larger proportion of participants invested in all available funds when choosing from the small versus large assortment (29.3% versus 3.5%, respectively, $p < .01$), as predicted. The proportion of available funds invested in also fell as fund assortment size increased: from 66.1% in the 5 fund assortment condition to 24.9% in the 25 fund assortment condition ($p < .01$). Fund assortment size also significantly impacted the number of funds invested in. Investors included an average of 3.35 funds when choosing from a 5 fund assortment, compared to 6.22 funds when choosing from a 25 fund assortment ($p < .01$).

1/n_{\$}. We then examined the tendency to spread dollars evenly across the chosen investment options. The proportion of investors who did this did not differ between the small (39.1%) and large (37.0%) assortment conditions ($p > .85$). The proportion of investors who chose to invest in an easy divisor number of funds decreased from the small (100.0%) to large (61.7%) assortment condition ($p < .01$). Conditional on choosing an easy divisor number of funds, the tendency to evenly allocate dollars rose significantly from the small (39.1%) to large assortment (54.2%) conditions ($p < .05$), as predicted.

Time. We measured the number of seconds that each respondent took to complete the task.

Because the distribution of times to complete exhibited a right-tailed skew, we applied a log transform (Kleinbaum et al. 1998) for the statistical analyses, but report the results in untransformed units. The total time to complete the task rose from 659 to 713 seconds in the small versus large assortment conditions ($t = 1.96, p < .05$), suggestive of increased task complexity. We also examined time spent per fund chosen for investment.² Choosing from a large assortment *reduced* the average number of seconds spent per fund chosen for investment ($p < .01$), from 196 seconds in the small assortment condition to 114 seconds in the large assortment condition. This result shows that respondents in the large fund assortment condition spent less time per chosen fund, suggestive of limited-resource decision making.

Discussion

In this study, we replicate results from Study 1a and provide process evidence with an alternative measure (time rather than thoughts) to support our framework. The results support our thesis that larger fund assortments reduce the tendency to invest in all funds available but increase the average number of funds invested in. The larger assortment also increases the tendency to spread dollars evenly across chosen funds among those choosing an easy divisor number of funds for investment. Because the thought listing task used in Study 1a and the time spent per chosen fund in Study 1b are only indirect indicators of cognitive resource availability, we now report results from a study in which we directly manipulate the availability of participants' cognitive resources.

STUDY 2

In this study, we provide a stronger test of our limited cognitive resources argument by actively manipulating respondents' resource availability (e.g., Schmeichel and Baumesiter 2004; Shiv and Fedorikhin 1999; Vohs et al. 2008). Here we ask participants to make investment choices

² We thank the Associate Editor for suggesting this metric.

while under a cognitive load manipulation for a stronger test of our framework via a dual task paradigm (Norman and Bobrow 1975). A cognitive load manipulation involves having participants attend to a task that is peripheral to the main task at hand, thereby reducing the amount of attention or cognitive resources that can be devoted to the main task. Cognitive load manipulations, or those that create cognitive busyness (Gilbert, Pelham, and Krull 1988), tax human performance because humans operate with limited cognitive resources.

Our cognitive load manipulation involved rehearsing a 5-digit (versus 2-digit) random number (DeSteno et al. 2002; Shiv and Fedorikhin 1999). Making investment choices while rehearsing a 5-digit number diverts cognitive resources away from the simultaneous investment task, because resources are divided up to perform these two functions simultaneously (Schmeichel and Baumesiter 2004; Vohs et al. 2008). We expect that, as in the previous studies, choosing from a larger fund assortment will reduce the tendency to invest in all available funds, reduce the proportion of funds invested in, and increase the absolute number of funds chosen. More importantly, we expect the cognitive load manipulation to impact investors' dollar allocation strategies in a manner similar to that of choosing from larger fund assortments. Specifically, we expect that in the small fund assortment condition, investors under a high (vs. low) cognitive load will be more likely to evenly allocate their dollars across their chosen funds, conditional on choosing an easy divisor number of funds. The high cognitive load will reduce the cognitive resources available for engaging in more complex allocation strategies, similar to the effect of choosing from a large fund assortment.

Method

Sample. In this study, 300 U.S. adult respondents from a nationwide consumer panel were paid to participate in an online survey involving "financial decisions." (Mean age = 30; 62% female). Since four participants chose to contribute \$0 to the 401(k) plan, the analyses are based on a sample of 296.

Design. This study consisted of a 2 (fund assortment size: small, large) X 2 (cognitive load: yes, no) full factorial between-subjects design. Assortment size was manipulated such that the 401(k) plan offered 6 or 18 mutual funds for investment (see web Appendix). The funds were listed in alphabetical order. In the small assortment condition there were 3 stock funds, 2 bond funds, and 1 money market fund offered for investment, while in the large assortment condition there were 9 stock funds, 6 bond funds, and 3 money market funds offered.

Procedure. The procedure in this study was similar to that of Study 1b, but one key difference was the manipulation of cognitive load (Shiv and Fedorhikin 1999). Just prior to viewing the funds for investment, respondents were asked to memorize either a 2-digit (low cognitive load) or 5-digit (high cognitive load) number presented on the computer screen. They were told they would be asked to provide this number after they completed the investment task. The number remained on the screen until the respondent pressed a key to continue (i.e., after they had memorized the number). The participants were instructed not to write down the number, but rather to retain it in memory during the investment task.

Another key difference was that we explicitly separated the two stages of the investment task: choosing funds versus allocating dollars across the chosen funds. That is, respondents were provided with the fund descriptions and asked to check off the boxes next to the fund(s) they chose to invest in. Once this decision was made, they were taken to a subsequent screen that presented their chosen funds and were asked how they would allocate their investment across these funds. Their task on this screen consisted of entering the percentage (from 0 to 100) of their investment that they would allocate to each of the chosen funds. After the investment decision, respondents were asked to write down the number they had been asked to memorize in a blank box. They also completed several closed-ended items, including demographic information.

Results

Manipulation Check. As a manipulation check for the cognitive load manipulation, we examine the time that participants spent on the page with the cognitive load manipulation. This reflects the amount of time spent memorizing either the short or long number before taking part in the investment task. Participants in the low cognitive load (i.e., 2-digit number) condition spent an average of 12.5 seconds compared to 22.1 seconds among those in the high cognitive load (i.e., 5-digit number) condition ($t(294) = 4.34, p < .01$).

1/n. None of the participants chose to allocate their investment dollars evenly across all the funds available (i.e., engaged in the strict definition of 1/n), in accord with the low 1/n incidence level observed by Huberman and Jiang (2006).

1/n#. Five participants invested in all available funds when choosing from the small assortment (3.6%), and no participants did so in the large assortment (0.0%, $p < .01$). The effects of cognitive load and the interaction between assortment and load were not significant. We examined the proportion of available funds chosen as a function of fund assortment size, cognitive load, and their interaction. Only the fund assortment size effect was significant, with the proportion of funds invested in decreasing as fund assortment size increased: from 38.3% in the 6 fund assortment condition to 19.6% in the 18 fund assortment condition ($p < .01$). Fund assortment size also impacted the number of funds invested in. Investors included an average of 2.29 funds when choosing from a 6 fund assortment, compared to 3.53 funds when choosing from an 18 fund assortment ($p < .01$). Neither cognitive load nor the interaction between assortment and cognitive load significantly impacted number of funds invested in.

1/n\$. We next examined the tendency to spread dollars evenly across the chosen investment options. We first examined whether or not investors divided their dollars evenly among the funds they chose as a function of assortment size, cognitive load, and their interaction ($p < .05$). Among the

89.5% of participants who chose an easy divisor number of funds, there was no significant main effect of fund assortment size on the tendency to allocate money evenly (48.9% in the 6-fund assortment condition, 49.2% in the 18-fund assortment condition; $p > .50$), but even allocation was impacted by cognitive load, increasing from 42.4% under low load to 55.0% under high load ($p < .05$). Importantly, there was a significant interaction between fund assortment size and cognitive load ($p < .05$). Inspection of the means shows that more people spread their dollars evenly when a cognitive load was imposed, but only in the small assortment condition, with the even allocation increasing from 33.8% under low load to 60.2% under high load ($p < .01$); this did not occur in the large assortment condition (50.0% versus 48.3%, respectively, $p > .80$). In this study, because a large majority of investors chose an easy divisor number of funds (89.5% of participants), a similar analysis conducted among all participants, independent of whether or not they chose an easy divisor number of funds, yields very similar results.

Discussion

This study provides additional evidence for our limited cognitive resources argument by actively manipulating respondents' resource availability, which was found to impact the tendency to evenly allocate dollars across chosen funds in a manner similar to that of choosing from a larger fund assortment. The findings of Studies 1a, 1b, and 2 consistently support our proposed mechanism, but they share the potential limitation that participants did not actually invest money in the chosen funds. In Study 3, we address this issue by assessing the effects of choosing from a smaller versus larger fund assortment on our dependent measures using real mutual fund investment data obtained from TIAA-CREF. Replicating our findings in this dataset will thereby enhance the external validity of our results and increase confidence in their generalizability.

STUDY 3

In this study we examine the effects of increasing fund assortment size using data from a state-level public pension system. Specifically, we compare investors' initial asset allocations in a defined contribution plan when choosing from a fund menu containing 10 versus 19 investment options. Consistent with our decision simulations, we expect that when choosing from the larger assortment size, the proportion of funds invested in will *decrease*, and the mean number of funds invested in will *increase*. We also expect that, conditional on choosing an easy divisor number of funds, plan participants in the large assortment condition will be more likely to evenly allocate their dollars across their chosen funds.

Method

Sample. In this study we analyze the choices of participants in the defined contribution plan of the Oregon University System, known as the Optional Retirement Plan (ORP). The ORP was introduced to public employees in the university system of Oregon in 1996 as an alternative to the traditional defined benefit plan.³ We obtained access to data from TIAA-CREF on the initial asset allocation decisions made by newly-eligible ORP participants between February 1998 and March 2010.

Data. On July 1, 2007, ORP increased the number of investment options available from TIAA-CREF from 10 to 19. Consequently, employees who became eligible for ORP after July 1, 2007 faced an assortment of investment options approximately double the size available to previous employees. The assortment size prior to July 2007 consisted of one money market fund, one fixed annuity fund, two bond funds, one balanced fund, two U.S. equity funds, two global funds, and one real estate fund. The larger assortment size included these original ten funds plus seven additional domestic equity funds, one additional global fund, and one additional real estate fund.

In the ORP, investors who choose not to make any allocation decisions are automatically

³ See Chalmers and Reuter (2011b) for a more-detailed discussion of the Optional Retirement Plan.

invested 100% into the money market fund. For our purposes, we omit the 527 participants who were routed to this default option, as it does not represent active allocation decisions. Interestingly, we find that the proportion of plan participants who chose this default option increased from 21.2% when a smaller fund assortment was offered, to 33.5% when a larger fund assortment was offered ($p < .01$). This result suggests that fewer investors were willing to make fund choice and allocation decisions when choosing from a larger assortment, and thus opted for the easier default choice (Iyengar and Lepper 2000). There were 1,451 new plan participants who actively chose how to invest their defined contribution investments between February 1998 and June 2007 (hereafter referred to as the small fund assortment), and 270 new plan participants between July 2007 and March 2010 (hereafter referred to as the large fund assortment).

Results

As in the previous studies, our regressions control for each participant's gender, age, and monthly income. Age (mean = 38.9) and monthly income (mean = \$4,649) were demeaned. We do not control for employment status or possession of a 401(k) plan because these characteristics do not vary within our sample. We also do not control for the initial 401(k) account balance since participants' monthly retirement contribution is a fixed percentage of their monthly income, so controlling for income is the same as controlling for initial 401(k) account balance. Since we observe asset allocation decisions over a thirteen-year period, we include the return on the Standard and Poor's 500 index over the prior 12 months as a control for possible changes in investor sentiment or market conditions (Chalmers and Reuter 2011a).

As a robustness check, we also analyze the choices of ORP participants who made their initial asset allocation decisions within 5-year and 4-year windows centered on the change in fund assortment size (July 1, 2007). These subsamples consist of 685 plan participants and 534 plan participants, respectively. A summary of the results based on the full sample is presented in Tables

1 and 2, and detailed results from our analyses based on the full sample and subsamples are reported in Table 3.⁴

Insert Table 3 about here.

1/n. Five participants engaged in the strict definition of *1/n* in the small assortment group versus zero participants in the large assortment group. This difference is in the predicted direction, but it is small (5/1451 versus 0/270) and not statistically significant ($p > .40$).

1/n_#. Only 0.7% of new plan participants chose to invest in all available funds, and this tendency did not differ by fund assortment size (small: 0.8% versus large: 0.4%; $p > .70$). However, the proportion of available funds participants chose to invest in declined as fund assortment size increased. Plan participants who chose from the smaller 10 fund assortment invested in 37.4% of the funds, whereas participants who chose from the larger 19 fund assortment invested in 27.4% of the funds ($p < .01$). Fund assortment size also significantly impacted the number of funds invested in. Participants invested in an average of 3.74 funds when choosing from the small fund assortment, compared to 5.30 funds when choosing from the larger fund assortment ($p < .01$), as predicted.

We explore the robustness of these differences in Table 3. When we study the tendency to invest in all available funds in the subsamples, we find that the fund assortment size coefficient is negative and statistically significant in the 4-year ($b = -0.01$; $p < .10$) and 5-year windows ($b = -0.02$; $p < .05$). These differences support the idea that larger assortment sizes reduce the likelihood of following the *1/n* heuristic by reducing the likelihood of investing in all available funds. Among the control variables, only the lagged return on the S&P 500 index predicts the decision to invest in all available funds ($p < .10$), and only in three of the four specifications.

In the regression with number of funds chosen as the dependent variable, the fund assortment size coefficient is positive and significant ($b = 1.56$; $p < .01$). This effect is stable across

⁴ As an additional robustness check, we reran the main analysis and the three ancillary analyses restricting the sample to the 1,470 plan participants who were younger than 50 years of age. The results are substantively identical and are available from the authors.

the 5-year ($b = 1.28; p < .01$) and 4-year windows ($b = 1.35; p < .01$). Among the control variables, only age is consistently significant across the analyses ($p < .01$).

In the regression with the proportion of funds chosen as the dependent variable, the fund assortment size coefficient is negative and significant ($b = -0.10; p < .01$). Again, the robustness checks reveal that this effect is stable across the 5-year ($b = -0.13; p < .01$) and 4-year windows ($b = -0.13; p < .01$). Among the control variables, age is consistently significant across the analyses and monthly income is significant in the analysis based on the full sample ($p < .05$), as well as the analysis based on the 4-year window ($p < .10$).

I/n₅. The proportion of participants who chose an even allocation is 23.4% in the small assortment condition and 21.1% in the large assortment condition ($p > .40$). In this data set even allocations were made only when participants chose to invest in an easy divisor number of funds. The proportion of participants who chose to invest in an easy divisor number of funds decreased from 87.9% to 57.4% when the assortment size increased ($p < .01$). When we restrict the sample to participants who chose an easy number of funds to invest in, we find that the larger fund assortment size increased the likelihood of an even allocation from 26.6% to 36.8% ($p < .05$), as predicted.

In the regression in Table 3, the coefficient for the interaction between fund assortment size and easy divisor number of funds is positive and statistically significant ($b = 0.10, p < .05$). In our robustness checks, the coefficient for the interaction term is positive and statistically significant in the 5-year window ($b = 0.14, p < .01$), and directionally significant in the 4-year window ($b = 0.10, p < .10$). The control variables suggest that the likelihood of choosing an even allocation increases with age ($p < .01$) and is lower for female participants ($p < .10$).

Discussion

Using actual consumer defined contribution plan data, we replicate our results from the decision simulations. We find that the change in the Oregon University System retirement program

in July 2007, which increased the available fund assortment from 10 to 19 funds, led to a systematic *decrease* in the proportion of funds invested in, but an *increase* in the number of funds invested in. Conditional on choosing an easy divisor number of funds, the tendency to evenly spread dollars across funds also increased with the larger fund assortment size. To test the robustness of these findings, we reran the analyses varying the number of years around the plan change, and find the results are stable across these windows of analysis.

Replicating our experimental results using data on actual retirement asset allocation decisions provides added support for our proposed mechanism and enhances the external validity of our findings. The increased propensity to evenly allocate dollars with age, and decreased propensity to do so among females are interesting avenues for future research. Since the period around the plan change was a time of marked market volatility, this may indicate that perceived risk plays a role in the $1/n$ heuristic as well. This is another interesting direction for future research.

GENERAL DISCUSSION

The findings across all of our studies suggest that investors offered larger fund assortments from which to choose tend to change both how they invest their dollars in terms of the number of funds invested in, and the methods used to spread their dollars across their chosen options. By decomposing investor behavior associated with this heuristic into its two underlying constituent parts, we find evidence for a weaker form of Benartzi and Thaler's (2001) $1/n$ heuristic. Our results suggest that a strict interpretation of the $1/n$ heuristic tends to be evident rarely – only when the number of funds offered for investment is very small, and even then, the incidence rate is low. Thus, one aspect of the $1/n$ heuristic, the tendency to invest in all available options, would seem to reflect, in part, a ceiling effect that dissipates when larger fund assortment sizes are offered for investment. Nevertheless, we find strong evidence for a weaker form of this dimension of the $1/n$ heuristic,

namely that increasing the number of funds offered for investment increases the mean number of funds invested in.

While evidence for investing in more funds emerged more strongly in our data than in some recent research (Huberman and Jiang 2006), this may be due to the effect of larger fund assortments increasing the tendency of investors to opt for the default choice – wherein they make no active decision about how to invest their dollars because they find the task too effortful and overwhelming. Instead, their dollars are automatically invested in a predetermined money market account. Indeed, in our Study 3, consisting of actual investor choices, we uncovered evidence that the tendency to choose the default increased in the large assortment setting, and that the larger assortment effects on fund allocation are muted when investors choosing the default are retained in the analysis.

We find that considering a larger number of funds to invest in may be overwhelming for many investors, resulting in choosing more funds for investment and allocating the invested dollars evenly across the chosen funds (if they have chosen a number of funds to invest in that makes this a cognitively simple task). Huberman and Jiang (2006) report a tendency of some investors to spread their contributions evenly across the chosen funds, but they fail to consider the role of fund assortment. Our findings therefore extend the work of Huberman and Jiang (2006) – we consistently find an effect of fund assortment size on investors' tendency to allocate their contributions evenly across chosen funds conditional on first choosing a number of funds for investment that makes it cognitively easy to do so.

Another contribution of our research is that we elucidate the process underlying the observed effects. We obtain indirect process support for limited-resource decision making in Studies 1a and 1b via thought-listing and time spent per chosen fund, respectively. We manipulate cognitive resource availability via a cognitive load manipulation in Study 2 to more directly test our thesis. The findings of Study 2 replicate both the choice and allocation heuristics seen with the larger fund

assortments in Studies 1a and 1b. Finally, Study 3 replicates our results using variation in fund assortment faced by real defined contribution investors.

Our results suggest that marketers responsible for developing the financial products offered to investors need to consider how the structure of their plans may impact their customers' cognitive processing efforts and investing behavior. Most investors seem to want to invest in a handful of mutual funds in their 401(k) plans (e.g., three to five funds). Therefore, firms may not want to constrain investors' choices by offering too small of a fund assortment (e.g., fewer than about six to ten funds). However, our findings suggest that while most investors want to invest in a handful of funds, the total number they invest in may be systematically influenced by the total number of funds offered in the plan. Larger fund assortments may cognitively tax the ordinary investor, who may then simply decide to not only increase the number they choose for their own portfolios when the number of funds in the plan is increased, and but also to divvy up their dollars evenly. This tendency may taper off in very large fund assortments, but future research is needed to assess this potential nonlinearity.

The effects of larger assortments on fund choice and dollar allocations may or may not represent normative outcomes. For those who are inadequately diversified, these effects could have a positive impact on their portfolios. Investors may or may not be aware of potential effects of fund assortment sizes on their allocation strategies, however. One possible solution might be for marketers of financial products to offer investors a larger number of funds in order to satisfy their desire for choice and variety, but to clearly categorize the options to help the investor perceive the set of offerings at a higher, more abstract level. Partitioning the funds may enhance asset class diversification while not reducing (in fact, increasing) the total number of funds invested in.

Subjectively grouping funds by asset class is more likely to assist novice than expert investors in their financial decision-making (Fox, Ratner, and Lieb 2005; Mogilner, Rudnick, and Iyengar 2008).

A potential alternative explanation to our proposed process is that investors might evenly allocate dollars across funds as a conscious attempt to diversify rather than to rely on an easy allocation heuristic. To explore this, we conducted a supplementary analysis from Study 1a. Specifically, we analyzed investors' perceptions of portfolio diversification based on two closed-ended items. Investors were asked the extent to which they agreed (on a scale of 1 to 5) with these items: "I created a highly diversified portfolio," and "I tried to include several different asset classes (e.g., stock, bond, and money market funds) in my portfolio" ($r = .50, p < .05$). We find that investors in the large (versus small) fund assortment condition score significantly lower on this scale ($M_{\text{Small}} = 3.60$ vs. $M_{\text{Large}} = 3.31, t = -2.10, p < .05$). Thus, investors' self-reports do not seem to support the notion that when choosing from a larger assortment, choosing more funds or evenly allocating their dollars is motivated by the desire to create a more diversified portfolio.

Another implication from our results is that investor education appears to be a critical need, because many people may have neither the time nor the ability to evaluate investment instruments. Thus, marketers of financial services may want to try to educate their customers about the tendency to use choice and allocation heuristics and how these tendencies are impacted by fund assortment sizes. Benartzi and Thaler (2001, p. 79) point out that almost any asset allocation strategy could represent utility maximization for a particular individual. Thus, we do not mean to suggest that a $1/n$ asset allocation strategy is inherently welfare reducing. However, it is of concern that merely altering plan structure, while controlling for the proportion of funds across asset classes, systematically impacts (1) the number and proportion of funds invested in, and (2) the way that invested dollars are allocated across the chosen funds – and this may occur without investors' conscious awareness.

Our primary aim was to better understand the impact of contextual variables on individual decision makers' retirement investing behavior. Research to date has shown that larger assortments can cause decision deferral, but relatively little is understood regarding other consequences of

mutual fund proliferation. The findings reported here increase our understanding of the effects of fund assortment sizes on investor decision-making behavior such as the use of allocation heuristics, as well as an appreciation of boundary conditions for these effects. Another practical implication of our research is to provide insight and direction to fiduciaries responsible for designing and implementing retirement plans in the best interest of their employees. If fiduciaries can control which options investors consider, they can design mutual fund assortments more optimally to increase the likelihood of participation and the quality of decisions made.

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Table 1.
Mean Results for Studies 1 to 3

| | Study 1a (Mail Sample) N = 260 | | Study 1b (Online Sample) N = 363 | | Study 2 (Online Sample) N = 296 | | Study 3 (TIAA CREF data) N = 1,721 | |
|--|--|---|--|---|--|---|--|--|
| | Small Assortment (3 funds) N = 135 | Large Assortment (15 funds) N = 125 | Small Assortment (5 funds) N = 133 | Large Assortment (25 funds) N = 230 | Small Assortment (6 funds) N = 141 | Large Assortment (18 funds) N = 155 | Small Assortment (before change) (10 funds) N = 1,451 | Large Assortment (after change) (19 funds) N = 270 |
| 1/n: Invest evenly in all available funds | 4/135 (3.0%) | 1/125 (0.8%) | 8/133 (6.0%) | 0/230 (0.0%) | 0/141 (0.0%) | 0/155 (0.0%) | 5/1451 (0.3%) | 0/270 (0.0%) |
| 1/n _i : Invest in all funds | 59/135 (43.7%) | 1/125 (0.08%) | 39/133 (29.3%) | 8/230 (3.5%) | 5/141 (3.6%) Low load: 3/61 (4.9%) High load: 2/80 (2.5%) | 0/155 (0.0%) Low load: 0/76 (0.0%) High load: 0/79 (0.0%) | 11/1451 (0.8%) | 1/270 (0.4%) |
| Proportion funds chosen | 74.6% | 24.7% | 66.1% | 24.9% | 38.3% Low load: 35.6% High load: 40.9% | 19.6% Low load: 19.0% High load: 20.1% | 37.4% | 27.4% |
| Number funds chosen | 2.25 | 3.68 | 3.35 | 6.22 | 2.29 Low load: 2.13 High load: 2.46 | 3.53 Low load: 3.43 High load: 3.63 | 3.74 | 5.30 |
| 1/n _s : Invest evenly in chosen funds | 48/135 (35.6%) | 49/125 (39.2%) | 52/133 (39.1%) | 85/230 (37.0%) | 67/141 (47.5%) Low load: 20/61 (32.7%) High load: 47/80 (58.7%) | 63/155 (40.6%) Low load: 33/76 (43.4%) High load: 30/79 (38.0%) | 339/1451 (23.4%) | 57/270 (21.1%) |
| Choose an easy divisor no. funds | 135/135 (100.0%) | 105/125 (84.0%) | 133/133 (100.0%) | 142/230 (61.7%) | 137/141 (97.1%) Low load: 59/61 (96.7%) 16/61 (26.2%) 43/61 (70.5%) 2/61 (3.3%) | 128/155 (82.5%) Low load: 66/76 (86.8%) 14/76 (68.4%) 52/76 (68.4%) 10/76 (13.2%) | 1276/1451 (87.9%) | 155/270 (57.4%) |
| Choose 1 fund | 28/135 (20.7%) | 16/125 (12.8%) | 26/133 (19.5%) | 30/230 (13.0%) | High load: 78/80 (97.5%) 34/80 (42.5%) 44/80 (55.0%) 2/80 (2.5%) | High load: 62/79 (78.4%) 13/79 (16.5%) 49/79 (62.0%) 17/79 (21.5%) | 190/1451 (13.1%) | 35/270 (13.0%) |
| Choose 2, 3, 4, 5, 10 funds | 107/135 (79.3%) | 89/125 (71.2%) | 107/133 (80.5%) | 112/230 (48.7%) | | | 1086/1451 (74.8%) | 120/270 (44.4%) |
| Choose other no. funds | N/A | 20/125 (16.0%) | N/A | 88/230 (38.3%) | | | 175/1451 (12.1%) | 115/270 (42.6%) |
| Invest evenly X choose easy divisor no. funds | 48/135 (35.6%) | 48/105 (45.7%) | 52/133 (39.1%) | 77/142 (54.2%) | Not Easy Divisor: 0/4 (0.0%) Low load: 0/2 (0.0%) High load: 0/2 (0.0%) Easy Divisor: 67/137 (48.9%) Low load: 20/59 (33.8%) High load: 47/78 (60.2%) | Not Easy Divisor: 0/27 (0.0%) Low load: 0/10 (0.0%) High load: 0/17 (0.0%) Easy Divisor: 63/128 (49.2%) Low load: 33/66 (50.0%) High load: 30/62 (48.3%) | Not Easy Divisor: 0/175 (0%) Easy Divisor: 339/1276 (26.6%) | Not Easy Divisor: 0/115 (0%) Easy Divisor: 57/155 (36.8%) |
| Herfindahl index | .596 | .411 | .466 | .356 | .626 Low load: .584 High load: .668 | .447 Low load: .456 High load: .438 | .438 | .387 |
| Time per chosen fund | N/A | N/A | 196 secs | 114 secs | N/A | N/A | N/A | N/A |
| No. thoughts | 1.70 ^a | 0.98 ^a | N/A | N/A | N/A | N/A | N/A | N/A |

Notes: Means are covariate-adjusted. In Studies 1a, 1b, and 2, means reflect gender, age, income, employment status, possession of a 401(k) plan, and dollars invested in the plan covariates. In study 3, all participants are employed by the Oregon University System and enrolled in the Optional Retirement System 401(a) plan. Covariates include gender, age, income, and the return on the S&P 500 index over the 12 months prior to asset allocation decision. For analyses of proportions where there are zero or near zero observations in one or more cells, linear regressions were run rather than logistic regressions, as the latter are highly sensitive to cells with low counts. In Studies 1a and 1b, analysis of even dollar allocation as a function of assortment X easy number of funds invested in was conducted among those choosing an easy divisor number of funds to invest in (i.e., 1, 2, 3, 4, 5 or 10 funds), since all investors in small assortment conditions chose an easy number of funds in which to invest.

Table 2.
Statistical Results for Studies 1 to 3

| Dependent Measure ² | Study 1a (Mail Sample) N = 260 | | Study 1b (Online Sample) N = 363 | | Study 2 (Online Sample) N = 296 | | | | Study 3 (TIAA CREF data) N = 1,721 | |
|---|--------------------------------------|---------------------------------------|--|---------------------------------------|--|--|---|--|--|---------------------------------------|
| | Model Result | Test of Large versus Small Assortment | Model Result | Test of Large versus Small Assortment | Model Result | Test of Large versus Small Assortment | Test of Low versus High Load | Test of Interaction of Assortment by Load | Model Result | Test of Large versus Small Assortment |
| 1/n: Invest evenly in all funds | $\chi^2(7) = 5.39$ $p > .60$ | Wald (1) = 1.90 $p > .15$ | F (7, 354) = 2.41 $p < .05$ | t = -3.77 $p < .0001$ | N/A | N/A | N/A | N/A | F (5, 1715) = 0.99 $p > .50$ | t = -0.81 $p > .40$ |
| 1/n _# : Invest in all funds | $\chi^2(7) = 83.82$ $p < .0001$ | Wald (1) = 19.67 $p < .0001$ | $\chi^2(7) = 56.91$ $p < .0001$ | Wald (1) = 37.14 $p < .0001$ | F (9, 286) = 1.10 $p > .30$ | t = -2.59 $p < .01$ | t = -.89 $p > .30$ | t = .69 $p > .40$ | F (5, 1715) = 1.13 $p > .30$ | t = -0.32 $p > .70$ |
| Proportion funds chosen | F (7, 232) = 50.02 $p < .0001$ | t = -18.27 $p < .0001$ | F (7, 354) = 32.41 $p < .0001$ | t = -14.91 $p < .0001$ | F (9, 286) = 12.6 $p < .0001$ | t = -10.04 $p < .0001$ | t = -1.31 $p > .10$ | t = 1.68 $p < .10$ | F (5, 1715) = 27.94 $p < .0001$ | t = -8.77 $p < .0001$ |
| Number funds chosen | F (7, 232) = 10.67 $p < .0001$ | t = 7.40 $p < .0001$ | F (7, 354) = 5.97 $p < .0001$ | t = 5.89 $p < .0001$ | F (9, 286) = 6.71 $p < .0001$ | t = 6.32 $p < .0001$ | t = -.46 $p > .60$ | t = 1.34 $p > .15$ | F (5, 1715) = 22.59 $p < .0001$ | t = 7.89 $p < .0001$ |
| 1/n _s : Invest evenly in chosen funds | $\chi^2(7) = 14.35$ $p < .05$ | Wald (1) = 1.40, $p > .20$ | $\chi^2(7) = 5.72$ $p > .55$ | Wald (1) = 0.25 $p > .85$ | $\chi^2(9) = 20.82$ $p < .05$ | Wald (1) = 0.27 $p > .60$ | Wald (1) = 3.90 $p < .05$ | Wald (1) = 6.38 $p < .05$ | F (5, 1715) = 5.69 $p < .0001$ | t = -0.69 $p > .40$ |
| Choose an easy divisor no. of funds | F (7, 232) = 4.88 $p < .0001$ | t = -4.74 $p < .0001$ | F (7, 354) = 12.40 $p < .0001$ | t = -8.94 $p < .0001$ | F (9, 286) = 2.89 $p < .01$ | t = -4.03 $p < .0001$ | t = -1.00 $p > .30$ | t = -1.28 $p > .20$ | F (5, 1715) = 22.91 $p < .0001$ | t = -9.47 $p < .0001$ |
| Invest evenly X choose easy divisor no. of funds ³ | $\chi^2(7) = 13.92$ $p < .10$ | Wald (1) = 4.08 $p < .05$ | $\chi^2(7) = 15.20$ $p < .05$ | Wald (1) = 6.23 $p < .05$ | Not Easy Divisor NA Easy Divisor F (9, 255) = 2.23 $p < .05$ | Not Easy Divisor NA Easy Divisor t = .56 $p > .50$ | Not Easy Divisor NA Easy Divisor t = 2.09 $p < .05$ | Not Easy Divisor NA Easy Divisor t = -2.11 $p < .05$ | F (7, 1713) = 77.03 $p < .0001$ | Interaction: t = 2.46 $p < .05$ |
| Herfindahl index | F (7, 232) = 6.58 $p < .0001$ | t = -5.81 $p < .0001$ | F (7, 354) = 2.34 $p > .05$ | t = -3.44 $p < .001$ | F (9, 286) = 4.67 $p < .0001$ | t = -5.07 $p < .0001$ | t = 1.20 $p > .20$ | t = -1.47 $p > .10$ | F (5, 1715) = 9.79 $p < .0001$ | t = -2.79 $p < .01$ |
| No. thoughts | F (7, 100) = 3.63 $p < .005^a$ | t = -4.51 $p < .0001^a$ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Time per chosen fund | N/A | N/A | F (7, 354) = 2.26 $p < .05$ | t = -3.10 $p < .005$ | N/A | N/A | N/A | N/A | N/A | N/A |

Table 3. Statistical Results for Study 3

| SAMPLE: | FULL | 5-YEAR WINDOW | 4-YEAR WINDOW |
|-----------------------------|---|----------------------|----------------------|
| Dependent Variable: | 1/n_i: 1 if participant <i>i</i> invests in all available funds; 0 otherwise | | |
| Post Menu Change? | -0.001 (0.004) | -0.009 (0.006) | -0.013 (0.008) * |
| Gender (Female) | 0.001 (0.004) | 0.003 (0.009) | 0.008 (0.010) |
| Monthly Income | 0.000 (0.001) | 0.000 (0.001) | 0.001 (0.001) |
| Age in Years | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) |
| Lagged return S&P 500 index | 0.021 (0.009) ** | 0.032 (0.016) * | 0.026 (0.013) ** |
| Constant | 0.006 (0.003) ** | 0.015 (0.007) ** | 0.016 (0.008) * |
| Sample size | 1,721 | 685 | 534 |
| R2 | 0.00 | 0.01 | 0.01 |
| Dependent Variable: | Number of funds that participant <i>i</i> chooses to invest in | | |
| Post Menu Change? | 1.561 (0.198) *** | 1.281 (0.254) *** | 1.349 (0.299) *** |
| Gender (Female) | 0.127 (0.101) | 0.125 (0.195) | 0.159 (0.233) |
| Monthly Income | 0.037 (0.023) | 0.008 (0.033) | 0.069 (0.042) * |
| Age in Years | -0.039 (0.006) *** | -0.053 (0.011) *** | -0.056 (0.012) *** |
| Lagged return S&P 500 index | 0.250 (0.360) | 0.825 (0.834) | 1.020 (0.906) |
| Constant | 3.740 (0.068) *** | 4.138 (0.139) *** | 4.193 (0.170) *** |
| Sample size | 1,721 | 685 | 534 |
| R2 | 0.10 | 0.08 | 0.08 |
| Dependent Variable: | Proportion of funds that participant <i>i</i> chooses to invest in | | |
| Post Menu Change? | -0.100 (0.011) *** | -0.129 (0.016) *** | -0.131 (0.019) *** |
| Gender (Female) | 0.014 (0.009) | 0.013 (0.015) | 0.020 (0.017) |
| Monthly Income | 0.004 (0.002) ** | 0.002 (0.002) | 0.006 (0.003) * |
| Age in Years | -0.003 (0.000) *** | -0.004 (0.001) *** | -0.004 (0.001) *** |
| Lagged Return S&P 500 Index | 0.024 (0.027) | 0.077 (0.048) | 0.082 (0.051) |
| Constant | 0.374 (0.006) *** | 0.414 (0.012) *** | 0.419 (0.014) *** |
| Sample Size | 1,721 | 685 | 534 |
| R2 | 0.07 | 0.15 | 0.15 |
| Dependent Variable: | 1/n_s: 1 if participant <i>i</i> invests evenly across chosen funds; 0 otherwise | | |
| Post Menu Change? | 0.001 (0.012) | -0.008 (0.026) | -0.032 (0.029) |
| Easy Number of Funds? | 0.255 (0.013) *** | 0.232 (0.024) *** | 0.252 (0.029) *** |
| Post? * Easy? | 0.102 (0.041) ** | 0.137 (0.048) *** | 0.098 (0.053) * |
| Gender (Female) | -0.046 (0.020) ** | -0.074 (0.029) ** | -0.075 (0.033) ** |
| Monthly Income | -0.004 (0.004) | -0.004 (0.006) | -0.011 (0.007) |
| Age in Years | 0.004 (0.001) *** | 0.006 (0.002) *** | 0.007 (0.002) *** |
| Lagged Return S&P 500 Index | -0.048 (0.062) | -0.088 (0.109) | -0.153 (0.114) |
| Constant | 0.032 (0.011) *** | 0.050 (0.018) *** | 0.062 (0.021) *** |
| Sample Size | 1,721 | 685 | 534 |
| R2 | 0.08 | 0.15 | 0.16 |

Note: *** $p < .01$; ** $p < .05$; * $p < .10$; Robust SEs used in analysis (in parentheses); inferences unchanged when using SEs clustered on the month of the choice.