Asset Allocation and Information Overload:
The Influence of Information Display, Asset Choice, and Investor Experience

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This paper examines whether information overload might partially explain why defined contribution plan participants tend to follow the "path of least resistance" (Choi et al. [2002]) In two experiments, we test how three common differences among defined contribution plans (the number of investment choices offered, the similarity of the choices, and the display of the choices) lead to varying degrees of information overload and the probability of opting for the default. Notably, we control for the financial aptitude of each individual. The findings suggest that the success of certain plan features depends strongly on the financial background of the participant. We find that low-knowledge individuals opt for the default allocation more often than high-knowledge individuals (experiment 1: 20% versus 2%). The results emphasize the importance of plan design, especially the selection of plan defaults, and the need to improve the financial literacy of participants.

For many people, financial security in retirement depends on decisions they make today in their defined contribution plans. However, despite the importance of these investment decisions, growing research shows that individuals are not making choices that best fit their needs (see, e.g., Agnew [2003], Benartzi [2001]). In fact, strong evidence suggests defined contribution plan participants are choosing the "path of least resistance" (Choi et al. [2002]).

One consequence of this behavior is that many individuals are investing in their plans' default options. Accepting the default options defeats the purpose of a self-directed investment account, and can even adversely affect savings. The importance of this issue is highlighted by the fact that over 50 million individuals participated in defined contribution plans in 1998, as well as by the current debate in Washington about whether to introduce voluntary personal accounts into the Social Security system (EBRI [2003]). Understanding what drives this behavior and how plan administrators can help alleviate the problem is critically important.

Literature suggests that procrastination, the status quo bias, and anticipated regret are all reasons for individuals' tendency to follow the path of least resistance (Choi et al. [2003], Madrian and Shea [2001]). In this paper, we offer an additional explanation for individuals' reluctance to make investment decisions in their defined contribution plans: information overload. In other words, participants are overwhelmed with information. As a result, they look for the easy way out.

Research in the decision-making literature suggests that consumers tend to reduce the amount of effort they expend when decisions become more complex (Payne, Bettman, and Johnson [1988], Payne, Bettman, and Luce [1996]). Therefore, it seems intuitive for plan administrators to simplify the choice environment in order to attenuate feelings of overload. The benefit of this action is that participants may be more likely to effectively evaluate their choice alternatives and make informed decisions.

This paper is motivated by previous research showing the strong influence of plan design on investment behavior. We investigate three common differences among plans that may lead to varying degrees of overload. In particular, in two experiments we manipulate how the investment information is displayed, how many choices are offered, and the similarity between the investment options. The goal is to determine how each change impacts the participants' degrees of overload. We also measure the financial knowledge of the participants, and include this measure as an independent variable. The main contribution of this analysis is that it explores the interaction between the individual's

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tested financial knowledge and the manipulated plan features. The results emphasize the importance of plan design, especially the careful selection of plan default options, and the need to improve the financial literacy of participants.

The remainder of this paper is organized as follows. In the background section, we present a review of the existing literature. Next we describe the participants and discuss their performance on the financial literacy exam. We then present the methodology and the results from experiments 1 and 2, respectively. We conclude with a summary discussion of our findings and their implications.

Background

A growing body of literature in finance and economics suggests that the design of defined contribution plans influences investment behavior (e.g., Choi et al. [2002]). Notably, seemingly benign decisions made by employers can have a large influence on participation rates, contribution levels, and asset allocation choices.

For example, an employer match program can positively influence participation and contribution levels (for a summary of the literature, see Munnell, Sunden, and Taylor [2001/2002]). Individuals also tend to invest more of their discretionary allocation in company stock when the employer match is in company stock (Benartzi [2001]). Recognizing the influence of plan design, some employers have introduced features, such as automatic enrollment plans and savings plans, that encourage participants to make better decisions and that increase participation and contribution levels (see, e.g., Choi et al. [2004]; Thaler and Benartzi [2004]).

This paper investigates how plan design can influence one current problem in defined contribution plans—the prevalence of individuals investing according to their plans' default options. This tendency is highlighted in a study by Choi et al. [2004]. The authors found that 80% of participants in plans with automatic enrollment initially accepted the plan's low default savings rate and the conservative default investment fund. Three years later, over half these individuals maintained these default elections.

So what is wrong with the default election? First, default options are generally not optimized for the individual. Typical defaults are "one-size-fits-all" and tend to be conservative. This can result in inadequate savings for many individuals. Second, choosing the default election suggests that individuals are not carefully considering their options, which may have an adverse effect on future financial security.

As mentioned earlier, one reason for this phenomenon could be that individuals are experiencing information overload while making their investment deci-

sions. There are a number of variables that may contribute to overload. One source could be how information about choices is presented to the investors. Effectively communicating choice information has long been a topic of interest for public policy makers and consumer researchers. Simply providing more information about investment options may not be enough to help investors make good decisions. As predicted in the economics of information literature, consumers will tend to use information more extensively if it costs less time and/or money to acquire (Stigler [1961]; Nelson [1970, 1974]). This suggests that when information is easier to obtain and evaluate, consumers are more likely to use it when making decisions or choices.

For example, literature on nutritional labeling shows that standardized information presented in labels and claims makes a difference in how consumers use the information and make their product choice. As dependable information becomes easier to use, consumers are more likely to use it to determine food quality, acquire more nutrition information prior to purchase, and improve their overall decision quality (Roe, Levy, and Derby [1999]; Ippolito and Mathios [1990, 1994]; Moorman [1990, 1996]; Muller [1985]). So if information about investment options is presented in a simpler way, investors should suffer less information overload and be more likely to use it when making asset allocation decisions.

Another potential source of information overload is the number of investment options offered in the plan. Research has shown that too many choices hamper decision making. A study conducted by Iyengar and Lepper [2000] compared consumers' reactions to two displays of jam—one with six flavors, the other with twenty-four. While more consumers showed an interest in the larger display, it was the smaller display that elicited more purchases. This experiment demonstrates that consumers not only reduce the amount of processing when a task becomes overwhelming, but they may also withdraw from the task entirely.

Increasing the number of choices has also been shown to be related to investment behavior. For example, Iyengar, Jiang, and Huberman [2003] find that increasing fund choice decreases 401(k) participation. The high number of choices offered in Sweden's public pension program (over 500) may explain the tendency of those participants to choose the default (although this hypothesis has not been formally tested). In that plan, with the exception of the first year, over 80% of eligible new participants invested in the default option (Weaver [2002]). While the number of choices in the Swedish system may seem extreme, the 403(b) plan we participate in offers over 285 investment choices across several vendors. One vendor alone offers 146 choices.

A third potential source of overload is the similarity of the options offered. As the number of funds grows, it

is possible that they may seem more alike. For example, when participants can choose from multiple vendors (e.g., as in many university 403(b) plans), the choices offered by each vendor may be quite similar. A great deal of overlap probably exists among the most popular fund types (e.g., index funds). As similarity among the funds increases, overload does too, because funds are harder to differentiate from each other. This may indicate that it is generally better to have more distinct choice offerings.

Finally, the last factor we consider is a person's own financial knowledge. According to consumer researchers, there is an inverted U-shaped relationship between information search and knowledge—consumers with a moderate level of knowledge search the most before making a product choice (Bettman and Park [1980]). Experts have no need to do an extensive search because they already know a great deal. Novices, who have very little knowledge, become overwhelmed by a choice task very quickly. So, despite the fact that they would benefit the most from an extensive information search, they are less likely to engage in one. People with moderate knowledge search the most because they have a basic understanding that allows them to interpret the information, but they also realize the value of a more extensive search.

If investors lack the knowledge and experience to compare the available investment alternatives, the whole process can seem even more intimidating, which makes it more likely they will look for an easy way out. In the case of defined contribution plans, the easy way out may be choosing the default or using some other choice heuristic.[1] Thus knowledge may be a critical individual difference that profoundly impacts a person's investment choices.

In summary, we focus on four variables that may impact feelings of overload, asset allocation, and satisfaction with investment decision: 1) display of information, 2) number of choices, 3) similarity among choices, and 4) individual financial knowledge. Experiment 1 manipulates the influence of information display and the number of choices. Experiment 2 manipulates the influence of the similarity of the options and the number of investment choices. In both experiments, financial knowledge is measured.

Experiment Participants and Financial Literacy

Experiment Participants

Participants for both experiments were solicited during the summer months at a mid-size public university in the Southeast via campus mail, e-mail, and flyers. Participation was not limited to college employees, although the majority of participants were associated

with the college. The study did attract several local tourists, parents of children attending camp on campus, and local construction workers. All participants were paid $10 for their assistance. In addition, each person was entered into a $500 drawing held at the conclusion of the study. As a result, each experiment had a broad representation of the overall population.

The participants were randomly assigned to each experiment. Table 1 provides a description of each experiment's sample. The demographics for both samples were very similar, suggesting that the randomization was successful. Both samples were predominantly female, with a majority of the individuals greater than thirty years old. There was a broad representation of occupations, including professional administrators, professors, secretarial staff, and maintenance workers. Salary and education levels were also well distributed.

Financial Literacy

In order to study the interaction between knowledge and the manipulated variables, each participant was given a ten-question financial literacy exam during the experiment. The questions in the exam were taken directly from or adapted from questions asked in the John Hancock Financial Services Defined Contribution Plan Survey and financial literacy exams used by Wilcox [2003] and Dwyer, Gilkeson, and List [2002].

Our results support prior findings that many investors lack even a basic understanding of financial concepts (John Hancock Financial Services [2002]). Each question in the ten-point exam was worth one point. Table 2 reports the results of the exam. In both samples, the mean and median test scores are below 50%. In fact, more than one-third of all participants answered two or less questions correctly.

Table 3 provides the questions and the percent of the combined sample that answered each question correctly. In the subsequent experiments, we use the mean of the test scores across all participants from both experiments as our indicator of average financial knowledge. Based on this average, we divided the individuals into two knowledge groups, high-knowledge (above the mean) and low-knowledge (below the mean). The distribution of test scores in both experiments was very similar.

There were several surprising results from the exam. First, there was only one question that a majority of the individuals answered correctly. In total, 84% of the combined sample understood that they could lose money in the stock market. This is probably due to the publicity surrounding the end of the technology stock bubble. Unfortunately, a much lower percentage (43%) understood that they could lose money in the bond market. Only 32% knew the best time to transfer money into a long-term bond fund, and only 22% knew

Table 1. *Description of Samples*

This table provides a description of the participants in each experiment based on demographic variables.

	Experiment One		Experiment Two	
	N	**%**	**N**	**%**
Gender				
Male	62	31	67	34
Female	135	68	131	66
Missing	1	1	2	1
Age				
Under 30 Years Old	26	13	22	11
30–39 Years Old	51	26	44	22
40–49 Years Old	49	25	54	27
50 Years Old and Older	64	32	73	37
Missing	8	4	7	4
Marital Status				
Single	53	27	65	33
Married	141	71	130	65
Missing	4	2	5	3
Children				
Yes	132	67	138	69
No	63	32	60	30
Missing	3	2	2	1
Job Title				
Part-time	19	10	13	7
Professional	61	31	64	32
Professor	16	8	26	13
Secretarial	27	14	27	14
Technical	17	9	12	6
Skilled Crafts	2	1	3	2
Maintenance	18	9	21	11
Teaching Assistant	3	2	3	2
Undergraduate	7	4	3	2
Graduate	2	1	3	2
Other	18	9	19	10
Missing	8	4	6	3
Salary				
$0–19,999	41	21	39	20
$20,000–$29,999	41	21	37	19
$30,000–$39,999	45	23	43	22
$40,000–$59,999	31	16	38	19
Greater than $60,000	33	17	37	19
Missing	7	4	6	3
Education				
High School or Less	19	10	28	14
Some College	51	26	48	24
College Graduate	45	23	41	21
Some Graduate Work	16	8	11	6
Graduate Degree	64	32	70	35
Missing	3	2	2	1

the definition of beta. Most people did not know what types of investment securities are found in money market funds: only 13% answered this question correctly. In fact, 10% of the sample believed money market funds are riskier than equity funds.

We ran an ordinary least squares regression to determine the relationship between each participant's demographic characteristics and test score. The results, which show a significant relationship between gender and test score, are presented in Table 4. Women scored one-half point lower on the exam than men. Age also had a significant influence, with the results suggesting that younger participants know less than older participants. One explanation for this result may be that as individuals age they tend to gain financial experience, thereby increasing their financial literacy.

We found that married individuals also did better than their single counterparts. This may be because married individuals are more interested in finance out of concern for providing for their spouses. This interest translates into higher scores, and may lead us to expect that people with children would also know more. However, we found that the people with children knew less than their counterparts without children, possibly be-

Table 2. *Summary of Test Scores*

Participants in each experiment were given a written test to assess their financial literacy. The test was comprised of ten questions worth one point each. The table below summarizes the participants' performance in each experiment.

Test Score	Experiment One			Experiment Two		
	N	%	Cum. %	N	%	Cum. %
0	13	7	7	9	5	5
1	19	10	16	24	12	17
2	38	19	35	39	20	36
3	39	20	55	28	14	50
4	29	15	70	30	15	65
5	14	7	77	20	10	75
6	14	7	84	20	10	85
7	12	6	90	11	6	91
8	9	5	94	8	4	95
9	10	5	99	9	5	99
10	1	1	100	2	1	100
Total	198			200		
Mean		3.73			3.84	
Median		3.00			3.50	

Table 3. *Summary of Test Questions*

Below are the ten questions given on the financial literacy exam. For each question, the percent of the total participants from both experiments who answered the question correctly is provided.

Percent of Combined Sample Who Answered Each Question Corectly	
Test Question	**Percent**
1. Which of the following types of investments are typically found in a money market fund? Stocks, Bonds or Short Term Securities	13
2. When is the best time to transfer money into a long-term bond fund? When interest rates are expected to … increase, remain stable, decrease, interest rate doesn't matter, don't know	32
3. If you were to invest $1,000 in a STOCK FUND, would it be possible to have less than $1,000 when you decide to withdraw or move it to another fund?	84
4. If you were to invest $1,000 in a BOND FUND, would it be possible to have less than $1,000 when you decide to withdraw or move it to another fund?	43
5. If you were to invest $1,000 in a MONEY MARKET FUND, would it be possible to have less than $1,000 when you decide to withdraw or move it to another fund?	45
6. A stock fund's beta rating can best be described as … a. A measure of relative volatility of the fund vs. the S&P 500 index, b. A measure of relative growth vs. the S&P 500 index, c. A measure of the relative capital outflow of the fund vs. the S&P 500 index.	22
7. A money market mutual fund is guaranteed by the U.S. government against principal loss.	45
8. High yield bond funds are invested in bonds with strong credit ratings.	37
9. If you invest in a bond mutual fund with an average maturity of five years, this means that you cannot withdraw your money from the fund within a five-year period without incurring a penalty.	29
10. A stock market index fund is actively managed by a fund portfolio manager.	24

cause people with larger families have less time to educate themselves about finance.

One of the largest significant influences on the test score is related to salary. The omitted category in the regression is participants earning $60,000 or more per year. Relative to these highly paid individuals, those earning less tend to know less about financial matters. The test scores decline as salary level declines, with those earning less than $20,000 scoring 2.6 points lower than the highest salary group.

Finally, education also played an important role. The omitted category is participants with graduate degrees. Relative to the most educated individuals, indi-

viduals with less than a college degree performed the worst on the exam. Taken together, a single female in her twenties, in the lowest wage category, with a high school education or less, would be expected to score 7.41 points lower on the exam than a married man over fifty, with a graduate degree, earning more than $60,000.

Table 5 examines the correlation between a person's perceived knowledge (what they think they know) and their actual financial literacy test score.[2] The point of this analysis is to study whether the correlation is stronger for certain types of individuals. The results seem to suggest that it is. There is a positive correlation

Table 4. *Financial Literacy Regression*

This table presents the results of an ordinary least squares regression. The dependent variable is the financial literacy test score earned by each participant. "Female" is a dummy variable equal to 1 if the participant is female, and 0 otherwise. "Under 30 Years Old," "30–39 Years Old," and "40–49 Years Old" are dummy variables equal to 1 if the participant falls in that age range. The omitted age range is "50 Years and Older." "Married" is a dummy variable equal to 1 if the participant is married. "Children" is a dummy variable equal to 1 if the participant has children. "$0–$19,999," "$20,000–$29,999," "$30,000–$39,999," and "$40,000–$59,999" are dummy variables that refer to the participant's annual salary. The omitted salary range is "Equal to or Greater than $60,000." "High School or Less," "Some College," "College Graduate," and "Some Graduate Work" are dummy variables referring to the participant's highest level of education. The omitted dummy variable is "Graduate Degree." P-values are based on robust standard errors adjusted for heteroskedasticity. ***indicates significance at the 1% level, **indicates significance at the 5% level, and *indicates significance at the 10% level.

Dependent Variable: Test Score

	Coefficent	P-Value
Constant	7.1675	0.000 ***
Female	–0.4456	0.085 *
Under 30 Years Old	–1.5968	0.001 ***
30–39 Years Old	–0.9387	0.006 ***
40–49 Years Old	–0.7953	0.007 ***
Married	0.6081	0.019 **
Children	–0.8379	0.010 **
$0–19,999	–2.6317	0.000 ***
$20,000–$29,999	–2.3217	0.000 ***
$30,000–$39,999	–2.0273	0.000 ***
$40,000–$59,999	–1.4631	0.002 ***
High School or Less	–2.1285	0.000 ***
Some College	–0.9431	0.011 **
College Graduate	0.0986	0.802
Some Graduate Work	–0.5906	0.247
Number of Observations	274	
R-Squared	0.42	

Table 5. *Correlation Between Test Score and Personal Perception of Relative Knowledge*

This table reports the correlation between the participants' financial literacy test scores and their own perceptions of their relative financial knowledge. The relative financial knowledge measure is derived from each participant's answer to a survey question. In both experiments, each participant was asked to rate his knowledge of retirement investments relative to other people on a scale from one to ten (with one equal to much less knowledge than others, and ten equal to a great deal more knowledge than others). The median test score and knowledge "confidence" level are reported below.

	N	Correlation	Median Test Score	Median Confidence
Job Title				
Part-time	25	0.61	2.0	5.0
Professional	99	0.49	4.0	6.0
Professor	31	0.77	6.0	7.0
Secretarial	36	0.56	3.0	3.0
Technical	22	0.35	3.0	6.0
Maintenance	26	0.17	2.5	4.0
Teaching Assistant	4	0.54	2.0	4.5
Undergraduate	8	0.41	2.0	3.0
Graduate	5	0.78	2.0	4.0
Other	26	0.26	3.0	4.5
Salary				
$0–19,999	59	0.42	2.0	4.0
$20,000–$29,999	57	0.38	3.0	3.0
$30,000–$39,999	68	0.49	4.0	5.0
$40,000–$59,999	52	0.45	4.0	6.0
Greater than $60,000	47	0.55	7.0	7.0
Education				
High School or Less	34	0.10	1.0	3.0
Some College	73	0.45	2.0	4.0
College Graduate	65	0.60	4.0	5.0
Some Graduate Work	19	0.71	4.0	6.0
Graduate Degree	98	0.59	5.0	6.0

of 0.77 for professors, which suggests these individuals "know what they know." On average, this group scored the highest on the exam and also accurately believes that they know more than others. Alternatively, the maintenance workers show a 0.17 correlation between their test score and their perceived knowledge. This group may not have a good understanding of how little they actually know about investments. Similarly, those earning the highest salaries report a higher correlation than those earning the least (0.55 versus 0.42). After reviewing the earlier regression results, it is not surprising that those earning the highest salaries perform the best on the exam and also perceive themselves to be more knowledgeable. The lowest correlation reported is for those with an education of high school or less (0.10).

Experiment 1:
Information Display (Table Versus Booklet) and Number of Investment Options (Low Number of Options Versus High Number of Options)

Method

Experiment 1 used a 2 (Display) × 2 (Number of Choices) × 2 (Knowledge) between-subjects design. Participants were asked to allocate a fictitious $1,000 in retirement savings among several mutual funds. They were also given the option of putting the entire $1,000 in a conservative default option (money market fund). To facilitate their decision making, they were given information about the performance of the asset choices based on eleven commonly reported attributes, including returns over various time periods, the stan-

dard deviation of the one-year returns, and investment type. The reported statistics we gave to participants were actual performance measures from real funds obtained from the Morningstar website.

The funds were divided into five fictitious fund families. Each offered at least one investment fund in each investment type. Table 6 summarizes the investment types and the reported statistics. The real names of the funds were changed to avoid biasing the results. Pretests were done on the fund family names to ensure they did not have any overly positive or negative associations.

To manipulate the display of information, we presented fund choices in either a table (low search cost) or a booklet (high search cost). We used existing 403(b) plan information to develop the stimulus for both conditions. For the low search cost condition (table), the asset choices were presented on one page, in a standard spreadsheet format organized by investment type. For the high search condition (booklet), the same exact information was presented for each asset, but the fund options were in a booklet organized by fund family. Each page of the booklet was dedicated to one fund family and the funds were not organized by type. This format produces higher search costs because participants must sort through multiple booklet pages in order to compare options within one investment type. This is similar to what a participant in a 403(b) must do when comparing offerings from different fund vendors.

The second source of manipulation was the number of fund choices. Participants were given either six funds (low number of choices) or sixty funds (high number of choices).[3] As described in the previous section, individuals were then divided into "high-knowledge" and "low-knowledge" categories based on their financial knowledge test scores.

Table 6. *Investment Types and Reported Financial Attributes*

Panel A. Investment Types

1. Money Market Funds
2. Bond Index Funds
3. Equity Index Funds
4. Equity Growth Funds
5. Equity Blended Funds
6. Equity Value Funds

Panel B. Reported Financial Attributes

1. Investment Type
2. Year-to-Date Return (%)
3. One-Year Return (%)
4. Three-Year Return(%)
5. Five-Year Return
6. Expense Ratio (%)
7. Net Assets ($ Millions)
8. Risk (Standard Deviation of One-Year Returns)
9. Analyst Risk Description (Relative to Other Funds in Investment Type: Low, Below-Average, Average, Above-Average, High)
10. Manager Tenure (Years)
11. Seven-Day Yield (%) (Only Reported for Money Market Funds)

Table 7. *Composition of Overload and Satisfaction Measures*

Panel A. Overload Measure (on a scale of 1 to 6, from strongly disagree to strongly agree)

1. There were too many different options to consider.
2. This decision required a great deal of thought.
3. This was a difficult decision.
4. I found this decision to be overwhelming.
5. It was difficult to comprehend all of the information available to me.
6. This task was stressful.
7. It was a relief to make a decision.

Standardized item alpha 0.8007

Panel B. Satisfaction Measure

1. How satisfied are you with your allocation decision? (Scale 1 to 7, Very Dissatisfied to Very Satisfied)
2. How certain are you that you made the best allocation decision? (Scale 1 to 7, Very Uncertain to Very Certain)
3. How confused did you feel while performing the task? (Scale 1 to 7, Very Confused to Not at all Confused)
4. How likely is it that you did not make the best allocation decision? (Reverse scored, Scale 1 to 7, Very Unlikely to Very Likely)
5. How likely is it that some of the funds that you did not choose would be equal to or better than the ones that you did select? (Reverse scored, Scale 1 to 7, Very Unlikely to Very Likely)

Standardized item alpha 0.7244

Once the participants made their allocation decisions, they were asked about information overload and choice satisfaction. Table 7 reports the questions and their reliability. To determine participants' perceptions of their ability to make good investment decisions, we also asked about confidence in their choices and the perceived quality of their decisions.

Results

Panel A of Table 8 reports the cell means for the overload measure. Using a three-factor analysis of variance, we found two significant main effects. As expected, there was a significant difference in measured overload between the two knowledge categories ($F(1, 186) = 20.54$, $p < 0.01$).[4] Individuals with less than average knowledge were significantly more overwhelmed than those with above average knowledge. In addition, individuals presented with more choices experienced greater overload ($F(1, 186) = 5.11$, $p < 0.05$). This supports the hypothesis that participants will begin to experience information overload as the number of alternatives increases. We did not find a main effect related to the display condition (booklet versus table).

We found two significant interaction effects, suggesting that how individuals react to changes in the number of options ($F(1, 186) = 2.71$, $p < 0.10$) or how the information is displayed ($F(1, 186) = 7.19$, $p < 0.01$) depends on their relative knowledge.

Figure 1 shows the results graphically. In the leftmost graph, low-knowledge individuals are overwhelmed regardless of the number of choices. This is confirmed statistically with Scheffe multiple-comparison tests. We found no statistical difference in experienced overload between the high choice and low choice conditions for these individuals, however.

Interestingly, the number of choices does have an impact on the reported overload of high-knowledge individuals. They experienced statistically greater feelings of overload with more choices ($p < 0.10$).[5] This is an important finding because it indicates that changes in plan design, such as decreasing the number of choices, may be effective in reducing information overload, but not for all participants. In this case, it only helped those with above average knowledge. For low-knowledge participants, a very vulnerable group, it did nothing.

Another striking result is that high-knowledge individuals with few investment options are significantly less overloaded than low-knowledge participants in either context ($p < 0.01$ in both cases).

The second significant interaction effect is between knowledge and the display condition. High-knowledge individuals who were given the table format were significantly less overloaded than low-knowledge individuals who were given either format ($p < 0.01$ in both cases). However, we found no differences in the overload measure of the high-knowledge participants in the booklet condition and the low-knowledge participants in either format. In addition, manipulating the display did nothing to attenuate either group's feelings of overload.

We also investigated reported feelings of satisfaction. In this case, there were only two significant main effects and no interactions. Table 8, Panel B, reports the means. High-knowledge individuals were more satisfied with their decisions than low-knowledge individuals ($F(1, 189) = 6.82$, $p < 0.01$). Individuals who received the table format were also more satisfied with their decision ($F(1, 189) = 3.11$, $p < 0.10$).

Focusing on the actual asset allocation, we coded an indicator variable that was equal to 1 if the participant chose the default option, and 0 for a non-default alloca-

Table 8. *Experiment 1: Cell Means*

The following tables present the cell means for the display experiment. The number of participants in each cell is in parentheses. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

Panel A. Mean of Overload Measure

	Table		Booklet		
	Low Number of Choices	**High Number of Choices**	**Low Number of Choices**	**High Number of Choices**	**Knowledge Type Mean**
Low Knowledge	27.10 (30)	28.83 (23)	26.52 (27)	25.96 (26)	27.05*** (106)
High Knowledge	19.09 (22)	23.12 (26)	22.78 (18)	26.18 (22)	22.81*** (88)
All	23.71 (52)	25.80 (49)	25.02 (45)	26.06 (48)	
Display Type Mean	24.72 (101)		25.56 (93)		
Low Number of Choices Mean:			24.32** (97)		
High Number of Choices Mean:			25.93** (97)		

Panel B. Mean of Satisfaction Measure

	Table		Booklet		
	Low Number of Choices	**High Number of Choices**	**Low Number of Choices**	**High Number of Choices**	**Knowledge Type Mean**
Low Knowledge	20.16 (32)	18.43 (23)	19.07 (28)	18.16 (25)	19.05*** (108)
High Knowledge	22.36 (22)	21.50 (26)	20.22 (18)	19.65 (23)	20.98*** (89)
All	21.06 (54)	20.06 (49)	19.52 (46)	18.88 (48)	
Display Type Mean	20.58* (103)		19.19* (94)		
Low Number of Choices Mean:			20.35 (100)		
High Number of Choices Mean:			19.47 (97)		

Panel C. Mean of Default Measure

	Table		Booklet		
	Low Number of Choices	**High Number of Choices**	**Low Number of Choices**	**High Number of Choices**	**Knowledge Type Mean**
Low Knowledge	0.31 (32)	0.09 (23)	0.25 (28)	0.12 (26)	0.20*** (109)
High Knowledge	0.00 (22)	0.04 (26)	0.00 (18)	0.04 (23)	0.02*** (89)
All	0.19 (54)	0.06 (49)	0.15 (46)	0.08 (49)	
Display Type Mean	0.13 (103)		0.12 (95)		
Low Number of Choices Mean:			0.17 (100)		
High Number of Choices Mean:			0.07 (98)		

FIGURE 1
Experiment 1: Interaction Effects for Overload

Overload Interaction Effects

Display Experiment

FIGURE 2
Experiment 1: Interaction Effects for Default

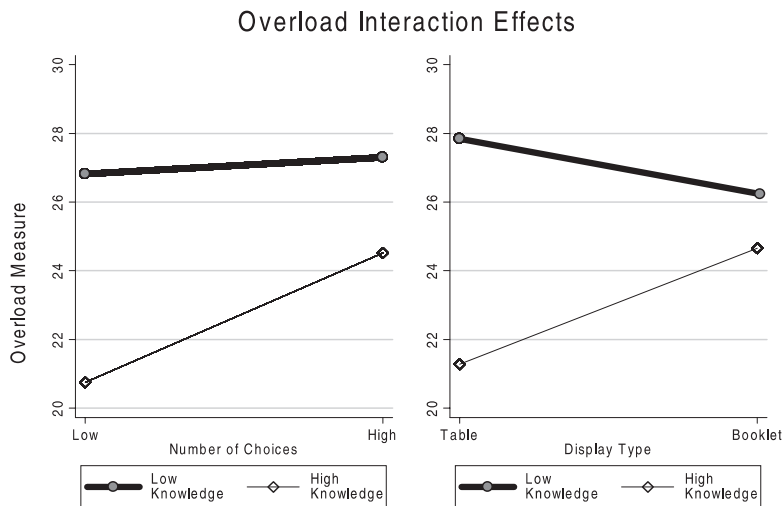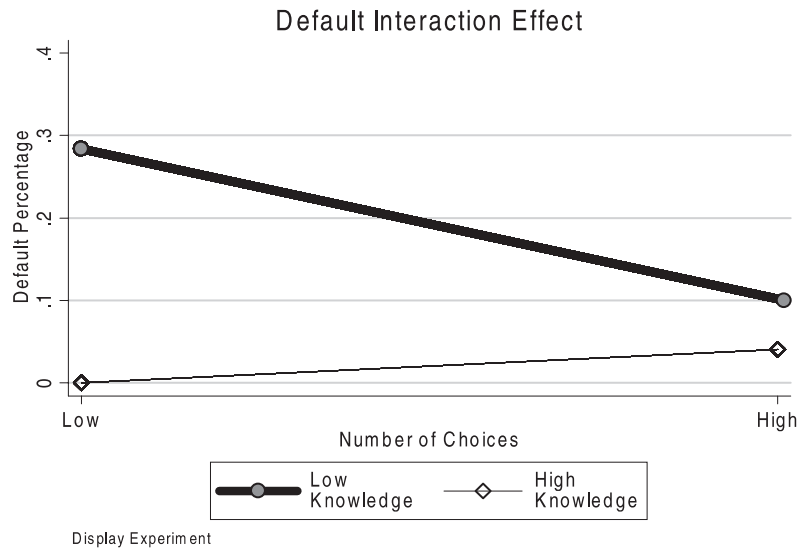Default Interaction Effect

Display Experiment

tion. The cell means of this variable equate to the percentage of individuals in each cell that opted for the default. The results are reported in Table 8, Panel C. Once again, the influence of knowledge is significant. 20% of the low-knowledge individuals chose the default option, compared to 2% of the high-knowledge individuals $(F(1, 190) = 14.41, p < 0.01)$. There we no other significant main effects.

We did find significant interaction between knowledge and the number of choices $(F(1, 190) = 6.04, p < 0.05)$ (see Figure 2). High-knowledge individuals showed an increase in the mean default rate when the number of choices increased. This was expected, because we saw earlier that these individuals experienced significantly greater overload when the number of choices increased. However, the difference in default means is not significant.

Contrary to our expectations, there was a significant difference between default means and the number of choices for low-knowledge individuals. Given that these individuals experienced an insignificant difference in overload, we expected the same insignificant difference in default to exist. As the number of choices increased, however, low-knowledge individuals invested less in the default option. According to the Scheffe multiple-comparison tests, the difference is significant $(p < 0.05)$.

Discussion

Taken together, our results suggest that knowledge has a strong mediating effect. Low-knowledge individuals did not experience any reduction in information overload from changing the number of options offered or the display type. On the other hand, reducing the

number of options did reduce information overload for high-knowledge individuals. They were also more satisfied with their decisions.

Turning to the actual asset allocation decision, significantly fewer high-knowledge individuals chose the default option compared to their low-knowledge counterparts. However, low-knowledge participants were less likely to choose the default often when given more choices. This result is inconclusive, and requires further investigation. Because these participants reported feeling overwhelmed, we expected that they would "shut down" their decision making through choosing the default. However, they may be using another heuristic that has not been captured here.

To examine further, we looked more closely at the sample of individuals in the high choice context who chose not to allocate 100% of their money to the default option. Our hypothesis is that the default still has an influence on investment choices even when participants do not choose to allocate their entire investment to it. If this is true, and assuming everything else equal, we would expect the default option to be chosen more often in the overall portfolios. In particular, we expect low-knowledge individuals to be influenced the most.

To investigate this, we limit ourselves to those individuals who invested in at least one money market fund. We do this because we assume that when individuals make their portfolio decisions, they first decide how much they will allocate to money market funds, and then select the fund from their available choices.

We designed the default option so there was no clear reason for an individual to choose it over other money markets. The default option was not the dominant fund based on the reported performance statistics (i.e., historical returns and seven-day yield), and

did not offer any fee advantage. In fact, all the money market funds reported the same expense ratio. Finally, we eliminated the role primacy and recency effects could play by listing the default option fourth (out of five possible choices) on the allocation form. Despite the design, twenty out of forty-three individuals chose to invest in our default fund. This is twice the number that invested in the second most popular fund, which was dominant in terms of historical returns and yield.

Finally, we broke down the individuals by knowledge. In most cases, the numbers of low-knowledge and high-knowledge individuals investing in each money market fund were equal. Interestingly, it was only in the case of the default fund that the number of low-knowledge individuals was much greater (thirteen versus seven individuals). While these results cannot be tested for statistical significance, they suggest that the default option may play a larger role than we expect in allocation decisions, and this role may be greater for low-knowledge individuals. This is an interesting area for future research.

Experiment 2:
Similarity, Number of Options,
and Knowledge

Experiment 2 used a 2 (similarity) × 2 (number of choices) × 2 (knowledge) between-subjects design. As in experiment 1, individuals were asked to allocate $1,000 in retirement savings among several asset choices or to a default option. We gave these participants the same information about investment options as in experiment 1. All the investment information was presented in the low search cost table format.

We again manipulated the similarity of the options offered, as well as the number of options (six or sixty). Participants were given options that were either highly similar or very distinct. The distinct options were the same as those offered in experiment 1. Specifically, similar options were found by choosing funds listed under the same Morningstar category, with comparable investment strategies and similar performance.[6]

For example, the high information/low similarity condition included sixty fund options, of which five were money market funds, five were bond funds, and fifty were equity funds. The fifty equity funds included five different equity index funds, fifteen growth funds, fifteen blended funds, and fifteen value funds.

In contrast, the high information/high similarity option included the same number of fund choices but only one money market fund and one bond index fund. The remaining fifty-eight were equity index funds. This is admittedly extreme; even when multiple ven-

dors offer similar funds, it is unlikely this many index funds would be offered. However, if similarity is not a significant factor in this extreme case, we can conclude it will not be a factor in less extreme and more realistic cases.[7]

Results

As in the first experiment, knowledge plays a large role in individual level of overload and decision satisfaction. Table 9 reports the cell means. Using a three-factor analysis of variance, we find that information overload is significantly higher for low-knowledge individuals ($F_{(1, 190)} = 37.54$, $p < 0.01$). In addition, information overload increases with the number of choices offered ($F_{(1, 190)} = 13.93$, $p < 0.01$). We find no significant interaction effects.

Satisfaction remains statistically higher for high-knowledge individuals ($F_{(1, 187)} = 13.80$, $p < 0.01$). Participants were also more satisfied with their decisions when given more distinct choices ($F_{(1, 187)} = 9.69$, $p < 0.01$), and fewer choices ($F_{(1, 187)} = 6.67$, $p < 0.05$). Again, we found no significant interaction effects.

As in experiment 1, high-knowledge participants chose the default option less often ($F_{(1, 192)} = 19.34$, $p < 0.01$). However, we also found a three-way interaction between similarity, information, and knowledge ($F_{(1, 192)} = 4.57$, $p < 0.05$). Figure 3 gives the results. High-knowledge individuals appear to choose the default option more frequently when more funds are offered and when the funds are more similar. This supports the notion that people become more overloaded as they find it harder to differentiate among the alternatives. The reaction of the low-knowledge individuals to the number of choices depends on similarity. When the number of choices is large, increasing their similarity does increase the number of participants who choose the default. However, when the number of choices is small, increasing their similarity has the opposite effect.

Discussion

Relative investor knowledge played a key role in reported overload, satisfaction, and whether an individual chose the default option, which supports our results from experiment 1. While the similarity of the options did not contribute to reported feelings of overload, it did have some influence on satisfaction and asset allocation. Once again, the investment patterns of low-knowledge individuals were unusual and unexpected. The lack of predictability in their investment choices may be a result of their high level of overload. This again highlights how important investor knowledge is to investment decisions.

Table 9. *Experiment 2: Cell Means*

The following tables present the cell means for the display experiment. The number of participants in each cell is in parentheses. *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

Panel A. Mean of Overload Measure

	Low Similarity		High Similarity		
	Low Number of Choices	High Number of Choices	Low Number of Choices	High Number of Choices	Knowledge Type Mean:
Low Knowledge	27.10 (30)	28.83 (23)	24.50 (24)	29.00 (21)	27.28*** (98)
High Knowledge	19.09 (22)	23.12 (26)	19.83 (24)	23.89 (28)	21.66*** (100)
All	23.71 (52)	25.80 (49)	22.17 (48)	26.08 (49)	
Similarity Mean:	24.72 (101)		24.14 (97)		
Low Number of Choices Mean:			22.97*** (100)		
High Number of Choices Mean:			25.94*** (98)		

Panel B. Mean of Satisfaction Measure

	Low Similarity		High Similarity		
	Low Number of Choices	High Number of Choices	Low Number of Choices	High Number of Choices	Knowledge Type Mean:
Low Knowledge	20.16 (32)	18.43 (23)	18.46 (24)	15.60 (20)	18.42*** (99)
High Knowledge	22.36 (22)	21.50 (26)	20.71 (21)	18.74 (27)	20.75*** (96)
All	21.06 (54)	20.06 (49)	19.51 (45)	17.40 (47)	
Similarity Mean:	20.58*** (103)		18.43*** (92)		
Low Number of Choices Mean:			20.35** (99)		
High Number of Choices Mean:			18.76** (96)		

Panel C. Mean of Default Measure

	Low Similarity		High Similarity		
	Low Number of Choices	High Number of Choices	Low Number of Choices	High Number of Choices	Knowledge Type Mean:
Low Knowledge	0.31 (32)	0.09 (23)	0.21 (24)	0.38 (21)	0.25*** (100)
High Knowledge	0.00 (22)	0.04 (26)	0.04 (24)	0.07 (28)	0.04*** (100)
All	0.19 (54)	0.06 (49)	0.13 (48)	0.20 (49)	
Similarity Mean:	0.13 (103)		0.16 (97)		
Low Number of Choices Mean:			0.16 (102)		
High Number of Choices Mean:			0.13 (98)		

FIGURE 3
Experiment 2: Interaction Effects for Default

Three Way Default Interaction Effects
by similarity, knowledge, and number of choices

Similarity Experiment
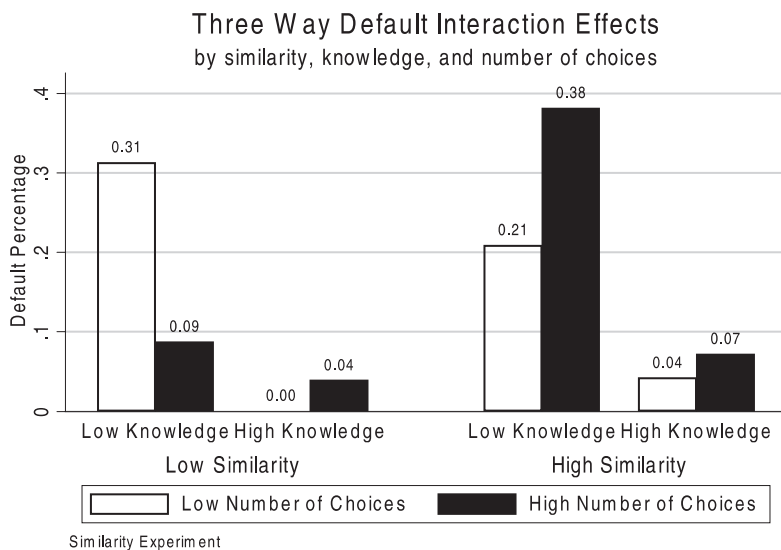
Conclusions

This study contributes to the literature on retirement plan design by examining three common differences among defined contribution plans that can lead to varying degrees of overload and satisfaction: 1) investment information display, 2) the number of investment choices, and 3) the similarity of those choices. These features can also influence the probability that participants will choose the default option. One of the most important aspects of this study is the incorporation of each individual's relative level of financial knowledge into the analysis. This knowledge factor is pivotal to our findings.

We found that changes to plan design can help some individuals. Those with above-average financial knowledge reported significantly less overload when given fewer investment choices, which confirms previous research that plan design is important. Our findings also suggest that individuals with below-average knowledge may find the investment decision overwhelming regardless of the plan features. Altering the plan by offering investment information in a more easily comparable format or by reducing the choices offered did not attenuate low-knowledge individuals' feelings of overload. Thus, in addition to improving plan design, plan sponsors may also want to consider improving financial education, although whether this would ultimately reduce feelings of overload when making financial decisions remains to be tested.

The importance of financial education is not new to policymakers. Alan Greenspan [2002] said "education can play a critical role by equipping consumers with the knowledge required to make wise decisions when choosing among the myriad of financial products and providers." Research into the success of financial education efforts is limited, but shows some promise (see, e.g., Clark et al. [2003]).

Our results show that sponsors must not only devise successful educational programs for participants, but also be aware that individuals who need the education the most often have the weakest perception of their own relative knowledge. If individuals do not realize they need assistance, they may not pursue opportunities to get it. Furthermore, plan sponsors must realize that printed educational material may be ineffective, because even in our small sample we had several participants who had difficulty reading the survey. It is daunting for plan sponsors to attempt to educate the most vulnerable participants, and more research into new and innovative methods is needed.

Our results also show that knowledge plays a large role in who chooses the default. We find that low-knowledge individuals choose the default allocation more often than high-knowledge individuals. In experiment 1, the ratio was 20% of the low-knowledge participants, versus 2% of the high-knowledge individ-

uals. The results were even more striking in experiment 2, which found 25% versus 4%. The often conservative nature of common default investments may mean that individuals invested in these assets will have inadequate retirement savings.

This concern is compounded by the fact that new evidence suggests that the individuals who tested the lowest on our financial exam are the same types of individuals who are not saving enough for retirement. The Employee Benefit Research Institute (EBRI [2003]) found that most older, low-income, single women will not have sufficient retirement savings to cover basic expenditures and healthcare needs. According to this study, some demographic groups can salvage their retirement savings by increasing savings today, but this will be unrealistic for most people. Thus, investment decisions are even more critical for this group. Their only opportunity to secure their retirement would be to make investment decisions that result in above-average returns, which is exactly what investment in a conservative default vehicle will not do.

So what can a plan sponsor do? One option is for plan sponsors to offer assistance to participants. Services such as Financial Engines© or those offering personal financial planners to participants are already available in some 401(k) plans. Similarly, increasing financial education efforts may promote more active choice. However, we must bear in mind the old adage, "You can lead a horse to water, but you can't make him drink." Despite all efforts, there will most likely be a subset of participants who will feel more comfortable choosing the default option. As a result, plans sponsors must focus on plan design, particularly plan defaults. The results of this paper support the move away from offering "one-size-fits-all" defaults.

In closing, the lack of financial knowledge in our sample raises general concerns about the public's ability to effectively manage their retirement accounts. More research is needed into how to design plans that promote sound decision making, how to improve the presentation and ease of use of investment information, and how to effectively educate individuals about finance.

Acknowledgments

Notes

1. For example, participants following the 1/n heuristic opt to divide their contribution allocations evenly among the fund options offered. While this strategy can result in a well-diversified portfolio, Benartzi and Thaler [2001] have shown it can also lead to large ex ante welfare losses. Agnew [2003] finds that those with relatively low salaries are most likely to follow the 1/n heuristic. In this case, salary may be proxying for financial knowledge.

2. During the experiment, individuals answered the following question: "How do you rate your knowledge of retirement investments relative to other people?" Individuals answered using a scale from 1 (much less knowledge) to 10 (a great deal more knowledge). We use their answers as a measure of how much they think they know.

3. Pretests were done to determine the number of funds that were considered "low" and "high."

4. Consistent with the marketing literature, we report the F statistic estimated from the ANOVA analysis related to the variable being discussed. Degrees of freedom are reported in parentheses. In this example, the F statistic is 20.54 for the knowledge variable. $p < 0.01$ indicates the significance level is less than 0.01.

5. The p-values reported in all the discussions of the interaction variables are based on the Scheffe-adjusted significance levels, which in this case is less than 0.10.

6. We confirmed similarity between funds through pretests.

7. In this experiment, responses for the low similarity cells were taken from the responses of participants in experiment 1's table format cells.

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