Naive Diversification Strategies in Defined Contribution Saving Plans

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There is a worldwide trend toward defined contribution saving plans and growing interest in privatized Social Security plans. In both environments, individuals are given some responsibility to make their own asset-allocation decisions, raising concerns about how well they do at this task. This paper investigates one aspect of the task, namely diversification. We show that some investors follow the "1/n strategy": they divide their contributions evenly across the funds offered in the plan. Consistent with this naive notion of diversification, we find that the proportion invested in stocks depends strongly on the proportion of stock funds in the plan. (*JEL* G11, G23, H55)

There is a worldwide trend toward defined contribution saving plans in which investment decisions are made by the plan participants themselves (Employee Benefit Research Institute, 1997). While the advantages of such plans are numerous (e.g., the plans tend to be fully funded and portable), many have expressed concern about the quality of the decisions being made by the participants (e.g., Olivia S. Mitchell and Stephen P. Zeldes, 1996). One of the reasons for concern is the lack of financial sophistication in the general public (B. Douglas Bernheim, 1996). To illustrate, a 1995 survey by John Hancock Financial Services found that a majority of respondents thought money market funds were riskier than government bonds, and felt that their own company stock was safer than a diversified portfolio.

Of course, it is possible that poorly informed employees are still making good decisions. How can we evaluate whether plan participants are making good choices in what is arguably the most important financial decision of their lives? We do not attempt to evaluate asset allocations on an individual case-by-case basis because nearly any combination of stocks and bonds could, in principle, be consistent with the maximization of some utility function. Rather, in this paper we look for evidence that participants make decisions that seem to be based on naive (or confused) notions of diversification. One extreme example we discuss is what we call the "1/*n* heuristic". Someone using this rule simply divides her contributions evenly among the *n* options offered in her retirement savings plan.

The use of the 1/*n* rule has a long history in asset allocation. In fact, it was recommended in the Talmud. Writing in about the fourth century, a Rabbi Issac bar Aha gave the following asset-allocation advice: "A man should always place his money, a third into land, a third into merchandise, and keep a third at hand."[1] There is anecdotal evidence the rule is still in use. For example, for many years TIAA-CREF, the largest defined contribution saving plan in the

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[1] Thanks to Hersh Shefrin and Meir Statman for this quote. Shefrin tells us that the reference to the original Aramaic is "Talmud Bavli, Baba Metzia 42a."

world, offered two investments: TIAA (bonds) and CREF (stocks). By far, the most common allocation of contributions was 50-50; about half of the participants chose this precise allocation of new funds (William Samuelson and Richard J. Zeckhauser, 1988).[2] Indeed, Harry Markowitz, a pioneer in the development of modern portfolio theory, reports that he used this rule himself. He justifies his choice on psychological grounds: "My intention was to minimize my future regret. So I split my contributions fifty-fifty between bonds and equities" (Jason Zweig, 1998).

Of course, there is nothing wrong with this allocation per se, but the complete reliance on the $1/n$ heuristic could be costly. For example, individuals who are using this rule and are enrolled in plans with predominantly stock funds will find themselves owning mostly stocks, while those in plans that have mostly fixed-income funds will own mostly bonds. While either allocation could be on the efficient frontier, the choice along the frontier should reflect factors other than the proportion of funds that invest in stocks. As we show below, using calculations based on Michael J. Brennan and Walter N. Torous (1999), the choice of the wrong asset allocation can be quite costly in utility terms.

The $1/n$ heuristic is a special case of a more general choice heuristic dubbed the "diversification heuristic" by Daniel Read and George Loewenstein (1995). The first demonstration of this phenomenon was by Itamar Simonson (1990). He gave college students the opportunity to select among six familiar snacks (candy bars, chips, etc.) in one of two conditions: (a) sequential choice: they picked one of the six snacks on each of three class meetings held a week apart; (b) simultaneous choice: on the first class meeting they selected three snacks to be consumed one snack per week over the three class meetings. Simonson observed that in the simultaneous choice condition subjects displayed much more variety seeking than in the sequential choice condition. For example, in the simultaneous choice condition 64 percent of the subjects chose three different snacks while in the sequential choice condition only 9 percent of the subjects made this choice. Simonson suggests that this behavior might be explained by variety seeking serving as a choice heuristic. That is, when asked to make several choices at once, people tend to diversify. This is sensible under some circumstances (such as when eating a meal—we typically do not order three courses of the same food) but can be misapplied to other situations.

Read and Loewenstein produce the same behavior in an ingenious experiment conducted on Halloween night. The "subjects" in the experiment were young trick-or-treaters. In one condition the children approached two adjacent houses and were offered a choice between two candies (Three Musketeers and Milky Way) at each house. In the other condition they approached a single house where they were asked to "choose whichever two candy bars you like." Large piles of both candies were displayed to assure that the children would not think it was rude to take two of the same. The results showed a strong diversification bias in the simultaneous choice condition: every child selected one of each candy. In contrast, only 48 percent of the children in the sequential choice condition picked different candies. This result is striking since in either case the candies are dumped into a bag and consumed later. It is the portfolio in the bag that matters, not the portfolio selected at each house.[3]

[2] For more recent statistics on the asset allocation of TIAA-CREF participants see TIAA-CREF (1997).

[3] Graham Loomes (1991) also finds evidence consistent with the diversification heuristic. He offers subjects a series of gambles with three possible states of the world A, B, and C where $\text{pr}(A) > \text{pr}(B) > \text{pr}(C)$. If state C occurs the subject wins nothing. The subject can divide £20 between A and B, winning the amount placed on a state if that state occurs. Rational subjects would put all the money on A, thereby maximizing the expected payoff, but very few subjects did this. Instead, most divided the £20 in proportion to $\text{pr}(A)/\text{pr}(B)$. In unpublished research, Daniel Kahneman and Thaler ran a similar experiment. The experimenter had two envelopes, one labeled Heads, the other Tails. Each envelope contained 20 numbered cards. Subjects were given a form with two rows of numbers, also labeled Heads and Tails. They were told to circle five numbers. The experimenter would then flip a coin and pick a number from the indicated envelope. Anyone who had circled the right number in the right row would win a prize: \$3 if the coin came up heads, \$2 following a tails. Again, rational subjects should only circle numbers in the Heads row but most subjects circled three numbers in the Heads row and two in the Tails row. Repeating the game 20 times did not help.

In these experiments with young people choosing snacks we see an inappropriate use of diversification, a strategy that is often sensible. In this paper we investigate whether the same behavior can be found in adults choosing how to invest their retirement savings. Namely, we see whether plan participants use naive diversification strategies in making their asset-allocation decisions. We do this using a variety of methods.

We begin our analysis with a set of hypothetical questionnaires, where university employees are asked to allocate their retirement contributions between two funds. Different groups of subjects choose between different pairs of funds; for example, one group chooses between a stock fund and a bond fund while another chooses between a balanced fund (half stocks and half bonds) and a stock fund. We find, consistent with the diversification heuristic, that the pair of funds offered has a strong influence on the asset allocation. Put another way, the participants are not sensitive enough to the options they are being asked to choose among. We also find that if participants are asked to choose one of many blends (that is, combinations of stocks and bonds) they make different choices than if they are allowed to compose their own blend (by allocating between a stock fund and a bond fund). This result has implications for the design of both retirement saving plans and privatized Social Security systems.

These experiments suggest that the array of funds offered to plan participants can have a surprisingly strong influence on the assets they end up owning. In particular, the allocation to stocks increases as the number of stock funds, relative to bond funds, increases. A comparison of the plan offered to TWA pilots with that offered to University of California (UC) employees dramatically illustrates this point. The TWA plan offers five core stock funds and one core bond fund (a stable value fund to be precise.) The participants in this plan invest 75 percent of their money in stocks which is well *above* the national average of 57 percent (Greenwich Associates, 1996). The University of California plan, on the other hand, offers one stock fund and four bond funds, and employees in this plan invest only 34 percent in stocks, well *below* the national average. Of course, there are many possible explanations for this result. One is that the pilots are more risk seeking than the UC employees are. To see if this factor drives the results we ran an additional experiment in which the UC employees were asked to make an asset-allocation decision in one of two conditions. They either chose from the array they face in their own plan or the funds available in the TWA plan. We find that when they chose from a set of mostly bond funds the UC employees selected an asset allocation heavy in bonds, but when they chose from a mostly stock mix as in the TWA plan they chose to invest mostly in stocks.

To supplement these controlled experiments, we also analyze the actual choices made by participants in 170 retirement saving plans. Using cross-sectional analysis we again find that the mix of funds in the plan has a strong effect on the asset allocation participants select, across a variety of plans. We also investigate whether the pattern can be explained by other factors such as the plan sponsors choosing an array of funds to match the preferences of the employees. To do this we study the choices of the employees of one firm for which we have been able to obtain quarterly time-series data. This time-series analysis reinforces the conclusions of the cross-sectional study.

The paper proceeds as follows. In Section I, we examine whether individuals use the diversification heuristic with a set of hypothetical questionnaires. In Section II, we use cross-sectional data on retirement saving plans to explore how the set of funds being offered affects the asset allocation participants select. Section III summarizes the results and discusses their practical implications.

I. Experimental Evidence on the Diversification Heuristic

We begin our investigation with surveys of the employees of the University of California. The employees were contacted by mail and told that if they replied they would be entered in a lottery in which one respondent would be paid $500. The respondents were asked one short question about how they would allocate their defined contribution retirement funds if they were offered a particular set of investment options. We use two different methods to investigate this question. The first experiment describes the investment strategies of the funds

verbally; the second displays historical returns graphically. We also conduct a third experiment that is designed to resemble the actual array of investment options offered by the University of California and TWA. All the experiments use a between-subject design; that is, each subject answered just one version of the question. Comparisons are made across groups.

A. *Verbal Savings Questionnaire: Experimental Methods*

In the first survey, employees were asked to allocate their retirement contributions between two funds labeled Fund A and Fund B. The manipulation in the experiment was the investment strategies of the two funds. In condition 1, Fund A invested in stocks and Fund B invested in bonds. In condition 2, Fund A was again a stock fund but Fund B was a "balanced fund" investing half its assets in stocks and half in bonds. In the third condition, Fund A was the balanced fund and Fund B was a bond fund. The investment strategies of the funds were described verbally using the language used by TIAA-CREF to describe its stock and bond funds. Thus in condition 1 they were told the following:[4] "Fund A includes almost the entire range of domestic stock investments, large and small companies alike. Fund B holds primarily high- and medium-quality fixed-income securities—bonds of many different companies or government agencies—all with varying maturities." The question we address is whether the set of funds offered influences the asset allocation chosen by the participants (by more than what would be expected by the constraints imposed). We are also interested in how many participants choose exactly the $1/n$ strategy of dividing their money evenly between the two funds offered.

B. *Verbal Savings Questionnaire: Results*

One hundred and eighty questionnaires were completed, yielding a response rate of 12 percent. The results are described in Figure 1. The left panel of the figure shows the allocations between the funds in the three conditions as well as the mean allocation to Fund A. In every condition there was a substantial group that elected the 50-50 allocation. In the first two conditions the 50-50 allocation is the modal choice, attracting 34 percent of the contributions in the first (stocks and bonds) condition and 21 percent in the second (stocks and balanced). In the third condition the allocations are bimodal, with 28 percent selecting the 50-50 allocation and 33 percent putting all of their money in the balanced fund. Note that the popularity of the $1/n$ allocation is not very sensitive to the funds offered.

In contrast, the final asset allocation does depend greatly on the funds offered. When choosing between stocks and bonds, the mean allocation to stocks is 54 percent. When choosing between a stock fund and a balanced fund the allocation to stocks rises to 73 percent, whereas when choosing between the bond fund and the balanced fund the mean percent in stocks falls to 35 percent. Of course, this simple analysis fails to take into consideration that some allocations are not feasible in conditions 2 and 3. (When choosing between the balanced fund and the bond fund, the highest feasible allocation to stocks is 50 percent.) Therefore, to more carefully determine whether the funds offered influence the asset allocation we do the following analysis. We first assume there is no difference in the underlying preferences of the subjects across conditions. We then take the asset allocation selected by each of the subjects in the first (stocks vs. bonds) condition and calculate the closest asset allocation that subject could have selected if in the other conditions. (In condition 2 all allocations between 50-percent and 100-percent stocks are feasible, while in condition 3 all allocations between 0- and 50-percent stocks are feasible.) We then ask what the mean allocation to stocks would be in conditions 2 and 3 if the subjects had the same preferences as those in condition 1 and were not influenced by the funds presented (except when constrained). Finally, we compare this "implied allocation" to the one actually selected. The results are shown in Table 1. As predicted, the allocations in conditions 2 and 3 are closer to 50-50 than the implied allocations. In condition

[4] For a complete set of the instructions to all of the experiments reported in this paper, contact Shlomo Benartzi.

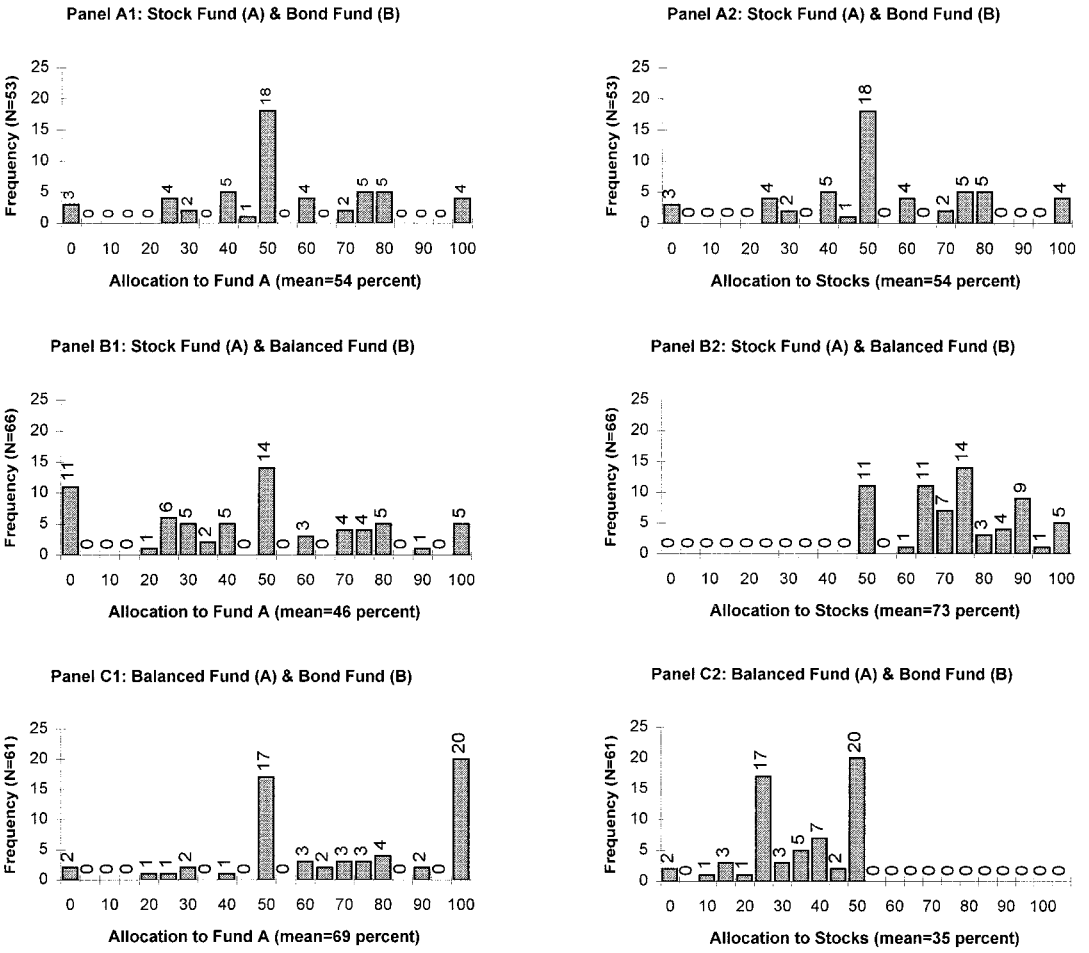

FIGURE 1. VERBAL SAVINGS QUESTIONNAIRE: HISTOGRAMS OF THE ALLOCATION TO FUND A AND THE RESULTING ALLOCATION TO STOCKS

Notes: Three groups of individuals were asked to allocate contributions between two funds, labeled Fund A and Fund B, based on a verbal description of the composition of the funds. The first group was asked to allocate contributions between stocks (Fund A) and bonds (Fund B). The second group was asked to allocate contributions between stocks (Fund A) and a balanced fund that was half stocks and half bonds (Fund B). The third group was asked to allocate contributions between a balanced fund (Fund A) and bonds (Fund B). The histograms on the left provide the actual allocation to Fund A by group, and the histograms on the right provide the resulting allocation to stocks.

2 the implied allocation to the stock fund is 21 percent but they put 46 percent of their money in this fund. In condition 3 the implied allocation to the balanced fund is 87 percent but the subjects only put 69 percent of the money in this fund. Both departures from the implied allocations are highly significant.[5]

C. *Graphic Savings Questionnaire: Methods*

One of the limitations of the first experiment is the use of the terms "stocks" and "bonds" to

[5] One concern is that allocations greater than 100 percent or lower than 0 are unfeasible, violating the normality assumption of the *t*-tests. We have repeated the statistical analysis using bootstrapping techniques that do not assume normality and obtained comparable significance levels. The specific techniques used and the resulting significance levels are available from the authors upon request.

TABLE 1—VERBAL SAVINGS QUESTIONNAIRE: MEAN ALLOCATION TO FUND A

Version	*N*	Fund A	Fund B	Mean actual allocation to Fund A (Median)	Mean implied allocation to Fund A (Median)	*p*-value for the difference in means (Medians)
One	53	Stocks	Bonds	54 percent (50)	54 percent (50)	N/A N/A
Two	66	Stocks	Half stocks and half bonds	46 (50)	21 (0)	0.001 (0.001)
Three	61	Half stocks and half bonds	Bonds	69 (70)	87 (100)	0.001 (0.001)

Notes: Three groups of individuals were asked to allocate contributions between two funds, labeled Fund A and Fund B, based on a verbal description of the composition of the funds. The first group was asked to allocate contributions between stocks (Fund A) and bonds (Fund B). The second group was asked to allocate contributions between stocks (Fund A) and a balanced fund, which was half stocks, and half bonds (Fund B). The third group was asked to allocate contributions between a balanced fund (Fund A) and bonds (Fund B). The table provides the actual allocation to Fund A by group. The table also includes what should have been the allocation to Fund A by the second and third groups to stay consistent with the choices of the first group—i.e., the implied allocation.

describe the investment options. Subjects might have ended up with the 50-50 allocation, simply because they do not know the difference between stocks and bonds. We have therefore replicated the previous study replacing the verbal descriptions of the funds with graphical displays of annual returns. In particular, we presented the subjects with a year-by-year chart of each fund's performance over the last 25 years. Stock returns were based on the S&P 500 index, and bond returns were based on the Lehman Aggregate Bond index. The experimental design (i.e., between subjects), the number of investment funds presented to the subjects, the composition of the funds, and the pool of subjects[6] were all identical to those used in the first experiment.

In addition to replicating the previous conditions we added a fourth condition to this experiment. In this condition, subjects have to choose one fund out of five different multi-asset funds, labeled as Fund A, B, C, D, and E. The proportion of stocks in the five funds varies from 0 to 100 percent by 25-percent increments. Fund A, for example, invests all of its assets in stocks whereas Fund E is invested completely in bonds. This means that a subject can choose any asset allocation in 25-percent increments, and thus is formally equivalent (up to rounding error) to the first condition where the subject explicitly divides her assets between stocks and bonds. This condition is motivated by the design of the privatized Chilean Social Security system.[7] In that system participants must choose among an array of funds, each of which is diversified across asset classes.[8] We are interested in whether this formulation of the choice leads to different asset allocations than the more traditional formulation in condition 1. A sample questionnaire, used in the fourth condition, appears in the Appendix.

D. *Graphic Savings Questionnaire: Results*

Four hundred and seventeen questionnaires were completed, yielding a response rate of 21 percent. The results are reported in Figure 2. When choosing between stocks and bonds, the mean allocation to Fund A (stocks) is 56 percent, quite similar to the 54 percent average we observed in the first experiment (Panel A1). Again we find that the mean allocation to Fund A is not very sensitive to variations in the composition of the funds. When choosing between stocks and a balanced fund, the mean allocation to Fund A (stocks) is 59 percent (Panel B1). Similarly, when choosing between a balanced

[6] Although the subjects in the various experiments were drawn from the same pool, no subject participated in more than one of the experiments we report in this paper.

[7] See Peter Diamond and Salvador Valdes-Prieto (1994) for details on the Chilean retirement system.

[8] We do not use actual data from Chile, because regulatory restrictions result in all the investment funds having similar asset allocations.

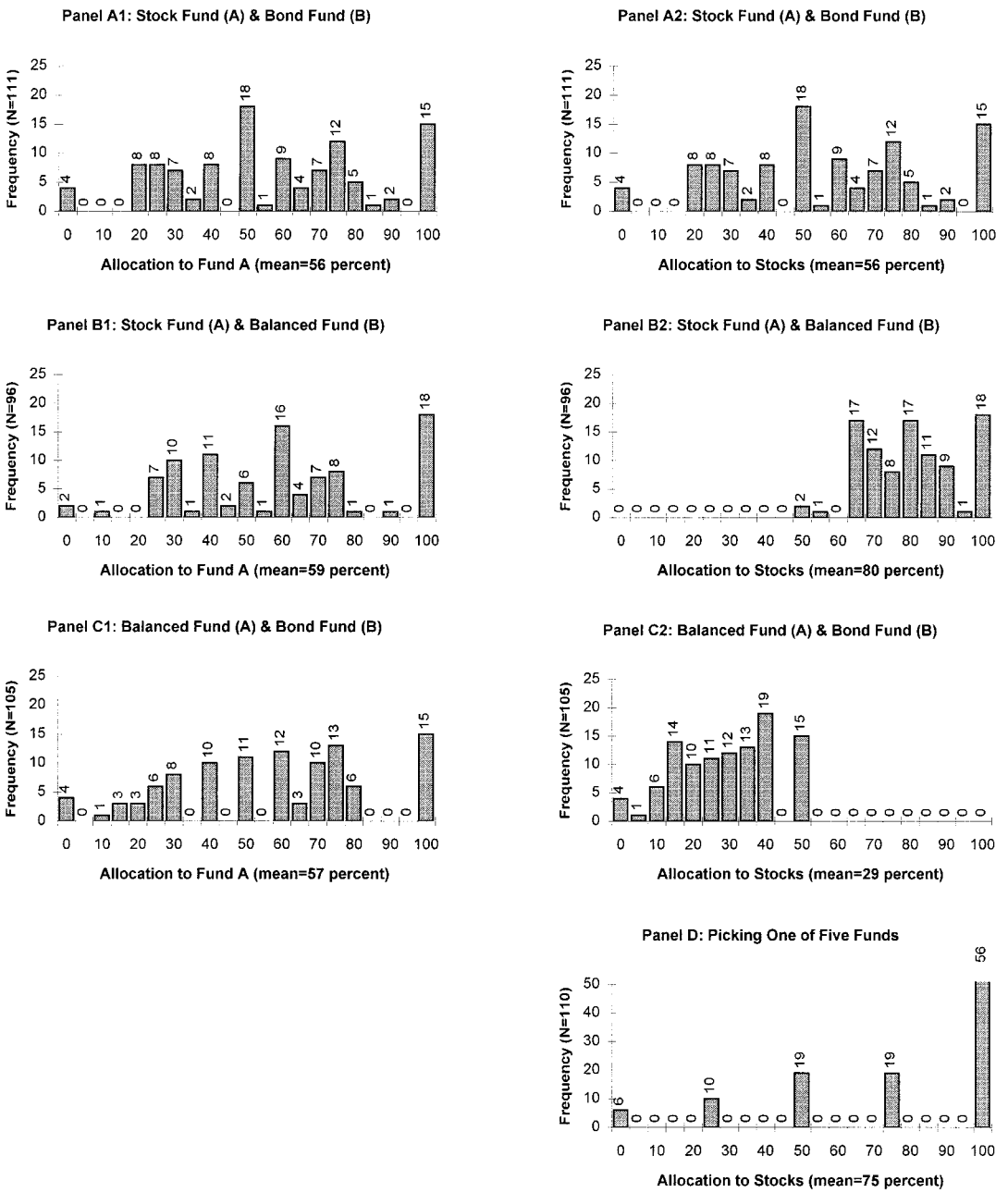

FIGURE 2. GRAPHIC SAVINGS QUESTIONNAIRE: HISTOGRAMS OF THE ALLOCATION TO FUND A AND THE RESULTING ALLOCATION TO STOCKS

Notes: Three groups of individuals were asked to allocate contributions between two funds, labeled Fund A and Fund B, based on a year-by-year chart of the performance of the funds. The first group was asked to allocate contributions between stocks (Fund A) and bonds (Fund B). The second group was asked to allocate contributions between stocks (Fund A) and a balanced fund that was half stocks and half bonds (Fund B). The third group was asked to allocate contributions between a balanced fund (Fund A) and bonds (Fund B). A fourth group of individuals was asked to pick one fund out of a list of five funds and invest all the contributions in that fund. The percentage of stocks in each of the five funds was varied from 0 to 100 by 25 increments. Stock returns were derived from the S&P 500 index and bond returns were derived from the Lehman Brothers Aggregate Bond index. The histograms on the left provide the actual allocation to Fund A by group, and the histograms on the right provide the resulting allocation to stocks.

TABLE 2—GRAPHIC SAVINGS QUESTIONNAIRE: MEAN ALLOCATION TO FUND A

Version	*N*	Fund A	Fund B	Mean actual allocation to Fund A (Median)	Mean implied allocation to Fund A (Median)	*p*-value for the difference in means (Medians)
One	111	Stocks	Bonds	56 percent (55)	56 percent (55)	N/A N/A
Two	96	Stocks	Half stocks and half bonds	59 (60)	29 (10)	0.001 (0.001)
Three	105	Half stocks and half bonds	Bonds	57 (60)	84 (100)	0.001 (0.001)

Notes: Three groups of individuals were asked to allocate contributions between two funds, labeled Fund A and Fund B, based on a year-by-year chart of the performance of the funds. The first group was asked to allocate contributions between stocks (Fund A) and bonds (Fund B). The second group was asked to allocate contributions between stocks (Fund A) and a balanced fund that was half stocks and half bonds (Fund B). The third group was asked to allocate contributions between a balanced fund (Fund A) and bonds (Fund B). Stock returns were derived from the S&P 500 index and bond returns were derived from the Lehman Brothers Aggregate Bond index. The table provides the actual allocation to Fund A by group. The table also includes what should have been the allocation to Fund A by the second and third groups to stay consistent with the choices of the first group—i.e., the implied allocation.

fund and bonds, the mean allocation to Fund A (balanced) is 57 percent (Panel C1). The differences across the three conditions are statistically insignificant based on an ANOVA test ($p = 0.77$). As in our first experiment, the asset allocation subjects elect depends strongly on the mix of funds they have to choose from. Also, as in the first experiment, a large segment of the respondents in each condition choose the 50-50 allocation in every condition.

Next, we repeat the analysis used in the previous experiment to determine whether the funds offered influence the asset allocation chosen, again correcting for the limited range of choices offered. The results are shown in the right panel of Table 2. To be consistent with the choices made in condition 1, the subjects in condition 2 (who are choosing between a stock fund and a balanced fund) would invest 29 percent of their funds in the stock fund, the rest in the balanced fund. Instead, they invest 59 percent in the stock fund. Similarly, in condition 3, where the subjects divide their funds between the balanced fund and the bond fund, if they made their constrained choices consistent with the preferences displayed by the subjects in the first experiment, they would place 84 percent of their funds in the balanced fund, rather than the 57 percent they actually select. Again both differences are highly significant.

The results of condition 4, in which subjects must choose a single fund, are displayed in the bottom right panel of Figure 2, which can be compared to condition 1 shown in the top panel, the simple stock-bond condition. Although the two choices are formally nearly identical, the choices subjects make are quite different. In condition 1, subjects allocated 57 percent of their money to stocks, while in the Chilean condition, subjects put 75 percent in stocks. Most striking is the large number who selected the 100-percent stock allocation (51 percent), compared to only 14 percent in condition 1. We believe this occurs because when investors must choose a single fund there is no opportunity for the diversification heuristic to kick in. Given the graphical displays and the good performance of the stock market over the period shown, many choose to put all their money in stocks. Whether this choice turns out to be a good one, of course, would depend on the future performance of the stock and bond markets.

E. *Verbal Savings Questionnaire with Multiple Funds per Asset Class: Experimental Methods*

In the experiments reported so far the subjects were asked to allocate their retirement contributions between just two funds. One question is whether the results are applicable to a more realistic scenario where there are multiple funds per asset class. To investigate this question, we conducted a third experiment in which University of California employees were asked to allocate their

TABLE 3—VERBAL SAVINGS QUESTIONNAIRE WITH MULTIPLE FUNDS PER ASSET CLASS: MEAN ALLOCATION TO EQUITIES

Version	*N*	Fund description and mean allocation: Fund A	Fund B	Fund C	Fund D	Fund E	Mean allocation to equities (Median)
Multiple fixed-income funds	179	Money markets	Savings	Insurance contracts	Bonds	Diversified equity	43 percent (40 percent)
		14 percent	14 percent	11 percent	18 percent	43 percent	
Multiple equity funds	169	Diversified fixed-income	Conservative equity	Equity index	Growth stock	International equity	68 percent (75 percent)
		32 percent	15 percent	16 percent	26 percent	11 percent	

Notes: Two groups of individuals were asked to allocate contributions among five funds (A, B, C, D, and E), based on a verbal description of the composition of the funds. The first group was asked to allocate contributions among four fixed-income funds and an equity fund. The specific funds are (A) money markets, (B) saving accounts, (C) guaranteed investment contracts, (D) bonds, and (E) diversified equity. The second group was asked to allocate contributions among one fixed-income fund and four equity funds. The specific funds presented to the second group consist of (A) diversified fixed-income, (B) conservative equity income, (C) equity index, (D) growth stock, and (E) international equity. The table provides the allocation to equities by group.

retirement contributions between five funds labeled Fund A, B, C, D, and E. The manipulation in this experiment is the proportion of fixed-income and stock funds. In condition 1, there are four fixed-income funds and one stock fund, which corresponds to the investment options offered by the University of California. The specific funds are money market, savings (bank deposits), insurance contracts, bonds, and diversified stocks. In condition 2, there is one fixed-income fund and four stock funds which resemble the investment options offered by the TWA Pilots plan. Here the specific funds are diversified fixed income, conservative equity income, equity index, growth stock, and international equity. The investment strategies of the funds were described verbally using the language used by the University of California and TWA. The question we address is how would the University of California employees invest their retirement contributions if they were offered a plan dominated by stock funds as opposed to the current plan that is dominated by fixed-income funds.

F. *Verbal Savings Questionnaire with Multiple Funds per Asset Class: Results*

Three hundred and forty-eight questionnaires were completed, yielding a response rate of 17 percent. The results are described in Table 3. The top row of the table shows the allocations in the first condition, which includes four fixed-income funds and one stock fund. In this condition, the average allocation to the stock fund is 43 percent. In the second condition, described in the bottom row, another group of subjects selected among one fixed-income fund and four stock funds. Here, University of California employees allocated 68 percent to stocks. The 25-percent difference (68 percent − 43 percent) between the two conditions is statistically significant at the 0.001 level, suggesting that the array of funds offered affects participants selecting between simple sets of two funds and among larger sets of five funds. Furthermore, the choices the university employees made in each condition were closer to the choices made by the actual employees in the respective plans (75 percent for the TWA pilots and 34 percent for the university employees) than to each other.

G. *Can the 1/n Heuristic Be a Sensible Strategy?*

We have seen that subjects do appear to employ something like the $1/n$ heuristic in choosing investments. Is this necessarily bad? There are several circumstances in which this strategy might be sensible. First, participants might realize they are not very sophisticated and are counting on the employer to put together a selection of choices that makes sense for them. Still, this strategy may make little sense if the plan sponsor does not anticipate participants choosing this way. A plan that adds equity funds in response to requests from sophisticated

investors who want lots of choices can find that naive new participants are investing more in stocks simply because there are proportionally more equity options available. Also, if employees are heterogeneous in terms of risk attitudes (as might be expected in a diverse setting), then it cannot be the case that the mix of funds in the plan reflects an optimal asset-allocation strategy for all of the employees.

Another explanation for our results is that employees increase their equity exposure when more stock funds are added because the additional funds allow them to diversify over active managers, and in so doing gain higher returns at little or no increase in risk. The question that needs to be asked about this explanation is how much we would expect the equity exposure to increase as the number of equity options is increased. This is a complicated question that we investigate using a commercial investment product (Ibbotson's Portfolio Optimizer) and data about the correlation among large-cap funds taken from Catherine Voss Sanders (1997).

We perform two analyses. First, we see how a rational, mean-variance optimizing investor changes his asset allocation as we add funds that invest in different asset classes. We begin by assuming that a plan offers just two options, a large-cap index fund and an intermediate-term government bond fund. We choose the parameters for the utility function so that our rational investor would choose a 50-50 mix of these two funds.[9] We then add a small-cap index fund (that is assumed to perform in line with historic performance of such funds, i.e., higher risk and higher returns than large-cap funds). Next we calculate the utility maximizing mix. The results are shown in Panel A of Table 4. As we see, the proportion invested in equities actually falls to 43 percent. The intuition for this result is that the addition of the small-cap fund shifts the efficient frontier out. A mean-variance maximizing investor substitutes some small stocks for large stocks, increasing both risk and return, but compensates by decreasing the overall equity exposure, to bring the risk level back down. In contrast, adding an international index fund increases the equity exposure to 56 percent since it offers greater diversification.

The second set of simulations investigates what happens if we just add actively managed large-cap funds. The additional funds allow an investor to diversify over manager performance risk, but since the performance of these funds is highly correlated, the benefits of such diversification are small. This fact is revealed in the results. Again we start with just two funds, here a large-cap actively managed fund and an intermediate-term government bond fund. Then we add another actively managed large-cap fund. In this case, an investor who selected a 50-percent equity exposure when offered just one equity fund increases his equity exposure to 54 percent with two funds. When four equity funds are offered, the equity exposure rises to 57 percent, but after that more funds do not increase the amount invested in equities (see Panel B of Table 4).

What should we conclude from these analyses? The primary conclusion is that adding more equity funds to the plan would not produce a dramatic increase in the proportion of assets invested in equities for a rational, mean-variance optimizing investor. The largest increase we obtain in our simulations is from 50 percent to 57 percent, and when the additional funds offer new asset categories such as small-cap, a rational investor would choose to *decrease* the proportion held in

[9] In most consumption-based asset-pricing models, a 50-50 asset allocation requires extreme levels of risk aversion. This is, of course, the famous equity premium puzzle (Rajnish Mehra and Edward C. Prescott, 1985). However, there are settings where a 50-50 allocation will be selected by someone who is not extremely risk averse. Using an alternative approach, Benartzi and Thaler (1995), for example, consider a representative investor who is loss averse (i.e., the disutility of losing money relative to a reference point is greater than the utility of making the same amount) and myopic (i.e., focuses on short-term performance). We find that a 50-50 allocation is quite plausible. Furthermore, we find that myopic loss-averse investors are sensitive to their investment horizon, where short horizons are associated with lower equity allocation. In the exercise, we use one-year returns (the default in the Ibbotson optimizer) in combination with a mean-variance utility function. For a mean-variance maximizer, very much like a myopic loss-averse investor, the investment horizon makes a difference. Consequently, in this setting a 50-50 allocation does not require extreme levels of risk aversion. Had we used longer horizons, the mean-variance maximizer would invest more, if not all, in stocks (Jeremy Siegel, 1998).

TABLE 4—THE EFFECT OF DIFFERENT PLAN STRUCTURES ON THE ASSET ALLOCATION OF A MARKOWITZ MEAN-VARIANCE OPTIMIZING INVESTOR

Scenario	Investment funds being offered	Allocation to stock funds
	Panel A: Diversification Across Asset Classes	
1.0	IT gov. (intermediate-term government) bonds and a large-cap index	50 percent
1.1	IT gov. bonds and large and small-cap indices	43
1.2	IT gov. bonds and large and international indices	56
1.3	IT gov. bonds, large, small, and international indices	40
1.4	IT gov. bonds, a large-cap index, and money markets	42
1.5	IT gov. bonds, a large-cap index, and long-term government bonds	49
1.6	IT gov. bonds, a large-cap index, money markets, and long-term government bonds	42
	Panel B: Diversification Across Actively Managed Funds Within an Asset Class	
2.0	IT gov. bonds and an actively managed large-cap fund	50
2.1	IT gov. bonds and two actively managed large-cap funds	54
2.2	IT gov. bonds and three actively managed large-cap funds	56
2.3	IT gov. bonds and four actively managed large-cap funds	57
2.4	IT gov. bonds and five actively managed large-cap funds	57
2.5	IT gov. bonds and ten actively managed large-cap funds	57

Notes: In this table, we hypothesize a mean-variance optimizing investor who, by assumption, selects 50 percent equities when there are just intermediate-term government bonds and a large-cap index fund. Then, we introduce additional asset classes and calculate how the mean-variance optimizing investor changes her allocation to stocks, using a commercial investment product (Ibbotson's Portfolio Optimizer). The results of this analysis are presented in Panel A. Next, we hypothesize a mean-variance optimizing investor who, again by assumption, selects 50-percent equities when offered intermediate-term government bonds and an *actively managed* large-cap fund. Here, we vary the number of actively managed large-cap funds from one to ten. The resulting allocations to stocks are reported in Panel B.

equities. These results help us interpret the behavior observed in the previous experiment, and the behavior reported in the next section. We will see that, consistent with the diversification heuristic, participants respond much more to changes in the mix of funds in the plan than we would expect based on these calculations.

II. Does the Array of Funds Offered Affect Participants' Choices?

The experiments reported in the previous section suggest that the array of funds offered to plan participants can affect the asset allocations they choose. Of course, these experiments are merely survey questions with no real money at stake. Therefore, our next step is to determine whether there is evidence of the same behavior in the actual choices made by plan participants. We also use the actual choices to investigate how employees treat investments in the stock of their own company.

A. *Data*

To investigate this question we obtained a proprietary database from the Money Market Directories (MMDs). The database covers 170 retirement saving plans (mostly corporations) with 1.56 million participants, annual contributions of $3.23 billion, and assets of $49.99 billion. This represents about 5 percent of the universe of defined contributions plans estimated to be $1,090 billion by the U.S. Department of Labor (1998). The plan sizes in our sample range from 100 participants up to 237,600 participants, and the industry affiliation of the sponsoring corporations consists of 37 different 2-digit SIC codes.

For each plan, the database includes a list of the investment options available to the participants. The database also provides the following information about each investment option: its investment style (i.e., money market, bonds, domestic equity, and so forth), its assets as a percentage of the plan assets, and the year in

TABLE 5—MEAN ASSET ALLOCATION FOR THE MMD SAMPLE OF 401(k) PLANS AS OF 6/30/96

Type of Investment	Plans not offering company stock as an investment option ($N = 103$)	Plans offering company stock as an investment option ($N = 67$)	All plans ($N = 170$)
Money market	7.06 percent	3.14 percent	4.74 percent
Stable value	33.16	10.24	19.61
Bonds	4.26	9.64	7.44
Company stock	0.00	41.98	24.81
Domestic equity	45.95	27.41	34.99
International equity	3.24	1.85	2.42
Multi-asset	4.63	0.86	2.40
Other	1.66	4.84	3.54
Total	100.00	100.00	100.00

Note: The mean allocation is weighted by plan assets.

which it was added to the plan. We should note that allocation percentages are based on plan assets as of mid-1996 rather than the contributions made during 1996. The Money Market Directories do not include the allocation of the annual contributions (and we have been unable to locate a source of such data). This limitation creates some problems for our analysis that we discuss below.

The average participant has accumulated retirement funds of $32,044 ($49.99 billion assets divided by 1.56 million participants), which is remarkably similar to the $32,010 figure reported by Access Research (1996). The average annual contribution per participant is $2,073 ($3.23 billion contributions divided by 1.56 million participants).

The average number of investment options available to the participants is 6.8. Two plans offer one investment fund only, and one plan offers as many as 21 funds. (We exclude from our analysis below the eight plans that offer less than four options.) We assume that hybrid funds, such as asset-allocation and multi-asset options, are invested half in equities and half in fixed-income securities.[10] The average number of equity-type options offered is 4.2, with a range from 0 to 14.5. Thus, 61.76 percent of all the available investment options are equity options (4.2 divided by 6.8). With three exceptions, it is always the case that at least half of the investment options are equities.

Table 5 displays the mean allocation to various asset classes. To examine where the "typical dollar" is invested, the allocations are weighted by plan assets. The mean allocation to equities, defined as the combined allocation to company stock, domestic equity, and international equity, is 62.22 percent (24.81 percent + 34.99 percent + 2.42 percent). The aggregate data offer a crude test of the diversification heuristic: 61.76 percent of the funds invest in equities and the allocation to equities is 62.22 percent. The remarkable similarity between the two percentages is consistent with the diversification heuristic. We provide more detailed tests below.

B. *The Time Weighting of Investment Options*

We wish to investigate the relation between the funds offered and the asset allocation of the participants. Given that our data consists of total fund assets (rather than new flows), this task is complicated by two factors. First, plans have been changing the mix of funds over time. In the early part of our sample the most popular investments (aside from company stock) were fixed-income funds, especially money market funds and guaranteed investment contracts (GICs). In the more recent years, most of the funds added were equity funds, and the proportion of equity funds (as a percentage of new funds) has increased over time from 25 percent in 1976 to 68 percent in 1996. Second, participants alter *existing* investments much less often

[10] Assuming that hybrid funds are either 25 percent or 75 percent in equities does not affect any of the results reported in this paper.

than they change the allocation of new contributions (*Pensions & Investments*, May 12, 1997). Samuelson and Zeckhauser (1988), who document the phenomenon among investors in TIAA-CREF, have dubbed this behavior the "status quo bias." To see the problem these two factors create for our research, compare two hypothetical plans. Plan A offers one fixed-income fund and one equity fund and has done so for ten years. Plan B was identical to Plan A until the last year when it added two more equity funds. Suppose further that every participant in both plans is using the $1/n$ heuristic. Since participants rarely rebalance their existing assets, the mix of assets in the two plans will be very similar (only participants who joined during the last year would be heavily in equities) although the mix of funds would appear to be very different.

To take into account the effect of the status quo bias on the results, we weight the number of each type of investment option by how long it has been in the plan and how well it has performed. The weighting procedure is best illustrated with an example. Consider a retirement saving plan that was established in 1995 with one fixed-income fund and one equity fund. After one year the plan adds another equity fund. Let's suppose that each year investors contribute (at year-end) an aggregate amount of \$100 to the plan, and that all investors use the $1/n$ heuristic. In that case at the end of the first year \$50 would be in bonds and \$50 in stocks. During the second year, 1996, this money would appreciate at the market returns for these two kinds of investments. We use the Lehman Aggregate Bond index and the S&P 500 index as benchmarks for bond and stock returns, respectively. For 1996, the bond and stock returns are 3 percent and 23 percent, resulting in gains of \$1.50 and \$11.50 for the bond and stock funds. Meanwhile, in the second year we assume that new money is being divided evenly among the three options. By the end of 1996, the balances in the fixed-income fund and the equity funds are \$84.50 (\$50 + \$1.50 + \$33) and \$128.50 (\$50 + \$11.50 + \$67). Thus, the *weighted* relative number of equity funds is 0.60 (\$128.50/(\$84.50 + \$128.50)). In the next subsection, we use the relative number of equity funds to explain cross-sectional differences in the percentage of assets invested in equities.

TABLE 6—THE RELATIVE NUMBER OF EQUITY-TYPE INVESTMENT OPTIONS AND ASSET ALLOCATION USING THE MMD SAMPLE OF 401(k) PLANS (AS OF 6/30/96)

Relative number of equity-type investment options	*N*	Mean relative number of equity investment options	Mean allocation to equities
Low	54	0.37	48.64 percent
Medium	54	0.65	59.82
High	54	0.81	64.07
p-value (ANOVA test)			0.01

Notes: Eight retirement savings plans with less than four investment options were excluded from the initial MMD sample of 401(k) plans, resulting in a sample of 162 plans. Then, the sample was partitioned into three groups based on the relative number of equity-type investment options: low, medium, and high. The relative number of equity options was based on the following calculation. At the beginning of each year, a contribution of \$1 was allocated evenly among the available investment options. The account balance in each investment option kept growing as additional contributions were made. The account balance also fluctuated with the return on either the S&P 500 index (for equity funds) or the Lehman Aggregate Bond index (for fixed-income funds). The ending balances in the various investment options were used as weights in the calculation of the relative number of equity-type investment options. Hybrid investment options such as multi-asset funds were assumed to be half in equities and half in fixed-income securities. Last, we calculated the average allocation to equities for plans with low, medium, and high relative number of equity-type investment options.

C. *Results*

We begin with a simple categorical analysis. We use the relative number of equity funds to categorize retirement saving plans into three equal-size groups: low, medium, and high.[11] As reported in Table 6, the relative number of equity funds for the three groups is 0.37, 0.65, and 0.81, respectively. For a plan with ten investment options, for example, a 0.37 figure implies that roughly four of the options are equity funds. Next, we calculated the mean allocation to equities for each group: 48.64 percent, 59.82 percent, and 64.07 percent.

[11] Eight plans with less than four investment options were excluded from the analysis, because they offer very little choice to the participants.

TABLE 7—THE RELATIVE NUMBER OF EQUITY-TYPE INVESTMENT OPTIONS AND ASSET ALLOCATION: A REGRESSION ANALYSIS
(DEPENDENT VARIABLE: THE PERCENTAGE OF PLAN ASSETS INVESTED IN EQUITIES)

WLS regression model	Intercept	Relative number of equity options	Indicator whether the plan offers company stock	Log of the plan assets in thousands	Adjusted R^2
		Panel A: No Industry Indicators ($N = 162$)			
1	22.09	63.14			34.61 percent
	(4.94)	(9.28)			
2	29.72	36.75	15.05		43.45 percent
	(6.73)	(4.49)	(5.10)		
3	10.57	36.77	14.78	1.40	44.16 percent
	(0.89)	(4.52)	(5.03)	(1.74)	
		Panel B: Including Industry Indicators Based on 2-Digit SIC Codes ($N = 142$)			
4		58.68			55.12 percent
		(8.29)			
5		43.90	12.93		58.91 percent
		(5.39)	(3.26)		
6		47.07	9.09	4.13	61.79 percent
		(5.93)	(2.25)	(2.96)	

Notes: The initial sample consists of the June 1996 MMD sample of 401(k) plans. Eight plans with less than four investment options were excluded, resulting in a sample of 162 plans. When we include industry indicators, the sample is further reduced to 142 plans due to missing industry information. The table reports WLS regression estimates with plan assets as weights (*t*-statistics are in parentheses).

Consistent with the diversification heuristic, there is a positive correlation between the relative number of equity funds and the percentage invested in equities. An ANOVA test for the difference across the three groups is statistically significant at the 0.01 level. Thus, we can reject the null hypothesis that participants are unaffected by the array of funds being offered.

How large is this effect? Participants in our sample increase their equity exposure from 48.64 percent to 64.07 percent as the proportion of equity funds goes from 37 percent to 81 percent. Calculations, in the spirit of those in Table 4, suggest that a mean-variance optimizer would increase her equity exposure from 50 percent to 53 percent as the proportion of equity funds varied from 33 percent to 87 percent. This implies that the shifts in equity exposure are much more strongly influenced by the array of funds in the plan than would be expected in an optimizing framework.

We also examined the relationship between the relative number of equity funds and asset allocation in a regression framework. The dependent variable is the percentage allocated to equities and the independent variables are the relative number of equity funds, the logarithm of plan assets as a control for size, and an indicator for the existence of company stock in the plan. (The role of company stock in asset-allocation decisions is addressed in the next section.) The weighted least-squared (WLS) estimation results with plan assets used as weights are reported in Table 7.

The main variable of interest is the relative number of equity options. The diversification heuristic predicts a positive coefficient on this variable, indicating that the higher the number of equity funds offered the higher the allocation to equities. Consistent with the diversification heuristic, the coefficient estimate is significantly positive at the 0.01 level in all of the regressions. It ranges from a low of 36.77 to a high of 63.14, depending on the regression specification.[12] To illustrate the magnitude of the regression coefficients, consider a plan with a mix of

[12] We obtain similar results when: (a) we run the analysis on plans with no company stock, (b) we use OLS rather than

fixed-income and equity funds and a total of ten funds. Replacing one of the fixed-income funds with an equity fund is expected to increase the allocation to equities by 3.67 percent to 6.31 percent.

We have also included fixed effects for the total number of funds offered in the plan, to investigate whether the use of the $1/n$ heuristic might decrease as the number of funds in the plan increases. However, this did not change the results. This may be due to the fact that the plans in our sample do not have a very large number of funds (only eight plans out of 170 have as many as 12 funds in the plan). We suspect that different behavior might be observed in plans that offer the full range of funds from a large mutual fund company such as Fidelity or Vanguard (often called a "Mutual Funds Window"). Such offerings are common in the 403(b) plans at universities and other nonprofits, but not in the corporate 401(k) plans in our sample.

D. *Alternative Explanations*

So far, we have interpreted the positive correlation between the relative number of equity options and the allocation to equities as supporting the diversification heuristic. One concern, though, is that different equity funds might serve different purposes. For example, adding a second growth fund to a plan that already had a mix of equity funds should probably have little effect on the overall asset allocation of the participants, but adding an international equity fund might provide a rational justification for increasing the total equity exposure. Thus, a positive correlation between the relative number of equity funds and the number of international funds offered could be driving our results. However, this is not what we find. In fact, the presence of an international equity fund in the plan is uncorrelated with the relative number of equity funds in the plan. Furthermore, the percentage invested internationally is small across the board. In plans with a small, average, and large number of equity funds the percentage invested abroad is 2.70 percent, 3.48 percent, and 2.24 percent, respectively. Thus, it does not seem that international diversification drives the results.

A more troubling objection to our analysis is the possibility that firms choose the array of funds in the plan specifically to meet the desires of the plan participants. A plan with a young workforce, for example, might offer many equity funds whereas a plan with a relatively mature workforce would be more likely to emphasize stable value and other fixed-income funds. Thus, the observed association between the relative number of equity funds and asset allocation could be driven by an omitted correlated variable—i.e., the underlying risk preferences of the plan participants.

It is difficult to test this explanation directly in our data since we do not have any information on the characteristics or preferences of the plan participants. However, two things argue against this interpretation. First, the experimental results are immune to this critique. Since subjects were assigned randomly to one of the treatment conditions, we would expect no systematic differences in risk preferences or demographics across the groups. The fact that we obtain the same results in these conditions when we know by construction that the array of funds was not selected to match the preferences of the participants supports our interpretation of the later results with actual choices. Second, if demographic differences in risk preferences are driving the array of funds being offered, we might expect those to be stronger between industries rather than within industries. Therefore, we have added industry dummies to the regression analysis using 2-digit SIC codes. The inclusion of the industry controls does not materially affect the results. The coefficient on the relative number of equity funds decreases from 63.14 to 58.68 in the univariate regression and increases from 36.77 to 47.07 in the multivariate regression. Still, the best way to test this alternative explanation is with time-series data. We use this technique in the next section.

E. *Time-Series Analysis*

The problem of endogeneity (that firms choose the options in the plan to match the

WLS regressions, and (c) we exclude observations with a studentized residual above two in absolute value.

TABLE 8—AVERAGE ALLOCATION OF FUTURE CONTRIBUTIONS BY QUARTER FOR A MIDSIZE COMPANY

		Average allocation of future contributions among the following funds:						
Quarter	Number of plan participants	Balanced fund	Bond fund	Stable value fund	S&P 500 fund	International stock fund	Aggressive stock fund	Equity exposure
Jun-93	4,406	29 percent	71 percent	N/A	N/A	N/A	N/A	18 percent
Sep-93	4,413	29	71	N/A	N/A	N/A	N/A	18
Dec-93	3,768	28	72	N/A	N/A	N/A	N/A	18
Mar-94	3,778	29	71	N/A	N/A	N/A	N/A	18
Jun-94	3,837	28	72	N/A	N/A	N/A	N/A	18
Sep-94	2,348	29	71	N/A	N/A	N/A	N/A	18
Dec-94	2,576	25	47	2	8	9	9	41
Mar-95	2,591	25	46	2	8	10	9	43
Jun-95	2,341	24	44	3	9	10	11	44
Sep-95	2,685	24	43	3	9	10	12	45
Dec-95	2,445	23	34	3	13	9	18	55
Mar-96	2,463	23	32	2	13	9	20	58
Jun-96	2,623	23	29	2	14	9	22	60
Sep-96	2,631	23	22	8	15	9	24	62
Dec-96	2,475	20	N/A	21	17	10	31	71
Mar-97	2,479	20	N/A	21	18	10	32	72
Jun-97	2,629	20	N/A	20	19	10	32	73
Sep-97	2,638	20	N/A	19	19	10	31	73
Dec-97	2,358	19	N/A	17	21	10	33	76

Notes: This table reports the mean allocation of future contributions by quarter for an anonymous midsize company. During the first quarter in our sample, the plan included two options: a balanced fund (63 percent in stocks) and a bond fund. In the last quarter of 1994, a stable value fund and three stock funds were added; in the last quarter of 1996, the bond fund was dropped. The last column reports the overall allocation to stocks (i.e., the allocation to individual stock funds plus the stock component of the balanced fund).

preferences of the employees) is greatly reduced if we switch from cross-sectional analysis across firms to a time-series analysis of changes in the asset mix within plans. To this end we have obtained data from Watson Wyatt (a pension consulting firm) for one midsize company. We selected this company to study (*before obtaining the data*) because it made two changes in the options in its savings plan in a relative short (3.5 years) period of time, and quarterly information was available about participants' asset allocations. The ability to study quarterly changes makes it possible to assume that employee preferences have not changed dramatically. This plan was also attractive because it began with a small number of options, making the subsequent alterations to the plan especially significant. Our database includes the investment choices of individual participants from June 1993 through December 1997. The company twice changed the array of funds offered during the sample period, offering two chances to observe any effect on participants' asset allocation. At the beginning of our time period the plan offered just two investment options: a balanced fund (63 percent in stocks) and a bond fund. In the last quarter 1994, a stable value fund and three stock funds were added, and in the last quarter of 1996, the bond fund was dropped.

The number of participants and the mean allocation across the different investment options is displayed quarter by quarter in Table 8. The discussion focuses on the allocation of future contributions because participants rarely change the allocation of their accumulated balances. The mean allocation between the balanced fund and the bond fund is quite stable from June 1993 through September 1994 with a rough mix of 30/70. The resulting equity exposure is 18 percent. During the last quarter of 1994, three stock funds were added and the allocation to stocks increased from 18 percent to 41 percent. The increase in the allocation to stocks continued to drift upwards thereafter, which probably reflects a combination of em-

ployees slowly altering their allocations combined with the strong performance in the stock market over this period.

One concern with this simple analysis is that equity exposures above 63 percent (the proportion in stocks in the balanced fund) were infeasible when the only options were the balanced fund and a bond fund. To explore the magnitude of this effect we calculate the number of participants who allocated 100 percent to the balanced fund and nothing to the bond fund. There were 279 such participants as of September 30, 1994. Next, we assume that all of those participants were constrained and would choose to increase their equity exposure from 63 percent to 100 percent when that became feasible. This behavior only increases the equity exposure by 4 percent.

We also examine participants' reaction to the elimination of the bond fund, which took place at the last quarter of 1996. During that quarter, equity exposure increased from 62 percent to 71 percent. Note that during the prior quarter (Sep-96) and the following quarter (Mar-97) equity exposure increased by a mere percent or two. The magnitude of the equity exposure increase during the last quarter of 1996 suggests it is driven by the elimination of the bond fund rather than a gradual migration into equity funds.

The evidence in this section documents that the array of funds offered to participants can have a strong influence on the asset allocation they select. Using time-series analysis, we are able to keep employee preferences relatively stable and attribute changes in investment behavior to the addition and elimination of specific investment options. We conclude that the greater the relative number of equity funds, the more is allocated to equities.

F. *The Mental Accounting of Company Stock*

Another aspect of diversification that can be investigated with our database is the role of company stock in retirement saving plans. This is potentially an important question since in the plans that offer company stock as one of the options, this investment captures nearly 42 percent of the assets, more than any other type of investment (see Table 5).

There are many pros and cons of including the company stock in the saving plan. From the company's point of view it can be attractive since employees who consider themselves stockholders may be better and more loyal workers. On the other hand, from the employees' point of view, tying up a substantial portion of their retirement wealth in an asset that is positively correlated with their primary source of income is a dubious strategy. However, our concern here is not why employees own so much company stock.[13] [There are numerous explanations; for example, owning company stock is often encouraged in some way, and employees may feel (rightly or wrongly) that they have good information about the prospects of their own firm.] Rather, we are interested in a mental accounting (Daniel Kahneman and Amos Tversky, 1984; Thaler, 1985, 1999) question related to our main theme in this paper, diversification. We ask how employees with large amounts of company stock choose to invest the rest of their retirement funds. Specifically, do they think of company stock as a substitute for other equities, or do they think of it as an asset in a different category altogether? We investigate this by comparing the investments of employees in plans that do not offer company stock as an option (103 plans) with those that do (67 plans). When company stock is not one of the available investment options, the assets are split evenly between equities (49.19 percent = 45.95 percent domestic + 3.24 percent international) and fixed-income securities. This nearly 50-50 split is similar to that observed in the plans in the public sector. *Pensions & Investments* (1998) reports that public plans were 48.8 percent in stocks at the end of 1996.

As we reported above, when the company offers its own stock in the plan this option captures 41.98 percent of the assets. What happens to the rest? If the employees treat this investment as part of their equity portfolio and want a roughly 50-50 asset allocation, then they would invest the bulk of the rest of their assets in fixed income. However, that is not what we observe. Instead the noncompany stock assets are split about evenly between equities and fixed-income securities. Of the remaining 58.02 percent of the assets, 29.26 percent are invested

[13] See Benartzi (2001) for a discussion of this question.

in other equities and the rest (28.76 percent) are invested in fixed-income investments.

It appears that the mental accounting of these investments involves putting the company stock into its own category separate from other equities. The diversification heuristic then pushes people toward the ubiquitous 50-50 split of the remaining assets. The result is that employees in plans that offer company stock have over 71 percent of their assets in equities (including the company stock) while those in plans without company stock have about 49 percent in stock.

A similar result emerges from the regression analysis reported above. When the company stock indicator is included in the analysis, its coefficient is significantly positive. The allocation to equities, defined as the combined allocation to company stock, domestic equity, and international equity, is roughly 15 percent higher for plans with company stock relative to plans without company stock.

G. *Is Naive Diversification Costly?*

Suppose that people do engage in naive diversification strategies, as the results of this paper suggest. There are two ways in which such behavior could be costly compared to an optimizing strategy. First, investors might choose a portfolio that is not on the efficient frontier. Second, they might pick the wrong point along the frontier. The cost of the first type of error is almost certainly quite small. Even the very naive $1/n$ strategy will usually end up with a well-diversified portfolio that is reasonably close to some point on the frontier. As one illustration of this point, Niko Canner et al. (1997) estimate that the popular advice of financial planners, while inconsistent with traditional models of portfolio selection, results in portfolios that are only 20 basis points below the efficient frontier. In contrast, the second inefficiency—i.e., picking an inappropriate point on the efficient frontier—can potentially be quite significant. Brennan and Torous (1999) report the following calculation. They consider an individual with a coefficient of relative risk aversion of 2, which is consistent with the empirical findings of Irwin Friend and Marshall E. Blume (1975). They then calculate the loss of welfare from picking portfolios that do not match the assumed risk preferences. Using a 20-year investment horizon, an individual who switched from an equity-rich plan that led to an 80-percent investment in stocks to a bond-rich plan that produced a 30-percent allocation to stocks would suffer a utility loss of 25 percent. If the horizon is increased to 30 years then the welfare loss can be as much as 35–40 percent. These are clearly significant costs. For an individual who is less risk averse, e.g., a coefficient of 1.0, which corresponds to log utility, the *ex ante* welfare costs of investing too little in equities can be much larger. Even larger *ex ante* welfare losses are associated with large holdings of company stock because of the lack of diversification.

III. Summary and Discussion

This paper examines how individuals deal with the complex problem of selecting a portfolio in their retirement accounts. We suspected that in this situation, as in most complex tasks, many people use a simple rule of thumb to help them. One such rule is the diversification heuristic or its extreme form, the $1/n$ heuristic. Consistent with the diversification heuristic, the experimental and archival evidence suggests that some people spread their contributions evenly across the investment options irrespective of the particular mix of options in the plan. One of the implications is that the array of funds offered to plan participants can have a strong influence on the asset allocation people select; as the number of stock funds increases, so does the allocation to equities. The empirical evidence confirms that the array of funds being offered affects the resulting asset allocation. While the diversification heuristic can produce a reasonable portfolio, it does not assure sensible or coherent decision-making.

The results highlight difficult issues regarding the design of retirement saving plans, both public and private. What is the right mix of fixed-income and equity funds to offer? If the plan offers many fixed-income funds the participants might invest too conservatively. Similarly, if the plan offers many equity funds the employees might invest too aggressively. Another question is how the plan should deal with differences across participants. If the plan offers many equity funds the participants

will end up with a fairly aggressive portfolio, which is consistent with the recommendation of many financial advisors for young workers but not for older ones. Should the plan offer different funds based on age?

In the context of private plans, our results suggest that the increase in retirement funds invested in equities over the past decade may be partly explained by the abundance of new equity funds that have been added to these plans (though the booming stock market in the 1990's has also been an important factor). This is a trend that could easily continue, in part because of the greater ease in differentiating the product of equity funds. Equity funds can be segmented by many factors: size of firm (e.g., small cap); style (e.g., active vs. index; value vs. growth); industry or sector (health care, technology); county or region (China, Asia); and so forth. It is somewhat more difficult to differentiate fixed-income funds other than by maturity and risk (especially since tax-exempt funds have no role in tax-sheltered pension plans).

It is more difficult to say with any assurance what the *ex ante* welfare costs to investors are of using simple rules of thumb to make their investment decisions. As the calculations in the previous section show, in some cases these costs can be substantial, even if investors obtain a portfolio close to the efficient frontier. And, though *ex ante* welfare costs are the proper concept for economists to worry about in designing savings plan, plan administrators (either private or public) may also be worried about *ex post* regret. A plan that by design encourages investors to put an unusually large or small proportion of assets in equities may suffer later if returns differ from historical norms.

APPENDIX: RETIREMENT SAVINGS QUESTIONNAIRE

Figure A1 shows the annual rates of return (or growth rates) for Funds A, B, C, D, and E from 1970 through 1996. These rates indicate the percentage change in the value of your funds in a given year. As you can see, funds on the top of the page had a higher average rate of return, but the returns were more variable. For example, in the best year Fund A grew by 37.5 percent, while in the worst year the fund lost 26.4 percent of its value. The average was 13.4 percent. On the contrary, funds on the bottom of the page had a lower average rate of return, but the returns were less variable. For example, Fund E offered an average return of 9.7 percent but less variability. The annual rate of return was between 32.6 percent and negative 2.9 percent. No adjustment has been made for inflation, which averaged 3.1 percent over this period.

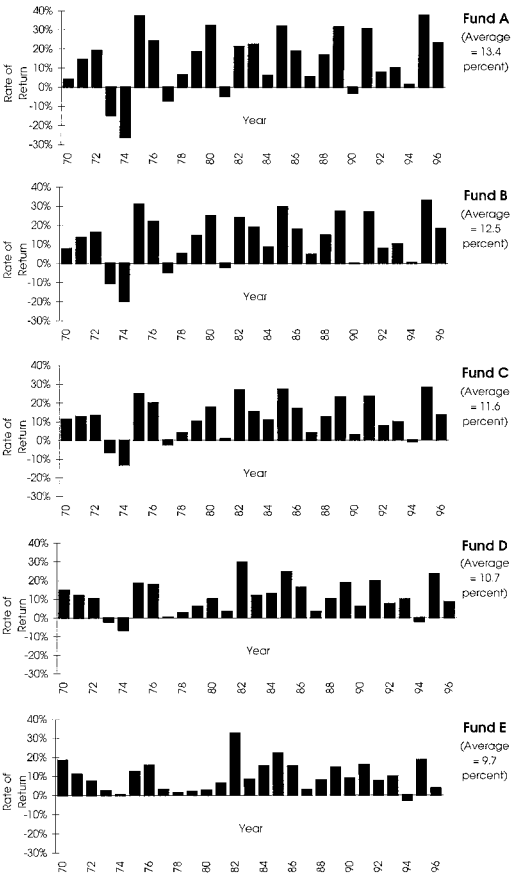

FIGURE A1. ANNUAL RATES OF RETURN FOR FUNDS A, B, C, D, AND E FROM 1970–1996

If these funds were my only retirement options, **and I had to choose one fund only,** I would choose the following fund: _A _B _C _D _E.

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