Choice Proliferation, Simplicity Seeking, and Asset Allocation[♣]

Sheena S. Iyengar
Columbia University, Graduate School of Business

Emir Kamenica
University of Chicago, Graduate School of Business

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ABSTRACT

Does the design of an individual's 401(k) plan affect his or her investment behavior? Records of more than 500,000 employees from 638 institutions reveal that the presence of more funds, even more equity funds, in an individual's 401(k) plan induces a greater allocation to money market and bond funds at the expense of equity funds. Two randomized experiments replicate the result: larger choice sets induce a stronger preference for simpler options. We offer a rationalization of the results based on the possibility that employees might make inferences about the offered funds based on the design of the plan.

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1. Introduction

401(k) plans, employer-sponsored plans in which employees are given monetary incentives to transfer some of their salary into investment funds provided by the plan, are an increasingly common vehicle for retirement savings. As of year-end 2005, 47 million American workers held $2.4 trillion in assets in their 401(k) plans (Holden and VanDerhei 2006).

The features of a 401(k) plan, such as the designation of the default options and the choice of the menu of funds to be offered, are determined jointly by the employer and the company administering the plan, such as Vanguard. With 17 percent of all assets for retirement held in 401(k) plans, the question of whether the resulting design of an individual's plan affect his or her investment behavior attains great importance. The existing literature on this question is divided.

On one hand, a number of papers, recently summarized by Benartzi and Thaler (2007), suggest that the design of the 401(k) plan influences savings behavior in various ways. For example, Madrian and Shea (2001) report that savings rates and allocations are sensitive to default options, Benartzi and Thaler (2001) argue that the menu of funds offered has a strong effect on portfolio choices, and Benartzi and Thaler (2002) demonstrate that a particular presentation of investment portfolios leads employees to prefer the median portfolio in their institution to the one they had chosen for themselves. Iyengar, Huberman, and Jiang (2004) report that a greater number of funds in a 401(k) plan is associated with lower participation rates. More broadly, Benartzi *et al*. (2007) argue that even minor details of the retirement plan design can have dramatic effects on savings behavior.

On the other hand, Huberman and Jiang (2006) contest the sensitivity of asset allocation on the features of the 401(k) plan and report that, contrary to the claims based on evidence from hypothetical choices: (i) the composition of funds offered (e.g., fraction of funds that are equity funds) does not sizeably affect asset allocation, and (ii) the number of funds offered does not affect the number of funds used by a plan participant.[1]

Our paper contributes to this debate by further examining whether the design of the plan impacts savings behavior. Our analysis is very similar in spirit to Huberman and Jiang (2006). We examine whether *the number of funds offered influences asset allocation*. Unlike Huberman and Jiang (2006), we find that the set of funds offered *does* have an impact on employees' asset allocations. Using data from the Vanguard Center for Retirement Research,[2] we analyze the investment decisions of over 500,000 employees in 638 firms**,** and find that, controlling for individual and plan-level attributes, with every additional 10 funds in a plan allocation to equity funds decreases by 3.28 percentage points. Moreover, for every 10 additional funds there is a 2.87 percentage point increase in the probability that a participant will allocate nothing at all to equity funds.

We further investigate the relationship between the size of the choice set and the chosen alternative by conducting two randomized experiments. The results echo the findings on 401(k) allocations: larger choice sets result in more subjects choosing a simpler option. These experimental results complement those on the retirement plan data, more clearly demonstrating the causal relationship between the number of options available and the characteristics of the chosen option, albeit with much smaller stakes.

[1] Benartzi and Thaler (2007) argue that this seeming lack of naïve diversification stems only from the design of the sign-up form.
[2] This is the same dataset used by Iyengar, Huberman, and Jiang (2004) and Huberman and Jiang (2006).

We offer one potential rationalization of our results by nothing that in a market setting smaller choice sets tend to be better *on average* than larger choice sets since the smaller choice sets include only the more select options (Kamenica, forthcoming). Therefore, a rational uninformed individual might be less likely to select an option she doesn't understand well (e.g., an equity fund) when more options are available.

The next section describes the 401(k) data and analyzes the relationship between the number of funds and asset allocation. Section 3 reports the findings from the randomized experiments. Section 4 discusses one possible explanation of the results. Section 5 concludes.

2. Fund Availability and Asset Allocation

Upon joining a 401(k) plan, an individual must choose both how much income to contribute to the plan and how to allocate the investment across the funds the plan provides. In our data, the number of funds available in a plan varies from 4 to 59.[3] This variation allows us to examine the relationship between the number of funds and asset allocation.

2.1 The Data

The data was provided by the Vanguard Center for Retirement Research, whose records from 2001 include 639 defined contribution (DC) pension plans[4] with 588,926 participating employees. Most of the DC plans offered Vanguard fund options and many

[3] In the raw data, for one single observation, the number of funds was apparently miscoded as 2. Under the inclusion criteria specified below, we exclude that observation from our analysis.
[4] For the purpose of this analysis, a plan refers to an institution which provides 401(k) plans to eligible employees.

offered funds from other fund families as well, e.g., TIAA-CREF. The data includes all the individuals regardless of how they chose to invest their money. An important feature of this choice-making environment was that employees could not turn to plan providers for explicit advice on which funds to invest in. In fact, existing 401(k) education materials purposefully avoid recommending specific plans so as to escape ERISA classification as investment advice (Mottola and Utkus 2003).[5]

At the individual level, the data provides information pertaining to gender, age, tenure, compensation, and wealth. Based on this information, we define self-explanatory variables *Female, Age, Age*^{2}*, Tenure, Tenure*^{2}*, logCompensation, and logWealth.*[6] Employees' wealth is measured through their IXI index: a company called IXI collects retail and IRA asset data from most of the large financial services companies at the 9-digit Zip Code level. IXI then assigns a wealth rank (from 1 to 24) to the Zip Codes, based on imputed average household assets.

We exclude individuals whose income is below $10,000 or above $1,000,000, as well as those below 18 years of age. We also exclude 165 individuals who did not contribute a positive amount to their 401(k) plan or had withdrawn money from any fund type. These criteria leave us with 580,855 employees in 638 distinct plans.

Our dependent variables are measures of the employees' contributions across different types of funds. The data provides information on how individuals allocated their total annual 401(k) contribution in 2001 (including the employer match) across seven different categories: money market funds, bond funds, balanced funds, active

[5] The Employee Retirement Income Security Act of 1974 (ERISA) is a federal law that created minimum standards by which most voluntarily established pension and health plans in private industry must provide protection for individuals in these plans.

[6] For the observations where gender was missing, we use the percentage of female employees in the plan. The results are unchanged if we instead drop those observations.

stock funds, indexed stock funds, company stock, and other funds (mainly insurance policies and non-marketable securities).[7] Variable *Equity%* indicates what fraction of the total 2001 contribution an employee placed in all types of equity containing funds (active funds, balanced funds, company stock, and index funds). Similarly, *Bond%* and *Cash%* indicate what fraction of the total 2001 contribution an employee placed in pure bond funds and money market funds, respectively. While we arbitrarily categorize balanced funds as equity, any other categorization (e.g., counting them as ½ bond and ½ equity, or counting them fully as bond funds) yields similar (and slightly stronger) results. We exclude "other" funds from the analysis, but since only 96 employees allocated a positive amount to these funds, any categorization of "other" leaves the results unchanged. We also define an indicator variable *NoEquity,* which takes the value of 1 if an employee allocated her entire contribution only to money market and bond funds, and value 0 otherwise. These four variables: *Equity%, Bond%, Cash%* and *NoEquity* will be our measures of employees' asset allocation.[8] Table I reports the summary statistics at the individual level.

At the plan level the data provides information about specific attributes of the retirement savings program. Employers in 538 out of 638 plans (covering 89% of the employees in the sample) offer some match to their employees' contributions. The match rates range from 0% to 250%, with most falling between 50% and 100%. Variable *Match* indicates the employer's match rate. In our sample, 102 plans (covering 53% of

[7] Note that even though we only have cross-sectional data from 2001, since most people change their 401(k) allocation very rarely (Ameriks and Zeldes 2004), our results reflect decisions made in various years before and including 2001.

[8] Unfortunately, we do not observe any asset holdings that the employees might have outside their 401(k) accounts. As with most other studies of retirement savings behavior, there is little we can do to overcome this limitation of the data.

the sample employees) have "own-company stock" as an investment option. Variable *CompanyStockOffered* is an indicator variable for whether the plan offers company stock, and *RestrictedMatch* is an interaction variable equal to zero if the match is with company stock only and equal to *Match* otherwise. A defined benefits (DB) plan is a company pension plan in which retired employees receive specific amounts based on salary history and years of service while their employers bear the investment risk. In our data, 215 plans (covering 62% of the employees in this sample) offer defined benefit options. Indicator variable *DBPlanOffered* indicates whether a defined benefits plan is available. Almost all of the plans offer internet accessibility. Variable *PercentWebUse* represents the percent of plan participants who registered for web access to their 401(k) accounts. Variable *logNumberEmployees* captures the size of the firm.

We also define plan level variables that capture aggregate measures of the attributes of employees in the plan. The self-explanatory variables *logPlanAverageCompensation*, *logPlanAverageWealth*, *PercentFemale*, *PlanAverageAge*, and *PlanAverageTenure* allow us to provide some control for plan-level policies that might depend on the aggregate characteristics of people within the plan.

Finally, our key independent variable of interest is *NumberOfFunds*, the number of funds offered by a plan. The mean and median number of funds in a plan are 12.49 and 11, respectively. The standard deviation around the mean is 6.86. Ninety percent of plans offer between 6 and 25 fund choices, and 18 plans offer 30 options or more. Table II provides summary statistics at the plan level and Figure 1 depicts the distribution of *NumberOfFunds*.

2.2 The Impact of Number of Funds on Allocation

We first consider OLS regressions of the form:

(1) $$Category\%_{ij} = \beta_0 + \beta_1 * NumberOfFunds + \beta_2 * X_{ij} + \beta_3 * Z_j + \varepsilon_{ij},$$

where $Category\%_{ij}$ is the percentage of contribution individual *i* in plan *j* allocated to a particular category (*Equity*, *Bond*, or *Cash*), X_{ij} is the vector of individual-specific attributes: {*Female, Age, Age*^{2}*, Tenure, Tenure*^{2}*, logCompensation, logWealth* }, and Z_j denotes plan-level characteristics: {*Match, CompanyStockOffered, RestrictedMatch , DBPlanOffered, PercentWebUse, logNumberEmployees, logPlanAverageCompensation, logPlanAverageWealth, PercentFemale, PlanAverageAge, PlanAverageTenure*}. We cluster the standard errors by plan.

Column (1) of Table III reports the impact of the number of funds on the contribution to equities. On average, for every 10 funds added to a plan, the allocation to equity funds decreases by 3.28 percentage points (t=2.81).[9] Figure 2 plots the residuals of the regression of *Equity%* on the individual and plan level controls against the percentile of the residuals of the regression of *NumberOfFunds* on those controls. The scatter plot suggests that the negative relationship between the number of funds and allocation to equity holds throughout the range of the data. Given the mean allocation equity funds of 78%, however, the decrease of 3.28 percentage points for every 10 funds is probably of limited economic significance.

[9] Recall that the standard deviation of the number of funds is around 7.

Column (2) reveals that some of the decrease in exposure to equities stems from an increased allocation to bond funds. On average, for every 10 funds added to a plan, the allocation to bond funds increases by 1.98 percentage points (t=2.74), relative to the mean of 6%. Since *Equity%*, *Bond%*, and *Cash%* must add up to one, these coefficients in columns (1) and (2) imply that the exposure to money market funds increases by 1.30 percentage points for every 10 additional funds in the plan, as indicated in column (3), though this effect is not statistically significant (t=1.17).

Finally, column (4) examines the impact of the number of funds on the probability that an employee invests no money whatsoever in equity funds, using a linear probability model:

$$(2) \qquad NoEquity_{ij} = \beta_0 + \beta_1 * NumberOfFunds + \beta_2 * X_{ij} + \beta_3 * Z_j + \varepsilon_{ij} .$$

While on average only 10.53% of employees do not invest any money in equities, this probability increases by 2.87 percentage points, or around 27%, for every 10 additional funds (t=2.76). Figure 3 plots the residuals of the regression of *NoEquity* on the individual and plan level controls against the percentile of the residuals of the regression of *NumberOfFunds* on those controls. The scatter plot again suggests that the negative relationship between participation in equity and the number of funds holds throughout the range of the data, though may be somewhat less strong in the upper half of the distribution of the residuals of *NumberOfFunds*.

Given that non-participation in the stock market, especially for younger employees, is likely to be detrimental to one's retirement income, this effect is potentially of substantial economic significance. Non-participation is particularly a concern because, in our data, employees under 30 years of age are as likely as others to allocate no money

at all to equity funds and their participation in equities is just as sensitive to the number of funds as that of older employees.[10]

Two factors, however, could bring into question the magnitude of the welfare consequences from non-participation. One is that the increase in the number of funds may increase non-participation only by shifting to zero those who would have otherwise invested very little in equities. For example, it might be that the increase in non-participants comes only from those who were investing less than 3% of their assets in equities. A closer look at the data, however, reveals that this is not an issue. Even though an employee at the 10.5th percentile of the distribution of equity exposure holds no equities, an employee at the 11th percentile already allocates over 10% of her contribution to equity funds, while an employee at the 13th percentile allocates 25% of her contribution to equity funds. By the 18th percentile, employees invest over half of their contributions to equities. Therefore, even in the most extreme case where marginal non-participants are drawn exclusively from the bottom of the distribution of equity exposure, the drop to non-participation induced by a plan design with more numerous fund options involves a substantial decrease in equity exposure.

The other factor to consider is the possibility that non-participants would have limited gains from participating since they would be less sophisticated investors and would invest inefficiently (Calvet *et al*. 2007). While Calvet *et al*. (2007) calculate that this might reduce the costs of non-participation by as much as one-half, even 50% of the potential loss in utility from non-participation in equities involves a substantial decrease in welfare under any reasonable assumptions about risk aversion. For a rough sense of

[10] For employees under 30, the coefficient of *NoEquity* on *NumberOfFunds* is actually greater (0.361) than for older employees (0.282), but this difference is not statisticallysignificant.

this magnitude consider a 45-year-old[11] individual with CRRA utility over wealth at retirement at age 65, with the coefficient of relative risk aversion equal to 5.[12] If this person annually invests $3,000[13] in a riskless asset with a 2% real return instead of investing that money in a risky asset with a lognormal distribution of returns with the mean of 9% and a standard deviation of 16% (which approximates the historic returns on U.S. stocks), the resulting loss is equivalent to foregoing an increase of about $17,000 in the individual's wealth at age 45.[14]

The fact that equity exposure and participation fall with the number of funds in a plan is all the more striking because the percentage of funds that are equity funds *increases* in the overall number of funds: for the median plan, roughly ¾ of the funds are equity funds and this percentage increases by 3.94 percentage points for every 10 additional funds. Hence, as Table IV shows, both the fraction of contributions allocated to equity funds and the probability that at least some money is allocated to equity funds are decreasing in the number of *equity* funds.[15]

Finally, we also examined whether the observed effect is greater for those employees who are more likely to be unfamiliar with asset allocation decisions. In particular, for both specifications (1) and (2), we included an interaction term between the number of funds and proxies for employee sophistication (i.e., income and wealth), and estimated the models separately for employees below and above the median on these

[11] The median age of the employees in our sample is 44.
[12] We consider this to be the upper end of plausible values for the coefficient of relative risk aversion.
[13] Median annual contribution for individuals 45 years and older is $2,984.
[14] Vissing-Jorgensen (2003) finds much smaller costs of non-participation in equities, with a $55 annual cost being sufficient to explain the non-participation of half the non-participants. The reason why the cost is low in her sample, however, is the low or nonexistent financial wealth of most households. By contrast, we look at employees who *are* contributing to their retirement savings each year and consider the cost of not investing any of these funds in equities.
[15] Recall that Huberman and Jiang (2006) find that exposure to equities is not sensitive to the *fraction* of equity funds.

measures. We were unable to detect any statistically significant heterogeneity in the effect of the number of funds on equity exposure.

2.3 Endogeneity and Selection

The interpretation of the results in Table III is complicated by the possibility that plans with different number of funds have different demographics, and the possibility that, within an institution, the type of employee that self-selects into participation varies with the number of funds in the plan. To address these two concerns, we compare the way in which *Category%* and *NoEquity* vary with the individual- and plan-level attributes with the way in which *NumberOfFunds* does so. Specifically, we compare the coefficients β_1 and β_2 across these OLS regressions:

(3) $$Category\%_{ij} = \beta_0 + \beta_1 * X_{ij} + \beta_2 * Z_j + \varepsilon_{ij},$$

(4) $$NoEquity_{ij} = \beta_0 + \beta_1 * X_{ij} + \beta_2 * Z_j + \varepsilon_{ij}, \quad \text{and}$$

(5) $$NumberOfFunds_{ij} = \beta_0 + \beta_1 * X_{ij} + \beta_2 * Z_j + \varepsilon_{ij}.$$

Table V reports the results. As one might expect, equity exposure is generally more correlated with individual characteristics, while the number of funds varies more closely with plan-level attributes. Moreover, the only covariates that have a significant impact on both allocation to equity and the number funds affect the two in the same direction. Therefore, the results in Table V suggest that, to the extent that observable characteristics are representative of the unobservables, the omitted variable bias is likely to *weaken* our

results.[16] Relatedly, as Table VI shows, the inclusion of controls either has no effect on the coefficients on *NumberOfFunds* in regressions (1) and (2) or strengthens our results.[17]

3. The Experimental Tests

We further examine the relationship between the number of options and the type of alternative selected by conducting two randomized experiments. A significant advantage of this approach is that is that it avoids concerns of endogeneity or selection. More importantly, it allows us to construct the choice sets in a way that reveals what particular features of an alternative (i.e., simplicity vs. low risk) make it more attractive when it is an element of a larger set.

Two experiments were conducted at Columbia University. Research assistants approached passers-by on or near the university campus and requested their participation in completing a brief one-page questionnaire, the content of which was unrelated to the experimental manipulations. Of the people approached, 90% agreed to participate.

In each experiment, after completing the survey the subjects were offered a set of gambles, from which they chose one as compensation. The subjects assigned to the Extensive conditions were offered a set of 11 gambles, while those in the Limited conditions were offered a subset of 3 gambles out of the original 11. The conditions and the order in which the gambles were presented were randomized across subjects for each research assistant. The subjects were not aware of the existence of the other conditions.

[16] The coefficients in Table IV suggest that *unobserved employee sophistication* in particular is likely to be associated with more funds and greater equity exposure.

[17] In principle, one could further address the issue of endogeneity by instrumenting for the number of funds in an employee's plan with the individual characteristics of other employees in the firm, but unfortunately the relationship between aggregate characteristics of the plan and its number of funds is too weak for this approach.

The gambles were constructed so that those with higher expected values have a higher variance,[18] and had similar, though not identical, prospect theoretic values as calibrated using estimates from Tversky and Kahneman (1992). The two experiments only differed in the structure of the gambles. The relevant excerpts from the instructions (excluding the unrelated questionnaire) are provided in the Appendix.

Experiment 1.

In the first experiment, subjects were provided with a menu of binary gambles. After the subject selected the gamble, the experimenter would flip a coin to determine the amount of the subject's compensation. Each gamble was described by the dollar amount the subject would receive should the coin fall heads and the amount should it fall tails. Of the 11 gambles, 10 were non-degenerate (e.g., if the coin indicates 'heads,' the subject gets $4.50; if the coin indicates 'tails,' she gets $7.75), and one was a sure bet ($5.00 whether the coin falls on 'heads' or 'tails'). The 3 gambles presented to the subjects in the Limited condition included the degenerate lottery. [19] The sure bet, which was the simplest option but had the lowest expected value, can be seen as an abstracted version of a money market fund in a 401(k) plan. Table VII provides the lists of the gambles in the two conditions. Note that, as the instructions in the Appendix reveal, the simple gamble was presented in the same format as the other gambles and was embedded in the list of the other gambles.

[18] This relationship is not strict, however. Due to rounding issues (we did not want to pay subjects in denominations less than 25 cents), there are pairs of gambles with the same expected value and slightly different levels of risk.

[19] The other two gambles were selected at random but were constant across subjects. Those two additional gambles were not atypically attractive, based on the choices in the Extensive condition. In Experiment 2, we select the two additional gambles independently for each subject.

Results. We observe a dramatic violation of regularity. Only 16% of the 69 subjects in the Limited condition chose the $5 for sure, but 63% of the 68 subjects in the Extensive condition did so (Fisher's exact p-value < 0.001). Figure 4 depicts the histogram of the distribution of choices in the two conditions. The magnitude of this difference is striking: subjects were roughly four times more likely to select the $5 for sure when facing 10 other options than when facing only 2.

Experiment 2.

In the first experiment, the simplest option was also the least risky. Experiment 2 is designed to test the hypothesis that simplicity, rather than lower risk, becomes more attractive as the size of the choice set grows. In the second experiment, there were six possible outcomes associated with each gamble, and compensation was determined by a die toss. Of the 11 gambles, 10 yielded a distinct amount[20] (between $0 and $10) for each outcome of the die toss (e.g., if the die falls on ⚀, the subject receives $4.25; if ⚁, $5.50; if ⚂, $9.75; if ⚃, $8.50; if ⚄, $0.00; if ⚅, $0.75), while one was riskier, paying out either $0 (on a ⚀, ⚁, or ⚂) or $10 (on a ⚃ , ⚄, or ⚅). The subset of 3 gambles presented to the subjects in the Limited condition always included the simpler, all-or-nothing bet, as well as two other gambles which were independently and randomly selected for each subject from the other ten gambles in the Extensive condition. As in the previous experiment, the simpler gamble was presented in the same manner as the others. Table VIII provides the lists of gambles in the Extensive condition.

[20] The amount for each outcome was selected *with* replacement, so even in these 10 gambles there is sometime the same payout for two distinct outcomes of the die toss.

Results. Once again, the simpler gamble was selected more frequently from a larger choice set. Only 16% of the 62 subjects in the Limited condition chose the simplest gamble, while 57% of the 58 Extensive condition subjects did so (Fisher's exact p-value < 0.001). Figure 5 illustrates the histogram of the distribution of choices in the two conditions.

These experimental findings compellingly echo the results on asset allocation and, moreover, suggest that it might be the perceived simplicity, rather than the lower risk, of money market and bond funds relative to equity funds that increases their appeal when employees are presented with a large menu of funds.

4. Discussion

Regardless of the mechanism that drives the increased preference for simpler options from larger choice sets, our findings have substantial implications for the design of 401(k) plans. Nonetheless, a better understanding of the mechanism driving the results could both increase our knowledge of how employees think about the allocation of their retirement savings and inform the company policies for designing 401(k) plans. Although our data is not well suited to identify the mechanism driving the observed relationship, we offer one way to reconcile the observed patterns with rational decision making.

A common feature of choice sets that arise as product market equilibria is that they contain precisely those goods that yield the greatest average utility (Kamenica, forthcoming). This means that, even though the *best* option becomes better as the choice set becomes larger, the *average* option becomes worse. Therefore, selecting a complex

option is fine when only a few options are available (since all elements of a small choice set yield high expected utility), but choosing such an option when there are many alternatives may be unwise (since the large choice set also includes niche products that yield low average utility). To avoid the possibility of selecting an inappropriate niche product, an uninformed individual is better off selecting a simple option when choosing from a large choice set.

In order for this argument to provide a rationalization of our results, we do need to make an additional assumption that people believe that choice sets they encounter across a variety of decision contexts share this feature of equilibrium product lines. In the decision contexts we examine, namely the experimental setting and the 401(k) allocation decision, rationality *per se* does not pin down the subjects' and employees' beliefs about the structure of the choice sets since the incentives of the experimenters and the 401(k) plan designers are not obvious. However, it seems reasonable to assume that in these settings people might act as if the choice set they face is not unlike everyday choice sets they encounter in the market.

The question remains of why might the employees find equity funds to be less simple than money market and bond funds. The resemblance of a money market fund to a savings account probably makes it seem more familiar than other types of funds, but we find that allocation to bond funds also increases with the number of options. This could be due to the fact that plans with high numbers of funds are likely to offer specialty equity funds (e.g., for developing markets, energy, or health care) but no corresponding specialty bond funds.[21] If uninformed employees interpret the class of equity funds as

[21]Unfortunately, our dataset does not provide any information about the funds other than their broad categorization described earlier.

containing relatively more niche options, they have reason to avoid equity funds in favor of money market and bond funds.[22] In this case, the perceived relative simplicity of money market and bond funds relative to equity funds would make the observed sensitivity of equity exposure to the number of funds consistent with rational, if uninformed, decision making.

5. Conclusion

Previous studies have suggested that decisions about retirement savings can be influenced by the structure of the savings program (Benartzi, Peleg, and Thaler 2007). Our results indicate that the number of funds offered is a particular feature of savings plans that can have impact on savings behavior. In considering the practical significance of these results, it is important to keep in mind that in the years between the collection of the data and its presentation, the number of options that the average employee faces has continued to increase. To give one example, each author's personal Vanguard 401(k) plan currently offers over 65 funds,[23] more than any of the plans included in our analysis. On a broader scale, the median number of funds offered by Fidelity's defined contribution plans has steadily increased from 12 in 2001, comparable to our data, to 20 in 2005. Moreover, not only did 61% of Fidelity plans increase the number of funds they offered between 2004 and 2005, but plans already offering 26 or more funds were especially likely to increase their offerings further still, with 76% of them doing so (Fidelity Investments 2007).

[22] To further examine the potential role of simplicity, we have also looked at whether the presence of more funds increases allocation to index funds relative to actively managed ones, but our estimates were too imprecise for any firm conclusions.

[23] Excluding any target retirement date funds.

Given the prevalence of large choice sets, the potential implications of our results are considerable. For example, some politicians in the United States are advocating a partial privatization of the Social Security system. Such a change would dramatically increase the number of investment options for retirement that individuals would have to choose from. This increase, unless accompanied with an effort to provide suitable information, could substantially impact the structure of pension portfolios, and in turn, the expected resources available to future retirees. The question of how to provide useful information that would allow individuals to benefit from the abundance of fund options generated by financial innovation thus becomes of great importance.

Table I: Descriptive Statistics of the Employees

	Mean	St. Dev.	Min	Max	Obs.
Female	0.38	0.46	0	1	580,855
Age	43.42	9.69	18	90	580,855
Age^2	1978.77	852.04	324	8100	580,855
Tenure	11.18	9.27	0	64	580,855
$Tenure^2$	210.90	304.76	0	4096	580,855
logCompensation	10.89	0.59	9.21	13.82	580,855
logWealth	9.75	1.58	0	14.59	580,855
Equity%	0.78	0.34	0	1	580,855
Bond%	0.06	0.17	0	1	580,855
Cash%	0.16	0.31	0	1	580,855
NoEquity	0.11	0.31	0	1	580,855

Female is an indicator variable denoting whether the employee is female, or if that individual's information is missing, the percentage of female employees in the plan. Age is the employee's age in years. Tenure is the number of years the employee has been employed by the company. LogCompensation is the logarithm of the employee's annual salary. LogWealth is the logarithm of the employee's wealth rating as measured by the IXI value associated with the subject's nine-digit ZIP code. Equity% is the percent of total 2001 contribution that the employee allocated to equity containing funds. Bond% is the percent of total 2001 contribution that the employee allocated to bond funds. Cash% is the percent of total 2001 contribution that the employee allocated to money market funds. NoEquity is an indicator variable that denotes whether the subject contributed only to money market and bond funds. For all variables, the level of observation is the employee.

Table II: Descriptive Statistics of the Plans

	Mean	St. Dev.	Min	Max	Obs.
Number of Funds	12.49	6.86	4	59	638
Match	49.44	34.13	0	250	638
Company Stock Offered	0.16	0.37	0	1	638
Restricted Match	3.87	15.97	0	100	638
DB Plan Offered	0.34	0.47	0	1	638
Percent Web Use	0.26	0.13	0	0.91	638
log Number Employees	5.77	1.64	1.10	11.15	638
log Plan Average Compensation	10.98	0.47	9.27	13.39	638
log Plan Average Wealth	10.79	0.79	8.04	14.22	638
Percent Female	0.38	0.19	0	1	638
Plan Average Age	42.82	3.87	30.47	59.67	638
Plan Average Tenure	9.35	4.51	0.27	26.76	638

Number of Funds is the number of funds offered by the plan. Match is the percentage rate at which the employer matches contributions to the plan. Company Stock Offered is an indicator variable denoting whether the plan offered company stock. Restricted Match is an interaction variable equal to zero if employee contributions are only matched with company stock, and equal to Match otherwise. DB Plan offered is an indicator variable denoting whether a defined benefits plan was available to employees. Percent Web Use is the percent of plan participants who registered for online access to their 401(k) accounts. Log Number Employees is the logarithm of the number of people employed at the company. Log Plan Average Compensation is the logarithm of the mean of the employees' yearly salaries. Log Plan Average Wealth is the logarithm of the mean of the employees' wealth ratings, as measured by IXI values for each participant's nine-digit ZIP code. Percent Female is the percentage of employees who are female. Plan Average Age is the mean of the employees' age. Plan Average Tenure is the mean of the number of years the employees have been employed by the company. For all variables, the level of observation is the plan.

Table III: Effect of the Number of Funds on Allocation

Dependent Variable	Equity% (1)		Bond% (2)		Cash% (3)		NoEquity (4)	
Number of Funds / 100	**-0.328**	**(0.117)****	**0.198**	**(0.072)****	**0.130**	**(0.112)**	**0.287**	**(0.104)****
Female	-0.004	(0.004)	0.007	(0.002)**	-0.003	(0.003)	-0.006	(0.004)
Age	0.007	(0.001)**	0.001	(0.000)	-0.008	(0.001)**	-0.006	(0.001)**
Age^2 / 100	-0.013	(0.001)**	0.000	(0.001)	0.013	(0.001)**	0.010	(0.001)**
Tenure	-0.004	(0.001)**	0.000	(0.001)	0.003	(0.001)**	0.002	(0.001)**
$Tenure^2$ / 100	0.003	(0.003)	-0.002	(0.002)	-0.001	(0.003)	-0.003	(0.003)
log Compensation	0.072	(0.007)**	-0.006	(0.002)**	-0.066	(0.007)**	-0.052	(0.007)**
log Wealth	0.013	(0.001)**	0.000	(0.001)	-0.013	(0.001)**	-0.008	(0.001)**
Match / 100	0.026	(0.024)	-0.034	(0.023)	0.008	(0.029)	-0.031	(0.027)
Company Stock Offered	0.031	(0.019)	-0.056	(0.016)**	0.026	(0.020)	-0.041	(0.021)*
Restricted Match / 100	0.109	(0.034)**	-0.003	(0.015)	-0.106	(0.034)**	-0.157	(0.038)**
DB Plan Offered	-0.031	(0.018)	0.012	(0.009)	0.019	(0.017)	0.017	(0.019)
Percent Web Use	-0.057	(0.079)	-0.020	(0.037)	0.077	(0.077)	0.001	(0.076)
log Number Employees	-0.004	(0.005)	0.012	(0.006)*	-0.008	(0.004)	0.005	(0.006)
log Plan Average Compensation	-0.005	(0.043)	-0.017	(0.017)	0.022	(0.041)	0.033	(0.043)
log Plan Average Wealth	0.014	(0.021)	0.005	(0.008)	-0.018	(0.020)	-0.024	(0.020)
Percent Female	-0.001	(0.064)	0.198	(0.069)**	-0.197	(0.061)**	0.005	(0.071)
Plan Average Age	0.004	(0.004)	0.005	(0.003)	-0.009	(0.004)*	0.001	(0.004)
Plan Average Tenure	-0.001	(0.004)	0.001	(0.001)	0.000	(0.003)	0.000	(0.003)
Observations	580,855		580,855		580,855		580,855	
R^2	0.06		0.12		0.06		0.05	

(1-3) Ordinary Least Squares; (2) Linear Probability Model. Robust standard errors in parentheses, clustered by plan. Equity%, Bond%, and Cash% are the fraction of allocation the employee put in all equity containing funds, bond funds, and money market funds, respectively. NoEquity is an indicator variable that denotes whether the subject contributed only to money market and bond funds. Number of Funds is the number of funds offered by the plan. Female is an indicator variable denoting whether a subject is female. Age is the subject's age in years. Tenure is the number of years the subject has been employed by the company. LogCompensation is the logarithm of the subject's annual salary. LogWealth is the logarithm of the subject's wealth rating as measured by the IXI value associated with the subject's nine-digit ZIP code. Match is the percentage rate at which employers match employee contributions to the plan. Company Stock Offered is an indicator variable denoting whether the plan offered company stock. Restricted Match is an interaction variable equal to zero if employee contributions are only matched with company stock, and equal to Match otherwise. DB Plan offered is an indicator variable denoting whether a defined benefits plan was available to employees. Percent Web Use is the percent of plan participants who registered for online access to their 401(k) accounts. Log Number Employees is the logarithm of the number of people employed at the company. Log Plan Average Compensation is the logarithm of the mean of the employees' yearly salaries. Log Plan Average Wealth is the logarithm of the mean of the employees' wealth ratings, as measured by IXI values for each participant's nine-digit ZIP code. Percent Female is the percentage of employees who are female. Plan Average Age is the mean of the employees' age. Plan Average Tenure is the mean of the number of years the employees have been employed by the company.

* significant at 5%; ** significant at 1%

Table IV: Effect of the Number of Equity Funds on Allocation

Dependent Variable	Equity% (1)		Bond% (2)		Cash% (3)		NoEquity (4)	
Number of Equity Funds / 100	**-0.346**	**(0.130)****	**0.282**	**(0.102)****	**0.064**	**(0.117)**	**0.346**	**(0.123)****
Female	-0.004	(0.004)	0.007	(0.002)**	-0.003	(0.003)	-0.006	(0.003)
Age	0.007	(0.001)**	0.001	(0.000)	-0.008	(0.001)**	-0.006	(0.001)**
Age^2 / 100	-0.013	(0.001)**	0.000	(0.001)	0.013	(0.001)**	0.010	(0.001)**
Tenure	-0.004	(0.001)**	0.000	(0.001)	0.003	(0.001)**	0.002	(0.001)**
$Tenure^2$ / 100	0.003	(0.003)	-0.002	(0.002)	-0.001	(0.003)	-0.003	(0.003)
log Compensation	0.072	(0.006)**	-0.006	(0.002)**	-0.066	(0.007)**	-0.052	(0.007)**
log Wealth	0.013	(0.001)**	0.000	(0.001)	-0.013	(0.001)**	-0.008	(0.001)**
Match / 100	0.027	(0.025)	-0.034	(0.022)	0.007	(0.030)	-0.031	(0.027)
Company Stock Offered	0.032	(0.019)	-0.056	(0.015)**	0.024	(0.020)	-0.041	(0.020)*
Restricted Match / 100	0.106	(0.034)**	-0.002	(0.015)	-0.105	(0.034)**	-0.155	(0.038)**
DB Plan Offered	-0.031	(0.018)	0.012	(0.009)	0.019	(0.017)	0.017	(0.019)
Percent Web Use	-0.065	(0.081)	-0.024	(0.039)	0.089	(0.080)	0.003	(0.076)
log Number Employees	-0.004	(0.005)	0.012	(0.006)*	-0.008	(0.004)	0.005	(0.006)
log Plan Average Compensation	-0.007	(0.043)	-0.018	(0.017)	0.025	(0.042)	0.033	(0.044)
log Plan Average Wealth	0.014	(0.021)	0.005	(0.008)	-0.019	(0.020)	-0.024	(0.020)
Percent Female	0.000	(0.064)	0.191	(0.065)**	-0.191	(0.060)**	0.001	(0.069)
Plan Average Age	0.004	(0.004)	0.005	(0.003)	-0.009	(0.004)*	0.000	(0.004)
Plan Average Tenure	0.000	(0.004)	0.001	(0.001)	0.000	(0.003)	0.000	(0.003)
Observations	580,855		580,855		580,855		580,855	
R^2	0.06		0.12		0.06		0.05	

(1-3) Ordinary Least Squares; (4) Linear Probability Model. Robust standard errors in parentheses, clustered by plan. Equity%, Bond%, and Cash% are the fraction of allocation the employee put in all equity containing funds, bond funds, and money market funds, respectively. NoEquity is an indicator variable that denotes whether the subject contributed only to money market and bond funds. Number of Equities is the number of equities offered by the plan. Female is an indicator variable denoting whether a subject is female. Age is the subject's age in years. Tenure is the number of years the subject has been employed by the company. LogCompensation is the logarithm of the subject's annual salary. LogWealth is the logarithm of the subject's wealth rating as measured by the IXI value associated with the subject's nine-digit ZIP code. Match is the percentage rate at which employers match employee contributions to the plan. Company Stock Offered is an indicator variable denoting whether the plan offered company stock. Restricted Match is an interaction variable equal to zero if employee contributions are only matched with company stock, and equal to Match otherwise. DB Plan offered is an indicator variable denoting whether a defined benefits plan was available to employees. Percent Web Use is the percent of plan participants who registered for online access to their 401(k) accounts. Log Number Employees is the logarithm of the number of people employed at the company. Log Plan Average Compensation is the logarithm of the mean of the employees' yearly salaries. Log Plan Average Wealth is the logarithm of the mean of the employees' wealth ratings, as measured by IXI values for each participant's nine-digit ZIP code. Percent Female is the percentage of employees who are female. Plan Average Age is the mean of the employees' age. Plan Average Tenure is the mean of the number of years the employees have been employed by the company.

* significant at 5%; ** significant at 1%

Table V: Endogeneity and Selection

Dependent Variable	Equity% (1)		Bond% (2)		Cash% (3)		NoEquity (4)		Number of Funds (5)	
Female	-0.004	(0.004)	0.007	(0.003)**	-0.003	(0.003)	-0.006	(0.004)	0.054	(0.062)
Age	0.007	(0.001)**	0.001	(0.000)	-0.008	(0.001)**	-0.006	(0.001)**	0.068	(0.031)*
Age^2 / 100	-0.012	(0.001)**	0.000	(0.001)	0.013	(0.001)**	0.009	(0.001)**	-0.081	(0.036)*
Tenure	-0.004	(0.001)**	0.000	(0.001)	0.003	(0.001)**	0.002	(0.001)**	0.048	(0.028)
$Tenure^2$ / 100	0.004	(0.003)	-0.003	(0.002)	-0.001	(0.003)	-0.003	(0.003)	-0.171	(0.092)
logCompensation	0.072	(0.006)**	-0.006	(0.002)**	-0.066	(0.007)**	-0.052	(0.007)**	-0.051	(0.119)
logWealth	0.013	(0.001)**	0.000	(0.001)	-0.013	(0.001)**	-0.008	(0.001)**	0.023	(0.034)
Match / 100	0.030	(0.026)	-0.037	(0.024)	0.006	(0.030)	-0.035	(0.028)	-1.339	(1.285)
Company Stock Offered	0.037	(0.020)	-0.060	(0.017)**	0.023	(0.020)	-0.046	(0.022)*	-1.737	(1.046)
Restricted Match / 100	0.104	(0.035)**	0.001	(0.016)	-0.104	(0.034)**	-0.152	(0.037)**	1.699	(2.259)
DB Plan Offered	-0.033	(0.018)	0.014	(0.009)	0.020	(0.017)	0.019	(0.020)	0.707	(0.788)
Percent Web Use	-0.108	(0.085)	0.011	(0.039)	0.097	(0.080)	0.046	(0.080)	15.597	(4.552)**
log Number Employees	-0.003	(0.006)	0.011	(0.006)	-0.008	(0.004)	0.004	(0.006)	-0.275	(0.337)
log Plan Average Comp.	-0.018	(0.043)	-0.009	(0.018)	0.027	(0.042)	0.044	(0.044)	3.848	(1.602)*
log Plan Average Wealth	0.017	(0.021)	0.002	(0.009)	-0.020	(0.019)	-0.027	(0.020)	-1.118	(1.125)
Percent Female	-0.027	(0.073)	0.214	(0.077)**	-0.186	(0.061)**	0.028	(0.079)	8.068	(3.729)*
Plan Average Age	0.003	(0.004)	0.006	(0.003)	-0.009	(0.004)*	0.002	(0.004)	0.315	(0.195)
Plan Average Tenure	-0.001	(0.004)	0.001	(0.002)	0.000	(0.004)	0.000	(0.003)	-0.025	(0.177)
Observations	580,855		580,855		580,855		580,855		580,855	
R^2	0.06		0.12		0.06		0.05		0.17	

(1,2,3,5) Ordinary Least Squares; (4) Linear Probability Model. Robust standard errors in parentheses, clustered by plan. Equity%, Bond%, and Cash% are the fraction of allocation the employee put in all equity containing funds, bond funds, and money market funds, respectively. NoEquity is an indicator variable that denotes whether the subject contributed only to money market and bond funds. Number of Funds is the number of funds offered by the plan. Female is an indicator variable denoting whether a subject is female. Age is the subject's age in years. Tenure is the number of years the subject has been employed by the company. LogCompensation is the logarithm of the subject's annual salary. LogWealth is the logarithm of the subject's wealth rating as measured by the IXI value associated with the subject's nine-digit ZIP code. Match is the percentage rate at which employers match employee contributions to the plan. Company Stock Offered is an indicator variable denoting whether the plan offered company stock. Restricted Match is an interaction variable equal to zero if employee contributions are only matched with company stock, and equal to Match otherwise. DB Plan offered is an indicator variable denoting whether a defined benefits plan was available to employees. Percent Web Use is the percent of plan participants who registered for online access to their 401(k) accounts. Log Number Employees is the logarithm of the number of people employed at the company. Log Plan Average Compensation is the logarithm of the mean of the employees' yearly salaries. Log Plan Average Wealth is the logarithm of the mean of the employees' wealth ratings, as measured by IXI values for each participant's nine-digit ZIP code. Percent Female is the percentage of employees who are female. Plan Average Age is the mean of the employees' age. Plan Average Tenure is the mean of the number of years the employees have been employed by the company.

* significant at 5%; ** significant at 1%

Table VI: The Impact of Controls

Dependent Variable	Equity%				NoEquity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of Funds / 100	-0.216	-0.343	-0.310	-0.328	0.236	0.328	0.276	0.287
	(0.164)	(0.159)*	(0.113)**	(0.117)**	(0.180)	(0.173)	(0.102)**	(0.104)**
Individual Level Controls	No	Yes	No	Yes	No	Yes	No	Yes
Plan Level Controls	No	No	Yes	Yes	No	No	Yes	Yes
Observations	580,855	580,855	580,855	580,855	580,855	580,855	580,855	580,855
R-squared	0.00	0.05	0.02	0.06	0.00	0.03	0.04	0.05

(1-4) Ordinary Least Squares; (5-8) Linear Probability Model. Robust standard errors in parentheses, clustered by plan. Equity% is the fraction of allocation the employee put in all equity containing funds. NoEquity is an indicator variable that denotes whether the subject contributed only to money market and bond funds. Number of Funds is the number of funds offered by the plan. Individual Level Controls are *Female, Age, Age^2, Tenure, Tenure^2, logCompensation,* and *logWealth*. Plan Level Controls are *Match, CompanyStockOffered, RestrictedMatch , DBPlanOffered*, *PercentWebUse, logNumberEmployees, logPlanAverageCompensation*, *logPlanAverageWealth*, *PercentFemale*, *PlanAverageAge*, and *PlanAverageTenure*.
* significant at 5%; ** significant at 1%

Table VII: Set of Gambles for Experiment 1

Extensive Condition		
Gamble #	If heads	If tails
1	$5.00	$5.00
2	$4.50	$7.75
3	$4.00	$8.25
4	$3.50	$8.75
5	$3.00	$9.50
6	$2.50	$10.00
7	$2.00	$10.50
8	$1.50	$11.25
9	$1.00	$11.75
10	$0.50	$12.50
11	$0.00	$13.50

Limited Condition		
Gamble #	If heads	If tails
1	$5.00	$5.00
2	$3.50	$8.75
3	$0.00	$13.50

Table VIII: Set of Gambles for Experiment 2

Extensive Condition						
Gamble #	If 	If 	If	If	If 	If 
1	$0.00	$0.00	$0.00	$10.00	$10.00	$10.00
2	$1.50	$9.25	$8.75	$7.00	$0.75	$1.25
3	$4.25	$5.50	$9.75	$8.50	$0.00	$0.75
4	$1.00	$2.00	$6.75	$7.50	$5.75	$4.75
5	$5.50	$1.00	$0.75	$6.50	$7.50	$6.75
6	$0.00	$0.00	$8.75	$2.75	$9.75	$8.00
7	$9.75	$3.00	$7.00	$6.50	$0.50	$1.50
8	$9.50	$1.50	$1.50	$2.50	$3.25	$10.00
9	$5.50	$8.50	$3.25	$0.00	$8.50	$2.50
10	$9.25	$7.75	$3.75	$2.00	$3.25	$2.00
11	$1.25	$4.50	$8.50	$8.75	$4.50	$0.75

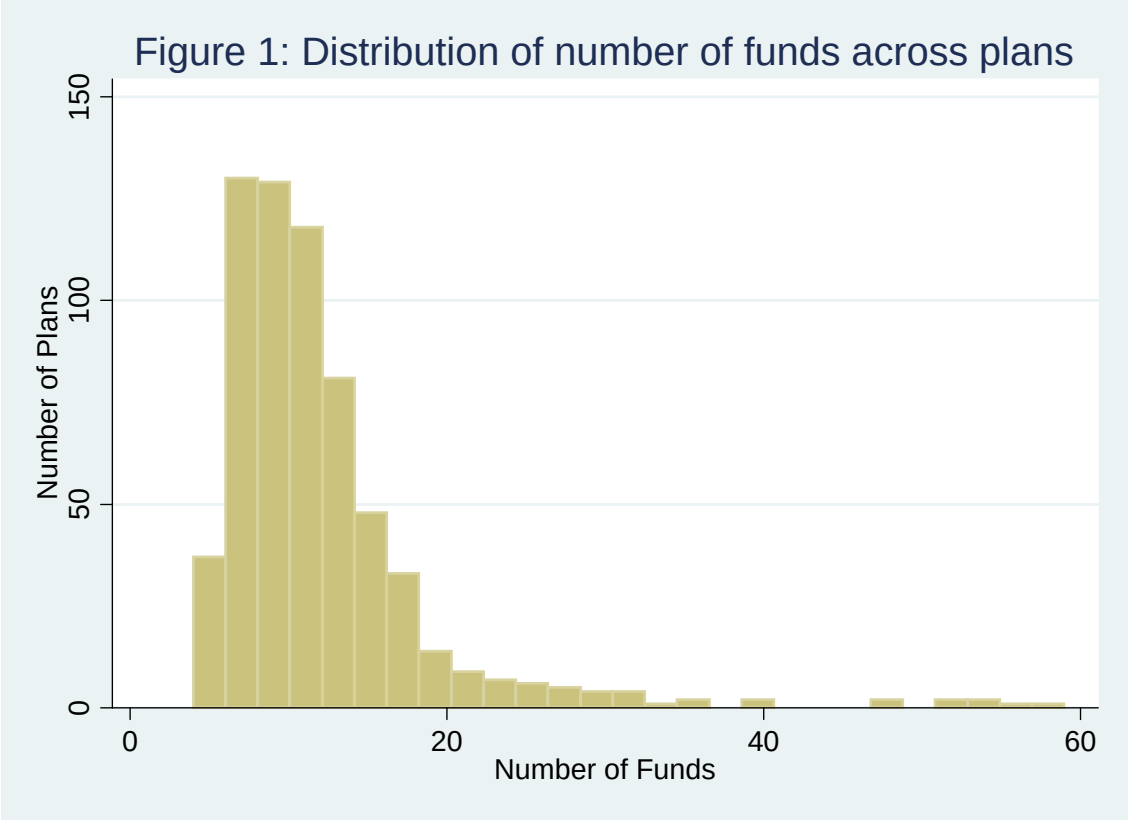
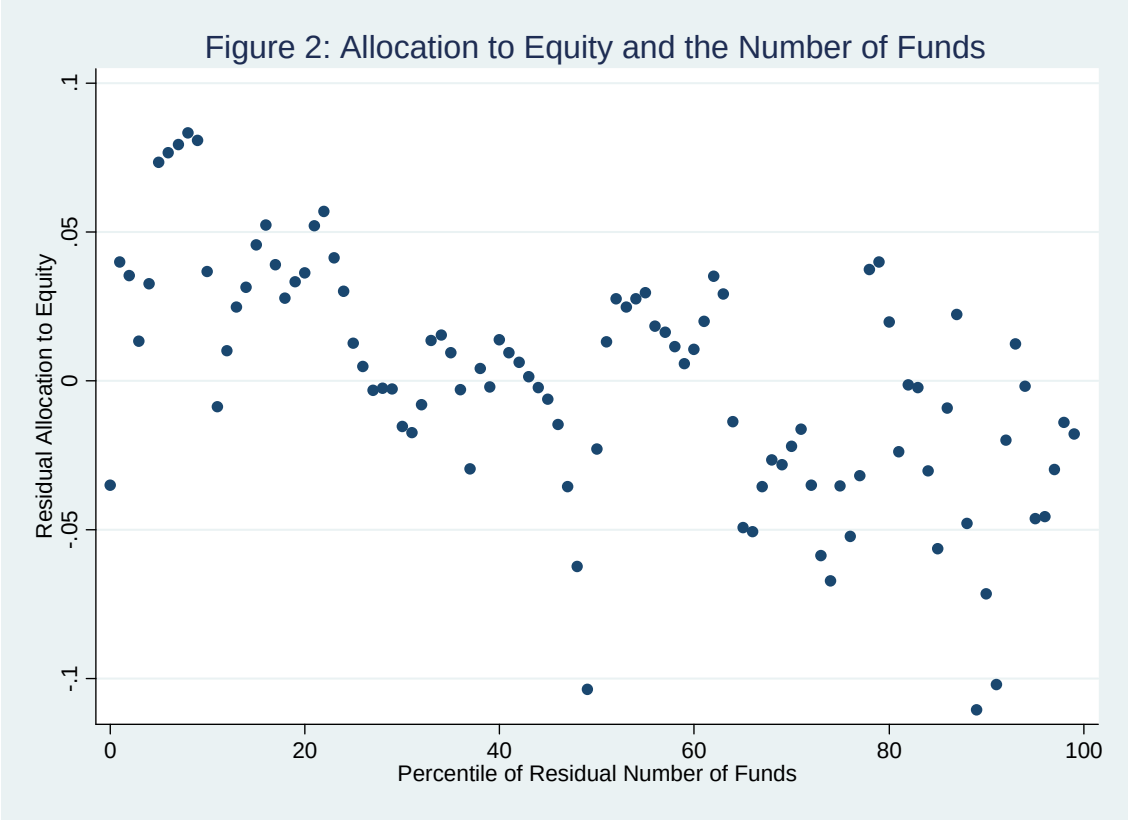
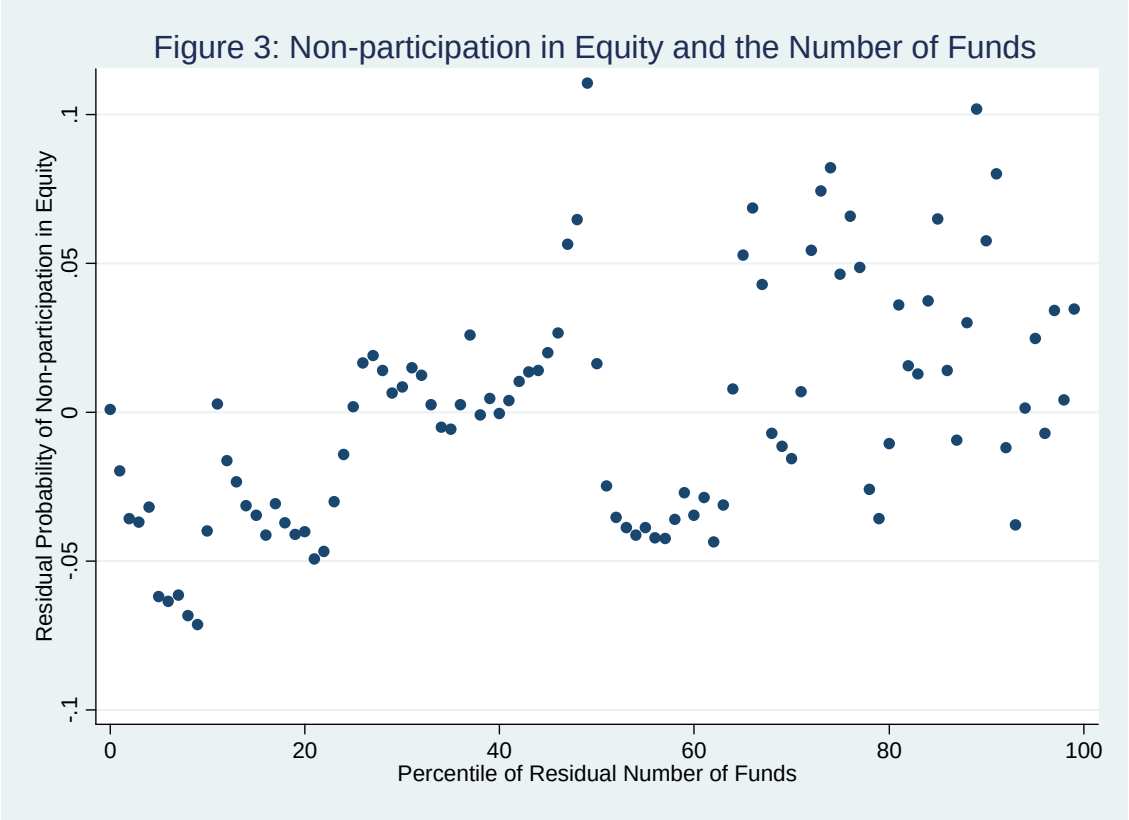


Figure 1: Distribution of number of funds across plans
Number of Plans
0
50
100
150
0
20
40
60
Number of Funds



Note: Residual Allocation to Equity is the residual of the OLS regression of *Equity%* on the individual- and plan-level controls. Percentile of Residual Number of Funds is the percentile of the residual of the OLS regression of *NumberOfFunds* on the individual- and plan-level controls.



Note: Residual Probability of Nonparticipation in Equity is the residual of the Linear Probability Model regression of *NoEquity* on the individual- and plan-level controls. Percentile of Residual Number of Funds is the percentile of the residual of the OLS regression of *NumberOfFunds* on the individual- and plan-level controls.

Figure 4: Fraction of subjects selecting a gamble as a function of the choice set in Experiment 1

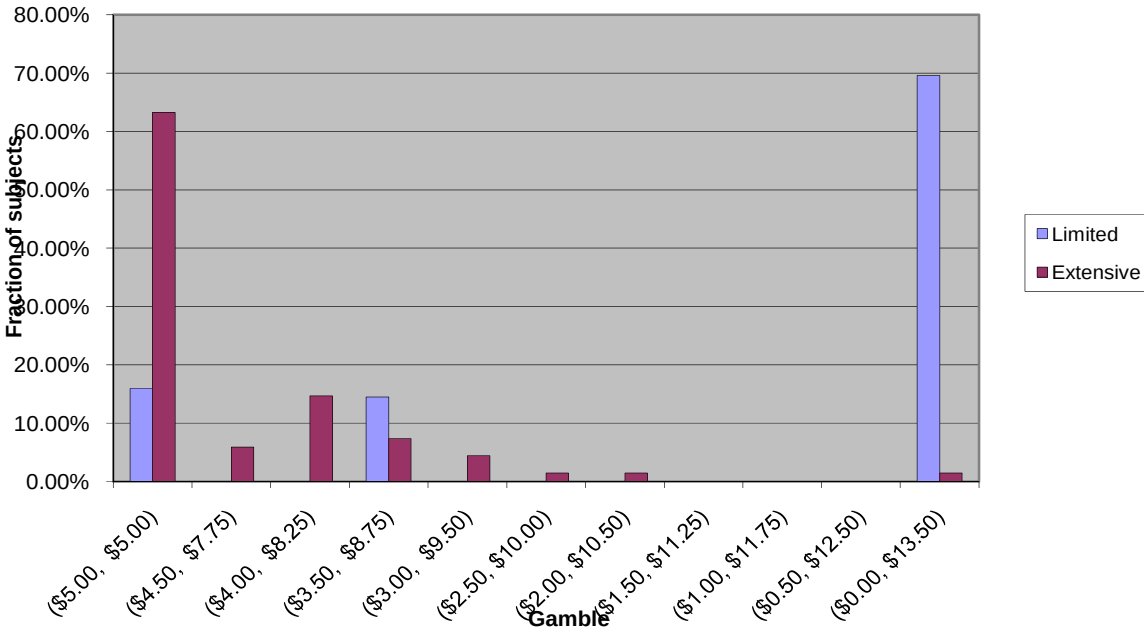
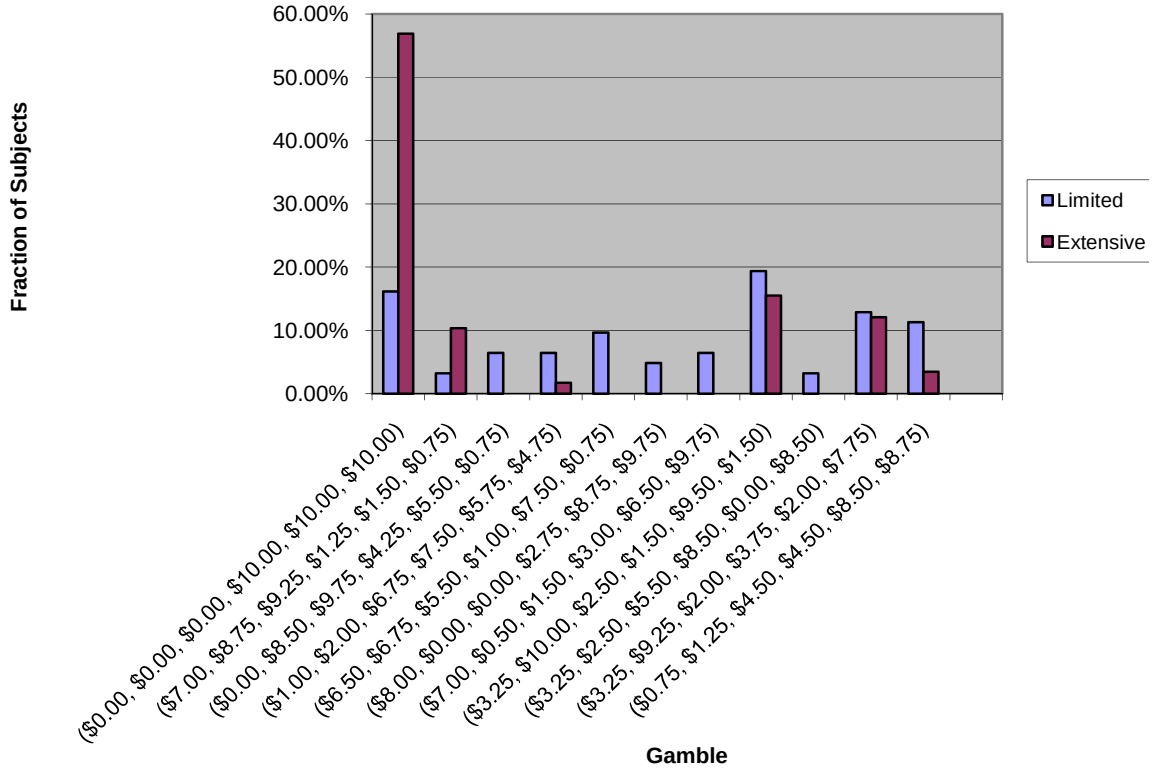


Figure 5: Fraction of subjects selecting a gamble as function of the choice set in Experiment 2



Appendix

Instructions for Experiment 1

We are interested in gathering Columbia students' opinions about other renowned universities. Each of the following 5 pages lists a college or university at the top and a brief list of questions probing your opinion about that college or university. The questions are relatively straightforward. Answer to the best of your ability.

Thank you for participating!

☺

Thank you for participating in the experiment. For compensation, please select one of the gambles below. The experimenter will then flip a coin. Should the coin land on "heads" you will receive the amount specified in the left column. Should the coin land on "tails" you will receive the amount specified in the right column. Please check off the desired gamble and the experimenter will proceed to flip the coin.

Please place a check next to the desired option	If the coin indicates "heads"	If the coin indicates "tails"
	$4.50	$7.75
	$10.50	$2.00
	$2.50	$10.00
	$12.50	$0.50
	$8.75	$3.50
	$1.50	$11.25
	$9.50	$3.00
	$5.00	$5.00
	$11.75	$1.00
	$4.00	$8.25
	$13.50	$0.00

Instructions for Experiment 2

We are interested in gathering Columbia students' opinions about other renowned universities. Each of the following 5 pages lists a college or university at the top and a brief list of questions probing your opinion about that college or university. The questions are relatively straightforward. Answer to the best of your ability.

Thank you for participating!

☺

Thank you for participating in the experiment. For compensation, please select one of the gambles below. The experimenter will provide you with a die. You will cast the die and, depending on how the die falls, receive the amount of money indicated in the table below. Please check off the desired gamble.

Please place a check next to the desired option	If the die falls on 1, you receive	If the die falls on 2, you receive	If the die falls on 3, you receive	If the die falls on 4, you receive	If the die falls on 5, you receive	If the die falls on 6, you receive
	$0.75	$9.25	$8.75	$7.00	$1.25	$1.50
	$0.00	$0.75	$4.25	$5.50	$8.50	$9.75
	$0.00	$0.00	$0.00	$10.00	$10.00	$10.00
	$1.00	$2.00	$6.75	$7.50	$5.75	$4.75
	$1.00	$7.50	$0.75	$6.50	$5.50	$6.75
	$8.00	$0.00	$2.75	$9.75	$0.00	$8.75
	$0.50	$3.00	$1.50	$9.75	$7.00	$6.50
	$2.50	$3.25	$9.50	$1.50	$10.00	$1.50
	$8.50	$3.25	$2.50	$8.50	$0.00	$5.50
	$2.00	$3.25	$3.75	$9.25	$7.75	$2.00
	$4.50	$4.50	$8.75	$8.50	$0.75	$1.25

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