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## How Much Choice is Too Much?: Contributions to 401(k) Retirement Plans

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## How Much Choice is Too Much?: Contributions to 401(k) Retirement Plans

### Abstract

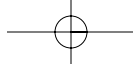
Although extensive choice seems appealing, research shows that it may hinder motivation to buy and decrease subsequent satisfaction with purchased goods. This paper examines whether these findings generalize to employees who are making decisions about whether to invest in 401(k) retirement saving plans. Using data from nearly 800,000 employees, we tested the hypothesis that employee 401(k) participation rates fall as the number of fund options increase. Our results confirm that participation in 401(k) plans is higher in plans offering a handful of funds, as compared to plans offering ten or more options.

### Disciplines

Economics

### Comments

The published version of this Working Paper may be found in the 2004 publication: *Pension Design and Structure: New Lessons from Behavioral Finance*.

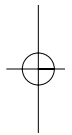


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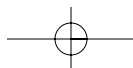
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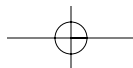
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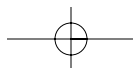
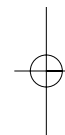
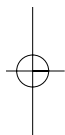
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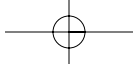
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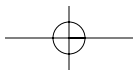
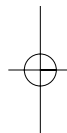
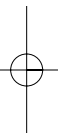
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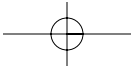
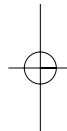
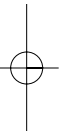
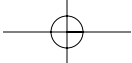




## **Part II**

# **Implications for Retirement Plan Design**





## Chapter 5

# **How Much Choice is Too Much? Contributions to 401(k) Retirement Plans**

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*Sheena Sethi-Iyengar, Gur Huberman, and Wei Jiang*

It is commonly supposed that the more choices we have, the better off we are—that the human ability to manage and the desire for choice are infinite. From classic economic theories of free enterprise, to mundane marketing practices that offer aisles of potato chips and soft drinks, the desire for infinite choice pervades our institutions, norms, and customs. Ice cream parlors compete to offer the most flavors while major fast-food chains urge customers to “Have it your way.” Furthermore, the challenges of choice are not merely confined to snack foods. With today’s plethora of retirement savings plans, important life decisions have also become a matter of choice, where employees become consumers, contemplating alternative career options and multiple investment opportunities.

These days, most workers cannot expect to retire on Social Security alone; therefore people are increasingly turning to company pension plans to help them save for retirement. Firms offer 401(k) plans in order to attract new employees, encourage superior performances from current employees, and increase employee retention. The 401(k) plan, named for section 401(k) of the Internal Revenue Code, permits employees of qualifying companies to set aside tax-deferred funds with each paycheck. While the employer is responsible for establishing a 401(k) plan, employees must decide what percentage of their paycheck will be deducted for their plans. Employees can legally contribute up to 25 percent of their annual earnings as long as the amount does not exceed the legal cap (which was \$12,000 in 2003). Over the past decade the number of employer-provided retirement plans has skyrocketed from under 100,000 in 1990, to over 400,000 by 2002.

While the promise of a greater variety of plans seems beneficial, is there such a thing as too much choice? Indeed, if we look beyond the number of plans available, and we examine the options within the plans themselves,

The authors acknowledge the contributions of Steve Utkus, who made available the data essential for conducting this analysis and provided the authors constructive feedback throughout the process. The authors would also like to thank Gary Mottola for his considerable time and effort.

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we find even more decisions waiting to be made. Most 401(k) plans offer employees a myriad of investment opportunities from mutual funds, insurance companies, and/or banks. Indeed, some providers even allow employees to invest in individual stocks, and on global capital exchanges allowing for maximum portfolio diversification. But, does bigger necessarily mean better? When large companies woo potential employees with a smorgasbord of options, do these options actually enhance employee welfare?

Inherent to consumerism is the assumption that choice is both desirable and powerful. Psychological theory and research have similarly presumed that choice is invariably beneficial. Repeatedly, across many domains of inquiry, psychologists have contended that the provision of choice can increase the individual's sense of personal control (e.g. Rotter, 1966; Taylor and Brown, 1988; Taylor, 1989) and feelings of intrinsic motivation (e.g. deCharms, 1968; Deci, 1981; Deci and Ryan, 1985). In turn, personal control and intrinsic motivation have been correlated with numerous physical and psychological benefits, including greater task enjoyment, enhanced task performance, and increased life satisfaction. Indeed, even seemingly trivial or wholly illusory choices have been shown to have powerful motivating consequences (e.g. Langer, 1975; Langer and Rodin, 1976; Dember et al., 1992).

More recently, however, a few researchers have demonstrated potential limitations to this assumption. Rather than presuming the benefits of choice to be ubiquitous, Iyengar and Lepper (2000) examined the consequences of offering choosers an extensive range of alternatives, in which the differences among options were relatively small. They hypothesized that choosers will be intrinsically motivated by the actual provision of extensive choices, because such contexts allow for maximal opportunity in the achievement of personal preference matching. Nonetheless, the very act of making a choice from an excessive number of options might result in "choice overload," in turn lessening both the motivation to choose and the subsequent motivation to commit to a choice.

Field and laboratory experiments were conducted in which the intrinsic motivations of participants encountering limited as opposed to extensive choices were compared (Iyengar and Lepper, 2000). In one compelling field demonstration, a tasting booth for exotic jams was arranged at Draeger's, a California gourmet grocery store. This grocery store is of particular interest because its salient distinguishing feature is the extraordinary selection it offers, especially when compared with large grocery chains. For instance, Draeger's offers roughly 250 different varieties of mustard, 75 different varieties of olive oil, and over 300 varieties of jam. Shoppers are frequently offered sample tastes of this enormous array of available products; consequently, Draeger's provided a particularly conducive environment for a naturalistic experiment, using tasting booths.

As customers passed the tasting booth, they encountered a display with either 6 or 24 different flavored jams. The number of passers-by who approached the tasting booth and the number of purchases made in these



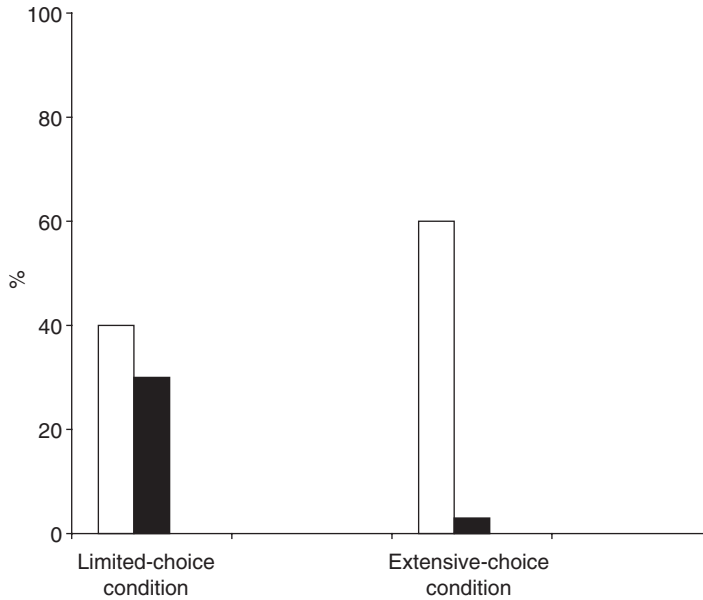
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Figure 5-1. Comparison of jam sampling versus purchasing in limited and extensive-choice conditions.

*Note:* White bars: Percentage of passers-by who approached the tasting booth; Solid bars: Percentage of "approachers" who subsequently purchased jam.

*Source:* Iyengar and Lepper (2000).

two conditions served as dependent variables. The results indicated that although extensive choice proved initially more enticing than limited choice, limited choice was ultimately more motivating. Thus, 60 percent of the passers-by approached the table in the extensive-choice condition as compared to only 40 percent in the limited-choice condition. However, as depicted in Figure 5-1, 30 percent of the customers who encountered the limited selection actually purchased a jam, while only 3 percent of those offered the extensive selection made a purchase.

This study's results challenge a fundamental assumption underlying classic psychological theories of human motivation and economic theories of rational choice; that is, that having more choice is necessarily more desirable and intrinsically motivating. These findings from this study show that an extensive array of options can at first seem highly appealing to consumers, yet it also can reduce subsequent motivation to purchase the product. Even though consumers presumably shop at this particular store in part because of the large number of selections available, having "too much" choice seems, nonetheless, to have hampered their later motivation to buy.

Subsequent laboratory experiments not only support the "choice overload" hypothesis, but they also provide insight into the potential mediators

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of this hypothesis (Iyengar and Lepper, 2000). In one experiment, this time involving displays of Godiva chocolate, participants once again encountered either a limited or an extensive array of option, and were asked to make a choice. Unlike the jam study, however, before being given the opportunity to sample the selection they had made, choosers' expectations about their choices were assessed. Participants provided predictions about how satisfied they would be with their stated preference—whether they expected the choice they made to be merely “satisfactory,” or “among the best.” After making their choices, participants were asked to provide ratings of their enjoyment, difficulty, and frustration during the choice-making process. Later, after sampling their choices, they again provided ratings of satisfaction and regret.

Study participants either sampled a chosen Godiva chocolate from a limited selection of six, or an extensive selection of 30. At the time they made their choices, participants reported enjoying the process more when choosing from the display of 30 chocolates as opposed to the display of six. Subsequently, however, participants choosing from the selection of six proved more satisfied and more likely to purchase chocolates again, as compared to participants choosing from a selection of 30. Collectively, these results suggest that choosers may experience frustration with complex choice-making processes, and that dissatisfaction with their choices—stemming from greater feelings of responsibility for the choices they make—may lead to a lower willingness to commit to one choice.

It is not that people are saddened by the decisions they make in the face of abundant options, but rather that they are rendered unsure, burdened by the responsibility of choosing optimally. In theory, the burden of choosing experienced by choosers in these studies should have been insignificant, since the task of choosing among chocolates or jams is less about distinguishing between “right” and “wrong” choices and more about the identification of personal preferences. Nevertheless, the findings demonstrate that the offer of overly extensive choices in relatively less consequential choice-making contexts can have significant demotivating effects. Participants in both the jam and chocolates studies proved less likely to buy these products when confronted with an overwhelming array of choices.

Perhaps the phenomenon of *choice overload* may be further exacerbated by contexts in which (i) the costs associated with making the “wrong” choice, or even beliefs that there are truly “wrong” choices, are much more prominent; and/or (ii) substantial time and effort would be required for choosers to make truly informed comparisons among alternatives. The more choosers perceive their choice-making task to necessitate expert information, the more they may be inclined not to choose. In such cases, in fact, they may even surrender the choice to someone else—whom they presumably see as more expert (de Charms, 1968; Langer and Rodin, 1976; Schulz, 1976; Zuckerman et al., 1978; Lepper, 1983; Deci and Ryan, 1985; Malone and Lepper, 1987; Taylor, 1989). In Schwartz's (1994) terms, one

important paradox confronting the modern world is that as the freedom of individuals expands, so too does people's dependence on institutions and on other people.

### **The Effect of Choice Overload on 401(k) Plan Contributions**

Given that the choice overload phenomenon was observed in less consequential choice-making contexts (i.e. when choosing jams and chocolates), to what extent might it also hold for major life decisionmaking situations? To test its presence in more consequential decisionmaking, we examined employees' decisions about whether—and how much—to participate in the 401(k) retirement benefit plan offered to them by their employers. The ramifications of employee investment decisions are potentially life-changing. Contributions to the 401(k) protect employees' income from being taxed, thus allowing employees to save more for their retirement. Moreover, employers often match employee contributions to the 401(k). One might have predicted participation rates to be at an all-time high, given the plethora of options available to employees and the ease with which many employees can transfer funds using the Internet. In fact, from 1998 to 2001, the average 401(k) plan has boosted its available investment options by 21 percent (Mottola and Utkus, 2003).

A Hewitt Associates survey as cited in *The Washington Post* shows that participation in 401(k) plans dropped to 68.2 percent of workers at the end of 2002, from 71 percent a year earlier (*Washington Post*, 2003). Additionally, the average 401(k) participant contributes less than 7 percent of pre-tax salary, even though financial advisors encourage a contribution of 10 percent or more of pre-tax salary (Financial Planning Association, 2002). Why are participation rates so low, despite an ever-increasing array of plan offerings? Could it be that the provision of more 401(k) plan options does *not* have a positive effect on employee willingness to participate in a plan? Instead, does the consequentiality of the investment decision, combined with employee intimidation by the complex details of the various plan offerings, contribute to a pronounced choice overload effect, resulting in a greater likelihood of investors choosing not to choose?

We test this hypothesis by examining 401(k) participation rates among clients of the Vanguard Group, an investment management company. The firm provided records of contributions to 401(k) plans at both the plan and individual levels for the year 2001. We identified employees as participants in the 401(k) plans if they contributed any part of their salary to the plan. We made no distinctions among participants based on the amount they contributed as long as it was above \$0. Those employees who chose not to contribute any part of their salary to a 401(k) were designated non-participants. The sample included 926,104 records for 899,631 employees of 647 plans in 69 industries. We excluded any employee hired after January 1,

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2001 (10 percent), who was less than 18 years old (0.02 percent), or whose annual salary was less than \$10,000 or above \$1,000,000 (7.51 percent), leaving an analysis group of 793,794 people. The records identified 442,544 of these people as male and 264,471 as female, and the mean age was 43. The mean and median salaries were \$61,150 and \$47,430, respectively. Over 71 percent of the employees contributed positive amounts to tax-deferred accounts in 2001, and 75 percent of the accounts had positive balances in tax-deferred accounts. The savings rate was 5.2 percent, and 12.2 percent of 401(k) participants contributed the maximum amount in 2001 (which was an annual limit of \$10,500).

We analyzed how individual and plan characteristics affect individual participation, and in particular, whether more funds offered correlated negatively with participation rates. The empirical regression examined the effect of the number of offered funds (which ranged from 2 to 59) on the employee likelihood of participating in the 401(k) plan.<sup>1</sup> Our regressions controlled for both employee and plan-level characteristics.<sup>2</sup> Employee-level data is particularly important because it is generally inappropriate to estimate a relation on an aggregate level and then infer that an analogous relation holds at the individual level. For example, our data shows that at plan level, a \$10,000 increase in average compensation, everything else equal, would increase average contribution by \$480, while at the individual level, the same coefficient is \$907. In some cases, even the sign of certain factors could be reversed (C.F., 2001).

The regressions, controlled for several employee attributes: Annual compensation in \$10,000 (COMP); gender (FEMALE); age in years (AGE); the wealth rank (1–24) of the nine-digit zip code neighborhood where the individual lives, WEALTH);<sup>3</sup> and the length (in years) of the individual's tenure with the current employer. Plan-level attributes for which we controlled were average compensation in \$10,000 (COMP\_MEAN), average age (AGE\_MEAN), average tenure (TENURE\_MEAN), average wealth rank (WEALTH\_MEAN), number of employees in natural logo (NEMPLOY), the rate of web registration among participants in the plan in percentage points (WEB), a variable indicating whether the plan allowed individuals to take loans out of their tax-deferred savings. Some 541 plans covering 88 percent of the employees offered loans, and about 17 percent of those employees had a positive loan balance at the end of 2001, with a median loan balance of \$4,373. Also controlled was the rate (in percentage points) at which employers matched employee contributions (MATCH); and a variable indicating whether the company's own stock was offered. There were 125 plans covering 59 percent of the employees in this population who were offered company-owned stock (COMPSTK). Most importantly, the number of funds offered (NFUNDS) was a key regressor.

As shown in Table 5-1, if a plan offered more funds, this depressed probability of employee 401(k) participation. Other things equal, every ten funds

TABLE 5-1 Determinants of Individual Participation in DC Plans (2001) (DepVar: Plan Participation rate, %)

	<i>Linear Probability</i>								<i>Probit</i>					
	<i>Pooled Regressions</i>				<i>Within-Between</i>				<i>Log-Linear</i>			<i>Linear</i>		
	<i>(1)</i>		<i>(2)</i>		<i>(3)</i>		<i>(4)</i>		<i>(5)</i>		<i>(6)</i>			
	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>Marginal Pr</i>	<i>COEF</i>	<i>t</i>	<i>Marginal Pr</i>
CNST	197.44	6.13	216.88	6.26	206.39	5.73	278.13	6.22	845.14	114.88	—	172.37	41.23	—
<i>I. Individual characteristics</i>														
COMP	15.12	0.162	22.19	0.190	15.00	0.175	15.19	0.101	57.00	0.406	15.31	7.84	0.068	2.54
FEMALE	5.73	0.406	7.74	0.809	4.35	0.879	6.12	0.108	19.57	0.401	5.26	17.60	0.375	5.71
AGE	0.47	0.078	0.38	0.091	0.39	0.123	0.47	0.048	1.10	0.132	0.29	2.09	0.124	0.68
AGE <sup>2</sup>	-0.01	0.002	0.00	0.000	0.00	0.000	-0.01	0.001	-0.01	0.001	0.00	-0.02	0.001	-0.01
WEALTH	5.96	0.049	—	—	5.91	0.064	5.91	0.034	23.29	0.142	6.25	2.9	0.056	0.94
TENURE	1.28	0.080	1.32	0.101	1.17	0.132	1.22	0.045	4.63	0.067	1.24	5.10	0.063	1.65
TENURE <sup>2</sup>	-0.03	0.002	-0.03	0.003	-0.03	0.005	-0.03	0.001	-0.11	0.002	-0.03	-0.12	0.002	-0.04
<i>II. Plan policy variables</i>														
LOANS	-3.69	3.765	-2.67	44.500	—	—	-1.02	3.778	-12.9	0.639	-3.46	-4.58	0.607	-1.49
MATCH	0.18	0.015	0.18	0.015	—	—	0.18	0.017	0.68	0.007	0.18	0.59	0.006	0.19
COMPSTK	2.89	1.338	2.94	1.598	—	—	3.11	1.139	6.46	0.423	1.74	7.45	0.406	2.42
NFUNDS	-0.2	0.083	-0.17	0.058	—	—	-0.21	0.077	-0.61	0.037	-0.16	-0.57	0.034	-0.19

TABLE 5.1 *Continued.*

	<i>Linear Probability</i>								<i>Probit</i>					
	<i>Pooled Regressions</i>				<i>Within-Between</i>				<i>Log-Linear</i>			<i>Linear</i>		
	<i>(1)</i>		<i>(2)</i>		<i>(3)</i>		<i>(4)</i>		<i>(5)</i>			<i>(6)</i>		
	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>COEF</i>	<i>t</i>	<i>Marginal Pr</i>	<i>COEF</i>	<i>t</i>	<i>Marginal Pr</i>
<i>III. Plan-level controls</i>														
COMP_MEAN	-1.09	3.759	-0.72	1.014	3.75	4.808	3.20	5.000	-10.63	0.756	-2.86	2.35	0.123	0.76
WEALTH_MEAN	0.69	2.300	—	—	-0.90	2.903	-0.69	2.654	4.88	0.424	1.31	-3.98	0.219	-1.29
AGE_MEAN	1.47	0.274	1.55	0.463	1.04	0.486	1.31	0.376	4.41	0.096	1.18	4.36	0.088	1.41
TENURE_MEAN	-1.06	0.275	-1.20	0.423	-0.82	0.371	-1.08	0.282	-3.52	0.074	-0.95	-3.64	0.069	-1.18
WEB	0.07	0.063	0.14	0.059	0.17	0.063	0.14	0.059	0.29	0.022	0.08	0.71	0.019	0.23
NEMPLOYEES	-2.88	0.331	-3.29	0.593	-3.37	0.832	-3.73	0.789	-9.23	0.119	-2.48	-10.82	0.110	-3.51
R <sup>2</sup>	0.19		0.16		0.18		0.16		0.18	0.33		0.12	0.23	

*Note:* The all-sample participation rate is 70.8%. All coefficients are multiplied by 100. Columns (1)–(4) are results from a linear probability model. COMP and WEALTH are expressed in dollars. The standard errors are obtained by bootstraps (50 replications) that adjust for both heteroskedasticity (both within and across groups, and group-specific disturbances) and within group correlation (due to the group-specific disturbance). Columns (5) and (6) report results from probit estimation. Pseudo R<sup>2</sup> and incremental probability of correct prediction are reported for goodness-of-fit. Marginal probabilities are calculated by setting all non-dummy variables at their mean values, and all dummy variables at zero. In column (6), COMP is expressed in \$10,000, and WEALTH is expressed in IXI ranks from 1 to 24. The number of observations is 793,794.

*Source:* Authors' computations.

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added was associated with 1.5 percent to 2 percent drop in participation rate. Figure 5-2 illustrates the decline of participation rates as a function of number of funds offered, controlling for all other variables listed in Table 5-1 (by setting them at their mean values). If there were only two funds offered, participation rates peaked at 75 percent, but when there were 59 funds offered, participation rates dipped to a low of approximately 60 percent. The majority of the plans included in this data set offered between 10 and 30 options, yet Figure 5-2 shows that plans offering (fewer than 10 plans) had significantly higher employee participation rates. Although the number of plans that offered between 30 and 60 options was few, there is a distinctive trend, which suggests that the decline in participation rates is exacerbated as offerings increased further.

While other researchers have considered some of the issues covered here, our results are particularly compelling because of the size and nature of the data used, namely actual employee records (including non-participants' records) from hundreds of 401(k) plans. Our findings have important implications for sponsors designing investment menus for 401(k) plans, as well as for policymakers considering private accounts within Social Security.

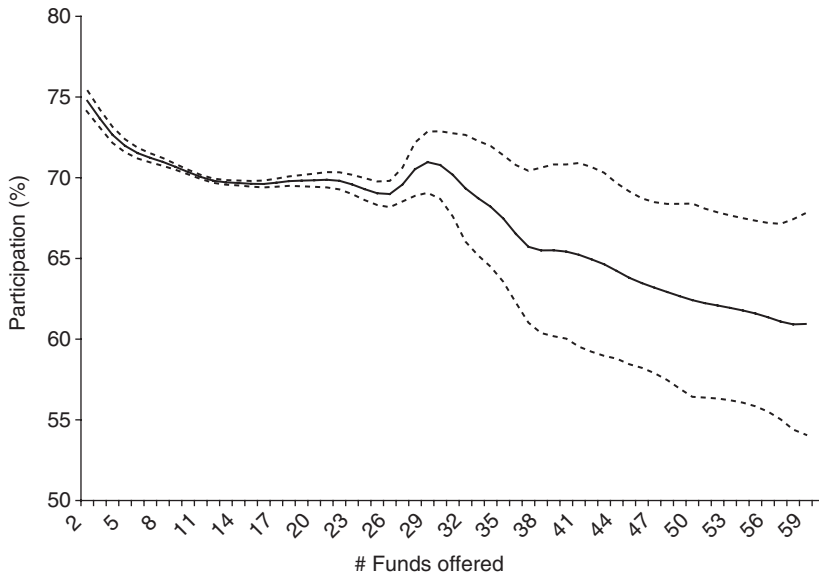


Figure 5-2. The relation between participation and number of funds offered.

*Notes:* The graph plots the relation between the plan participation rate. Explanatory variables except the number of funds offered are set at their respective mean values and the number of funds offered using a two-stage parametric estimation method. The dotted lines represent the 95% confidence intervals.

*Source:* Authors' analyses.

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Both sponsors and policymakers may intuitively feel that limiting the number of options to a manageable few is desirable based on considerations such as the demographics of participants/employees, their investment knowledge or experience, and the complexity of investment decisionmaking generally or from the options themselves. Our research provides a quantitative basis for this intuition.

Recently, there has also been a trend to offer “fund windows” or “brokerage accounts,” in which employees are offered hundreds or thousands of securities. A fund window is an investment structure that significantly expands 401(k) plan investment choices by allowing participants to choose from funds beyond their main investment options. Although record-keeping for assets in the fund window is usually performed on the same system as the main 401(k) investments, the funds in the window are considered distinct from the main options (Hewitt Associates, 2001). With brokerage accounts, employees are permitted to trade virtually any US stock, bond, or mutual fund; the problem, of course, is if they are not informed, they run the risk of investing rashly.

Plan providers who continue to present participants with a plethora of options including brokerage accounts and fund windows might perhaps consider “tiering” the options. This could include focusing communication activities on a core set of investment options, with more limited information about the larger number of choices (or perhaps just a reference to where the information can be found—for example, a website). As an example, a plan could offer two tiers of investments including ten main funds in Tier I, and 60 in the fund window in Tier II. Another possibility, rather than offering a menu of 100 or 1,000 options, is to present participants with a menu of 10 options plus one—with the last being “many more choices.”

Pension fiduciary law requires the plan sponsor to investigate fund options, provide manageable choices to employees, and offer educational programs through which employees can verse themselves in their options. Yet, often employees fail to avail themselves of the necessary information. Industry evidence indicates that half of all these participants never contact their money managers in any given year, and those who do tend to be affluent, higher-balance participants. Perhaps in attempting to provide employees with a generous number of 401(k) options, employers may actually intimidate rather than induce employees to invest in personal retirement plans. One way to combat the dangers of choice overload in which employees “choose not to choose,” is to implement for “libertarian paternalism,” a phrase recently coined to describe institutional efforts to affect individuals’ behavior while respecting their freedom of choice. Sunstein and Thaler (2003) who develop this notion, propose that people’s preferences often are ill-informed, which leads to decisions, that are unduly influenced by default rules, framing effects, and starting points (Sunstein and Thaler, 2003). An employer aware of such issues could react by steering employee



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choices in a welfare-promoting direction, yet without eliminating their freedom of choice. In the present case, the libertarian paternalist employer would design the plan carefully so as not to offer too much choice to employees. In order to ensure that employees engage in some form of retirement savings, the employer might declare a “standard” or default 401(k) plan into which workers are automatically enrolled, if they do not elect to opt out. While this is currently permitted by US pension regulation, but it may actually be dictated by the tenets of libertarian paternalism.

### Notes

<sup>1</sup> Strictly speaking, we lack data on the total number of funds offered by each plan, so we approximate it by counting the number of funds used by at least one participant in each plan. As a result, the number of funds offered could be under estimated for plans with few employees and/or with low participation ratios. Given that the average plan in our sample had 1,486 employees, the measurement error should be minimal. If a bias arises from this approximation, it will bias against finding a demotivating effect of more choices.

<sup>2</sup> Specifically the following empirical equation was estimated:

$$y_{ij}^* = \beta_0 + \bar{\beta}_1 X_{ij} + \bar{\beta}_2 \bar{X}_j + \bar{\beta}_3 Z_j + \delta_j + \epsilon_{ij}$$

$$y_{ij} = \begin{cases} \underline{v}, & \text{if } y_{ij}^* < \underline{v} \\ \bar{v}, & \text{if } y_{ij}^* > \bar{v} \\ y_{ij}^*, & \text{otherwise} \end{cases}$$

Here,  $y_{ij}^*$  is the *desired* contribution made by individual  $i$  in plan  $j$ .  $y_{ij}$  is the *observed* contribution which is doubly censored at  $\underline{v} = 0$  and  $\bar{v} = 10,500$ . There are three sets of regressors.  $X_{ij}$  is a set of individual characteristics variables;  $\bar{X}_j$  represents the plan-level averages of individual characteristics; and  $Z_j$  is a set of plan policy variables. The disturbance can be decomposed into a plan-specific error,  $\delta_j$ , assumed uncorrelated across difference plans, and an individual disturbance,  $\epsilon_{ij}$ , which is independently distributed across individuals. Both  $\delta_j$  and  $\epsilon_{ij}$  could be heteroskedastic across different plans and/or individuals, but are assumed to be independent of the regressors. From an economic analysis perspective, the meaningful contribution is the “desired contribution,” and not necessarily the observed one. For example, if next year the 401(k) contribution cap is raised from \$12,000 to \$15,000, those who are currently contributing \$12,000 would likely contribute more because their desired contribution is greater than the observed level. Personal and plan attributes both determine desired contribution, but the latter is only partially observed.

<sup>3</sup> A company called IXI collects retail and IRA asset data from most of the large financial services companies, Vanguard being one of them. IXI then aggregates the data from all the companies at the Zip+4 level. IXI divides the total of retail and IRA assets in each Zip+4 by the number of households (based on US Census data) to determine the average assets for each Zip+4. This enables IXI to assign a code (from 1 to 24) at the Zip+4 level which indicates about how much money in investable assets people living in each particular Zip+4 have. A Zip+4 has, on

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average, about 10–12 houses in it. So, the IXI system works under the premise that peoples' financial situation is similar to that of their immediate neighbors, which is a reasonable premise. Further, using the wealth level of the neighborhood, instead using that of the individual under consideration, eliminates spurious correlation between current contribution and accumulated wealth. The term "wealth" used here includes bank, brokerage, and mutual fund investment assets.

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