Individual financial decisions in retirement saving plans: the role of participant-direction

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Abstract

Workers with individual retirement saving accounts often make decisions about contribution rates and asset allocation that affect ultimate retirement income. This paper presents econometric evidence from two data sets on the role that participant investment choice plays in asset allocation, contributions, and account balances. My preferred estimates indicate that participants with investment choice are 36 percent more likely to make an annual contribution. These participants are estimated to invest 13 percentage points more in stocks, contribute between one and three percentage points more of salary, and have at least $9000 more in their account than comparable participants without investment choice.
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1. Introduction

The trend toward defined contribution (DC) pension plans, and the striking growth of 401(k) plans in particular, has vastly expanded the number of individuals with some discretion regarding their retirement assets. In 1997, the most recent year for which the U.S. Department of Labor, Pension and Welfare Benefits Administration (2001) has released detailed information from Internal Revenue Service (IRS) Form 5500 filings, about 82 percent (28.2 million) of the 34 million participants in 401(k) plans had some control over their investments. These participants owned over $1.04 trillion in assets,

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accounting for 83 percent of 401(k) assets. Self-direction of retirement saving accounts will become increasingly common as traditional defined benefit plans are supplemented with or replaced by defined contribution plans. Many state and local governments, traditional defined benefit providers, are considering adoption of 401(k)-type plans. In 1998, for example, the state of Michigan switched from a traditional defined benefit plan for new state government employees to a DC plan.

In the traditional defined benefit (DB) plan, participants are automatically included after meeting a participation standard, and they typically do not make participation, contribution, or investment decisions. Their pension benefit is based on earnings history and years of service. In contrast, participation in a defined contribution plan often requires active involvement by the individual participant. DC plans are individual accounts that may only be created once the employee makes a (usually pre-tax) contribution. Participants decide how much to contribute subject to plan and IRS limits. Often the employer will match the contribution up to a pre-determined limit, or the employer's contribution may vary annually with profits. Participants usually direct the investment of their own contribution, and often that of their employer. This is typically the case for a 401(k) plan.[1]

Asset allocation choices that participants make, or that their employers make for them, can determine in part the rate of return on retirement assets, and therefore the adequacy of retirement income. Unfortunately, there is limited evidence concerning the effect of participant investment choice on financial decisions in saving plans. Several recent papers relate demographic characteristics to investments in stocks or bonds, but only for populations that uniformly control their investments. This paper uses participant-level data from the 1992 National Longitudinal Survey of Mature Women (NLS-MW) and the 1992 Health and Retirement Study (HRS) to estimate the effect of pension asset self-direction on investment choices. I use the NLS-MW to examine determinants of asset allocation. I use both the NLS-MW and HRS to examine the effect of choice on participation, the size of contributions to the pension plan, and ultimate account balances.

Understanding the role that plan characteristics play in individual account retirement plans is critical as more workers rely on this type of retirement plan. For example, in many 401(k) plans the employer contribution is made in company stock. This structure may encourage employees to hold extremely risky portfolios—their pension assets as well as their human capital in one company. Further, the behavior of participants in self-directed individual retirement accounts can inform the questions concerning the degree of individual autonomy that should be allowed in the proposals to privatize all or part of Social Security.

The next section presents some survey evidence on the prevalence of participant direction and the choices presented to plan participants. Section 3 briefly summarizes research findings to date on investment patterns at the participant level. Section 4 provides econometric evidence on the effect of choice on investment patterns, employee contribution rates, and defined contribution plan balances. I discuss the possible endogeneity of the choice variable in the regression models. I rely on the proxy variable approach to this

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[1] There are other types of savings and thrift plans, beside the 401(k) form, that have participant direction. See Wiatrowski (2000) for a detailed comparison.

problem (including individual and firm characteristics), but this may not be a completely satisfactory solution. Section 5 briefly concludes with implications of the findings for pension policy and for individual accounts proposed for Social Security.

2. Plan assets: is there choice? If so, how much?

Before there were 401(k) plans, supplemental DC plans were organized as saving and thrift plans where employees made contributions out of after-tax dollars. Employees were generally allowed to direct their contribution, but only about half of these plans allowed the participant to direct any employer contribution (Wiatrowski, 2000). It was common for the employer's contribution to be constrained—often to company stock. Many of these saving and thrift plans were converted when 401(k) plans became available (generally, 1981) to allow employee pre-tax contributions (Papke, 1999) and these characteristics continued. The organizational form of the 401(k) plan also affects the extent of participant control. If the plan is organized as a profit-sharing plan, as many 401(k) plans are, initial investment in company stock is common; it is required for those organized as Employee Stock Option Plans.[2]

The U.S. Government Accounting Office (GAO, 1997) examined summary plan descriptions—documents describing plans features that employers file with the Department of Labor—for a sample of private employers that sponsored only single-employer DC plans. The GAO reports that participants were more frequently allowed to direct the investments of all but the nonmatching (employer) contributions to their accounts. The largest employers (over 10,000 employees) were more likely to allow participants to direct investments of all types of contributions.[3]

Section 404(c) of the federal regulations pertaining to fiduciary responsibility encourages companies to provide a sufficiently diverse offering of assets. Section 404(c) of ERISA, finalized in 1992, provides conditions under which the sponsor is not liable for loss or breach of fiduciary responsibility that may result from the participant's exercise of control over assets. Broadly, the participant must be able to 'exercise independent control' over assets in the account. The sponsor must (1) provide sufficiently varied investment alternatives to allow the participant an opportunity to materially affect the potential returns on assets and account risk; (2) allow the participant to choose from at least three alternative investments, each of which must be diversified and each with different risk/return characteristics (employer's securities may not be one of the three); (3) provide sufficient

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[2] ESOPs must invest primarily in qualified securities of the employer (debt instruments are not included). Plan administrators must allow participants nearing retirement to diversify at least 25 percent of the account (see Employee Benefit Research Institute, 1997). Stock-option plans and stock purchase plans (the latter provides employees the opportunity to purchase company stock at a discount) are not tax-qualified defined contribution plans.

[3] For the sample of sponsors with 100 or more employees, the GAO reported no employee choice over investments for pretax contributions in 15 percent of plans, no choice for after-tax contributions in 23 percent of plans, no choice for matching contributions in 16 percent of plans, and no choice for nonmatching contributions in 45 percent of plans.

information for the participant to make investment decisions; (4) allow the participant to change investments with a frequency that is appropriate for the expected market volatility of the investment.[4]

Perhaps due in part to this regulation, participant direction has grown over the decade of the 1990s. The IRS Form 5500 is one source of information on the extent of participant direction. The form asks if the plan has a participant direction feature, but does not indicate whether the participants direct the investment of employee contributions, employer contributions or both. Tabulations of the 1997 Form 5500 indicate that of the 265,251 401(k) plans, 78 percent allow some participant direction. These plans include 83 percent of active participants in 401(k) plans and 83 percent of 401(k) assets (U.S. Department of Labor, Pension and Welfare Benefits Administration, 2001).

Wiatrowski (2000) summarizes the trends in investment choice for full-time employees using several years of the Bureau of Labor Statistics National Compensation Survey. He reports that, in 1985, 90 percent of full-time employees had investment choice over their own contribution, and 48 percent had control over their employer's contribution. By 1997, there was a slight drop in the percentage who could control their own contributions (87 percent), but over 65 percent had choice over their employer's contribution. Possibly as a result of Section 404(c) regulations, a smaller percentage of participants may choose company stock as an investment option. In 1985, for example, 70 percent of employees could choose employer stock for their contribution, and 61 percent could choose employer stock for their employer's contribution. In 1997, 42 percent could choose it for their contribution, and 25 percent could choose it for their employer's contribution.

3. Existing evidence on demographics and asset allocation

Several recent studies have examined the effect of age, income, and other demographics on pension investment choices on samples of participants with choice. In addition, investment companies publish tabulations of the funds they manage. Generally, the tabulations are informative because they have finer asset categories than are available in publicly available data sets (but they have few participant characteristics). Holden and VanDerhei (2001) report asset allocations for a large 401(k) database that accounts for 11 percent of all 401(k) plans, 26 percent of 401(k) participants and about 35 percent of 401(k) assets. They find that three-quarters of these plan balances are invested directly or indirectly in equity securities in 1999, including 19 percent in company stock. The remaining non-equity allocation includes 10 percent in guaranteed investment contracts (GICs), seven percent in balanced funds, five percent in bond funds, and four percent in money funds. However, the average figures conceal substantial variation. About 30 percent of participants hold more than 80 percent in equities, while 27 percent do not hold any equities.

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[4] See Section Number 2550.404c-1, Rules and Regulations for Fiduciary Responsibility, ERISA section 404(c) plans of the Code of Federal Regulations Pertaining to PWBA at http://www.dol.gov/dol/allcfr/pwba.

Several econometric studies relate asset choice in pensions to demographic characteristics. These studies generally find that pension assets reflect the standard investment advice that portfolio equity share should fall with age (specifically, it is recommended that the equity percent equal 100 minus one's age) and rise with income (which indicates a greater ability to bear risk), although presumably participants optimize over all of their assets, of which retirement assets are a part.[5]

In these papers, a common finding is that women invest somewhat more conservatively than men, and equity investment rises with income and education. Hinz et al. (1997) use survey data of federal employees participating in the federal Thrift Saving Plan, Bajtelsmit and VanDerhei (1997) study the asset choice of 20,000 participants of a single large U.S. employer, and Poterba and Wise (1998) explore the asset choices of TIAA-CREF participants. Bodie and Crane (1997) also analyze TIAA-CREF participants and survey them for additional non-financial information. They add homeownership to the list of characteristics that appears to increase equity investment.

These papers draw interesting comparisons between characteristics of participants and investment patterns, but since all participants in these studies already have choice, they cannot directly address the issue: how does the ability to choose your investments distinguish your financial decisions from those who are restricted? This question is examined in the next section.

4. The effects of choice on individual financial decisions

This section presents evidence on the effect of choice on three aspects of pension decisions: asset allocation, contributions, and account balances. I use data on pension participants from two data sets that focus on pre-retirement age participants: the 1992 National Longitudinal Survey of Mature Women (NLS-MW) and Wave 1 (1992) of the Health and Retirement Study (HRS). The respondents in the two samples are of similar ages (in the HRS the respondents are 51–61 in 1992 and in the NLS-MW the respondents are 55–69 in 1992). While the sample sizes in the HRS are much larger and the survey includes more detailed pension questions, only the NLS-MW reports plan asset allocation for respondents both with and without choice. The next subsection describes the NLS-MW and presents econometric evidence of the effect of asset choice on plan asset allocation. In Sections 4.2 and 4.3, I use both the NLS-MW and the HRS to analyze the effect of choice on contributions and account balances.

4.1. The 1992 National Longitudinal Survey of Mature Women

The NLS-MW is an ongoing survey that began in 1967 with 5083 women aged 30–44 (3094 were included in the latest survey). The panel is available for 16 years between 1967 and 1992. In addition to detailed demographic data on the respondent and her household, supplementary questions on her and her spouse's pension eligibility and benefits from

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[5] See Bodie et al. (1992) and Samuelson (1989) for a treatment of age and equity holdings.

current/past employers or from other pension sources (e.g., personal plans) were included in the 1979, 1982, 1986, and 1989 questionnaires. The 1992 questionnaire expanded the set of pension questions collected to include multiple pension coverage from (1) future pensions from current employers; (2) current pensions from previous employers; and (3) future pensions from previous employers. These data are unique in that pension asset choices are recorded for participants both with and without choice.

Each series gathered details on participation in up to four defined benefit and/or four defined contribution pension plans offered by an employer. For those participating in defined contribution plans, information includes the type(s) of plan (e.g., thrift/savings, 401(k), profit sharing, stock purchase, or other), dollar amounts that both employer and respondent contributed and the employee's contribution percentage, account balance, and how the dollars were invested. Specifically, respondents were asked: Were you able to choose how the money in your account is invested? How is the money in this account invested? Is it mostly in stocks, mostly in interest-earning assets, is it split evenly between these, or what? The three responses are: mostly or all stocks; mostly or all interest-earning assets; split evenly between the two.

Note that the NLS-MW question does not distinguish employer from employee contributions explicitly, so it is possible that the employee would report having choice even if the employer directs the firm's contributions. If the employer contribution is made in company stock, while the participant reports choice over her/his investment, a larger fraction of the pension is reported to be in equities than the participant would choose completely unconstrained.

In the 1992 NLS, there are 947 women and 976 men who have at least one pension plan. The women in the sample range in age from 55 to 69 and over half are married. By construction, all men are married. There are 1554 households with access to at least one employer-provided pension plan, either DB or DC; there are 2237 pension participants in total. For my purposes, I restrict the sample to participants in DC plans, and further, to those who respond to the investment questions. This reduces the sample to 232 participants.

Because the survey is of mature women, the sample is not representative of the pension age population in the U.S. In particular, the sample is older, and excludes single men, so that analyzing these data may not tell us about asset choices of younger people. Still, this is an interesting group to look at since these people, nearing the end of their professional careers, are likely to have pensions and to consider retirement income seriously.[6]

Table 1 reports summary statistics for the sample of respondents reporting their DC asset allocation. There are 232 such plans for 204 families. That is, 28 of the plans are second plans for the family—either a second plan for the respondent, or two plans for the spouse, or one for each spouse. Women's plans comprise 59 percent of the sample and the

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[6] If we are concerned about estimating effects for the entire population with pensions, the selection of the sample based on demographics will not bias the effects of choice or other explanatory variables because I control for demographic characteristics. A female participant in this survey may have answered pension questions about her husband's plans without the presence of her spouse. At the time of the 1992 survey, the NLS did not record whether the spouse was actually at the interview, or whether the interviewer pursued the option to contact the husband directly. Nevertheless, there does not appear to be a great deal of difference in self-reported knowledge of the pension plans for women and men. Seventy-six percent of respondents know 'a lot' or 'some' about the plans with female participants, compared to 71 percent for plans with male participants.

Table 1
Summary statistics

	1992 NLS-Mature Women		1992 HRS	
	Mean (S.D.)	Obs.	Mean (S.D.)	Obs.
Choice of pension assets	0.62		0.59	
	(0.49)	226	(0.49)	1973
Percent stock	46.98			
	(39.64)	232		
Contribution percentage	4.68		5.05	
	(5.23)	228	(4.83)	1973
Account balance ($000)	27.83		40.60	
	(42.81)	251	(87.09)	1492
Single female	0.59		0.13	
	(0.49)	232	(0.33)	1981
Single male			0.07	
			(0.26)	1981
Married female	0.33		0.32	
	(0.47)	232	(0.47)	1969
Age	60.74		54.46	
	(4.31)	232	(4.85)	1981
Education	13.49		13.49	
	(2.56)	225	(2.54)	1981
Years in plan	11.16		8.93	
	(9.62)	216	(10.30)	1492
Profit-sharing plan?	0.21			
	(0.41)	208		
Income <25k	0.26			
	(0.44)	222		
Income 25–50k	0.43		0.30	
	(0.50)	222	(0.46)	1981
Income 50–100k	0.24		0.44	
	(0.43)	222	(0.50)	1981
Income >100k	0.063		0.17	
	(0.244)	232	(0.37)	1981
Net worth <50k	0.24			
	(0.43)	232		
Net worth 50–100k	0.19		0.19	
	(0.39)	232	(0.39)	1981
Net worth 100–250k	0.33		0.35	
	(0.47)	232	(0.48)	1981
Net worth 250–500k	0.15		0.18	
	(0.36)	232	(0.39)	1981
Net worth >500k	0.095		0.094	
	(0.294)	220	(0.292)	1981
Spouse holds equity in DC plan (%)	5.91			
	(19.38)	220		
Stocks in 1989 ($000)	7.66			
	(18.11)	232		
Has a DB plan	0.39		0.42	
	(0.49)	238	(0.49)	1981
Has an IRA	0.49		0.58	
	(0.50)	232	(0.49)	1981

plans of married women comprise 33 percent of the sample. Choice is available for 62 percent of the plans, and 21 percent of plans have a profit-sharing component, that is, the employers' contribution is determined in part by profits. The average account balance is $27,830 and the average employee contribution percentage is 4.68 percent of salary. The next subsection considers the asset allocation question.

4.2. Econometric results for pension asset allocation

This section presents econometric evidence on how choice, non-pension investments, and participant characteristics affect asset allocation in DC plans using data from the NLS-MW. In simple tabulations, 28 percent of participants respond that their account is invested mostly or entirely in stocks, 37 percent report a mixed account, and 34 percent report investing mostly or entirely in interest-bearing assets (hereafter, bonds for short). Even in this older sample, investment in stocks falls with age. For example, about 38 percent of participants under age 55 invest entirely in stocks, while in the over 55 age group, the percent falls to 23 percent.

Since the response categories are mostly stocks, mixed, and mostly bonds, this is a discrete ordered outcome and so ordered response methods—such as ordered logit and ordered probit—are appropriate. These methods have some shortcomings, however. Estimating an ordered response model allows us to estimate the effect of choice and other variables on the probability of each response, but not on the effect of the percentage invested in stock. The coefficients from ordered logit or probit give directions of effects but even these magnitudes are difficult to interpret. This can be overcome by calculating partial effects at various values of the explanatory variables, but the information is difficult to summarize.

Because linear models are easy to interpret and are likely to give good estimates of the average effects, I focus on linear regression. This requires defining a percentage invested in stocks variable. I code the response 'mostly stocks' as 100 percent in stocks, 'mixed' as 50 percent in stocks, and 'mostly bonds' as zero percent invested in stocks. Choosing the extreme values of zero and 100 likely overestimates the effect of any variable on the true percentage in stock.[7] But without knowing the distribution of the true percentage, we cannot know by how much except in the simplest cases.[8]

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[7] Ameriks et al. (1997) also provide some evidence in favor of extreme portfolios. Analyzing the asset allocation choices of TIAA-CREF participants from 1986 to 1996, they find that the percent of participants investing 100 percent in equities rises from 3.3 percent in 1986 to 22.2 percent in 1996. The percent of participants investing exclusively in fixed income securities rises from 1.5 in 1988 (when the option first became available) to 4.1 percent in 1996. The percent investing in a mix of 50 percent in equity and 50 percent in guaranteed annuity falls from 46.2 percent in 1986 to 20.9 percent in 1996. These 1996 figures are greater than the percent of participants invested mostly (defined to be between 50.1 and 75 percent) in equity (17.2 percent), mostly guaranteed (7.3 percent), and mostly fixed income (3.3 percent).

[8] In some simple cases, we can compute the bias. For example, suppose all people invest either 20 percent or 80 percent in stocks. For people with choice, 70 percent invest 80 percent in stocks. For people without choice, only 50 percent invest 80 percent in stocks. On average, people with choice invest 12 percentage points more in stocks. By using 100 and zero percent as the two outcomes, I would find on average a 20 percentage point difference due to choice.

While this results in a mismeasurement of the true percentage invested in stocks, it provides a useful base case since it is easy to obtain the estimates for a symmetric reassignment of the extreme values. For example, if we choose 25, 50, and 75 as the numeric responses, the slope coefficients (that is, all but the intercept) I report are divided by two—the *t*-statistics do not change.[9] Statistical significance does not hinge on the definition of percent in stock. To be sure that the conclusions are not influenced by using a linear model, I also estimate ordered logit models and compare the signs and significance of the coefficients.[10]

Table 2 presents OLS estimates of the percentage invested in stock. Because the dependent variable is discrete, I report heteroskedasticity-robust standard errors. In addition, about 14 percent of the identifiers have two observations. Therefore, the standard errors are corrected for within family (identifier) correlation.[11]

The basic regression (column one) includes demographic and an asset choice dummy, but no financial information. There is no evidence of a gender difference in stock investment between married men (the omitted category) and either single or married women (recall, all men in the sample are married). The effect of choice is large and statistically significant, indicating that people who are able to choose their investments put about 14 percentage points more in stock than people without choice (assuming the plan is not profit-sharing). This formulation assumes the effect of choice is the same for men and women. When I allow for gender differences, the effect of choice for men is 17.71 with a standard error of 9.21, and the effect for women is 12.58 with a standard error of 7.33. The difference, −5.13, is not statistically significant—its *t*-statistic is −0.45. Subsequent regressions assume the effect of choice is the same for men and women.

I find, as others have, some evidence that investment in stocks declines with age—the coefficient estimate indicates about a 1.6 percentage point drop in stock for each additional year of age. (This is remarkably close to the 'rule of thumb' among financial planners that the equity fraction should decline by one percentage point per year of age.) The *P*-value for this estimate is 0.03. An extra year of education has no statistically significant effect on investment patterns, although the coefficient is positive.[12]

DC plans are not a homogenous group. Of particular relevance for a regression of investment in stocks, profit-sharing plans often distribute the employer's contribution in shares of stock. I include a profit-sharing dummy as well as one interacted with choice. As

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[9] The general formula for rescaling the reported slope coefficient for a symmetric reassignment *c*, 50, 100 − *c* for *c* between zero and 50 is $1 - (c/50)$.

[10] Ordered logit estimates are available from the author. They are consistent with the linear regression results. The statistically significant OLS coefficients have the same sign and are still statistically significant in the logit regressions.

[11] An alternative is to use random effects estimation. These produce very similar results to OLS. Because of the small number of duplicate observations and the lack of variation across family in the explanatory variables, fixed effects estimation is not informative.

[12] Using the most complete model (column three) in regressions not reported here, when I replace the years of education variable with dummy variables for certain educational milestones I find that receiving a high school diploma leads to substantially larger stock investments (the estimate is 13.62 percentage points more in stock with a *P*-value of 0.16). Additional schooling does not increase that percentage.

Table 2
Linear models of percentage of defined contribution assets in equities: NLS-MW

	(1)	(2)	(3)
Choice	14.34	14.77	13.26
	(6.00)	(6.46)	(7.29)
Single female	0.39	0.34	3.00
	(7.88)	(8.80)	(9.34)
Married female	0.13	2.09	2.38
	(7.41)	(8.33)	(9.02)
Age	−1.57	−1.55	−0.88
	(0.72)	(0.79)	(0.84)
Education	0.67	0.73	−0.018
	(1.01)	(1.11)	(1.23)
Profit sharing	25.92	23.38	33.09
	(11.12)	(11.27)	(12.40)
Profit sharing*	−19.75	−15.71	−28.53
Choice	(14.81)	(15.15)	(16.24)
Income 25–50k		8.87	16.90
		(8.25)	(8.46)
Income 50–100k		2.20	14.83
		(10.86)	(11.20)
Income >100k		−14.14	−5.58
		(11.03)	(12.27)
Net worth 50–100k		−7.45	−14.72
		(9.49)	(10.18)
Net worth 100–250k		3.10	−5.22
		(8.27)	(8.80)
Net worth 250–500k		3.21	−8.52
		(10.52)	(11.33)
Net worth >500k		−4.30	−9.72
		(12.21)	(14.66)
Spouse holds equities			0.16
in DC plan (%)			(0.16)
Stocks in 1989			0.30
($000)			(0.16)
Has DB			−3.36
			(6.23)
Constant	121.11	115.66	83.32
	(49.47)	(53.91)	(57.48)
Observations	201	194	174
Adjusted R^2	0.042	0.031	0.059

Notes: The OLS regressions are estimated using the 1992 National Longitudinal Survey of Mature Women. The dependent variable is coded 100, 50, or 0 for responses 'mostly stocks,' 'mixed,' and 'mostly bonds.' Standard errors that are robust to heteroskedasticity and to correlation within family are in parentheses.

expected, profit-sharing plans are predicted to allocate almost 26 percentage points more in stock if the participants have no choice. The negative coefficient on choice for profit-sharing plans suggests an effort to reduce stock holdings, but the difference (5.41 percentage points) is not statistically significant.

The second specification in Table 2 adds categorical variables for family income and net worth. No consistent pattern emerges, and no financial coefficient is statistically

significant on its own (an *F*-test of all seven variables has a *P*-value of 0.16). The effect of choice is unchanged. The final column of Table 2 adds three variables designed to account for portfolio integration across family pension and non-pension assets. The first two measure equity holdings by the spouse in his/her pension, and by the family. Both estimates suggest the presence of a family taste for stock, rather than diversification. The coefficient on the percent of stock that one's spouse holds in his/her DC plan is 0.16 but is not statistically significant at conventional levels (*P*-value of 0.33).[13] The coefficient on the amount of stock the family held outside of pension plans in 1989 (the year the NLS-MW survey included detailed financial questions) of 0.30 also suggests a family taste for stocks: for every $1000 of stock held in 1989, the participant holds almost one-third of a percentage point more in stock in his/her DC plan. This estimate has a *P*-value of 0.068.

This finding—that participants are more likely to hold stock in their pension plans if they hold stock outside the pension—is consistent with other research. Bodie and Crane (1997) report a positive relationship between the share of equity in retirement accounts and the share in non-retirement assets in their sample of TIAA-CREF participants (they do not report the coefficient estimate). Poterba (2001), in summarizing empirical evidence on asset location decisions by U.S. investors, concludes that relatively few investors are choosing markedly different asset allocation patterns in their taxable and tax-deferred accounts.

Finally, I include a dummy variable indicating whether the participant also has a defined benefit (DB) plan. DB plans have little market risk so participants in both types of plans might be expected to hold more equities in their DC plan. The negative and statistically insignificant coefficient (a *P*-value of 0.591) provides no conclusive evidence on this matter.

4.3. Econometric results for employee contribution percentage

Choice may also affect the level of participation in a pension plan. This section presents models explaining the employee's contribution percentage to the DC plan with both the NLS-MW and HRS samples. The 1992 HRS is a much larger sample and includes the same asset choice question as the NLS-MW, as well as additional pension questions for up to three DB and three DC plans. In the typical regression, there are 1690 individual DC plan participants, with 180 multiple plans for a total of 1870 observations. Summary statistics for the HRS sample are presented in Table 1.

In the NLS-MW, 62 percent of DC participants report having asset choice, while the figure is 59 percent in the HRS. In the NLS-MW, the average percentage contribution is 4.68 percent of salary with a standard deviation of 5.23. The median contribution is 3.5 percent of salary. The mean of those who contribute is 8.26 percent with a standard deviation of 4.31, while 43 percent report a zero contribution. In the HRS, the average contribution percent is 5.05 percent of salary with a standard

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[13] Apparent independence of spouses' retirement or investment decisions has been found elsewhere. Using household survey data, Bernheim and Garrett (1996) find that spouse's eligibility does not affect participation in a 401(k) plan.

deviation of 4.81. The median is 5.00 percent, and the mean of those who contribute is 7.10 percent, with a standard deviation of 4.27. About 29 percent (573) report a zero contribution.

Tables 3 and 4 present OLS regressions of the percent of salary the participant contributes to the plan estimated with the NLS-MW and HRS, respectively. As before, the standard errors are corrected for heteroskedasticity and cluster correlation. Using the NLS-MW data, after controlling for income and wealth and the presence of other pensions (column 3 of Table 3), only choice has a statistically significant effect on the contribution percentage. The estimate indicates that participants with choice contribute

Table 3
Linear models of participant's contribution percentage to defined contribution plan: NLS-MW

	(1)	(2)	(3)
Choice	3.43	3.55	3.34
	(0.74)	(0.78)	(0.89)
Single female	−1.10	−0.99	−0.46
	(1.02)	(1.08)	(1.16)
Married female	1.07	1.20	1.14
	(0.87)	(0.91)	(1.00)
Age	0.068	0.100	0.13
	(0.089)	(0.094)	(0.10)
Education	0.15	0.13	0.073
	(0.13)	(0.15)	(0.159)
Years in plan	−0.056	−0.057	−0.066
	(0.043)	(0.044)	(0.048)
Income 25–50k		−0.40	−0.55
		(0.97)	(1.08)
Income 50–100k		0.70	1.34
		(1.26)	(1.43)
Income >100k		−1.10	−1.42
		(2.05)	(2.30)
Net worth 50–100k		0.49	0.87
		(1.11)	(1.21)
Net worth 100–250k		0.79	1.14
		(1.03)	(1.17)
Net worth 250–500k		0.11	0.61
		(1.29)	(1.37)
Net worth >500k		0.024	0.45
		(1.510)	(1.74)
Has DB			0.88
			(0.91)
Has IRA in 1989			−0.50
			(0.76)
Constant	−1.98	−4.15	−5.63
	(6.21)	(6.55)	(6.88)
Observations	199	192	180
Adjusted R^2	0.122	0.100	0.096

Notes: The OLS regressions are estimated on data from the 1992 National Longitudinal Survey of Mature Women. The dependent variable is the participant's contribution percentage to their pension plan. Standard errors that are robust to heteroskedasticity and to correlation within family are in parentheses.

Table 4
Linear models of participant's contribution percentage to defined contribution plan: HRS

	(1)	(2)	(3)
Choice	3.251	3.120	2.867
	(0.210)	(0.210)	(0.216)
Single female	−0.069	0.738	0.577
	(0.302)	(0.339)	(0.356)
Single male	0.218	0.597	0.604
	(0.418)	(0.418)	(0.391)
Married female	0.925	0.851	0.854
	(0.262)	(0.258)	(0.281)
Age	0.081	0.071	0.080
	(0.022)	(0.022)	(0.021)
Education	0.124	0.046	−0.042
	(0.042)	(0.046)	(0.054)
Income 25–50k		1.098	0.899
		(0.358)	(0.359)
Income 50–100k		1.453	1.127
		(0.400)	(0.406)
Income >100k		1.242	0.896
		(0.492)	(0.510)
Net worth 50–100k		0.647	0.634
		(0.305)	(0.307)
Net worth 100–250k		1.074	0.965
		(0.294)	(0.310)
Net worth 250–500k		1.932	1.717
		(0.389)	(0.399)
Net worth >500k		0.418	0.957
		(0.470)	(0.482)
Has DB			1.195
			(0.238)
Has IRA			0.202
			(0.234)
Industry, firm size, and occupation dummies?	No	No	Yes
Constant	−3.223	−3.739	−4.862
	(1.423)	(1.432)	(1.508)
Observations	1961	1961	1870
R^2	0.1260	0.1460	0.1926

Notes: The OLS regressions are estimated on data from the 1992 Wave 1 Health and Retirement Study. The dependent variable is the participant's contribution percentage to their pension plan. Standard errors that are robust to heteroskedasticity and to correlation across multiple plans for an individual are in parentheses.

over three percentage points more than those without choice. This is an economically large effect and the only one estimated with some precision in this model. The income and net worth coefficients are not jointly significant.[14] I include dummy variables for

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[14] To examine whether income and wealth are proxying for higher paid employment (that typically includes higher benefits), I exclude choice from the regression with income and wealth. Income and net worth variables continue to be statistically insignificant.

whether the participant also has a DB plan or an IRA in 1989, but the coefficients are individually and jointly statistically insignificant.[15]

In Table 4 the coefficients are more precisely estimated using the larger HRS sample, yet the predicted effect of choice on the percentage of salary contributed is remarkably similar—about three percentage points. Column two has the usual demographic and financial controls, while in column three I include additional controls intended to capture other features of the job or pension that may be correlated with choice. This model includes industry, occupation, and firm size dummy variables, and a dummy variable for whether the participant also has a DB plan (this may or may not be at the same employer). I also include a dummy variable indicating the presence of an IRA to proxy for the taste for saving. Even with these controls, the estimated effect of asset choice is economically large, suggesting that participants with choice are estimated to contribute about 2.89 percentage points more to their DC plan.

The other pension and IRA dummies indicate a taste for saving—a participant with a DB plan is predicted to contribute about 1.2 percentage points more to his or her DC plan, indicating a taste for saving. The sign of the coefficient on the IRA dummy is also positive, but is imprecisely measured. The percent of salary contributed is greater for each included income and net worth category relative to the omitted categories (income less than $25,000 and net worth less than $50,000), but the difference is usually less than a percentage point. (It is 1.7 percentage points for the $250–500k net worth category.) This suggests that the benefits of tax deferred saving, in percentage terms at least, is fairly evenly spread among income groups.

It may be that the ability to direct one's investments encourages participation, but that budget constraints determine in large part the amount contributed. With the larger HRS sample, I am able to split the participation decision into two parts: the decision to make a positive contribution, and, conditional on making a positive contribution, the percent of income contributed. Column one of Table 5 reports estimates of a linear probability model of the decision to make a non-zero contribution. Choice over assets has the largest economic effect and indicates that choice increases the probability that participants make a contribution by almost 36 percent (*P*-value of 0.000). An extra year of education increases the probability of participation by a small amount (about one percent) and while net worth does not appear to influence participation, the income dummies are economically and statistically significant. They indicate that, relative to individuals with under $25,000 of income (the omitted group), the higher income groups are between about 11 and 14

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[15] Because 43 percent of the participants contribute zero, I also estimate Tobit models that are reported in an earlier version of this paper. To summarize, the signs are the same as in the linear models, and choice remains statistically significant (the standard errors in the Tobit models are not adjusted for cluster correlation). Since the OLS estimates likely provide a good estimate of the mean effect, I do not calculate the partial effects of $E(y \mid x)$ in the Tobit model that can be compared with the OLS estimates (Angrist, 1991; Wooldridge, 1997). The Tobit coefficients do estimate the marginal effects of the explanatory variables on the median once the predicted percentage contributed is positive. The coefficient on choice indicates that participant direction increases the median contribution percentage (3.5 percent) by almost eight percentage points.

Table 5
Two-part decision: (1) linear probability model of decision to contribute; (2) participant's contribution percentage to a defined contribution plan: HRS

	(1) Positive contribution?	(2) Contribution % (contribution % >0)	(3) Contribution % (contribution % >0)
Choice	0.356	1.080	0.960
	(0.021)	(0.242)	(0.268)
Single female	0.046	0.570	0.809
	(0.033)	(0.401)	(0.438)
Single male	0.011	0.875	0.780
	(0.041)	(0.439)	(0.478)
Married female	0.022	1.008	1.207
	(0.023)	(0.283)	(0.347)
Age	0.0021	0.078	0.061
	(0.0022)	(0.024)	(0.025)
Education	0.010	−0.0080	−0.055
	(0.0044)	(0.050)	(0.066)
Income 25–50k	0.110	0.695	0.199
	(0.041)	(0.440)	(0.532)
Income 50–100k	0.144	0.842	0.414
	(0.043)	(0.485)	(0.588)
Income >100k	0.116	0.792	0.647
	(0.050)	(0.572)	(0.724)
Net worth 50–100k	0.0080	0.996	0.708
	(0.033)	(0.363)	(0.395)
Net worth 100–250k	0.016	1.452	0.908
	(0.030)	(0.348)	(0.378)
Net worth 250–500k	0.030	2.389	1.448
	(0.036)	(0.427)	(0.446)
Net worth >500k	−0.137	2.182	1.348
	(0.045)	(0.551)	(0.544)
Has DB			0.364
			(0.263)
Has IRA			0.335
			(0.285)
Industry, occupation, and firm size dummies?	No	No	Yes
0<Match rate≤0.1			3.266
			(0.976)
0.1<Match rate≤0.2			4.399
			(0.724)
0.2<Match rate≤0.3			2.926
			(0.591)
0.3<Match rate≤0.4			2.733
			(0.597)
0.4<Match rate≤0.5			−0.341
			(0.366)
0.5<Match rate≤0.6			3.071
			(1.339)

Table 5 (continued)

	(1) Positive contribution?	(2) Contribution % (contribution % >0)	(3) Contribution % (contribution % >0)
0.6<Match rate≤0.7			−0.019
			(0.601)
0.7<Match rate≤0.8			−0.505
			(0.735)
0.8<Match rate≤0.9			−0.991
			(0.467)
0.9<Match rate≤1.0			−1.928
			(0.324)
1.0<Match rate≤1.5			−1.587
			(0.734)
1.5<Match rate≤2			−3.717
			(0.547)
Constant	0.126	−0.365	1.213
	(0.145)	(1.580)	(1.868)
Observations	1961	1397	1057
Adjusted R^2	0.1742	0.0622	0.2098

Notes: The OLS regressions are estimated on data from the 1992 Wave 1 Health and Retirement Study. Column (1) is a linear probability model for the decision to contribute zero or a positive fraction of salary. Columns (2) and (3) are models estimated for individuals that make a positive contribution. The dependent variable is the participant's contribution percentage to their pension plan. Standard errors that are robust to heteroskedasticity and to correlation across multiple plans for an individual are in parentheses.

percent more likely to participate. Single females are almost five percent more likely than married men to participate.

Columns two and three present estimates of the effect of choice, given that the individual is making a positive contribution. Column two has the usual demographic and financial controls, and column three includes industry, occupation, and firm size dummy variables, and the DB and IRA dummy variables. In addition, since the participant has made a positive contribution, I construct an 'effective' match rate (discussed below) as a measure of plan generosity—a characteristic likely to be correlated with choice.[16]

In the most complete model, conditional on participating, choice increases the percent contributed by about one percentage point (P-value 0.000)—still a large effect relative to a mean contribution of five percent. There is a gender difference in contribution percentages—relative to married males, married females contribute about 1.2 percentage points more. These higher contribution levels may reflect an effort to catch-up due to fewer years in the labor force or a lower salary base. Single females and single males are also estimated to contribute about 0.80 percentage points more than married males, but the differences are not statistically significant at conventional levels.

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[16] Limiting the NLS-MW sample to those making a positive contribution, the choice coefficient falls to 1.94 with a P-value of 0.052.

There are a limited number of questions about plan features in the HRS data, but the participant does report his or her contribution as well as the employer contribution. I construct an effective match rate equal to the ratio of the employer to employee contribution. This is not the marginal match rate that applies to the participant's next dollar of contribution but is an approximation and, as I have argued elsewhere, is a good measure of plan generosity (Papke, 1995).[17]

I include dummy variables for effective match rates in 10 cent increments up to dollar for dollar, and a dummy variable for matches between 1.0 and 1.5, and 1.5 and 2. The coefficient estimates in Table 5 indicate that, relative to a zero match rate (that is, no employer contribution), a match rate of between 0.1 and 0.4 increases the employee contribution by about 3 or 4 percentage points. These coefficients have the largest economic effect and P-values of 0.000. In the middle range of match rates the coefficients are not statistically significant, but I estimate that employer matches above 0.8 reduce the participant's contribution significantly. This pattern of match rate effects is similar to those obtained in Papke (1995) where the match rate was constructed at the plan level from Form 5500 reports as the ratio of total employer to total employee contributions.

4.4. Econometric results for account balances

Choice appears to increase both the amount invested in stocks and employee contribution rates. Over time, these differences may result in larger DC account balances for participants with choice. Table 6 presents account balance regressions with the NLS-MW and Table 7 presents the HRS results. The results are generally similar—when the coefficients differ in sign the NLS-MW estimates are not estimated precisely. For brevity, I discuss the most complete model estimated with HRS data. Consistent with the finding that participants with choice contribute more, account balances are estimated to be about $8900 higher for participants with choice (P-value of 0.001) (Table 7, column three). Generally, participants with higher income and higher net worth have higher account balances. Controlling for income and wealth, married females have significantly less than married males in DC accounts—about $18,500, and the difference is about $13,300 for single women.

The model in column 3 includes industry, occupation, and firm size dummies, and two dummy variables for alternative forms of tax-deferred saving. DC account balances are not higher for people with a DB plan—the coefficient is negative but imprecisely measured. The positive coefficient on the IRA dummy points to a positive taste for saving (and account balances about $3000 higher) but has a P-value of 0.172.

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[17] A plan may be established with a certain nominal match rate, but often, when the plan is organized as a profit-sharing plan, the employer contribution is determined at the end of the fiscal year. In addition, the employer may make so-called 'helper' contributions to ensure the plan passes non-discrimination requirements (or conversely, may return pre-tax contributions to employees who have contributed 'too much' for the plan to pass the tests).

Table 6
Linear models of defined contribution account balances ($000): NLS-MW

	(1)	(2)	(3)
Choice	11.76	9.92	16.94
	(5.41)	(4.93)	(4.68)
Single female	−13.73	−3.91	0.34
	(6.87)	(7.63)	(7.84)
Married female	−2.56	−13.06	−14.20
	(4.54)	(5.84)	(6.20)
Age	−0.75	−0.65	−0.57
	(0.56)	(0.49)	(0.50)
Education	3.43	1.45	1.09
	(1.15)	(1.25)	(1.26)
Years in plan	1.21	1.10	1.09
	(0.33)	(0.34)	(0.32)
Income 25–50k		5.03	6.70
		(4.57)	(4.87)
Income 50–100k		22.54	21.24
		(7.67)	(7.88)
Income >100k		51.80	52.35
		(22.00)	(20.38)
Net worth 50–100k		7.58	7.85
		(5.38)	(5.32)
Net worth 100–250k		8.18	15.86
		(4.80)	(5.67)
Net worth 250–500k		0.32	8.63
		(7.29)	(7.89)
Net worth >500k		20.17	26.70
		(13.29)	(14.96)
Has DB plan			−6.03
			(5.68)
Has IRA in 1989			−10.34
			(6.16)
Constant	18.01	20.64	16.73
	(37.39)	(32.54)	(32.18)
Observations	225	220	208
Adjusted R^2	0.197	0.292	0.314

Notes: The OLS regressions are estimated on data from the 1992 National Longitudinal Survey of Mature Women. The dependent variable is the dollar amount in a DC plan (in thousands). Standard errors that are robust to heteroskedasticity and to correlation within family are in parentheses.

4.5. Is choice endogenous?

I estimate that participant-direction of pension assets has a statistically significant and economically large effect on pension stock investment, plan participation, contribution percentages, and account balances. However, one might argue that choice is an endogenous variable in these regressions. That is, participants with some financial sophistication and taste for saving join firms that offer plans with investment choice. I examine this possibility by using a question from the NLS Mature Women that asks how much the respondent knows about the plan (responses are 'a lot,' 'some,' and 'very little'). I create a

Table 7
Linear models of defined contribution account balances ($000): HRS data

	(1)	(2)	(3)
Choice	19.459	14.216	8.911
	(3.349)	(2.980)	(2.764)
Single female	−25.405	−10.093	−13.290
	(3.482)	(3.530)	(3.339)
Single male	8.605	8.668	−3.165
	(12.969)	(11.491)	(4.579)
Married female	−16.937	−17.837	−18.533
	(3.559)	(3.400)	(2.819)
Age	0.525	0.382	0.132
	(0.336)	(0.324)	(0.216)
Education	5.146	0.941	0.745
	(0.722)	(0.643)	(0.517)
Years in plan	4.928	4.348	4.165
	(0.344)	(0.290)	(0.271)
Income 25–50k		1.260	1.115
		(2.644)	(2.544)
Income 50–100k		8.628	6.412
		(3.327)	(3.118)
Income >100k		47.346	27.160
		(7.600)	(5.617)
Net worth 50–100k		0.487	0.987
		(2.122)	(2.003)
Net worth 100–250k		3.063	2.355
		(2.453)	(2.445)
Net worth 250–500k		4.204	5.126
		(3.787)	(3.741)
Net worth >500k		77.305	40.032
		(13.048)	(10.270)
Has DB			−1.834
			(2.905)
Has IRA			2.832
			(2.070)
Industry, occupation, and firm size dummies?	No	No	Yes
Constant	−101.832	−52.615	−22.208
	(22.269)	(18.756)	(16.766)
Observations	1818	1818	1735
Adjusted R^2	0.2212	0.3302	0.3663

Notes: The OLS regressions are estimated on data from the 1992 Wave 1 Health and Retirement Study. The dependent variable is the dollar amount in a DC plan (in thousands). Standard errors that are robust to heteroskedasticity and to correlation across multiple plans for an individual are in parentheses.

dichotomous variable *knowsome* by grouping those who answer 'a lot' or 'some' together. I estimate a linear probability model of choice as a function of the *knowsome* variable. In that regression, the *knowsome* coefficient is 0.039 with a standard error of 0.080 (the estimated constant term is 0.585 with a standard error of 0.068). Apparently, choice and plan knowledge are not strongly correlated, which suggests that choice is not endoge-

nous.[18] This also suggests that choice is not simply measuring employer-provided investment education programs that Bernheim and Garrett (1996) and Muller (2000) have shown to increase rates of saving.[19]

Further, I have tried to include enough individual characteristics correlated with preferences for stock investment or saving propensity to control for any unobserved heterogeneity. In the models of percent investment in stock, I control for taste for stock by including a variable indicating whether the spouse holds stock in his/her pension plan, and whether the family invests in stocks outside of its pension plans. In the models of contribution amounts and account balances, I control for saving propensity by including the ownership of an IRA and participation in a DB plan.

Choice may also be related to unobserved plan features that increase saving. Absent much detail on plan features, I include industry, occupation, and firm size dummy variables—generosity of benefits is known to increase with firm size. The DB plan dummy variable also indicates 'good firm' benefits. I also include a constructed employer match rate in the contribution equation. These additional controls do reduce the size of the choice coefficient, but not its fundamental economic importance. Finally, an alternative to this proxy variable approach to address the endogeneity issue is to find an instrumental variable for choice, but none suggests itself in these data sets.

It is interesting to speculate by what mechanism choice over one's assets compels participants to invest more in equities, and to participate and contribute more to their plan. Regarding equity investment, these results may simply indicate that, for this period in the early 1990s, plan managers invested pension accounts more conservatively than the employees would have preferred. Finding that asset choices increase participation and contributions is intriguing and lends support to behavioral theories of saving.[20] Thaler and Shefrin (1981) argue that individuals have conflicting preferences—those of a patient saver conflict with more short-sighted preferences. A change in the economic environment, like requiring participants to make choices about assets in a pension plan, may tip the internal balance toward the more patient self and stimulate saving. With employer-provided pensions in place, individuals are more likely to learn that others ('authorities' and peers) think saving is important. I estimate that having investment choice raises the percent of salary contributed over and above the influence of the plan's match rate—the contribution's initial rate of return. It may be that having to choose some or all of your investments causes participants to increase their level of participation since their asset choices will in part determine their return. This may be in contrast to more passive behavior in plans where employers manage the investment.

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[18] When knowsome is included in the regressions, its coefficient is statistically insignificant and small.

[19] Due to data limitations, Bernheim and Garrett (1996) are unable to examine the effects of workplace financial education on asset allocation. However, generally employer-provided financial education became more common after 1992, so it is not clear if the participants in these samples would have been affected.

[20] Bernheim (1997) compares behavioral theories of saving to those that come from the traditional life cycle hypothesis.

5. Conclusion

This paper presents estimates from two data sets that indicate that participant control over assets increases the likelihood of DC plan participation, the size of the contribution, and eventually the size of the DC account balances. My preferred estimates indicate that participants with investment choice are 36 percent more likely to make an annual contribution. These participants are estimated to contribute between one and three percentage points more of salary annually, and have at least $9000 more in their account than comparable participants without investment choice. In addition, for those who choose to contribute, contributions are about three percentage points higher if the firm offers a small match rate. These results are estimated using data on older, pre-retirement plan participants, so the results may not generalize to younger cohorts. Having said that, the findings are remarkably similar across the two data sets, giving us confidence in the findings.

Using the smaller of the two data sets, I also find an increased tendency to invest in stocks, given the choice. For the near-retirement sample I use here, women do not invest more conservatively than men. I find that participants invest similarly both inside and outside their pension fund. Several caveats attach to these results. The asset categories in the NLS Mature Women are broad. We cannot determine with these data, for example, whether the equity investment is in employer stock. The GAO (1997) found that employer securities are concentrated among the largest 401(k) plans (representing 26 percent of participants in 401(k) plans). Investment in *employer* stock has different implications for the participant's personal investment risk than an investment in a diversified stock fund, since his/her employment fortunes and retirement income are tied to the same employer.[21]

The finding that having choice tends to increase stock investment is consistent with recent tabulations that suggest that participants may be strongly influenced by their employer's asset choice. In their tabulation of 401(k) plan assets, Holden and VanDerhei (2001) report that, in plans where the employer contribution must be in company stock, participants put a higher percentage of their self-directed balances in company stock (29.3 percent) and a lower percentage in equity funds (42.1 percent), compared to participants without employer-directed contributions (20.2 and 48.7 percent, respectively). This finding would be consistent with behavioral theories of saving pointing to peer or authority figure effects.

Choice over assets does seem to increase participant involvement on many levels—in the decision whether or not to save, and in increasing the amount saved. These estimated differences in investment behavior between participants with and without choice indicate economically meaningful differences in ultimate retirement income even over a short time horizon.[22] Some proposals to privatize Social Security recommend adding an individual

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[21] For example, Color Tile's 401(k) plan was invested largely in company stock which lost most of its value when the parent filed for bankruptcy in 1996.

[22] In an earlier version of this paper, I include simple projections using the NLS-MW results. A single woman in a plan with choice is predicted to have about 58 percent more in her account by age 65, a married man with choice about 49 percent more, and a married woman about 184 percent more, than identical participants without choice.

account component to benefits. These results suggest that allowing participants a choice of investment options may increase their retirement saving. Further, a small government match would have the greatest effect in increasing the amount contributed.

Acknowledgements

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