Original Article

Investment choice and savings in defined contribution pensions

Received (in revised form): 22nd November 2011

Zhe Li

received her PhD in Economics from New York State University at Stony Brook in 2010. Her primary research interest is financial economics, labor economics, computational economics, and pension economics and aging. Her dissertation was working on the households' optimal saving decisions and portfolio choices in tax-deferred retirement account over the life cycle. Dr Zhe Li has presented her papers at meetings of American Economic Association, Southern Economic Association and Eastern Economic Association.

ABSTRACT This article presents econometric evidence from Health and Retirement Study on the role that investment choice plays in the participants' saving levels in the defined contribution (DC) pensions. I distinguish the effect of unconstrained investment choice from the one constrained in company stocks. My preferred estimates indicate that participants with investment choice contribute over three percentage points more of their salary into the DC plan than people without choice, and people constrained in company stocks contribute about three percentage points less in their retirement saving account.

Pensions (2012) 17, 25–35. doi:10.1057/pm.2011.30

Keywords: investment choice; pension; saving

INTRODUCTION

The defined contribution (DC) pension plans, especially the striking growth of 401(k) plans, have vastly expanded the number of individuals, with some discretion regarding their retirement assets. Self-directed individual retirement accounts (IRA) will become increasingly common as traditional defined benefit (DB) plans are supplemented with or replaced by DC plans. Many state and local governments, traditional DB providers, are considering adoption of 401(k)-type plans. In particular, the behavior of participants in IRA can inform the questions concerning the degree of individual autonomy that should be allowed in the proposals to privatize all or part of the US Social Security program.

In the traditional 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, DC plans require an employee contribution, typically on a pretax basis under the provisions of Internal Revenue Code Section 404 (k). Employers then match some or all of the employee contributions. The combined employee and employer funds are placed in an individual account for the employee, and can be invested in a variety of ways. Participants usually direct the investment of their own contribution, and often that of their employer.

According to the release of US Department of Labor,¹ approximately 82 per cent (28.2 million) of the 34 million participants in 401(k) plans had some control over their investments. These participants owned over US\$1.04 trillion in assets, accounting for 83 per cent of 401(k) assets. Asset

Correspondence: Zhe Li

Department of Economics and Business Administration, Framingham State University, 100 State Street, Box 9101, Framingham, MA 01701-9101, USA

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. Once employees have initiated participation in the 401(k) plan, the choice that has the greatest direct impact on asset accumulation is how much is contributed to the plan. In this study, I intend to use Health and Retirement Study (HRS) to estimate the impact of investment choice on participants' contribution levels in DC Pensions.

In most studies, people who report that they have control over assets allocation in pension plans do not distinguish the choice between the participant contribution and the employer contribution. In fact, it was common for the employer's contribution to be constrained – often to company stock. Wiatrowski² summarizes the investment choice for full-time employees using the Bureau of Labor Statistics National Compensation Survey. He reports that, in 1985, 90 per cent of full-time employees had investment choice over their own contribution, and 48 per cent had control over their employer's contribution. In many DC plans, the employer contribution is made in company stock, and thus the effect of investment choice on savings in pension plans would be overestimated if employees do not have control over the employer contribution. In this study, beyond estimating the general role of investment choice on individual behavior in retirement accounts, I will distinguish the impact of unconstrained choice from the constrained one in company stock.

Using the first wave from Health and Retirement Survey (HRS), I find that participants with investment choice contribute over three percentage points more of their salary into the DC plan than people without choice, and people constrained in their investment contribute about three percentage points less in their retirement saving account. Male and lower-income participants are more likely to be affected by the ability to direct individual accounts. In addition, the impact of investment choice is also significant in the effort to encourage participants making a positive contribution rather than zeros.

The next section presents the literature background of the previous studies. The section after that briefly summarizes the data used in this analysis. The penultimate section provides econometric evidence on the effect of investment choice on participants' contribution levels. The final section concludes with implications of the findings for pension policy and for individual accounts proposed for Social Security System.

LITERATURE

Plan designs have strong effects on employee contribution.³ A handful of studies have considered plan-level attributes that affect participation and contribution levels in such plans, but the impact of investment choice on contribution rates has only recently been examined in the literature, and the results are limited.

Cunningham and Engelhardt⁴ find that the ability to direct investment of the voluntary balance is associated with very large increase in 401(k) savings, but they only raise the phenomenon and do not give detailed explanation. Papke⁵ use two data sets to estimate the role that participant investment choice plays in asset allocation, contributions and account balances. He finds that the ability to exercise choice over investment allocations in DC plans increases contribution rates by one to three percentage points relative to the contribution rate that would be chosen in the absence of participant direction. The investment options referred in Papke⁵ are a combination of both constrained and unconstrained choice.

In contrast to the positive effect of participant investment choice, the effect of the company stock investment on the pension plans is quite controversial. Some studies argue that company stock guarantees the presence of a familiar option in the menu, so that familiarity breeds investment.^{6,7} However, many other studies show evidence that the presence of company stock increases the risk, and therefore reduces the retirement savings.^{8–10}

In this study, I define the participant investment options as constrained if the investment is required to invest, mostly or

partially, in company stock. Isolating the constrained choices from the unconstrained ones is important at least for two reasons. On one hand, there would be an upward bias in the estimation of the impact of investment options on individual saving behavior, for the employee would report having choice even if the employer directs the firm's contributions. On the other hand, the effect of the company stock requirement in the investment on contribution levels would be overestimated without the differentiation, as some employees still have control over their own retirement savings. These problems will be explained in detail in the following sections.

DATA

Although plan-level data set is a good tool to study the effect of plan design factors, most of them cannot be used to analyze the impact of investment choice, as, within each employer-sponsored pension plan, participants either all have a choice in assets investment or they all do not. A survey data set will be able to overcome this problem, in the sense that it includes participants in the DC plans both with investment choices and without the choice. In this study, I use the first wave from HRS, a biennial household survey that started in 1992 until now. In addition to detailed demographic data on the respondent and her household, supplementary questions on his/her and his/her spouse's pension eligibility and benefits from current/past employers or from other pension sources were included in the questionnaires.

Because the survey is of the older population, the sample is not representative of the pension-age population in the United States. In particular, the sample is older, and thus analyzing these data may not tell us about retirement savings of younger people. Nevertheless, this is an interesting group to look at as these people, nearing the end of their professional careers, are likely to have pensions and to consider retirement income seriously.

Some features of the reported contribution level in the data set should be emphasized. First, many employers providing pension plans impose a default level of contribution rate to the

employees, that is, participants who decide to participate in the DC plan should automatically contribute the default rate of their salaries. Without this information, it prevents us from measuring the real contribution rates of the participants who desire to contribute between zero and default rate. There is no study in the literature of pension contribution rates considering this problem by now, and thus this part would be worth extending if with complete data set. Second, the employer-sponsored DC plans usually impose a maximal level of employee's contribution rate. In that case, if the participant contributes the maximum amount, his/her desired contribution level may be higher than his/her reported contribution rate. A censored regression of the max-out amount has been studied by Huberman and Jiang (2007), using a plan-level data set. In addition, the employer usually provides some match to the employees' contribution, but only up to a limited percentage of pay. This limit is called match threshold. Many participants save in the retirement account only to the match threshold amount, as the match rate is considered as the initial rate of return. However, HRS does not include such questions that can capture the default contribution level requirement, the maximum contribution rates and match threshold.

Despite of the above restrictions imposed on participant contribution level, people can still control their contributions voluntarily in several ways. First, they can usually decide whether or not to contribute a positive amount. Second, they can choose any amount between the default and the maximum contribution rates. In addition, they can contribute more than the employer match threshold. In this study, I primarily focus on the first two aspects.

The investment choice variable of pension assets adopted here is the reported information by the respondents themselves in HRS. This is the one not distinguishing between constrained and unconstrained control over pension investments. I also include a dummy variable indicating that the participants are constrained in using their own contributions or their employers' contribution. This is usually the case of profit-sharing and

company stock purchase plans, in which the employers' contributions are constrained in company stock, as well as the employees' contribution sometimes.

In the 1992 HRS, there are 2277 non-retired respondents who have at least one pension plan, among which 20.9 per cent people report that they participate in a DC plan. I restrict the sample to participants in DC plans, and to those who respond to the investment questions. This reduces the sample to 476 individuals. Table 1 reports summary statistics for the sample of respondents with DC plans, the subsample of people with positive contributions to individual account and those with zero contributions, respectively.

In the full sample, the participants averagely contribute 5.99 per cent of their salary into the DC account, and thus the average contribution amount is about 1.84 thousands dollars per year. The average account balance is US\$31 080 by the survey year. Investment choice is available for 60 per cent of the participants, and 16 per cent of them have a profit-sharing or stock purchase component, that is, the employees do not have perfect control over the employer's contribution. Women comprise 47 per cent of the sample, and over 80 per cent of the sample are married. In addition, about 27 per cent of the respondents have a DB plan together with a DC plan.

Compared with the subsample of participants with zero contributions, the subsample with

Table 1: Summary statistics

<i>Variables</i>	<i>Full sample in DC plan</i>	<i>Subsample with positive contributions</i>	<i>Subsample with zero contributions</i>
	<i>Mean (Standard Deviation)</i>	<i>Mean (Standard Deviation)</i>	<i>Mean (Standard Deviation)</i>
Contribution percentage	5.99 (7.81)	8.08 (8.09)	—
Contribution amount (US\$1000)	1.84 (2.57)	2.49 (2.70)	—
Account balance (US\$1000)	31.08 (56.12)	27.46 (50.25)	41.47 (69.49)
Investment choice	0.60 (0.49)	0.71 (0.45)	0.28 (0.451)
Constrained choice in company stocks	0.16 (0.37)	0.11 (0.31)	0.31 (0.46)
Employer contribution rate	8.71 (17.45)	7.70 (13.20)	11.62 (25.90)
Years in DC plans	7.96 (7.44)	7.05 (6.68)	10.55 (8.83)
Annual income (US\$1000)	33.29 (21.77)	32.52 (22.93)	35.52 (17.95)
Net worth (US\$1000)	217.68 (408.93)	214.75 (428.42)	226.04 (348.85)
Has a DB plan	0.27 (0.44)	0.21 (0.41)	0.43 (0.50)
Has an IRA	0.01 (0.09)	0.00 (0.05)	0.02 (0.15)
Female	0.47 (0.50)	0.49 (0.50)	0.40 (0.49)
Married	0.82 (0.39)	0.81 (0.39)	0.82 (0.38)
Age	54.09 (4.74)	54.22 (4.66)	53.72 (4.97)
Highest education	13.18 (2.63)	13.13 (2.67)	13.30 (2.50)
White	0.88 (0.33)	0.88 (0.32)	0.86 (0.35)
Black	0.10 (0.30)	0.08 (0.28)	0.14 (0.35)
Number of observations	476	353	123

positive contributions display more ability in controlling investment of pension funds, that is, 71 per cent of this subsample have choice of pension assets, whereas only 28 per cent have this choice in subsample with zero contribution. People with positive contributions are also less constrained in company stocks, and they are associated with more income and less employer contribution rate, which is defined as the ratio of employer's contribution to the employee's salary.

Figure 1 shows the distribution of contribution levels in DC plans of the participants with investment choice and without the choice, respectively. Generally speaking, participants with the ability to direct investment save more in the DC plans, and, specifically, compared with the group without choice, there is a large drop among the respondents who contribute zero amount, and a remarkable increase of the people who save more than 15 per cent of their salaries. This graph indicates that investment choice encourage the saving rates in the DC plan.

ECONOMETRIC RESULTS

This section presents econometric evidence on how investment choice affect contribution levels in DC plans using data from HRS. In the

regression, there are 476 individual DC plan participants, with 22 multiple plans for a total of 498 observations. The average percentage contribution is 5.99 per cent of salary with a standard deviation of 7.81. The mean of those who contribute is 8.08 per cent with a standard deviation of 8.09, whereas 123 participants report a zero contribution.

Results for basic regression

Table 2 present ordinary least squares (OLS) regression of the percentage of salary the participant contributes to the pension plan. Because about 3.2 per cent of the identifiers have two observations, the standard errors are corrected for within family (identifier) correlation. In addition, I report heteroskedasticity-robust standard errors, for people display different variation in contribution rate at different compensation levels.

The basic regression (Column 1) includes asset choice dummies, demographic factors and financial information of the respondents. Employer's contribution rate in the DC plans is estimated in Column 2, and other plan and IRA dummies are included in Column 3. The coefficient of investment choice is positive and statistically

Figure 1: Distribution of contribution rates (%).

Table 2: Linear models of participant's contribution rate to defined contribution plans

	(1)	(2)	(3)
Investment choice	3.381*** (0.777)	3.315*** (0.741)	3.251*** (0.717)
Constrained choice in company stocks	-2.085* (1.1210)	-3.160** (1.417)	-3.534** (1.488)
Investment choice × constrained choice	2.188 (1.819)	2.934 (1.899)	3.218*** (1.956)
Years in DC plans	0.073 (0.082)	0.073 (0.080)	0.078 (0.079)
Annual income (US\$1000)	0.044** (0.022)	0.046** (0.023)	0.045** (0.023)
Employer contribution rate	—	0.074* (0.041)	0.073* (0.040)
Has a DB plan	—	—	-0.723 (0.706)
Has an IRA	—	—	-8.921*** (2.207)
Constant	-1.079 (4.628)	-1.246 (4.559)	-0.518 (4.510)
Adjusted R^2	0.0874	0.1143	0.1255

Note: Significance level: *10 per cent, **5 per cent, and ***1 per cent. Robust standard errors are in the parentheses. All regressions include demographic information and industry, occupation and firm size dummies.

significant, indicating that people who are able to choose their own investments and not constrained by plan designs contribute 3.25 percentage points (Column 3) more of their salary into the DC plan than the rest of participants. This result is consistent with that in Papke,⁵ who finds that participants with choice contribute over three percentage points more than those without it.

In contrast, the coefficient of constrained choice is negative and significant, predicting a 3.53 percentage points less in the contribution rates for the employees constrained in company stock of both the employer's and employee's contribution, suggesting that people would rather give up their opportunity to invest in the pension plan if they cannot fully self-direct their IRA. The following shows one possible explanation. If the employer contribution is made in company stock in the DC plans, this structure may encourage employees to hold extremely risky portfolios. Therefore, for the employees who have fully control over their own contributions, they have two options to balance the risk. The one way is to invest less risky assets within the DC plan; the other way is to choose other risk free retirement plans, such as the DB plan. However, for the employees who have partial or

no control over their own contributions, the wise choice would be to reduce the contribution in the DC plan and resort to risk free pension plans.

It is interesting to speculate by what mechanism choice over one's assets compels participants to contribute more to their pension plans. Thaler and Shefrin¹¹ argue that individuals have conflicting preferences – those of a patient saver conflict with more short-sighted preferences. A change in a pension plan may tip the internal balance toward the more patient side and simulate saving. The estimates show that having investment choice raises the percentage of salary contributed and above the influence of the employer matching 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 contribution, as 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.

The above formulation assumes that the effect of assets choice is the same for men and women. When I allow for gender differences, the significant effect of asset choice for men is 4.01 with a robust standard error of 0.76, and the

effect for women is 1.89 with a standard error of 1.11, but not significant in a 95 per cent confident interval. In contrast, the negative effect of the constrained choice variable is significant for women (-5.30 with a standard error of 2.28), whereas this effect is negative but not significant for men (-3.07 with a robust standard error of 2.05). The gender difference suggests that women are less likely influenced by the investment options in their savings to a DC plan, and they are more conservative in the risky asset investment. There are at least two explanations, which are not mutually exclusive. One is that women have a stronger preference for saving, perhaps because they typically live longer than men. Two, the unit of decision is the household, and in many cases women are secondary wage earners whose incomes supplement those of their husbands. In these cases women's recorded incomes are substantially lower than their households' incomes and their behavior is likely to reflect their households' incomes.

Income is an interesting individual attributes. The result shows that controlling for all other variables, participants contribute 0.4 per cent more of their salaries into a DC plan for an increase of US\$10 000 in compensation. There are several reasons behind this fact. First, the progressivity of the income tax code entails stronger incentives of those who earn more to contribute in a tax-deferred plan. Moreover, low-income employees are more likely to have, or anticipate having liquidity constraints that will deter them from contributing large sums to a 401(k) plan, where the money is locked up until retirement. In addition, low-income employees expect higher salary replacement rates from Social Security upon retirement than high-income employees. This anticipation lowers the desire to save for retirement. In fact, whether those who earn more also save a larger fraction of their incomes has been a well-known question, going back decades before Friedman¹² classic work on the consumption function. Recently, Dynan *et al*¹³ revisit the issue and conclude that those with higher expected lifetime earnings also have higher savings rates. This study uses the sample of older population HRS, and savings are narrowly

defined as contribution to DC plans, and thus the result cannot be extended to lifetime saving behavior.

In addition, the effects of individual characteristics, such as gender, age, education and marriage are not significant in this analysis. When I include a dummy of DB plan in the regression (Column 3), the coefficient is negative and insignificant. This result is consistent with that in Clark and Schieber,¹⁴ who find no difference between the 401(k) contribution rates of participants that do or do not have a DB pension plan.¹⁵ Different from the effect of DB plans, the coefficient of having IRA is significantly negative, which suggests that DC plans and IRAs are substitutes in tax-deferred saving. This result is consistent with Engelhardt and Kumar,¹⁶ who find that the estimated after-tax cross-price elasticity of 401(k) contributions with respect to IRA saving is negative.

I include employer contribution rate in the regression of Column 2 and Column 3. The coefficient of employer contribution rate is about 0.073 with a *P*-value of 0.054, indicating a 1 per cent more in the employer contribution rate will lead to a 0.073 percentage increase in the employee contribution rate. I use employer contribution rate instead of match rate in this setting because there are limited number of questions about plan features in the HRS data. Some papers, like Papke,¹⁷ construct an effective match rate equal to the ratio of the employer to employee contribution, but that is not the marginal match rate that applies to the participant's next dollar of contribution. In addition, when I use this treatment in HRS data, the inclusion of the approximated match rate does not influence the fundamental economic importance of investment choice variable.

The impact of variation in compensation

The DC plan participants are not a homogeneous group. There are a few differences between low- and high-income employees. One, the tax benefits of saving through a tax-deferred vehicle are more generous to the higher-income employees. Two, lower-income employees are

more likely to face liquidity constraints that will prevent them from putting money away, even in a tax-deferred plan. Three, Social Security benefits offer high salary replacement rates to lower-income employees, and render alternative retirement savings less urgent. Four, low-income employees may be less educated and sophisticated about the benefits and costs of participating in a 401(k) plan. Huberman and Jiang⁷ find that the low-income employees are more likely to be influenced by plan design factors, such as including company stock in the investable funds. Engen and Gale¹⁸ suggest that the savings behavior varies across earnings groups, and therefore DC plans have different effects on household wealth.

The differences between low- and high-income employees suggest a re-examination of the data separately for various levels of compensation. In this section, I report the estimates from the regression of three groups – lower income (<25 per cent), middle income (25–75 per cent) and higher income (>75 per cent). The ability to direct investment still plays a significant role in the participant contribution throughout three groups, with a slightly higher effect for the lower-income respondents, whereas the constrained choice is only significant for lower-income group. The empirical evidence shows that lower-income participants will decrease their contribution rates by 4.64 per cent if they are constrained in the ability to direct the asset investment, and this negative effect is more likely to be compensated by the asset options (the coefficient of the interacted term is 7.04). This result may come from the fact that lower-income respondents are more likely to face liquidity constraint, and thus they are less likely to put money into extremely risky asset, and therefore, are more likely to be attracted by the self-direction ability in asset options. The same implication can also be derived from the negative and significant coefficient of having other pension plans, which suggests that DB plans or IRA is a substitute retirement saving plan of DC plans especially for low-income employees.

In the regression by each compensation level, the effects of gender on contribution rates are

also different (Table 3). The contributions of women are 2 per cent higher than men's in the lower-income subsample, but the effect of female are not significant in other subsamples. One explanation for the gender difference is that women are residual income earners in their families: many more low-compensation women than men are married to working spouses, and women earn less than men among the majority of working couples. If the contribution decision reflects the family's needs, as opposed to just the employees', then low-income women will contribute as if they had higher incomes than their recorded compensation. This observation may explain the gender gap at the low end of the pay scale, although here the inclusion of the net worth variable should control for the 'family' effect. Moreover, that women at the higher income levels behave similarly to men of similar income can also confirm the above explanation.

Another thing that needs to be mentioned is the effect of employer contribution rate across different income groups (Table 4). The presence of such a match increases contribution rates at all compensation levels, and such inducement is stronger the lower the compensation. In fact, for low-income participants, a 50 per cent more

Table 3: Linear models of participants contribution rate to DC plan – Gender differences

	<i>Male</i>	<i>Female</i>
Investment choice	4.015*** (0.761)	1.897* (1.112)
Constrained choice in company stocks	–3.070 (2.048)	–5.30** (2.279)
Investment choice × constrained choice	0.206 (2.105)	7.181** (3.367)
Years in DC plans	0.038 (0.055)	0.178 (0.179)
Annual income (US\$1000)	0.035* (0.020)	0.048 (0.054)
Employer contribution rate	0.084* (0.046)	0.059 (0.054)
Has a DB plan	–1.400 (0.845)	–0.489 (1.203)
Has an IRA	–23.975 (20.379)	–7.947*** (1.220)
Adjusted <i>R</i> ²	0.2179	0.1191

Note: Significance level: *10 per cent, **5 per cent, and ***1 per cent. Robust standard errors are in the parentheses. All regressions include demographic information and industry, occupation and firm size dummies.

Table 4: Linear models of participants contribution rate to DC plan – By income percentile

	Lower-income group (<25%)	Middle-income group (25–75%)	Higher-income group (>75%)
Investment choice	3.192*** (1.088)	2.756** (1.034)	2.915*** (0.978)
Constrained choice in company stocks	–4.639** (1.905)	–2.231 (2.464)	–2.911 (2.122)
Investment choice × constrained choice	7.044 (4.349)	0.018 (2.811)	4.248 (2.557)
Years in DC plans	0.253 (0.258)	0.072 (0.114)	0.022 (0.079)
Annual income (US\$1000)	0.318 (0.189)	0.264** (0.117)	0.018 (0.013)
Employer contribution rate	0.139 (0.085)	0.085 (0.051)	0.045 (0.060)
Has a DB plan	–2.437* (1.371)	–0.239 (1.097)	–0.431 (1.175)
Has an IRA	–10.390*** (2.587)	–9.013* (0.988)	–5.281 (5.163)
Adjusted R^2	0.2736	0.2020	0.2053

Note: Significance level: *10 per cent, **5 per cent, and ***1 per cent. Robust standard errors are in the parentheses. All regressions include demographic information and industry, occupation and firm size dummies.

employer contribution would increase the contribution rates by 7 per cent, and the effect is only 2 per cent for higher-income respondents.

Results for two-part regression

Participants' involvement in the DC plans has several levels, such as whether to contribute the first dollar and how much contribution to make after that. It may be that the ability to direct one's investments encourages participants' positive contribution, but that budget constraints determine in larger part the amount contributed. Therefore, I split the contribution decision in two parts: the decision to make a positive contribution, and, conditional on making a positive contribution, the percentage of income contributed.

After correcting by Heckman selection, the coefficient of the inverse Mills ratio (λ) show positive selection bias for contribution rates in DC plan. Thus, the observed saving rate among participants with positive contributions is higher than the population mean would have been observed for the average member of the sample within DC plans had he chosen to contribute a positive amount. One explanation would be that the respondents who enter larger firms or some specific occupation, such as

managers, are those who are more likely to save for retirement.

Column 1 of Table 5 reports estimates of a probability model of decision to contribute a non-zero amount, and Column 2 presents estimates of the effect of investment choice given that the individual is making a positive contribution. Assets choice has the largest economic effect and indicates a 25 per cent increase (marginal effect) in the probability that participants make a contribution (P -value of 0.000), whereas the constrained choice significantly decreases the probability of making a positive contribution by 45.4 per cent (P -value is 0.000 too). The coefficient of investment choice is still positive and significant even conditional on positive contribution, whereas the effect of company stock constraint fades away (becomes insignificant).

This finding rejects the hypothesis that investment choice encourage the participants to contribute in a retirement saving account, but it is the budget constraint, not the self-direction ability, that determines in large part the employees' saving levels in the DC plans after they contribute the first dollar. Investment choice not only encourages the first dollar contribution from employees in the retirement account, but

Table 5: Two-part decision (a) probit model of positive DC contribution; (b) linear model of conditional contribution rate to DC plans

	<i>Positive contribution</i>		<i>Contribution rates (contribution > 0)</i>
	<i>Coefficient (Standard Deviation)</i>	<i>Marginal effect</i>	<i>Coefficient (Standard Deviation)</i>
Investment choice	0.971*** (0.168)	0.252	2.048 (3.628)
Constrained choice in company stocks	-1.333*** (0.282)	-0.454	1.650 (10.631)
Investment choice × constrained choice	0.672*** (0.374)	0.313	-0.836 (8.534)
Years in DC plans	-0.025 (0.010)	0.057	0.647 (1.263)
Annual income (US\$1000)	0.000 (0.004)	0.000	0.045** (0.022)
Employer contribution rate	—	—	0.186** (0.081)
Has a DB plan	-0.634*** (0.161)	-0.183	-0.177 (2.711)
Has an IRA	-2.858* (0.954)	-0.813	-13.523 (19.519)
λ	—	—	1.778 (11.135)
Adjusted R^2	0.2681		0.1668

Note: Significance level: *10 per cent, **5 per cent, and ***1 per cent. Robust standard errors are in the parentheses. All regressions include demographic information and industry, occupation and firm size dummies.

also boosts the amount they decide to save. In contrast, the inclusion of company stock as an investment constraint threaten most employees completely out of the retirement account (zero contribution), and they choose to seek other types of vehicles for retirement savings, such as DB plans and IRA.

In contrast to asset choice variables, employer's contribution rate has no significant effect on the probability of the non-zero contribution rates, but it plays a significant role in the employee contribution rates conditional on positive contribution. The result shows that, conditional on their non-zero contribution, participants will contribute about 20 per cent more if they have 100 per cent increase in the employer contribution. This finding is consistent with the result of Engelhardt and Kumar,¹⁶ who use non-linear budget constraint methods to estimate how much employees contribute to the 401(k) plan. That methodology explicitly incorporates both the match rate and the match threshold in the employees' optimization problem.

CONCLUSION

This article analyzes the effect of participant control over assets on the size of the contribution, using the first wave data from HRS. As people who reported having investment choice may, wholly or partially, not be able to control the employer contribution in their pension accounts, I construct a constrained choice variable distinguishable from the unconstrained one.

My preferred estimates indicate that participants with investment choice contribute over three percentage points more of their salary into the DC plan than people without choice, and people constrained in their investment contribute about three percentage points less in their retirement saving account. Male and lower-income participants are more likely to be affected by the ability to direct individual accounts. Further, the impact of investment choice is more significant in the effort to encourage participants making a positive contribution than its effect on the actual percentage contributed, whereas the factors

influencing budget constraint, such as the employer contribution rate, would play an important role in the decision of how much percentage of the salary to contribute into the retirement account.

Choice over assets does seem to increase participant involvement on many levels – in the decision of 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. Some proposals to privatize Social Security recommend adding an individual account component to benefits. These results suggest that allowing participants a choice of investment options may increase their retirement saving.

There are several extension that could be made based on this study. First, participants in a DC plan usually cannot perfectly control how much contribution to make out of the salary, for default and maximum contribution rates restrict their choices. A survey data set with handful plan design characteristics would be good for an empirical study of contribution rates. Second, this study provides an econometric effect of the investment choice, but it does not analyze how the choice variable will enter the budget constraint of the participants. An individual optimization model with budget set of plan design factors would be useful to study the effect of pension designs to a further step.

REFERENCES

- 1 U.S. Department of Labor: Pension and Welfare Benefits Administration. (2001) Private Pension Plan Bulletin: Abstract of 1997 Form 5500 Annual Reports no. 10: Winter.
- 2 Wiatrowski, W.J. (2000) Putting stock in benefits: How prevalent is it? *Compensation and Working Conditions*, Fall: 2–7.
- 3 Choi, D., Laibson, J. and Madrian, B. (2004) Plan design and 401(k) savings outcomes. *National Tax Journal*, June (57): 275–298.
- 4 Cunningham, D.R. and Engelhardt, G. (2002) Federal tax policy, employer matching, and 401(k) savings: Evidence from HRS W-2 Records. *National Tax Journal*, September (55): 617–645.
- 5 Papke, L.E. (2003) Individual financial decisions in retirement saving plans: The role of participant-direction. *Journal of Public Economics* 88(1): 39–61.
- 6 Huberman, G. (2001) Familiarity breeds investment. *Review of Financial Studies* 14(3): 161–178.
- 7 Huberman, G., Iyengar, S.S. and Jiang, W. (2006) Defined Contribution Pension Plans: Determinants of Participation and Contribution Rates. Working Paper.
- 8 Huberman, G. and Sengmuller, P. (2004) Performance predicts asset allocation: Company stock in 401(k) plans. *Review of Finance* 8(3): 403–443.
- 9 Liang, N. and Weisbenner, S. (2002) Investor Behavior and the Purchase of Company Stock in 401(k) Plans – The Importance of Plan Design. NBER. Working Paper no. 9131.
- 10 Ramaswamy, K. (2002) Company Stock and Pension Plan Diversification. Pension Research Council. Working Paper.
- 11 Thaler, R.H. and Shefrin, H. (1981) An economic theory of self-control. *Journal of Political Economy* 89(2): 392–406.
- 12 Friedman, M. (1957) *A Theory of the Consumption Function*. Princeton, NJ: Princeton University Press.
- 13 Dynan, K.D., Skinner, J. and Zeldes, S.P. (2004) Do the rich save more? *Journal of Political Economy* 112(2): 397–444.
- 14 Clark, R.L. and Schieber, S.J. (1998) Factors affecting participation rates and contribution levels in 401(k) plans. In: O.S. Mitchell and S.J. Schieber (eds.) *Living with Defined Contribution Pensions: Remarking Responsibility for Retirement*. Philadelphia, PA: University of Pennsylvania Press, pp. 69–97.
- 15 Munnell, A.H., Sunden, A. and Taylor, C. (2001) What Determines 401(k) Participation and Contribution? Center for Retirement Research. Working Paper.
- 16 Engelhardt, G. and Kumar, A. (2006) Employer Matching and 401(k) Saving: Evidence for the Health and Retirement Study. NBER. Working Paper no. 12477.
- 17 Papke, L.E. (1995) Participation in and contributions to 401(k) pension plans: Evidence from plan data. *Journal of Human Resources* 30(2): 311–325.
- 18 Engen, E.M. and Gale, W.G. (2000) The Effect of 401(k) Plans on Household Wealth: Differences across Earning Groups. NBER. Working Paper November 8032.