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Gender differences in defined contribution pension decisions

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Abstract

This paper considers gender differences in allocation of household wealth to defined contribution pensions. Using data from the 1989 *Survey of Consumer Finances*, we estimate the coefficient of relative risk aversion based on the allocation of wealth into defined contribution pensions. Unlike previous studies, we consider the problem in the context of the household's overall portfolio. We find that women exhibit greater relative risk aversion in their allocation of wealth into defined contribution pension assets.

JEL classification: J16; G11; G23

Keywords: Risk aversion; Pension; Gender differences

1. Introduction

Trends in employer provision of private pensions show that defined contribution pension plans are becoming increasingly prevalent (Gustman and Steinmeier, 1992). The United States Department of Labor (1997) reports that the number of workers covered by defined benefit plans decreased by 1.7 million between 1975 and 1993 whereas the number covered by defined contribution plans increased nearly 300% over that same period to 36.4 million in 1993. Bajtelsmit and VanDerhei (1997) summarize recent trends in pensions and conclude that an increasing percentage of new plans also require participants to make their own

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investment decisions. Although investment choice is arguably a source of empowerment, increasing evidence that individuals tend to choose conservative investment strategies for self-directed accounts raises questions of whether today's workforce will retire with significantly lower pension benefits than those that would have resulted from investment by professional pension managers. Thus this trend has potentially serious implications for the retirement income adequacy of American workers.

A related problem that has received less attention is the impact of this trend on women in retirement. Previous studies have found that women display greater risk aversion in a wide variety of activities, including smoking, seat belt usage, and financial decision making (Hersch, 1996; Jianakoplos and Bernasek, 1998; Bajtelsmit and Bernasek, 1996). There is also evidence that women tend to exhibit greater risk aversion within their defined contribution plans (DCPs) (Bajtelsmit and VanDerhei, 1997; Hinz, McCarthy and Turner, 1997; Sunden and Surette, 1998). Women's greater longevity implies that, even with the same investment strategy and pension investment accumulation as men, retirement wealth must support a longer period of retirement. Thus, all else, equal, consumption in retirement will be lower for women. Furthermore, although the pension gap between women and men has closed more rapidly than the earnings gap, women still tend to have lower coverage, lower participation rates, and lower contribution rates (Magenheim, 1993).

This paper differs from previous studies of gender differences in pension decisions by investigating pension allocations within the larger context of the household's overall portfolio balance. The studies by Bajtelsmit and VanDerhei (1997) and Hinz, et al. (1997) rely on data from a single employer/provider. Many other studies of pension allocation, such as those conducted by pension plan providers (e.g., Goodfellow and Schieber, 1997), are flawed in that the researchers lack complete information on the household. For example, a conservative pension portfolio might be part of an overall portfolio that includes investment in a risky privately-held business or a small stock mutual fund. A similar problem arises when the researcher considers individual investment portfolios in isolation because many households may pool their resources. One spouse may have a conservative pension portfolio when the other spouse has their pension invested in risky assets such that the overall household portfolio is more diversified than it would appear by considering each in isolation. Jianakoplos and Bernasek (1998), investigating gender differences in financial risk taking, find that demographic and household variables are highly significant determinants of risky decision making.

The paper proceeds as follows. Section 2 explains the theoretical models underlying our estimation of relative risk aversion. In Section 3 we explain the empirical methodology and provide the results of the estimations. Finally, conclusions and policy implications are given in Section 4.

2. Measurement of risk aversion

Under expected utility theory, the dollar amount and proportion of risky assets in an investor's portfolio are a function of wealth and individual risk preferences. The relationship between risk preferences and wealth was further developed by Pratt (1964) and Arrow

(1971), who define measures of absolute risk aversion (change in dollar allocation to risky assets as wealth increases) and relative risk aversion (change in portfolio allocation to risky assets as wealth increases). Based on empirical and experimental studies of individual decision-making under risk, there is now general consensus that *absolute* risk aversion declines with wealth. That is, individuals will invest a higher dollar amount in risky assets as their wealth increases. The characteristics of individual *relative* risk aversion are not as clear and seem to exhibit systematic differences by some characteristics such as age and income. The impact of gender on relative risk aversion was considered in Jianakoplos and Bernasek (1998) who find evidence that single women exhibit greater relative risk aversion than single men do.

The empirical estimation of risk aversion in pension allocations undertaken in this paper follows the methodology developed by Friend and Blume (1975). This methodology for measuring relative risk aversion is also employed by Siegal and Hoban (1982,1991), Morin and Suarez (1983), Ballante and Saba (1986), Riley and Chow (1992), Jianakoplos and Bernasek (1998), and Schooley and Worden (1996).

They define an individual's division between risky and riskfree assets in their portfolio, in the absence of taxes, according to the following:

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} * \frac{1}{C_k} \tag{1}$$

where α_k is the proportion of investor k's net worth that is placed in risky assets, $E(r_m - r_f)$ is the expected difference between the return on the market portfolio of risky assets (r_m) and the return on the risk free asset (r_m), σ_m^2 the variance of the returns on the market portfolio of risky assets, C_k is Pratt's measure of relative risk aversion $(C_k = [-U“(W_{kt})/U'(W_{kt})]W_{kt})$” and W_{kt} is investor k's wealth in period t. We ignore the effects of taxes in the estimation of the model based on previous research which shows that taxes do not have a significantly affect on the results (Bellante and Saba, 1986).

The model assumes that financial assets are infinitely divisible and can be traded with zero transactions costs. These assumptions are problematic when applied to housing wealth and human capital. For that reason, some studies estimate the value of wealth with and without the value of housing (Friend and Blume, 1975). To include human capital in net wealth, a reformulation of Eq. (1) is required takes into account the dependence of α_k on the covariance between the return on the market portfolio (r_m) and the return on human wealth (r_h). This results in the following specification for allocation to risky assets:

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} * \frac{1}{C_k(1 - h_k)} - \frac{h_k}{(1 - h_k)} * \beta_{h,m} \tag{2}$$

where h_k is the ratio of investor k's human wealth to net wealth, and $\beta_{h,m}$ is the ratio of the covariance of r_m and r_h to σ_m^2. This equation can be simplified however, by making use of the findings by Liberman (1980) and Fama and Schwert (1977) that $\beta_{h,m}$ is zero. Then Eq. (2) becomes:

$$\alpha_k = \frac{E(r_m - r_f)}{\sigma_m^2} * \frac{1}{C_k(1 - h_k)} \tag{3}$$

For the analysis in this paper, Eq. (3) is rewritten to focus on the proportion of risky *pension* assets in an individual's portfolio as follows:

$$\alpha_{k1} = -\alpha_{k2} + \frac{E(r_m - r_f)}{\sigma_m^2} * \frac{1}{C_k(1 - h_k)} \tag{4}$$

where α_{k1} is the proportion of net worth of investor k in risky *pension* assets and α_{k2} is the proportion of net worth of investor k in *other* risky assets. Eq. (4) forms the basis for estimating the coefficient of relative risk aversion when we consider an individual's investment in risky pension assets.

3. Empirical model and estimation

3.1. Data

This study employs data from the 1989 *Survey of Consumer Finances* (SCF89) to examine whether defined contribution pension allocation decisions differ by gender. The SCF89 includes interview data collected from a sample of 2, 277 households, chosen to be representative of households in the contiguous 48 states of the United States. Because one of the principal goals of the survey was to obtain estimates of household wealth, which is a highly skewed variable, an additional oversampling of 866 wealthy households was undertaken, selected from tax records to represent wealthier households. The combined sample of 3,143 households reported on the composition of their balance sheets, employment status, income, pensions, and other economic and demographic information. Kennickell and Shack–Marquez (1992) provide more details on the survey methods. According to several studies (Curtin, et al., 1989; Juster and Kuester, 1991; and Starr–McCluer, 1996) the *Surveys of Consumer Finances* are the best available source of individual household wealth data collected in the United States.

The SCF89 respondents reported balances in defined contribution pensions (DCPs) for both themselves and spouse/partners, if any. Because the focus of this study is on pension balances of individuals, rather than of households, data for respondents and spouses are included separately in the sample. Consequently, pension allocation behavior is examined for a sample of 5, 287 individuals—the 3, 143 respondents and an additional 2, 144 spouse/partners. In the cases where there are two individuals from the same household, they have the same household wealth, because there is no basis for dividing their joint assets. Because of the oversampling of the wealthy households, all summary statistics reported in this paper are sample weighted. In addition, the multiple imputation procedure employed on the public-use data tapes by the Federal Reserve System to handle missing data is used here.

3.2. Empirical methodology

Based on Eq. (4), that is the theoretical basis for the allocation of an individual's portfolio into risky pension assets, the estimating equation takes the following specification:

$$\begin{aligned} ALPHA = \beta_1 &+ \beta_2 ln\ WEALTH + \beta_3 AGE + \beta_4 AGE^2 + \beta_5 AGE\text{-}S \\ &+ \beta_6 AGE^2\text{-}S + \beta_7 EDUC\text{-}12 + \beta_8 BLACK \\ &+ \beta_9 KIDS + \beta_{10} SINGLE + \beta_{11} HUMAN_j + \beta_{12} HUMAN\text{-}S \\ &+ \beta_{13} RISKY + \beta_{14} HOMEOWNER + \beta_{15} OTHERPENS \\ &+ \beta_{16} OTHERPENS\text{-}S + \beta_{17} LAMBDA + \mu, \end{aligned} \tag{5}$$

where *ALPHA* is the ratio of *individual* holdings of dollar balances in DCPs to total *household* wealth (*WEALTH*) that includes both riskfree and risky assets. Riskfree assets include dollar balances in checking, savings, and money market accounts, certificates of deposit, U.S. savings bonds, IRA balances invested in certificates of deposit or bank accounts, and the cash value of life insurance less policy loans outstanding. Risky assets are the sum of: balances in IRAs not invested in bank deposits, stock holdings less margin loans outstanding, bonds, trust assets, the net value of real estate other than residential housing, the net value of businesses owned, the net value of other miscellaneous assets (e.g., precious metal, futures contracts, art work, etc.) reported by the household, and balances in DCPs.

To control for demographic differences, the specification includes: *AGE* and AGE^2, the individual's age in years and it's square; *AGE-S* and AGE^2-S, age and age squared of the spouse, if any; *EDUC*-12, a dummy variable that equals one if the individual has completed more than 12 years of schooling; *BLACK*, a dummy variable that equals one if the individual's race is reported as black; *KIDS*, the number of children living in the household; and *SINGLE*, a dummy variable equal to one if the individual's marital status is not reported to be married or living with a partner.

A number of variables are included to capture other aspects of the individual's portfolio. *RISKY* is the ratio of other risky assets, excluding assets held in DCPs, to *WEALTH* (the empirical estimate of α_κ) in Eq. (4). Other risky assets are all household risky assets except those included in $ALPHA_{ij}$. *HUMAN* and *HUMAN-S* are the ratios of the individual's and spouse's (if any) human capital to wealth, respectively. Human capital for each individual is calculated as the present value of the stream of future earnings, assuming that current wages, salaries, and/or self-employment earnings grow at a constant rate until retirement. Retirement is assumed at age 65 for those 65 or younger. If the individual is still working and between the ages 65 and 69, current earnings are assumed to continue for four more years; if between 70 and 74, to continue for three more years; if between 75 and 79, to continue for two more years; and if over 79, for one more year, consistent with Friend and Blume (1975). The discount rate is assumed to be 2%, which approximates the long run growth in real GDP. Although this measure of human capital is obviously an approximation, analysis by Thornton, Rodgers, and Brookshire (1997) suggests that the assumption of a constant growth rate of earnings, rather than the traditional inverted u-shaped pattern, is supported by longitudinal data.

Given the ambiguity between investment and consumption aspects of residential housing, rather than including it as a risky asset, we have included a dummy variable, *HOMEOWNER* that equals one if the respondent owns a house. *OTHERPENS* and *OTHERPENS-S* are dummy variables that equal one if the individual or spouse, respectively, reports entitlement to defined benefit pensions.

Following previous research, the sample is limited to those individuals with $WEALTH_j$ greater than $1, 000. Furthermore, the nature of the question under consideration requires that the sample be limited to those individuals with defined contribution pensions. If sample selection were random, OLS would be an appropriate estimation technique. However, if the sample selection is not random, OLS yields inconsistent results (Greene, 1993). To correct for possible sample selection bias, Heckman's (1979) two-step procedure is employed. A probit regression of the factors that influence inclusion in the sample is estimated over all observations jointly with Eq. (5). The specification of the probit equation is:

$$HASDC = \gamma_1 + \gamma_2 AGE + \gamma_3 UNION + \gamma_4 BIGFIRM + \gamma_5 PROF + \gamma_6 SALES + \gamma_7 CRAFTS + \gamma_8 LABOR + \gamma_9 FARM + \upsilon, \tag{6}$$

where *HASDC* is a dummy variable that equals one if the individual has a defined contribution pension and has *WEALTH* greater than $1, 000. The explanatory variables include: *AGE*, *UNION*, a dummy variable that equals one if the individual belongs to a union, *BIGFIRM*, a dummy variable that equals one if the individual works for a firm employing over 500 people, and a set of five occupational dummies (*PROF*, *SALES*, *CRAFTS*, *LABOR*, and *FARM*), where the excluded occupational category is service jobs. An estimate of the inverse Mill's ratio is calculated from this equation and included in Eq. (5) as the variable *LAMBDA*.

3.3. Results

Because the sample used for analysis in this paper is comprised of only those survey participants who report having DCPs and wealth greater than $1, 000, Table 1 provides a comparison of variable means for the DCP subset and the rest of the SCF89 sample. Individuals in this subset are, on average, more likely to be younger, to be union members, to be employed by a large firm, to have higher education, and to have more children. Comparison of male and female variable means shows differences that would be expected. On average, women with DCPs allocate a smaller proportion of wealth to their pensions (27%) compared to men (35%). The results of the first stage probit estimation, that are available from the authors upon request, indicate that the survey subset is significantly different from the overall SCF89 survey sample. The inclusion of the *LAMBDA* variable in the estimation procedure therefore serves to ensure that the other coefficients are consistent.

The results of the full information maximum likelihood estimations of Eq. (2) are shown separately for men and women in Table 2. To test whether the factors determining the proportion of wealth allocated to DCPs differ by gender, all of the variables in Eq. (2) were

Table 1
Variables means

	Defined contribution pension		No defined contribution pension	
	Women	Men	Women	Men
Alpha	0.27	0.35	—	—
Wealth	116, 044	212, 933	134, 763	148, 497
Age	40.5	41.6	48.4	37.4
Age-S[a]	41.1	39.8	48.5	46.5
Educ-12	0.58	0.68	0.35	0.41
Black	0.10	0.06	0.13	0.08
Kids	0.99	1.21	0.95	0.92
Single	0.35	0.15	0.33	0.20
Human	32.33	45.8	194.76	81.51
Human-S[a]	32.76	12.30	192.90	99.36
Risky	0.36	0.34	0.41	0.42
Homeowner	0.74	0.78	0.62	0.63
Other pension	0.41	0.42	0.14	0.25
Other pension-S[a]	0.43	0.20	0.27	0.17
Union	0.26	0.25	0.07	0.16
Big firm	0.66	0.60	0.16	0.23
Professional	0.39	0.46	0.13	0.18
Sales	0.49	0.18	0.20	0.13
Crafts	0.01	0.19	0.01	0.15
Labor	0.06	0.11	0.05	0.12
Farm	—	0.01	0.01	0.04
N	319	573	2, 489	1, 906

[a] Means are calculates only for individuals with a spouse present.

interacted with a dummy variable *FEMALE* and the equation was re-estimated for the sample including both men and women. A likelihood ratio test of the null hypothesis that all the female interaction terms equal zero is rejected, indicating that the factors determining women's allocation of wealth to DCPs are different from men's. The test statistic was 220.66 distributed χ^2 with 16 degrees of freedom. The critical value at the 1% level of significance is 31.99. Thus, the null hypothesis is rejected.

Coefficients that differ significantly between the men's and women's equations are indicated in Table 2. Significant gender differences exist for age (both respondent's and spouse's), education, number of children, marital status, human capital (both respondent's and spouse's), allocation to other risky assets, and having claims on other pensions.

The coefficient of *lnWEALTH* is an estimate of relative risk aversion (C_k) up to a positive multiplicative constant. A positive (negative) coefficient indicates decreasing (increasing) relative risk aversion. For men, the coefficient is significantly positive, indicating decreasing relative risk aversion. The estimated coefficient for women is negative, but not significantly different from zero, indicating constant relative risk aversion. Thus women exhibit greater relative risk aversion than men in the allocation of wealth to DCPs, holding other factors constant.

To illustrate the impact on individual portfolios, consider the following application of these estimation results. If initial wealth for both men and women is assumed to be \$116, 000, the mean wealth of the women in the sample, and all other variables are held

Table 2
Dependent variable: Proportion of wealth held in defined-contribution pensions

	Women		Men	
Independent variables	COEF	SE	COEF	SE
ln Wealth	−0.004†††	0.004	0.007***	0.002
Age	0.021***††	0.006	0.005	0.003
Age^2	−0.000***	0.000	−0.000	0.000
Age-S	−0.027***†††	0.006	0.006**	0.002
Age^2-S	0.000***†††	0.000	−0.000**	0.000
Educ-12	−0.015†††	0.011	−0.054***	0.010
Black	−0.004	0.018	0.002	0.018
Kids	0.007†	0.005	0.017***	0.003
Single	−0.634***†††	0.146	0.168***	0.050
Human	−0.000†††	0.000	0.000***	0.000
Human-S	−0.000	0.000	−0.000	0.000
Risky	−0.376***†††	0.018	−0.561***	0.015
Homeowner	−0.027**	0.014	−0.013	0.011
Other pension	−0.014†††	0.011	0.024***	0.008
Other pension-S	−0.025**††	0.013	0.011	0.010
Constant	0.650***†††	0.106	0.161**	0.072
Lambda	−0.028**	0.013	0.022**	0.010
N:Probit|Regression	2, 808	319	2, 479	573
Log likelihood[1]	−3140		−4707	

*,**,*** Significantly different from zero at the 10%, 5%, and 1% levels, respectively.

†,††,††† Significantly different from male coefficient at the 10%, 5%, and 1% level, respectively.

[1] The likelihood ratio statistic for the women's equation was 2, 929.96 distributed X^2 with 23 degrees of freedom. The equation is significant at the 1% level. The likelihood ratio statistic for the men's equation was 2, 469.51 distributed X^2 with 24 degrees of freedom. The equation is significant at the 1% level.

constant at the sample means for men and women separately, the proportion of wealth held in DCPs is predicted to be 27.1 and 35.5% for women and men, respectively. If wealth is now increased to $213, 000, the mean wealth of men in the sample, the proportion of wealth held in DCPs is predicted to decrease slightly to 26.3% for women and to increase only slightly to 35.9% for men.

The gender difference in relative risk aversion explains only part of the difference in allocation of wealth to DCPs. For example, an increase in number of children is estimated to increase allocations to DCPs for both men and women, but by a small proportion for women. Holding everything else constant, single men are estimated to allocate more to DCPs compared to married men, but single women are estimated to allocate significantly less than married women. When either the individual or spouse has access to pensions other than DCPs, men are estimated to increase relative allocations to DCPs, but women are estimated to reduce their DCP allocations.

One way to assess the relative importance of the factors that contribute to the lower allocation of wealth to DCPs by women is to consider the following example. If the sample mean characteristics for women are applied to the coefficients of the men's equation, the allocation to DCPs is predicted to be 33.8% of wealth compared to the sample average of 27%. This would bring the female allocation to DCPs very close to the mean for men which is 35%. On the other hand, if women were assumed to have the same characteristics as the sample average for men, and these mean values were applied to the estimated coefficients of the women's equation, the predicted proportion of wealth in DCPs would increase to only 27.9%. Thus, the gender differences in the allocation of wealth to DCPs are largely attributable to differences in male versus female behavior. This is a reflection of the differences in the estimated regression coefficients, rather than differences in the characteristics of women versus men as summarized in the variable means.

4. Conclusions and policy implications

Although several previous studies have examined the issue of gender differences in investing, this study specifically considers the allocation of wealth to pensions and improves on earlier studies by including important socio-economic and demographic explanatory variables. The results of this analysis demonstrate that there are significant gender differences in allocation of wealth into defined contribution pensions. This study improves on earlier research by analyzing pension decisions within the broader context of the household portfolio.

This conclusion has important implications for public policy, particularly in light of recent demographic and legislative trends. Although pension coverage rates for women have improved substantially in the last two decades as the number of women in the workforce has increased, this study indicates that women allocate a smaller proportion of their total wealth to these retirement vehicles. At the same time, Social Security replacement ratios are lower than they have been in the past and most new pensions require self-direction of pension account allocations. Given evidence that women tend to be very risk averse with respect to the pension allocation decision, it is likely that women will retire with significantly lower pension wealth than their male counterparts. Furthermore, this smaller wealth will have to be spread over a longer retirement due to greater average longevity.

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