



1995

Risk Aversion and Pension Investment Choices

Vickie L. Bajtelsmit

Jack L. VanDerhei

Follow this and additional works at: https://repository.upenn.edu/prc_papers



Part of the [Economics Commons](#)

Bajtelsmit, Vickie L. and VanDerhei, Jack L., "Risk Aversion and Pension Investment Choices" (1995).
Wharton Pension Research Council Working Papers. 580.

https://repository.upenn.edu/prc_papers/580

The published version of this Working Paper may be found in the 1997 publication: *Positioning Pensions for the 21st Century*.

This paper is posted at ScholarlyCommons. https://repository.upenn.edu/prc_papers/580
For more information, please contact repository@pobox.upenn.edu.

Risk Aversion and Pension Investment Choices

Disciplines

Economics

Comments

The published version of this Working Paper may be found in the 1997 publication: *Positioning Pensions for the 21st Century*.

Positioning Pensions for the Twenty-First Century

Edited by Michael S. Gordon,
Olivia S. Mitchell, and Marc M. Twinney

Published by

The Pension Research Council

The Wharton School of the University of Pennsylvania

and

University of Pennsylvania Press

Philadelphia

Copyright © 1997 The Pension Research Council of the Wharton School
of the University of Pennsylvania

All rights reserved

Printed in the United States of America on acid-free paper

10 9 8 7 6 5 4 3 2 1

Published by

University of Pennsylvania Press

Philadelphia, Pennsylvania 19104-6097

Library of Congress Cataloging-in-Publication Data

Positioning pensions for the twenty-first century / edited by Michael S. Gordon, Olivia S.
Mitchell and Marc M. Twinney.

p. cm.

Includes bibliographical references and index.

ISBN 0-8122-3391-3 (acid-free paper)

I. Pensions—United States. I. Gordon, Michael S. II. Mitchell, Olivia S.

III. Twinney, Marc M.

HD7125.P67 1997

331.25'2'0973—dc21

96-53837

CIP

Chapter 4

Risk Aversion and Pension Investment Choices

Vickie L. Bajtelsmit and Jack L. VanDerhei

If current trends in mortality and labor force participation continue, retirees in the twenty-first century can expect to live longer and healthier lives than their twentieth-century counterparts.¹ This implies that, for those baby boomers who survive to age 65, wealth and income in retirement will need to be sufficient to support more than twenty years of retirement.² Since Social Security benefits replace only a small portion of average pre-retirement earnings, they cannot necessarily be viewed as an adequate safety net for individuals with insufficient savings, particularly given the future tax increases that will be necessary to support promised benefits beyond the early part of the next century.³ It is therefore essential that today's workers be encouraged to make savings choices during their working years that will enable them to achieve their retirement income goals.

As a backdrop for exploring the future of pension policy, this chapter focuses on the emergence of defined contribution plans as primary pension vehicles and the implications of this trend for plan participants and their retirement income security. Recent theoretical and empirical evidence concerning individual investment decisionmaking suggests that individuals are more risk averse and have more diverse reasons for saving than do their employers. They are therefore expected to allocate their plan assets more conservatively, resulting in lower accumulated assets to fund retirement. Furthermore, the diversity of individual characteristics and needs implies that the allocations of individual participant accounts can be expected to exhibit a great deal of variation. If risk aversion is higher for certain groups, such as women, minorities, or low-income households, greater conservatism in retirement investment will result in lower income replacement for these groups.

Due to the lack of available data, most studies of defined contribution

asset allocation have used aggregated data, and there have been relatively few studies examining individual decisionmaking. The data set used in this chapter includes information on a sample of 20,000 active management participants for a single, large United States employer, as well as valuable demographic information for each participant. We examine asset allocation decisions as a function of demographic characteristics that have been suggested in the literature to be associated with risk aversion. The empirical evidence indicates that demographic characteristics of workers are important determinants of their allocation decisions. Generally more conservative patterns of investment by women are also found to exist. We conclude with a discussion of policy implications and areas for further consideration.

The Emerging Importance of Defined Contribution Plans

Predominance of New Plans

In the last decade, there have been significant changes in pension provision. Although Yakoboski and Silverman (1994) report that the much publicized downward trend in pension sponsorship and participation rates during the 1980s has apparently reversed direction, there are still many employers that do not offer pension plans and, even when offered, not all employees choose to participate. Based on tabulations by the Employment Benefit Research Institute (EBRI) of the April Current Population Survey, 62.1 percent of all civilian nonagricultural wage and salary workers age 16 and over work for an employer where a plan is sponsored. When a plan is available, 75.9 percent of these workers choose to participate. More than half of all workers in this category are not participating in a plan.

Most new plans are of the defined contribution type, and these plans are an increasing percentage of total plans. Eighty-four percent of all plans offered are now defined contribution and, for 16 million participants, this plan is their primary plan. The total number of private-sector qualified plans increased in number by 80,000 between 1985 and 1990. However, during that period, the number of defined benefit plans declined by 57,000 and that of defined contribution plans increased by 137,000.

Key Features of Defined Contribution Plans

The increasing proportion of defined contribution plans is related to characteristics that distinguish them from defined benefit plans. The key differences are related to risk bearing and investment decisionmaking.

Risk Bearing

In defined contribution plans, ultimate retirement income is dependent on the level of contributions made to the plan and the investment performance of the participant's account. In comparison, defined benefit plans typically provide retirement benefits based on years of service and level of pay at retirement. Thus, defined contribution plan participants face much greater uncertainty regarding the expected level of retirement benefits and increasing short-term investment risk as they approach retirement. By comparison, the benefit promise to defined benefit participants becomes more certain as they approach retirement. It has been argued that the shifting of risk to employees is a trend that is detrimental to retirement income security. However, when the trends are examined carefully, it is apparent that most new plans are for small employers (two to nine employees) who did not previously provide a retirement plan at all. Since small employers are not substantially better than their employees at bearing investment or inflation risk, the trend is probably a net gain in that more individuals have access to tax-preferred savings vehicles than previously.

From the standpoint of risk bearing, an advantage of defined contribution plans over final average defined benefit plans is that they can provide lump sum "cash-outs" for workers who leave the firm. If workers change jobs several times over their working careers, participation in a different defined benefit plan at each employer will result in lower total retirement income as compared to participation in a single plan for their lifetime. This is due to the loss of inflation adjustment when benefits are determined based on the last salary earned at a previous employer. In a defined contribution plan, a participant who leaves his or her current employer can roll over plan assets into a different retirement savings vehicle, thus avoiding the penalty for mobility that is inherent in the defined benefit plan.

Investment Decisionmaking

The second important characteristic of defined contribution plans is that participants are often allowed to contribute additional funds to the plans and are required to direct the allocation of their accounts into different investment alternatives. Calculation of the current contribution levels necessary to support future retirement is an extremely complex actuarial and financial problem that requires estimates of investment returns, future inflation, life expectancy, wage growth, and many other factors. Most individuals simply do not have the mathematical skills necessary to do more than ballpark the answer. As an aid to participant de-

TABLE 1 Asset Allocations of Private Pension Plans with More Than 100 Participants, 1991

<i>Asset Class</i>	<i>Percent of DC Assets</i>	<i>Percent of DB Assets</i>
Cash Equivalents	13.0	6.6
Government Securities	10.0	28.7
Corporate Debt	7.8	15.5
Stock	26.6	42.9
Employer Securities	38.5	0.9
Other	4.1	5.4

Source: U.S. Department of Labor tabulations of the 1991 Form 5500s.

cisionmaking, it is increasingly common for employers or plan providers to provide participants with projections of expected retirement income. For example, TIAA-CREF routinely provides tables of replacement ratios resulting from specific investment choices for hypothetical entry and retirement age scenarios (TIAA-CREF 1994).

The contribution decision is closely tied to the allocation decision, since conservative investments will require greater current contribution levels to achieve desired retirement goals. Evidence of allocations for different types of plans indicates that defined contribution plans have had lower allocations to equities than have defined benefit plans. Based on the United States Department of Labor summary of the 1991 Form 5500 Annual Reports, Table 1 provides the percentage allocations to various asset classes by single employer plans with more than 100 participants (excluding assets held in pooled or separate accounts, trusts, and insurance company general accounts, for which asset allocation information is not given). The allocation to equities (not including employer stock) by defined benefit plans is nearly twice the equity allocation by defined contribution plans.

Will Current Investment Decisions Meet Retirement Goals?

Participation

Studies seem to indicate that the baby boom is not preparing adequately for retirement. Bernheim (1993) compared simulated savings requirements to actual savings and found that, not including housing wealth, baby boomers are saving at one-third the necessary rate. With housing wealth included, they are still saving at only 84 percent of the necessary rate. A study by Arthur D. Little, Inc. (1993) reached similar conclusions,

estimating that even households with pension plans will fall far short of retirement goals. Those headed by women and those without private pensions will fare substantially poorer. Furthermore, since Social Security currently replaces a large proportion of pre-retirement income for these groups, any substantial alterations in that system will impact heavily on their financial well-being relative to the rest of the population.

It could be argued that one of the best ways to encourage participation by employees in an employer-sponsored plan is for the employer to offer a salary reduction plan with employer matching contributions. For an employee in the 28 percent tax bracket, a one dollar contribution, matched by the employer, is equivalent to receiving US \$2.76 in current income. Thus, in the absence of liquidity constraints, it would be expected that employees would contribute up to the maximum percentage of compensation that is eligible for matching. However, the groups that are more likely to be liquidity constrained are also the groups that have shown lower levels of participation in the past. It is also possible that secondary funding objectives, such as the purchase of a house or saving for college tuition, will supersede retirement planning for younger families, thus reducing participation.

Although participation percentages are higher for plans that offer employer matches, the difference is not as great as one might expect (77.8 percent as compared to 71.8 percent). The April 1993 Current Population Survey data indicates that more than half of employers with salary reduction plans provide matching contributions with an average match rate of 65 percent for every dollar contributed by the employee. The average contribution rate by participants in plans without matching was slightly lower than those that provided matching (Yakoboski and Reilly 1994).

Salary reduction plans are another means by which employees can increase their overall savings level, and participation in these plans has been increasing over time. During the period 1988 to 1993, the fraction of workers participating in salary reduction plans, such as 401(k) plans, 457 plans, and 403(b) plans, increased from 15.3 percent to 23.8 percent, representing a 62 percent increase in the number of participants. Among workers with an employer offering a salary reduction plan in 1993, 64.4 percent actually participated in the plan as compared to 57.0 percent in 1988 (Yakoboski and Silverman 1994).

Lump-Sum Distributions

There is evidence that many individuals who receive lump-sum distributions spend some or all of the distribution rather than preserving it on a tax-deferred basis. Tabulations of the April 1993 Current Population

Survey indicate that over 11 percent of the experienced labor force aged 25 to 64 have received a lump-sum distribution from a pension or retirement plan. Of these, 29 percent spent all of the money received, 21 percent rolled it over into another form of retirement savings, and 35 percent saved or invested it in some other form. Although the percentage of recipients who save the entire distribution shows an upward trend, only 6 percent in 1980 and 15 percent for the years 1981 to 1986 did so. Nevertheless, the large percentage of distributions that are not rolled over is cause for concern. Myopic treatment of lump-sum distributions reduces the ability of individuals to meet their retirement income goals without substantial contributions in later years. The advantages normally attributed to defined contribution plans for individuals who switch jobs several times over their lifetime disappear without rollover of contributions to each plan.

With the increasing use of defined contribution plans, it is more likely that individuals will receive distributions several times. The United States Department of Labor (1993) estimates that, between the ages of 18 and 30, the average number of jobs held is 7.5 (with a median of seven). Although this number has increased over the last two decades, it is not clear whether this has been due to greater job mobility, more involuntary terminations, or some other factors. A recent examination of job tenure figures for prime age workers (25 to 64 years) revealed that tenure levels in the 1980s and early 1990s were actually higher than for comparable age workers in the three previous decades.⁴ Whether the larger number of jobs held by younger workers will make it more likely that participants will spend lump-sum distributions is not clear but should certainly be watched closely for its potential impact on retirement income security. Provision of information regarding this issue should undoubtedly be an important element of any participant education program.

Asset Allocation in Defined Contribution Plans

Although it is not clear that defined benefit plans are being replaced with defined contribution plans, the increased prevalence of the latter type of plan shifts much of the burden of retirement planning from employers to individuals.⁵ Available evidence indicates that, in the aggregate, defined contribution plan assets tend to be more conservatively invested than their defined benefit counterparts, an indication that individuals are making different allocation decisions than professional plan managers.

Greater conservatism by individuals could be due to a lack of knowledge regarding the risk and return characteristics of investment alternatives. The complexities of the economic and investment environment

and the proliferation of different choices are confusing to even the best informed and, although the variety of investment options offered under salary reduction plans has increased, employers have shown reluctance specifically to advise participants on investments.⁶ They recognize that even if they carefully explain the potential for short-term losses to participants, individuals do not have much patience in down markets. Evidence of this can clearly be seen in the large volume of shares sold at the bottom of the markets in 1987 and 1989.

Furthermore, financial experts are not in agreement regarding optimal investment strategies for individuals over their life cycle. Clearly, since individuals differ in time to retirement, level of income, home ownership, inheritance prospects, liquidity requirements for other major expenditures, and other characteristics, their investment portfolios must differ as well to satisfy their particular needs. The pension portfolio is only one part of the individual's wealth, which includes housing wealth, human capital, Social Security wealth, and other assets. If the pension allocation decision is made in the context of the individual's overall portfolio, ownership of other non-pension risky assets would imply that the pension's allocation to risky assets should be adjusted downward. Since managers of defined benefit plans are concerned primarily with meeting the employers' benefit obligations as opposed to balancing pension portfolio wealth with other participant investments, it is not surprising that their allocation decisions would differ from those made by individual participants.

Risk Versus Return

There is a general consensus based on historical data that, for long-term investors, returns on equity portfolios will exceed returns on all other asset classes. Average annual returns for stocks over the years 1964 to 1993 exceeded bond returns by more than 3 percent. If invested for 30 years at the average annual rates of return for that period of time, a one dollar annual contribution to a stock fund in 1964 would have accumulated to almost twice as much as the same investment in a bond fund by 1993.⁷ Although this is a simplified example, it illustrates the powerful effect of long-term compounding. When inflation is taken into account the proportionate difference in accumulation is greater, since the "safe" investment returns do not always have positive real returns. Treasury bills generated negative real after-tax returns in fourteen of the years 1970 to 1991 (Williamson 1994).

If the higher returns on stocks are accompanied by higher risk, then lower allocations to stocks in defined contribution plans may be a reflection of greater participant risk aversion. Although Siegel (1994) ar-

gues that, for long holding periods, the risk of stock portfolios is lower than that of bond portfolios, there is strong disagreement on this point (Bodie 1995; Samuelson 1963 and 1989).

In Siegel's study of nearly 200 years of returns on different asset portfolios, he shows that even in the worst (meaning worst for stocks and best for bonds) post-1926 thirty-year period, stock investment accumulations were three times that of bond investments. He demonstrates that, for long-term investors (twenty-year holding periods), the risk as measured by standard deviation of holding period returns is even lower than that of T-bills. For shorter time horizons there is less time diversification and therefore the reductions in risk are lower but still substantial. Furthermore, the investment strategies commonly referred to as "low risk" may in fact be the highest risk. Siegel finds that, for longer holding periods, real returns on fixed-income assets become relatively less certain. Bodie (1995) argues that, although the probability of a shortfall declines over the long run, this ignores the potential size of the shortfall. He models insurance against shortfall risk as a put option and shows that the price of this option actually increases with the time to maturity, thus casting doubt on the conventional wisdom regarding long-run stock investment risk.

An interesting aspect of this debate is the different impact that long-run stock investment may have on defined contribution versus defined benefit pensions. If Siegel's observations of past historical patterns hold true for the future, then it would seem that participants would be better served by investing substantial portions of their retirement portfolio in equities, at least until they are closer to retirement, and in fact this is the strategy often recommended by investment advisors. However, for defined contribution participants, the success of this strategy is sensitive to the choice of retirement date and may necessitate delaying retirement if the stock market does particularly poorly in the years immediately preceding that date. In contrast, as long as employers have an age-diversified set of employees, they will be better able to take advantage of time diversification, a fact that may explain the greater stock allocations in defined benefit plans.

Evidence of Individual Risk Aversion and Myopia

It is a generally accepted principle that investors do not make decisions based solely on expected outcomes, but also consider the possibility of deviation from the mean. The way in which individuals trade risk and return is subject to dispute,⁸ and decision theorists argue that behavioral decisions over uncertain outcomes are made with reference to a system of judgments and beliefs that are often based on faulty reasoning.⁹ For

individuals with high levels of risk aversion or loss aversion, a low-risk strategy will result in greater current utility. Unfortunately, over a long-term investment horizon, a short-term, low-risk investment strategy can result in negative real return. Although the available data regarding individual investment decisionmaking is not ideal for analyzing the issue of risk aversion, there have been several studies that provide evidence supporting the hypothesis that individuals exhibit some degree of risk aversion and myopia with regard to consumption. A recent study by Jianakoplos and Bernasek (1994) reports that, in the Surveys of Consumer Finances, when responses are sample weighted, 51.08 percent of all women in 1983, and 57.12 percent in 1989, indicated that they were not willing to take any financial risks at all. Compared to the men's responses of 36.4 percent for 1983 and 40.66 percent in 1989, and without controlling for other factors, women appear to be more risk averse than men. However, if women tend to have lower income and there is a correlation between income and risk-taking behavior, then the lower risk taking could be an income effect rather than a gender-related effect. In addition, if women are not the head-of-household, their risk aversion may not have as great an impact on household wealth.

The survey evidence of risk aversion in pension allocations is mixed. A Hewitt Associates (1993) survey found that where GICs were offered, they accounted for 47 percent of employee contributions, indicating fairly low risk tolerance. Employer stock accounted for 33 percent of employee contributions and 67 percent of employer contributions. Equity and balanced funds had much smaller average shares, accounting for only 21 percent and 13 percent respectively of employee contributions. Fidelity Investments, on the other hand, reports that, for companies with an employer stock option, 45.5 percent of plan assets were in equity (other than company stock), 16 percent in company stock, 28.7 percent in GICs.¹⁰ Without a company stock alternative, the stock and GICs each had larger shares (52.4 percent and 34.2 percent). Goodfellow and Schieber (this volume) report 52.8 percent of assets in their sample invested in GICs.

Another potential explanation for participant allocations is that they have a shorter time horizon for decisionmaking. In early working years, savings may be targeted toward housing, then for college expenditures. Alternatively, individuals may simply have a strong preference for current consumption. Often termed "myopia," short-sighted decision horizons may not be irrational but may instead be evidence that prevailing life cycle theories are flawed. However, one of the reasons for passage of Social Security and, later, ERISA was the observed failure of individuals to save adequately for the future. Although it could be argued that alternative reasons for saving are legitimate, the fact remains that inadequate

savings, or inadequate accumulation of savings due to overly conservative investment by a large segment of the population, can have serious implications for the future.

An additional observation regarding conservatism in investment allocations is that individuals tend to exhibit inertia (i.e., they do not change their allocations in response to changes in age or in the market). A study examining allocations between the TIAA fixed income alternative and the CREF equities fund found that the vast majority of individuals picked a 50–50 mix and did not alter their allocations in later periods. In some ways, this finding is consistent with a strategy of investing more in equities in later years, since the better performance of the equities account will increase the allocation to that account over time. However, failure to change allocations as retirement approaches would probably result in an overly risky portfolio in later years. Furthermore, in many fixed income alternatives, there are restrictions on changing allocations of balances, which makes large portfolio shifts impossible (for example, TIAA restricts movements out of their guaranteed contracts to 10 percent of the balance per year).

Investment in Employer Securities

Many defined contribution plans now offer the opportunity for participants to invest all or part of their pension contributions in the plan sponsor's stock. For example, in the Hewitt sample above, 40 percent of the plans offered employer stock as an investment alternative for employee contributions and 50 percent offered it for employer contributions. Although one of the arguments originally put forth in favor of Employee Stock Ownership Plans (ESOPs) was that stock ownership would give employees incentive to work harder for "their own company," empirical evidence has shown only a weak relationship between employee stock ownership and stock returns (Kruse 1992). Furthermore, Conte and Jampani (1996) find that, although ESOP returns are higher than diversified equity portfolios, they are substantially riskier and, on a risk-adjusted basis, are substantially lower than those of diversified plans.

There are several possible explanations for popularity of employer stock investments. In some cases, high allocations to this asset class are due to restrictions on the employer match, which can be entirely in employer stock. However, employees often choose employer stock on their own. This may be because they feel they have an informational advantage over other investors in their employer's stock. Ownership of employer stock may give employees an "illusion of control" (Kahneman, Slovic, and Tversky 1987) over the performance of their investment as compared to alternatives that appear to be more volatile. It is also pos-

sible that individuals consider investment in employer stock the least risky of the investment alternatives, offering equity-like returns without the same level of perceived risk. A past history of good performance may add to this misconception.¹¹ Finally, the negative signal inherent in company managers selling their employer stock might result in allocations that exceed employees' desired allocations to that asset category. This may be particularly the case where employer matches are given in the form of employer stock.

Regardless of the past and current performance of an employer's stock, the fact remains that investment of pension dollars in employer stock violates one of the most basic rules of investing. Not only is the pension undiversified, but the employee has both human and financial capital tied to the success or failure of a single business. In the extreme, the failure of the employer, particularly when retirement is imminent, could be disastrous. Even without failure, poor stock performance late in a person's working career could severely impact retirement wealth. For example, if the employer's stock dropped in value just prior to retirement, it would result in a percentage decline in pension annuity comparable to the percentage decline in total portfolio value. It is doubtful that plan participants fully realize the extent of the risk they assume in investing in employer stock and, for obvious reasons, it is even more doubtful that any employer is going to tell them not to do so.

Is Risk Aversion a Group Characteristic?

The usual argument regarding differences in risk aversion is that "in the small" they make little difference (Pratt 1964). However, if certain groups exhibit largely different levels of risk aversion, there may be important implications for pension policy that go beyond mere preferences. For example, if wealthy households exhibit less aversion to investment risk than their poorer counterparts, "in the large" the net effect will be a wider wealth gap in retirement.¹²

More perplexing are the implications of risk preferences across race and gender. There is an economics literature that links risk-taking behavior to economic success, which depends upon, among other things, the decisions made over the lifetime that affect wages, income, and wealth. Observed wealth and income differences by race and gender, although often argued to be the result of discrimination, are also potentially explainable as the result of greater risk aversion exhibited by these groups. If this is the case, then the recent trend toward giving individuals greater control over their retirement investments could be particularly detrimental to elderly women who will be supporting their longer retirement period with less accumulated wealth than their male counterparts.

In addition, although the wage gap has narrowed in the last two decades, women and racial minorities still tend to earn less than white males in equivalent jobs, a fact that implies even greater retirement income inequality.

Although there is historical evidence that elderly women have never been as well off as their male counterparts, this may be the result of years of lower wages and labor force participation as opposed to differences in risk tolerance. At least for older generations, it was common for a woman to enter the labor force after the children were in school and, with lower education and experience, her lower income was considered secondary to her husband's.

The evidence on investment risk taking is not clear. Jianakoplos and Bernasek (1994) were unable to show any significant gender- or race-related differences in risk preferences after controlling for other explanatory characteristics such as savings, home ownership, insurance, and other assets. Riley and Chow (1992) find that asset holdings of women exhibit greater risk aversion than those of men, but they do not control for other characteristics such as age, income, and wealth. However, Hinz et al. (this volume) analyze recent survey data from the Thrift Savings Plan for federal government workers and find that gender differences in investing persist even after controlling for demographic differences.

Evidence from Individual Level Data

Sample Description

The sample of 20,000 management employees used in this study is based on the information supplied by a large United States employer and includes demographic, wage, and pension information on the firm's employees for calendar year 1993. Table 2 provides descriptive statistics for

TABLE 2 Sample Descriptive Statistics ($n = 16,963$)

<i>Variable</i>	<i>Mean</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard Deviation</i>
Age	43.88	22.95	64.98	8.53
Female	0.30	0	1	0.45
Tenure	17.58	1.91	46.97	9.06
Non-caucasian	0.17	0	1	0.37
Accumulated 401(k) balance (in US \$1,000s)	73.84	0	892.49	78.08

Source: Authors' calculations based on sample firm's internal records for 1993.

TABLE 3 Portfolio Allocations for Sample, by Gender

<i>Investment Choice</i>	<i>Beginning of Year 1993 Account Allocation</i>		<i>Allocation for 1993 Contributions</i>	
	<i>Men (n = 11,863)</i>	<i>Women (n = 5100)</i>	<i>Men (n = 11,863)</i>	<i>Women (n = 5100)</i>
Employer Stock	41.0%	42.1%	42.4%	43.5%
Diversified Equity Portfolio	14.2%	12.9%	18.8%	16.7%
Fixed Income (Government Bonds and GICs)	44.8%	45.0%	38.8%	39.8%

Source: Authors' calculations based on sample firm's internal records.

this sample. There are nearly twice as many men as women and, as might be expected, men are overrepresented in the sample of employees nearing retirement and those in the higher salary ranges.

The employer provided five investment alternatives for the plan participants during this time period, including employer stock, a diversified equity portfolio, a government bond portfolio, a guaranteed interest fund (GIC), and a socially responsible equity fund. In order to better distinguish low-risk and high-risk strategies, the GIC and government bond allocations are consolidated in the following analysis and discussion. Given the nonfinancial objectives that may influence the social choice fund, we exclude this asset class from the analysis. The allocation percentages for the reweighted account balances as of the beginning of year 1993 and for the 1993 contributions are given in Table 3 by gender.

Empirical Methodology

The empirical hypothesis is that employee characteristics will have an affect on the likelihood of allocation to particular asset classes. As in Hinz et al. (this volume), we estimate the Tobit under the assumption that the data are censored (i.e., observation of bunching at the extremes of the allocation choices indicates that the participants might have preferred to invest in portfolios with lower or higher risk than those offered in the plan).

Allocation Decisions

Tables 4 and 5 report the results for three different dependent variables: percent allocation to fixed income (government bonds and GICs);

TABLE 4 Determinants of Investment Allocations for 401(k) Account Balances

Independent Variables	Dependent Variable					
	(1) Percent in Fixed Income		(2) Percent in Equities		(3) Percent in Employer Stock	
	Coeffic. (Std. Err.)	Prob > Chi	Coeffic. (Std. Err.)	Prob > Chi	Coeffic. (Std. Err.)	Prob > Chi
Intercept	0.3674 (0.1258)	0.0035	0.1476 (0.1029)	0.1513	0.2153 (0.1178)	0.0677
Age	-0.0205 (0.0063)	0.0042	-0.0066 (0.0052)	0.2071	0.0201 (0.0060)	0.0007
Age ²	0.0003 (0.0001)	0.0001	0.0001 (0.0001)	0.1762	-0.0003 (0.0001)	0.0001
Female	0.0330 (0.0109)	0.0026	0.0035 (0.0092)	0.7067	-0.0251 (0.0102)	0.0142
Tenure	0.0204 (0.0029)	0.0001	-0.0360 (0.0024)	0.0001	0.0105 (0.0027)	0.0001
Tenure ²	-0.0005 (0.0001)	0.0001	0.0007 (0.0001)	0.0001	-0.0002 (0.0001)	0.0004
Salary	0.0032 (0.0003)	0.0001	0.0023 (0.0002)	0.0001	-0.0052 (0.0002)	0.0001
Race	-0.0003 (0.0131)	0.9840	-0.0101 (0.0110)	0.3606	0.0056 (0.0122)	0.6468
401(k) Wealth	-0.0017 (0.0001)	0.0001	0.0012 (0.00012)	0.0001	0.0018 (0.0001)	0.0001
401(k) Wealth ²	2.0906E-6 (3.21E-7)	0.0001	-1.383E-6 (2.57E-7)	0.0001	-2.69E-6 (3.27E-7)	0.0001

Source: Authors' calculations.

TABLE 5 Determinants of Allocations for Current Contributions

Independent Variables	Dependent Variable					
	(1) Percent in Fixed Income		(2) Percent in Equities		(3) Percent in Employer Stock	
	Coeffic. (Std. Err.)	Prob > Chi	Coeffic. (Std. Err.)	Prob > Chi	Coeffic. (Std. Err.)	Prob > Chi
Intercept	0.1433 (0.1696)	0.3980	0.0715 (0.1324)	0.5884	0.3738 (0.1410)	0.0080
Age	-0.0188 (0.0086)	0.0270	-0.0076 (0.0067)	0.2598	0.0201 (0.0072)	0.0050
Age ²	0.0003 (0.0001)	0.0009	0.0001 (0.0001)	0.2742	-0.0003 (0.0001)	0.0002
Female	0.0457 (0.0148)	0.0020	0.0045 (0.0118)	0.7028	-0.0388 (0.0123)	0.0016
Tenure	0.0203 (0.0039)	0.0001	-0.0356 (0.0031)	0.0001	0.0060 (0.0033)	0.0656
Tenure ²	-0.0004 (0.0001)	0.0001	0.0007 (0.0001)	0.0001	-0.0001 (0.0001)	0.0777
Salary	0.0020 (0.0003)	0.0001	0.0031 (0.0003)	0.0001	-0.0058 (0.0003)	0.0001
Race	0.0088 (0.0177)	0.6208	-0.0285 (0.0141)	0.0438	0.0165 (0.0147)	0.2604
401(k) Wealth	-0.0022 (0.0002)	0.0001	0.0014 (0.0001)	0.0001	0.0009 (0.0001)	0.0001
401(k) Wealth ²	2.5656E-6 (4.41E-7)	0.0001	-1.569E-6 (3.36E-7)	0.0001	-1.902E-6 (4.28E-7)	0.0001

Source: Authors' calculations.

percent allocation to diversified equities; and percent allocation to employer stock. For each asset category, the allocation is measured in two ways. Table 4 reports the empirical results for the likelihood of allocation for the account balance, which is measured as the dollar value of assets in the category divided by the total account balance. The estimated model for allocation of current contributions, measured as the dollar investment in the category for 1993 divided by the total contributions for 1993, is reported in Table 5. Although it might seem that these would be highly correlated, if pension participants tend to modify allocations for new contributions without modifying allocations in account balances, then both specifications have informational value. The account balance allocation is obviously a better indication of overall riskiness of the portfolio, but the current contribution allocation is more likely to capture changes that are made in response to changing life circumstances, such as job tenure, age, and accumulated wealth.

Explanatory Variables

The data set includes valuable demographic information on plan participants that allows us to control for factors that are hypothesized to influence risk preference and thus the likelihood of certain investment choices. Gender and race (defined as Caucasian or non-Caucasian) are binary variables, whereas the age, length of employment (tenure), salary, and total defined contribution savings (401(k) wealth) are continuous. To control for expected non-linearities in age, tenure, and wealth, squared terms were also used as controls. The results for the account balance allocations and the current contributions do not differ substantially in that the same variables are found to influence both decisions. Therefore, the following discussion applies to the results in both Tables 4 and 5.

Gender Effects

Consistent with existing theoretical and empirical literature, we find that the women in this sample are more likely to invest in the fixed-income alternative than are their male counterparts. Although fixed-income investment is less risky than stock investment, we do not necessarily view this result as conclusive evidence of gender differences in risk aversion. Missing information on marital status and other household wealth and income make it impossible to draw such a general conclusion. Although gender does not have a strong influence on diversified equity allocation, the employer stock results show that women are less likely than men to invest in this asset class.

Age and Job Tenure. Money managers often recommend a life-cycle approach to investment allocation. Although specific allocations may differ, this type of strategy usually results in lower-risk portfolios in the early years of work (when individuals have a greater need for liquidity), increasing allocation to equities during mid-work years, and reduced riskiness of the portfolio as retirement approaches. The coefficients on age and age-squared for the fixed-income allocation tend to support the non-linearity of the allocation decision over time. Age has a significant negative effect on the fixed-income allocation, but the positive sign on the squared term implies that the function has a minimum and that, at higher ages, individuals begin increasing their allocation to fixed-income securities. The age effect on allocations to employer securities is also non-linear, but shows the reverse pattern: allocations increase with age to a maximum, after which they decrease, a pattern that is consistent with a reduction in risk as retirement approaches.

After controlling for age, the impact of job tenure on the allocation decision was found to be one of considerable risk aversion for the first few years of employment with the sponsor, followed by a more aggressive asset allocation thereafter. Regression results (not included) with a series of dummy variables for age and tenure provided significant differences at all ages for the likelihood of investing in fixed-income assets between short- and long-tenure employees.¹³ In Tables 4 and 5, tenure has a significant positive effect on the fixed-income allocation, but the negative sign on the squared term implies that the function has a maximum and that, at longer tenures, individuals begin decreasing their allocation to fixed-income securities. The tenure effect on allocations to equities is also non-linear, but shows the reverse pattern: allocations decrease with tenure to a minimum, after which they increase.

Wealth and Income

The participants' pension account balance is used as a proxy for the missing household wealth variable and is shown to exhibit non-linearities indicative of a concave (risk-averse) utility function. The allocation to equities increases with wealth but at a decreasing rate, supporting the hypothesis of decreasing relative risk aversion. This variable has a similar impact on the employer stock allocation, showing that individuals are treating this as they would other risky investments.

Although salary appears positively to influence allocations to both fixed-income and equity securities, this effect is undoubtedly influenced by the significant negative relationship between salary and employer stock. This would be expected if the sponsor's stock options are positively correlated with employee salary.

Conclusions and Policy Implications

The trend toward giving individuals more control over investment of their defined contribution accounts has caused concern among pension economists who fear that overly conservative investment by risk-averse individuals will translate into lower retirement income. If certain groups, particularly those that already have lower income and wealth, exhibit different risk preferences, income and wealth differentials in retirement will be even greater. Existing theoretical work suggests that higher levels of risk aversion are associated with lower wealth, but empirical studies related to pension investing have been hampered by inadequacy of available data.

In this study, we used a rich database of employee pension and demographic characteristics to examine the hypothesis that individual characteristics are important determinants of pension allocation decisions. The general results indicate that investment allocations for this sample are consistent with an assumption of decreasing relative risk aversion. However, allocations to stock and fixed-income alternatives show a life-cycle pattern that conforms to expectations. As expected, those with shorter time horizons for investment and those with alternative motivations for saving are more inclined to invest in fixed-income securities, an empirical finding that is largely consistent with our hypotheses. Although more than one-third of all of the plan assets are invested in low-risk, low-return assets, the fact that this strategy is being used primarily by younger employees and those approaching retirement does not imply, as some have suggested, that individuals are generally too risk averse in their investing behavior.

Our results also provide evidence that gender has a significant effect on allocation decisions. Specifically, the women in this sample are significantly more likely to invest in fixed-income securities and are less likely to invest in employer stock. However, since we are missing important information on household wealth and marital status, this result does not necessarily imply that elderly women will be worse off in retirement. Given the potentially serious consequences of inadequate retirement wealth for women, this is an issue that deserves further examination.

Notes

1. For a recent discussion of the issues related to retirement and longevity, see Munnell (1991).

2. It is not currently expected that longer lives will imply retirement at older ages. In fact, the trend is to earlier retirement. In the 1980s, two-thirds of all men over the age of 60 were retired from the labor force. See Ransom, Sutch, and

Williamson (1991). Fries (1991), however, shows that although life expectancies have lengthened over the last decades, the average age of disability has not changed substantially.

3. In 1990, for those retired households with income at or more than three times the government-determined poverty level (US \$18,804 for a single person age 65 or over), Social Security benefits represented only 25 percent of retirement income. For higher income retirees, these benefits will be an even less important source of income; see Yakoboski and Silverman (1994).

4. These figures are based on compilation by the Employee Benefits Research Institute of United States Department of Labor statistics and reported in Yakoboski and Silverman (1994).

5. Silverman (1993) reports that although the number of primary defined benefit plans declined over the period 1985–1989, two-thirds of the decline was in plans with fewer than nine participants, and the number of large defined benefit plans has remained stable. At the same time, there has been a large increase in the number of defined contribution plans across all plan sizes, indicating that the increases were not simply the result of shifts from one type to the other.

6. According to a Hewitt (1993) survey, 4.5 choices are offered on average, with equity options being offered by 89 percent of the plans. Other popular options are money market accounts, GICs, and employer stock.

7. See Ibbotson Associates, Chicago as cited in Blair and Sellers (1994). With annual compounding, an annuity of one dollar for 30 years at 10.5 percent (the thirty-year holding period return for stocks over that period) has a future value of US \$180.88. The comparable bond investment with annual interest of 7.4 percent has a future value of US \$101.54. Equivalently stated, the stock investor could have reduced their annual contribution to US \$0.56 and achieved the same portfolio value as the one dollar annual contribution to the bond fund.

8. Mossin (1968) suggested that investors may exhibit partial myopia, having utility functions characterized as constant relative risk aversion (CRRA) or constant absolute risk aversion (CARA). With CRRA, they will choose portfolios each period as if that period were their last. With a risk free asset choice, the utility function will be CARA. Musumeci and Musumeci (1996) perform dynamic programming simulations under different utility assumptions and find that simulated outcomes with partial myopia utility is consistent with observed patterns of investing (i.e., greater proportions in the low-risk asset choices).

9. For a discussion of these generally invalid heuristics and biases, see Kahneman, Slovic, and Tversky (1987). As an example in the investment context, individuals may estimate the probability of a stock market crash by use of the heuristic called "availability" which essentially states that if you can remember a recent occurrence of an event, you will judge it more likely to occur in the future. A similar rule of thumb in judgments of unknown probability is that a short sequence of events is indicative of a pattern, so that a recent period of rising stock price will imply that, in the next period, the stock price will also rise.

10. The Fidelity data included over 1500 plans and 2 million participants as of June 30, 1994.

11. In a study of returns on ESOPs, Conte and Jampani (1996) found substantially higher returns in ESOPs than for the control group of diversified defined contribution plans, but this greater return was accompanied by greater risk. On a risk-adjusted basis, the returns to large ESOPs were similar to diversified plans but those of smaller ESOPs were substantially lower.

12. For example, Palsson's (1993) cross-sectional study of Swedish households

finds that wealthy households exhibit greater investment risk tolerance than do poorer households.

13. Alternative thresholds of three-, five-, and seven-year job tenures produced similar results.

References

- Arthur D. Little, Inc. *America's Retirement Crisis: The Search for Solutions*. Final Report to Oppenheimer Management Corporation. June 24, 1993.
- Bernheim, B. Douglas. *Is the Baby Boom Generation Preparing Adequately for Retirement?* New York: Merrill Lynch & Co., 1993.
- Blair, Dennis T. and Andrea T. Sellers. *Retirement Planning More Than Investment Education*. New York: The Alexander Consulting Group, New York, 1994.
- Bodie, Zvi. "Pensions as Retirement Income Insurance." *Journal of Economic Literature* 28, 1 (1990): 28-49.
- . "On the Risks of Stocks in the Long Run." *Financial Analysts Journal* 51, 3 (May/June 1995): 18-22.
- Conte, Michael, and Rama Jampani. "Financial Returns of ESOPs and Similar Plans." *Pensions, Savings, and Capital Markets*. U.S. Department of Labor. Washington, DC: USGPO, 1996.
- Fries, James F. "The Workspan and the Compression of Morbidity." In Alicia H. Munnell, ed., *Retirement and Public Policy*. Washington, DC: Kendall-Hunt, 1991: 159-71.
- Gustman, Alan L. and Olivia S. Mitchell. "Pensions and Labor Market Activity: Behavior and Data Requirements." In Zvi Bodie and Alicia H. Munnell, eds., *Pensions in the Economy: Sources, Uses, and Limitations of Data*. Philadelphia: Pension Research Council and University of Pennsylvania Press, 1992.
- Gustman, Alan L. and Thomas Steinmeier. "The Stampede Toward Defined Contribution Plans: Fact or Fiction?" *Industrial Relations* 31, 2 (1992): 361-69.
- Hewitt Associates. *401(k) Plan Hot Topics*. Lincolnshire, IL: Hewitt Associates, 1993.
- Hinz, Richard P., David D. McCarthy, and John A. Turner. "Are Women Conservative Investors? Gender Differences in Participant-Directed Pension Investments." This volume.
- Ippolito, Richard A. "Encouraging Long-term Tenure: Wage Tilt or Pensions?" *Industrial and Labor Relations Review* 44, 3 (1991): 520-35.
- . "A Sorting Theory of Defined Contribution Pensions." Pension Benefit Guaranty Corporation Unpublished working paper, Washington DC, 1994.
- Jianakoplos, Nancy and Alexandra Bernasek. "Are Women More Risk Averse?" Paper presented at Western Economics Association annual meeting, Vancouver, June 1994.
- Kahneman, Daniel, Paul Slovic, and Amos Tversky. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge, MA: Harvard University Press, 1987.
- Kruse, Douglas L. "Profit Sharing and Productivity: Microeconomic Evidence from the United States." *Economic Journal* 102 (1992): 24-36.
- Kusko, Andrea L., James M. Poterba, and David W. Wilcox. Employee Decisions with Respect to 401(k) Plans: Evidence from Individual Level Data. NBER Working Paper No. 4635, 1994.
- Lazear, Edward P. "Pensions and Deferred Benefits as Strategic Compensation." *Industrial Relations* 29 (Spring 1990): 263-80.

- . "Incentive Effects of Pensions." In David Wise, ed., *Pensions, Labor and Individual Choice*. Chicago: University of Chicago Press, 1985: 357–75.
- Mitchell, Olivia S. "Worker Knowledge of Pension Provisions." *Journal of Labor Economics* 61, 1 (1988): 21–38.
- Mossin, Jean. "Aspects of Rational Insurance Purchasing." *Journal of Political Economy* 79 (1968): 553–68.
- Munnell, Alicia H., ed. *Retirement and Public Policy*. National Academy of Social Insurance. Washington, DC: Kendall Hunt, 1991.
- Musumeci, Jim and Joe Musumeci. "Optimal Diversification Strategies Given a Distant Planning Horizon." *Pensions, Savings, and Capital Markets*. U.S. Department of Labor. Washington, DC: USGPO, 1996.
- Palsson, A. "Household Risk Taking and Wealth: Does Risk Taking Matter?" In Edward N. Wolff, ed., *Studies in the Distribution of Household Wealth*. Research on Economic Inequality 4. Greenwich, CT: JAI Press, 1993: 225–61.
- Papke, Leslie E. Participation in and Contributions to 401(k) Pension Plans: Evidence from Plan Data. NBER Working Paper No. 4199, 1992.
- Papke, Leslie E., Mitchell Peterson, and James M. Poterba. Did 401(k) Plans Replace Other Employer Provided Pensions? NBER Working Paper No. 4501, 1993.
- Pratt, J. "Risk Aversion in the Small and the Large." *Econometrica* 32, 1–2 (1964): 122–36.
- Quattlebaum, Owen M. "Loss Aversion: The Key to Determining Individual Risk." *Journal of Financial Planning* 1, 2 (1988): 66–68.
- Quinn, Joseph F., Richard V. Burkhauser, and Daniel A. Myers. *Passing the Torch: The Influence of Economic Incentives on Work and Retirement*. W. E. Upjohn Institute. New York: Basic Books, 1990.
- Ramaswami, Sridhar N., Rajendra K. Srivastava, and Thomas H. McInish. "An Exploratory Study of Portfolio Objectives and Asset Holdings." *Journal of Economic Behavior and Organization* 19 (1992): 285–306.
- Ransom, Roger L., Richard Sutch, and Samuel H. Williamson. "Retirement: Past and Present." In Alicia H. Munnell, ed., *Retirement and Public Policy*. Washington, DC: Kendall-Hunt, 1991: 159–71.
- Riley, William B., Jr. and Victor K. Chow. "Asset Allocation and Individual Risk Aversion." *Financial Analysts Journal* (November/December 1992): 32–37.
- Samuelson, Paul A. "The Judgment of Economic Science on Rational Portfolio Management: Timing and Long-Horizon Effects." *Journal of Portfolio Management* 16, 1 (Fall 1989): 4–17.
- . "Risk and Uncertainty: A Fallacy of Large Numbers." *Scientia*, ser. 6, 5 (April/May 1963): 1–6.
- Schmitt, Ray, ed. *The Future of Pensions in the United States*. Philadelphia: Pension Research Council and University of Pennsylvania Press, 1993.
- Siegel, Jeremy J. *Stocks for the Long Run*. Burr Ridge, IL: Irwin, 1994.
- Silverman, Celia. "Pension Evolution in a Changing Economy." *EBRI Issue Brief No. 141*. Washington, DC: Employee Benefits Research Institute, September 1993.
- TIAA-CREF. "Replacement Ratio Projections in Defined Contribution Retirement Plans: Time, Salary Growth, Investment Return, and Real Income." *Research Dialogues* 41 (September 1994): 1–6.
- U.S. Department of Labor. Bureau of Labor Statistics. *Work and Family: Turning Thirty. Job Mobility and Labor Market Attachment*. Report 862. Washington DC: USGPO, 1995.

- Williamson, Gordon K. *Low Risk Investing*. Holbrook MA: Bob Adams, 1994.
- Yakoboski, Paul and Annmarie Reilly. "Salary Reduction Plans and Individual Saving for Retirement." *EBRI Issue Brief No. 155*. Washington, DC: Employee Benefits Research Institute, November 1994.
- Yakoboski, Paul and Celia Silverman. "Baby Boomers in Retirement: What Are Their Prospects?" *EBRI Issue Brief No. 151*. Washington, DC: Employee Benefits Research Institute, July 1994.