Management of Defined-Benefit Pension Funds and Shareholder Value

Sharad Asthana*
Temple University

Roland Lipka
Temple University

This paper examines the determinants of portfolio management of defined-benefit pension funds and the impact of portfolio management on shareholder value. We present evidence that managers of funds that perform poorly (well), relative to funds with similar risk profiles, are more (less) likely to reallocate their pension assets in the following period. Moreover, poorly (well) performing funds, relative to funds with similar risk profiles, are more (less) likely to improve their performances in the subsequent period. The effect on shareholders is mixed. The market reacts negatively to the increase in portfolio risk, while the reaction to improved performance is positive. The results persist even after controlling for financial structure and pension characteristics. This paper contributes to our understanding of the link between shareholder value, the management of pension funds, and the factors that influence the decision making process of fund managers. Pension plan adjustments and improvement in performance are reliably predictable. They impact future earnings and, although not an integral part of core earnings, do reduce future pension costs. Thus, earnings forecasts should incorporate the effects of these predictable adjustments on earnings.

Introduction

Total defined-benefit pension assets of U.S. companies today are substantial and run into several trillion dollars. For a typical firm, these pension assets are over 15.0 percent of the firm's total assets, over 35.0 percent of its market value, and over 55.0 percent of its book value.[1] The pension asset management policy significantly affects

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[1] This is based on the information available on COMPUSTAT database for the sample period 1990-1992.

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the future returns on these assets and, therefore, the contributions to be made by the firm. Understanding the incentives of pension fund managers helps us to predict asset allocation decisions and fund performances better. Knowing how plans adjust to past performance also helps in the use accounting numbers to forecast future earnings.

Performance measurements are indispensable to hiring fund managers, checking their performance, and firing them if necessary (Arnott, 1997). Plan sponsors are increasingly interested in establishing performance-related termination thresholds for investment managers. Managers are terminated when they underperform the applicable benchmark by either an absolute amount or by a certain percentage of the benchmark return. A major criterion to judge the pension fund manager's performance is the return earned by his or her pension asset portfolio. Higher returns imply lower employer contributions to the defined-benefit pension fund in the future. For higher expected returns, fund managers have to invest in riskier portfolios and on the efficient frontier. Most sponsoring firms establish fund management policies that state the desirable risk-return profiles for their pension funds. These policies are typically guidelines and fund managers have adequate freedom to determine the risk-return profile of their portfolios.

We find that dismal performance (relative to funds with similar risk profiles) prompts managers to reallocate their assets in the subsequent periods. This result persists even after controlling for riskiness of the asset portfolio, firm and plan sizes, funded status, profitability, leverage, and age distribution of participants. We also observe that these actions of the managers result in improved portfolio performances even after controlling for investment risk and the mean-reversion phenomenon of asset returns. Further, we observe that the market responds negatively to pension asset reallocations to riskier portfolios. Finally, we observe that shareholder value is positively affected by good performance. These results persist even after controlling for a firm's risk, profitability, leverage, and funded status. Thus, we find that the pension gains that ensue from improvements in plan performance and that are included in accounting income are a fundamental and predictable part of doing business. As such, these gains impact future pension costs and indirectly impact what has become known as "core earnings" (Standard & Poor, 2002). Hence, we question Standard & Poor's treatment that excludes pension gains from core earnings.

Theory and Development of Hypotheses

According to McGill and Grubbs (1984), the total accumulation of assets in a pension plan comes from contributions and returns on investments of pension assets, after adjustments for benefits paid and administrative expenses. The return on investments reduces the future costs of a defined benefit pension plan and increases

the benefits under a defined contribution plan.[2] Thus, productive deployment of pension assets is a major concern of both the sponsoring firm and regulatory authorities. For the sponsoring firm a sound investment policy reduces the future cash outflows from the firm to the defined-benefit plan. For the regulatory authorities it reduces the chances of default on the part of defined benefits plan and subsequent payments of benefits by the Pension Benefit Guaranty Corporation (PBGC). Management of pension plan assets is regulated at both federal and state levels. The federal controls arise from the statutes of the Employee Retirement Income Security Act of 1974 (ERISA) and the Internal Revenue Code (IRC). The full responsibility for the management of assets rests upon the sponsoring firm.[3] Other restrictions include segregation of plan assets,[4] identification of plan assets, diversification of investments,[5] and prudence standard.[6] Investment management is also governed by the Securities Act of 1933, the Securities Exchange Act of 1934, the Investment Company Act of 1940, and the banking laws (in cases of investments in banks and trusts). In addition to the federal restrictions, several states also have promulgated laws to regulate pension investments in trusts and insurance companies.

Unlike defined-contribution plans, where the investment risks are borne by the beneficiaries, in defined-benefit plans the plan sponsor bears most of the investment risk. For defined-contribution plans, a poor return on assets lowers the future benefits to participants but future costs to the sponsoring firm are unaffected. On the other hand, for defined-benefit plans poor returns on assets do not affect future benefits to participants (unless plans terminate prematurely and entire benefits are not insured by the PBGC) but future costs to the plan sponsor are increased.

Thus, sponsors of defined-benefit plans can invest in riskier assets (follow a more aggressive investment policy) without violating their fiduciary obligations under ERISA, unlike sponsors of defined-contribution plans who have to be more cautious and conservative in their investment policy. Good and Love (1990) also report that defined-benefit plans typically are more actively managed and have riskier portfolios with higher long-term returns. This gives fund managers of defined-benefit plans more investment freedom but added responsibility for results, in comparison to their counterparts in defined-contribution plans.[7] In the current paper, we examine the investment policies of defined-benefit plan managers.[8]

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[2] For example, if the assets of a fully funded defined-benefit plan are invested such that they earn a 6 percent rate of return in a stable economic environment, on the average, about 70 percent of the plan's benefits will be paid out of investment earnings and only 30 percent will have to be contributed by the plan (McGill and Grubbs 1984).

[3] ERISA §402(b) and §405(c)

[4] ERISA §403 and IRC §401(a)(1)

[5] ERISA §404(a)(1)(C)

[6] ERISA §404(a)(1)(B)

[7] The asset reallocations can be achieved, either by actively moving around investments, or by managing the cash inflows (contributions) and outflows (benefit payments). According to

Given the emphasis on pension portfolio performance, we hypothesize that managers of defined-benefit pension funds with poor performance (relative to benchmarks) will attempt to improve their performances. On the other hand, managers with good performances are unlikely to make extra efforts to improve more, because this might raise the expectations about their future performances. One reason for performance below the benchmark could be that the portfolio is not on the efficient investment frontier, i.e., portfolio holds an interior, less efficient position. Managers of pension portfolios can improve their performance by reshuffling their asset-mix to get closer to the efficient frontier. On the other hand, pension fund managers with good performances have no such incentives to reallocate. Thus, the first pair of alternative hypotheses is:

Hypothesis 1: Defined-benefit pension funds with poor performances are more likely to reallocate their assets in comparison to those with good performances.

Hypothesis 2: Defined-benefit pension funds with poor performances are more likely to improve their performances in comparison to those with good performances.

Shareholders are assumed to be risk averse. News that the sponsored pension plan holdings are riskier will be priced negatively. On the other hand, shareholders will react positively to improvement in performance, driving up share values, as higher returns on pension assets imply reduced cash outflow from the firm in the

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Kehrer (1991), the active asset management can be achieved by using the so-called derivatives markets in index funds and stock index futures. The extreme liquidity and low transaction costs of future contracts make them attractive vehicles for active portfolio management. Thus, a round-trip trade typically costs one-fifth of a similar transaction in the cash market. The author quotes an executive of a leading firm as saying, "(We) traded over $1 billion worth of stock futures in a single day, easily, efficiently, cheaply, and without anyone noticing...while physical stock trades take days to settle, futures represent an almost immediate shift. Plus futures won't affect the fund's income stream."

[8] According to McGill and Grubbs (1984), most investment policies of defined-benefit plans have four components. (1) *Rate of Return Objective:* This can be qualitative or quantitative. Quantitative targets can be absolute or relative. Absolute targets can be general or specific. Relative targets can be set in terms of market standards or performances of managers of other fund managers, both within and outside the sponsoring firm. Relative targets are more sophisticated and are commonly used by plan sponsors. (2) *Risk Tolerance:* This is the amount of portfolio risk that the plan sponsor is willing to take. Assuming that managers are rational and invest on the efficient frontier, increased portfolio risk implies greater expected returns on assets. (3) *Liquidity Requirements:* These depend on the specific needs of pension plans. Plans with more aged participants will need more cash for benefits payments and may choose to invest in short term instruments while plans with younger participants have a longer investment horizon and may choose to invest in long-term instruments. (4) *Diversification:* This is mandated by ERISA in order to safeguard the interests of beneficiaries (ERISA §404(a)(1)(C)).

future as employer's contribution. Thus, the last pair of alternative hypothesis can be written as:

Hypothesis 3: Share prices are negatively affected by asset reallocations to riskier investment categories by defined-benefit pension funds.

Hypothesis 4: Share prices are positively affected by improvements in performances of defined-benefit pension funds.

Research Design

To test our hypotheses, we need to measure portfolio risk (RISK), fund performance (PERFORM), and inter-investment category transfers of assets (TRANSFER). Notionally, RISK is the weighted average of the risk premia attached to each of the asset categories. PERFORM is the plan's return adjusted for risk. TRANSFER is an index from zero to two that measures the shifts in categories. Zero indicates no shift and two indicates the maximum shift possible. It is constructed by summing the squares of the changes in the percentages of each of the categories. To illustrate, assume that the plan's assets are in just two categories: stock and bonds with all of assets in stock the first year and all of the assets in bonds the second year. Then our measure of transfer would be the maximum value of two $((100\%-0\%)^2 + (0\%-100\%)^2)$.[9] Improvement in fund performance (IMPROVE) is defined as PERFORM in the current year minus PERFORM in the previous year.

Tests of Hypotheses 1 and 2
Portfolio and Correlation Analysis

Tests of hypotheses 1 and 2 are made by forming decile portfolios on the basis of PERFORM in the previous year. Portfolio 1 contains the worst performers, and portfolio 10 contains the best performers. Hypothesis 1 predicts that poor performers are more likely to reshuffle their asset allocations relative to good performers. Thus, the value of TRANSFER for poor performers (lower decile portfolios) is expected to be more than the corresponding value for good performers (higher decile portfolios). Hypothesis 2 predicts that poor performers are more likely to improve their performances than good performers in the subsequent period. Hence, we expect that IMPROVE for poor performers will exceed the corresponding value for good performers. Pearson and Spearman correlation coefficients are also calculated. According to hypotheses 1 and 2, TRANSFER and IMPROVE in the current period will be negatively associated with PERFORM in the previous period.

[9] A more detailed explanation of the measurement of these variables is discussed in the appendix.

Regression Analysis

Regression tests also are conducted for the first two hypotheses by estimating the following equations:

$$TRANSFER_t = f_1(LOSER_{t-1}, WINNER_{t-1}, \Delta RISK_t, \Delta LOG(FA)_t, \Delta LOG(PA)_t, \Delta FRATIO_t, \Delta PROF_t, \Delta DEBT_t, \Delta AGE_t) \quad (1)$$

$$IMPROVE_t = f_2(LOSER_{t-1}, WINNER_{t-1}, \Delta RISK_t, \Delta LOG(FA)_t, \Delta LOG(PA)_t, \Delta FRATIO_t, \Delta PROF_t, \Delta DEBT_t, \Delta AGE_t), \quad (2)$$

where t and t-1 index the current and previous years, respectively. Functions f_1 and f_2 are linear regression functions. LOSER and WINNER represent poor and good performers, respectively. The variable LOSER is constructed by setting it equal to the absolute value of PERFORM if the value for PERFORM is less than zero, and zero otherwise. Similarly, the variable WINNER is equal to the value of PERFORM if its value is greater than zero, and zero otherwise. The motivation for constructing the definitions in this manner is to permit the poor performers to adjust differently relative to good performers (regression coefficients have different values), as hypothesized.

The mathematical difference operator, Δ, measures the change in the value of the variable in the current year over previous year. LOG(FA) is the natural logarithm of the sponsoring firm's total assets, and LOG(PA) is the natural logarithm of the plan's pension assets. FRATIO is the plan's funding ratio (pension assets divided by pension liabilities). PROF is the firm's profitability (net income divided by firm assets). DEBT is the firm's total debt divided by total assets. AGE (number of active participants divided by total number of participants in the plan) is a proxy for the age profile of the participants. The last seven variables are included to control for the effects of changes in portfolio risk, size, pension, and financial characteristics.

Hypothesis 1 predicts that poorly performing plans are more likely to be reallocated relative to good performing plans. Thus, the coefficient of $LOSER_{t-1}$ is expected to be positive and larger than the coefficient for WINNER in regression 1. Hypothesis 2 posits that, as a result of the asset reallocations, poor performers are expected to improve their performance relative to good performers in the subsequent period. Thus, the coefficient of $LOSER_{t-1}$ is expected to be positive and larger than the coefficient for $WINNER_{t-1}$ in regression 2.

Tests for Hypotheses 3 and 4 on Market Reaction

The asset allocations are disclosed by pension funds on IRS Form 5500 under ERISA requirements. The "Rules and Regulations for Reporting and Disclosure" published by the Department of Labor (DOL) in the *Federal Register* of March 10, 1978 (43 FR 10130) and Section §2520.104b-1 of ERISA require that a copy of the annual report must be made available by the plan administrator, usually at the

administrator's office or at the work site, for inspection by plan participants and beneficiaries. Moreover, copies of the report must be furnished within ten days upon request.

The date of receipt of the ERISA reports (Form 5500 and Schedule B) at the Internal Revenue Service (IRS) is documented as the *transaction date* (this was confirmed by the Office of Technical Assistance, Department of Labor) on the ERISA tapes used in this study. This date, henceforth, is referred to as day 0. Assuming a postal delivery time of three to four working days, the day -3 or -4 would be the day when the report was dispatched and was also first publicly available at the administrator's office. An eleven-day event window (-5, 5) that covers the above dates, and an eleven-day non-event window (-16, -6) relative to day 0 are used for the analysis in this paper.

Interested parties, such as financial analysts and large stockholders, also can request copies of the report. The firms may also send these reports. Moreover, plan beneficiaries could be stockholders. As a result, the market should react to any value relevant information in the ERISA reports during the event window. Moreover, because disclosure dates do not vary much across years, the expected dates of release of the ERISA reports are known to the market.[10] As a result, those interested can request and obtain copies expeditiously from the sponsoring firm. Asthana (1998) has documented significant market reactions around the ERISA disclosure dates, suggesting that Form 5500 contains value relevant information. We repeat his tests (results not reported) and find significant market reactions within the event window (-5, 5). This result further confirms that the event dates have been correctly identified.

To test hypotheses 3 and 4, the following regression is estimated:

$$CAR = f_3(\Delta RISK, IMPROVE, \Delta RISK*IMPROVE, PRET, CHBETA, PROF, DEBT, FRATIO) \quad (3)$$

CAR is the cumulative abnormal return during the event window, calculated with the firm-specific capital asset pricing model (CAPM) parameters estimated during a 100-day period preceding the event window. f_3 is a linear regression function. PRET is the return for the period between last year's and this year's ERISA disclosure dates. This variable is included to correct for measurement errors in the expected values due to the exclusion of information that arrives in the market prior to the event window.[11] CHBETA is the change in systematic CAPM risk in a 50-day period before and a 50-day period after the disclosure date. This variable controls for

[10] Eighty percent of the sample plans release ERISA information within five days of last year's disclosure date.

[11] Brown et al. (1987) and Easton and Zmijewski (1989) use this additional independent variable to mitigate measurement error. The variable is correlated with measurement error but uncorrelated with the dependent variable. Cho and Jung (1991) predict a negative coefficient for this variable.

Table 1—Variable Definitions (in alphabetical order)

Variable	Definition
AGE	Number of active participants divided by total number of participants in the plan
AROPA	Actual return on pension assets during the plan year
BONDS	Value of interest in corporate debt instruments (preferred and others) and U.S. government securities divided by pension assets
CAR	Cumulative abnormal returns during the window (-5, 5) relative the date of disclosure of asset reallocations
CHBETA	Change in systematic risk in a 50 day period prior to and 50 day period after the disclosure of portfolio reallocations
CTRUST	Value of interest in common/collective trusts divided by pension assets
DEBT	Sponsoring firm's long term debt divided by its total assets
EROPA	Expected return on pension assets
FA	Sponsoring firm's total assets (in million dollars)
FRATIO	Sponsoring firm's funding ratio equal to its pension assets divided by pension liabilities
IBC	Value of interest bearing cash (including money market funds) divided by pension assets
ICGA	Value of funds held in insurance company general accounts (unallocated contracts) divided by pension assets
IMPROVE	Improvement in fund performance, equals PERFORM for current year minus PERFORM for previous year
LOG(FA)	Natural logarithm of FA
LOG(PA)	Natural logarithm of PA
LOSER	Equal to absolute value of PERFORM if value is less than 0 (performance below benchmark); 0 otherwise
MISC	Value of investments in miscellaneous asset categories (with investments less than 5 percent) divided by pension assets. Includes total receivables (4 percent), certificates of deposit (0.98 percent), partnerships/joint ventures (0.14 percent), real estate (0.13 percent), all types of loans (0.21 percent), 103-12 investment entities (0.04 percent), registered investment companies (3.06 percent), other investments (3.93 percent), and employer related investments (0.19 percent)
MTRUST	Value of interest in master trusts divided by pension assets
MV	Market value (in million dollars) of the sponsoring firm on day –6 relative to the ERISA disclosure date
NIBC	Value of non-interest bearing cash divided by pension assets
PA	Pension plan's assets (in million dollars)
PL	Pension plan's liabilities (in million dollars)
PERFORM	Risk-adjusted performance of the pension fund. See Appendix for estimation method.
PRET	Returns for the period prior to this year's ERISA disclosures starting after last year's disclosures
PROF	Profitability of the sponsoring firm measured as its net income divide by total assets
PSA	Value of interest in pooled separate accounts divided by pension assets
RISK	Portfolio risk measured as the mean of MTRUST, STOCK, CTRUST, MISC, IBC, BONDS, PSA, and ICGA, weighted by their respective risk premia (see Appendix for estimation method)
STOCK	Value of interest in corporate stocks, both preferred and common, divided by pension assets
TRANSFER	Measure of inter-investment category transfers, defined as the sum of squares of changes in MTRUST, STOCK, CTRUST, MISC, IBC, BONDS, PSA, and ICGA
WINNER	Equal to PERFORM if value is greater than 0 (performance above benchmark); 0 otherwise
Δ	Difference operator, defined as its current period value minus the previous period value

measurement error in CAR due to change in systematic risk of the firm. Table 1 summarizes all the variable definitions.

In regression 3, the variables ΔRISK and IMPROVE pertain to the disclosing pension fund, while all the other variables pertain to the firm. The market reaction to these two variables will depend on the size of the pension fund relative to the firm size. To avoid possible model mis-specification, these variables are prorated by multiplying them by the ratio of the disclosing fund's pension assets to the firm's market value. Hypothesis 3 predicts that the market will react adversely to increase in portfolio risk implying a negative coefficient of ΔRISK. Hypothesis 4 predicts that the market will react favorably to improvement in portfolio performance. Thus, the coefficient for IMPROVE is expected to be positive. The term ΔRISK*IMPROVE is included to control for possible interaction effects.

Lys (1984) points out that if there is a systematic misspecification of the model, then the estimated coefficients of the cross-sectional regression could differ from zero and result in an inappropriate rejection of the null hypothesis. Therefore, it is important to determine the size of the estimated coefficients on non-event dates. We rerun regression 3 with CAR estimated for a non-event window (-16, -6). Insignificant coefficients will confirm that the regression 3 is properly specified.

Data and Sample Selection

Employers with defined-benefit plans (with 100 or more participants) are required to submit an audited Form 5500 to the IRS on or before the last day of seventh month after the close of the plan year.[12] Each defined-benefit pension plan (subject to ERISA minimum funding requirements) also must file Schedule B with Form 5500.

For a pension plan to be included in the ERISA sample, it must satisfy the following criteria: (1) the fund is included on the ERISA tapes; (2) it is a defined-benefit pension plan; (3) it is a single-employer plan; (4) the plan year and fiscal year of the sponsoring firm end on December 31; (5) the plan was not terminated, amended or merged with other plans during the plan year; and (6) there are no missing observations for at least two consecutive years.[13]

Multi-employer plans are dropped from the sample because the implications of asset reallocations are not clear for individual firms. Only plans and firms with a December 31 year-end are included to align the observations so that fixed-year effects can be controlled. Merged, terminated, or amended funds also are excluded because the motivations of managers of such funds are not clear. Selection criteria 1 through 5 result in a sample of 16,702 firm-year observations. This sample is used

[12] ERISA §104 and §4065,and IRC §6039(d), §6057(b), and §6058(a)

[13] The data used in this paper pertain to the period 1990-1992 and have been purchased from the DOL under the Freedom of Information Act.

for estimating the variables in the appendix. Further imposition of the sample criterion 6 results in a sample of 7,531 observations that is used for the portfolio and correlation analyses.

The COMPUSTAT sample is obtained by manually matching the names of the sponsoring firms of the ERISA sample with the names on COMPUSTAT database and verifying that the information needed in the analysis is available for at least two consecutive years. This results in 582 firm-year observations. The COMPUSTAT sample is used for estimating regressions 1 and 2. Finally, the CRSP sample is obtained by identifying the subset of the COMPUSTAT sample that has returns data available on CRSP database for the CAPM estimation period (-116, -17), the non-event window (-16, -6), and the event window (-5, 5). Firms with other contemporaneous disclosures (reported in *The Wall Street Journal Index*) during the event window are deleted to ensure clean disclosures. If two or more plans sponsored by the same firm disclose ERISA information such that their event windows overlap, the observations are consolidated by using the means of the variables ΔRISK and PERFORM. This results in the CRSP sample of 363 firm-year observations that is used to estimate regression 3.[14] Both the COMPUSTAT and CRSP samples comprise 237 firms.

Empirical Results

The sample profile is presented in Table 2. Panel A compares our sample firms to the population of firms. Evidently, the condition that the firm is included on both COMPUSTAT and CRSP databases results in a bias toward larger firms. This is consistent with prior pension related research (Asthana and Mishra, 2003; Asthana, 1999; and Asthana, 1998). Panel B presents the distribution of variables used in the analysis. The average (median) pension assets of the sample is $24.6376 ($4.4980) million and the average (median) market value is $3.2965 ($0.7348) billion. The mean (median) AROPA is 0.0953 (0.0804), and the mean (median) EROPA is 0.0851 (0.0850). The first quartile of FRATIO is greater than one (1.0740), suggesting that more than 75 percent of sample plans are overfunded.

Table 3 shows the results of portfolio analysis. Panel A presents the distribution of the variables RISK, PERFORM, TRANSFER, and IMPROVE. Mean TRANSFER and IMPROVE are both significantly greater than zero. Thus, on average, pension funds engage in significant asset transfers between different investment categories. Intra-category transfers (for example, from one stock to another stock) will not show in TRANSFER. This will bias our tests against finding significance.

[14] Such reductions in sample size are common in pension research (Amir and Ziv, 1997; Asthana and Mishra, 2003) due to missing data. Moreover, several firms included in the ERISA database are excluded from the COMPUSTAT and CRSP databases (Asthana, 1998; Asthana, 1999).

Table 2—Sample Profile

Panel A: Comparison of Sample with Population (in $ billion)

Variable	Measure	Population	Sample
Total Assets	Mean	2.5372	3.8644
	Median	0.0745	1.0995
	Inter-Quartile Range	0.5523	2.3958
Net Sales	Mean	1.3826	2.9922
	Median	0.0686	1.0537
	Inter-Quartile Range	0.4461	2.1090
Total Liabilities	Mean	1.9942	3.5481
	Median	0.0345	0.6212
	Inter-Quartile Range	0.3207	1.7210
Market Value	Mean	0.9368	3.2965
	Median	0.0359	0.7348
	Inter-Quartile Range	0.2825	2.3958

Panel B: Distribution of Variables Used in the Analysis

Variable	Mean	Standard Deviation	First Quartile	Median	Third Quartile
PA*	24.6376	271.4400	1.7155	4.4980	13.2475
PL*	17.9009	156.2300	1.3845	3.4243	9.8081
FA*	3,864.4300	11,634.4000	440.6740	1,099.5000	3,022.1470
MV*	3,296.5200	9,297.1800	176.9288	734.7644	2,572.6570
AROPA	0.0953	0.0715	0.0467	0.0804	0.1523
EROPA	0.0851	0.0053	0.0800	0.0850	0.0900
FRATIO	1.3887	0.6596	1.0740	1.3045	1.5593
AGE	0.6666	0.2246	0.5465	0.7060	0.8333
PROF	0.0303	0.0684	0.0087	0.0314	0.0570
DEBT	0.2380	0.1855	0.0970	0.2583	0.3344
CAR	0.0013	0.0585	-0.0306	-0.0016	0.0317

See Table 1 for variable definitions

* In million dollars

Panel B (Table 3) shows the profiles of the decile portfolios. Portfolio 1 represents the worst performers, and portfolio 10 represents the best performers. Because the portfolios are formed on $PERFORM_{t-1}$, the increasing values of $PERFORM_{t-1}$ are expected. $RISK_t$ shows a decline and then an increase as we move from portfolio 1 to 10. This pattern is more evident in Figure 1. Thus, portfolios with high risks are more likely to over- or under-perform. This is consistent with higher risk being associated with larger standard deviation of expected return in portfolio theory. Inter-portfolio comparisons are presented in Panel C (Table 3). Average $RISK_t$ for portfolios 1, 2, 3, 4, and 5 are significantly more than those for portfolios 10, 9, 8, 7, and 6, respectively. Thus, on average, poor performers have higher portfolio risks than good performers.

Table 3—Portfolio Analysis

Panel A: Distribution of Risk and Performance Measures

Variable	Mean	t Statistic (H0: Mean = 0)	First Quartile	Median	Third Quartile
RISK	0.1408	172.5310***	0.0887	0.1327	0.1602
PERFORM	0.0222	32.2666***	-0.0253	0.0103	0.0685
TRANSFER	0.1616	33.3801***	0.0001	0.0049	0.0422
IMPROVE	0.0371	27.0674***	-0.0601	0.0248	0.1368

Panel B: Characteristics of Portfolios formed on Previous Period's Performance

	Mean Values for the Portfolio			
Portfolio	$PERFORM_{t-1}$	$RISK_t$	$TRANSFER_t$	$IMPROVE_t$
1	-0.1325***	0.2033***	0.2040***	0.2057***
2	-0.0913***	0.1783***	0.1971***	0.1482***
3	-0.0697***	0.1494***	0.1934***	0.1294***
4	-0.0520***	0.1392***	0.2101***	0.1077***
5	-0.0319***	0.1208***	0.2016***	0.0620***
6	-0.0107***	0.0953***	0.2056***	0.0214***
7	0.0074***	0.0734***	0.1356***	-0.0036***
8	0.0369***	0.1402***	0.1270***	-0.0576***
9	0.0718***	0.1480***	0.1179***	-0.0990***
10	0.1227***	0.1601***	0.1219***	-0.1425***

Panel C: Inter-Portfolio Comparisons

Variable	t-Statistics for Inter-Portfolio Comparisons (using absolute values)				
	1 vs. 10	2 vs. 9	3 vs. 8	4 vs. 7	5 vs. 6
RISK	13.5175***	9.1784***	2.5425**	23.0683***	9.4707***
TRANSFER	4.3727***	3.6622***	3.1307***	3.3465***	-0.1710
IMPROVE	22.0774***	20.1780***	29.8021***	43.8029***	15.1965***

See Table 1 for variable definitions. The decile portfolios are formed on the basis of fund performance (PERFORM) in period t-1 (1 = worst performers; 10 = best performers)

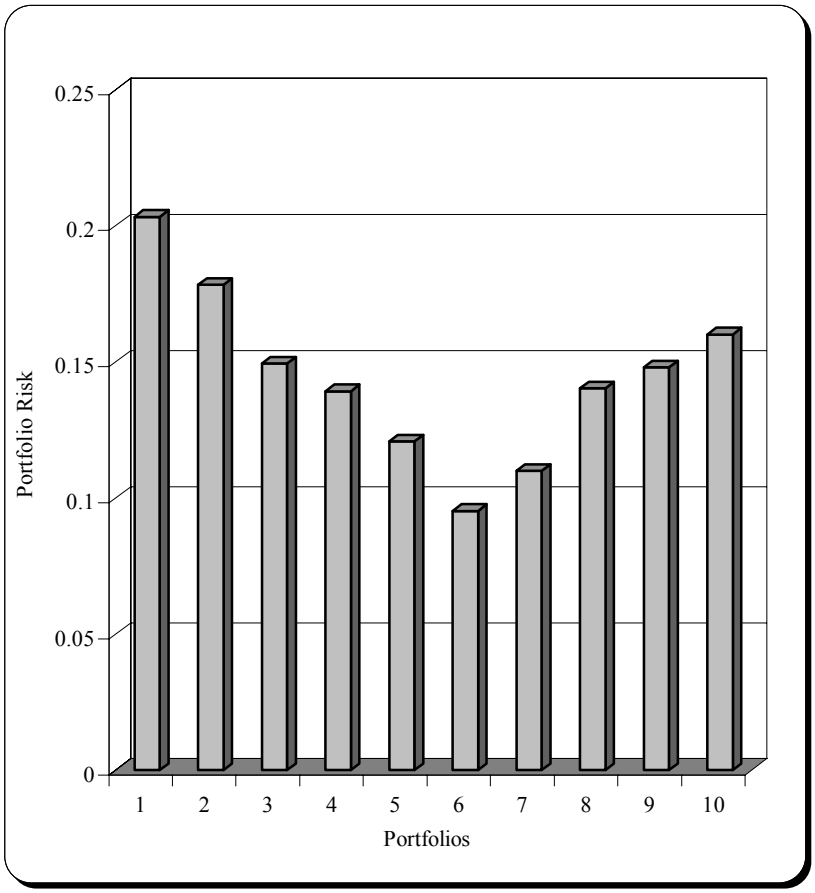
*** Significant at the 1 percent level

** Significant at the 5 percent level

Panel B shows that $TRANSFER_t$ has a decreasing trend from portfolios 1 to 10. This trend is more evident in Figure 2. Panel C confirms that $TRANSFER_t$ for poor performers is significantly larger than those for good performers (except for portfolios 5 and 6). Thus, poor performers are more likely to reshuffle their portfolios in comparison to good performers. This result confirms hypothesis 1.

In Panel B, $IMPROVE_t$ shows a consistent declining trend (Figure 3). As expected, poor performers are more likely to improve their performance in the subsequent period than good performers. The negative values for portfolios 7 through 10, however, are unexpected. An obvious explanation is that mean reversion

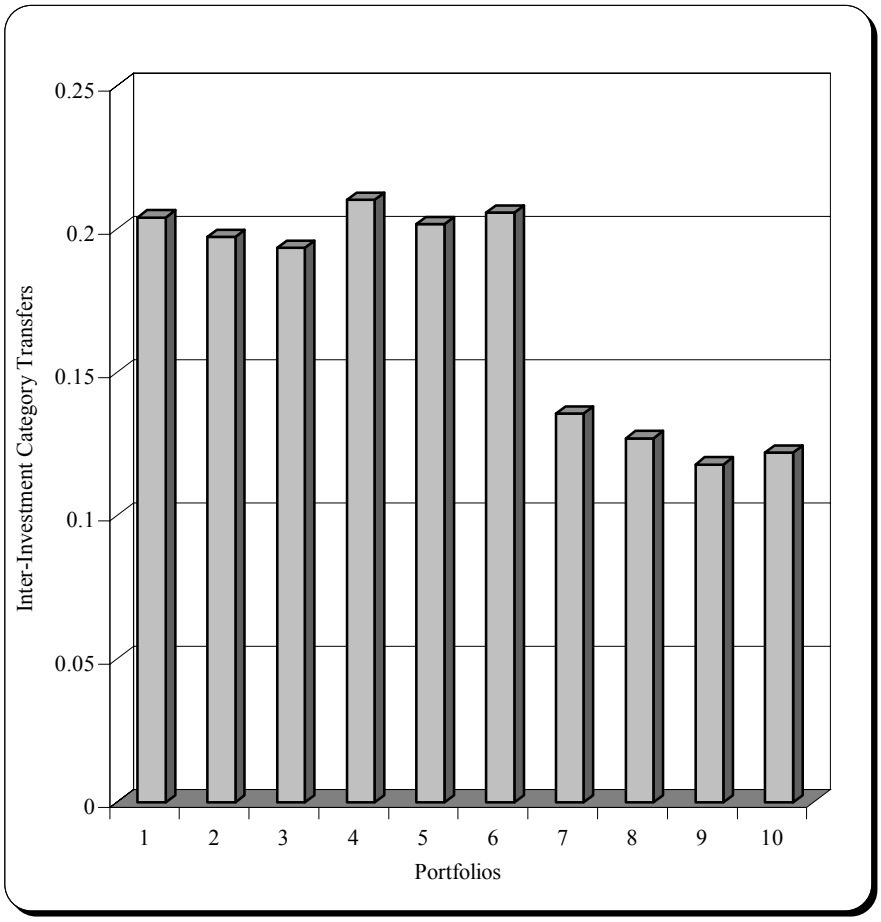
Figure 1—Portfolio Performance and Risk



Portfolios are formed on the basis of risk-adjusted performance in the previous period. Portfolio 1 contains the worst performers and portfolio 10 contains the best performers. Portfolio risk is measured by the variable RISK as defined in Table 1

phenomenon is responsible for this effect. To distinguish the effect of mean reversion from predictions of hypothesis 2, the values for extreme portfolios are compared. If mean reversion is symmetric, the mean absolute values of $IMPROVE_t$ for portfolios 1, 2, 3, 4, and 5 are expected to be equal to those for portfolios 10, 9, 8, 7, and 6, respectively. Panel C shows that the five pairs are not equal in absolute value and that the absolute values of $IMPROVE_t$ for portfolios 1, 2, 3, 4, and 5 are significantly larger than those for portfolios 10, 9, 8, 7, and 6, respectively. Thus, consistent with asymmetric mean reversion, poor performers are more likely to

Figure 2—Inter-Investment Category Transfers

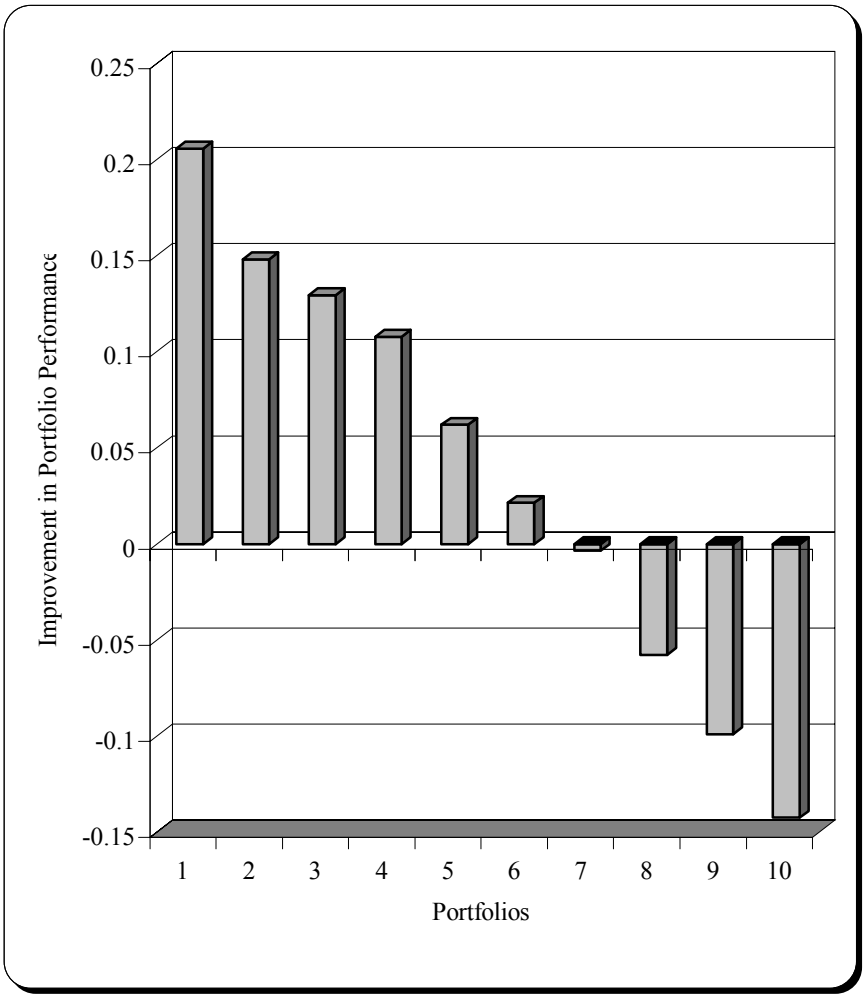


Portfolios are formed on the basis of risk-adjusted performance in the previous period. Portfolio 1 contains the worst performers and portfolio 10 contains the best performers. Inter-Investment category transfers are measured by the variable TRANSFER as defined in Table 1

improve their performances in the subsequent periods than good performers. This result supports hypothesis 2.

Table 4 reports the Pearson and Spearman correlation coefficients between $PERFORM_{t-1}$, $RISK_t$, $TRANSFER_t$, and $IMPROVE_t$. $PERFORM_{t-1}$ is negatively correlated with $RISK_t$, $TRANSFER_t$, and $IMPROVE_t$. In other words, performance in the previous period is inversely associated with asset reallocations and improvement in fund performance in the subsequent period. These results are consistent with the results in Table 3 and support hypotheses 1 and 2.

Figure 3—Portfolio Performance



Portfolios are formed on the basis of risk-adjusted performance in the previous period. Portfolio 1 contains the worst performers and portfolio 10 contains the best performers. Improvement in performance is the increase in risk-adjusted performance in the current period over previous period

The results of regressions 1 and 2 are presented in Table 5. The adjusted R - squares are 25.53 percent and 86.17 percent, respectively. As predicted by hypotheses 1 and 2, the coefficients of $LOSER_{t-1}$ ($WINNER_{t-1}$) are significantly positive (negative) in both the regressions. In other words, poor performers from the previous period are more likely to make significant asset reallocations and improve their performances in the current period than good performers. We compare the coefficients of $LOSER_{t-1}$ and $WINNER_{t-1}$ to evaluate the possibility that symmetrical mean reversion is driving these results,. Under the mean reversion phenomenon,

absolute values of the two coefficients will be equal. Tests reveal that the absolute values differ significantly (for regression 1, F = 6.5200, p = 0.0109; for regression 2, F = 10.1821, p = 0.0015). The above results support hypotheses 1 and 2. Coefficients of $\Delta RISK_t$ and $\Delta LOG(PA)_t$ are significantly positive in regression 1 and coefficients of $\Delta LOG(PA)_t$ and $\Delta DEBT_t$ are significantly positive in regression 2. The positive coefficients on $\Delta LOG(PA)_t$ and $\Delta DEBT_t$ suggest that larger pension plans and plans sponsored by firms with higher debt ratios are more likely to improve their poor performances due to the larger adverse visibility costs.

Table 4—Correlation Analysis (Pearson Coefficients above diagonal and Spearman Coefficients below diagonal)

	$PERFORM_{t-1}$	$RISK_t$	$TRANSFER_t$	$IMPROVE_t$
$PERFORM_{t-1}$	1	-0.1608***	-0.0316***	-0.9090***
$RISK_t$	-0.2040***	1	0.0070	0.1206***
$TRANSFER_t$	-0.0578***	-0.1436***	1	0.0165*
$IMPROVE_t$	-0.9146***	0.1239***	0.0579***	1

See Table 1 for variable definitions. t indexes the year.
*** Significant at the 1 percent level
** Significant at the 5 percent level

Table 6 reports the tests of market reaction on shareholder value. The adjusted R-squares are 6.03 percent (event window) and −1.55 percent (non-event window). The p values are 0.0002 and 0.9623, respectively. In the event window regression, the coefficient of ΔRISK is significantly negative, and the coefficient of IMPROVE is significantly positive. Thus, the market reacts negatively to unexpected increase in portfolio risk and positively to unexpected improvement in performance. These results are consistent with hypotheses 3 and 4. The coefficient of PRET is significantly negative, as expected. None of the coefficients is significant during the non-event window. This result confirms that significance of the coefficients is not due to chance or model mis-specification.

Regression Diagnostics

Belsley, Kuh, and Welsch's (1980) test for multicollinearity is conducted on all the regressions. The highest variance inflation factors are 1.7466 (regression 1), 1.7466 (regression 2), 4.3930 (regression 3, event window), and 4.3930 (regression 3, non-event window). These values are below the critical level of 10. Therefore, multicollinearity does not appear to be a serious problem in any of the regression estimations. White's (1980) test for heteroskedasticity is conducted on all the regressions. The null of homoskedastic errors is rejected for regressions 1 and 2 at 1 percent level. When White's heteroskedasticity corrected t statistics are used, the results of regressions 1 and 2 do not change qualitatively. Thus, none of the conclusions in the paper are found to be sensitive to the presence of heteroskedasticity.

Table 5—Regression of Portfolio Revision and Improvement in Performance on Previous Portfolio Performance

	Dependent Variables			
	$TRANSFER_t$		$IMPROVE_t$	
Independent Variables	Estimate	t Statistic	Estimate	t Statistic
Intercept	0.1675***	5.3210	-0.0033	-0.6630
$LOSER_{t-1}$	0.9509***	2.9470	1.5640***	31.1170
$WINNER_{t-1}$	-0.7719 *	-1.8130	-1.2286***	-18.5330
$\Delta RISK_t$	5.0590***	12.1050	0.0977	1.5000
$\Delta LOG(FA)_t$	0.1466	1.2360	0.0159	0.8590
$\Delta LOG(PA)_t$	0.1173***	4.1670	0.0181***	4.1340
$\Delta FRATIO_t$	0.0109	0.2800	0.0154	2.5340
$\Delta PROF_t$	0.0962	0.4300	-0.0131	-0.3750
$\Delta DEBT_t$	0.1869	0.9700	0.0671 **	2.2340
ΔAGE_t	0.0101	0.0650	0.0004	0.0180
Adjusted R^2	25.53%		86.17%	
F value	23.1660		403.9120	
Prob. > F	0.0001		0.0001	
Observations	582		582	

t and t-1 index current and previous plan years, respectively. See Table 1 for variable definitions

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Table 6—Regression of Market Reaction to Portfolio Reallocation Disclosures on Risk and Performance

	Dependent Variable = CAR			
	Event Window (-5, 5)		Non-Event Window (-16, -6)	
Independent Variables	Estimate	t Statistic	Estimate	t Statistic
Intercept	0.0052	0.6420	-0.0026	-0.3010
ΔRISK	-0.1551***	-3.187	0.0007	0.0140
IMPROVE	0.0804 *	1.8440	-0.0009	-0.0200
ΔRISK*IMPROVE	0.8941 *	1.8660	-0.1550	-0.3020
PRET	-0.0265***	-2.8040	0.0015	0.1530
CHBETA	0.0004	0.2460	0.0023	1.1820
PROF	0.0369	0.8210	-0.0157	-0.3260
DEBT	0.0021	0.1270	-0.0014	-0.0780
FRATIO	-0.0014	-0.3670	-0.0027	-0.6570
Adjusted R^2	6.03%		-1.55%	
F value	3.9030		0.3090	
Probability>F	0.0002		0.9623	
Observations	363		363	

See Table 1 for variable definitions

*** Significant at the 1 percent level
** Significant at the 5 percent level
* Significant at the 10 percent level

Tests for outliers are conducted on all the regressions using Belsley, Kuh, and Welsch's (1980) procedure. Studentized residuals are computed (without the current

observation) and any observation deviating more than two standard deviations from the mean studentized residual is deleted. Results (not reported) do not change qualitatively when outliers are removed.

Conclusions

This paper examines the effect of pension fund performance on the managers' asset reallocation decisions. Empirical evidence is presented to show that managers of funds that perform poorly (well), relative to funds with similar risk profiles, are more (less) likely to reallocate their pension assets in the subsequent period. Moreover, funds that perform poorly (well), relative to funds with similar risk profiles, are more (less) likely to improve their performances in the subsequent period. The effects on shareholder value are mixed. The market reacts negatively to plan adjustments that increase portfolio's riskiness and reacts positively to improvement in performance. These results persist even after controlling for the firms' financial and pension characteristics. The predictable adjustments by pension plan managers have, therefore, predictable effects on shareholder wealth: increased risk is priced negatively, and better performance is priced positively. Furthermore, earnings forecasts should incorporate the effects of these predictable adjustments on earnings. Whether the ensuing pension gains should be excluded from core earnings as suggested by Standard & Poor is open to debate. Our results show that the gains are expected for underperforming plans and that the market values the improvement in performance.

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Appendix—Estimation of RISK, TRANSFER and PERFORM

RISK

The expected return on a portfolio is equal to the expected risk-free return plus the sum of the products of the risk premia for various asset categories and the percentage of total assets invested in those categories.[15] To estimate the risk premia, we regress (cross-sectional) the expected return (EROPA)[16] on the components of the pension plan in the linear regression A1:

$$\text{EROPA} = f_{A1}(\text{MTRUST, STOCK, CTRUST,, IBC, BONDS, PSA, ICGA, MISC}), \quad \text{(A1)}$$

MTRUST, STOCK, CTRUST, IBC, BONDS, PSA, and ICGA are the fractions of pension assets invested in master trusts, corporate stocks (preferred and common), common/collective trusts, interest-bearing cash (including money market funds), corporate debt instruments (preferred and others) and U.S. government securities, pooled separate accounts, and insurance company general accounts (unallocated contracts), respectively. MISC is the fraction of pension assets invested in miscellaneous asset categories with investments less than 5 percent. An eighth category, NIBC, the fraction of total pension assets invested in non-interest bearing cash, is excluded from regression (A1); otherwise, the model is not full rank (because, by definition, the sum of MTRUST, STOCK, CTRUST, MISC, IBC, BONDS, PSA, ICGA, and NIBC equals 100 percent). These asset categories correspond to the IRS Form 5500 disclosures required by ERISA during the sample period (1990-1992).

Regression A1 is run as a fixed-year effect model. The coefficients for each year pick up the effects of expected risk-free return and any common information in the slope coefficients. The slope coefficients are then prorated to add to one and serve as estimates of relative risk premia for the corresponding asset categories. The portfolio risk (RISK) is defined as the mean of MTRUST, STOCK, CTRUST, MISC, IBC, BONDS, PSA, and ICGA weighted by their respective risk premia (estimated above). [17]

TRANSFER

To measure the extent of inter-investment category transfers, we define TRANSFER as the sum of squares of changes in MTRUST, STOCK, CTRUST, MISC, IBC, BONDS, PSA, and ICGA. (A value of 0 implies no change and a value of 2 implies the maximum change.)

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[15] The risk premium is the expected return on the risky asset in excess of the risk-free rate of return and represents the premium to the investor for undertaking extra risk.

[16] Firms report this variable on the ERISA Form 5500.

[17] The results do not change qualitatively when the ranks (1-8) of the risk premia are used to construct RISK.

PERFORM

Arnott (1997) suggests that performance measure benchmarks should be relative and that peer group comparisons are better than those against market indices, as the latter tend to be erratic and unreliable. To estimate the benchmark performance of the pension portfolio, we run the following linear regression.[18]

$$AROPA = f_{A2}(RISK), \qquad (A2)$$

where AROPA is the actual return on pension assets. The benchmark performance (BENCHMARK) is defined as the predicted value of AROPA from regression (A2). Thus, BENCHMARK is the risk-adjusted return of the portfolio. Portfolio performance (PERFORM) is defined as the difference between AROPA and BENCHMARK. Negative values indicate poor relative performance. Positive values indicate good performance.

[18] We also run a non-linear version of regression (A2) to accommodate the well-known parabolic returns –risk relationship. The results (not reported) do not change qualitatively