

# **LIFE INSURANCE COMPANIES INVESTING IN HIGH-YIELD BONDS**

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September, 1999

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## **ACKNOWLEDGEMENTS**

The current paper incorporates data from a similar study for years 1986 through 1992. That first study set the stage for the staff at the Society of Actuaries office for collecting this information. Thomas Hartman and Bob Callahan at the New York State Insurance Department contributed time and information to support this study. Gathering of DM schedules was the most difficult part of data collection, and in the earlier years those schedules were not available in machine readable form. Particular thanks are due to Harold Philips at the California Department of Insurance who supplied access to hard copies of statements, and to Mark Doherty from the Society of Actuaries Office, and Mary Vizcarrondo and Valerie Chan from the MetLife San Francisco Head Office who reviewed these on site and assembled information needed for the analysis.

For this new study the efforts of the staff at the Society of Actuaries office, and particularly Zain Mohey-Deen for obtaining updates for 1993 through 1995 were indispensable. Diane Mackoul at AM Best assisted in verifying 1994 results. Kathia Martinez a student at the University of Central Florida, improved the readability of this report with her suggestions and by incorporating the data tables into the discussion.

This research was sponsored by the Committee on Life Insurance Research of the Society of Actuaries. The Project Oversight Group made many suggestions to improve the final report, particularly Bob Callahan who contributed historical background. Further, the project had the support of the Life and Health Actuarial Task Force of the National Association of Insurance Commissioners.

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## **1. BACKGROUND AND OBJECTIVES**

As a consequence of actions by the Federal Reserve Board and liberalization during the late 1970s and early 1980s in the regulation of 1) maximum interest rates on loans by banks and other financial institutions, 2) maximum valuation interest rates and subsequent reserve requirements for guaranteed interest contracts of life insurance companies, and 3) the quality and quantity of bond investments by insurance companies, investments in high yield, lower quality bonds became popular with various financial institutions, including many life insurance companies.

A few companies that specialized in high yield bond investments grew rapidly during the mid 1980s. Questions were raised as to the risk of losses from bond default. Was the net return on lower quality bonds after default really higher than the net return on higher quality bonds after default? This study focuses on the question of the extra return of high yield bond investments after asset losses, as well as some corollary items such as relative growth rate of high yield bond companies, emphasizing life insurance company results.

In recent years life insurance company interest in high yield bonds has diminished due to a number of factors, such as direct regulatory limitation on the quantity of lower quality bonds as a percentage of total assets held by a life insurance company; reserve requirements of the former mandatory securities valuation reserve and its successor in part, the asset valuation reserve; new risk based capital requirements; and the general decline in investment rates which had reached their apex in the mid-1980s.

Two regulatory actions affected the attractiveness of high yield bonds to financial institutions. In 1989 the Resolution Trust Corporation mandated the immediate sale of low quality bonds held by failed savings and loan associations. This, in turn flooded the market and caused a temporary decline in the market value of low quality bonds held by life insurance companies. New York (Regulation 130 in 1987 and 1991) and the NAIC imposed limitations on the percentage of low quality bonds that could be held by life insurance companies. The rules did not require sale of such bonds to reach compliance levels, but prohibited any purchases of low quality bonds until compliance levels had been reached.

## **2. DATA**

Publicly available data from Annual Statements were used. These include data from Page 2, the assets; Exhibit 3, gross investment income; Exhibit 4, realized capital gains and losses; Schedule D, the distribution of bonds by grade and maturity; and Schedule DM, showing the market and book value of bonds held at year end.

All the data except for the DM schedules were available from the database maintained by the National Association of Insurance Commissioners (NAIC). The Society of Actuaries office obtained the required data in spreadsheet format from the NAIC and supplied it to the researchers for use in this project.

Results for experience years 1986 through 1992 were modified from the earlier study. Companies were excluded from the current study if information required for determining the return was either missing or zero. Examples of such items are realized capital gains and losses, gross investment income or the amount invested in noninvestment grade bonds. The earlier study included these companies and reflected zero holdings where information was missing.

When two sources were available for DM information, the hard copy of the schedule was used. In years 1994 and 1995 DM data were submitted to the NAIC in electronic format. The analysis for 1993, 1994 and 1995 included fewer companies, primarily because their DM information could not be retrieved.

Schedule D, Part 1A indicates the distribution of bond maturity. However, for years 1989 and earlier more than half of the companies had not fully completed the schedules. So data regarding the average duration of bonds were not available for use as a variable for predicting return.

Historical information on mean investment returns for US Treasuries and US High-Yield Bonds and for years 1986 through 1995 is quoted in Table 20. The data were available from Working Paper Series, S-98-1, Edward I. Altman and Vellore M. Kishore, "Defaults and Returns on High Yield Bond: Analysis through 1997," NYU Salomon Center Publications Department, January 1998, Exhibit 15. Historical information on mean investment returns for life insurance companies, classified as either high-yield or control companies, is quoted from Table 1 of this report.

The forced immediate sale of high yield bonds by Savings and Loan Associations in 1989 depressed the market for these instruments, while changes in regulations have encouraged insurance companies to reduce high-yield bond investments. Further, this ten-year period has seen consolidation in the life insurance industry. Many companies have merged. Others have become insolvent. Companies were identified for inclusion in this study based on data available in 1989. Other years of the study included these same companies wherever data were available. For example, Executive Life was a high profile company that aggressively invested in high-yield bonds and was forced to liquidate; in years 1990 and later Executive Life was not in the study.

#### **4. METHODOLOGY**

This research consisted of two parts. The first showed returns on total bond investments for years 1986 through 1995. The second developed statistical analyses of yield. These analyses were performed on the hypothesized predictive factors: relative proportion of bonds, relative proportion of high-yield-bonds, size of company, and growth rate. Results for companies with

relatively large high-yield-bond portfolios were compared with those for a control group of companies with a smaller proportion of high-yield-bonds.

### *A. Determination of Sample Base*

The criteria for identification as a high-yield-bond company resulted in 70 companies for inclusion. Asset percentages based on the average of year end holdings for 1988 and 1989 include:

- companies whose ratio of bonds classified as below investment grade by the NAIC to cash and invested assets were 5% or more, and whose total assets were \$500 million or more,
- companies not included in the first group, having a ratio of below investment grade bonds as defined by the NAIC classification of 20% or more, and having total assets of at least \$100 million,
- companies for which Schedules DMs were not available were excluded from the study.

The criteria for identification as a control company for the study resulted in 58 companies for inclusion. The criteria were:

- companies whose ratio of below investment grade bonds to cash and invested assets was less than 5%, and
- companies having total assets as close as possible to those of one of the below investment grade companies, and
- companies for which Schedules DMs were not available were excluded from the study.

This resulted in a total of 128 companies in the sample base.

Analyses used four different groupings of this database.

#### *1. All Sample Companies/1989 Classification*

For this grouping, companies identified as high-yield-bond companies in 1989 were categorized as high-yield-bond companies across all calendar years. Similarly, companies identified as control companies in 1989 were defined as control companies across all calendar years. This approach used all available companies each year and held the definition of the high-yield group and the control group constant across years. Analyses based on these criteria compared the same companies or subsamples of the same companies, from year to year because the categorization of a particular company (as a high-yield company or a control company) did not change. However, a company's data may not have been available for all years (in such cases most often the Schedule DM was missing) so generality of results across years may be limited.

The analysis reflected in the earlier report grouped companies according to 1989 year end asset balances. However, the calculation of investment return for a calendar year averaged the beginning and ending asset values. For this report the 1989 base group was determined using the



mean of the assets for year end 1988 and 1989. This was consistent with the reclassification of companies between the high-yield and control grouping each year.

### *2. All Sample Companies/Reclassified Each Year*

Based on the criteria outlined above, each year companies were reevaluated and reclassified into either the high-yield or control group. Thus, a company may have been classified as a high-yield-bond company one year and a control company the next. This contrasted high yield versus control from year to year. Missing data resulted in some companies being dropped from the study for one or more years.

### *3. Companies with Data in All Years/1989 Classification*

These analyses were used to check that the results of all sample companies were not significantly affected by year-to-year changes in the all-sample-companies grouping. Therefore, this grouping included only those 66 companies that had data available for all ten years of the study. Also the 35 companies identified as high-yield-bond companies and the 31 companies identified as control companies in 1989, remained in their groupings across the ten years of study.

Tests based on these criteria addressed concerns about changing the mix when reclassifying, adding and/or removing companies from year to year.

### *4. Companies with Data in All years/Reclassified Each Year*

As in point 3., this final grouping involved the 66 companies whose data were available for all ten years of the study. Here companies were assigned to the high-yield or control group based on the percentage of high-yield bonds each year. This analysis had a somewhat different mix each year between the high-yield and the control group. This approach emphasized the contrast between high yield and control but held the total underlying sample constant.

## ***B. Description of Dependent Variables***

Two dependent variables for bond rates of return were calculated and analyzed, as follows:

- *Percentage return with DM assets MV* (bond rate of return with asset values adjusted to market) gives total credence to the change in the market value of bonds in determining both the investment income and the average market value of the bonds. This takes full account for fluctuations in asset values from year to year in calculating the investment return.

Percentage return with DM assets MV =

$$\frac{2 \times 100 \times (\text{GII} + \text{RCG} + \text{DM difference})}{P \text{ bond assets} + P \text{ DM} + C \text{ bond assets} + C \text{ DM} - (\text{GII} + \text{RCG} + \text{DM difference})}$$

<i>GII</i>	=	gross investment income (sum of lines 1, 1.1, 1.2, from Exhibit 3, Life Statement p. 8)
<i>RCG</i>	=	realized capital gains and losses (sum of lines 1, 1.1, 1.2 from Exhibit 4, Life Statement p. 8)
<i>P</i>	=	prior year
<i>C</i>	=	current year
Bond assets	=	Line 1 bond assets from Life Statement p. 2
<i>DM</i>	=	bond market value – bond book value
<i>DM</i> Difference	=	$C\ DM - P\ DM$

- *Percentage return* considers coupon income plus adjustments for amortization of bond premium and accrual of discount plus realized capital gains on bonds disposed of during the year in determining investment income. The average book value of those bonds still in the company portfolio is the basis for the bond asset value in the denominator. This calculation is presented as the investment return in the annual statement.

$$\text{Percentage return} = \frac{2 \times 100 \times (GII+RCG)}{P \text{ bond assets} + C \text{ bond assets} - (GII+RCG)}$$

- In addition to these two variables, the previous study included percentage return with DM. The two variables “percentage return with DM” and “percentage return with DM Assets MV” produced similar results. Because the separate analysis seemed to complicate matters without clarifying any of the findings, it was omitted in this study.

### ***C. Description of Independent Variables***

Four predictors of return were computed for each of the ten years used in this study:

- *Average percentage high yield.* The average percentage of assets invested in below-investment-grade bonds was calculated as the average of the prior and current year non-investment-grade-bond percentage relative to total assets for that year.

In 1990 the NAIC changed the way it rated bonds. In particular the NAIC’s Securities Valuation Office was no longer permitted to raise the grade of a security above that of an approved rating agency. This resulted in an increase in the number of below investment grade bonds.

The effect of this change on the figures for 1990 was examined by classifying high-yield-bond companies in two different ways: (1) based on the 1990 asset distribution alone, and (2) the same as for all the other years’ analyses. The additional calculation for 1990 affected the analyses that reclassified companies each year but not those that used the 1989 classification.

$$\text{Average percentage high yield} = 100 \times .5 \times \left( \frac{P \text{ noninvestment grade bonds}}{P \text{ total assets}} + \frac{C \text{ noninvestment grade bonds}}{C \text{ total assets}} \right)$$

Total assets = Line 10A from Life Statement p. 2  
 Non-investment grade bonds = 1990-95 Schedule D, Part 1A Life Statement p.29B, sum of lines 5.3-5.6, minus affiliates, lines 4.3-4.6  
 1988-89 Schedule D, Part 1A Life Statement p.29B, sum of lines 5.2-5.4, minus affiliates, lines 4.2-4.4  
 1986-87 Schedule D, Part 1B Life Statement p.29B, sum of lines 5.2-5.4, minus affiliates  
 average percentage for 1988-89.

Note: The average for 1986 was calculated by using the prior-year data from the 1986 files; all other calculations used current-year data from the appropriate file year.

- *Log size assets.* Because the sizes of the companies differed greatly based on total assets, the logarithm of the average of prior and current year's assets was used in the analyses to normalize the size variable.

$$\text{Log size assets} = \log (0.5 \times C \text{ total assets} + 0.5 \times P \text{ total assets})$$

- *Average bond percentage assets.* The mean percentage of assets in bonds was calculated by averaging prior and current years' percentages.

$$\text{Average bond percentage assets} = (100 \times .5) \times \left( \frac{P \text{ bond assets}}{P \text{ total assets}} + \frac{C \text{ bond assets}}{C \text{ total assets}} \right)$$

- *Growth (1-10).* The yearly growth rate for a company was based on the prior-year's total assets. The percentage growth varied widely, neither log nor square root transformations normalized the values; therefore growth rate was divided into ten ordered categories from 1 to 10, where:

1 = less than -5%	6 = 15% to less than 20%
2 = -5% to less than 0%	7 = 20% to less than 30%
3 = 0% to less than 5%	8 = 30% to less than 50%
4 = 5% to less than 10%	9 = 50% to less than 100%
5 = 10% to less than 15%	10 = more than 100%

$$\text{Growth} = 100 \times \frac{C \text{ total assets} - P \text{ total assets}}{P \text{ total assets}}$$

## D. STATISTICAL TECHNIQUES USED IN ANALYSES

### 1. *For Life Insurance Companies*

A t-test was used to test for differences in the means of high-yield-bond companies and control companies. The tests were applied to each of the return variables (percentage return with DM assets MV, and percentage return) and to the set of independent variables (average percentage high yield, log size assets, average bond percentage assets, and growth).

Pearson's correlation coefficients tested for linear relationships between pairs of independent variables.

Multiple regression analyses tested whether a linear relationship existed between each of the return variables and the set of independent variables. Co-linearity was reviewed and tolerances were greater than 0.1. This analysis answered the question, "Did the set of independent variables predict the return?" The  $R^2$  statistic measured the percentage of variability of returns explained by the set of independent variables. The F test examined whether  $R^2$  was significantly greater than zero.

### 2. *For comparing investments returns among US Treasuries, US high-yield bonds, and Life Insurance Companies*

The Chi-square test was used to test whether overall results followed a normal distribution.

The non-parametric Friedman Rank Sum Test tested for differences among the mean investment returns.

#### 4. RESULTS

Tables 1-4 show the means, standard deviations, and t-tests for investment returns by year of experience for high-yield-bond companies and control companies for each of the four study groups.

**Table 1**  
**Means and Standard Deviations for Return Variables**  
**for All Sample Companies/1989 Classification**

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986
Percentage Return with DM Assets MV											
High Yield	Mean	18.55	-0.09	8.85	9.97	19.48	5.65	11.25	10.79	5.33	14.84
	Std Dev	6.94	3.69	3.75	3.46	5.94	4.30	3.70	2.95	2.90	3.18
	N	61	51	46	54	64	70	68	67	57	50
Control	Mean	17.69	0.00	8.56	8.12	16.88	8.81	12.72	9.34	4.29	15.78
	Std Dev	5.18	3.76	3.75	3.16	3.10	2.67	4.30	3.61	4.39	4.67
	N	52	46	43	48	53	58	53	52	46	43
	Difference	0.86	-0.09	0.28	2.82	2.60	-3.16	-1.47	1.45	1.04	-0.94
	t statistic	0.75	-0.12	0.37	3.21	3.03	-5.08	-1.97	2.35	1.38	-1.11
	p value	0.46	0.91	0.72	0.01**	0.01**	0.01**	0.05*	0.02*	0.17	0.27
Percentage Return											
High Yield	Mean	8.05	8.35	8.91	10.60	10.42	8.75	10.25	10.94	11.01	13.63
	Std Dev	1.57	0.77	1.11	1.75	1.88	3.07	1.59	1.43	1.85	2.44
Control	Mean	7.45	8.09	8.57	10.18	10.66	9.98	9.91	10.27	10.16	11.88
	Std Dev	1.23	1.02	1.16	1.87	2.14	1.16	2.13	1.44	2.10	1.97
	Difference	0.60	0.26	0.34	0.42	-0.24	-1.23	0.34	0.67	0.85	1.75
	t statistic	2.27	1.47	1.40	1.18	-0.65	-3.10	0.98	2.54	2.15	3.82
	p value	0.02*	0.15	0.16	0.24	0.52	0.01**	0.33	0.01*	0.03*	0.01**

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

Table 2

Means and Standard Deviations for Return Variables  
for All Sample Companies/Reclassified Each Year

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990	1990	1989	1988	1987	1986
Percentage Return with DM Assets MV												
High Yield	Mean	19.62	-0.83	10.34	10.45	19.45	5.51	5.38	11.26	10.59	4.96	15.53
	Std Dev	3.40	3.25	2.95	3.25	6.04	4.11	4.12	3.70	2.76	3.17	4.13
	N	34	26	23	37	66	72	67	68	81	69	55
Control	Mean	17.52	0.24	8.14	8.33	16.81	9.10	8.95	12.72	9.23	4.69	14.92
	Std Dev	6.97	3.84	3.72	3.32	2.64	2.66	2.80	4.30	4.17	4.55	3.68
	N	79	71	66	65	51	56	61	53	38	34	38
	Difference	2.10	-1.07	2.20	2.12	2.64	-3.59	-3.53	-1.46	1.36	0.27	0.61
	t statistic	2.15	-1.37	2.87	3.14	3.18	-5.96	-5.78	-1.96	2.10	0.31	0.75
	p value	0.03*	0.18	0.01**	0.01**	0.01**	0.01**	0.01**	0.04*	0.04*	0.76	0.46
Percentage Return												
High Yield	Mean	8.27	8.44	8.89	10.77	10.25	9.19	8.89	10.25	10.87	10.74	13.35
	Std Dev	2	0.88	1.08	1.95	1.94	2.37	3.11	1.59	1.35	2.30	2.55
Control	Mean	7.56	8.15	8.69	10.20	10.89	9.45	9.76	9.91	10.18	10.42	12.05
	Std Dev	1.08	0.91	1.16	1.71	2.03	2.59	1.36	2.13	1.60	1.20	1.92
	Difference	0.71	0.29	0.20	0.57	-0.64	-0.26	-0.87	0.34	0.69	0.32	1.30
	t statistic	1.94	1.43	0.74	1.47	-1.71	-0.57	-2.07	0.98	2.30	0.92	2.80
	p value	0.06	0.16	0.46	0.15	0.09	0.57	0.04*	0.31	0.02*	0.36	0.01**

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

Table 3

Means and Standard Deviations for Return Variables  
for Companies with Data in All Years/1989 Classification

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986
Percentage Return with DM Assets MV											
High Yield	Mean	17.56	0.24	8.99	10.36	18.52	6.15	11.90	10.82	5.66	14.80
	Std Dev	8.48	3.65	3.96	3.76	3.89	2.41	3.20	2.37	3.05	3.17
	N	35	35	35	35	35	35	35	35	35	35
Control	Mean	18.19	-0.45	8.98	8.12	17.08	8.13	13.26	8.59	4.70	15.90
	Std Dev	4.38	3.58	3.16	3.43	3.45	2.33	3.40	2.08	3.42	4.47
	N	31	31	31	31	31	31	31	31	31	31
	Difference	-0.63	0.69	0.01	2.24	1.44	-1.98	-1.36	2.23	0.96	-1.10
	t statistic	-0.39	0.78	0.02	2.54	1.60	-3.40	-1.67	4.07	1.20	-1.13
	p value	0.70	0.44	0.98	0.01*	0.11	0.01**	0.10	0.01**	0.23	0.26
Percentage Return											
High Yield	Mean	8.06	8.37	8.74	10.39	10.41	9.42	10.24	11.10	11.16	13.65
	Std Dev	1.15	0.78	0.86	1.10	1.76	1.58	1.69	1.32	1.47	2.80
Control	Mean	7.51	8.16	8.65	9.75	10.54	9.74	9.80	10.11	10.39	11.81
	Std Dev	0.82	0.53	0.86	2.00	2.45	1.42	2.00	1.19	1.37	1.96
	Difference	0.55	0.21	0.09	0.64	-0.13	-0.32	0.44	0.99	0.77	1.84
	t statistic	2.23	1.33	0.56	1.58	-0.23	-0.88	0.97	3.19	2.20	3.12
	p value	0.03*	0.19	0.68	0.12	0.82	0.38	0.34	0.01**	0.03*	0.01**

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

Table 4

Means and Standard Deviations for Return Variables  
for Companies with Data in all Years/Reclassified Each Year

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990	1990	1989	1988	1987	1986
Percentage Return with DM Assets MV												
High Yield	Mean	19.12	-0.29	10.44	10.61	18.44	6.07	5.96	11.90	10.58	5.32	15.64
	Std Dev	3.81	3.42	3.27	3.35	4.31	2.51	2.31	3.20	2.64	2.99	3.76
	N	18	17	16	20	37	39	35	35	43	43	40
Control	Mean	17.39	-0.01	8.52	8.20	17.08	8.54	8.35	13.26	8.27	5.00	14.83
	Std Dev	7.63	3.70	3.58	3.56	2.71	1.84	2.24	3.40	2.22	3.72	4.00
	N	48	49	50	46	29	27	31	31	23	23	26
	Difference	1.73	-0.28	1.92	2.41	1.36	-2.47	-2.56	-1.36	2.31	0.32	0.81
	t statistic	1.22	-0.29	2.00	2.63	1.56	-4.61	-4.27	-1.67	3.99	0.35	0.82
	p value	0.23	0.77	0.06	0.01**	0.12	0.01**	0.01**	0.10	0.01**	0.73	0.42
Percentage Return												
High Yield	Mean	8.15	8.46	8.80	10.36	10.15	9.65	9.47	10.24	10.96	11.00	13.36
	Std Dev	1.50	0.99	0.97	0.98	1.87	1.28	1.61	1.69	1.28	1.68	2.86
	N											
Control	Mean	7.67	8.21	8.65	9.98	10.88	9.47	9.70	9.80	10.03	10.41	11.89
	Std Dev	0.79	0.52	0.82	1.81	2.33	1.80	1.39	2.00	1.27	0.84	1.83
	Difference	0.48	0.25	0.15	0.38	-0.73	0.18	-0.23	0.44	0.93	0.59	1.47
	t statistic	1.28	1.03	0.57	1.12	-1.39	-1.91	-0.62	0.97	2.82	1.91	2.55
	p value	0.22	0.32	0.57	0.27	0.17	0.06	0.54	0.34	0.01**	0.06	0.01*

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

The variable percentage return with DM Assets MV fluctuated more widely than percentage return. In 1994 the percentage return with DM Assets MV hovered around zero for the entire group of companies in the study. The Best's Life-Health industry composite analysis showed the market value of bonds compared to the statement value of bonds went from +3.3% in 1993 to -2.0% in 1994 to +3.2% in 1995. The impact of these changes in the market value of bonds held by life insurance companies generally was reflected in the companies in this study and accounts for the low percentage return with DM Assets MV in 1994.

For all four sample groups, the independent variable percentage return with DM assets MV showed significant differences between high-yield-bond companies and control companies for the years of 1992, 1990, and 1988. Considering Table 1, all sample companies/1989 classification, high yield companies averaged significantly higher returns in 1988, 1991 and 1992. Table 2, all companies reclassified each year, showed high-yield companies averaged significantly higher returns than control companies in 1995, 1993, 1992, 1991, and 1988.



However, in 1989 and 1990 the situation was reversed, control companies showed better average investment returns than high-yield companies. Table 3, showed the 1989 classification study of companies with data in all years were significantly different only for the three years 1988, 1990 and 1992.

The percentage return variable showed a different picture. Using the 1989 classification, differences in return were significant for 1986 and 1988 for all companies in the study and for companies with data in all years. In every case the high-yield companies averaged higher returns.

Table 2, where companies were reclassified each year, indicated a dramatic drop in the number shown as high-yield for years 1992 and later. Many companies changed their investment strategy and reduced their high-yield bonds in response to new regulations for risk based capital and new valuation criteria promulgated by the NAIC, as well as direct limitations by the NAIC on the percentage of assets in low quality bonds. By comparing the top and bottom sections of these tables, the two variables cited in this research show that when change in the market value of assets is incorporated into the definition of investment return, returns fluctuate more widely.

Tables 5-8 show means, standard deviations and t-tests for each independent variable by year of experience for high-yield companies and control companies.

Percentage of high-yield bonds was significantly different for each year and for all groups. Notice that this percentage has diminished considerably in the later years of the study for all companies, but particularly the high-yield companies. Considering the 1989 classification for all sample companies, Table 5, for high-yield companies the average percentage of assets in high yield bonds was 12.5% or higher from 1986-1991, and was less than 7% thereafter.

Log size of assets was not different between high-yield bond companies and control companies. This was controlled by the selection of control companies for the 1989 classification.

The control company group showed a consistently rising percentage of assets in bonds over the 10-year study period for all four classification methods. The same trend is seen in the high-yield companies. The magnitude of the difference in average bond percentage assets declines after 1990, particularly with the 1989 company classification. Average bond percentage assets, is generally greater, and significantly so, for companies classified as high-yield companies.

This study indicates significantly higher growth rates for high-yield bond companies during the years 1986-1988. See, for example, Table 5.

Table 5

Means and Standard Deviations for Predictors  
for All Sample Companies/1989 Classification

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990 #	1990	1989	1988	1987	1986
Average Percentage of High Yield Bonds												
High Yield	Mean	4.81**	5.08**	4.93**	6.31**	11.47**	14.96**	12.83**	13.21**	16.91**	15.96**	14.20**
	Std Dev	2.56	2.47	2.80	4.27	9.68	13.36	10.57	9.40	11.34	11.01	12.20
	N	61	51	46	54	64	70	70	68	67	57	50
Control	Mean	2.31**	2.11**	1.91**	2.25**	3.07**	3.41**	2.54**	2.39**	4.13**	5.80**	4.45**
	Std Dev	2.24	1.85	1.51	1.68	2.51	2.84	2.02	1.43	3.45	8.24	5.05
	n	52	46	43	48	53	58	58	53	52	46	43
Log size assets												
High Yield	Mean	9.47	9.46	9.47	9.47	9.35		9.29	9.29	9.20	9.15	9.11
	Std Dev	0.58	0.52	0.53	0.55	0.57		0.55	0.54	0.59	0.61	0.62
Control	Mean	9.32	9.30	9.30	9.34	9.28		9.23	9.19	9.11	9.15	9.09
	Std Dev	0.76	0.68	0.69	0.62	0.55		0.58	0.59	0.64	0.60	0.62
Average Bond Percentage Assets												
High Yield	Mean	74.78	75.85**	74.42**	70.89	69.77*		70.78**	70.28**	69.19**	67.31**	64.49**
	Std Dev	15.94	16.32	15.18	17.24	16.86		15.94	16.34	16.53	16.87	17.86
Control	Mean	68.69	65.41**	64.41**	64.98	62.21*		57.62**	56.39**	55.65**	52.87**	50.33**
	Std Dev	19.66	19.65	16.07	15.93	18.57		20.09	18.72	18.27	18.43	17.85
Growth (1-10)***												
High Yield	Mean	3.97	3.69	4.17	4.04	4.53		4.81	5.35	5.94**	5.92**	6.02**
	Std Dev	2.19	2.02	2.03	2.03	2.23		2.27	2.28	2.28	2.25	1.87
Control	Mean	3.92	4.37	4.37	4.42	4.42		4.55	5.15	4.67**	4.70**	4.88**
	Std Dev	1.70	1.73	2.00	1.84	1.87		2.10	2.20	1.91	1.87	2.18

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

\*\*\*1= less than -5%

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8=30% to less than 50%

9=50% to less than 100%

10=100% or more

#See text on page 10 for explanation

Table 6

Means and Standard Deviations for Predictors  
for All Sample Companies/Reclassified Each Year

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990 #	1990	1989	1988	1987	1986
Average Percentage of High Yield Bonds												
High Yield	Mean	7.00**	7.19**	7.10**	7.99**	11.88**	15.49**	16.05**	13.21**	15.41**	15.67**	14.75**
	Std Dev	1.83	1.76	2.22	4.20	9.19	12.69	13.02	9.40	10.94	11.27	11.42
	n	34	26	23	37	66	72	67	68	81	69	55
Control	Mean	2.22**	2.39**	2.21**	2.36**	2.21**	2.33**	2.78**	2.39**	2.63**	2.81**	2.37**
	Std Dev	1.48	1.50	1.43	1.46	1.37	1.36	1.75	1.43	1.53	1.38	1.42
	n	79	71	66	65	51	56	61	53	38	34	38
Log size assets												
High Yield	Mean	9.39	9.47	9.50	9.53	9.35	9.29	9.25	9.29	9.20	9.19	9.14
	Std Dev	0.56	0.52	0.59	0.60	0.55	0.55	0.54	0.54	0.59	0.64	0.64
Control	Mean	9.40	9.35	9.35	9.34	9.28	9.23	9.27	9.19	9.07	9.08	9.04
	Std Dev	0.72	0.63	0.62	0.57	0.58	0.58	0.59	0.59	0.64	0.51	0.60
Average Bond Percentage Assets												
High Yield	Mean	77.66*	78.52**	76.21*	69.50	71.40**	71.17**	71.20**	70.28**	67.42**	65.60**	62.27**
	Std Dev	16.24	13.90	14.03	18.24	15.63	16.02	15.67	16.34	16.59	16.65	16.65
Control	Mean	69.53*	68.12**	67.28*	67.32	59.80**	56.66**	57.81**	56.39**	54.44**	51.26**	51.69**
	Std Dev	18.16	19.43	16.52	16.04	18.84	19.62	20.03	18.72	19.48	19.85	20.89
Growth (1-10)***												
High Yield	Mean	3.88	3.73	3.83	3.49**	4.56	4.93	4.79	5.35	5.78**	5.72*	5.95**
	Std Dev	2.24	2.10	1.99	1.91	2.25	2.21	2.29	2.28	2.21	2.16	1.95
Control	Mean	3.97	4.11	4.42	4.63**	4.37	4.39	4.59	5.15	4.55**	4.68*	4.84**
	Std Dev	1.86	1.84	2.00	1.85	1.80	2.15	2.09	2.20	1.97	2.04	2.14

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

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10=100% or more

#See text on page 10 for explanation

Table 7

Means and Standard Deviations for Predictors  
for Companies with Data in All Years/1989 Classification

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990 #	1990	1989	1988	1987	1986
Average Percentage of High Yield Bonds												
High Yield	Mean	4.68**	4.75**	4.87**	6.15**	10.08**	12.98**	11.10**	12.07**	15.47**	14.24**	12.46**
	Std Dev n=35	2.40	2.37	2.80	4.69	7.81	10.06	8.17	8.38	10.58	8.65	9.07
Control	Mean	2.40**	2.18**	1.92**	2.30**	3.32**	3.84**	2.88**	2.55**	3.93**	4.47**	4.27**
	Std Dev n=31	2.45	1.98	1.54	1.42	2.25	2.76	2.00	1.41	2.16	2.79	3.10
Log size assets												
High Yield	Mean	9.45	9.44	9.42	9.39	9.35		9.31	9.25	9.19	9.12	9.04
	Std Dev	0.68	0.57	0.57	0.57	0.57		0.57	0.58	0.58	0.59	0.60
Control	Mean	9.45	9.43	9.41	9.39	9.39		9.35	9.29	9.22	9.18	9.13
	Std Dev	0.70	0.71	0.71	0.65	0.55		0.54	0.55	0.56	0.56	0.58
Average Bond Percentage Assets												
High Yield	Mean	75.71	75.10*	73.20*	70.35	68.46		68.62*	68.31**	67.50**	66.75**	65.62**
	Std Dev	13.83	13.94	14.49	15.71	15.82		15.46	15.77	16.49	16.99	17.89
Control	Mean	68.28	66.78*	65.27*	63.98	62.22		59.23*	56.48**	55.52**	53.83**	52.18**
	Std Dev	17.38	17.58	16.66	16.78	16.72		17.24	17.66	17.35	17.21	16.76
Growth (1-10)***												
High Yield	Mean	3.63	3.57	4.34	4.29	4.54		4.77	5.11	5.63**	5.26	5.94*
	Std Dev	1.90	1.67	1.80	1.95	2.11		2.17	2.14	2.00	1.99	1.75
Control	Mean	3.71	4.13	4.39	4.52	4.39		4.61	5.10	4.39**	4.58	4.77*
	Std Dev	1.66	1.73	1.96	1.93	1.91		2.12	2.41	1.67	1.89	2.28

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

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10=100% or more

#See text on page 10 for explanation

Table 8

Means and Standard Deviations for Predictors  
for Companies with Data in All Years/Reclassified Each Year

Company Grouping	Means and Standard Deviations	1995	1994	1993	1992	1991	No Average 1990 #	1990	1989	1988	1987	1986
Average Percentage of High Yield Bonds												
High Yield	Mean	7.03**	6.93**	7.20**	8.28**	10.31**	12.85**	13.57**	12.07**	13.90**	13.22**	12.64**
	Std Dev	2.03	1.89	2.48	5.22	7.37	9.37	9.66	8.38	10.07	8.07	7.99
	n	18	17	16	20	37	39	35	35	43	43	40
Control	Mean	2.32**	2.37**	2.30**	2.63**	2.56**	2.67**	3.18**	2.55**	2.85**	2.99**	2.43**
	Std Dev	1.46	1.44	1.41	1.41	1.29	1.33	1.74	1.41	1.43	1.39	1.46
	n	48	49	50	46	29	27	31	31	23	23	26
Log size assets												
High Yield	Mean	9.31	9.37	9.45	9.46	9.32	9.28	9.24	9.25	9.23	9.17	9.10
	Std Dev	0.56	0.60	0.66	0.65	0.57	0.56	0.53	0.58	0.60	0.62	0.61
Control	Mean	9.51	9.46	9.41	9.36	9.42	9.40	9.43	9.29	9.16	9.11	9.05
	Std Dev	0.66	0.65	0.63	0.59	0.55	0.55	0.57	0.55	0.51	0.49	0.56
Average Bond Percentage Assets												
High Yield	Mean	80.00**	74.79	74.73	69.26	69.69*	68.09*	70.21**	68.31**	64.81	63.92	61.16
	Std Dev	12.80	14.44	14.41	16.17	15.98	16.14	15.41	15.77	16.97	16.74	17.02
Control	Mean	69.30**	69.94	67.79	66.53	60.22*	58.61*	57.44**	56.48**	56.37	54.64*	56.46
	Std Dev	16.10	16.70	16.16	16.62	15.69	16.60	16.06	17.66	18.43	19.53	20.62
Growth (1-10)***												
High Yield	Mean	3.33	3.35	3.63	3.50*	4.46	4.90	4.86	5.11	5.37	5.12	5.73
	Std Dev	1.68	1.66	1.75	1.79	2.21	2.19	2.38	2.14	1.94	1.88	1.95
Control	Mean	3.79	4.00	4.60	4.78*	4.48	4.41	4.52	5.10	4.43	4.61	4.88
	Std Dev	1.81	1.71	1.85	1.87	1.74	2.06	1.84	2.41	1.83	2.10	2.21

\* Groupings are significantly different at 5% level

\*\*Groupings are significantly different at 1% level

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10=100% or more

#See text on page 10 for explanation

Correlation analyses do not depend on whether a company is high-yield or control. Table 9 shows results for all sample companies, and Table 10 for companies with data in all years.

**Table 9**

**Correlations Between Return Variables and Predictors for All Sample Companies**

<b>Year</b>	<b>Average Percentage High Yield</b>	<b>Log Size Assets</b>	<b>Average Bond Percentage Assets</b>	<b>Growth</b>
Percentage Return with DM Assets MV				
1995	0.16	0.21*	0.29*	0.07
1994	-0.13	0.01	-0.22*	-0.08
1993	0.19	-0.01	0.16	0.08
1992	0.30*	0.17	0.01	0.18
1991	0.71*	-0.14	0.14	0.01
No Average 1990	-0.75*			
1990	-0.75*	0.10	-0.22*	0.07
1989	-0.43*	0.29*	0.05	-0.06
1988	0.35*	0.03	0.01	-0.02
1987	0.14	-0.26*	0.16	0.09
1986	-0.11	0.06	-0.07	-0.20
Percentage Return				
1995	0.34*	-0.05	0.16	-0.43*
1994	0.21*	0.07	0.14	-0.08
1993	0.15	0.14	0.09	-0.01
1992	0.17	0.11	0.04	-0.03
1991	-0.19*	0.04	-0.10	0.14
No Average 1990	-0.34*			
1990	-0.39*	0.18*	-0.01	0.13
1989	-0.01	0.30*	.20*	0.02
1988	0.45*	0.17	0.13	0.24*
1987	0.24*	0.09	0.19*	0.07
1986	0.39*	0.15	0.20*	0.22*

\*Correlations are significantly different from zero at 5% level.

Table 10

Correlations Between Return Variables and Predictors for Companies with Data in All Years

Year	Average Percentage High Yield	Log Size Assets	Average Bond Percentage Assets	Growth
Percentage Return with DM Assets MV				
1995	0.10	0.23	0.24	0.17
1994	-0.05	0.02	-0.13	-0.14
1993	0.18	-0.15	0.03	-0.03
1992	0.25*	0.19	0.01	0.25*
1991	0.47*	-0.10	0.14	0.06
No Average 1990	-0.65*			
1990	-0.66*	0.16	-0.12	-0.09
1989	-0.42*	0.38*	0.05	-0.12
1988	0.42*	-0.01	0.13	0.06
1987	0.13	-0.26*	0.10	0.09
1986	0.07	-0.07	-0.11	-0.17
Percentage Return				
1995	0.41*	-0.14	0.09	-0.53*
1994	0.19	0.07	-0.04	-0.19
1993	0.18	0.07	0.10	0.19
1992	0.08	0.21	0.25*	0.09
1991	-0.02	0.02	-0.23	-0.11
No Average 1990	-0.15			
1990	-0.22	0.09	0.08	-0.04
1989	-0.03	0.30*	0.16	0.19
1988	0.52*	0.05	0.27*	0.40*
1987	0.26*	0.06	0.06	0.27*
1986	0.52*	0.11	0.17	0.28*

Considering the dependent variable Percentage return with DM assets MV, 1988 through 1992 showed significant correlation with the average percentage of bonds classified as high-yield. Years 1988, 1991 and 1992 were positive indicating companies with higher average percentage of high-yield bonds had a higher yield; years 1989, and 1990 were negative, indicating companies with higher average percentage of high-yield bonds had a lower yield. The same holds for the study of companies with data in all years.

These observations indicated investment results had been significantly related to the percentage of high-yield bonds in an insurance company portfolio in six of the ten study years, but in different directions in different years. The other independent variables were not significant for more than three of the 10 years, and again, in different directions.

The dependent variable Percentage return showed a significant correlation with the average percentage of bonds classified as high-yield in seven of the ten years for all sample companies, of which 1990 and 1991 were negatively correlated and 1986, 1987, 1988, 1994 and 1995 were positively correlated. Only four of the ten years were correlated for those companies with data in all years: 1986, 1987, 1988 and 1995 had positive correlations. Again the other independent variables were not significantly correlated in the majority of years.

Tables 11 and 12 show correlations between pairs of return variables and pairs of predictors, respectively, for all sample companies. Tables 13 and 14 show correlations between pairs of return variables and pairs of predictors, respectively, for companies with data in all years. As with Tables 9 and 10, these analyses did not depend on categorization into high-yield or control companies, but only on the actual percentage of assets a company held in below investment grade bonds.

**Table 11**  
**Correlations between Pairs of**  
**Return Variables for All Sample Companies**

Year	Percentage Return with DM Assets MV and Percentage Return
1995	0.25*
1994	0.07
1993	0.17
1992	0.45*
1991	0.15
1990	0.58*
1989	0.52*
1988	0.36*
1987	0.29*
1986	0.08

\*Correlations significantly different from zero at 5% level.



**Table 12**

**Correlations between Pairs of Predictors for All Sample Companies**

<b>Year</b>	<b>Average Percentage High Yield and Average Bond Percentage Assets</b>	<b>Average Percentage High Yield and Growth</b>	<b>Average Percentage High Yield And Log Size Assets</b>	<b>Average Bond Percentage Assets and Log Size Assets</b>	<b>Average Bond Percentage Assets and Growth</b>	<b>Log Size Assets and Growth</b>
1995	0.27*	-0.04	0.15	0.04	0.11	0.24*
1994	0.33*	-0.23*	0.16	0.13	0.18	-0.03
1993	0.23*	-0.16	0.13	-0.02	0.36*	-0.03
1992	0.12	-0.28*	0.02	-0.25*	0.30*	-0.01*
1991	0.22*	-0.21*	-0.11	-0.13	0.36*	0.01
No Average 1990	0.34*	-0.14	-0.08			
1990	0.32*	-0.16	-0.12	-0.13	0.24*	0.02
1989	0.40*	0.03	0.01	-0.12	0.14	-0.21*
1988	0.45*	0.32*	-0.01	-0.12	0.45*	-0.14
1987	0.49*	0.25*	-0.06	-0.17	0.29*	-0.17
1986	0.44*	0.43*	-0.07	-0.19	0.47*	-0.20

\*Correlations are significantly different from zero at 5% level.

**Table 13**

**Correlations between Pairs of Return Variables for Companies with Data in All Years**

<b>Year</b>	<b>Percentage Return with DM Assets MV and Percentage Return</b>
1995	0.10
1994	0.22
1993	0.16
1992	0.32*
1991	0.46*
1990	0.36*
1989	0.63*
1988	0.45*
1987	0.25*
1986	0.01

\*Correlations significantly different from zero at 5% level.

Table 14

Correlations between Pairs of Predictors for Companies with Data in All Years

Year	Average Percentage High Yield and Average Bond Percentage Assets	Average Percentage High Yield and Growth	Average Percentage High Yield and Log Size Assets	Average Bond Percentage Assets and Log Size Assets	Average Bond Percentage Assets and Growth	Log Size Assets and Growth
1995	0.28*	-0.17	-0.03	-0.02	0.14	0.19
1994	0.28*	-0.28*	0.01	-0.05	0.13	-0.02
1993	0.20	-0.22	0.02	-0.15	0.33*	-0.08
1992	0.16	-0.30*	-0.06	-0.32*	0.23	0.03
1991	0.25*	-0.27*	-0.12	-0.37*	0.37*	-0.08
1990	0.36*	-0.01	-0.15			
1990	0.37*	-0.03	-0.21	-0.34*	0.18	-0.02
1989	0.39*	0.11	-0.20	-0.28*	0.10	-0.17
1988	0.36*	0.32*	-0.15	-0.28*	0.49*	-0.05
1987	0.37*	0.34*	-0.18	-0.29*	0.20	-0.14
1986	0.33*	0.40*	-0.20	-0.27*	0.40*	-0.27*

\*Correlations are significantly different from zero at 5% level.

Consider Tables 11 and 13. Correlations between the two return variables were significant in six of the ten study years for all sample companies and for a slightly different six of ten years for companies with data in all years. So the definition of return makes a difference in assessing investment results. Recently, returns that reflect changes in market value have been emphasized in the business community. In fact, this is one reason for the reduced reliance on investment returns reflected in Life Insurance Company annual statements.

Consider Tables 12 and 14. Correlations between the average percentage high yield and the average bond percentage assets for all samples companies showed a significant positive correlation for all years except 1992. Companies with proportionately greater amounts of high yield bonds also had a high percentage of assets in all bonds. The situation was similar for companies with data in all years, but both 1992 and 1993 correlations were not significant.

For all sample companies and for companies with data in all years there was a significant positive correlation between the average percentage high yield and growth for years 1986, 1987 and 1988. The correlation becomes negative in 1990 and remains negative throughout the remainder of this study. These negative correlations were significant in 1991, 1992 and 1994.

There was no significant correlation between average percentage high yield and log size assets for either all sample companies or companies with data in all years.

The average bond percentage assets and log size assets were significantly negatively correlated in 1992 for all sample companies, and significantly negatively correlated for companies with data in all years for the first seven years of the ten-year study. The companies with data in all years had more stable reporting. This suggests that smaller, more stable companies had a higher percentage of assets in bonds, at least for the period 1986 through 1992. In the single year where there was a significant correlation between average bond percentage assets and log size assets for all sample companies, this correlation was negative as well.

Average bond percentage assets and growth for all sample companies were positively correlated in all years of the study, and these were significant in seven of the 10 years, 1986, 1987, 1988, 1990, 1991, 1992, and 1993. For companies with data in all years results were similar, but the correlations were significant only in 1986, 1988, 1991, and 1993.

The relationship between log size assets and growth do not show a consistent pattern. For all sample companies there was a significant negative correlation in 1989 and 1993, and a significant positive correlation in 1995. For companies with data in all years there was significant negative correlation in 1986.

Tables 15 and 16 display the regression analyses for all sample companies for each return variable, respectively. The percentage of variability in the investment return explained by the regression equation adjusted for the number of predictors was significant for percentage return with DM Assets MV for all sample companies in six of the ten study years, 1988, 1989, 1990, 1991, 1992 and 1995. For percentage return for all sample companies the same applies to five of the study years, 1986, 1988, 1989, 1990, and 1995.

Table 15

Regression Analysis of Percentage Return with DM Assets MV for All Sample Companies

Year	<i>n</i>	Adjusted R <sup>2</sup>	Factor	Average Percentage High Yield	Log Size Assets	Average Bond Percentage Assets	Growth	Intercept	F score	<i>p</i> value
1995	113	9.6%	Raw Coef	0.150	1.782*	0.091*	-0.011	-5.648	3.98	0.005*
			Std Error	0.216	0.862	0.032	0.293	8.129		
			Std Coef	0.066	0.194	0.264	-0.003			
1994	97	1.7%	Raw Coef	-0.135	0.261	-0.035	-0.140	1.071	1.41	0.237
			Std Error	0.158	0.629	0.022	0.210	5.940		
			Std Coef	-0.097	0.043	-0.178	-0.072			
1993	89	1.2%	Raw Coef	0.253	-0.199	0.020	0.148	7.704	1.27	0.288
			Std Error	0.153	0.640	0.027	0.215	6.261		
			Std Coef	0.189	-0.033	0.087	0.081			
1992	102	17.1%	Raw Coef	0.359*	0.778	-0.022	0.583*	-0.721	6.19	<.001*
			Std Error	0.086	0.551	0.021	0.179	5.624		
			Std Coef	0.405	0.133	-0.110	0.329			
1991	117	52.4%	Raw Coef	0.457*	-0.633	-0.032	0.519*	20.502*	32.87	<.001*
			Std Error	0.041	0.579	0.020	0.176	5.686		
			Std Coef	0.770	-0.071	-0.115	0.213			
No Average 1990	128	56.1%	Raw Coef	-0.267*	0.321	0.012	-0.102	6.377	41.53	<.001*
			Std Error	0.022	0.420	0.014	0.113	4.067		
			Std Coef	-0.779	0.045	0.060	-0.056			
1990	128	54.7%	Raw Coef	-0.322*	0.088	0.008	-0.108	8.909*	39.39	<.001*
			Std Error	0.027	0.427	0.014	0.115	4.140		
			Std Coef	-0.767	0.012	0.037	-0.060			
1989	121	32.5%	Raw Coef	-0.25*	2.347*	0.067*	-0.036	-11.811	15.42	<.001*
			Std Error	0.037	0.551	0.018	0.139	5.486		
			Std Coef	-0.553	0.329	0.312	-0.002			
1988	119	12.7%	Raw Coef	.137*	0.009	-0.028	-0.139	11.018*	5.28	0.001*
			Std Error	0.030	0.470	0.019	0.148	4.662		
			Std Coef	0.447	0.002	-0.154	-0.092			
1987	103	4.8%	Raw Coef	0.028	-1.446*	0.015	0.001	16.872*	2.29	0.066
			Std Error	0.037	0.602	0.022	0.173	5.961		
			Std Coef	0.085	-0.238	0.077	0.001			
1986	93	0.1%	Raw Coef	-0.018	0.176	0.010	-0.377	15.328*	1.01	0.405
			Std Error	0.044	0.680	0.026	0.234	6.678		
			Std Coef	-0.048	0.028	0.049	-0.199			

\*Significant at 5% level.

Table 16

## Regression Analysis of Percentage Return for All Sample Companies

Year	<i>n</i>	Adjusted R <sup>2</sup>	Factor	Average Percentage High Yield	Log Size Assets	Average Bond Percentage Assets	Growth	Intercept	F score	p value
1995	113	27.9%	Raw Coef Std Error Std Coef	0.150* 0.045 0.282	0.012 0.180 0.005	0.011 0.007 0.137	-0.319* 0.061 -0.435	7.579* 1.700	11.85	<.001*
1994	97	1.3%	Raw Coef Std Error Std Coef	0.055 0.039 0.162	0.040 0.154 0.027	0.005 0.005 0.094	-0.027 0.051 -0.057	7.435* 1.451	1.30	0.275
1993	89	-0.3%	Raw Coef Std Error Std Coef	0.048 0.048 0.114	0.240 0.201 0.129	0.005 0.008 0.076	-0.011 0.068 -0.019	6.006* 1.964	0.94	0.443
1992	102	0.3%	Raw Coef Std Error Std Coef	0.076 0.050 0.163	0.358 0.318 0.116	0.006 0.012 0.052	0.006 0.103 0.007	6.294 3.248	1.07	0.374
1991	117	2.4%	Raw Coef Std Error Std Coef	-0.031 0.023 -0.131	0.038 0.329 0.011	-0.013 0.012 -0.120	0.148 0.100 0.153	10.641* 3.237	1.72	0.150
No Average 1990	128	13.5%	Raw Coef Std Error Std Coef	-0.078* 0.019 -0.367	0.750* 0.366 0.171	0.017 0.012 0.133	0.051 0.099 0.045	1.759 3.551	5.96	<.001*
1990	128	16.9%	Raw Coef Std Error Std Coef	-0.109* 0.023 -0.415	0.666 0.360 0.151	0.018 0.012 0.142	0.035 0.097 0.031	2.668 3.491	7.43	<.001*
1989	121	13.7%	Raw Coef Std Error Std Coef	-0.023 0.019 -0.108	1.158* 0.286 0.353	.028* 0.009 0.282	0.047 0.072 0.057	-2.450 2.848	5.76	<.001*
1988	119	23.6%	Raw Coef Std Error Std Coef	0.061* 0.012 0.454	0.446* 0.191 0.185	-0.010 0.008 -0.126	0.115 0.061 0.173	5.878* 1.924	10.09	<.001*
1987	103	4.2%	Raw Coef Std Error Std Coef	0.033 0.020 0.185	0.429 0.330 0.129	0.012 0.012 0.117	0.015 0.095 0.017	5.491 3.268	2.12	0.084
1986	93	15.5%	Raw Coef Std Error Std Coef	0.077* 0.025 0.343	0.781* 0.379 0.203	0.006 0.014 0.047	0.100 0.131 0.087	4.081 3.722	5.22	0.001*

\*Significant at 5% level.

Table 17 displays the regression analyses for companies with data in all years for each return variable in more abbreviated form. This table showed similar results to tables 15 and 16.

**Table 17**  
**Regression Analysis of Percentage Return for Companies with Data in All Years**

Year	Adjusted R <sup>2</sup>	Average Percentage High Yield	Raw Coefficients			Intercept	F score	p value
			Log Size Assets	Average Bond Percentage Assets	Growth			
Percentage Return with DM Assets MV								
1995	6.8%	0.185	2.290	0.089	0.436	-12.458	2.18	0.082
1994	-2.6%	-0.093	0.067	-0.022	-0.304	2.336	0.58	0.677
1993	-0.6%	0.250	-0.906	-0.009	0.018	17.194*	0.91	0.464
1992	17.4%	0.356*	1.040	-0.020	0.718*	-4.215	4.43	0.003*
1991	21.4%	0.305*	-0.353	-0.025	0.445	18.666*	5.43	0.001*
No Average 1990	43.5%	-0.205*	0.559	0.030	-0.158	2.480	13.52	<.001*
1990	45.0%	-0.253*	0.360	0.031	-0.185	4.436	14.28	<.001*
1989	32.5%	-0.206*	2.229*	0.067*	-0.059	-10.443	8.83	<.001*
1988	13.7%	0.117*	0.247	0.004	-0.131	6.751	3.58	0.011*
1987	1.4%	0.030	-1.365	0.001	0.047	17.171*	1.23	0.308
1986	0.9%	0.081	-0.794	-0.022	-0.426	25.404*	1.15	0.341
Percentage Return								
1995	34.7%	0.117*	-0.071	0.005	-0.280*	8.737*	9.65	0.000*
1994	0.7%	0.048	0.073	-0.003	-0.051	7.829*	1.11	0.359
1993	3.4%	0.075	0.107	-0.001	0.115	6.989*	1.57	0.195
1992	10.2%	0.021	0.857*	0.033*	0.013	-0.325	2.84	0.032*
1991	-0.4%	0.011	-0.257	-0.033	-0.010	15.011*	0.93	0.452
No Average 1990	0.1%	-0.036	0.339	0.019	-0.050	5.772	1.00	0.414
1990	3.4%	-0.059*	0.287	0.021	-0.060	6.260	1.57	0.193
1989	16.0%	-0.018	1.339*	0.029*	0.193*	-5.022	4.10	0.005*
1988	30.0%	0.062*	0.317	0.002	0.170*	6.108	7.97	0.000*
1987	6.6%	0.040	0.310	-0.003	0.165	6.917*	2.15	0.085
1986	29.2%	0.166*	1.152*	0.003	0.164	-0.181	7.71	<.001*

\*Significant at 5% level.

Table 18 shows what accumulated earnings would have been for:

- (1) a company earning the high yield bond company mean percentage return with DM Assets MV,
- (2) a company earning the control company mean percentage return with DM Assets MV,
- (3) a comparison of results.

In the comparison “1” indicated the average high yield bond company return exceeded that of the average control company return. Results assumed \$1 was invested at the beginning of the year of investment and withdrawals occurred at the end of the year of withdrawal. For most years average results for

companies investing in high yield bonds were better than the control companies. This result should be used with caution. Different companies were included in the high yield bond vs. control category each year and in many cases the difference in accumulated return was small and might mean little. In the previous report that included years 1986 through 1992, most of the comparisons resulted in greater returns for the average control companies.

**Table 18**

**Index of Total Returns for All Sample Companies/Reclassified Each Year**

Year of Withdrawal	Year of Investment									
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
High Yield Bond Companies										
1986	1.155									
1987	1.213	1.050								
1988	1.341	1.161	1.106							
1989	1.492	1.291	1.230	1.113						
1990	1.575	1.363	1.299	1.174	1.055					
1991	1.881	1.628	1.551	1.403	1.261	1.195				
1992	2.078	1.798	1.713	1.549	1.392	1.319	1.105			
1993	2.292	1.984	1.890	1.709	1.536	1.456	1.219	1.103		
1994	2.273	1.968	1.875	1.695	1.524	1.444	1.209	1.094	0.992	
1995	2.719	2.354	2.243	2.028	1.823	1.727	1.446	1.309	1.186	1.196
Control Companies										
1986	1.149									
1987	1.203	1.047								
1988	1.314	1.144	1.092							
1989	1.483	1.290	1.233	1.128						
1990	1.616	1.406	1.343	1.229	1.090					
1991	1.887	1.642	1.569	1.436	1.273	1.168				
1992	2.044	1.779	1.699	1.556	1.379	1.265	1.083			
1993	2.211	1.924	1.838	1.682	1.491	1.368	1.171	1.081		
1994	2.216	1.928	1.842	1.686	1.494	1.372	1.174	1.084	1.002	
1995	2.604	2.266	2.165	1.982	1.756	1.612	1.380	1.274	1.178	1.175
Years in which Average Results for High Yield Bond Companies Exceeded Control Companies										
1986	1									
1987	1	1								
1988	1	1	1							
1989	1	1	0	0						
1990	0	0	0	0	0					
1991	0	0	0	0	0	1				
1992	1	1	1	0	1	1	1			
1993	1	1	1	1	1	1	1	1		
1994	1	1	1	1	1	1	1	1	0	
1995	1	1	1	1	1	1	1	1	1	1

Table 19 examines companies in the 1989 classification as a high yield bond company. Of these 35 companies, only two achieved investment returns above the mean for control companies in as many as eight of the ten study years. And 18 of the 35 companies achieved investment returns above the mean for control companies for five or fewer years

**Table 19**  
**Return above the Control Companies' Mean**  
**High Yield Bond Companies with Data in All Years/1989 Classification**

Number of Years	Number of Companies	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986
8	2	1 1	1 0	1 1	0 1	1 1	0 1	1 1	1 1	1 1	1 0
7	6	1 1 1 1 1 1	1 1 1 1 1 0	0 0 1 0 0 1	1 1 1 1 1 1	1 1 1 1 1 1	0 0 0 0 0 0	0 0 0 1 1 1	1 1 1 1 1 1	1 1 1 0 0 0	1 1 0 1 1 1
6	9	1 1 1 0 1 1 1	0 0 0 1 0 0 0	1 0 1 1 1 1 1	1 1 1 1 0 1 1	1 1 1 0 1 1 1	0 1 0 0 0 0 0	0 1 1 1 1 0 0	1 1 0 1 1 1 1	1 0 1 1 0 1 1	0 0 0 0 1 0 0
5	7	1 0 1 1 0 0	1 0 0 0 0 0	0 1 0 1 0 1	0 1 1 1 1 1	1 0 1 1 1 1	1 0 0 0 0 0	1 0 1 1 0 0	0 1 0 0 1 1	0 1 1 0 1 1	0 0 0 1 1 1
4	9	0 0 0 0 1 1 0 0	1 0 1 0 1 0 1 1	0 1 0 0 1 0 0 0	1 1 0 1 0 1 1 1	0 1 0 0 0 1 0 0	0 0 1 0 0 0 0 0	0 0 0 0 0 0 0 0	1 0 0 1 1 0 1 1	1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0
3	2	0 0	0 0	0 1	1 0	1 0	0 1	0 0	1 0	0 0	0 1



Have investments selected by life insurers performed differently from those selected by other investors? To answer this broader question, investment return information from the universe of all bonds was compared to investment returns of life insurers.

Table 20  
Investment Returns  
Comparison of US Bonds and Life Insurance Company Results

YEAR	US High-yield bonds Mean % Return	US 10-Year Treasuries Mean % Return	Table 1 % return with DM assets MV	
			High-yield Companies	Control Companies
1995	19.91	23.58	18.55	17.69
1994	1.17	8.29	-0.09	0.00
1993	17.18	12.08	8.85	8.56
1992	18.16	6.50	9.97	8.12
1991	34.58	17.18	19.48	16.88
1990	4.36	6.88	5.65	8.81
1989	1.62	15.99	11.25	12.72
1988	13.47	9.20	10.79	9.34
1987	4.67	2.67	5.33	4.29
1986	16.09	24.08	14.84	15.78
Mean	13.121	12.645	10.482	10.219
Ranks' sum	20	23	27	30

Table 20 shows the average investment return by calendar year, the mean, and ranks' sum for each of the four categories for the ten-year period. The data were analyzed to determine whether any one group had a significantly different average return for the ten-year period.

The Chi-square test indicated that the data points did not follow a normal distribution. The Friedman Rank Sum Test, a non-parametric test that does not rely on the normality of the underlying distribution was applied. Ranks from 1 to 4 were assigned to each row of data with 1 given to the biggest value; then each column was summed; and finally the statistic, 3.48, was calculated. At an alpha value of 0.05, the statistic to reject the null hypothesis that the returns for the four groups are not different, was 7.81 or greater. So, this test indicated at a 95% confidence level that no significant difference exists in the mean investment returns among the four groups.

## 5. CONCLUSIONS

This study included data for the 10-year period from 1986 to 1995. It tried to answer the question; “Do high-yield-bond investments improve investment results for insurance companies?”

The regression analysis was performed by calendar year, and separated companies according to size, total bond holdings, high-yield-bond holdings, and growth rate. Data availability was a problem for many companies and years, especially in light of the consolidation in the life insurance industry and increasingly restrictive regulation regarding investment in high-yield bonds. Investment returns were measured in two alternate ways; first the traditional approach used in life insurance company annual statements, and second, an approach taking the change in the market value of bond holdings into account.

Findings about life insurance investment results were interesting, if not definitive. Investment results were neither consistently better nor consistently worse for high-yield companies. None of the four variables used to predict investment results were significant for even a majority of the years studied. Different calendar years showed significant results overall for the two different investment measurements. Review of average results of high-yield companies compared to control companies indicated either group might be better, depending on the year of investment and the year of measurement. No particular company appears to have been able to consistently do better with high-yield investments; only 2 of the 35 high-yield companies with data in all study years exceeded the mean investment return in as many as 8 years of the study.

The increasing diversity of insurance company asset portfolios makes a study concentrating on high-yield bonds vs. all bonds less useful. The current challenge would be to categorize all assets held by life insurance companies into more vs. less speculative.

The overall review included a comparison of investment returns for high-yield and 10-year treasuries. Results for this test confirmed the theory that investment instruments are priced properly in the capital market. When higher coupons are available for risky bonds, the market adjusts properly. So the overall investment return, on the average, for high yield bonds, will be comparable to less risky bonds, once defaults are taken into account