A NONPARAMETRIC APPROACH TO EVALUATING REINSURERS' RELATIVE FINANCIAL STRENGTH

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Abstract

There have been a number of past attempts aimed at using financial data of individual companies to produce predictive models of insurance company solvency. These models have come in two forms: parametric and nonparametric. For example, the NAIC, with its Insurance Regulatory Information System, is taking a nonparametric approach to this problem, while the AIA has used a parametric approach in producing its formula for assessing an insurer's financial strength. However, when used to evaluate a reinsurer's *financial strength, these two systems have several shortcomings. For example, these models were developed by analyzing a primary company data base, and it is not clear whether a model created for primary companies will be effective when applied to reinsurance companies. Additionally, the criteria against which the models measure a company's financial strength are fixed, and thus do not reflect each year's changing economic conditions. Since economic conditions alter the value that a ratio can have, this could be a serious defect.*

The model that is presented in this article uses properties of a ranking distribution. The Wilcoxon rank sum test is initially used to determine which financial ratios have historically discriminated between "strong" and "weak" companies. For those ratios that are selected as good discriminators, the test ranks are summed for each company. This statistic is then used as the measure of relative financial strength. Since each year is considered separately, it is assumed that economic conditions of that year will affect all the companies' ratios similarly. It is hoped that this procedure will self-adjust in response to these variable conditions, and provide a more accurate and consistent indicator of a reinsurer's relative financial strength.

1. INTRODUCTION

Evaluating the solvency of an individual insurance market is at best a difficult task. Due to the underwriting practices prevalent during the industry's recent past, many companies are still feeling the effects on their bottom line. The reinsurance market has been especially hard hit, with numerous companies withdrawing from the market either voluntarily or by state order, thus causing a capacity shortage in certain areas of reinsurance. At the same time, as both direct and reinsurance rates have rebounded, new untested capacity has started to enter into the reinsurance arena. While solvency-tracking models have been in place for many years, there have been no models developed specifically for the reinsurance industry. In this paper we present a nonparametric model for ranking reinsurance companies according to their relative financial strength, and compare its results to the NAIC model which has been used in the past, but which was not specifically developed for reinsurers. It should be noted here that in formulating this model, our goal was *not* to produce something which would replace all existing solvency-tracking systems. Rather, our intent, much like the NAIC's, was to produce a straightforward method for quickly developing a ranking based on relative financial strength, with the results being used to highlight those companies for which a more extensive reivew of the financials is urgently needed.

2. HISTORY

As mentioned above, a number of models have been produced in the past, none of which specifically addressed reinsurers. These models can generally be split into two broad categories: (1) nonparametric, and (2) parametric. A brief review of three of these models follows.

NAIC Insurance Regulatory Information System—Nonparametric

Established over a decade ago, the Insurance Regulatory Information System (IRIS) tests consist of the following eleven ratios which provide a quick overview of a company's operations:

		Usual Range
1.	Net Written Premium to Surplus	≤ 300%
2.	Change in Net Written Premium	−33% to +33%
3.	Surplus Aid to Surplus	< 25%
4.	Two-Year Overall Operating Ratio	< 100%
5.	Investment Yield	≥ 6%
6.	Change in Surplus	−10% to +50%
7.	Liabilities to Liquid Assets	< 105%
8.	Agents' Balances to Surplus	< 40%
9.	One-Year Reserve Development to Surplus	< 25%
10.	Two-Year Reserve Development to Surplus	< 25%
11.	Estimated Current Reserve Deficiency to Surplus	< 25%

Usual ranges have been established for each ratio, and any company which falls outside of these ranges for four or more of these tests is classified as a "priority" company.

In applying these eleven tests to reinsurance companies, several shortcomings in this model become apparent. First, since only one set of usual ranges has been established for the entire insurance industry, they may not be stringent enough to identify "priority" reinsurance companies. For example, while a Net-Premium-to-Surplus ratio of 3.0 may be fine for a direct company, it may not be proper for a reinsurance company. Further, the criteria for passing a particular test could be very dependent on the year. For example, the investment yield ratio may have a very changeable range, depending, in part, on the prime interest rate and current tax laws as well as other undetermined factors. Short of a complete study each year, there may be no way to determine the usual range by year. However, no yearly adjustments are currently made to these ranges.

In order to assess the adequacy of the NAIC model, a data base was established for eighty-four domestic companies which predominantly wrote a reinsurance book and also had net written premiums of at least $1 million per year over the 1980–84 period. For these eighty-four companies which comprise our domestic reinsurance "industry," the distribution by number of test failures is shown below:

Number Outside of Usual Range	1980	1981	1982	1983	1984	1985
0	33	41	31	19	5	1
1	29	23	28	22	11	10
2	12	11	17	18	16	13
3	7	4	5	15	13	14
4	0	1	3	8	14	19
5+	3	4	0	2	25	27

As is shown, the first point at which a significant number of "priority" companies are identified is when year-end 1983 data is available, which would be early 1984. This can hardly be described as an "early warning". It is safe to say that a reinsurance buyer, relying solely on NAIC IRIS test results as an authoritative statement regarding the financial strength of its reinsurers, could have easily made a number of costly mistakes in its choice of reinsurers. Moreover, unlike individual policyholders who have the state guaranty funds to fall back on in case of a bad insurance-buying decision, an insurance company which makes a mistake in its choice of reinsurance markets has no such safety net.

A. M. Best Ratings

A. M. Best Inc., founded in 1899, annually assigns ratings to several thousand domestic insurers. These ratings range from a high of A^+ (Excellent) to a low C^- (Fair). There are also a number of conditions under which Best will not assign a letter rating, for example: NA-3 (Insufficient Experience), NA-6 (Reinsured by Unrated Reinsurer), NA-7 (Below Minimum Standards), or NA-10 (Under State Supervision).

As described in their literature, Best reviews a number of financial ratios as a part of its analysis, with these ratios coming from the following general areas:

1. Profitability Tests
2. Leverage Tests
3. Liquidity Tests
4. Loss Reserve Tests
5. Cash Flow Tests

A listing of the individual tests is given in Exhibit 1.

While details of their rating assignment methodology are confidential, there is no question that A. M. Best ratings have historically been heavily relied upon as an aid in making both insurance and reinsurance buying decisions. However, as with the NAIC IRIS test results, the question which must be addressed is whether or not the Best ratings are appropriate for the reinsurance industry in general, and whether or not they provided an early warning against some of the "weak" reinsurers. Shown below is the historical distribution of companies by Best rating for the eighty-four companies in our domestic reinsurance industry data base:

A. M. Best Rating	1980	1981	1982	1983	1984	1985
A$^+$	37	37	32	26	7	4
A	12	18	31	37	37	28
A$^-$	-	-	-	-	-	-
B$^+$	7	5	2	5	14	19
B	2	2	3	3	1	2
B$^-$	-	-	-	-	-	-
C$^+$	1	-	-	1	-	1
C	-	-	-	-	-	-
C$^-$	-	-	-	-	-	-
NA-3	25	22	16	9	7	4
NA-6	-	-	-	-	-	6
NA-7	-	-	-	1	10	6
NA-10	-	-	-	-	-	1
Other	-	-	-	2	8	13
Total	84	84	84	84	84	84

Similar to the IRIS tests, the A. M. Best Ratings do not show a significant downward movement until 1984.

AIA Formula—Parametric

The AIA model, developed by Aetna Life and Casualty and completed in 1978, uses a mathematical formula to differentiate between solvent and insolvent companies. This formula is:

Company Score = 19.00916

           − .11305 × (Two-year Operating Ratio)

           − .04106 × (Liabilities to Liquid Assets)

           − .06742 × (Change in Surplus)

           − .00335 × (Net Written Premium to Loss and Loss
                         Adjustment Expense Reserves)

           − .07314 × (Change in Liability Mix)

A company's score produced by this formula is then compared to the following index of financial strength:

Score (S)	Index of Financial Strength
$2.2 \leq S$	10 Very Strong
$1.4 \leq S < 2.2$	9
$1.0 \leq S < 1.4$	8
$.5 \leq S < 1.0$	7
$0 \leq S < .5$	6
$-.5 \leq S < 0$	5
$-1.0 \leq S < -.5$	4
$-1.4 \leq S < -1.0$	3
$-2.2 \leq S < -1.4$	2
$S < -2.2$	1 Very Weak

Due to the unavailability of some of the necessary data, we did not test the AIA model's predictive power. However, it is reasonable to assume that since this model was derived from a general insurance industry base and not from a specific reinsurance industry base, its results, much like the NAIC model, would not provide the necessary "early warning."

The choice of a regression model for this type of analysis may not be appropriate. The uses and assumptions under which a model would operate need to be examined. Also it should not be overlooked that companies can influence their published statistics. Given that a regression model must rely on only a few financial ratios so that collinearity will not cause overspecification, slight alterations of a particular ratio may have dramatic impacts on the final indication.

3. CHOICE OF MODEL

At the start, there was a good deal of support for selecting an AIA formula type approach. This parametric method was tested and found to be a poor predictor, since, in this case, the assumptions required by the model are not generally met. For example, the errors are not at all random or normally distributed about a mean of zero, in part, due to the difficulty in obtaining proper solvent and insolvent groups of companies from which the coefficient can be estimated. This step is critical, because an outlier can greatly impact the results. Even the notion that a company is either insolvent or solvent, with no possible middle ground, is extremely questionable. Solvency may only be in the eye of the beholder until certain obligations can no longer be met and nonpayments occur.

The estimates and subsequent predictions are further complicated because a regression requires a set of independent variables. This reduces the possible number of ratios that can be used without overspecifying the model. If one of the ratios used was influenced by a company for the sake of appearance, then the results could change dramatically. Clearly, the process used had to be as immune as possible to companies making small cosmetic modifications to their published results.

Exhibit 2 shows some of the results that were obtained using regression. The best fit equation for each year often consisted of different independent variables. Additionally, in many cases, even when the same variable was selected for different years, the magnitude or the sign of the coefficient was quite different. Consequently, this model was abandoned as unsatisfactory.

The NAIC's nonparametric method had a great deal of appeal. In fact, it was used with slight modifications. Instead of employing usual ranges, a ranking scheme was constructed that would dynamically update itself, rather than relying on out of date ranges. This method recognizes the difference between a greatly divergent value and a value which falls just outside of a usual range.

4. THE NONPARAMETRIC MODEL

Data was collected for eighty-four companies which predominantly wrote a reinsurance book, and which had net written premiums of at least $1 million for each of the years 1980–84. To obtain a fair com-

parison between companies, it was considered important that the data be uniformly collected. The *A. M. Best Trend Report* contains uniform data for five years of history, and provided the data for this analysis. The financial ratios that were tested are shown in Exhibit 3.

Selection of Ratios

To determine which financial ratios discriminated between financially strong and weak companies, a sample of both "strong" and "weak" companies had to be established. This was not a simple task, since if the financial well being of a company was easily determinable, there would be no reason to complete the analysis. Also, the selection of strong and weak companies for the sample should be random, so that no bias for size, age, or other attributes is inherent in the decisions. It was not considered necessary that a company actually be declared insolvent to be included in the sample of "weak" companies, but rather the selection was made following an in-depth review of the companies' annual statements, combined with informed judgments about the companies' management practices. Ten strong and ten weak companies comprised our sample for selecting financial ratios.

The selection of companies for the sample was, in part, a motivating influence on the procedures that were adopted. The regression model was heavily dependent on an absolute discrimination of strong from weak companies, in order to produce tight confidence intervals on the regression coefficients. While it was felt that the two groups were generally correct as chosen, they were neither the ten strongest nor the ten weakest companies in the population. For determining which test ratios were good discriminators, a test that was not quantitative, but only determined if the groups had different means was not only sufficient, but stood a better chance at improved resolution because it was less stringent. The Wilcoxon Rank Sum test was chosen for determining a financial ratio's ability to discriminate between groups.

Briefly, the Wilcoxon Rank Sum test works as follows. For a given ratio (e.g., gross leverage) and a given year (e.g., 1980) the twenty companies were ranked in ascending order. Then, the *ranks* of the ten "strong" companies and the *ranks* of the ten "weak" companies were summed. If the gross leverage ratio perfectly distinguished between the two groups back in 1980, the rank sums would be 55 and 155, respec-

tively, for the "strong" and "weak" groups. For this particular example, the actual rank sums were 84 for the "strong" companies and 126 for the "weak" companies, which indicates that this ratio displayed substantial discriminative power as early as 1980. This procedure provides a statistical method for evaluating whether the two groups come from distributions with the same mean financial ratio. The resulting sums of 84/126 indicate that the probability of the rank sum being equal to or less than 84 would occur only 5.67% of the time, given that the means of the two groups were the same. This statement can be expressed equivalently as: the probability is 5.67% that the sum of the second group would be greater than or equal to 126. The percentages were calculated using the normal approximation. For the example of two groups of ten, the mean and variance are calculated as $M = N_1 \cdot (N_1 + N_2 + 1)/2$ and $V = N_1 \cdot N_2 \cdot (N_1 + N_2 + 1)/12$, respectively.

The results are $M = 105$, and $V = 175$, and for a sum of 126 the Z score

$$Z = \frac{(126 - 105)}{\sqrt{175}} = 1.59,$$

which corresponds to the 5.67% probability.

The Wilcoxon test was performed on each of the ratios for each of the five years of data, with the results being used to choose those ratios which consistently (1980–84) discriminated between the two groups of companies. The results of this Wilcoxon Rank Sum Test are shown in Exhibit 4. Based on this procedure, the following ten ratios were chosen as being "good" discriminators:

Gross Leverage
Surplus Aid to Surplus
Operating Ratio
Net Operating Income to Net Earned Premium
Yield on Investments
Premium Balances to Surplus
Ceded Leverage
1-Year Loss Development to Surplus
2-Year Loss Development to Surplus
Gross Leverage/Net Leverage

For those ratios which were not identified as being "good," an additional technique was employed. By redefining the test ratio to be the absolute value of the difference between the company's actual ratio and that ratio's median value, an attempt was made to highlight those additional ratios, such as Change in Net Written Premium, where the "strong" companies may be clustered around the median value, while the "weak" companies show up at both extremes. By redefining these remaining ratios and then performing the Wilcoxon test, the following ratios were also identified as "good" discriminators:

Change in Net Written Premium
Combined Ratio
Estimated Reserve Deficiency
% Change in Gross Leverage/% Change in Net Leverage

Exhibit 5 shows the results of the Wilcoxon test on the redefined ratios for each year. Thus, of the initial twenty-two ratios, fourteen of these have historically shown an ability to discriminate between "strong" and "weak" reinsurance companies.

Ranking Methodology

Given the fourteen ratios, our method for ranking the companies works as follows:

A. For each year of data (1980–84), the companies were ranked (1 through 84) for each of the fourteen ratios individually.

B. For each company and year, that company's average rank for the fourteen ratios was computed.

C. For each individual year, a final ranking of the companies was prepared by ordering the companies based on their 14-ratio average ranks.

D. Our "best guess" at ranking the companies was made by then taking a weighted average of the 1982, 1983 and 1984 individual year rankings, with relative weights of 1:2:4 used to arrive at a final ranking. These weights were selected using judgment.

It should be stated that each year's result is also viewed independently, and any company exhibiting a dramatic change in ranking from one year to the next is carefully examined. Attention is also given to a

company whose rank increases or decreases steadily over time. Ideally, a "good" company is one that maintains an acceptable ranking consistently over time.

5. RESULTS

How well would this ranking technique have worked historically? We have tried to evaluate our results in several different ways as a means of answering this question. First of all, has there been any consistency to the rankings we have developed? To address this question we have (1) used the 1982–84 weighted average ranking as our "best guess" of the correct ranking, (2) eliminated the ten "strong" and ten "weak" companies from our eighty-four company data base, and (3) split the remaining sixty-four companies into thirds (top twenty-one, middle twenty-two, bottom twenty-one). We then looked back to see if these companies have historically fallen into the same categories based on the individual year rankings (1981–84). For example, Exhibit 6 shows that thirteen of the current top twenty-one companies were also ranked in the top twenty-one based on the 1981 data, while six were ranked in the middle twenty-two and two were ranked in the bottom twenty-one. More importantly, it shows that only one of the current bottom twenty-one was ranked in the top twenty-one based on 1981 data, while thirteen of the current bottom twenty-one would have already been placed in the bottom twenty-one based on 1981 data. If we look at 1982 data, seventeen of the current bottom twenty-one companies were already correctly identified.

A second, more important question is: while the rankings may have exhibited reasonable consistency over the years, are they correct? To help answer this question, we looked at the average Best rating historically assigned to companies in our top twenty-one, middle twenty-two and bottom twenty-one. We have assigned the following point scheme to the Best ratings:

A.M. Best Rating	Points
A^+	8
A, A⁻	7
B^+	6
B, B⁻	5
C^+	4
C, C⁻	3
NA–7	2
NA–10	1
Liquidated	0

Using the 1982–84 weighted average ranks as a base, we have computed the average Best ratings historically assigned to the current top twenty-one, middle twenty-two, and bottom twenty-one companies. As a point of comparison, we have also displayed the average Best ratings of the ten "strong" and ten "weak" companies which were used to develop this model.

	Average Best Ratings					
	1980	1981	1982	1983	1984	1985
Top 21*	7.5	7.6	7.5	7.4	6.7	6.4
Middle 22*	7.5	7.6	7.5	7.4	6.8	6.3
Bottom 21*	7.1	7.2	7.1	6.4	3.9	3.7
"Strong" 10	7.8	7.6	7.6	7.7	7.6	7.3
"Weak" 10	7.1	7.2	6.9	6.0	3.6	2.5

*Based on 1982–84 weighted average ranking

The above table highlights the divergence of results between the nonparametric ranking model and the Best ratings. While the Best ratings become significantly lower in 1984 for the bottom twenty-one, there is never any differentiation in the Best ratings between the top twenty-one and the middle twenty-two. Therefore, from a reinsurance buyer's perspective, the average Best ratings conclude that given the same reinsurance cost, a buyer would be indifferent between using a middle twenty-two company or a top twenty-one company. The nonparametric model, however, explicitly differentiates between companies through the ranking procedure, thereby indicating that a reinsurance buyer should not be

indifferent between choosing a middle twenty-two or a top twenty-one company.

If we rank the companies based solely on 1981 data, the same movement in the average Best ratings is again apparent:

	1980	1985
Top 21**	7.7	6.3
Middle 22**	7.4	5.6
Bottom 21**	7.1	4.3

**Based on 1981 ranking

As can be seen, based on 1981 data, the nonparametric model produces a ranking which is very successful in identifying those companies which are today carrying much lower Best ratings. While both the NAIC model and the A. M. Best ratings failed to recognize these potential problem companies until 1984, the nonparametric model would have already identified a majority of these companies in 1981. This would have truly constituted an "early warning."

6. ENHANCEMENTS

Although the current version of the nonparametric model appears to have worked well, several potential enhancements to the present model are readily apparent:

Additional Tests/Data Sources

One shortcoming of the *A.M. Best Trend Report* as a data source is that not all areas of a company's operations are equally covered. Several areas from which additional ratios should be tested are as follows:

1. Schedule F

   a. Ceded Leverage

      This test, even though it is currently being used by the model, might prove to be even more effective if it were split into two pieces—ceded to affiliates and ceded to nonaffiliates. Other possible splits might be ceded to authorized and ceded to unauthorized, or ceded to domestic and ceded to foreign.

b. Reinsurance Recoverables

Reinsurance recoverables could be split along the same lines
as the ceded leverage tests, possibly resulting in a test which
identifies those companies possessing the greatest uncollectible
reinsurance exposure.

2. Property/Liability Premium Breakdown

Differences in the gross and net leverage positions of the various
companies may be in some part attributable to their individual
property/liability mixes of business. By identifying each com-
pany's property/liability split, more meaningful test results may
occur. This information is available on a detailed basis in Part
2C—Premiums Written, and on a summarized basis in the Five-
Year Historical Data in each company's Annual Statement.

Removal of Highly Correlated Tests

The model presented here may include tests that are so highly cor-
related they provide limited additional information. This is not felt to be
a serious defect of the model, however, but merely a situation where
one area of a company's operation (e.g., leverage) may be exerting a
relatively greater influence on the final rankings than some other area
(e.g., loss reserves).

Better Balance

As currently constructed, the fourteen tests contained in the nonpar-
ametric model are distributed as follows:

General Area Tested	Number of Tests
Leverage Tests	6
Profitability Tests	4
Loss Reserve Tests	3
Liquidity Tests	1
Cash Flow Tests	0

Future research should concentrate on identifying additional ratios
from the liquidity and cash flow areas in order that a more balanced
number of tests from each area can be achieved.

Miscellaneous Concerns

As it now stands, there are several areas which are not addressed by the model, and it is questionable whether several of these items are even quantifiable, and thus usable, by the model. The items are:

1. Geographical Distribution of Exposures

   While Schedule T lists direct premiums written by state, neither reinsurance assumed nor net premiums are shown. Therefore, it is impossible to assess a reinsurer's geographical distribution of exposures.

2. Parent Company Commitment

   The willingness of a parent company to back the obligations of its reinsurance subsidiary is often questionable. Regardless of the ranking assigned to a company by the nonparametric model, any information which reflects either positively or negatively on the parent's commitment to the insurance industry should be used to subjectively evaluate the rankings assigned by the model.

3. Management Philosophy

   The quality of management may not necessarily be reflected totally in a company's published financial statements. Although this does introduce another subjective element into the analysis, this is not an area which should be neglected when reviewing potential reinsurance markets.

7. CONCLUSION

It is unreasonable to assume that a solvency-tracking system established for the entire insurance industry would work equally as well, or at all, for the reinsurance industry. As a result of this study, five of the IRIS ratios were found to discriminate between strong and weak companies, while another two discriminated after being adjusted by that ratio's median value.

It was assumed that future insolvent companies could not be identified with certainty. Therefore, the objective was to find a screening process that could provide early warning as to which companies would most

likely be subject to financial stress. These could then be more closely watched. If the market remains profitable, this may be unnecessary. But during a long-term low pricing cycle, this type of monitoring could save a company from poor reinsurance decisions.

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EXHIBIT 1

BEST'S ADVANCE RATING REPORTS TESTS

PROFITABILITY TESTS

1. Loss Ratio
2. Expense Ratio
3. Combined Ratio
4. Operating Ratio
5. Net Operating Income to Net Earned Premium
6. Yield on Investments
7. Change in Surplus
8. Return on Surplus

LEVERAGE TESTS

1. Change in Net Written Premium
2. Casualty % of Net Earned Premium
3. Direct Written Premium to Surplus
4. Net Written Premium to Surplus
5. Net Liabilities to Surplus
6. Net Leverage
7. Ceded Reinsurance Leverage
8. Gross Leverage
9. Surplus Aid to Surplus
10. Reinsurance Recoverable to Surplus

CASH FLOW TESTS

1. Net Cash Flow
2. Net Cash Flow to Quick Assets
3. Quick Liquidity

LIQUIDITY TESTS

1. Current Liquidity
2. Overall Liquidity
3. Agents' Balances to Surplus
4. Premium Balances to Surplus
5. Investment Leverage

LOSS RESERVE TESTS

1. Development to Surplus
2. Estimated Reserve Deficiency to Surplus
3. Loss Reserves to Surplus
4. Developed to Industry Average
5. Projected to Reported
6. Developed to Net Earned Premium
7. Change in Loss Reserves

EXHIBIT 2

MINIMUM SQUARED ERROR
FOUR PARAMETER REGRESSION EQUATIONS
BY YEAR

Year	Parameter	Coefficient
1980	Operating Ratio	−.160
	Investment Yield	1.907
	Gross Leverage	1.227
	Ceded Leverage	−4.570
1981	Operating Ratio	−.099
	Investment Yield	2.405
	Surplus Aid to Surplus	−.481
	Gross Leverage/Net Leverage	−5.464
1982	Net Income/Net EP	.403*
	Gross Leverage	.988
	2-yr Reserve Dev./Surplus	−.388
	Surplus Aid to Surplus	−.979
1983	Net WP/Surplus	5.602
	Agents' Balances/Surplus	.173
	Ceded Leverage	−5.320
	2-yr Reserve Dev./Surplus	−.142
1984	Net Income/Net EP	−.089*
	Return on Surplus	.397
	Premium Balances/Surplus	.080
	Investment Leverage	.101

*Note reversal of sign in coefficient between 1982 and 1984.

EXHIBIT 3

MEDIAN TEST SCORES FOR REINSURERS

Description	1980	1981	1982	1983	1984	1985
Change in Net WP	7	8	4	6	14	32
Premium to Surplus	1.4	1.3	1.2	1.2	1.4	1.6
Net Leverage	3.8	3.9	3.3	3.5	3.9	4.2
Gross Leverage	4.5	5.1	4.6	4.4	5.3	5.5
Surplus Aid to Surplus	1	1	1	1	1	1
Combined Ratio	107	107	114	117	132	120
Operating Ratio	89	89	93	99	113	102
Net Operating Inc. to Net EP	8	9	6	2	−9	−5
Yield on Investments	7.9	8.6	8.7	8.3	8.5	8.8
Change in Surplus	16	8	9	5	−13	7
Return on Surplus	15	9	10	7	−14	−1
Quick Liquidity	40	42	33	49	44	N/A
Overall Liquidity	123	119	117	121	105	N/A
Agents' Balances to Surplus	18	19	15	15	22	20
Prem. Balances to Surplus	22	22	21	17	19	16
Investment Leverage	26	26	24	25	24	25
Estimated Reserve Deficiency	−5	−6	−8	−2	8	15
Ceded Leverage	0.5	0.5	0.5	0.7	1.3	1.2
1-yr Reserve Dev. to Surplus	3	4	4	6	16	2
2-yr Reserve Dev. to Surplus	0	4	6	7	13	0
% Change in Gross Lev./ % Change in Net Lev.	—	1.01	1.00	1.01	0.77	1.03
Gross Leverage/Net Lev.	1.13	1.13	1.19	1.21	1.33	1.32

EXHIBIT 4

WILCOXON RANK SUM TEST RESULTS
(Sum of Ranks for Strong Companies)/(Sum of Ranks for Weak Companies)

	1980	1981	1982	1983	1984
Change in Net Written Premium	103/107	97/113	120/90	118/92	120/90
Net Written Premium to Surplus	98/112	96/114	93/117	91/119	97/113
Net Leverage	106/104	104/106	102/108	98/112	93/117
Gross Leverage	84/126	83/127	77/133	78/132	90/120
Surplus Aid to Surplus	71/139	73/137	67/143	70/140	76/134
Combined Ratio	100/110	104/106	75/135	68/142	58/152
Operating Ratio	97/113	90/120	66/144	57/153	55/155
Net Operating Income to Net Earned Premium	116/94	122/88	142/68	144/66	155/55
Yield on Investments	116/94	120/90	124/86	117/93	112/98
Change in Surplus	112/88	104/106	120/90	127/83	138/72
Return on Surplus	120/90	102/108	144/66	131/79	153/57
Quick Liquidity	94/116	92/118	122/88	100/110	100/110
Overall Liquidity	90/120	89/121	111/99	123/87	130/80
Agents' Balances to Surplus	116/94	117/93	113/97	123/87	112/98
Premium Balances to Surplus	132/78	128/82	127/83	121/89	120/90
Investment Leverage	100/110	103/107	111/99	109/101	93/117
Estimated Reserve Deficiency	89/121	80/130	98/112	96/114	100/110
Ceded Leverage	63/147	62/148	62/148	65/145	80/130
1-Year Reserve Development to Surplus	96/114	95/115	69/141	55/155	79/131
2-Year Reserve Development to Surplus	109/101	93/117	68/142	57/153	69/141
% Change in Gross Leverage/% Change in Net Leverage	N/A	98/112	120/90	118/92	142/68
Gross Leverage/Net Leverage	60/150	59/151	63/147	64/146	69/141

EXHIBIT 5

WILCOXON RANK SUM TEST RESULTS
(Sum of Ranks for Strong Companies)/(Sum of Ranks for Weak Companies)
Based on Company Ratio Minus Industry Median

	1980	1981	1982	1983	1984
Change in Net Written Premium	83/127	113/97	78/132	80/130	91/119
Net Written Premium to Surplus	114/96	127/83	112/98	91/119	77/133
Net Leverage	102/108	124/86	98/112	108/102	70/140
Combined Ratio	90/120	78/132	75/135	90/120	88/122
Change in Surplus	94/116	85/125	101/109	92/118	59/151
Return on Surplus	109/101	93/117	88/122	84/126	101/109
Quick Liquidity	98/112	98/112	93/117	105/105	112/98
Overall Liquidity	104/106	121/89	124/86	118/92	103/107
Agents' Balances to Surplus	119/91	111/99	105/105	121/89	115/95
Investment Leverage	102/108	113/97	102/108	94/116	84/126
Estimated Reserve Deficiency	88/122	98/112	86/124	81/129	75/135
% Change in Gross Leverage/					
% Change in Net Leverage	N/A	87/123	81/129	80/130	91/119

EXHIBIT 6

COMPARISON OF RESULTS
INDIVIDUAL YEAR RANKING VS. 1982/83/84 WEIGHTED AVERAGE RANKING

Individual Year Rankings	Group	1982/83/84 Weighted Average Ranking		
		Top 21	Middle 22	Bottom 21
1981	Top 21	13	7	1
	Middle 22	6	9	7
	Bottom 21	2	6	13
1982	Top 21	15	6	0
	Middle 22	4	14	4
	Bottom 21	2	2	17
1983	Top 21	15	6	0
	Middle 22	6	10	6
	Bottom 21	0	6	15
1984	Top 21	18	3	0
	Middle 22	3	16	3
	Bottom 21	0	3	18