SIZE, STRENGTH AND PROFIT

BY

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I. INTRODUCTION

It has seemed almost axiomatic in America that the bigger something is, the better it is. There is a natural association of *big* with *strong* and of *small* with *weak*. This has permeated our way of life to such an extent that we often accept the conclusion without consideration of the conditions surrounding the specific situation. This paper will statistically test two of our commonly held "truths" in the insurance industry about size, strength and profit.

Generally speaking, we feel that the larger insurance companies tend to be somewhat more efficient. However, many of the larger companies have found that the advantage of size in terms of efficiency does not increase without bound. There comes a point when the size of the unit is simply too unwieldy to be properly handled expediently, and the company begins to break its organization down into smaller units. Homogeneous units of a simple nature will be decentralized leaving the head office with the more complex operations. Ultimately this may lead so far as to create nearly autonomous regional home offices. We have also observed that specialty companies, which tend to be smaller, have often been capable of producing good, efficient operations. Because of these conflicting lines of reasoning, it was felt that an objective study of the facts would be worthwhile.

The first important fact to remember is that while the operating ratio (i.e., the sum of the loss ratio and the expense ratio) of a company is commonly used as an indicator of profitability, it can also be misleading. I'm sure that if we had the choice between getting the profits of a $10,000,000 company with a 95% operating ratio or a $100,000,000 company with a 99% operating ratio we would choose the latter. Ratios, therefore, may be deceptive, but in this study underwriting profit only is to be considered, and ratios were believed to be the only practical method of studying the profitability phenomena despite their limitations. Secondly, discussions of size and profit are almost always carried out in the context of their effect on rate levels and rate competition. Since rates are made on a basis which uses losses and expenses expressed as a percent of premiums, it is natural to measure profitability by a ratio to premium. Finally, we must remember that on a purely logical basis it can be argued easily that big companies *must* be more profitable than small companies, since if this were not true, the big company would not let itself get big. This is perhaps a corollary of the first point, and it sets an *a priori* limit on the iconoclastic findings of any study. This tacitly assumes that the profit motive is sufficiently strong and linked to the other objectives of the company that profitable operations are necessary to the satisfactory operation of the organization. Let's hope we never reach a point where this ceases to be true.

II. SURVEY OF THE FIELD

A search of the literature shows that Hedges[1] made an extensive study of the fire operations of 58 leading companies licensed in New York. This was an interesting study that covered a long period of time and illustrated the great overlap in fire expense ratios between large, medium and small companies. He touched upon the question of profitability only indirectly in saying that ". . . such relationship as exists between claims and underwriting ratios is direct, not inverse." From the data presented, I'm sure that he realized that "such relationships as exists" between the loss ratio and the expense ratio could not be found from the data. The χ^2 test shows that the weak tendency indicated in the data could very easily have arisen by chance from a population in which the correlation was zero and there is a strong counter-tendency found in one section of the table.

Hedges again discussed this subject and amplified it a little in a prepared statement before the Senate Antitrust and Monopoly Subcommittee.[2] In illustration of the thesis that large companies had lower fire expense ratios, the following information was presented:

Company	Premium Volume	Expense Ratio
K	$ 600,000	50%
L	1,000,000	47%
M	4,000,000	45%
N	16,000,000	43%
O	32,000,000	42%

Using the same source and the same year, it was easy to construct a counter-example as follows:

Company	Premium Volume	Expense Ratio
K'	$ 500,000	39%
L'	1,000,000	41%
M'	6,000,000	44%
N'	16,000,000	46%
O'	75,000,000	47%

Harwayne[3] has also studied the relationship between size and expenses. He concluded ". . . even the smallest 'average' company may expect the actual expense and profit allowance [in the automobile bodily injury rates] to at least cover its actual expenses." *But,* "It is apparent that the allowance for profit or contingencies is not enough to cover the added costs incurred

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[1] Bob A. Hedges, "Evaluation of property insurance companies' expense ratios," *The Journal of Insurance,* 25, pp. 1-16 (1959)

[2] "Hearings before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, United States Senate, 86th Congress, 1st Session, pursuant to S. Res. 57." Part 2, pp. 1108-1117 (1960)

[3] Frank Harwayne, "Observations on the latest reported stock insurance company expenses for 1960," *Proceedings of the Casualty Actuarial Society,* 48, pp. 109-120 (1961)

by the least efficient companies."[4] No mention is made of the variation in the loss experience among the companies.

While these studies have considered the expense ratio and its relationship to size of company, the opinion is often expressed that as the size of the company increases, its control over the loss ratio is decreased. First of all, the underwriter loses his intimate knowledge of the geographic area, the types of hazards and the individual risks which he is underwriting. Further, in the effort to increase volume, underwriting standards are modified and often lowered slightly. Underwriters and agents in companies which underwrite each risk individually are very familiar with the opposing pressures of production and quality. Underwriters who do class underwriting are similarly pressed to accept new classes or increase lines on old ones.

Another difficulty with these studies is that they are on an individual company basis as contrasted with the fleet basis. This sometimes makes the results appear rather distorted or shows somewhat less than the complete picture. For example, inter-company reinsurance can produce unrealistic commission ratios due to ceding commissions. A consolidated fleet report would correct this type of problem.

The previous studies have been on individual lines of business (within an individual company) which also carry some special problems into the analysis. Expense allocations to line of insurance are conducted within the regulatory framework but the assignment to function is much more accurate than to line. The very difficult allocation problems will be solved with varying degrees of precision by the individual companies, which introduces a disturbing factor into inter-company comparisons. Then, too, a given size company may find itself treated as small in one line but large in another. This is undesirable in many ways and precludes reaching meaningful conclusions on a company basis.

III. SIZE AND PROFIT

The first study, therefore, was to investigate the combined effect of expenses and losses on an all-lines fleet basis and its relationship to premium size. The raw data was collected under the following conditions: (1) A company or fleet of companies under a common management was treated as a single unit and will be referred to as "company" hereafter. (2) "Best's Insurance Reports" containing 1960 statistics was used. (3) Only companies with more than $10,000,000 net written premium were included. (4) Factory mutuals, companies whose principal business was reinsurance and companies whose main line of business was accident and health in an affiliated

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[4] When Mr. Harwayne goes on in the same paragraph to question whether the savings of the most efficient carrier ought not be passed on to the policyholder, he is expressing the thought which faces every company management. If one devises a very efficient method of conducting a certain phase of the insurance operation and this leads to lowered costs, then management must decide among many alternatives such as: (1) reduce the rates; (2) offer broader protection; (3) plow the money back into research and development; (4) pay dividends to policyholders; (5) allow surplus to increase; (6) increase stockholder's dividends; (7) raise commissions; (8) increase expenses through bonuses or higher salaries. As long as the operation of the companies is to remain in the hands of the owners represented by the management they elect, then the decision as to which combination of alternatives to choose must remain in the hands of that management.

life company were excluded. (5) The company profit ratio was calculated
by subtracting the following ratios from unity: (a) losses and loss adjust-
ment expenses to net earned premium; (b) underwriting expenses to net writ-
ten premium; (c) dividends to policyholders to net earned premium. (6)
Net written premium was recorded as a measure of size. (7) Surplus to
policyholders was recorded (in fleet operation it was necessary to properly
reflect ownership of subsidiary companies). (8) The ratio of Surplus to Net
Written Premium was calculated. The last two items are used in the second
study.   ⦿

Applying the first four rules above produced a group of 180 companies
representing 13.5 billion dollars in premium or approximately 90% of the
property and casualty industry. The next objective was to calculate certain
descriptive statistics on this population. If it is a fact that the profit ratio,
(5), increases as size, (6), grows larger, then there should be a positive cor-
relation between these two items. The size of the correlation indicates the
strength of the relationship. As shown in Appendix A, the correlation be-
tween premium size in millions of dollars and profit ratio for the entire group
of companies was only .052. This is such a weak relationship that it would
be of no value at all in predicting a company's profit ratio from the company's
size.

There are times when a true correlation will be masked if two dissimilar
groups are thrown together. It was natural here to question whether there
might be a difference between stock and non-stock companies, since their
methods of operation are sometimes widely different. Correlations here were
not much better with the stock companies having .042 and the non-stock .104.

To illustrate how meaningless these small correlations really are, a special
study of the non-stock companies was made to see how well profit was cor-
related with the *last* three digits of premium. It will readily be agreed, I'm
sure, that the last three digits of premiums should be a random variable and
thus have a zero correlation with profit. As shown in the appendix, the cor-
relation for these 72 companies is —.144. Thus on this data, there is a closer
correlation (the minus sign is of no special significance here and only the size
of the number is important) between the *last* three digits of premium and
profit than there is between the *first* three digits (millions of dollars) of
premium and profit. This is a rather clear indication that correlations of this
magnitude have no meaning.

Pursuing this idea of subdivision a little further, it was noticed that the
stock company group contained a number of companies that had a rather
high concentration of business in one line. Therefore, the stock company
group was divided between multiple line companies and specialized com-
panies. This latter group includes many cases of what we would not ordinarily
call a "specialty company" in the sense of writing only one line of insurance.
However, they tended to specialize or to have their results dominated by a
single major line of insurance (e.g., Automobile, A & H, Workmen's Com-
pensation, etc.) constituting 50% or more of their net premium written. Here
again, the correlations were weak, being .211 for the multiple line companies
and .108 for the specialized companies.

Finally, the multiple line group was subdivided between Group A—com-
panies who were not members of the National Bureau of Casualty Under-
writers, and Group B—companies who were members of the National Bureau

of Casualty Underwriters. This division may be considered by some to be rather arbitrary since the National Bureau is a rate making organization for casualty lines, and these companies include property insurance, workmen's compensation and accident and health lines as well. However, there tends to be a certain homogeneity of approach within a management group which leads it to belong to a number of bureaus if it belongs to one. The Group A correlation is again very small at .194. To get a clearer picture of this correlation refer to the Scatter Diagram. On the other hand, the Group B correlation of .489 is the largest encountered in the study. It can be calculated from the statistics in Appendix A that the average premium size of Group B companies is 161 million which is considerably larger than the average size of 92 million in Group A. This means that a direct comparison of the two correlation coefficients is not strictly proper within the context of this study. While the .489 figure looks rather large, it must be remembered that this means that size only accounts for 24% (that is, $.489^2$) of the variation in the profit ratios. Thus, even among these 21 companies (the most homogeneous group in the study) we find that size is of very little value in predicting operating results.

With the four finest breakdowns of the data each indicating a positive relationship, it would be in order to emphasize what was said at the close of Section I. Companies of a larger premium size are naturally *expected* to be more profitable than smaller companies, otherwise we would find many holding companies which would establish autonomous managements to operate artificially created smaller companies. In other words, big companies would not allow themselves to get big. However, we did find the results in agreement with our logic since the correlations are positive. At the same time, we have found that premium size is an almost insignificant factor in determining the profit ratio.

SCATTER DIAGRAM

RAW DATA OF STOCK COMPANIES — GROUP A
PREMIUM VOLUME PLOTTED ON LOGARITHMIC SCALE

PERCENT PROFIT

PREMIUM VOLUME (IN MILLIONS)

LINE OF BEST FIT
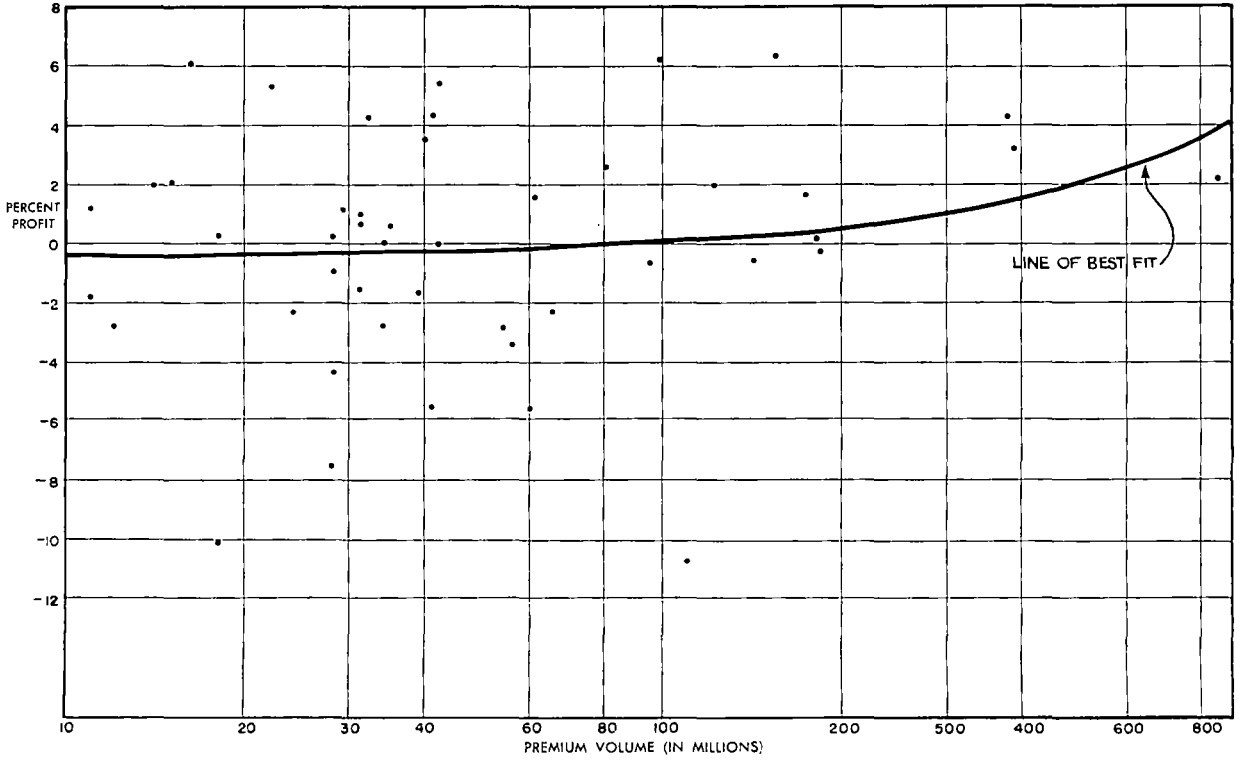
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IV. SIZE AND STRENGTH

Periodically some writer or speaker takes up the banner of the "small" company (although we usually find this crusading voice coming from quite a different quarter). He exhorts us to beware of this or that change because it will hurt the small company. What compassionate listener would not like to be protector of the defenseless, champion of the underdog? But is it really the small that need the protection or is it the weak? Immediately we can see that it is quite a different problem if we speak of weak, declining companies who are operating with archaic methods and making unsound management decisions. We all know a number of companies which have aggressive, modern, competent managements. Some of these companies are small and some are large. To test these subjective feelings statistically, my attention turned next to a measurement of strength and its relationship to premium size.

One of the commonly used measurements of a company's ability to withstand adversity is the ratio of the surplus to policyholders to the net written premium. Although this does not give a complete picture and contains a number of pitfalls, certain precautions were taken in this study to avoid some of the difficulties. Only stock, multiple line companies not owned by a foreign parent company were included. In this way a relatively homogeneous group was obtained and the surplus could be determined for each. This resulted in 54 useable companies. Appendix B presents the statistics and indicates a correlation coefficient of .154. Here again one of our favorite balloons is burst. The expected positive correlation is found, but there is certainly no significant relationship between size and strength. The small, strong company is more than just a convenient ideal to refer to; it is a statistical reality. Conversely, the big, weak company is also present and perhaps more regulatory attention must be directed to this quarter. Now we see how badly we have been misled, because it isn't the small company that needs to be protected, *it is the policyholder.* And he needs to be protected against the financially weak company regardless of its size.

V. CONCLUSION

In summary then we have observed two important facts. Within the limits of the study, we find that no meaningful relationship, exists between the premium size of a company and its profitability or between the premium size of a company and its strength as measured by the ratio of surplus to net premium written.

A study like this whets the appetite and leaves many avenues open for further study. Will different years behave similarly? Was this true prior to the S.E.U.A. decision? What about companies under ten million in net written premium? Is there a relationship between strength and profit?

The economic structure of our industry has not received sufficient attention from the actuary. Basic studies of the role of the regulated independent company, the operation of combinations of companies and the effects of mergers might be of great assistance in our effort to attain a better understanding of the industry and the more effective ways of promoting progress.

Appendix A

X_i = Millions of dollars of Net Written Premium

Y_i = Profit ratio

Z_i = Last three digits of Net Written Premium

The subscripts "i" define different groups of companies:

    1 = Stock, Multiple Line—Group A (i.e., not NBCU member)
    2 = Stock, Multiple Line—Group B (i.e., NBCU member)
    3 = Stock, Specialized
    4 = Non-Stock
    12 = Stock, Multiple Line (i.e., combined 1 and 2)
    123 = All Stock (i.e., combined 1, 2 and 3)
    1234 = All Companies (i.e., combined 1, 2, 3 and 4)

	Number of Cases	Sum of Scores	Sum of Squares		Number of Cases	Sum of Scores	Sum of Squares
X_1	47	4,319	1,358,045	Y_1	47	2.0	697.72
X_2	21	3,384	1,055,942	Y_2	21	−43.4	322.60
X_3	40	1,667	318,125	Y_3	40	136.5	2,181.65
X_4	72	3,706	703,044	Y_4	72	90.2	1,730.44
X_{12}	68	7,703	2,413,987	Y_{12}	68	−41.4	1,020.32
X_{123}	108	9,370	2,732,112	Y_{123}	108	95.1	3,201.97
X_{1234}	180	13,076	3,435,156	Y_{1234}	180	185.3	4,932.41
Z_1	72	34,097	21,425,759				

	Sums of Cross Products	Correlation Coefficient
X_1Y_1	5,218.0	.194
X_2Y_2	− 1.663.4	.489
X_3Y_3	7,913.1	.108
X_4Y_4	7,650.0	.104
$X_{12}Y_{12}$	3,554.6	.211
$X_{123}Y_{123}$	11,467.7	.042
$X_{1234}Y_{1234}$	19,117.7	.052
Z_1Y_4	29,408.0	−.144

Appendix B

V_{12} = Millions of dollars of Net Written Premium of Stock, Multiple Line Companies.

W_{12} = Ratio of Policyholders Surplus to Net Written Premium of Stock, Multiple Line Companies.

N_{12} = Number of Companies = 54

ΣV_{12} = 6,517 ΣW_{12} = 38.97

ΣV^2_{12} = 2,280,925 ΣW^2_{12} = 34.98

$\Sigma V_{12}W_{12}$ = 5,198.70   Correlation Coefficient = .154