A DISCRIMINANT ANALYSIS OF NON-LIFE INSURANCE COMPANIES IN THE PHILIPPINES

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BACKGROUND OF THE STUDY

The Philippines is in the age of liberalization. Practically all areas of business are now open to foreign investors and Filipino businesses are free to compete in other markets. Global competition is the game. More and more business managers today take advantage of management science and statistics as tools for planning and control.

The financial services find themselves in an environment where they have to act or they die. The banking industry was the first among financial services to be liberalized. The insurance industry followed. Whereas before the industry was closed to new companies for a number of years, today, about ten foreign insurance companies have received the authority to do business in the Philippines.

As of 1994, the country has 98 non-life insurance companies, 91 of which are domestic Philippine national and non-Philippine national non-life insurance companies and seven are foreign companies. The majority of the non-life companies have a 20 percent share of the market. Eighty percent of the market are with the foreign, the domestic non-Philippine national and about five of the domestic, Philippine national non-life companies.

Several issues confront the non-life insurance sector. Why are there many small participants in the market? Are the small companies as profitable as the big companies? Will liberalization force companies to close shop or merge to compete?

Are there and if there are, what are the discriminating factors that make a non-life insurance company perform more or less profitably than most of the other companies in the industry?

OBJECTIVES OF THE STUDY

The primary objective of the study is to understand what makes non-life insurance companies outperform (high profit margin) or underperform (low profit margin) as compared to the industry average net profit margin.

The specific objectives are:
• to determine if capitalization, investments, risk management and operating efficiency are determining factors for a firm to outperform or underperform the average profit margin of the industry;
• To determine which of the independent variables account the most for the differences in the average score profits of the outperformers and underperformers;
to establish procedures for classifying firms as outperformers and underperformers on the basis of their scores on a set of independent variables; and

- to establish the number and composition of the dimensions of discrimination between groups formed from the set of independent variables.

RESEARCH DESIGN

The study will use the two-group discriminant analysis.

Selection of the dependent and independent variables

The dependent variable shall be the classification of the companies as "outperformer" or "underperformer." The outperformer is the company that can generate a net profit margin above the industry average. The underperformer is the company that incurs a net loss or generate a net profit margin equal to or below the industry average.

Group 1 will be the underperforming firms with profit margin less than the average of the industry; and Group 2 will be the outperforming firms with profit margin higher than the average of the industry.

The independent variables are the factors considered to be the determinants of the success of the company to generate net income. Seven independent variables will be used, namely; 1) Total Networth; 2) Percentage Investments in Stock and Bonds; 3) Percentage Investments in Real Estate; 4) Percentage Investments in Short Term Securities; 5) Loss Ratio; 6) Expense Ratio; and 7) Total Underwriting Income.

Total networth refers to the capitalization of the company and distinguishes the big from the small company. By sheer size, net operating results may be affected.

The core business of the non-life insurance company is to collect policy premiums and pay claims when loss/damage to property occurs. The loss or damage may or may not happen. The time when it will happen is also unpredictable. Thus, funds are accumulated and decisions as to where these funds may be invested to meet all future claims is a secondary but equally important function of the fund manager of the insurance company. The distribution of the funds into possible alternative placements affects the firm's bottomline. Making the right placements at the right time spells the difference between the successful and the unsuccessful firms.

The loss ratio is the ratio of the losses incurred to premiums earned. This is a measure of the efficiency of risk management of the company. Net profit margins will be affected by company policies and decisions. To balance between the conservative and the aggressive strategy needs skills and expertise.

The expense ratio is the ratio of the general administrative expenses to total underwriting income. This is a measure of the efficiency of the firm to control selling and administrative expenses.

Total underwriting income is the measure of how the firm has successfully marketed its products and how it has decided to do other related business to generate revenues.
DISCRIMINANT ANALYSIS

Population

The study will use the data from all the non-life insurance companies operating in the Philippines, domestic Philippine national, domestic non-Philippine national and foreign. There are ninety-eight companies. For seven independent variables, the ratio of observations/cases is 14:1, an acceptable ratio for the discriminant analysis.

Data

The study uses secondary data taken from the 1995 Annual Report of the Philippine Insurance Commission which used the 1994 financial reports of the insurance companies.

Net profit margins were computed to determine a zero or one grouping. The underperformers, Group 1, is zero. Group 2, the outperformers, is one. Variable 8 in the data set is the dependent variable with a 0 or 1 classification. Variable 1 is taken from the Balance Sheet. Variables 2, 3, and 4 are computed as Stocks plus Bonds, Real Estate, Short Term Investments, each divided by Total Admitted Assets data from the Balance Sheet. Variable 5 is computed as Losses Incurred divided by Premiums Earned in the Income Statement. Variable 6 is computed as Total General Expenses divided by Total Underwriting Income data from the Income Statement.

Methodology

The study used the computer program Statistica to run the computations needed to do a two-group multiple discriminant analysis.

A stepwise discriminant function analysis was used. The squared Mahalanobis distances of the groups were computed. The multivariate aspects of the model are reported under Canonical Discriminant Functions. The canonical correlation squared shows the significance of the discriminant function. The standardized canonical discriminant function coefficients are the weights that will be used in the validation phase.

To assess the predictive accuracy of the discriminant function, a classification matrix is developed.

ANALYSIS AND INTERPRETATION OF RESULTS

Discriminant Function Analysis Summary

<table>
<thead>
<tr>
<th>WILKS LAMBDA</th>
<th>F-REMOVE</th>
<th>P-LEVEL</th>
<th>TOLERANCE</th>
<th>1-TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.736502</td>
<td>2.82439</td>
<td>0.09631</td>
<td>0.387244</td>
</tr>
<tr>
<td>2</td>
<td>0.736232</td>
<td>2.79031</td>
<td>0.09831</td>
<td>0.610921</td>
</tr>
<tr>
<td>3</td>
<td>0.723212</td>
<td>1.4936</td>
<td>0.28655</td>
<td>0.799899</td>
</tr>
<tr>
<td>4</td>
<td>0.851876</td>
<td>17.36537</td>
<td>0.000071</td>
<td>0.718819</td>
</tr>
<tr>
<td>5</td>
<td>0.797161</td>
<td>10.46948</td>
<td>0.001699</td>
<td>0.917161</td>
</tr>
<tr>
<td>6</td>
<td>0.715353</td>
<td>0.1588</td>
<td>0.69121</td>
<td>0.888994</td>
</tr>
<tr>
<td>7</td>
<td>0.72296</td>
<td>1.1221</td>
<td>0.2923</td>
<td>0.453899</td>
</tr>
</tbody>
</table>
The Wilks lambda measures the statistical significance of the discriminatory power of the discriminant function. The seven independent variables, namely net worth (Var 1), percentage investments in stocks and bonds (Var 2), percentage investments in real estate (Var 3), percentage investments in short term instruments (Var 4), loss ratio (Var 5), expense ratio (Var 6); and total underwriting income (Var 7), entered the function.

Variable 6, expense ratio, has the lowest F value while the percentage investments in short term investments and loss ratio, Variables 4 and 5 had the high F values, followed by Variables 1 and 2, networth and percentage investments in stocks and bonds, followed by Variables 3 and 7, percentage investments in real estate and total underwriting income.

Chi Squared Test with Successive Roots Removed

<table>
<thead>
<tr>
<th>P-level</th>
<th>G-1 = 0</th>
<th>G-2 = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eigenvalue</td>
<td>0.400378</td>
<td></td>
</tr>
<tr>
<td>Canonical R</td>
<td>0.534703</td>
<td></td>
</tr>
<tr>
<td>Wilks Lambda</td>
<td>0.713093</td>
<td></td>
</tr>
<tr>
<td>Chi Square</td>
<td>31.14869</td>
<td></td>
</tr>
<tr>
<td>DF</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>P-level</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The overall model has a Wilks lambda equal to 0.71309, an approximate F value of 5.147723 and p < .0001. These findings show that overall, the model is significant in distinguishing between the outperformers and underperformers. The variables 1 to 7 were significant discriminators based on their Wilks lambda and squared Mahalanobis distance from Group centroids with p= .51020 and p = .48980 for Groups 1 and 2 respectively. Distances between groups show p-level of .000059 for Group 1 and Group 2.

Relative Significance of Each Independent Variable in Discriminating Between the Groups

The standardized discriminant weights which show the discriminating power of each of the independent variables are as follows:

- X4 Percentage investment in short term securities .887
- X5 Loss ratio -.630
- X1 Networth .520
- X2 Percentage investment in stocks and bonds .414
- X7 Total underwriting income -.308
- X3 Percentage investment in real estate .235
- X6 Expense ratio .083

The above data show that percentage investment in short term instruments has the highest and the expense ratio, the lowest discriminating power to classify non-life insurance companies as outperforming or underperforming relative to the industry average profit margin.
Looking at the loadings or structure correlations, the same order appears except for X2 percentage investment in stocks and bonds (X2) and networth (X1) exchanging positions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X4</td>
<td>percentage investment in short term instruments</td>
<td>17.365</td>
</tr>
<tr>
<td>X5</td>
<td>loss ratio</td>
<td>10.469</td>
</tr>
<tr>
<td>X1</td>
<td>networth</td>
<td>2.824</td>
</tr>
<tr>
<td>X2</td>
<td>percentage investment in stocks and bonds</td>
<td>2.7903</td>
</tr>
<tr>
<td>X3</td>
<td>percentage investments in real estate</td>
<td>1.149</td>
</tr>
<tr>
<td>X7</td>
<td>total underwriting income</td>
<td>1.122</td>
</tr>
<tr>
<td>X6</td>
<td>expense ratio</td>
<td>0.1588</td>
</tr>
</tbody>
</table>

These loadings are considered relatively more valid because of its correlational nature. They measure the simple linear correlation between each independent variable and the discriminant function.

According to their F values, percentage investment in short term instruments, loss ratio, networth and percentage investment in stocks and bonds remain on top, confirming the discriminatory power of these four variables.

<table>
<thead>
<tr>
<th>Standardized Coefficients</th>
<th>Factor Structure (loadings)</th>
<th>F-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>
Assessing Overall Fit

There are 50 firms in Group 1 and 48 firms in Group 2. The cutting score is computed as follows.

\[ Z_{ou} = \frac{N_aZ_a + N_bZ_b}{N_a + N_b} \]

where  
- \( N_a \) = number in group 1
- \( N_b \) = number in group 2
- \( Z_a \) = centroid for group 1
- \( Z_b \) = centroid for group 2

\[ Z_{ou} = \frac{50 \ (-.613611) + 48 \ (.639179)}{98} \]

\[ Z_{ou} = 0 \]

Because the cutting score is 0, firms will be classified as follows: if the discriminant score is negative, the firm is performing below industry average profit margin; if discriminant score is positive, the firm is performing above the industry average profit margin. Using this criterion, the computer program developed classification matrices for the observations. The classification matrix shows that the model is 78% correct in classifying Group 1 and 68% correct in classifying Group 2, with an overall accuracy of 73%.

The model is tested whether it is significantly better than the apriori chance of classifying the firms correctly without the discriminant function.

Proportional Chance Criterion

\[ C_{pro} = p^2 + (1-p)^2 \]

where  
- \( p \) = proportion of firms in Group 1
- \( (p-1) \) = proportion of firms in Group 2

\[ C_{pro} = (.5102)^2 + (.4898)^2 \]

\[ C_{pro} = 50\% \]

The 73% accuracy of the discriminant model is significantly higher than the classification accuracy relative to chance. The final measure of classification accuracy is Press's Q.

\[ \text{Press's Q} = \frac{[ N - (n \times K) ]^2}{N (K - 1)} \]

\[ \text{Press's Q} = \frac{[ 98 - (26 \times 2) ]^2}{98 (2 - 1)} \]

\[ \text{Press's Q} = 21.59 \]
A Press's Q of 21.59 is much higher than the critical value of 6.63 at the significance level of .01. The study concludes that the predictions of the discriminant function are significantly better than chance.

Aiming for greater predictive accuracy, the discriminant analysis was run two more times. The second run, referred to as Model 2 removed Variable 3, percentage investment in real estate and Variable 6, expense ratio, from the function. These were the least statistically significant in terms of their p-values. The third run, referred to as Model 3, eliminated two more variables, Variable 2, percentage investment in stocks and bonds and Variable 7, total underwriting income, from the function, based on their p-values. Discriminant analysis was applied with three independent variables in the model, namely Variable 1, networth; Variable 4, investment in short term securities; and Variable 5, loss ratio.

The predictive accuracy results for each model are:

<table>
<thead>
<tr>
<th>Model</th>
<th>No. of Independent Variables</th>
<th>Percent Correct Group 1</th>
<th>Percent Correct Group 2</th>
<th>Percent Correct Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
<td>78</td>
<td>68.75</td>
<td>73.47</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>78</td>
<td>66.67</td>
<td>72.45</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>80</td>
<td>64.58</td>
<td>72.45</td>
</tr>
</tbody>
</table>

Model 2 did not improve the predictive accuracy of the function. Model 3 raised to 80% the predictive accuracy of classifying firms as underperforming relative to the industry average profit margin but did poorly in classifying firms who outperformed the industry average profit margin.

**Validation of the Discriminant Results**

The standardized canonical discriminant function coefficients are the weights that will be used in the validation phase.

\[
Z = W_1X_1 + W_2X_2 + W_3X_3 + W_4X_4 + W_5X_5 - W_6X_6 - W_7X_7
\]

where

- \( W_1 = .520 \)
- \( W_2 = .414 \)
- \( W_3 = .235 \)
- \( W_4 = .887 \)
- \( W_5 = .630 \)
- \( W_6 = .083 \)
- \( W_7 = .308 \)

for Model 1.

\[
Z = (.520)X_1 + (.414)X_2 + (.235)X_3 + (.887)X_4 + (.630)X_5 + (.083)X_6 + (.308)X_7
\]

Applying the discriminant function to selected observations in the data set gives the following results.
Case # | Z    | Classification |
-------|------|----------------|
  3    | -9224 | 0              |
 24    | +30,368 | 1              |
  *28  | +5,570 | 1              |
  35   | -16,675 | 0              |
  *41  | -8,284 | 0              |
  60   | +2639  | 1              |
  69   | -164.971 | 0              |
  77   | -1,690.7783 | 0              |

*cases misclassified.

The variate was applied to all observations using the standardized coefficients of Models 1, 2 and 3.

CONCLUSION AND RECOMMENDATIONS

Outperformers and underperformers can be determined by the chosen variables, namely networth, percentage investments in stocks and bonds, real estate and short term instruments, loss ratio, expense ratio and total underwriting income. The degree of influence of each varies. In all three models, percentage investment in short-term securities and loss ratio have the greatest discriminatory power based on their standardized coefficient and loadings. This shows that the firm's ability to earn on their investments and manage risk have a great impact on their profit margin—a fact that does not only have statistical significance but also true in reality for non-life insurance companies.

Model 3 came out to be the most statistically significant, having a Wilks lambda of .7597867 and a p-value of .00001. Model 3 shows an 80% accuracy of discriminating firms who underperform the industry average profit margin but only 65% accuracy of discriminating firms who outperform the industry average profit margin. Therefore the model is better for predicting underperformers rather than outperformers.

A firm's self analysis through the use of these variables explains their present position in the industry and makes possible the prediction into what group the firm can belong in the future relative to the other market players. The firm's distance from the group centroid and its distance from the means of each variable can give signals as to which of these variables are the firm's strength or weakness.

The use of statistical tools through computer programs will bring more extensive business applications of these tools. This can bring deeper insights into business situations. Caution must be taken in the use of these statistical tools. Otherwise the result of the analysis can be misleading to its users. Setting up the variables require theoretical as well as expert opinion and judgment. The computer will only run the programs with the data encoded.

Based purely on financial data gathered from the financial statements of the company, the study was able to identify variables which can discriminate outperformers and underperformers relative to the industry's average profit margin.

Other factors like owners, composition of the Board of Directors; management style, organizational structure, human resource management, product development, sales networking, claims settlement efficiency, among others, were not considered in the study. The incorporation of these variables may improve the predictive power of the model.
REFERENCES


