Health and Epidemiology of the Internal Risk Factors in the Financial Statements of the Tourism Sector in Colombia

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Abstract: - It was applied a statistical and epidemiological model of health to financial statements, analyzing the influence of internal risk factors in 150 companies in the tourism sector in Colombia. As global health indicators they were used cash flow of the present year, profit and loss and ownership equity, companies were classified into two groups (worse or better financial health) by the values in these indicators. Different variables of the financial statements were considered risk factors (for the group of companies with the worst financial health or sick) or protective factors (for the group of companies with the best financial health or healthy). The relative risk and odds ratio were computed to determine the influence of these factors.

Key-Words: - Financial statements, financial health, risk factors, cash flow, profits and loss, ownership equity.

1 Introduction

At times, it has been highlighted the complexity of economic processes [1], using multi-criteria models in the analysis of cash flow [2] and decision making [3], among others. Organizations can be regarded as complex [4] and living systems [5], where health indicators acquire a complex perspective [6]. Health can be defined by global indicators summarizing many factors [7] and integrating different concepts of health [8, 9, 10] at the individual level [11]. Similarly, the financial statements of companies can be summarized in global indicators such as the balance sheet (ownership equity, or assets minus liabilities), cash flow (cash flow of the present year) and the income statement (profit and loss). These three indicators are related to each other and can be considered indicators of financial health.

In previous studies, it was observed that the use of a health model and the theory of chaos provided a good predictability of the relationship among different aggregated financial indicators in the industry of crude oil and natural gas [12] and in the health sector [13].

2 Problem Formulation

Bearing in mind the metaphor of the organization as a living entity, capable of adopting health and disease states, it is possible to use financial indicators of ownership equity, cash flow of the present year and profit and loss, as health indicators. This can be accomplished from the perspective of health and illness as a statistical process.

It is also possible to analyze whether companies can be classified according to these process and indicators, and whether the influence of internal risk factors of financial statements on the financial health of business can be observed.

3 Problem Solution

The financial statements of 150 companies in the tourism sector in Colombia, for the year 2008, according to the information provided by the Superintendence of Societies, were analyzed. No difference was made by type of activity within the sector, company size or other characteristics.

For the overall indicator of financial health of the companies, they were used the variables cash flow of the present year, gains and loss and ownership equity. Table 1 shows descriptive data for these variables in the tourism sector.

Within the statistical model of health, it is assumed a multivariate normal distribution, where the health status is situated [10]. To accommodate to this model, the scores of cash flow of the present year, gains and loss and ownership equity, were normalized and transformed into a standardized scale, with a mean of 50 and a standard deviation of 10.

In this multivariate normal distribution, it is necessary to set cut-off points to differentiate healthy individuals (companies) of non-healthy or sick [14]. This could be done in the financial statements using the usual ratios, related to solvency, liquidity or

sustainability, among others. These ratios are accompanied by some interpretation rules to decide which company is in a good financial state.

Table 1. Descriptive statistics for the tourism sector in Colombia.

	Minimum	Máximum	Mean	SD
Ownership equity	-1010618	8987346	682254,54	1085288,230
Cash flow this year	0	3607850	342974,97	568735,391
Profit and loss	-1570126	2202603	90876,32	323978,878

In thousands of colombian pesos

However, on this occasion, a statistical approach was used, and in the absence of a cut-off point that applies to the new standard scores, it was instead used a hierarchical clustering procedure, with the clustering method of Ward and the squared of the euclidean distance to calculate similarities, which maximizes the differences between the groups obtained. This allowed classifying companies by their financial health, according also to the statistical approach to health [15], which establish that health or illness should be determined based on statistical classification of individuals.

The classification thus obtained accounted for a distribution in two groups, and it is shown in Figure 1. In this figure, the original values of variables, or the indicator of health, ie cash flow of the present year, profit and loss and ownership equities, are shown, instead of the normalized and standardized values which were only used for classification purposes.

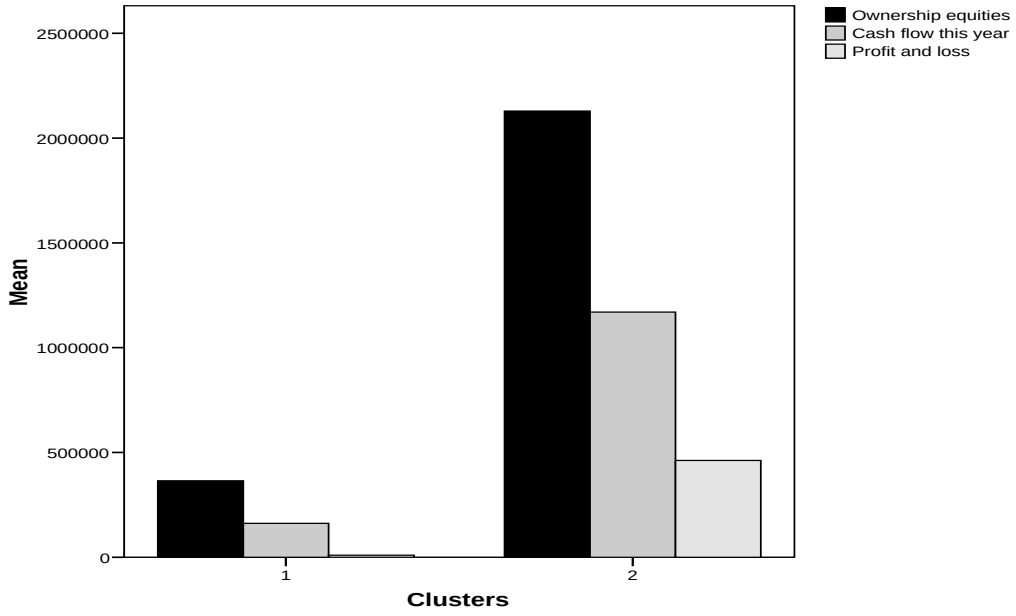

Figure 1. Cluster of companies according to financial indicators. In a relative classification, Cluster 1: Sick companies. Cluster 2: Healthy companies.

In the figure, we can see clearly how the variables of cash flow of the present year, profit and loss and ownership equity, allow the classification of companies in an orderly manner, according to the simultaneous increase in these three variables.

Considering the state of health or disease, such as in the grouping shown in Figure 1, there is the possibility of using classical epidemiological analysis of the influence of risk factors, on the belonging to one group or another. For this, it is assumed that, in this figure, group one is the group

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with symptoms of disease, due to the small score of its financial indicators and the second group is the healthy group, due to the high score of its financial indicators. This is a relative classification based on the comparation between the two groups, and not in any absolute criteria.

These groups show an uneven distribution of the companies, as in group one (sick) are located 123 companies and in group two (healthy) are only 23 companies.

The variables in the financial statements used as risk factors were: 1) 11 Available subtotal, 2) 13 Debtors subtotal st, 3) 14 Inventories subtotal st, 4) 17 Deferred Subtotal st, 5) Current total assets, 6) 13 Long-term receivable subtotal, 7) 16 Intangible subtotal, 8) 17 Deferred subtotal, 9) 18 Other asset subtotal, 10) 19 Valuations subtotal, 11) Non-current asset total, 12) Total assets, 13) 23 Payable account subtotal st, 14) 26 Estimated liabilities and provisions subtotal st, 15) 28 Other liabilities subtotal st, 16) 29 Bond and commercial paper subtotal st, 17) Current liability total, 18) 23 Payable account subtotal, 19) 26 Estimated liability and provision subtotal, 20) 27 Deferred subtotal, 21) 28 Other liability subtotal, 22) Total non-current liabilities, 23) Total liabilities, 24) 31 Social capital subtotal, 25) 32 Capital surplus subtotal, 26) Gross profit, 27) Operating income, 28) Income before taxes and adjustments for inflation, 29) Partial subtotal, 30) Net cash flow from operating activities, 31) Net cash flow from investing activities, 32) Net cash flow from financial activities, and 33) Cash last year.

To get the effect of these variables, considered as risk factors, values in them were grouped into two categories, by an optima interval procedure so as to favor the difference in values, using as a classification variable the two groups obtained for the health indicators represented in Figure 1. The grouping made out of these new variables was adequate with appropriate coefficients of entropy, ranging between .115 and .579, which are satisfactory, guaranteeing the adequacy of the model. This model also provides a measure of threshold for each variable, ie the value of the original variable that differentiates between the new two categories obtained.

However, in this grouping, some variables were not significantly different between the two groups, so they could not be categorized. These variables were: 1) 14 Inventory subtotal st, 2) 17 Deferred subtotal st, 3) 13 Long-term receivable subtotal, 4) 16 Intangible subtotal, 5) 18 Other asset subtotal, 6) 19 Valuation subtotal, 7) 26 Estimated liability and provision subtotal st, 8) 29 Bond and commercial paper subtotal. Cp, 9) 23 Payable account subtotal, 10) 26 Estimated liability and provision subtotal, 11) 27 Deferred subtotal, 12) 28 Other liabilities subtotal, 13) Total non-current liabilities, 14) 32 Capital surplus subtotal, 15) Partial subtotal, 16) Net cash flow from investing activities, and 17) Net cash flow from financial activities. These variables could not be considered risk factors.

Thus, the variables that were significantly different between groups were considered the risk factors with two categories, this risk factors can be present (one category) or absent (another category).

Similarly, health indicators have the two categories shown in Figure 1, which can be considered as a group of healthy companies and a group of sick companies. Thus, it is possible to calculate the odds ratio and the relative risk for each risk factor, according to the model of classical epidemiology in health. These indicators are shown, in Table 2, for each of the variables used as risk factor and the healthy and diseased groups.

Besides, the table shows the original cut-off values, which differentiates healthy from sick companies, according to each one of the risk factors. It is also shown the Chi square test of significance for the frequencies in the table, which results to be highly significant for all of the variables. This is not surprising, as this variables were rearrange into categories by the optimal interval statistic procedure.

In this table, we must take into account that a relative risk equal to one indicates no association, if it is greater then it is a risk factor and if it is lower it becomes a protective factor. Data are presented for each group of companies, diseased and healthy. The odds ratio is depicted for the overall table, meaning the disparity between the presence / absence of risk factor and the companies that are healthy and sick. It is a measure of the effect and precision of the association, the higher it is the greater effect is produced. None of the confidence intervals for these indicators had values of one inside them, which would indicate that this factor was not significant.

Actually, the odd ratios for all of the risk factors are quite high, so they have a real incidence in every group of companies. The relative risk is over one for all the factors for the group one, the diseased group. This means these are risk factors for this group. On the contrary, these same factors are under one for the group two, the healthy group. This means they are protective factors for this group. The difference comes from the cut-off point established for each variable. This point determines whether a company is in one or another group, in this sense if a company has its financial indicators over the cut-off points, this company will be in the second group, or healthy

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group, but if its financial indicators are under the cut-off points, the company will be in the first group, o diseased group.

Besides, the relative risk value determines the extent to which this is true. It indicates the probability for a company to be in the first group, if its financial indicators are under the cut-off points, exposed to the risk factor, compare to a company which is not. This probability is lower for the second group.

According to this, this combination of analysis provides several types of information based on health and epidemiological models.

4 Conclusion

The application of health and epidemiological models could be of interest in analyzing financial statements. However, it is needed to go deeper into the application, incorporating the use of complex calculations and the usual ratios of financial analysis.

Moreover, in addition to these models, it is also necessary to include a health or epidemiological model that explains why the variables listed have become risk factors, which has not been done in this paper for space reasons.

Table 2. Odds ratios and relative risk for the association between risk factors and sick-healthy companies.

		Total	Group 1 (Sick)	Group 2 (Healthy)	Chi squared
	Cutt-off points for sick-healthy companies[a]	Odds ratio	Relative risk	Relative risk	
11 Available subtotal	502171	112.125	4.674	,042	91.556**
13 Debtors subtotal st	1070217	74.000	2.921	.039	76.009**
Total current assets	1800192	179.688	4.054	.023	95.620**
17 Deferred subtotal	57829	20.000	3,478	.174	28.712**
Total non-current assets	110352		1.482		26.579**
Total assets	2294396	264.727	3.334	.013	90.915**
23 Payable account subtotal st	97346	18.595	1.593	.086	31.733**
28 Other liabilities subtotal st	193705	22,750	1,694	.074	37.408**
Total current liabilities	886292	151.667	2.421	.016	71.227**
Total liabilities	1178347	77.941	2.425	.031	68.144**
31 Social capital subtotal	250000	23.406	2.190	.094	49.983**
Gross profit	1821177	101.333	3.573	.035	85.850**
Operating income	198130	72.833	3.435	.047	79.992**
Income before taxes and inflation adjustments	195868		7.750		126.397**
Net cash flow from operating activities	637879			.140	33.450**
Cash flow last year	439044	85.800	4.475	.052	85.573**

[a] In thousands of Colombian pesos

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