

An Ecological and Health Model of The Software Consultancy and Supply of Computer Software in Bogota, Colombia

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Abstract. An ecological and health model was applied to the economic activity of software consultancy and supply of computer software in the city of Bogotá, Colombia, to determine whether this activity was influenced by other computer sector activities in the same city, as well as by all computer activities in the surrounding department and the country. The financial statements of 316 companies in the sector were analyzed. Comparison tests (Mann-Whitney's U) yielded no significant differences among the mesosystem (computer activities in the city of Bogotá), the exosystem (computer activities in the surrounding department, Cundinamarca) and the macrosystem (computer activities in Colombia). By a structural equation model it was determined that a great uniformity exists in the economic performance of the companies in the sector, showing a great influence among all type of activities.

Keywords: Ecological model, financial health, computer sector, financial statements.

1. Introduction

Analysis of financial performance requires of new developments, i.e. new models of reporting [1] or new ratios [2], to exert appropriate influence in making decisions [3]. Financial analysis is performed to help assess a company's history and build a prospective of what its financial performance will be [4]. It is clear that such analysis should take into account the economic sector where companies are and their interaction with other companies. In addition, financial statements are becoming more important in environments with low levels of control and regulation, such as small companies environments [5], what is reflected in the motivations to exert some influence on presentations of financial results [6]. Another way to influence financial results comes from interacting forces in contexts related to economic activity.

In the field of human sciences, the ecological model introduced a new perspective in human development, based on circles of influence and interactions among these circles or systems and the individual. In this model, environment is thought from the perspective of the person, or unit in development [7] and consists of the following nested circles: a) microsystem, or close relations of individuals, such as family, b) mesosystem, or relations among different systems within the microsystem, i.e. family and school (this is a system of microsystems), c) exosystem, or influences from external systems, such as parent's workplace, and d) macrosystem, or influences from all the other systems, such as country culture or behaviour styles [7]. Development of individuals is the result of individual's interaction with environment [8].

Given the approach to organizations as living systems [9] in development, the ecological model can be useful in the analysis of the influences, exerted by environmental circles, affecting their financial health, what may be related to self-sufficiency [10], bankruptcy [11], or income, expenditure and assets [12]. From a health perspective in the study of the economic sectors, the balance sheet (equity, or assets minus liabilities), cash flow (cash flow of the present year) and the income statement (profit and loss) have been used as financial health indicators, within an epidemiological and statistical risk approach [13], or along with concepts borrowed from chaos theory [14, 15].

Based on the ecological model, we can differentiate: a) an economic activity, as a microsystem, b) the relation of this activity with other activities within sector, as a mesosystem, c) sector activities within a

department or state, as an exosystem and d) the relation of an activity with those of the rest of the country, as a macrosystem.

Accordingly, the objective of this research is to apply the ecological model in the analysis of circles of influence on financial statements and determine differences or similarities among the health financial statements of different systems. The underlying assumption is that if no differences are found, there are interactions and influences among companies located in different influence circles, and the more these influences increase, companies will tend to homogenize their results. Comparison was a method used in the ecological model [7]. Interactions among individuals shape behavior, so the greater the influences the greater the resemblance.

2. Methods

2.1. Sample

The financial statements of 316 companies, belonging to computer sector in Colombia, according to the information provided by the Superintendence of Societies for the year 2010, were taken as a purposeful sample. This is a medium size sector in Colombian economy, with small and medium companies involved in activities such as: a) Computer equipment consultancy (ISIC = K7210), b) Software consultancy and supply of computer software (ISIC = K7220), c) Data processing (ISIC = K7230), d) Activities related to databases (ISIC = K7240), e) Maintenance and repair of office, accounting and computing machinery (ISIC = K7250), f) Other activities (ISIC = K7290). The software consultancy and supply of computer software activity (ISIC = K7220) within the city of Bogotá, was selected to analyze its relations with other environments. Regarding computer sector, Bogotá has the highest economic concentration, with 251 companies, while the rest of the country has only 65 companies.

Equity, cash flow of the present year and profit and loss were selected as health financial indicators.

2.2. Results

The computer software consultancy and supply of software (K7220) activity in Bogota, has an average equity of 3,003,902 (SD = 9,086,786), an average profit and loss of 296,307.39 (SD = 2,536,847) and an average cash flow of the present year of 509,807 (SD = 1,256,730) (average figures in thousands of Colombian pesos). These indicators have the following correlation with each other (Spearman's ρ coefficient): a) Equity-Profit and loss, $\rho = .531$, $p < .01$, b) Equity-Cash flow of the present year, $\rho = .582$, $p < .01$ and c) Profit and loss-Cash flow of the present year, $\rho = .425$, $p < .01$.

The financial performance of computer sector in Colombia shows an uneven distribution in the country, what is depicted in Figure 1, where values are concentrated around zero, with a few companies reaching higher values.

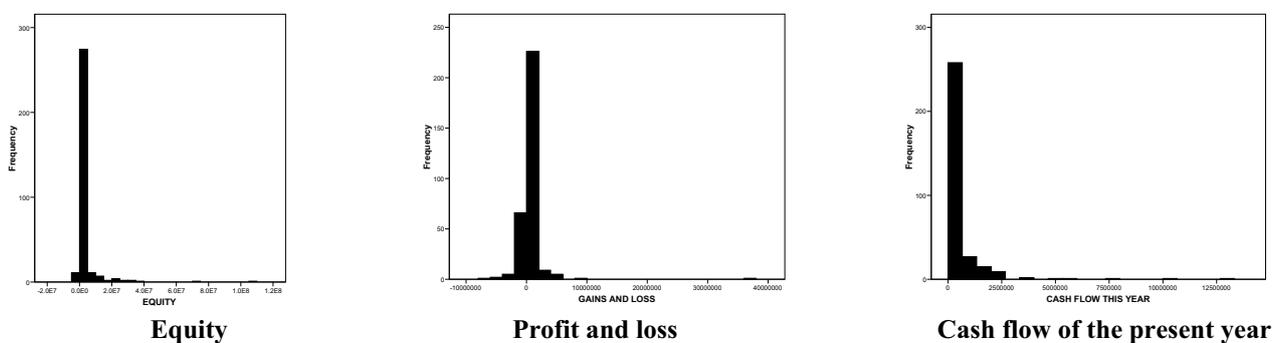


Figure 1. Distribution of health financial indicators in computer sector.

To analyze differences among systems, according to ecologic model, companies were grouped:

- 1) Companies involved in Software consultancy and supply of computer software within the city of Bogota (microsystem).
- 2) Companies involved in all other activities in the computer sector in the city of Bogotá (mesosystem).
- 3) Companies involved in all type of activities in the computer sector in the department of Cundinamarca, where the city of Bogotá is located (exosystem), but not in Bogotá.
- 4) Companies involved in all type of activities in the computer sector in the country (macrosystem), but neither in Bogotá nor in Cundinamarca.

Differences in health financial indicators (equity, profit and loss and cash flow of the present year) among systems were determined by comparisons between:

- 1) Companies involved in Software consultancy and supply of computer software activity in the city of Bogotá compare to all the other activities of the computer sector in the city of Bogotá.
- 2) Companies involved in Software consultancy and supply of computer software activity in the city of Bogotá compare to all the computer activities in the department of Cundinamarca.
- 3) Companies involved in Software consultancy and supply of computer software activity in the city of Bogotá compare to all the computer activities in the country.

Comparisons were made between systems (group of companies) and not for a single company (the individual in the ecological model). Table 1 shows the results of nonparametric Mann-Whitney's U test, assuming the hypothesis that no relation exists between each pair of systems. Each box depicts the difference between the column and row.

Table 1. Man-Whitney's U to test differences among circles of influences.

		Bogotá: Other computer activities	Department: All computer activities	Country: All computer activities
Software consultancy and supply of computer software activity in Bogotá	Equity	U=6489.00 p= .333	U=392.00 p= .452	U=7318.00 P= .593
	Profit and loss	U=6964.00 p= .927	U=469.00 P= .822	U=6722.00 P= .140
	Cash flow of the present year	U=6783.00 p= .670	U=429.00 p= .618	U=7565.50 p= .887

Table shows no significant differences (all $p > .05$), which reflects that the Software consultancy and supply of computer software activity in the city of Bogotá have interactions with all other computer activities in the sector, leading to homogenize this sector all over the country.

However, to verify the influence of the other activities in Bogotá, Cundinamarca department or elsewhere in the country, on the Software consultancy and supply of computer software activity in the city of Bogotá, a structural equation model was applied to data. Although the use of these models for assessing the ecological model has been criticized [8], this criticism is based on the incorrect assumption that it is not possible to include interaction effects within structural equation model. To properly apply this model, the scores of cash flow of the present year, profit and loss and equity, were normalized and standardized with a mean of 50 and a standard deviation of 10 (T scores). The structural equation model is depicted in Figure 2.

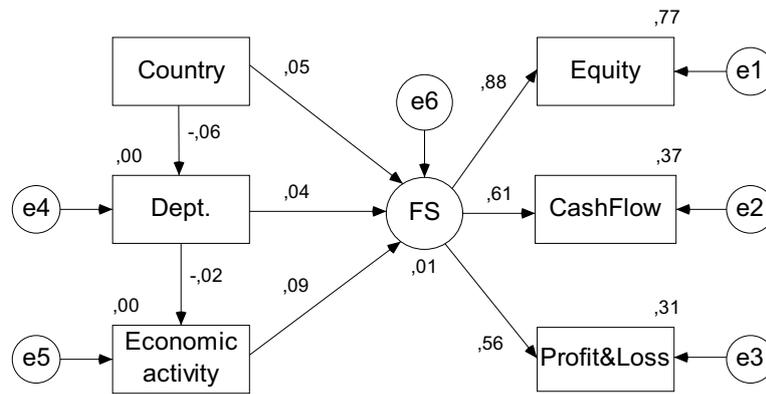


Figure 2. Influences of economic activity, country and department on the financial health indicators of Software consultancy and supply of computer software activity in Bogotá (FS = Financial Statements).

The model was significant (Chi square = 5.216, $p = .734$), but most of the influences were not. As shown in Table 2, the only significant influences were those of the latent variable (FS) on the observed variables named equity, profit and loss and cash flow of the present year.

Table 2. Structural equation model. Regression coefficients.

		Estimate	p
Department.	<--- Country	-.016	.325
Economic activity	<--- Department	-.087	.716
Financial Statements (FS)	<--- Country	1.000	
Financial Statements (FS)	<--- Economic activity	1.702	.144
Financial Statements (FS)	<--- Department	2.798	.568
Equity	<--- Financial Statements (FS)	1.000	
Profit and loss	<--- Financial Statements (FS)	.637	***
Cash flow of the present	<--- Financial Statements (FS)	.695	***

*** $p < .001$

Accordingly, there are no differences in the health financial indicators among the systems where the companies are located and, therefore, strong influences among them exist.

2.3. Discussion

In the ecological model, influence or interaction is a core concept. In this research, interactions is understood as removing differences; it is assumed that the greater the interaction among companies the lower the differentiation among their health financial indicators. This is confirmed by the results, which show no difference in overall indicators of financial health by economic activity within computer sector or by geographical location. This fits what was stated by Porter [16], that in developing countries, there is a tendency for industrial concentration, in large cities, as it happened in the sample, and that government policies do not foster competitiveness, meaning that all companies behave in the same way. In the Software consultancy and supply of computer software activity and even all the activities in the computer sector, homogenization has created an inflexible structure of services by a process of mutual influence, companies focus on products in the same range with uncompetitive prices.

In other Colombian sectors, it has been clearly observed the existence of a few leading companies with excellence results, and a large group of companies with similar financial performance but much lower than the first group [13]. It seems to happen equally in this sector, as shown in Figure 1. Thus, it requires a new logic of innovation, since it is possible that companies assume the same set of principles about the status of the sector, which takes them to reduce innovation and differentiation [17].

In a sector where technology should push towards a clear positioning within the economy, by

diversification and development of more competitive strategies, the test results reveal homogeneity. However, the interaction and influence must not necessarily come from a direct relation among companies, it is possible that the context, set by government policies, unintentionally promote this type of homogenizing activity [16], which prevents a proper development in the computer sector.

3. References

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