

Chaotic Recurrence of the Fixed Assets-Infrastructure Influence on Financial Health of the Hospitality Industry in Emerging Markets

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Abstract: The influence of fixed assets (property, plant and equipment) and the quality of infrastructure in financial health was analyzed in the hospitality industry in emerging markets. Colombia was chosen as representative unit of CIVETS emerging market group. Financial health was determined by ratios of fixed assets net worth, fixed assets turnover and return on fixed assets. A recurrence analysis was applied, and recurrence plot, phase space and recurrence quantification analysis were all applied; first, to determine the influence of fixed assets on the financial health and second to determine the combined influence of infrastructures and fixed assets. Results showed that a non-linear and non-monotonic relationship exists between infrastructure and fixed assets with financial health. Investment in fixed assets and infrastructure leads to chaotic results making it difficult to make investment decisions in emerging markets.

Key-Words: Hospitality industry, fixed assets, infrastructure, financial health, recurrence, chaos, emerging markets.

1 Introduction

Assets, such as properties, plant and equipment, are essentials to the hospitality industry. The impairment of assets affects future cash flows [1] and profits; besides, they prevalence along the time [2] and are linked to capital structure decisions and production [3] or service.

The replacement allowance of furniture, fixtures and equipment is crucial in valuation of hotels [4] and contracts between owners and operators [5]. Besides, infrastructure and technology are crucial [6] in commercial and development issues [7] and successful hotels are dependent on infrastructure [8] and the development context of their location [9].

In emerging markets, politics matter [10] and policymakers must judge their past policies [11] as well as pay attention to cyclical change in regional economies [12]. In this sense, a non-linear and chaotic effect, in the business financial growth, have been pointed out [12, 13, 14, 15], and, accordingly, better facilities or investment in infrastructure can lead to past financial positions, without no increase in profit.

2 Problem Formulation

The linear interpretation that given certain improvement in some conditions the industry will develop in a proper manner might not be correct. An

increase in reserves for maintaining the quality of the hotel facilities, and doing the necessary upgrade will not always result in a better occupancy and profits.

Not paying attention to past states and assuming a linear effect of public or private policy of investment, may lead to confusing results, especially in emerging markets, where many factors affect economic sectors.

Therefore, the influence of the volume of fixed assets and infrastructure on indicators of financial position, performance and profits could follow a non-linear trend weakening these indicators instead of leading to better results. Accordingly, the hypothesis to be tested is whether an increase in the value of fixed assets and quality of infrastructure would result in a better financial position, performance and profits of the firms, as determinants of financial health.

3 Problem Solution

The unit of analysis is the industry of hospitality in Colombia, which comprises 270 firms. Colombia belongs to the group of emerging markets named CIVETS (Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa). These countries have political and macroeconomic instability, lack of

safety and inadequate infrastructure [16, 17, 18, 19]. However, their tourism industry is steady growing.

In Colombia, there is a long delay in the development of an adequate ground infrastructure, still well below the Latin American average [20].

Colombia has been promoting to improve the quality of infrastructures by development planning. This planning targets the departments of the country and has a different level of accomplishment in each department. Accordingly, the degree of accomplishment in the development planning for each department will be a measure of the infrastructure quality.

Despite financial health has been associated to global financial indicators [21], it can be defined in terms of processes or ratios. In this sense, fixed assets management comprises the following financial ratios: a) Fixed assets net worth ratio = Fixed Assets / Net Worth; with Net Worth = total assets minus total liabilities, b) Fixed assets turnover

ratio (or Fixed assets coverage ratio) = net sales / fixed assets, and c) Return on assets ratio = Net Income / Average total Assets. These ratios will be used as indicators of the financial position, performance and profits of the firms.

In Table 1, they are shown descriptive statistics of financial and infrastructure information. These variables do not fit a normal distribution (Kolmogorov-Smirnov tests, $p \leq .00$), and correlations (Spearman rho) among them go from .127 (Fixed assets net worth and net sales) to .838 (Fixed assets return and fixed assets), showing a large dispersion not associated to specific ratios or association between the fixed assets item and one single ratio.

Table 1. Descriptive statistics of financial and infrastructure data

	Mínimum	Máximum	Mean	Standard error
Properties, plant and equipment.	.00	147770.59	2930.76	11205.18
Net sales	.00	97891.55	3961.66	10424.27
Net income	-4038.93	47964.84	415,10	3142.89
Fixed Assets Turnover	.00	208.17	6.22	17.84
Fixed Assets Return	-66.36	25.87	-.31	5.66
Fixed Assets Net Worth	-12.04	509.48	2.75	31.30
Infrastructure Accomplishment (0-100)	63	100	90.55	8.41

All figures in thousands of USD

To test the hypothesis that more investment in fixed assets and infrastructure lead to better firms financial health, a recurrence analysis was conducted. Recurrence analysis is based on the relationships that the values of variable poses on its past and previous values and uses recurrence visual analysis, phase space plots and recurrence quantification analysis. These analytical methods help identifying chaotic and complex relationships among data.

To obtain recurrence analysis of a variable, its values are ordered by time or values of another variable [14, 15]. In this case, to see whether financial ratios are yielding better results, as long as fixed assets (properties, plant and equipment) value increases, these ratios are ordered by ascending values of fixed assets. After that, phase spaces were obtained for the ratios; they have a lag of 1 to 5, and from 8 to 10 dimensions. The delay is the lag

between a value in the series and another previous one; the multidimensional space of vectors embeds the series within vectors that have as coordinates the present and lead values of the series.

All of the space plots showed a strong trend to associate any value to the first positions in the series of data. It means that no matter what the values is, a high probability exists of returning to the first positions; or the opposite, if a first position is assumed, then the value of the ratio can move to any other value in the series. First positions in series act like an attractor.

This association to first values in financial ratios series depicts a complex environment where managers have to make decisions. Investment in fixed assets could be not the best way to improve the financial health of the firm.

In Table 2, the parameters of recurrence quantification analysis are shown. This analysis

introduces several parameters to determine how points in recurrence plot are distributed.

Determinism is the fraction of recurrence points in diagonal lines of recurrence plot, which is a measure of predictability; entropy is the Shannon entropy of the diagonal lines, and it is a measure of

diversity; laminarity is the fraction of recurrence points in vertical lines, which is a measure of laminar states and trapping time is the length of vertical lines, which is a measure of the time the system stay in a specific state [22].

Table 2. Recurrence quantification analysis of financial ratios by fixed assets

Parameters	Fixed Assets Net Worth	Fixed Assets Turnover	Fixed Assets Return
Delay	1	5	3
Dimensions	8	10	10
Method	Minimum	Minimum	Minimum
Rescaling	Absolute	Absolute	Absolute
Criteria of diagonal points	5	5	5
Determinism	99.97%	96.01%	99.97%
Laminarity	99.97%	98.75%	99.97%
Entropy	8.01	6.94	7.90
Trapping time	133.50	54.523	123.50

According to these parameters, the models yielded proper fit; they have a high fraction of determinism and laminar states. However, only five points are introduced in the diagonal lines, to identify the existence of association, what makes all the parameters substantially to increase. Besides, distances among values are determined by minimum and absolute parameters, what also leads to a better fit but changes the model to a weak one. This is

contrary to other results obtained in emerging markets [22].

To test the influence of the degree of accomplishment in infrastructure development planning on the financial ratios, new phase spaces were created. To this, data were ordered by the degree of infrastructure accomplishment and the values of fixed assets. Results are shown in Table 3.

Table 3. Recurrence quantification analysis of financial ratios by infrastructure and fixed assets

Parameters	Fixed Assets Net Worth	Fixed Assets Turnover	Fixed Assets Return
Delay	1	3	2
Dimensions	6	5	3
Method	Minimum	Minimum	Minimum
Rescaling	Absolute	Absolute	Absolute
Criteria of diagonal points	5	5	5
Determinism	99.97%	89.84%	97.74%
Laminarity	99.97%	92.39%	98.75%
Entropy	8.22	5.85	6.78
Trapping time	134.50	32.96	88.89

Phase spaces of financial ratios showed similar arrangement with a strong tendency to associate to first values in the series, so starting with these values in a financial ratio would indicate that any other thing could happen. When ordered by fixed assets, the smallest values in financial ratios, act like

an attractor, a place where all the future values would return eventually.

The parameters of these models show excellent properties; however the same precautions must be taken when interpreting them. Prediction and laminarity point out that a structure exist in the series, but this structure is made out of parameters

of scaling, method and points in diagonal lines that favor it.

4 Conclusion

Making fixed assets investment decision is not easy in the hospitality industry. These assets investments cannot easily be reversed, and firms have to extract the most profit from them. So companies would expect that the investment made be follow by an increase in profits.

However, financial ratios associated to fixed assets do not show this increase is monotonic, and returning to previous positions is highly probable to happen.

Besides, the quality of infrastructure and its interaction with fixed assets do not favor superior financial health, neither. Moreover, complementing the analysis with the degree of accomplishment in infrastructure development, add nothing to results in visual plots, phase space and parameters of recurrence analysis.

Accordingly, in the hospitality industry of emerging markets, financial health is not related to investment in fixed assets and infrastructure, in a linear and monotonic manner. This relation consists on a chaotic recurrence; it is a risk for the sustainability of the firms, making them reduce liquidity and increase debt [21].

Increasing investment in fixed assets or having a proper development of infrastructure combined with an increase in the value of fixed assets do not lead to improvements in financial health, in this industry. The relationship is complex and involves recurrence patterns and independency of the fixed assets or infrastructure value. This relationship is a non-linear one and poses chaotic characteristics, although a mathematical model of chaos is not precisely identified.

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