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Analysis and interpretation of financial statements under conditions of uncertainty

Análisis e interpretación de estados financieros en condiciones de incertidumbre

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Abstract

Today's world is characterized by dynamic, changing, uncertain economic and financial sense, and it is this dynamic where companies must desarollarse. A very useful financial tool in companies it is the analysis of financierios states. Analyze financial statements, means not only apply the various techniques developed in this field, means to interpret the results, activity carried out by experts in finance and the information they generate is used for decision making. This research addresses important areas. Fuzzy sets, as given to uncertainty and complexity in which businesses operate. Financial ratios are used, information obtenidad this analysis should be performed by experts in the financial area, however this interpretation implies the subjectivity of who plays, their level of education, experience, knowledge of the company, in particular: your worldview, which aims to develop the interpretation by fuzzy numbers.

Financial analysis, Financial ratios, Fuzzy numbers

Resumen

El mundo actual se caracteriza por ser dinámico, cambiante, incierto en sentido económico y financiero, y es en esta dinamica en donde deben desarollarse las empresas. Una herramienta financiera muy util en las empresas lo es el análisis de estados financierios. Analizar estados financieros, significa, no solo aplicar las diversas técnicas desarrolladas en este campo, significa interpretar los resultados obtenidos, actividad que se lleva a cabo por expertos en el área financiera y la información que generan sirve para la toma de decisiones. La presente investigacion aborda areas importantes. Los conjuntos borrosos, como propuesta a la incertidumbre y complejidad en la que se desenvuelven las empresas. Se utilizan las razones financieras, La información obtenidad por este analisis debe ser interpretada por expertos en el area financiera, sin embargo esta interpretación lleva implicita la subjetividad de quien interpreta, su nivel de estudios, su experiencia, el conocimiento de la empresa, en concreto: su cosmovisión, por lo que se propone desarrollar la interpretacion por medio de numeros borrosos

Analisis financiero, Numeros borrosos, Razones financieras

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Introduction

Man has taken as his own the Newtonian message, the orderly and predictable universe; it is assumed that there are laws expressed in mathematical language and we can discover them. From this arises the obsession with control; man believes that the more techniques are developed and implemented, the more control he will have over the world. But with each new technology that is introduced, a greater number of problems are added, and for each of which new procedures and new techniques have to be developed and new technologies invented. Borjón (2002) points out that the theory of complex dynamic systems is not incompatible with chaos theory, as it is itself a sister of complexity, just as social, economic and financial systems, etc. are also complex. The adventure of complexity, as Prigogine (2000), one of its founding fathers, said, has only just begun. And the financial world is and will be particularly attractive to follow. Chaos and complexity are actually much more perfect than our artificial order; we must understand chaos and complexity and not try to create a rigid, inflexible order, closed to interaction with the environment.

Uncertainty and fuzzy sets

The main characteristic of our time is change and with it the uncertainty in which we live; every day there are fewer barriers between countries and the great problems are not only of one country, region or culture. Global warming, water, food and energy shortages, in the field of economics, economic and financial crises are becoming increasingly global and it is in this uncertain world that companies must operate, develop and achieve their objectives.

New knowledge developed within the "hard" sciences, such as fuzzy sets, is emerging as an alternative in the field of organisations as a tool to help them manage under conditions of uncertainty.

Uncertainty has a wide and varied field of influence, for example Caballero Argáez (2008): In the evolution of the world economy in the short, medium and long term, in the relations between neighbouring countries, in the strength of institutions. In our future as a local society in the midst of a globalisation process that seems irreversible.

The fact that the world is becoming increasingly ambiguous and uncertain should not hold us to polarised convictions under the logic of either/or, good and bad, pro or anti. This logic does not help to clarify but to confuse. There is a principle of uncertainty at the very heart of logic. There is no uncertainty in the syllogism; but at the moment of assembly into a system of ideas, there is a principle of uncertainty. Morin (2005)

The uncertainty principle, Asimov (2002) arises with Heisenberg who succeeded in demonstrating that it is impossible to devise some method of determining exactly and simultaneously the position and momentum of an object. The more accurately we determine position, the less accurately we determine momentum, and vice versa. Heisenberg calculated the magnitude of this inaccuracy or uncertainty of these properties and called it the uncertainty principle.

Since ancient times there have been approaches to the nature of the world and its processes.

Sametband (1994) points out in this respect: Emphasis must be placed on the processes of change over time, accepting that in many cases the behaviour of processes cannot be accurately predicted by simple laws that govern behind the phenomena, on the other hand, our complex world is governed by simple laws that we will progressively discover by means of the methods developed by science. The changing environment has led organisations to uncertainty in the environment and therefore, as new knowledge is gained, new variables arise that need to be quantified. How to plan financially in such a changing, dynamic and uncertain world? How to apply financial management models, when the data we have, such as sales prices, variable costs, profits, cash flows, capital costs, etc., are constantly changing? How to measure quality, how to measure the acceptance of products, how to work with incomplete or inaccurate information?

The above questions give possibilities to answer them by means of fuzzy sets and to evaluate the uncertainty of the information. In this respect Borjón (2003) citing Maculan and Poderse (1993) points out:

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"True nature, as we should understand it, is acoustic, holistic, holographic and simultaneous, it is incomprehensible to Euclidean mathematics" (p. 118). Also, from the point of view of quantum mechanics Hesita, (2004) points out that not everything can be measured with total precision, but it will be possible to measure precisely what is intended to be found. When analysing a company, it should be under a criterion of systemic, holistic and not only technical thinking.

Fuzzy sets

Fuzzy sets have more and more applications every day, the field of engineering, economics, computing, intelligent systems, among others have benefited from it, the present research tries to find possible applications in companies and through financial management.

Can deterministic chaos move within a certain range, can there therefore be a link between chaos and fuzzy sets? Does the complexity of non-linear business systems give rise to or justify fuzzy logic and fuzzy sets?

Aristotelian logic has served as the basis for the mathematics of normal sets and is based on the principle of the excluded third, a principle which indicates that a proposition can only be true or false, there being no intermediate degree of truth. As a consequence of this principle, in set theory, for a subset A defined on a universe or referential set X, an element of the referential either belongs or does not belong to the said set A. That is, there is no ambiguity about its membership.

Most of the time, classes of objects found in the real world do not have a precisely defined membership criterion. For example, the class 'animals' includes among its members dogs, horses, birds, etc. and clearly excludes objects such as rocks, plants, etc. However, objects such as starfish, bacteria, etc. have an ambiguous status in relation to that class. This same ambiguity appears in the case of the number 10 in relation to the class of real numbers much larger than 1.

Since the beginning of the theory of fuzzy sets Zadeh (1965, 1981), they have been defined as: A collection of objects with membership values between zero: completely excluded and, One complete membership.

MEMBERSHIP values express the degree to which each object is compatible with the distinctive properties or characteristics of the collection. A fuzzy set is characterised by a membership or domain function, space or universe of discourse X, for a unit interval of (0,1).

Here is an example of fuzzy sets: The height of a person is a variable that can be represented in this way. Suppose someone is asked how tall a person must be to be considered short, medium or tall, he will probably answer with a concrete datum, short will be with a height less than 1.60 m. from that height up to 1.80 m. He will be a person of medium height and more than 1.80 m. He will then be a person of tall height. Measuring or quantifying, low, medium or high represents a problem, since you can have answers from different people and each one can have their own appreciation of what low, medium or high means. According to the logic of normal sets, up to a height of 1.60 m a person will be short and a single centimetre, i.e., 1.61 m, means medium height, medium ends at 1.80 m and then suddenly he or she will be tall. The increase of 1 cm means that a height of 1.61 m stops belonging, i.e., stops being a little member of the low set, and starts belonging (membership) to the middle set.

So, successively with the height, we have then a model that is not absolutely sharp but a tendency of decreasing membership in a low set and a tendency of increasing membership in a medium set of the height, and so on from medium to high.

In fuzzy sets, linguistic labels are used. These labels indicate the degree of belonging that an element has to a fuzzy set, in our case you can have not only heights, low, medium, high, but you can also have very low, neither low nor medium or regular height and these linguistic labels is the most common way to express ourselves.

The following graph shows the representation of the fuzzy set height:

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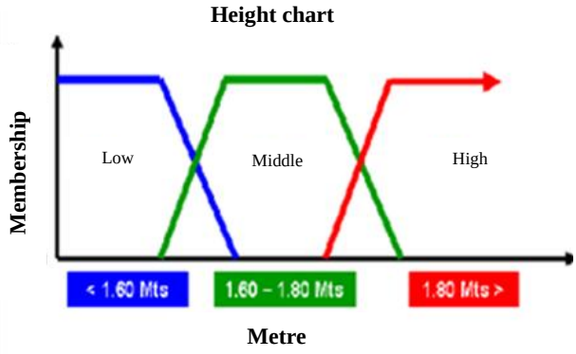

Figure 1 Height with fuzzy numbers

Fuzzy numbers:

Performing operations with fuzzy sets, is carried out by means of fuzzy numbers Casanovas (2003) defines them as: That fuzzy subset that fulfils three properties:

The variables under study take values in the field of real numbers.

The membership function is normal; normality means that at least one value of the variable under study has the maximum level of assumption associated with it, i.e. unity.

The membership function is convex, this means that from the lower end to the value of highest possibility the levels of assumption or possibility increase, or are maintained, but at no time decrease. Similarly, from the maximum possibility value to the upper end, the presumption levels decrease or remain the same, but never increase.

The most commonly used fuzzy numbers are triangular fuzzy numbers (TFN) and trapezoidal fuzzy numbers (TRFN), Lazzari (1997). An NBT is determined by only three real numbers, (the minimum value, the maximum value and the value with the highest level of assumption), b1, b2, b3 such that b1 b2 b3 and is usually represented A = (b1 , b2 , b3).

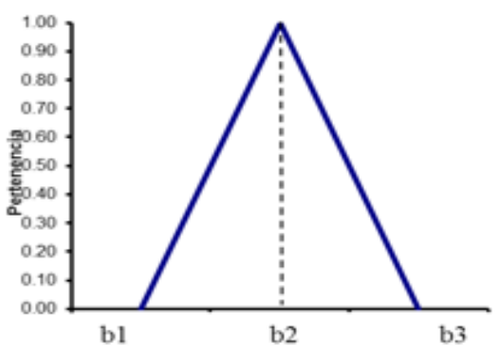

Figure 2 Triangular fuzzy number

Lazzari (1997) also defines. An NBTr is uniquely determined by four real numbers (the minimum value, the maximum value and the highest level of assumption values) , b1, b2, b3 , b4 such that b1 b2 b3 b4 and is usually represented A = (b1 , b2 , b3, b4). See figure above.

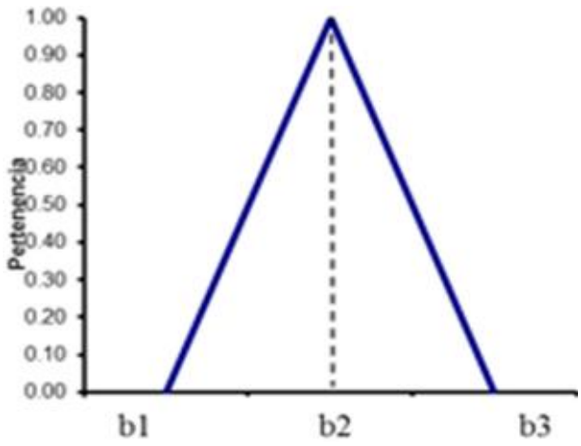

Figure 3 Trapezoidal fuzzy number

Operations with fuzzy numbers

Developing models with uncertain data requires determining the rules of operation with fuzzy numbers, Monserrat (2003).

Operation	Operation
Sum	$(a_1\,\alpha\,, a_2\,\alpha\,, a_3\,\alpha) + (b_1\,\alpha\,, b_2\,\alpha\,, b_3\,\alpha) = (a_1\,\alpha + b_1\,\alpha\,, a_2\,\alpha + b_2\,\alpha\,, a_3\,\alpha + b_3\,\alpha)$
Subtraction	$(a_1\,\alpha\,, a_2\,\alpha\,, a_3\,\alpha) - (b_1\,\alpha\,, b_2\,\alpha\,, b_3\,\alpha) =$ $(a_1\,\alpha - b_3\,\alpha, a_2\,\alpha - b_2\,\alpha, a_3\,\alpha - b_1\,\alpha)$
Multiplication	$(a_1\,\alpha\,, a_2\,\alpha\,, a_3\,\alpha)\,.\,(b_1\,\alpha, b_2\,\alpha, b_3\,\alpha) = (a_1\,\alpha.b_1\,\alpha, a_2\,\alpha.b_2\,\alpha, a_3\,\alpha.b_3\,\alpha)$
Division	$(a_1\,\alpha, a_2\,\alpha, a_3\,\alpha) / (b_1\,\alpha, b_2\,\alpha, b_3\,\alpha) =$ $(a_1\,\alpha / b_3\,\alpha, a_2\,\alpha / b_2\,\alpha, a_3\,\alpha / b_1\,\alpha)$
Power	$(a_1\,\alpha, a_2\,\alpha, a_3\,\alpha)^n = (a_1\alpha)^n\ (a_2\,\alpha,)^n\ (a_3\,\alpha)^n$

Table 1 Operations with fuzzy numbers

Where α is the number of cuts or degree of membership that an element can have in the fuzzy sets. From the point of view of quantum mechanics, it is not possible to measure everything with total precision, but you can measure precisely what you want to find.

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When analysing a company, it should be under a systemic, holistic and not only deterministic thinking criterion.

Analysis and interpretation of financial statements

The analysis of financial statements is the critical process of assessing the present and past financial position and results of operations of a company, with the objective of establishing the best possible estimates and predictions about future conditions and results. Ortega (2008).

Financial analysis shows to what extent the company is achieving its objectives, pointing out the successes obtained in its management, as well as the deficiencies incurred, serving to make decisions, strengthening the successes and correcting the failures. There are different methods to analyse financial statements such as: Ortega (2008) integral ratios and simple ratios or financial ratios, Gitman (2000).

Financial ratio method

This method consists of finding the relationship between a concept of a financial statement with another concept of the same or different financial statement. Financial ratios are simple measures, which should be used for analysis and study. According to their objective, ratios can be classified, according to Gitman (2000), into four main groups:

Liquidity Ratios

A company's liquidity is judged by its ability to meet its short-term obligations and its ability to convert certain current assets into cash.

Solvency or Debt Ratios

These measure the level and structure of debt contracted by the company and its ability to meet its commitments to third parties.

Activity Ratios

Assets are acquired for use in the company's operations with the intention of generating sales and ultimately profits, Ochoa (1998).

Profitability Ratios.

These are the ratios that measure the overall effectiveness of the company, Weston (1994), in terms of profit generation. These ratios mainly involve.

Interpretation of financial statements

Interpreting the results obtained means decomposing and breaking down the information generated by accounting, through an information transformation technique that converts basic data and information into processed information, useful for decision making regarding the financial activities of the company. Therefore, the Analysis and Interpretation of Financial Statements are very important, as the

Financial Statements are very important, as the information they provide gives a broader view of the company, which improves the quality of decision making. Below is an income statement and a statement of financial position to be analysed by means of the financial ratio technique and to interpret the results obtained.

Comprehensive income statement

Interpretation of financial ratios using fuzzy sets

The application of the formulas is given in conditions of total certainty, since they are based on concrete data, and the application of the fuzzy sets will also result in deterministic values. This information does not incorporate any level of uncertainty, however the interpretation of the results obtained is not given in a unanimous and unique way, but incorporates the knowledge, experience and point of view of the person interpreting the financial analysis, and it is in the interpretation where uncertainty arises, derived from the worldview of the interpreter.

The financial analysis needs to be interpreted by experts to determine the financial situation of the company. The interpretation is carried out by three experts who give their opinion on the results obtained in the different financial ratios using the following endecadary scale.

Endecadary scale for the interpretation of financial ratios.

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Casanovas, Fernández (2003 p.23) define expertons as "all expertons result from the aggregation of the opinions of various experts on a variable or phenomenon in question". Similarly, Gil and Tinto (2007) point out that expertons can be the object of operations that can be carried out with fuzzy sets and numbers.

According to Monserrat. (2003), Kaufmann and Gil (1993) the experton results from:

$$a + (b-a)\,\alpha \qquad (1)$$

Where a and b are the limits of the intervals or confidence levels, which for the company are:

(a) minimum possible value zero (0) and (b) maximum possible value one hundred (100) and α is the experton that results from the experts' opinion.

Following Monserrat. Fernández (2003, p. 24) the experton will be elaborated, starting from the level of presumption of the experts by determining the absolute frequency, and then the normalised frequency and finally the experton is determined from the sum of the normalised frequencies.

This will be done for each financial ratio as follows.

In the same way, we proceeded with each of the financial ratios and with the information obtained the following graph was drawn up.

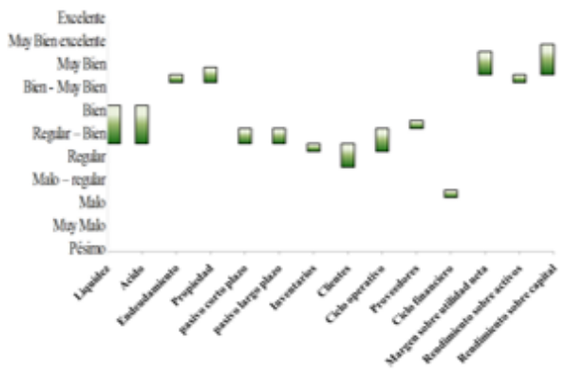

Figure 4 Interpretation of financial ratios as fuzzy numbers

The graphic shows in less technical and clearer language how the company is doing, based on expert opinion. It highlights that there is a very good return for shareholders, as well as a very good return on sales as a proportion of sales, and also a very good return on assets.

As far as indebtedness is concerned, it practically does not exist, since the company has a very good level of ownership, and the indebtedness is mainly with suppliers, who grant long terms in accordance with the company's production. The term to customers is not entirely favourable, because the company's customers have a great bargaining power in their favour.

In terms of liquidity, the company has no problems to cover its short-term commitments, being in good payment conditions.

The chart also shows, like the candlestick analysis, those financial ratios that experts agree on the most in their interpretation.

Smaller bodies, as well as financial ratios where the body is wider, mean a lower degree of agreement.

A "traditional" chart with the results of the financial ratios + is shown below

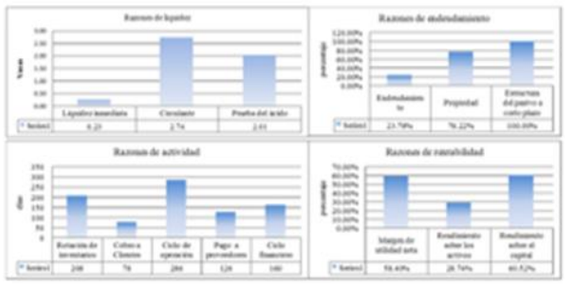

Figure 5 Deterministic financial ratio chart

Comparison of the deterministic and fuzzy results of the financial analysis

Figure 5.- shows graphically the result of the financial ratios, noting that a graph is required for each of the types of ratios, given the different magnitudes in which these ratios are presented: times, percentages, days. These ratios represent the analysis of the financial statements.

Figure 4.- shows the interpretation of financial ratios in the opinion of experts about the financial situation of the company, the basic difference lies in the approach to the understanding of financial indicators for people who are not necessarily experts in the analysis of financial statements.

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