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A NEW MEASURE OF VOLATILITY USING INDUCED HEAVY MOVING AVERAGES

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Abstract. The volatility is a dispersion technique widely used in statistics and economics. This paper presents a new way to calculate volatility by using different extensions of the ordered weighted average (OWA) operator. This approach is called the induced heavy ordered weighted moving average (IHOWMA) volatility. The main advantage of this operator is that the classical volatility formula only takes into account the standard deviation and the average, while with this formulation it is possible to aggregate information according to the decision maker knowledge, expectations and attitude about the future. Some particular cases are also presented when the aggregation information process is applied only on the standard deviation or on the average. An example in three different exchange rates for 2016 are presented, these are for: USD/MXN, EUR/MXN and EUR/USD.

Keywords: volatility, IHOWMA operator, exchange rate, moving average.

JEL Classification: C13, D81, F31, G17.

Introduction

Volatility is a basic concept in economics for measuring the variance of some variables like exchange rate, stock prices and some other (Garman & Klass, 1980; Rabbani, Grable, Heo, Nobre, & Kuzniak, 2017). To calculate the volatility, the coefficient of variation is used in historical data (Minton & Schrand, 1999), but some researchers have identified other variables that can make the results vary from forecast results, for example: a) in stock markets, Officer

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(1973) indicates that volatility is related to macroeconomic variables, b) in electoral voting, van Biezen, Mair, and Poguntke (2012) and Hooghe and Kern (2015) found that volatility is related to a decline in party memberships and c) in exchange rate, Aristotelous (2011) says that volatility in exchange rate can be related to exchange-rate regimes.

It is important to note, that volatility is not only influenced by the historical data, but can also be influenced by some macroeconomics variables like GDP, interest rate, foreign reserves and others Grossmann, Love, and Orlov (2014), but also there are some other information that can be added to the results, such as, knowledge of the decision maker about the future scenarios that it is important to add when there is important uncertainty in the problem (Yager, 1996, 2006).

In the context of planning of regional development, Kacprzyk and Straszak (1984) introduced a concept of stability of a regional development strategy to express a natural human bias, both of the regional authorities and inhabitants, that the variability of crucial development indicators (e.g. values of life quality indicators) should be limited, to yield some feeling of "stability". The changes of values of these indicators at consecutive planning stages are then subjected to an objective (against targets set by the authorities) and objective (against expectations of inhabitants) limitations, and then their degrees of satisfaction are aggregated, using both simple tools like the t/s-norms or some averages or more sophisticated ones like the various ordered weighted average (OWA) operators (Yager, 1988; Yager, Kacprzyk, & Beliakov, 2011). The approach was then extended by Kacprzyk (2015) and Kacprzyk, Romero, and Gomide (1999), and used for the modeling of regional development planning in many regions around the world. The OWA operators proposed in this paper can yield a new quality in a human consistent aggregation of such an assessment of stability which is clearly opposite to the volatility, and their application to the planning of regional development will be shown in next papers.

One way to add information to the volatility formula, is changing the usual average by adding weights and other tools. In this sense, we can use the ordered weighted average (OWA) operator, developed by Yager (1988) to generate new scenarios between the minimum and the maximum operator. Also, more complex operators using the OWA as a base have been studied by many authors (Yager et al., 2011; Emrouznejad & Marra, 2014; Blanco-Mesa, Merigó, & Gil-Lafuente, 2017). For example, the heavy OWA (HOWA) operator (Yager, 2002), where the weights are not bounded to the sum equal to 1, and the induced OWA (IOWA) operator (Yager & Filev, 1999), where the weights are induced according to the characteristics of the decision makers.

The aim of this paper is to analyze the use of the OWA operator and some of its extensions in the volatility formula. The main advantage of doing this is that it is possible to generate new scenarios identifying different elements that the traditional formula can't include, such as an optimistic and pessimistic results. In this sense, we introduce new concepts of volatility like the OWMA-volatility, IOWMA-volatility, HOWMA-volatility and IHOWMA-volatility.

An application of these new formulas in foreign exchange market is also developed. We use exchange rate USD/MXN, EUR/MXN and EUR/USD information from 2015–2016 to forecast the volatility for all the months for the year 2016. The information provided by the different formulations is presented in tables and graphs for the analysis.