The ordered weighted average inflation

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Abstract. This paper introduces the ordered weighted average inflation (OWAI). The OWAI operator aggregates the information of a set of inflations and provides a range of scenarios from the minimum and the maximum inflation. The advantage of this approach is that it can provide a flexible inflation formula that can be adapted to the specific characteristics of the enterprise, region, state or country. Therefore, the novelty of this operator is that experts can forecast the information and provide optimistic or pessimistic results of the expected average inflation according to the knowledge, aptitude or expectations for the whole country or an event that represents a specific sector, market or industry. The paper develops several extensions by using the induced, heavy and prioritized aggregation operators. The work studies the applicability of the operator to the analysis of Mexican inflation by developing some aggregation systems that consider the average inflation of Mexico.

Keywords: Inflation, induced aggregation operators, economics, Mexico

1. Introduction

Inflation has been an interest for countries since Friedman’s [1] novel lecture about the relationship between inflation and growth and how the uncertainty in the first one can affect the second one, arguing that the noise in the price systems that is caused by economic institutions and factors reduces the economic efficiency and affects other variables such as employment and enterprise performance [2, 3].

Because of these, policy makers in every country are usually willing to trade some short-term losses in order to have price stability [4]. Additionally, because of the relation between growth and inflation [5–7], many countries have policies that focus on inflation targets that can be either intervals or a point target and are usually based on the central bank’s internal information [8, 9]. In this sense, the formulation for targeting inflation is very important [10, 11], and the use of a formulation that can include the historical data and the expectations will be important.

Among the aggregation operators, one of the most used and studied ones is the Ordered Weighted Average (OWA) operator that was developed by Yager [12]. This operator aggregates several inputs that lie between the maximum and minimum operators. Additionally, some extensions have been developed [13], such as the induced OWA (IOWA) operator [14] that uses induced values that are provided by the decision maker in the reordering process between the

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weights and the arguments instead of the maximum or minimum criteria, the heavy OWA (HOWA) operator [15] that instead uses an unbounded weighting vector that will help to over- or underestimate the results according to different qualitative elements obtained by the decision maker, the prioritized OWA (POWA) operator [16] that is very useful when the problem seeks to unify the ideas of different decision makers and not everyone has the same importance assigned to the result, among other extensions. In recent years, aggregation operators have been applied to different economic and financial problems such as stock markets [17], exchange rates [18, 19], price analysis [20], enterprise risk management [21], government transparency [35] and many more.

The main motivation for studying inflation using aggregation operators is that this important economic variable is not the same for every country, and not all countries use the same categories or the same weights, thus making the comparison process difficult. In addition, when inflation is published by the Central Banks, this information is based on the weights that are determined by them; however, sometimes, this scenario does not reflect the specific scenario for the companies. In this sense, the idea of using different weights and induced values becomes relevant to understanding the reality of a specific market/sector. As can be seen, there is a gap between the information that want to be provided by the government and the real inflation that a specific case can have, in this sense, it is possible to adequate the results based on the weighting vector, that is because most of the countries calculate their inflation based on a weighted average (WA) operator, where they have some product/service divisions that are multiplied by a weight according to their importance in the specific country. In this sense, the basic idea of inflation can be improved by the OWA operator proposed by Yager (1988) and more scenarios can be obtained.

Most of the countries calculate their inflation based on a weighted average (WA) operator, $t$. This paper presents the Ordered Weighted Average Inflation (OWAI) operator. An interesting way to calculate and present the inflation is to calculate the maximum and the minimum inflation. This idea is important because when inflation is calculated, usually the government tends to focus on the items that have higher weights in the formulation and then ignore the others with lower importance to the final score. This generates conflicts within countries since sometimes purchasing power is lower than the inflation indicates. That is why the idea of generating the minimum and the maximum inflation can better explain the reality of the country or the sector of the economy that is to be analyzed.

Additionally, some extensions of the OWAI operator combined with prioritized, induced and heavy operators are introduced. This new aggregation operator is called the prioritized induced heavy ordered weighted average inflation (PIHOWAI) operator, and this operator can be obtained as special cases of the induced heavy ordered weighted average inflation (IHOWAI), induced ordered weighted average inflation (IOWAI), heavy ordered weighted average inflation (HOWAI), prioritized ordered weighted average inflation (POWAI) and OWA operators. These special cases can be used when the formulation does not need all of the information that the PIHOWAI operator needs. In this sense, when the problem is not that complex, it is possible to use a more simplified form of the operator. Additionally, it is important to note that there are 4 different cases when using the PIHOWAI operator that include the total operator in which the OWA operator and its extension are used in all the elements that compose the formula of case 3 where it is only used in the final formula. Finally, an example assessing Mexican inflation in 2017 using the PIHOWAI operator with three experts was given to provide new ranges of inflation in the country compared with the usual formula that is provided by the National Institute of Statistics and Geography (INEGI is its acronym in Spanish).

The remainder of this paper is organized as follows. In Section 2, a revision of the basic formulations of inflation and the OWA are presented. Section 3 presents the general idea of the OWAI operator, the particular case of Mexico and a numerical example. Section 4 analyzes the inflation in Mexico for 2017 using different aggregation operators, and Section 5 summarizes the main conclusions of the paper.

2. Preliminaries

2.1. Inflation formula

Depending on the country, the inflation formula is different with respect to the elements that compose the formula, but, in a general sense, the idea is the same. In the case of Mexico, the formulation is as follows [22]$^1$.

$^1$The parameter values assigned to $I_s$ and $I_{as}$ are the official ones that are used by the Mexican government.