

Chapter 1

AN ORDINAL MULTI-CRITERIA DECISION- MAKING PROCEDURE IN THE CONTEXT OF UNIFORM QUALITATIVE SCALES

José Luis García-Lapresta¹ and Raquel González del Pozo²

¹*PRESAD Research Group, BORDA Research Unit, IMUVA, Departamento de Economía Aplicada, Universidad de Valladolid, Spain*

lapresta@eco.uva.es

²*PRESAD Research Group, IMUVA, Departamento de Economía Aplicada, Universidad de Valladolid, Spain*

raquel.gonzalez.pozo@uva.es

Abstract In this contribution, we propose a multi-criteria decision-making procedure that has been devised in a purely ordinal way. Agents evaluate the alternatives regarding several criteria by assigning one or two consecutive terms of a uniform ordered qualitative scale to each alternative in each criterion. Weights assigned to criteria are managed through replications of the corresponding ratings, and alternatives are ranked according to the medians of their ratings after the replications.

Keywords: Multi-criteria decision-making; Group decision-making; Qualitative scales; Majority Judgment.

1. Introduction

Majority Judgment (MJ) is a recent voting system introduced and analyzed by Balinski and Laraki [2, 3]. Under MJ, agents evaluate each alternative with a linguistic term of a fixed ordered qualitative scale (the authors consider six linguistic terms for evaluating candidates in political elections: ‘to reject’, ‘poor’,

‘acceptable’, ‘good’, ‘very good’ and ‘excellent’). The alternatives are ranked according to the medians of the obtained ratings. The authors also propose two different tie-breaking processes for obtaining a final ranking on the set of alternatives.

MJ does not care whether the qualitative scale is or not uniform (the psychological distance between consecutive terms of the scale could be or not the same). Additionally, when the number of ratings is even MJ only considers one of the medians, the lower median (as shown in Felsenthal and Machover [8, Example 3.7], if the upper median is chosen the outcome could be different to the one obtained when choosing the lower median). This asymmetry and loss of information could be relevant when the number of ratings is low.

As all voting systems, MJ may produce some paradoxes and inconsistencies (some of them can be found in Felsenthal and Machover [8]). Some problems of MJ have been solved by using different techniques (see García-Lapresta and Martínez-Panero [10] and Falcó and García-Lapresta [5]).

In this contribution, we propose an alternative and extended procedure of MJ by allowing agents to assign one or two consecutive terms of the qualitative scale, when they hesitate. Moreover, we consider different criteria that can be weighted in a different way, but by using an ordinal treatment. Additionally, we take into account the two medians of the corresponding ratings, avoiding a loss of information. This richer information requires to consider an appropriate linear order on the set of feasible pairs of medians.

We note that the possibility of using more than one linguistic term for assessing alternatives has been considered by Travé-Massuyès and Piera [14], Roselló *et al.* [13], Agell *et al.* [1], Falcó *et al.* [6, 7] and García-Lapresta *et al.* [9], among others.

The proposed multi-criteria decision-making procedure is shown by taking into account some data obtained in a case study (García-Lapresta *et al.* [9]).

The rest of the contribution is organized as follows. Section 2 is devoted to introduce the proposed multi-criteria decision-making procedure. Section 3 includes the case study. Finally, Section 4 concludes with some remarks.

2. The Decision Procedure

In this section we establish the multi-criteria decision-making procedure. First, we introduce the notation and basic notions.

2.1 Notation and Basic Notions

Let $A = \{1, \dots, m\}$, with $m \geq 2$, be a set of agents and let $X = \{x_1, \dots, x_n\}$, with $n \geq 2$, be the set of alternatives which have to be evaluated by the agents regarding a set of different criteria $C = \{c_1, \dots, c_q\}$. Initially, each agent may assign a linguistic term to every alternative in each criterion within an ordered