Decision Method of Optimal Investment Enterprise Selection under Uncertain Information Environment

Xiaoyong Liao, College of Mathematics and Physics, Huanggang Normal University, Huanggang, China

ABSTRACT

To select an optimal investment enterprise is the key to effectively reduce the investment risk for an investment company. In this paper, the author studies the problem of optimal investment enterprise selection decision under uncertain information environment (fuzzy information and grey information coexist), and present a fuzzy grey multi-attribute group decision making model to select the optimal investment enterprise. In this model, the author defines the concept and operations of fuzzy grey number; and present a ranking method based on fuzzy grey deviation degree to rank the alternative investment enterprises. The author also gives an application example of selecting optimal investment enterprise to highlight the implementation, availability, and feasibility of the proposed decision making model.

Keywords: Fuzzy Grey Deviation Degree, Investment Enterprise Selection, Multi-Attribute Group Decision Making, Risk Investment

1. INTRODUCTION

For an investment company, the risk investment is a kind of investment form with high risk, low liquidity and high profitability, and it combines with investment and financing. This high risk requires the investment company to select the optimal enterprise to avoid risk and to improve revenues. So the investment company must evaluate and select the investment enterprises by considering multiple attributes such as sales capacity, management capacity, throughput, technology capacity, fund capacity, and so on.

However, when evaluating the performance of investment enterprises under multiple attributes, the investment company will face dual uncertain information because of the complication and uncertain of the decision making systems. The first kind of uncertain information is fuzzy information. This uncertain information belongs to a subjective uncertainty, and is caused by the complexity of the decision-making system and
In the fuzzy information environment, the attribute values are usually given in the forms of linguistic fuzzy numbers, such as “worst, worse, bad, common, good, better, best” or “lowest, lower, low, common, high, higher, highest” by the decision makers (Li, 2014; Yu & Li, 2014; Wang & Ren, 2005; Sun, 2007). The second kind of uncertain information is grey information. This uncertain information belongs to an objective uncertainty, and is caused by the differences in knowledge frame, experience level, status and individual preference for the decision makers, and there exist incomplete and inadequate information in the decision making problems, so the attribute values given by decision makers have a certain grey degree (Grey degree is the measurement to measure the insufficiency or unlikelihood of information (Deng, 1989; Deng, 2002; Xiao et al., 2005; Rao & Xiao, 2006; Rao et al., 2009). In addition, the weights of decision makers also have a certain grey degree. In the practical optimal investment enterprise selection decision, the fuzzy information and the grey information usually coexist. This kind of multi-attribute group decision making with fuzzy information and grey information is called a fuzzy grey group decision making.

Nowadays, some scholars studied the problems of multi-attribute decision making with the fuzzy information (Fan & Xiao, 2004; Li & Liu, 2014; Li & Wan, 2014a, 2014b; Wan & Li, 2014; Wei, 2007; Wei et al., 2014a, 2014b; Peng et al., 2014). For example, Fan and Xiao (2004) presented a new method to deal with the multi-attribute group decision making problem with two different formats of preference information on alternatives: fuzzy preference relations and multiplicative preference relations. Li and Liu (2014) defined the concepts of fuzzy numbers and the value-index and ambiguity-index, and developed a difference-index based ranking method to solve the problem of multi-attribute group decision making with the fuzzy information. Li and Wan (2014a, 2014b) presented new fuzzy linear programming methods for solving a type of fuzzy heterogeneous and inhomogeneous multiattribute decision making (MADM) problems with fuzzy truth degrees and incomplete weight information. Wan and Li (2014) developed a new Atanassov’s intuitionistic fuzzy (A-IF) programming method to solve heterogeneous multiattribute group decision-making problems with A-IF truth degrees in which there are several types of attribute values such as A-IF sets (A-IFSs), trapezoidal fuzzy numbers, intervals, and real numbers. Wei (2007) proposed an approach to solve the problem of multiple attribute group decision making with uncertain linguistic information based on the ULWGM and the ULHGA operators. Wei et al. (2014a, 2014b) established an optimization model based on the maximizing deviation method to solve the problem of hesitant fuzzy multiple attribute decision making with incomplete weight information. Peng et al. (2014) proposed a multi-attribute decision making method based on prospect theory to deal with the multi-attribute decision making problems with trapezoidal fuzzy probability and unknown weight. These studies provided valuable methods and model to deal with the problems of multi-attribute decision making under the fuzzy information environment.

Up to now, the research on the problems of multi-attribute decision making with both fuzzy information and grey information are fewer. Luo and Liu (2004), Pu and Zhang (2002) integrated the membership degree and the grey degree to define grey fuzzy numbers and grey fuzzy relation, then used the calculation formula of possibility degree or analytic method of entropy to rank order for all alternatives. However, membership degree is uncertain itself. If the attribute values are expressed as the grey fuzzy numbers based on membership degree and grey degree, then it is difficult to scientifically quantify the attribute in essence.

In this paper, based on the disadvantages of the existing methods, we will present a fuzzy grey multi-attribute group decision making method based on fuzzy grey deviation degree to select the optimal investment enterprise in the problem of optimal investment enterprise.
Decision Method of Optimal Investment Enterprise Selection under Uncertain Information Environment