
INCOMPLETE FERMATEAN FUZZY PREFERENCE RELATIONS AND SOCIAL NETWORK DECISION-MAKING: THE INVESTMENT PORTFOLIO SELECTION APPLICATION

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ABSTRACT

The modern portfolio theory is a valuable technique for choosing investments to optimize total returns while maintaining a manageable amount of risk. An investment portfolio is built to optimize expected return given a specific level of risk using this mathematical framework. Problems with portfolio selection are ideally suited for multi-attribute decision-making algorithms. Within the multi-attribute decision-making paradigm, complicated subjective preferences and diversified financial indices influence investment decisions.

There may be cases where experts do not have in-depth knowledge of the problem to be solved in decision-making problems. In such cases, experts may fail to express their views on certain aspects of the problem, resulting in incomplete preferences, in which some preference values are not provided or are missing. A new model for group decision-making methods will be given in which experts' preferences can be expressed as incomplete Fermatean fuzzy preference relations. The additive-consistency property guides this model and only uses the expert's preference values. An additive consistency definition characterized by a Fermatean fuzzy priority vector has been given. The additive consistency property is also used to measure the level of consistency of the information provided by the experts. The proposed additive consistency definition's property and a model for obtaining missing judgments in incomplete Fermatean fuzzy preference relations will be provided. A method for adjusting the inconsistency for Fermatean fuzzy preference relations, a model for obtaining the priority vector, and a method for increasing the consensus degrees of Fermatean fuzzy preference relations will be used.

In recent years, the development of information technology has enabled social networks to be online communication platforms for individuals to exchange messages and share information. This enhanced communication environment leads to a new format of group decision-making that acknowledges the influence of the social relationships among experts on the decision process and results, i.e., social network group decision-making.

Our research has developed a social network group decision-making framework using incomplete Fermatean fuzzy preference relations to address portfolio investment selection issues, especially when multiple decision-makers are involved.

Keywords Fermatean fuzzy set · incomplete preference relations · social network · investment portfolio selection · decision-making

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