

Straddling between hope and uncertainty: Using decision trees and neural networks to predict fan orientations to competitive balance

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Abstract 139**

Competitive balance (CB) has been and continues to be important to professional sport leagues. CB is arguably the most significant factor in determining league revenues in professional team sport, as it has been linked to fan interest, gate revenues, and other sources of team and league income (see, for example, Schmidt & Berri, 2001). Based on two dominant perspectives of CB and the current state of the literature, we propose to investigate the demographical and behavioral predictors of fans' orientation towards maintaining interest in professional sports leagues. That is, we address the question: "what factors contribute to one's interest in (i) uncertain outcomes versus (ii) hope of post-season play?" In addition, this investigation shows how decision trees and neural networks can be used as classification methods in sport management.

The evolution of the field of CB has given rise to two main perspectives. According to the first definition of CB, full CB exists when there is a 50% chance of each team winning each game, and as a corollary, an equal chance for any team in the league to win the league championship. From a fan perspective, this approach to CB is said to increase and sustain interest because fans are interested in watching events where the outcome is uncertain. This approach is termed the uncertainty of outcomes hypothesis (UOH) (see Zimbalist, 2002). Recently, however, a new definition of CB has emerged. This approach states that "proper competitive balance will not exist until every well-run club has a regularly recurring hope of reaching postseason play" (Levin et al., 2000, p.5). Under this definition, CB is a consumer's feeling of hope that his/her team will make post-season play. This, in essence, is not the same as the UOH. While the proponents of the "hope" perspective have noted that hope is a binary and dynamic construct (i.e., fans either have, or do not have, hope that their team will make the playoffs, which changes over time), UOH has been defined as a continuous and objective measure of league CB (O'Reilly, Kaplan, Rabinel, & Nadeau, 2007). It is critical to note, however, that neither camp views their explanation as mutually exclusive from the other. That is, a fan or potential fan may be sensitive to one more than the other and this sensitivity will differ from individual to individual. Thus, the following study assesses the factors that contribute to one's interest in (i) uncertain outcomes versus (ii) hope of post season play. We also show how decision trees and neural networks can be used to build classification models when other methods are unable to reasonably fit the data.

A questionnaire was administered to 367 individuals from an urban centre with a professional baseball team. Subjects were recruited randomly at a local park by three researchers who asked every fifth person who walked by to complete a questionnaire. Subjects were given a cold bottle of water for their participation. The questionnaire included nine questions designed to elicit one's orientation towards hope and one question to accomplish the same for the UOH. Two extra questions were also included as decoys. Additional information to be used as independent variables such as gender, household income, allocation of free time to activities, and whether the respondent had attended a baseball game (previous attendance), listened to a baseball game on the radio (previous radio), or watched a baseball game on TV (previous TV) were collected. All questions were worded in a non-technical way. The ethics board of the principal investigator approved all protocols before proceeding.

Those respondents who had hope scores exceeding their score on the UOH measure were classified as hope oriented; those respondents who had hope scores below the UOH measure were classified as UOH oriented. This formed the dependent variable.

After cleansing the data and additionally excluding those who had not answered all the hope and UOH questions, 196 valid records were left. Eighty of these were hope oriented and the remaining 116 were UOH oriented. First, a neural network was constructed to predict one's CB orientation. The sample was partitioned to prevent overtraining. The neural network converged at an optimal solution that used three neurons in the hidden layer (between the input and output layer) to convert the independent variables into an estimation of the dependent variable. The results of a confusion matrix show that the neural network is able to predict 57% of cases correctly, although it is much better at predicting those who are UOH oriented (62% correct) versus hope oriented (50% correct). Looking at the relative importance of inputs and a web diagram reveals that previous radio was, by far, the most significant variable in predicting one's CB orientation. Other significant variables include gender, previous TV, and previous attendance.

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A decision tree was then created to derive a rule set for predicting one's CB orientation. The results of the decision tree conversely show that previous attendance is the most important variable in discriminating between hope and UOH orientations. Previous radio is only important for those who have previously seen a game on TV whereas household income was only important for those who had previously not seen a game on TV. The amount of time allocated to TV in general and age were also discriminating variables in the lower echelons of the tree. Overall, the tree produces very low levels of entropy in the leaf nodes with a maximum of four nested rules to derive a prediction.

Considering both models, increased levels of some indices of fandom (such as previous radio and previous attendance) led to increased levels of UOH orientation. This was contrary to our expectations, as it was felt increased fandom would lead to longer-term and contextual views of CB, such as those espoused by the hope perspective. Nevertheless, both the neural network and decision tree were able to predict orientations significantly better than previous models we had attempted to use in the past, such as logistic regression and discriminant analysis. This leads us to support these models in complex decision making environments such as those that arise in considering CB.