Chapter 2
Decision Tree Analyses

ABSTRACT

As a branch of statistics that uses probability, decision trees have been widely applied to variety problems from numerous disciplines and serve two primary goals. First, they help us to resolve uncertainties in making investment decisions. Second, using decision trees we can determine which alternatives, at any point in time produces the most favorable, or least painful, consequences. In contrast, classical statistics focus on estimating a parameter, such as the population means, constructing a confidence interval, or conducting a hypothesis test. Classical statistics do not address the possible consequences of a decision. In this chapter I illustrate the essentials of using a decision tree for making financial decisions, and demonstrate how a decision is made using both criteria: expected monetary value and expected utility. At the end, I discuss the imperfectability of the traditional techniques and tools and suggest alternative decision tools inspired by some areas of research in signal processing, known as wavelet analysis. To set up and solve decision tree problems, TreePlan, and add-in for Excel, is used.

The possible solution to a given problem emerges as the leaves of a tree, each node representing a point of deliberation and decision (Niklaus Wirth, 1934, Programming language designer).

INTRODUCTION

The first comprehensive and authoritative book on decision tree analysis is published by Howard Raiffa in 1968. As a branch of statistics that uses

probability, decision trees have been widely applied to variety problems from numerous disciplines and serve two primary goals. First, they help us to resolve uncertainties in making investment decisions. Second, using decision trees we can determine which alternatives, at any point in time produces the most favorable, or least painful, consequences. In contrast, classical statistics focus on estimating a parameter, such as the population means, constructing a confidence interval, or conducting a hypothesis test. Classical statistics do not address the possible consequences of a decision.

There are 4 basic elements in decision theory, namely: acts, events, outcomes, and payoffs.

- Acts are the actions being considered by the agent. In the decision tree, it is represented by a square, ■, or a decision node. This node could refer to the decision to invest or not invest, or how much to invest.
- Event occurrences are taking place outside the control of the agent. This uncertain events are represented by a circle, ●, or chance node. Uncertain events may occur before or after decision.
- Outcomes are the result of the occurrence of acts and events. They are represented with a triangle, ◄.
- When a decision process arrives at an outcome, the decision maker knows the payoff he will receive. The payoffs can be positive or negative.

A decision tree extends from a starting point through a series of branches, showing the flow from the question to the answer. It is used to make sequences of decisions. The order in which the shapes are connected is very important. For example: a square that is followed by a circle means that a decision is made before the uncertainty is resolved and vice versa. (See Figure 1)

CONSTRUCTING A DECISION TREE

Giving an Example

To illustrate the essentials of using a decision tree for making financial decisions, consider the following example:

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