Chapter 4

Optimizing Investment Decisions Using DCF, Decision Tree Analysis, and Real Options Analysis: The Case of Hotel Expansions

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ABSTRACT

Large scale infrastructure expansions in hotels are exposed to uncertainty. Since the costs involved in these expansion projects are high and often irreversible, hotels would benefit from analyses that incorporate uncertainty along with traditional valuation techniques like the discounted cash flow (DCF) method. Decision tree analysis (DTA) and real options analysis (ROA) have been in use for the past couple of decades to handle uncertainties and optimize investment decisions. DTA provides a distinct approach to strategic investments that quantitatively takes into account the uncertainties involved in the investments. Under uncertainty, the decision about whether to expand is analogous to the decision about whether to exercise an American call option. By using ROA to the hotel expansion scenario, managers can incorporate and quantify, flexibility and timing in their analysis. The objective of this chapter is to detail the DCF, DTA and ROA methodologies and their applications specific to hotel expansion investments.

INTRODUCTION

The discounted cash flow (DCF) technique is the most widely used valuation technique in practice. In this technique, a project is valued by discounting its expected cash flows at its cost of capital. The cost of capital, usually the weighted average cost of capital (WACC) is used to estimate the worth of future cash flows today. This process of estimating how much these future cash flows are worth

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today is called discounting and hence the name for the technique. The net present value (NPV) of
the project is then calculated as the difference between the total of all discounted future cash flows
and the initial investment. A project is valuable to be undertaken if the NPV is not negative. Ac-
cepting projects with NPV less than zero decrease the value of the firm. Also, the higher the NPV
of the project is, the higher it contributes to the overall value of the firm.

However, DCF works best when the certainty of future cash flows is high. But valuation using
DCF is shaky when it’s difficult to predict and estimate future cash flows with much confidence.
Also, this analysis does not take into account the flexibility inherent in the investment decision.
Also, past real estate studies suggest that DCF may be insufficient for evaluating real estate invest-
ment projects (Hayes & Abernathy 1980; Hodder & Riggs, 1985; Sirmans, 1997).

The complexity of the investment process is that the firm can take dynamic decisions which is
not accounted for by DCF. When there is a lot of complex information that needs to be accounted
for, decision trees (Gertner & Rosenfield, 1999) are often used as techniques for investment decision
making. They provide an effective configuration in which different decisions and the consequences
of taking those decisions are portrayed in a diagram and evaluated. Eventually they help to picture
an accurate and balanced opinion of the risks and rewards that evolve from making a specific invest-
ment choice. In this regard, decision tree analysis is superior to the DCF analyses in the context of
inclusion of uncertainty in the investment decision process. Although decision-tree analysis tends
to pay a lot of attention to the cash flow uncertainties, it rarely considers dynamic decision making.

In 1970s, stochastic calculus was introduced in the finance literature leading to theories and
models in pricing financial options. Many studies then applied these financial option-pricing models
to investment projects. This new area of ‘real option’ analysis received a lot of attention in several
areas especially in real estate valuation (Quigg 1993, 1995; Buetow & Albert 1998; Hendershott &
Ward 2000; Holland et al. 2000). Real options analysis (ROA) has been in use for the past couple of
decades to handle uncertainties and optimize investment decisions. It provides a distinct approach
to strategic investments that quantitatively takes into account the risks and uncertainties. Similar
to DCF, ROA also focuses on the goal of value maximization. However, ROA acknowledges that
managers use available information to make decisions while DCF makes managers to choose years
in advance and does not accommodate the changes that may happen in the future. ROA uses the
“backward induction” approach like the decision tree analysis and combines this with a valuation
model.

In the following sections, we evaluate a hypothetical hotel expansion project using DCF, deci-
sion tree analysis and real options analysis and explain the fundamental differences among these
techniques. This chapter is divided into the following distinct sections. The first section provides
the background of literature. Section 2 discusses the motivation for the book chapter. Section 3
discusses the DCF valuation framework, the basic decision tree valuation approach that is used in
both single period and multi-period cash flow scenarios and introduces the ROA analysis. This
section also discusses the advantages and disadvantages of each valuation technique. Section 4
introduces the case’s basic framework and applies all three valuation techniques on this mini case.
The chapter also provides ROA application to the hypothetical case study with illustrations of the
real options optimization technique step by step in Excel.
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