

# The Effects of Non-Stationarity Demand on Hotel Financial Performance

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## Abstract

Although discounting hotel room rates to boost occupancy is one of the most popular forms of promotions used in the lodging industry, there is debate in lodging literature regarding the effectiveness of this pricing strategy. Most of the studies that reflect upon the effectiveness of discounting use descriptive statistical methods to form pricing recommendations and conclusions. However, these descriptive studies may err in providing an understanding of whether discounting works in the lodging industry. The current study analyzes the empirical effects of the non-stationarity demand of seasonal hotel room rate discounting on hotel financial performance as supported by the principles of the rational expectations theory. The study uses a series of unit root tests to determine the time series data properties and then proceeds to a co integration analysis. The study may be useful to both academics and practitioners as the results provide evidence that discounting is an effective short-term pricing strategy in the lodging industry. Additionally, the study contributes to advancing the considerable literature regarding the use of discounting as a pricing strategy in the lodging industry.

**Keywords:** Non-stationarity; Rational expectations theory; Discounting; Hotel; Financial performance; Seasonality; Cobweb model

## Introduction

Lodging literature reveals disagreement among researchers regarding how discounting room rates relate to hotel financial performance. For example, Enz, Canina and Lomanno [1,2] report decreased revenue per available room (RevPAR), Chan and Wong [3] report increased competition and deterioration of hotel status when room rates are discounted, Croes [4,5] claim discounting is an effective short-term pricing strategy, and Semrad [6] advocates for discounting as a means to sustain markets in low seasons. Berezina et al. [7-9] conducted additional research pertaining to the use of flash sales websites offering discounted rooms. These studies suggest that travelers that search for discounted rates via flash sales websites spend more in hotels, are just as likely to recommend the hotel if satisfied, and are not more price sensitive than those customers that do not use flash sales to buy hotel rooms.

Advocates of discounting room rates in the hotel industry support the microeconomic principle of supply and demand, which infers that increased incremental revenue through increased consumer interaction and room sales could transpire [10-13]. Due to the cyclical nature of the hotel industry, managers require an optimal room rate to maintain market equilibrium. In other words, hotel managers must determine a room rate that will maximize revenues while maintaining a profitable balance between supply and demand. Without equilibrium, demand is elastic rather than inelastic, and hotel managers must generally compete for market share via price wars and deeply discounting rooms (e.g. flash sales discounts).

Perhaps the disagreement in literature regarding whether discounting room rates is effective or not may be based on three interrelated limitations with regard to the manner in which the studies' results were derived. First, most studies are descriptive in nature thus lacking theoretical frameworks that could further advance the implications of discounting in the lodging industry. Second, most studies that strive to analyze the relationship between discounting and financial performance use models that is static in nature. These models fail to capture the seasonal dynamics (high and low seasons) of the industry. Third, most studies overlook assessing the properties

of the financial time series datasets involved. In other words, most of the studies are based on the hypothesis that discounting and financial performance are stationary. The frequency of the series, as well as the time period, plays a major role in results of these tests. These studies fail to recognize that the hotel industry's application of discounting strategies supports the premise that managers could forecast demand based on past supply and demand schedules. This means that time series data points should not be free from influence of one another, and therefore must hold "memory" if hotel managers are able to predict how discounting room rates may effect financial performance from past experience. If the time series exhibit non-stationary characteristics, then cointegration procedures (as opposed to binary regression techniques) could be used and would provide more reliable statistical results.

This study claims that hotel managers may forecast demand in low occupancy periods by discounting room rates with the expectation that the price decrease will lead to an increase in hotel financial performance, thus achieving market equilibrium. This process would occur when managers have all available past market information to forecast room demand. In the current study, the market information that is necessary to assist hotel managers in forecasting room demand is revealed through the application of the rational expectations theory that assumes that past data information may be used in the formation of future sales expectations.

It is important to note that the use of the rational expectations theory and its associated statistical assessments allows researchers to treat data that may be influenced by "memory" within the dataset. "Memory" is typically referred to as a unit root in statistical terminology. If a time series dataset contains a unit root (memory), the data is said to be non-stationary. If data is non-stationary, a researcher cannot use traditional regression analyses without risking the generation of spurious

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results. This would mean that researchers could not logically assume that hotel managers will form tomorrow’s hotel room rates based on past performance. For example, a hotel manager may decide the room rate for this Friday based on what he charged last week Friday. However, without the use of the rational expectations framework and its corresponding statistical analyses that may treat data for unit roots it would be impossible for researchers to build upon the logical assumption that hotel managers may use past information to formulate future prices without generating spurious results.

This is because regression techniques that do not operate under the assumptions of the rational expectations theory require datasets to meet the assumption of freedom of influence between data points. If the assumption of independence for regression techniques is not met, the results may be tainted or unreliable. Therefore, this study is unique in that it functions within the framework of the rational expectations theory where we may thoroughly investigate the relationship between discounting and hotel financial performance without worry that the results are erroneous due to memory (a unit root) contained within the dataset. Consequently, the results from this study may provide some inferential statistical knowledge to help resolve the disagreement in lodging literature regarding the relationship between discounting room rates and hotel financial performance.

The study validates that occupancy reaches levels above or below normal when demand exceeds or is less than supply [14]. This confirms the characteristics of seasonal demand, indicative of a dynamic industry. The cobweb model may conceptualize the dynamics of the hotel industry. The cobweb model and the rational expectations theory are typically coupled with one another to demonstrate how past information builds upon itself to form new expectations. In the case of the hotel industry, the cobweb model demonstrates that managers may respond to low occupancy by reducing the average daily rate (ADR) of rooms. Based on the study’s claim, the following questions are investigated.

Q1) What are the effects of non-stationary conditions on hotel financial performance?

Q1a) What is the nature of the relationship?

Q2) What is the empirical relationship between discounting and hotel financial performance?

## Literature Review

### Industry characteristics

The hotel industry is a dynamic industry comprised of perishable products. This means that if a hotel room is not sold today it cannot be stored for sale tomorrow. Thus, room rates traditionally follow a dynamic pricing approach that may be conceptualized by the cobweb model that displays long lags between occupancy and room rental changes, as well as between room rental rates and new supply [6]. This cyclic frequency, or seasonality, is characterized by fluctuating occupancy levels that significantly impact prices of services and perishable products within the hotel industry [15]. The seasons of the hotel industry may be predicted over time as evidenced through application of the economic principles of the rational expectations theory.

### Theoretical framework

Opposition of discounting room rates stems in part from studies that correspond to a static rather than dynamic industry, such as that

of the hotel industry. Within a dynamic industry, it is assumed that expected price equals actual price from the previous fiscal period; that supply is a function of expected price, and that actual price adjusts to demand so as to clear the market [4,5]. This formulation generates either convergent or divergent sequences resulting in the rise and fall of hotel room prices to regain market equilibrium. In periods where the relative slopes of demand and supply are off-set, market equilibrium becomes discordant with supply and demand functions [16]. Such off-sets are captured in hotel seasonality levels of occupancy resulting in price fluctuations of room rates.

In examining room rates across fiscal periods, the dynamics of the hotel industry are revealed through the analysis of seasonal price fluctuations of high, low, and shoulder seasons. These fluctuations may be conceptualized via the cobweb model. Figure 1 is an example of a cobweb model that represents changes in hotel room prices over time.

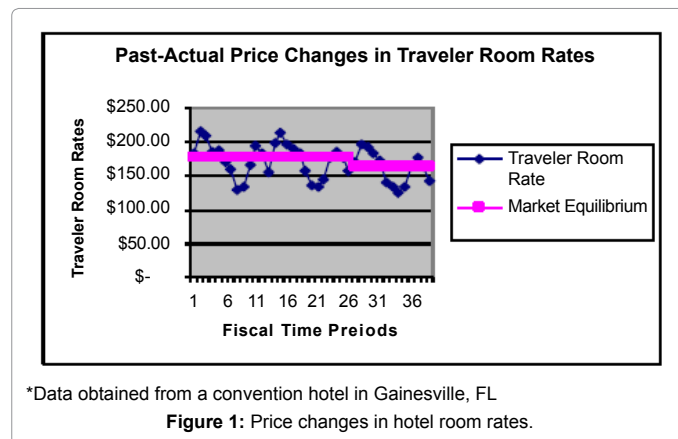
A visual of the cobweb model (Figure 1) exposes periods of high and stable prices where demand is excessive and periods of excess supply exist where prices become downwardly flexible. The lagged relationship between room rates and occupancy in a cobweb model demonstrate specific time periods where hotel managers respond to excessive supply of hotel rooms by discounting room rates. The practice of discounting room rates to achieve market equilibrium is accomplished by forecasting seasonal demand through use of the rational expectations theory.

Through application of the rational expectations theory, managers may forecast room demand from past demand schedules of travelers. Short-term room rate discounts compensate for the current lag time between supply and demand, with the anticipation that the reduction in price will increase future demand. However, this anticipation is based on the assumption that managers are using past data to forecast room rates and that the data holds “memory” (unit root).

There is limited research regarding the importance of a unit root in time series data when assessing the relationship between discounting and hotel financial performance in the hotel industry. Literature reveals little about the connection between non-stationarity conditions and the use of the rational expectations theory as applied to discounting room rates.

### Discounting and hotel financial performance

Discounting is a short-term pricing strategy that aims to maximize hotel financial performance by bringing the market back to equilibrium. Discounting strategy advocates recognize that the goal of hotel management is to generate revenue with hotel room sales.



Because room nights are perishable products, occupancy becomes a key factor in hotel financial performance. Occupancy data provides the one widely available, consistent, and temporally disaggregated means of monitoring hotel performance; managers must consider that the value of the room night becomes zero if not sold by a specific point in time [4]. Thus, it seems that short-term discounting may inflate a low occupancy percentage and increase hotel financial performance.

## Methodology

### Data collection

This study was based on secondary data provided by a convention hotel in the Gainesville, Florida market. The data was compiled between the years 2011-2013, and contained the following data points: monthly demand, monthly available rooms, actual room rates, occupancy rates, and department profit. The dataset consisted of thirty-nine data points accumulated during analysis of thirteen consecutive fiscal periods within each year. A convention hotel was selected because it serves a variety of market segments, has multiple operating departments, and enables this study to utilize ProfitPAR as a unit of measurement. ProfitPAR is the total profit per available room. ProfitPAR is a financial benchmark indicator for the hotel industry that is sometimes deemed more robust than RevPAR.

### Operational definitions

Discounting is the offering of a rate that is below the premium rate. It is a short-term strategy measured as the percentage difference between premium rate available and actual market room rate. Formula 1 calculates periodic discounting rates for travelers.

#### Formula 1: Discounted rate equation

$$D_{rate} = 1 - (ADR/PR)$$

Where  $D_{rate}$  is the Discounted Rate; PR is the Premium Rate; and ADR is the Actual Average Daily Rate provide to each Traveler

Hotel financial performance is the total profit contributed by travelers and is measured by profit per available room (ProfitPAR). Formula 2 calculates total profit of travelers.

#### Formula 2: Profit PAR

$$\text{Profit PAR} = DP/AR$$

Where Profit PAR is the total profit per available room; DP is the additional department profit contributed by travelers; and AR is the number of rooms available during each of the 13 fiscal periods in a year.

## Statistical Procedures

### Unit root tests

The Augmented Dickey Fuller (ADF) and the Phillips and Perron (PP) tests were utilized to determine if a unit root existed in the time series discounting data. Table 1 presents the results of the unit root tests. The data points were converted to natural logarithm form to standardize the data points into a consistent unit of measurement. When compared with the critical value at the 1% level significance, it was revealed that the ADF test statistic did not exceed that value. The tests suggest that the series did contain a unit root (memory) in log form, thereby indicating that the series of observations were non-stationary and therefore the data points were not free of influence from one another.

This finding indicates that the hotel managers for this particular convention hotel located in Gainesville, FL were forming future prices based off of past performance. This means that if a traditional regression analysis was used to determine the relationship between discounted room rates and hotel financial performance that the results may be erroneous based on the assumption of independence and the violation of that assumption. Therefore, this is the first clue that the rational expectations theory may be an appropriate framework to provide guidance to researchers in clearly assessing the relationship between one of the most prominent pricing strategies used in the lodging industry (discounting) and financial performance.

In order to proceed to the next statistical step, the data was treated to resolve the unit root (memory) in the data. This means that the first difference of the data was used and the unit root tests were repeated. After the data was differenced, the unit root issue was resolved and the data was said to be stationary; thus, the researcher could proceed to a form of regression analysis (cointegration analysis) that would determine if discounting is an effective means for hotel managers to correct for decreased demand (market disequilibrium).

### Cointegration analysis

A cointegration analysis determined that past discounting information permanently influenced the memory of the data. A cointegration is an advanced regression equation that determines whether the variables will cointegrate overtime, or revert to the mean (Table 2). In order for this to occur, the cointegration model's statistical residuals must not contain memory (unit root). Because the cointegration analysis is a form of a regression, it was important to not violate the assumption of independence. In this case, the residuals were stationary (did not possess memory) in level form, thus indicating that the data would cointegrate over the course of time. In other words, the

Variables	ADF Levels	PP Levels
Log form	-	-
Discounting	3.045	3.043

Note: Estimates are obtained from STATA version 14 and correspond to 39 observations. The ADF and PP tests should be compared to the critical values of -2.614, -2.964, and -3.662 at the 10%, 5% and 1% levels of significance, respectively.

Table 1: Unit root test results.

Relationships	Trace R=0	Trace R=1	Critical Values Trace (5%)
Log FinPerf and LogDisc	58.46	15.89	3.76

Note: Trace is the likelihood ratio statistic for the number of cointegration vectors. Each equation contains linear trends but not quadratic trending; and parameters for the trends are restricted. Estimation has been performed with STATA 14.

Table 2: Cointegration analysis results.

use of discounting as a short term pricing strategy would assist hotel managers to correct for disequilibria between supply and demand over the long run of time, thus positively impacting hotel financial performance.

## Conclusions and Implications

The study investigated the relationship between discounting room rates and hotel financial performance while considering the properties and the empirical nature of time series datasets. The current study found that under the assumption of the rational expectations theory, managers use past information to form future room rates. As a result, it seems that discounting has a positive long run relationship with financial performance. It is important to note that the current study defined discounting as a short-term pricing strategy. This means that a hotel manager that practices discounting as a long-term pricing strategy may not experience similar results. The current study found that by using unit root tests to assess the time series stationarity that the data did contain a unit root. In past discounting studies, researchers have not considered testing for unit roots. Thus, some of the past findings from previous researchers may have been misleading - especially those studies indicating that discounting is not an effective pricing strategy for hotels. The findings from the current study tend to support the premise of the rational expectations theory.

However, in order to augment the internal validity of this study it is necessary to increase the sample size thus making the findings more reliable and applicable to the general population of convention hotels in the industry. Further, to advance the findings from this study it is necessary to determine a method of measurement that is capable of measuring the discounting cycle of the convention hotel industry across markets. In other words, different markets may possess different lengths of time that would be appropriate to discount.

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