Introduction

The average hotel manager recognizes the criticality of forecasting. However, most managers are either frustrated by complex models researchers constructed or appalled by the amount of time and efforts to master the nuances of statistical theories (Frechtling, 2001). As hotel competition intensifies, managers require an effective method to forecast financial performance (Chon & Singh, 1993).

Luckily, lodging industry data has underlying patterns and trends that repeat themselves daily, weekly, monthly and yearly (Wheaton & Rossof, 1998). This provides an opportunity for a time-series forecasting model for revenue managers, considering time-series models' intuitive nature of assuming that the history is useful in predicting the future, specifically, the value of a financial performance variable can be a function of itself and other variables from the past (Weatherford & Kimes, 2003; Banker & Chen, 2006; Schmidgall, 2006). Moreover, time-series forecasting models, if constructed properly, can be very easy and intuitive to use in the lodging context. Considering annual forecast of sales is critical for budgeting, revenue management and control purposes, (Schmidgall, 2006; Steed & Gu, 2008), this paper focuses on how to forecast annual sales one year ahead using an easily applicable time-series model in the lodging industry and provides evidence of the model forecasting accuracy. Findings of this paper are timely and extremely valuable, especially considering the need for lodging companies to accurately forecast future sales in a time of decreasing demand (Weatherford & Kimes, 2003).

The application of times series forecast models could potentially reduce the risks and challenges associated with management decisions in the lodging industry. For example, 2009 was a highly challenging year, characterized by declining unit-level profits that directly impact

labor management practices and decisions because of the relationship between profit and expense (Woodworth, 2009).

Lodging Industry Characteristics

Nicolau (2003) asserts that hotels are market-oriented businesses, and consequently "are revenue-dependent in that they are normally required to maintain high revenue levels to survive and generate adequate profit returns." This argument clearly steered the business objective from one of being focused on profit through cost control to one focused on profit through revenue maximization. Brown and Dev, (1999) as well as Wheaton and Rossoff (1998) show that the dynamic lodging industry can be characterized by a structural model that displays relatively long lags between occupancy and room rental changes, as well as between room rental rates and new supply.

Due to the cyclical nature of the hotel industry, the predictability of revenue is based on management's optimal allocation of units and prices, which is in turn based on predicted demand (Chen and Schwartz, 2006). The hotel industry follows the neoclassical economic theory, which stipulates further that demand and pricing, and therefore revenue, are interrelated. Because the hotel industry is comprised of perishable products, it is further acutely subject to the temporal imbalance in guest demand according to the season of travel (Jang and Chen, 2007; Jeffrey, Barden, and Butley, 2002; Jones, 2008; Kennedy, 1998).

Importance of Forecasting

The objective of forecasting systems is to maximize future revenue predictions while considering factors such as a constrained supply and changes in expenditures (Rajopadhye, Ghalia & Wang, 2001). Past studies of forecasting in the lodging industry involve testing extrapolative

forecasting models designed to predict occupancy levels in a hotel by focusing on the shape of past booking curves (Schwartz & Hiemstra, 1997). While understanding this type of booking behavior is important, these forecasts fail to consider the importance of hotel level expenses and the relationship to net income and revenue (Banker & Chen, 2006). In fact, most hotel industry research utilizes two methods to estimate demand: number of rooms or arrivals for the same day of the previous year to estimate the forecast, or a more complex exponential smoothing method for a long-term forecast.

Sophisticated econometric forecasting models have also been developed which are helpful for the lodging industry as a whole, however, the single hotel manager needs a simpler, more practical model designed for use at a specific property. Utilizing income statement line items to aid in predicting future revenues is a simpler design that may provide accurate and efficient forecasts. Therefore, this paper carefully sifted through a sea of financial variables and identified the following based on both their theoretical and empirical significance.

Net Income

Historical net income is an important predictor of future revenues, as total revenues (sales) are the key driver of profit, and variable costs often vary with total sales (Vinod, 2004; Banker & Chen, 2006). Including net income as a predictor of future and current revenues ensures inclusion of appropriate cost relevant financial information (Banker & Chen, 2006). The traditional model of considering fixed and variable costs provides a strong basis for earnings prediction which translates into accurate future sales forecasts. In addition, utilizing net income offers an effective proxy for profitability, as net income serves as the calculation of the economic return based on some future expectation of cash flow and earnings retention (Nicolau, 2003). The investment decisions based on net income depend upon the expectation of market conditions

that are likely to prevail years in advance. Understanding this expectation formation is crucial, therefore, to modeling of the hotel anticipated future revenues.

Advertising Expenditures

Advertising and marketing expenses (including franchise fees and loyalty programs) are among the largest in hotels, second only to payroll (O'Neill, Hanson & Mattilla, 2008). Advertising is often used to enhance brand and hotel recognition and to differentiate a brand or hotel from its competitors, while simultaneously increasing sales figures. In many industries, including the hospitality industry, product differentiation and the value of brand names translate as the product of advertising effectiveness. In other words, a high rate of advertising may be closely linked to the brand equity and overall firm value (Chauvin and Hirschey 1993; Reilly, McGann, and Marquardrat 1977; Ho, Keh, and Ong 2005). As a result of spending on advertising, firm performance may be viewed as a form of investment in intangible assets with predictably positive effects on future cash flows and firm performance.

Despite the conceptual importance of incorporating cost behavior such as advertising expenditures into forecasting models and profitability analysis, few empirical studies have systematically examined the forecasting ability of models that explicitly recognize the relation between costs and sales when forecasting future sales.

Model

This study was based on secondary data that combines annual financial data for publicly traded lodging companies from the years 1963 – 2008. Considering the focus of this study is to assess the structure and fit of times-series forecasting models that include revenue, expense and net income one year before as independent variables to predict future revenue, the intention is to

gain a basic understanding of the influence that past financial variables have on predicting future revenues. If the model is descriptively valid, then its estimation using past data should provide a basis for forecasting future sales (Banker & Chen, 2006).

An autoregressive model of lag one (AR(1)) with the dependent variable of annual revenue is explored first. Then to further enhance the prediction accuracy, this paper explicitly incorporates two more lagged variables of annual advertising expense and net income in conjunction with lagged annual revenues to better capture the behavior of current revenues, considering the dual role revenue plays as a proxy for both demand and size and the significance of profitability and advertising from one year earlier in supporting and predicting future demand/sales (Wheaton & Rossof, 1998; Steed & Gu, 2008). The proposed models recognize the dynamics of the cyclical behavior of the hotel industry through the application of forecasting based on past behavior (Nicolau, 2003).

When forecasting future demand based on past supply and demand schedules, time series data points should not be free from influence of one another, and therefore must hold memory if hotel managers are to be able to predict future performance from past financial behavior (Bull, 1997; Kalnins, 2006).

Therefore, the first proposed model considers total revenue (Rev) in period t-1, as a predictor of current total revenue in period t (Rev). The model is presented below, representing a common application of forecasting sales in the lodging industry (Wheaton & Rossof, 1998):

$$\text{Rev}_t = f(\text{Rev}_{t-1}) \qquad (1)$$

Where Rev_t represents annual revenue from year t and Rev_{t-1} stands for annual revenue from year t-1.

In addition, this study argues that current annual revenue is a function of revenue, advertising expense, and net income from the prior year. Therefore, an autoregressive model with two additional lagged independent variables is constructed, specifically:

$$\text{Rev}_t = f(\text{Rev}_{t-1}, \text{XAD}_{t-1}, \text{NI}_{t-1}) \quad (2)$$

Where XAD_{t-1} represents total annual advertising expense from year t-1 and NI_{t-1} represents total annual net income from year t-1.

Results

The firm year observations included in this study spans a wide range of hotel firms, with the final usable 656 observations mainly due to the lagging operation and missing advertising expense, yet the final data set satisfies the basic requirements for both models constructed in this study. Revenue ranges from $14,000 to $12,990 million, with a standard deviation of $1,552 million. Advertising expense spans the spectrum of 0 and 214 million dollars. And net income ranges from -1,072 to 2,490 million dollars. One observation is that standard deviations of all the variables are large, indicating the hotel business is of high risk (Table 1).

Table 1. Summary Statistics (In Millions of USD, except for N)

Variable	N	Mean	Std. Deviation	Min	Max
Rev_t	656	481.363	1552	.01400	12990
Rev_{t-1}	656	470.701	1514	.01400	12990
XAD_{t-1}	656	7.816	20.354	0	214.00
NI_{t-1}	656	26.726	148.473	-1072	2490

Note:
Rev_t= Annual Revenue from year t.
Rev_{t-1} = Annual Revenue from year t -1.

XAD_{t-1} = Annual Advertising expense from year t -1.
NI_{t-1} = Annual Net Income from year t -1.

Table 2 reports the AR(1) estimation results. When only past revenue is used to predict current revenue, the overall model was significant, with an F statistic equal to 18396.1 and corresponding p-value less than .0001. It is evident from the model test results that current hotel revenues are significantly influenced by past revenues, considering 94.74% of the variance in future revenues was explained by past revenues; further confirming that the relationship between the variables is strong. Parameter estimates under this model suggests that an almost 1 to 1 relationship exists between past revenues (Rev_{t-1}) and current revenues (Rev_t).

A Dickey-Fuller test (1979) failed to reject the null that the errors are white noise, suggesting the time series considered are stationary even though the coefficient associated with Rev_{t-1} is very close to one. White errors are calculated to account for possible heteroscedasticity impacts. Further, tests of autocorrelation are carried out with regressing current residual from Model (1) on residuals for the previous five periods, only slight autocorrelations observed for lag one and lag two residuals at .10 and .15 levels.

Table 2. Parameter Estimates, AR(1) model, Model (1).

Independent Variable	Coefficient	St. Err. (White)	t-statistic	Adjusted R^2
Rev_{t-1}	.9933	.0068	146.09***	0.9474

Note:
Rev_{t-1} = Annual Revenue from year t -1.
***= p<0.001.**

Understanding cost behavior is one of the most important aspects of profit and forecasting revenue analysis for managers (Banker & Chen, 2006). Therefore, a second forecasting model was proposed to consider the effects of past net income (NI_{t-1}), past revenues (Rev_{t-1}) and past advertising expense (XAD_{t-1}). This model produced significant results, and proved to be a better fit than the earlier presented model that just included past revenue as a predictor of current revenue. The new model explained 98.59% of current revenues and was significant with an F statistic of 16401.6 and a corresponding p-value less than .0001 for all variables (refer to Panel A of Table 3). The parameter estimates under this model suggests that past advertising expense has a 1 to 1.4 relationship with current revenues, while past net income a 1 to .2 relationship with current revenues. A variable, trend, is also created by introducing the relevant years in the data for each firm to account for any time trends, considering it is considered very undesirable to omit a trend from a model when the data generating process has one (Zorn, 2001). Echoing the findings from the previous model, past revenues has an almost 1 to 1 relationship with current revenues. In addition, a Dickey-Fuller test (1979) fail to reject the null that the errors are white noise, suggesting the time series considered are stationary even though the coefficient associated with Rev_{t-1} is very close to one. To address the possible autocorrelation impact, residuals from Model (2) are tested for five lags to see if any autocorrelation exists. Panel B of Table 3 shows no autocorrelation is detected going back five lags.

Table 3. Parameter Estimates, AR(1) model, Model (2).

Panel A: Model (2) results		Std. Err. Adjusted for 62 clusters in firm			Adjusted R-square 98.59%
		Robust			
Rev t	Coef.	Std. Err.	t P>t	[95% Conf.	Interval]
Advertising t	0.0109128	0.0037993	2.87 0.006	0.0033157	0.01851
Rev t-1	0.9859111	0.0125368	78.64 0.000	0.9608421	1.01098
Advertising t-1	0.0113454	0.003654	3.10 0.003	0.018652	0.0040388
Net Income t-1	0.0001416	0.0000958	1.48 0.145	-0.00005	0.0003333
Trend	0.0000375	0.0000492	0.76 0.449	-0.0000609	0.0001359
_cons	0.108338	0.049202	2.20 0.031	0.0099526	0.2067234

Panel B: Test of autocorrelation

Source	SS	df MS		Number of obs	300
				F(5, 294)	1.82
Model	0.448097968	5 .089619594		Prob > F	0.108
Residual	14.4444749	294 .049130867		R-squared	0.0301
				Adj R-squared	0.0136
Total	14.8925729	299 .049807936		Root MSE	0.22165
Residual t	Coef.	Std. Err. T	P>t	[95% Conf.	Interval]
Residualt-1	0.1074207	.0635521 1.69	0.092	-0.0176539	0.2324953
Residualt-2	0.0500055	.0630455 0.79	0.428	-0.0740722	0.1740832
Residualt-3	0.0918686	.0621079 1.48	0.14	-0.0303639	0.214101
Residualt-4	0.0670696	.0601336 1.12	0.266	-0.0512773	0.1854164
Residualt-5	-0.0308612	.0568766 -0.54	0.588	-0.1427981	0.0810757
_cons	-0.0301065	.0130072 -2.31	0.021	-0.0557055	-0.0045075

Note:
Rev_{t-1} = Annual Revenue from year t -1.
XAD_{t-1} = Annual Advertising expense from year t -1.
NI_{t-1} = Annual Net Income from year t -1.

The Pearson's correlations revealed that all of the independent variables are significantly correlated and results are reported in Table 4. Only moderate correlations between independent variables are present. Multicollinearity does not appear to be a problem considering the VIFs are generally less than 4.

Table 4. Correlations Between Predictor Variables

	rev t	Rev t-1	Advertising t	Advertising t-1	Net Income t-1
Rev t	1				
rev t-1	0.9758	1			
Advertising t	0.5751	0.5889	1		
Advertising t-1	0.5708	0.5738	0.9785	1	
Net Income t-1	0.3641	0.3678	0.5558	0.5348	1

Note:

All variables are significant at the .01 level

Conclusions

This study finds that annual revenue follows an autoregressive model, AR(1). When constrained by financial resources and time, hotel managers can simply look at the current annual revenue to predict next year's sales, which in turn can be used to gauge operation efficiency and improve financial control while providing the opportunity for maximization of financial resources, considering that the model employed in this study yields a high prediction accuracy of 93.95%.

Moreover, for the first time, this study provides empirical evidence regarding the power that past advertising expense has in predicting future revenues in the lodging industry. The magnitude of parameter estimates in the second model combined with the overall model fit of 98.59% strongly suggest the consideration of advertising expenditure as a powerful driver of future business as well as an accurate predictor of future sales. Further, past profitability significantly enhances a lodging firm's future sales, which can be contributed to that fact that more financial resources from the past enable the firm to improve other areas of the business.