

# THE EFFECT OF HOLIDAYS ON HOTEL DAILY REVENUE

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*The holiday effect phenomenon has been studied in industry sectors such as securities, retail, and so on. Literature is devoid of a purposeful study specific to the hospitality industry that evaluates the economic impact of holidays on the hotel industry. The purpose of this study was to examine the impact of holidays on hotel daily revenue. Using daily occupancy data of the U.S. lodging industry between January 2000 and February 2004, the study found a significant holiday effect prevalent in the hotel industry. Findings indicate that individual effects of holidays on hotel daily revenue differ significantly from one to another. In addition, some holidays have differential impacts depending on the day of the week on which they fall. Findings can be used to develop more targeted strategies by the lodging industry as a whole.*

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**KEYWORDS:** *economic impact; daily revenue; holiday effect; lodging industry*

“Holiday effect” is a phenomenon much studied in fields such as finance and economics. In marketing, the term has a more applied context for firms to tailor strategies structured around the emerging opportunities (or lack thereof) because of holidays. For example, according to the International Council of Shopping Centers’ 1998 data, the top shopping days in the United States are the days between Thanksgiving and Christmas, both of which are big holidays.

In the stock market, studies have shown significant differences in pre-holiday returns compared to post-holiday returns (Brockman & Michayluk, 1998; Lakonishok & Smidt, 1988; Meneu & Pardo, 2004). Most studies empirically validate greater returns during pre-holidays than post-holidays (Brockman & Michayluk, 1998; Lakonishok & Smidt, 1988; Meneu & Pardo, 2004).

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However, the holiday effect is only part of a larger context of the study of seasonality. In tourism and the lodging industry in particular, seasonality has been the focus of several studies (Butler, 1994; Jeffrey & Barden, 2000; Koenig & Bischoff, 2004). In fact, the term "holiday," within this context of seasonality in tourism, has typically assumed a period spanning several days (even weeks or months) compared to the shorter (single-day) application in finance and economics. However, except for sparse attention in the trade press (Lomanno, 1999), academic literature in the hospitality field is devoid of any specific examination of the holiday effect on the lodging industry.

The purpose of this study is to examine the holiday effect phenomenon in the lodging sector. More specifically, the article aims to identify the specific impact of each U.S. major holiday (totaling 26 holidays, including some religious holidays) on hotel revenue. To identify the specific-day effect, a smooth curve was fitted to the longitudinal data and outliers were identified. These outliers represented the main holidays in the United States and the Generalized Additive Model (GAM) was used. GAM is a widely used method in statistical literature when the primary objective of the study is to identify outliers and their relative magnitudes (Diggle, Heagerty, Liang, & Zeger, 2002). The method used, special investigation, is also done to determine effects on hotel revenue based on the day of the week on which the actual holiday falls. The study uses consecutive 4-year U.S. hotel revenue data from January 2000 through February 2004 to achieve the objectives of the study.

## REVIEW OF LITERATURE

Many studies provide evidence of abnormal returns on days prior to a holiday in the securities markets. Lakonishok and Smidt (1988) and Ariel (1990) separately found pre-holiday effects in organized stock markets through their research. In an international context, several studies support the existence of a pre-holiday effect in many countries and with different trading systems (Brockman & Michayluk, 1998; Cadsby & Ratner, 1992; Kim & Park, 1994; Pettengill, 1989). More recently, a Financial Management Association International study ("Market Efficiency", n.d.), investigated the ex-post holiday reaction in exchange markets by examining main stock indices of six countries and proved the existence of an ex-post holiday anomaly for all exchanges tested. These studies indicate that the holiday effect in the securities market is not country specific or time specific but is a persistent and cross-border economic phenomenon. On the contrary, the holiday effect on hotel revenue is country specific largely because of individual calendars pursued by countries.

A holiday effect also exists in the retail industry. Holidays such as Easter, Thanksgiving, and Boxing Day in Australia (December 26, the day after Christmas) have been known to produce large increases in sales. For instance, retail spending prior to big holidays such as Easter is usually higher than normal and post-holiday spending is lower (Australian Bureau of Statistics, 2004). Lin and Liu (2002) studied the impact on the retail market of the Lunar New Year holiday season, which is the most important holiday in East Asia, and found similar phenomena.

On a broader economic note, Lin and Liu (2002) analyzed holiday effects on 10 economic indices specific to Taiwan. The indices included were the unemployment rate, average salary of non-agricultural sectors, production index of the electrical and electronic industry, exports, imports, Taiwan Weighted Stock Index, and so on. Chinese New Year, Dragon-Boat Festival, and Mid-Autumn Day were the three holidays studied. Of these three holidays, the Chinese New Year had a significant impact on most indices, whereas Dragon-Boat Festival and Mid-Autumn Day had a marginal impact on a few indices. The study proved the extensive impact of holidays on several economic indicators while also indicating the differences in individual effects of holidays. Although, studies such as these have either focused on very few specific holidays (Lin & Liu, 2002) or have regarded holidays in a wider sense as periods of days or weeks or months (Brockman & Michayluk, 1998; Meneu & Pardo, 2004). This study aims to differentiate the individual effects of holidays and simultaneously provide a comparative perspective of the phenomenon in general.

As discussed earlier, seasonality has received more attention in tourism and hotel industry literature. Seasonality is a more popular topic because of the relatively high fixed costs and the perishability of the hotel product. Seasonality is defined as the “systematic or unchanging intrayear movements that are caused by climatic changes, timing of religious holidays, business practices and expectations that give rise to spectral peaks around the seasonal frequency and its harmonics” (Alper & Aruoba, 2001, p. 7). It stems from natural (e.g., weather) and institutional factors (e.g., the calendar, school holidays; Lim & McAleer, 2001).

The hotel industry is seasonal in nature. However, the periods of seasonality in which hotels may experience higher revenue activities vary depending on location and a host of other factors (Jeffrey & Barden, 2000; Koenig & Bischoff, 2004). In fact, Koenig and Bischoff (2004) warn against a broad-brush approach to distinguishing lodging segments based on a conventional understanding of seasonality (summer and winter).

Often, anomalies in occupancy cannot be explained by seasonality. For example, weekly seasonality can be the result of holidays occurring during specific weeks, a fact that has not been empirically determined. Intuitively, we do know that holidays do affect demand for hotel rooms that can be positive or negative depending on the nature of the specific holiday. For example, Valentine’s Day may enhance hotel room demand from the newlyweds or couples segments. On the contrary, Easter, which is often regarded as a feast for family reunions, may considerably reduce business trips, which make up the larger source of hotel room demand. Smith and Lesure (1997) analyzed the Easter holiday impact and demonstrated that hotel revenue preceding Easter Sundays dropped significantly.

In 1999, a Smith Travel Research (STR) study (Lomanno, 1999) measured the impact of special events on lodging industry performance and found evidence of a holiday effect on hotel performance. For example, Valentine’s Day had a positive effect on hotel revenue. In contrast, Halloween and Easter resulted in hotels facing a downturn in occupancy and revenue.

**Table 1**  
**List of Holidays**

Holiday	2000	2001	2002	2003	2004
New Year's Day	01/01/00	01/01/01	01/01/02	01/01/03	01/01/04
Martin Luther King's Day	01/17/00	01/15/01	01/21/02	01/20/03	01/19/04
Lincoln's Birthday	02/12/00	02/12/01	02/12/02	02/12/03	02/12/04
Valentine's Day	02/14/00	02/14/01	02/14/02	02/14/03	02/14/04
President's Day	02/21/00	02/19/01	02/18/02	02/17/03	02/16/04
St. Patrick's Day	03/17/00	03/17/01	03/17/02	03/17/03	—
Good Friday	04/21/00	04/13/01	03/29/02	04/18/03	—
Easter Sunday	04/23/00	04/15/01	03/31/02	04/20/03	—
Passover <sup>a</sup>	04/20/00	04/08/01	03/28/02	04/17/03	—
Mother's Day	05/14/00	05/13/01	05/12/02	05/11/03	—
Memorial Day	05/29/00	05/28/01	05/27/02	05/26/03	—
Father's Day	06/18/00	06/17/01	06/16/02	06/15/03	—
Independence Day	07/04/00	07/04/01	07/04/02	07/04/03	—
Labor Day	09/04/00	09/03/01	09/02/02	09/01/03	—
Rosh Hashanah <sup>a</sup>	09/30/00	09/18/01	09/07/02	09/27/03	—
Yom Kippur <sup>a</sup>	10/09/00	09/27/01	09/16/02	10/06/03	—
Columbus Day	10/09/00	10/08/01	10/14/02	10/13/03	—
Halloween	10/31/00	10/31/01	10/31/02	10/31/03	—
Election day	11/07/00	11/06/01	11/05/02	11/04/03	—
Thanksgiving	11/23/00	11/22/01	11/28/02	11/27/03	—
Hanukkah <sup>a</sup>	12/22/00	12/10/01	11/30/02	12/20/03	—
Christmas Eve	12/24/00	12/24/01	12/24/02	12/24/03	—
Christmas	12/25/00	12/25/01	12/25/02	12/25/03	—
Boxing Day	12/26/00	12/26/01	12/26/02	12/26/03	—
New Year's Eve	12/31/00	12/31/01	12/31/02	12/31/03	—

Note: Data are not available after President's Day 2004.

a. All Jewish holidays start at sundown the day before they are listed here.

## Data

In the following study, we use data collected by STR from January 1, 2000, through February 21, 2004. They summarize daily revenue data reported by most U.S. hotels. As an example of the composition of these data, on January 1, 2000, there are a total of 1,584,643 hotel rooms, of which 1.1% are luxury, 16.4% are up-upscale, 9.3% are upscale, 20.6% are middle with food and beverage (F&B), 23.2% are middle without F&B, 28.4% are economy, and 1.0% are independent hotel rooms.

## Holidays

The holidays considered in this research include most of the U.S. holidays and some religious holidays. They are listed in Table 1. Some of the holidays are pre-determined for certain days of the week. For example, Mother's Day, Father's Day, and Easter are always on Sunday. Labor Day, Memorial Day, Martin Luther King's Day, President's Day, and Columbus Day are always on Mondays. Thanksgiving is on Thursday and Good Friday is always on Friday. Some holidays are date specific. For example, New Year's Day is on January 1, Valentine's

Day is on February 14, Independence Day is on July 4, and Christmas is on December 25 each year.

### Data Patterns

Data provided by STR were in time-series format covering a 4-year time period. The plot of daily revenue over time is shown in Figure 1.

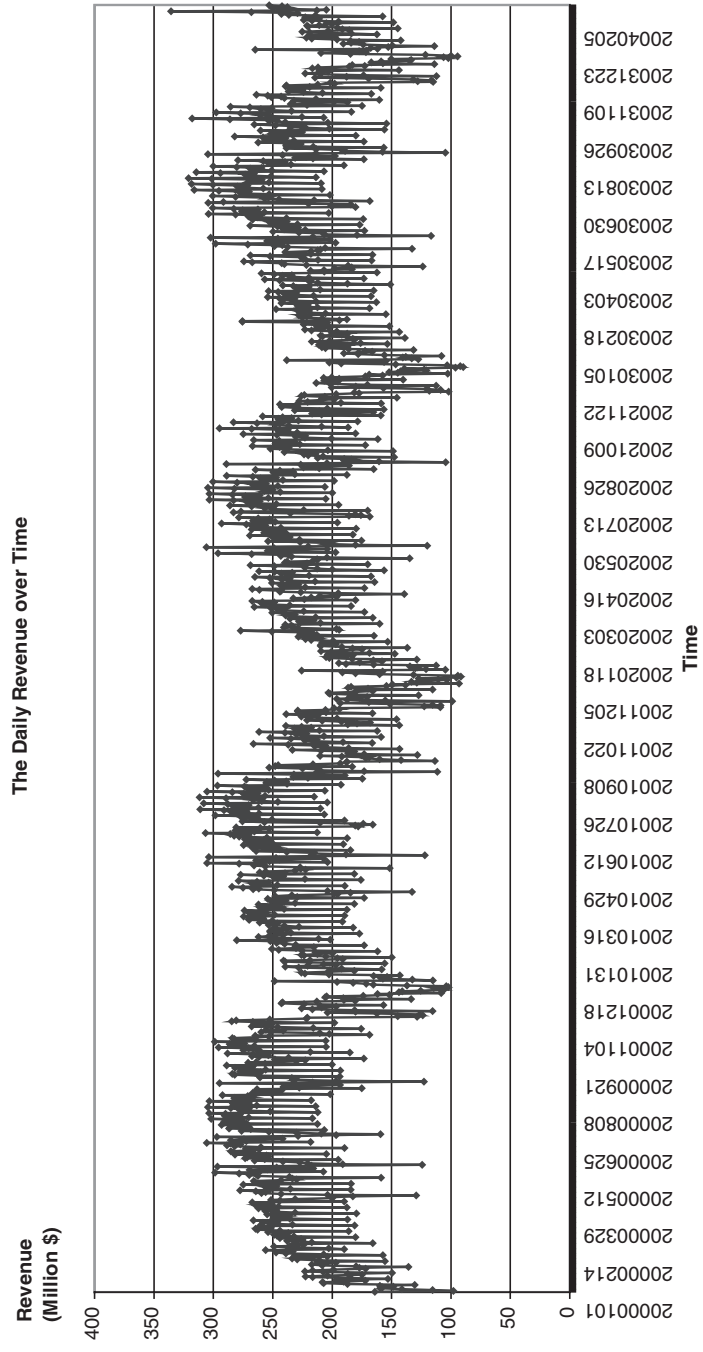
From Figure 1, we can see that the data exhibit a strong seasonal and weekday-weekend effect. Generally speaking, summer (June, July, and August) has the peak revenue, followed by spring (March, April, and May), then fall (September, October, and November), and winter (December, January, and February), which has the lowest revenue. The difference in the average daily revenue between summer and winter is about US\$64.72 million. The hotel revenue on weekends (Friday and Saturday) is higher than on weekdays (Monday through Thursday); the revenue on Sunday is somehow the lowest. The difference of the average revenue between a weekday and Sunday is about \$54.35 million, and the difference between weekends and Sunday is as high as \$70.73 million. The averages of the daily revenue by season and weekday are shown in Table 2 and Table 3, respectively.

## STATISTICAL METHOD

The GAM is used to examine the holiday effect controlling for the seasonal effect, weekday effect, and a linear time trend. GAM is an adaptation of the generalized linear model (GLM) in regression. Like GLM, it is additive and flexible in dealing with a wide range of distributions. Its distinguishing characteristic is its use of smoothing functions instead of regression parameters typical of GLM. GAM is a very flexible technique and can provide an excellent fit in the presence of nonlinear relationships and significant noise in the predictor variables (Xiang, 2002).

In this case, GAM was chosen over other regression models because it helps to smooth out some of the unknown random noises so as to identify the possibility of a holiday effect clearly (Diggle et al., 2002; Hastie & Tibshirani, 1990). GAM is useful when the underlying data are usually highly nonlinear and may take on many different distribution forms. After removing obvious effects (i.e., the parametric aspect of the fit), the smoothing function enables clearer identification of fluctuations around the local trend. There are holidays that fall on certain days of the week, such as Memorial Day (always on Monday), and there are holidays that fall on certain dates, such as Christmas or New Year's Day. Using GAM, we could separate the weekday and month effect from the holiday effect. In other words, we could control the weekday and month effects more effectively, while focusing largely on the holiday effect only. It is important that the holiday effects are implied in fluctuations and in unusually large fluctuations or interesting patterns in the fluctuations, which may suggest explanations due to the presence of holidays. This approach was largely exploratory wherein the outliers were first determined a priori and then studied against the U.S. calendar.

Figure 1  
Plot of Daily Revenues Over Time



**Table 2**  
**Average Daily Revenue by Season**

Season	No.	Mean Revenue (million \$)	Standard Deviation	Minimum	Maximum	Average Revenue (row <i>i</i> – last row)	Differences in Average Revenue (row <i>i</i> – last row)
Mar., Apr., May	368	230.25	34.59	116.71	305.92	42.64	
June, July, Aug.	368	252.33	35.28	159.23	320.94	64.72	42.64
Sept., Oct., Nov.	364	215.84	44.61	99.03	317.87	28.23	64.72
Dec., Jan., Feb.	413	187.61	41.54	89.63	335.52	—	28.23

**Table 3**  
**Average Daily Revenue by Weekday**

Season	No.	Average Revenue (million \$)	Standard Deviation	Minimum	Maximum	Average Revenue (row <i>i</i> – last row)	Differences in Average Revenue (row <i>i</i> – last row)
Mon.-Thu.	864	223.59	40.16	89.63	290.88	54.35	
Fri.-Sat.	433	239.97	44.25	109.46	335.52	70.73	54.35
Sunday	216	169.24	31.55	93.25	248.46	—	70.73

The specified GAM model was

$$Y = u + Mi + Wj + S(date) + error.$$

Where Y is the daily revenue,

*Mi* is the month effect,  $i = 1, 2 \dots 12$  (January, February . . . December);

*Wj* is the weekday effect,  $j = 1, 2 \dots 7$  (Monday, Tuesday, Wednesday . . . Sunday);

*S(date)* is the smoothing spline function of date and is so-called nonparametric.

In the model, we suppose that the daily revenue is the sum of two main terms and an error term with Gaussian distribution. Whereas the main terms or the parametric part contains the month and day effect, the nonparametric part is a smooth curve fitted to the data. The estimation methods are least-squares regression for the day and month effect and cubic spline smoothing for dates. Smoothing is a technique used frequently to identify outliers, especially with data that are longitudinal in nature (Diggle et al., 2002; Hastie & Tibshirani, 1990). Proc GAM of Statistical Analysis System (SAS) 8.1 was used to analyze the data. It is imperative to note that the goal was to identify the days with extremely large or small revenues relative to the general tendency. After fitting the model, our main interest was in finding the outliers. Once the model was fitted, the residuals, which are the vertical distances from the curve representing daily revenues, were determined. These outliers, or points with large standardized residuals, were identified and served as the anomalies we sought to determine outside the general trend.

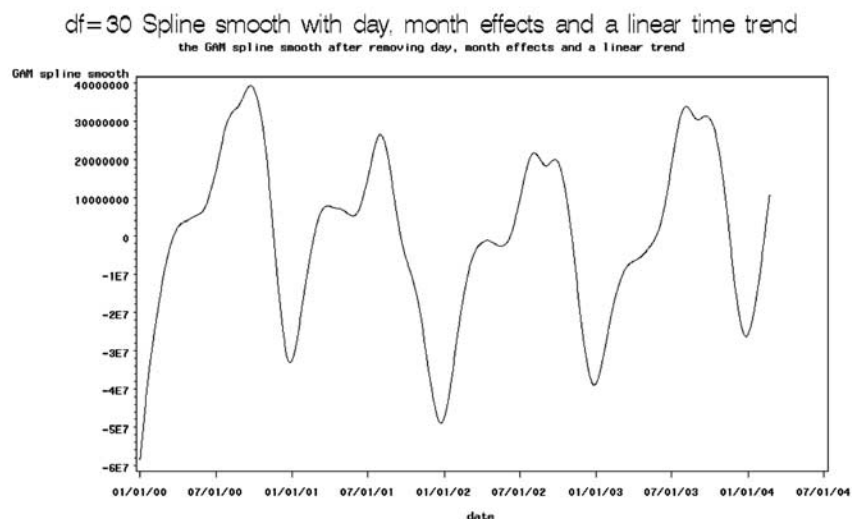
## RESULTS

We used data from a 4-year time interval, the daily revenue of 1,513 consecutive days. Of this, 127 days were outliers beyond the 95% confidence level. Of the 128 outliers (days), 29 days had revenue greatly above the fitted curve, and 98 days had revenue greatly below the fitted curve. Of the 127 outliers, 113 (89%) were pertinent to holidays, which showed that the model had effectively identified what was originally sought.

Proc GAM from SAS 8.1 was used to analyze the data. Results indicate a significant model with a seasonal effect, weekday-weekend effect, and the linear trend was statistically significant at the  $p < .01$  level. Parameter estimates, though significant, are not included because our focus was largely on the residuals; it can be produced on request. A key model diagnostic specific to Proc GAM is the analysis of deviance that evaluates the smoothing effect {spline(Date)} in the model and provides a chi-square statistic comparing the deviance between the full model and the model without this variable. This was significant at the  $p < .001$  level, with a chi-square statistic of 413.8700. The specified degrees of freedom for the spline fit were specified as 30 to achieve the best fit. Figure 2 shows the smoothed revenue curve after removing the weekday and seasonal effects and a linear trend. Evident from Figure 2 is a periodical pattern to revenue fluctuation over the 4 years. However, one may note that the curve (the drop in revenues) is relatively steep in



**Figure 2**  
**The Spline Smooth Curve**



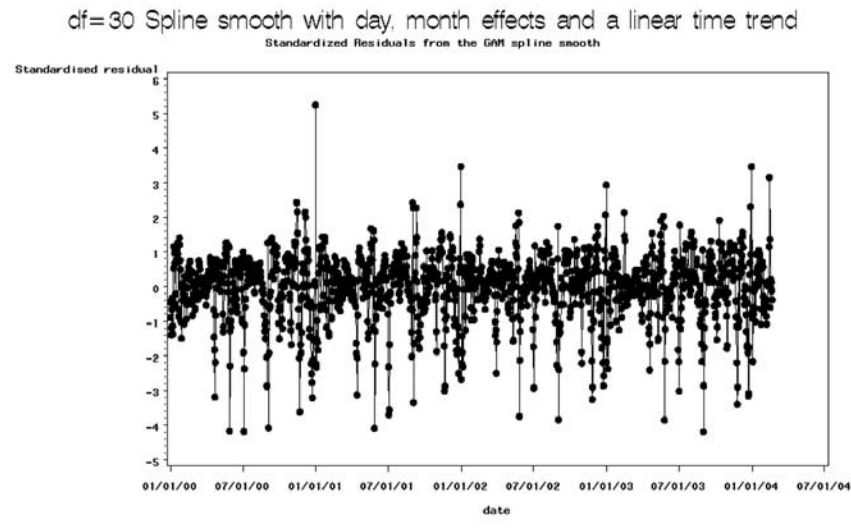
Note: GAM = generalized additive model. One may note that there are significant drops to the curve near and about the start of every year, reflecting low revenues during New Year's Eve. One may also note that the New Year's Eve before 2002 has the highest drop, which can be attributed to the overall slump in hotel revenues in the months after September 11, 2001.

2002 around the winter months compared to the remaining years. This can be attributed to the economic effects of September 11.

Figure 3 shows a plot of standardized residuals of revenues derived from the GAM implementation. Although most residuals are centered around 0, in some cases there are large residuals that are relatively far from 0. If the cases with large standardized residuals are mostly holidays, findings support the existence of the holiday effect, and they also support that the model is deemed appropriate to find the holiday effect. In total, there are 131 cases with standardized residuals either below  $-1.645$  or above  $+1.645$  (beyond 90% confidence interval of the predicted revenues). About 110 of these cases (accounting for 84%) are holidays or days preceding or following a holiday. This result suggests strong support for the presence of the holiday effect and that the model determines this effectively.

The sign of the residuals of holidays and their magnitudes are summarized in Table 4. The plus sign indicates a positive standardized residual (i.e., observed revenues are higher on these days than the predicted values, suggesting that these holidays have a positive impact on hotel revenues), and the minus sign indicates a negative standardized residual (i.e., the observed revenues are lower on these days than the predicted values, suggesting that these holidays have negative impact on hotel revenues). Two plus or minus signs indicate that the predicted average revenues are beyond the 95% confidence interval (residuals either above 1.96 or

**Figure 3**  
**Plot of the Standardized Residuals of Revenues**  
**From the Generalized Additive Model (GAM)**



below  $-1.96$ ). In this case, we say the holiday effect is highly significant (the same notation is used in the rest of the article). In Table 4, if there is one plus or minus sign, it indicates that the predicted average revenues are beyond the 90% confidence interval but within the 95% confidence interval. Therefore, these residuals are either between 1.65 and 1.96 or between  $-1.96$  and  $-1.65$ . In this case, we say the holiday effect is significant. Armed Forces Day is added because it shows a significance influence on revenue.

As seen in Table 4, effects of some holidays show a significantly positive impact on hotel revenue, whereas some do not. Holidays such as Martin Luther King's Day, Lincoln's Birthday, President's Day, St. Patrick's Day, Passover, Mother's Day, Father's Day, Columbus Day, Yom Kippur, Election Day, and Boxing Day do not have any significant influences on the hotel revenue over this 4-year time interval. Conversely, Valentine's Day, Armed Forces Day, and New Year's Eve have significantly positive effects in at least 2 years out of 4 shown. New Year's Day, Good Friday, Easter, Memorial Day, Labor Day, Halloween, Hanukkah, Christmas Eve, and Christmas show significantly negative effects on hotel revenue in 2 years out of 4. Independence Day, on the other hand, has a negative effect on hotel revenue in 2000 and 2001 but a positive effect in 2003.

A further investigation of the residuals confirmed that for those holidays that did not have any significant influence on revenues, the days around them did not show any significant influences either. For some of the holidays that show the significant influences, the days around them also have significant influences. The examination of the residuals of the days around the holidays helps to better understand how these holidays influence the revenue. The results are shown in Table 5.

**Table 4**  
**The Sign and Magnitude of Residuals of Holidays**

Holiday	2000	2001	2002	2003	2004
New Year's Day		—	—	—	
Martin Luther King's Day					
Lincoln's Birthday					
Valentine's Day				++	++
President's Day					
St. Patrick's Day					
Passover <sup>a</sup>					
Good Friday	-	-			
Easter Sunday	—	—		-	
Mother's Day					
Armed Forces Day		+	+	+	
Memorial Day	—	—	—	—	
Father's Day					
Independence Day	—	—		+	
Labor Day	—	—	—	—	
Rosh Hashanah <sup>a</sup>		-			
Columbus Day					
Yom Kippur <sup>a</sup>					
Halloween	-	-		-	
Election day					
Thanksgiving	-				
Hanukkah <sup>a</sup>	—			-	
Christmas Eve		-	—	—	
Christmas	—	—	—	-	
Boxing Day					
New Year's Eve	++	++	++	++	

Note: Data are not available after President's Day 2004. + = residuals fall between 1.645 and 1.96. ++ = residuals are above 1.96. - = residuals fall between -1.96 and -1.645. — = residuals are below -1.96.

Table 5 only lists those holidays that reported significant effects (positive or negative) on hotel revenues. Their effects for each year are listed together with the actual day of the week that the holiday happened. Table 5 illustrates various holidays showing different patterns of impact on hotel revenues. Some holidays have a pre-holiday effect, which means that the days before the holidays have significant impacts on hotel revenues. Conversely, some holidays have a post-holiday effect, wherein the days after the holidays have a significant impact on hotel revenues.

Some holidays have both the pre-holiday and post-holiday effect. We use the same notation as in Table 4 with positive and negative signs indicating positive or negative effects and the one or two plus and minus signs indicating significant or highly significant effects.

As we can see from Table 4, Memorial Day and Labor Day have both pre-holiday and post-holiday effects on hotel revenue. Memorial Day and Labor Day always fall on Monday. They have significant positive effects on the weekend (Saturday and Sunday) before the holiday and a significant negative post-holiday

**Table 5  
Residuals of Influential Holidays and Days Around**

Holiday	2000		2001		2002		2003		2004	
	Day	Effect	Day	Effect	Day	Effect	Day	Effect	Day	Effect
New Year's Day	Sat.	—	Mon.	—	Tue.	—	Wed.	—	Thu.	—
One day after New Year's Day	Sun.	—	Tue.	—	Wed.	—	Thu.	—	Fri.	—
Sat. after New Year's Day	Sat.	—	Sat.	—	Sat.	—	Sat.	—	Sat.	—
Valentine's Day	Mon.	—	Wed.	—	Thu.	—	Fri.	++	Sat.	++
Good Friday	Fri.	—	Fri.	—	Fri.	—	Fri.	—	Fri.	—
Easter Sat.	Sat.	—	Sat.	—	Sat.	—	Sat.	—	Sat.	—
Easter Sun.	Sun.	—	Sun.	—	Sun.	—	Sun.	—	Sun.	—
Armed Forces Day	Sat.	—	Sat.	+	Sat.	+	Sat.	+	Sat.	+
Sat. before Memorial Day	Sat.	—	Sat.	+	Sat.	++	Sat.	++	Sat.	++
Sun. before Memorial Day	Sun.	—	Sun.	—	Sun.	+	Sun.	+	Sun.	+
Memorial Day	Mon.	—	Mon.	—	Mon.	—	Mon.	—	Mon.	—
Tue. after Memorial Day	Tue.	—	Tue.	—	Tue.	—	Tue.	—	Tue.	—
Three days before Independence Day	Sat.	—	Sun.	—	Mon.	—	Tue.	—	Tue.	—
Two days before Independence Day	Sun.	—	Mon.	—	Tue.	—	Wed.	—	Wed.	—
One day before Independence Day	Mon.	—	Tue.	—	Wed.	—	Thu.	—	Thu.	—
Independence Day	Tue.	—	Wed.	—	Thu.	—	Fri.	+	Fri.	+
One day after Independence Day	Wed.	—	Thu.	—	Fri.	—	Sat.	—	Sat.	—
Thu. before Labor Day	Thu.	—	Thu.	—	Thu.	—	Thu.	—	Thu.	—
Sat. before Labor Day	Sat.	—	Sat.	++	Sat.	—	Sat.	—	Sat.	—
Sun. before Labor Day	Sun.	—	Sun.	++	Sun.	+	Sun.	—	Sun.	—
Labor Day	Mon.	—	Mon.	—	Mon.	—	Mon.	—	Mon.	—

Tue. after Labor Day	Tue.	-	Tue.	-	Tue.	-	Tue.	-	Tue.	-
Rosh Hashanah <sup>a</sup>	Sat.	-	Tue.	-	Sat.	-	Sat.	-	Sat.	-
One day before Halloween	Mon.	-	Tue.	-	Wed.	-	Thu.	-	Thu.	-
Halloween	Tue.	-	Wed.	-	Thu.	-	Fri.	-	Fri.	-
Mon. before Thanksgiving	Mon.	-	Mon.	-	Mon.	-	Mon.	-	Mon.	-
Tue. before Thanksgiving	Tue.	-	Tue.	-	Tue.	-	Tue.	-	Tue.	-
Wed. before Thanksgiving	Wed.	-	Wed.	-	Wed.	-	Wed.	-	Wed.	-
Thanksgiving	Thu.	-	Thu.	-	Thu.	-	Thu.	-	Thu.	-
Hannukah <sup>a</sup>	Fri.	-	Mon.	-	Sat.	-	Sat.	-	Sat.	-
Fri. before Christmas	Fri.	-	Fri.	-	Fri.	-	Fri.	-	Fri.	-
Sat. before Christmas	Sat.	-	Sat.	-	Sat.	-	Sat.	-	Sat.	-
One day before Christmas Eve	Sat.	-	Sun.	-	Mon.	-	Tue.	-	Tue.	-
Christmas Eve	Sun.	-	Mon.	-	Mon.	-	Wed.	-	Wed.	-
Christmas	Mon.	-	Tue.	-	Wed.	-	Thu.	-	Thu.	-
Sun. before New Year's Eve	Sun.	++	Sun.	++	Sun.	++	Sun.	++	Sun.	++
New Year's Eve	Sun	++	Mon	++	Tue.	++	Wed.	++	Wed.	++

Note: Data are not available after President's Day 2004. + = residuals fall between 1.645 and 1.96. ++ = residuals are above 1.96. -- = residuals fall between -1.96 and -1.645. --- = residuals are below -1.96.

a. All Jewish holidays start at sundown the day before they are listed here.

effect a day after. Whenever there is a significant positive effect of Memorial Day on weekend, the average increase of daily revenue is about \$47 million (computed from results not shown). A significant negative impact of Memorial Day and the Tuesday after indicates an average drop in daily revenue of about \$77 million. A significant positive effect of Labor Day weekend is that the average increase of the daily revenue is about \$55.7 million. In the case of a negative impact on Labor Day and the Tuesday after, the average drop in daily revenue is about \$76 million. It is interesting that revenues on the Thursdays before Labor Day are significantly lower, with the average drop of \$58 million for all 4 years of the study. However, there was no significant impact on hotel revenue caused by the Fridays before the Labor Day weekend. This can be explained by a drop in business travel on Thursdays and Fridays, although the drop on Fridays is cushioned by a marginal increase in the leisure weekend demand.

Independence Day also seems to have both pre-holiday and post-holiday effects. Revenues tend to decrease 3 days before and 1 day after. However, the negative effect is not significant if the before or after days are Fridays, Saturdays, or Sundays. However, the Independence Day effect itself varies in signs. Out of the four Independence Day observations, the two falling on weekdays (Tuesday and Wednesday) reduced the average daily revenue by \$97.2 million, and the one that fell on a weekend (Friday) raised average daily revenue by \$44.7 million. Clearly, holiday effect as a result of Independence Day depends largely on whether it falls on weekday or weekend.

New Year's Day tends to have a negative holiday and post-holiday effect. The negative effect is highly significant on New Year's Day and a day after, particularly when these 2 days fall on weekdays. There is also a significant negative impact on hotel revenue on the first Saturday after New Year's Day. The average revenue of this Saturday is about \$54.5 million lower, compared with other Saturdays in general.

The holidays of Easter, Halloween, Thanksgiving, Christmas Eve, Christmas, and New Year's Eve all show significant pre-holiday effects. The Saturday night before Easter has a significantly negative impact on hotel revenues. Three out of four Easters had significantly negative impacts on hotel revenues. Halloween also results in a drop of average daily revenue by \$47 million. The day before Halloween sometimes has lower revenue, too.

As for Thanksgiving, a negative effect was significant only in the year 2000. However, the pre-holiday effect of Thanksgiving is significantly negative across all 4 years. The average daily revenues of Monday, Tuesday, and Wednesday before the Thanksgiving Thursday drop to about \$70.6 million. Christmas Eve and Christmas also have negative effects on hotel revenues, and they also reduce revenues on the Fridays and Saturdays before Christmas, as well as a day before Christmas Eve. This all-around significant drop in the average revenue across the 5 days collectively reaches up to \$59 million.

The effect of Valentine's Day, Rosh Hashanah, and Hanukkah also affect hotel revenue depending on whether they fall on weekdays or weekends. When Valentine's Day falls on a Friday or Saturday, it increases hotel revenue significantly. On the contrary, hotel revenues drop if Valentine's Day falls on a Monday,

Wednesday, or Thursday. When Rosh Hashanah falls on a Tuesday, it tends to have a significantly negative impact on hotel revenue, but the same cannot be said if it falls on a Saturday. In the same vein, when Hanukkah falls on a Friday or Saturday, it tends to have negative impact on hotel revenue, but the same cannot be said if Hanukkah falls on a Monday.

## CONCLUSIONS

Some holidays show a significant influence on hotel revenue, but some do not. Martin Luther King's Day, Lincoln's Birthday, President's Day, St. Patrick's Day, Passover, Mother's Day, Father's Day, Columbus Day, Yom Kippur, Election Day, and Boxing Day did not have any significance influences on hotel daily revenue. Conversely, Valentine's Day, Armed Forces Day, and New Year's Eve may have significantly positive effects with findings indicating so in 2 years out of the 4 studied. Whereas New Year's Day, Good Friday, Easter, Memorial Day, Labor Day, Halloween, Hanukkah, Christmas Eve, and Christmas showed significantly negative effects on hotel revenue in least 2 years out of 4, the effect of Independence Day on hotel revenue seemed to depend on whether it fell on a weekday or weekend.

Holidays show different patterns in their impacts on hotel revenues. Some holidays have pre-holiday effects, some holidays have post-holiday effects, some holidays have both pre-holiday and post-holiday effects, and some holidays have neither pre-holiday nor post-holiday effects.

Memorial Day and Labor Day have significantly positive pre-holiday effects, a negative holiday effect, and negative post-holiday effects. New Year's Day tends to have a negative holiday effect as well as a negative post-holiday effect; Easter, Halloween, Thanksgiving, Christmas Eve, and Christmas show negative holiday effects as well as negative pre-holiday effects; New Year's Eve shows a positive pre-holiday effect, Valentine's Day, Good Friday, Armed Forces Day, Rosh Hashanah, and Hanukkah have neither pre-holiday nor post-holiday effect.

The effect of Valentine's Day, Independence Day, Rosh Hashanah, and Hanukkah seems to depend on whether they fall on weekdays or weekends. When Valentine's Day and Independence Day fall on weekends, they have a positive impact on hotel revenues. However, when they fall on weekdays, they either do not have any significant influences or even have negative influences on hotel revenue. When Rosh Hashanah falls on a weekday, it tends to decrease revenue significantly. When Hanukkah falls on a weekend, it tends to decrease revenue significantly.

By understanding the impact of a holiday effect, a marketing strategy can be developed by the hotel to maximize revenue to the hotel. For example, if Valentine's Day falls on a weekend, hotels can develop weekend packages to attract couples and "up sell" this promotion to increase profit yield. When Halloween falls on a weekend, and customers may be more likely to stay at home and pass out treats, hotels may offer promotions such as a dress-up *Star Wars* costume night or other Halloween promotion appropriate for the hotels demographic. This article demonstrates that holiday effect should be proactively ascertained by hotel man-

agement and a marketing and sales strategy developed to maximize revenue for the shareholders.

### LIMITATIONS AND IMPLICATIONS

One limitation of this study is that the time interval of the data is only 4 years. Namely, the same holiday has only four observations. Future research can validate the study's findings by using a wider sample of observations. Another limitation is that this study only focuses on the holiday impact toward the whole industry performance. Differentiation of each hotel segment or category is not considered, therefore limiting the direct application to every particular hotel. Future research can focus on the holiday effects on individual industry segments such as luxury, upscale, midscale, budget, and economy. It can also distinguish based on other characteristics such as location, and even if the hotel is franchised or independent.

The study uses the GAM technique to delineate unknown random noises and known calendar anomalies such as seasonal effect, weekday-weekend effect, and linear time trend to prove the existence of the holiday effect. Since hotel revenue is a result affected by many other factors, future study should explore more contingencies so as to identify distinguishing patterns at a more microlevel. Though the data used for this research cover only 4 years, the result of this article has high value for hotel operators who tend to make the most of information to maximize operation revenue. On the other hand, this article starts a new research area on holiday effect in the hotel industry. More studies can be done in the future from other perspectives with exciting results.

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