

Report on the Analysis of Hotel Occupancy in the Richmond, Virginia Area 2011

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The goal is to determine the variables that affect the occupancy of hotels in the Richmond, Virginia area and to identify the events that are associated with higher hotel occupancy. Hotel occupancy data from January 1, 2011 through December 31, 2011 is available and is used in this analysis.

A multiple linear regression model is used to predict the hotel occupancy and to determine which variables are significant predictors of hotel occupancy. It is thought that major conventions or events affect hotel occupancy, so variable "Major" is used to include the number of major conventions or events occurring in the region each day. Similarly, variable "Minor" records the number of minor events occurring in the region each day. It is also suspected that hotel occupancy is higher on weekends than during the week, so the variable "Weekend" takes the value of 1 if the day is a Friday or Saturday, and takes the value of 0 for all other days. The variable "Day Number" takes a value between 1 and 7, with 1 representing Sunday and increasing sequentially to 7 representing Saturday. Both of variables "Weekend" and "Day Number" were significant variables in the model, but they did not explain much variation in hotel occupancy, so they were replaced by six variables that identified the specific day of the week. Hence the variable "Monday" takes the value of 1 if the day is a Monday, 0 otherwise; the variable "Tuesday" takes the value of 1 if the day is a Tuesday, 0 otherwise; the variable "Wednesday" takes the value of 1 if the day is a Wednesday, 0 otherwise; the variable "Thursday" takes the value of 1 if the day is a Thursday, 0 otherwise; the variable "Friday" takes the value of 1 if the day is a Friday, 0 otherwise; and the variable "Saturday" takes the value of 1 if the day is a Saturday, 0 otherwise. Note that a variable "Sunday" is not needed since a day being a Sunday is designated by the other six variables all taking the value of 0.

The multiple linear regression model with eight variables (Major, Minor, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday) was run. Overall the model was highly significant (p -value $< .0001$) and each individual variable was highly significant (all individual p -values $.0001$ or less). The most significant variable was "Saturday", explaining approximately 24% of the variation in hotel occupancy and the model

parameter estimate indicating that the predicted hotel occupancy increases 20% on Saturdays versus other days. "Tuesday" and "Wednesday" each explain approximately 22% of the variation in hotel occupancy, "Friday" explains approximately 20% of the variation in hotel occupancy, and "Monday" and "Thursday" each explain between 12% and 13% of the variation in hotel occupancy. The existence of one or more major conventions or events explains approximately 11% of the variation in hotel occupancy, while the existence of a minor event explains only 4% of the variation in hotel occupancy. The existence of multiple major conventions or events on the same day additively increases the predicted hotel occupancy for that day.

Correlation coefficients were computed to measure the relationship between hotel occupancy and the individual variables listed above. The most significant variable was "Day Number" with a correlation value of .42, indicating that as the week progresses from Sunday to Saturday the hotel occupancy tends to increase. Looking just at the "Weekend" variable it has a correlation of .29, suggesting that hotel occupancy is higher on the weekend than on the other days. Variable "Major" has a correlation of .26, suggesting that as the number of major conventions or events increases, the hotel occupancy also increases. Finally, variable "Minor" has a correlation of .18, suggesting that as the number of minor events increases, the hotel occupancy also increases but at a slower rate than for the other variables. Using appropriate statistical testing procedures, the correlations for all four variables are significantly greater than 0 (all p-values .0005 or less).

The figure on the last page displays the data, and the variation in the data is obvious. To determine the typical hotel occupancy and to measure the variation in the data, the average hotel occupancy was calculated to be 55% and the standard deviation (a measure of variation) calculated to be 12.3%. On the figure the green horizontal line at $55 + 12.3 = 67.3\%$ is one standard deviation above the average, and the red horizontal line at $55 + 2(12.3) = 79.6\%$ is two standard deviations above the average. There are seven dates/periods where the observed hotel occupancy is two standard deviations (or more)

above the mean, indicating that these dates have extremely large hotel occupancies. The dates and corresponding events are as follows.

March 18 – 19	Events (3) – Jefferson Cup Tournament (Girls Teams), Speech-Language-Hearing Association of Virginia Annual Conference, and Virginia Association for Early Childhood Education Annual Convention
April 29 – 30	Event (1) – NASCAR Races Richmond International Raceway
May 27 – 28	Events (4) – Big Shots Basketball, Richmond Volleyball Club Boys’ East Coast Championship, Randolph-Macon College Commencement and Central Virginia Amateur Softball Association Richmond Round Robin Softball Tournament
July 14 – 16	Events (4) – IWLCA Capital Cup, Watchtower Bible and Tract Society Jehovah’s Witnesses; and minor events Virginia State Board of Elections Conference, and Democratic Party of Virginia Summit
August 26 – September 3	Event (1) – Hurricane Irene
September 8 – 10	Event (1) – NASCAR Races Richmond International Raceway
November 11 – 12	Events (3) – Richmond Marathon, Eastern Cheer and Dance Virginia State Championships, and U.S. Marine Corps Ball

There are an additional 17 dates/periods that fall between one and two standard deviations above the average (between the green and red lines). Instead of listing all 17, only the six that fall between 1.5 and 2 standard deviations above the average will be listed, as follows.

March 11 – 12	Event (1) – Jefferson Cup Soccer Tournament (Boys’ Teams)
April 1 – 2	Events (2) – Trinity Motivation, and Monument Avenue 10K
April 15 – 16	Events (3) – Blue Chip Basketball 2011 Girls’ Preseason Challenge, JAMfest Cheer and Dance, and Garden Week in Virginia
May 20 – 21	Events (2) – Alpha and Omega Church 2011 Women’s Retreat, and Virginia Commonwealth University Commencement
July 20 – 23	Events (5) – U.S. Field Hockey Association-USA Field Hockey National Club Championship, Triple Crown Sports U.S. Baseball Championships, Big Shots Basketball, Watchtower Bible and Tract Society Jehovah’s Witnesses, and Rocketts Landing Triathlon
September 20 – 21	Events (3) – all minor, National Tactical Officers Association Annual Conference, International Council of Shopping Centers 2011 Virginia Idea Exchange, and Indigent Defense Commission

As a group, these two lists represent 13 dates/periods with at least one day of hotel occupancy exceeding 73%. The only period that does not include a Friday and Saturday is September 20 – 21, where three minor events combined to increase the hotel occupancy. The other period that is an exception is August 26 through September 3 in the aftermath of Hurricane Irene.

2011 Occupancy

