Refining Estimates of Hotel-financing Costs

by John O'Neill and Stephen Rushmore

Hotel mortgage-interest rates are closely tied to corporate bond values. Here's how that works.

Accurate estimates of current hotel-financing costs are essential to determining whether a proposed hotel deal is feasible. Furthermore, inaccurately estimating financing costs can result in potential purchasers' making unwise bids for hotel investments—whether bidding too low or too high. Even slight upward or downward fluctuations in mortgage-interest rates can have a substantial effect on debt-service payments. Moreover, mortgage-interest rates are an important component of hotel values, as explained in a previous article with Jan deRoos.[1] For those reasons, owners and investors, lenders, operators, and analysts (such as appraisers and consultants) should strive to accurately assess hotel-financing costs.

In this article we explain a model that we have developed which has proved highly accurate in determining the costs of hotel financing. The calculation employs corporate-bond interest rates, which are reported daily by *Moody's Bond Survey*.[2] Thus, the user may continuously adjust financing estimates for fluctuations in the financial markets.

[1] J.A. deRoos and S. Rushmore, "Investment Values of Lodging Property," *Cornell Hotel and Restaurant Administration Quarterly*, Vol. 36, No. 6 (December 1995), pp. 62–69.

[2] Moody's, Inc., *Moody's Bond Survey* (New York: Moody's, 1990–1999).

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We argue that this model is superior to lender surveys that are published by several hotel consulting and appraisal firms, because those data frequently are neither timely nor accurate.[3] The data's timeliness problem arises because compiling those data—from the time that they are secured to the time the report is printed—consumes between one and two months. The report is then not usually updated for another six to twelve months. The surveys' accuracy problem stems from the tendency of survey respondents (i.e., mortgagees) to respond with opening offers (i.e., asking prices) rather than with final negotiated and committed interest rates.[4]

To overcome the problems inherent in investor surveys, we decided to analyze the relationship of bond rates to hotel interest rates. We chose bonds because of their numerous similarities to real estate. For example, bonds and real estate each commence with an initial investment; each has periodic cash flow (although the bond's is fixed); and each has a terminal value (again, that of the bond is fixed).[5] The study with Carey Hirschman found significant support for estimating hotel interest rates using corporate "A" bond rates (as published and distributed by *Moody's Bond Survey*) and conducting a linear-regression analysis to arrive at an estimate of current hotel interest rates.[6] The primary benefit of this approach is that the Moody's information enjoys wide and frequent distribution, whereas the distribution of hotel interest-rate information is not so wide or frequent. Thus, the bond-based information is more accurate than compilations of hotel-rate data.

The first purpose of this article, then, is to refine hotel-financing estimates of the kind we have been discussing by analyzing the extent to which corporate "A" bond rates (as reported by *Moody's*) are effective as predictors of hotel interest rates. Second, we analyze whether forms of regression analysis other than linear regression (including curvilinear and multiple-regression analysis), would be appropriate techniques for such prognostications.

About regression. Regression analysis is a mathematical technique for predicting a response, or dependent variable (in this case, hotel interest rates), using a predictor, or independent variable (in this case, corporate bond rates). Regression analysis predicts the value of a dependent variable assuming a constant, or straight-line relationship between the values of the dependent value and those of the independent variable. Regression thus seeks to develop a "line of best fit" among the values (as though the values were arrayed as points on a graph with a straight line running as close as possible through the midpoints of those values). Rushmore and Hirschman found support for using American Council of Life Insurance (ACLI) data as the dependent variable, indicating that it represents the only source of hotel mortgage-interest-rate information that has been compiled with reasonable consistency and over a relatively long period of time.[7] For regression analysis to be implemented with a high degree of reliability, one must have a relatively large data set. While the ACLI data represent the most long-term and largest source of hotel mortgage-rate information, this source has the disadvantage of comprising figures from only 20 major life-insurance companies, which are primarily involved in relatively large, high-end hotel projects. Therefore, while ACLI's report represents the best data available for this study, it might not be representative of the entire universe of hotel lending, which would include relatively smaller lodging properties.

Curves ahead. Like linear-regression analysis, curvilinear-regression analysis is a mathematical technique for predicting a dependent variable using an independent variable. However, curvilinear-regression analysis offers a higher level of sophistication over simple regression analysis because it is capable of detecting curved trends between the independent and dependent variables. In cases where a curved trend exists, curvilinear-regression analysis produces a higher regression coefficient (R^2) than does simple regression analysis. Curvilinear-regression analysis has also been referred to as quadratic modeling or polynomial-regression analysis.[8]

Our analysis used SPSS 8.0 for Windows to compare the "A" bond rates with the ACLI data.[9] We examined a total of 97 data points (97 quarters) for which we had both corporate "A" bond rates and hotel interest rates from ACLI. We first conducted both linear and curvilinear analyses for those 97 quarters, starting with the first quarter of 1973 and continuing through the first quarter of 1999. Linear-regression analysis resulted in a significant regression coefficient (R^2) of 0.930, ($F = 1270.66$, $p < .001$). The linear-equation results indicate that corporate "A" bond rates are an excellent predictor of hotel mortgage-interest

[3] S. Rushmore and C. Hirschman, "Estimating the Current Cost of Hotel Financing," *Real Estate Finance Journal*, Winter 1997, pp. 6–10.

[4] *Ibid.*

[5] R.E. Copley, "The Similarities of Valuing Real Estate and Bonds, and the Diversification Benefits of Investing in Real Estate," *The Appraisal Journal*, July 1996, pp. 304–309.

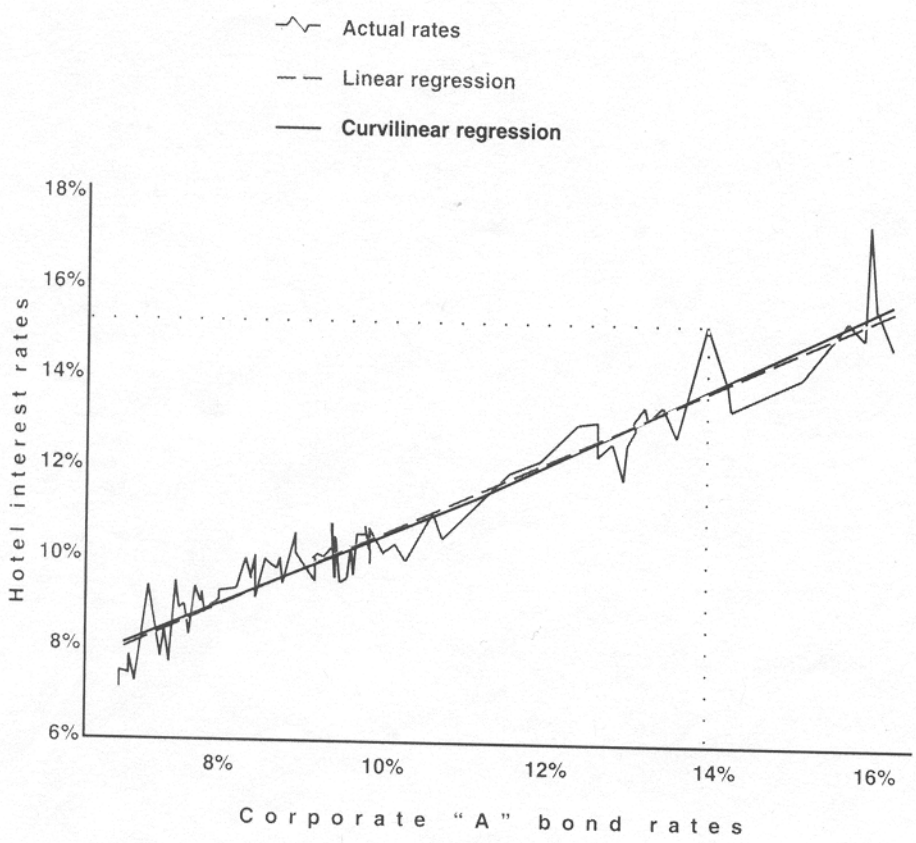
[6] Rushmore and Hirschman, pp. 6–10.

[7] *Ibid.*

[8] See: M.L. Berenson and D.M. Levine, *Statistics for Business and Economics*, 2nd Ed. (Englewood Cliffs, NJ: Prentice-Hall, 1993).

[9] *Statistical Package for Social Sciences*, Version 8.0 (Chicago: SPSS, 1997).

Exhibit 1
Hotel mortgage-interest rates against corporate "A" bond rates



The gray line —— shows the actual corporate bond rates and hotel interest rates, as tallied in 97 of the 105 calendar-year quarters beginning with the first quarter of 1973 and ending with the first quarter of 1999. As an example, the dotted line shows that during one of the quarters (the fourth quarter of 1982), bond rates averaged just under 14 percent, while hotel interest rates were nearly 15.5 percent. The dashed light color line — — — shows a linear regression of the relationship, which seeks to plot a straight line through the midst of the many points (using the shortest possible distance from the regression line to the actual line). The dark color line —— shows a curvilinear relationship, a solution which allows for changes in the relationship. This line shows, for instance, the amplification of the relationship at either end of the graph. As discussed in the accompanying article, this shows a change in the assumptions about the relative risk of bonds and hotel financing when the rates are either very high or very low.

rates. That is, 93.0 percent of the variance in hotel interest rates can be predicted based on corporate "A" bond rates. The regression formula derived from the quarterly hotel mortgage-interest rates and corporate "A" bond rates is as follows:

$$Y = 2.470 + 0.806\ (X)$$

In the above equation, Y = predicted hotel interest rate, and X = corporate "A" bond rate.

Curvilinear Analysis

We then analyzed the 97 data points for evidence of a curvilinear relationship. Curvilinear-regression analysis resulted in a significant regression coefficient (R^2) of 0.931 ($F = 634.65, p < .001$). Those results indicate that corporate "A" bond rates are an excellent predictor of hotel interest rates using a quadratic equation. That is, 93.1 percent of the variance in hotel interest rates can be predicted based on corporate "A" bond rates given a polynomial equation. The curvilinear-regression formula derived from the quarterly hotel mortgage-interest rates and corporate "A" bond rates is as follows:

$$Y = 3.421 + 0.625\ (X) + 0.008\ (X^2)$$

This equation has the same variables as the linear equation. Y = predicted hotel interest rate, and X = corporate "A" bond rate. Although the increase in the regression coefficient from linear to curvilinear regression analysis seems slight (i.e. from 93.0 to 93.1), this increase may be significant. The refined regression equation indicates that as corporate "A" bond rates rise, hotel mortgage rates increase at a faster rate. In other words, the debt market appears to assume that disproportionately greater levels of risk are associated with hotel mortgages when corporate "A" bond rates become relatively high. Similarly, the market appears to assume that disproportionately lower levels of risk are associated with hotel mortgages when corporate "A" bond rates are

relatively low. Thus, particularly during periods of relatively high or low rates, the curvilinear model should do a better job of predicting hotel mortgage rates than does the linear model. Exhibit 1 presents a comparison of hotel interest rates and corporate "A" bond rates, together with regressions of those variables.

We analyzed whether corporate "A" bond rates are becoming increasingly better or worse predictors of hotel interest rates by calculating regression coefficients using linear and curvilinear models starting with the first quarter of 1973 and running through five different ending periods, those being the fourth quarters of 1995, 1996, 1997, and 1998, and the first quarter of 1999. This approach allowed us to also analyze the relative strength of linear versus curvilinear regression analysis. The regression coefficients are presented in Exhibit 2.

As indicated by Exhibit 2, regardless of the ending year of analysis, the regression coefficients for curvilinear analysis are generally higher than (or at least equal to) those of linear analysis. That finding provides further support for using a curvilinear regression to predict hotel interest rates. Furthermore, while Exhibit 2 indicates that there has typically been some degree of fluctuation in regression coefficients calculated from both linear and curvilinear analyses, regression coefficients have generally increased with the inclusion of more-recent data. This increase indicates that corporate "A" bond rates appear to be becoming increasingly better prognosticators of hotel interest rates.

Exhibit 2
Corporate "A" bond rates and hotel mortgage-interest rates

Ending year of analysis	Regression Coefficients	
	Linear analysis	Curvilinear analysis
1995	91.2	92.6
1996	91.1	92.1
1997	91.4	91.8
1998	91.6	91.6
First quarter 1999	93.0	93.1

How Interest Rates Lag Bonds

In an effort to determine more about the predictive nature of corporate bond rates on hotel interest rates, we analyzed the extent to which hotel interest rates might lag behind corporate bond rates. We wanted to know, for instance, whether corporate bond rates predict hotel interest rates occurring one or perhaps two quarters later. To answer this question, we first conducted linear and curvilinear regression analysis using quarterly corporate "A" bond rates as the independent variable and ACLI hotel interest rates for the subsequent quarter as the dependent variable. In other words, we compared each quarterly corporate "A" bond rate with the ACLI hotel interest rate for the following quarter. For example, we compared the corporate bond rate in the first quarter of 1990 to the second quarter of 1990's ACLI hotel interest rate.

Linear-regression analysis resulted in a significant regression coefficient (R^2) of 0.933 ($F = 1303.26, p < .001$). Those results indicate that using a linear equation, corporate "A" bond rates are an excellent predictor of hotel interest rates in the subsequent quarter—even better than in the current quarter. The regression formula derived from the quarterly hotel mortgage-interest rates for the subsequent quarter and corporate "A" bond rates is as follows:

$$Y = 2.414 + 0.810\ (X)$$

In the above equation, Y = predicted hotel interest rate, and X = corporate "A" bond rate.

We then analyzed the data points for evidence of a curvilinear relationship. Curvilinear-regression analysis resulted in a significant and higher regression coefficient (R^2) of 0.935, ($F = 665.98, p < .001$). The curvilinear regression formula derived from the quarterly hotel mortgage interest rates and corporate "A" bond rates is as follows:

$$Y = 4.166 + 0.479\ (X) + 0.015\ (X^2)$$

In the above equation, like the former equation, Y = predicted hotel interest rate, and X = corporate "A" bond rate. Like the previous curvilinear equation, this polynomial equation indicates that as corporate "A" bond rates increase, hotel mortgage rates increase at a faster rate. Again, the debt market appears to assume disproportionately greater levels of risk are associated with hotel mortgages when corporate "A" bond rates become relatively high. Similarly, the market appears to assume disproportionately lower levels of risk are associated with hotel mortgages when corporate "A" bond rates are relatively low.

In addition, we analyzed corporate "A" bond rates relative to ACLI hotel interest rates recorded two quarters later. These analyses resulted in relatively lower R^2 values than did the equations testing a lag of just one quarter.[10] Thus, hotel interest

[10] Values for the linear regression were: $R^2 = 86.6$, $F = 603.00$, $p < .001$; and for the curvilinear regression: $R^2 = 86.7$, $F = 300.50$, $p < .001$.

Plainly stated, corporate "A" bond rates exhibit high levels of predictive ability relative to hotel mortgage-interest rates.

rates appear to lag behind corporate "A" bond rates by approximately one quarter.

Analyzing Rate Differentials

To better understand the historical relationship between corporate "A" bond rates and hotel interest rates, we analyzed the historical rate differentials, or the spreads between the two rates. This analysis indicates that the two rates exhibit a high degree of similarity in movement. Corporate "A" bond rates have historically fluctuated from a low of 6.97 percent in 1998 to a high of 16.22 percent in 1982. Hotel interest rates (as reported by ACLI) have ranged from a low of 7.12 percent in 1998 to a high of 17.50 percent in 1982. Despite those great fluctuations, the two rates have generally been within two points of one another, as indicated by Exhibit 3.

Exhibit 3 illustrates that hotel interest rates have historically been higher than corporate "A" bond rates. An exception to this trend occurred in the 1980s when hotel interest rates were generally below, or approximately the same as corporate "A" bond rates. That inversion ended within approximately one year after the U.S. Congress passed the Tax Reform Act of 1986. It appears that the debt market once again attributed greater levels of risk to hotel debt than to corporate bonds once the distortion caused by federal tax policy ended. One could argue that the favorable tax treatment in the 1980s had the effect of decreasing the risk of hotel investments.[11] This decreased risk occurred because carefully structured hotel syndications could capitalize on tax benefits allowing investors to recoup their total outlay in the hotels' first year of operation and to reap additional benefits in the future, regardless of the actual economic success of the underlying hotel asset.[12] Consequently, at least some of the historical fluctuation in hotel interest rates that is not explained by changes in corporate "A" bond rates might be explained by changes in U.S. income-tax regulations.

Due to the apparent influence in the 1980s of U.S. income-tax laws on hotel interest rates, we conducted multiple-regression analysis to include this factor. Multiple-regression analysis allows the implementation of two independent variables to predict a single dependent variable.[13] In this instance, independent variables were corporate "A" bond rates (X) and a qualitative (yes–no), or "dummy" variable. The dummy variable (Z) consists of a binary code where 1 (no favorable tax treatment) = periods prior to 1980 and subsequent to 1987 and 0 (yes, favorable treatment) = 1980 through 1987 to take into account the change in rate differentials during this period. This analysis resulted in a regression coefficient (R^2) of 93.7 ($F = 704.38, p < .001$). The multiple-regression formula derived from the hotel mortgage interest rates is as follows:

$$Y = 1.155 + 0.898\,(X) + 0.591\,(Z)$$

In the above equation, as in the previous equations, Y = predicted hotel interest rate, and X = corporate "A" bond rate. The Z here represents the previously described dummy variable.

Finally, we conducted multiple-regression analysis using a one-quarter lag between corporate "A" bond rates and hotel interest rates. This analysis resulted in a regression coefficient (R^2) of 94.3, the highest

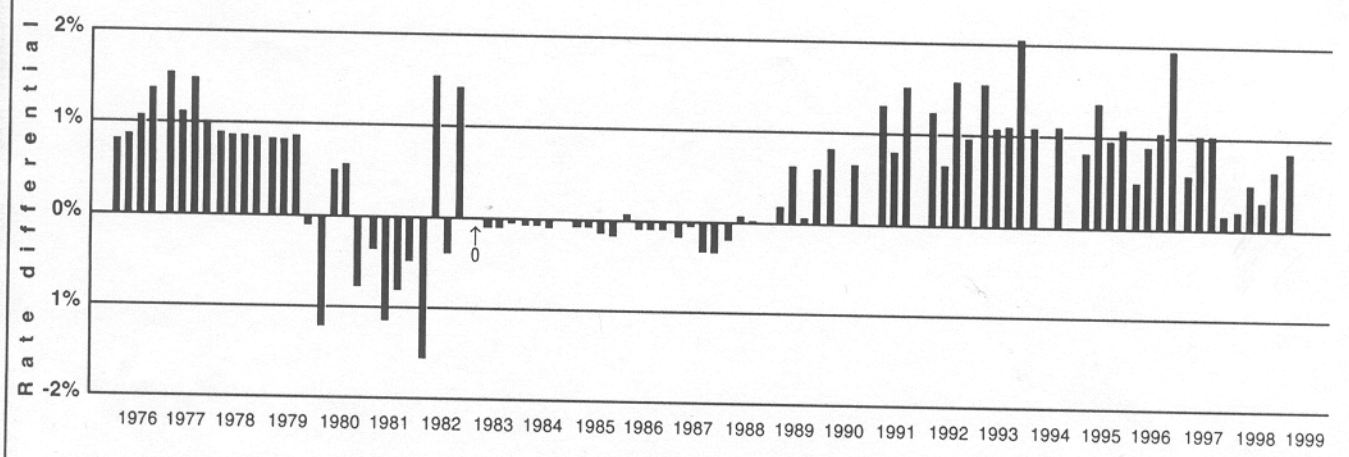
[11] W.J. Hoffman, "Lessons from the Hotel Trenches: Avoiding Another Crash," *Real Estate Finance Journal*, Spring 1997, pp. 24–27.

[12] S. Rushmore, *Hotels and Motels: A Guide to Market Analysis, Investment Analysis, and Valuations* (Chicago: Appraisal Institute, 1992).

[13] Berenson and Levine, *op. cit.*

Exhibit 3

Difference between hotel mortgage-interest rates and corporate "A" bond rates



Interest rates for hotel financing are generally higher than those for corporate "A-rated" bonds, apparently reflecting the perception that hotel investments are more risky than bonds. However, federal tax law in the 1980s changed that relationship by altering the relative risk perception between the two investments. The rates were identical in the first quarter of 1983 (designated by 0, above), and observations are missing for certain quarters (e.g., second and fourth quarters of 1990).

of our study ($F = 772.76$, $p < .001$). This regression coefficient means that hotel interest rates are correlated with the X and Z variables at an extremely high rate of 97.1 percent (the square root of 94.3). The multiple-regression formula derived from the hotel mortgage interest rates is as follows:

$$Y = 0.758 + 0.927\,(X) + 0.736\,(Z)$$

Substituting into the above equation the actual fourth-quarter-1998 corporate "A" bond rate of 6.87 percent, as reported by *Moody's*, results in a predicted hotel interest rate of 7.86 percent for the first quarter of 1999. This predicted figure is identical to the actual first-quarter-1999 interest rate, to the nearest one hundredth of a percentage point. This calculation was as follows: 0.758 + (0.927 x 6.87%) + 0.736 = 7.86 percent. Despite the accuracy of this particular prediction, we would not expect the multiple-regression equation consistently to predict hotel interest rates so precisely. Nevertheless, this approach clearly demonstrates predictive abilities that are greater than any previously presented technique. By comparison, the other three equations result in estimated interest rates of 8.10 percent (for linear regression), 8.18 (for curvilinear regression), and 8.02 percent (for straight multiple regression).

Although we have managed to develop mathematical equations using variables that explain high degrees of variance in the fluctuation of hotel interest rates, other factors must exist that would explain the small amount of variance not explained here. Other factors that debt markets may consider when arriving at hotel interest rates could include such risk factors as supply and demand trends, barriers to competition, customer profiles, and business-mix trends.[14]

[14] L.E. Raleigh, "Asset Management," in *Hotel Investments: Issues and Perspectives*, 2nd Ed. (Lansing, MI: Educational Institute of the American Hotel & Motel Association, 1999), pp. 91–109.

Predictive Ability

This article supports earlier research which found that corporate "A" bond rates exhibit high levels of predictive ability in relation to hotel mortgage-interest rates. We expanded on earlier work by presenting here a polynomial model that appears to be equal to or superior to previous linear models. Furthermore, our results indicate that since 1995, corporate "A" bond rates have developed improved predictive abilities for hotel interest rates. Finally, we found extremely high predictive capabilities using multiple-regression analysis where corporate "A" bond rates from the previous quarter predicted hotel interest rates for the current quarter. Future research should seek to further refine such mathematical modeling by evaluating the efficacy of including within such models factors such as supply and demand trends, barriers to competition, customer profiles, and business-mix trends. CQ