Cornell Hospitality Report

Looking Under the Hood:
The Catalysts of Hotel Credit Spreads

by Jan A. deRoos, Ph.D., Crocker H. Liu, Ph.D., and Andrey D. Ukhov, Ph.D.

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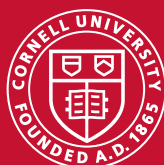
School of Hotel Administration

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EXECUTIVE SUMMARY

The interest-rate spread (or credit spread) between hotel loans and office building loans is an effective predictor of the relative change in delinquency for hotel loans, as explained in a prior report, "A New Canary for Hotel Mortgage Market Distress" (published by the CHR). In this companion report, we take a look under the loan spread hood to see what are the catalysts that drive that credit spread (which is also known as the relative risk premium or risk premium differential). Using a Vector Autoregression (VAR) statistical framework, we find that hotel credit spreads (against office loans) widen if the general economy worsens, anticipated corporate profitability declines, capital availability decreases, hotel revenues decrease, or relative risk increases. The variables that are statistically significant capture risk and return information embedded in the risk premium differential (credit spread), and it is the decline in these factors that makes our canary stop singing (as a warning of impending trouble with hotel loans).

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Looking Under the Hood:

The Catalysts of Hotel Credit Spreads

by Jan A. deRoos, Crocker H. Liu, and Andrey D. Ukhov

One of the important credit spreads in the hotel real-estate industry is the difference in loan rates for hotels as compared to rates for other real estate, notably, office buildings. There is substantial interest among finance practitioners and researchers in the behavior of credit or interest rate spreads, and in this report, we analyze the factors that underlie the hotel credit spread. This spread is of particular interest to the hospitality industry because it forecasts the relative delinquency rate of hotel loans as compared to office loans.[1] As we explain here, the credit spread captures many of the factors that increase the riskiness of hotel loans.

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[1] See: Jan A. deRoos, Crocker Liu, and Andrey Ukhov, "Relative Risk Premium: A New Canary for Hotel Mortgage Market Distress," *Cornell Hospitality Report*, Vol. 14, No. 21 (November 2014), Cornell Center for Hospitality Research.

Exhibit 1

Interest-rate spreads
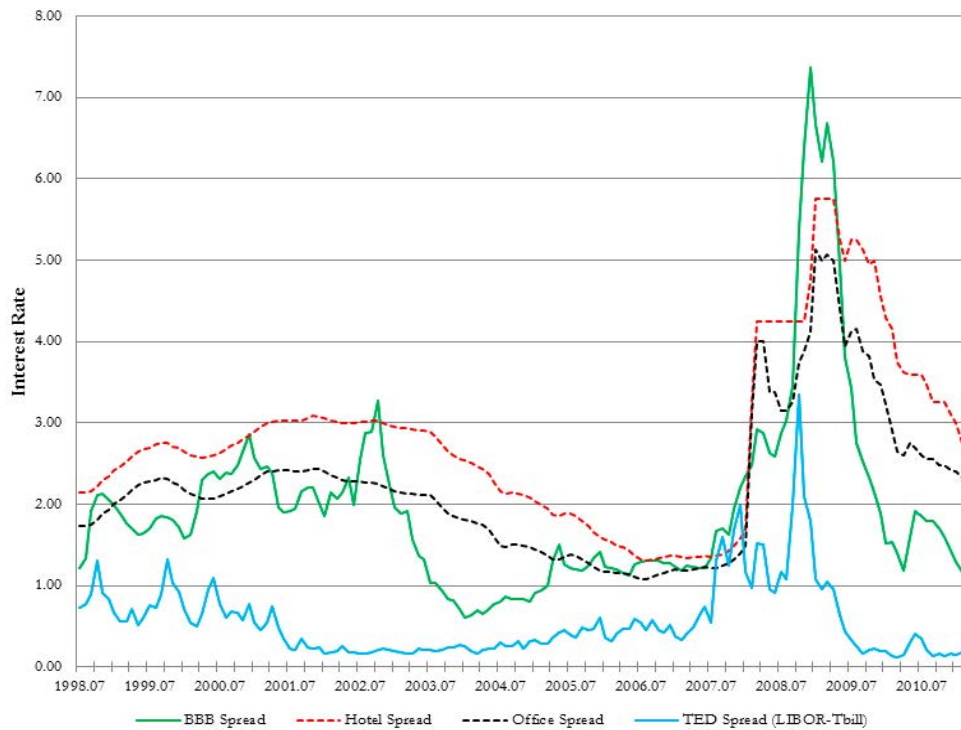
Financial markets see many types of credit spread, which is defined as the difference between interest rates on two types of investments. As with the hotel credit spread, the generic spread calculation is as follows: the rate on a less risky benchmark is subtracted from the rate on the riskier investment. The spread represents the incremental compensation paid to lenders for bearing the incremental risk of the hotel loan (in this instance). The spreads vary with the market's perception of the level of specific investment risk as well as the degree of overall market risk aversion. As examples, Exhibit 1 shows four spreads: the BBB corporate spread (the yield on BBB rated corporate bonds minus the yield on 10-year Treasuries), the TED spread (3-month LIBOR rate minus 3-month Treasuries), the hotel spread (the rate on hotel loans minus the rate on 10-year Treasuries), and the office spread (the rate on office property loans minus the rate on 10-year Treasuries). Although general economic conditions affect all of the spreads (as depicted, for example, by the sharp, but temporary increase during the 2008 financial crises), hotel spreads have their own specific characteristics.[2]

As we said at the outset, hotels pay higher interest rates on loans compared to the rates on other property types such

as office buildings, as shown by the shaded yellow band in Exhibit 2 and the heavy solid line in Exhibit 3 (both overleaf). The argument that lenders advance for charging those higher rates is that underwriting loans on hotel property is riskier than loans on other property types. Our earlier CHR Report, "A New Canary for Hotel Mortgage Market Distress," showed that changes in the interest rate spread between hotel loans and loans on office properties contain important economic information for forecasting hotel loan delinquencies. Of greatest concern, an increase in the hotel credit spread forecasts increased delinquency levels. Because of the direct relationship between the loan spread and relative hotel delinquencies, the incremental risk premium for hotels merits the deeper, more tailored analysis that is the focus of this study. As we explain below, we use Vector Autoregression (VAR) to capture the interactions of the variables that drive the hotel credit spread. So, after outlining our theory and data, we'll explain why VAR is an appropriate analytical tool. We'll then present the factors involved in the credit spread, which, not incidentally, capture the riskiness of hotel loans in relation to other real estate.

Components of interest rates. The interest rate on a risky loan such as that for a hotel consists of four components, beginning with the nominal risk-free interest rate, which is equal to the real rate of interest and the expected

[2] The correlation between BBB corporate spread and the TED spread equals 0.53, while the correlation of hotel spread and the TED spread is substantially lower, at 0.11.

EXHIBIT 2

Incremental interest rate components for hotels
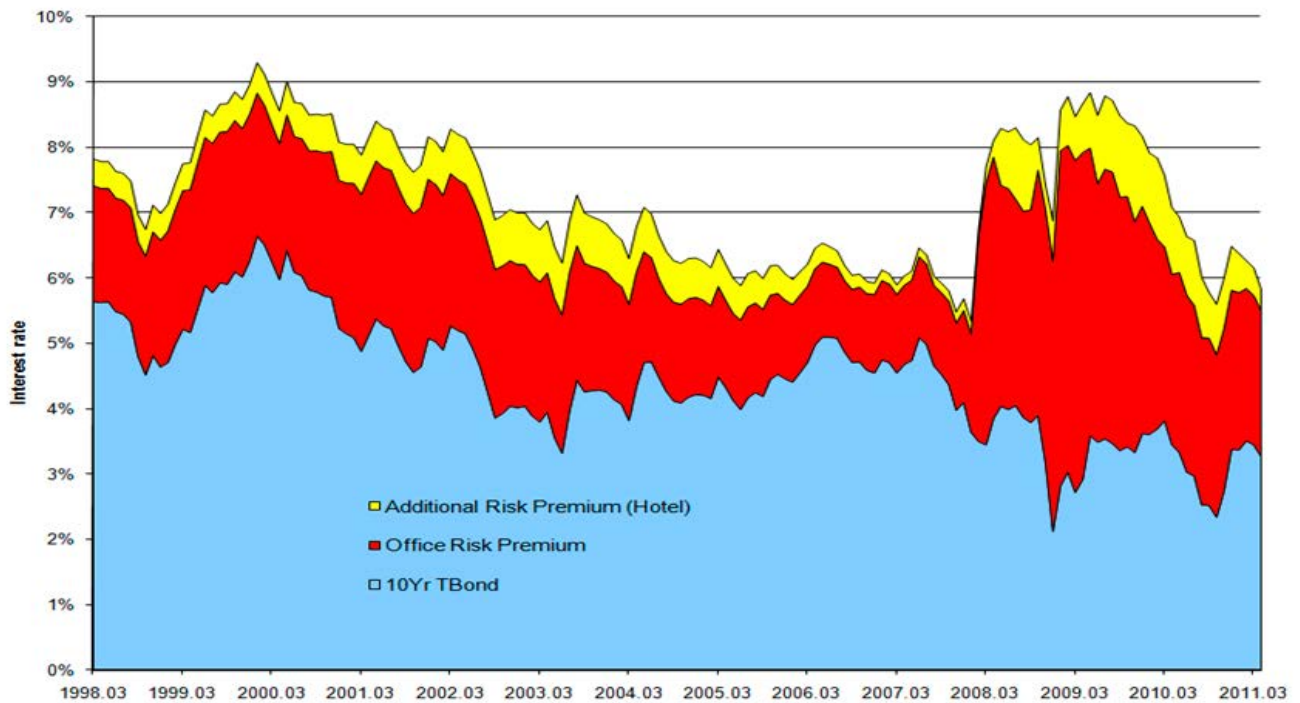
inflation premium.[3] The second component, a market risk premium for risky assets, reflects lenders' uncertainty. A third component is the term structure of interest rates, since a longer-term loan generally involves a higher rate. The final component is the risk premium, which is specific to a particular type of investment. We already alluded to the risk premium for hotels, shown in Exhibit 2. This graph also shows the other key elements of hotel loan rates. The area in blue represents the first component, the nominal interest rate on 10-year constant-maturity Treasury bonds, which includes the real rate of interest and an inflation premium.[4] The second component, shown in red, captures overall market risk, and can be thought of as the systematic risk adjustment that is shared by all property types, plus the idiosyncratic risk associated with offices. This risk premium includes the general real estate market risk premium, compensation for

the general illiquidity of the commercial real estate market, transaction costs, tax treatment, and other imperfections in the commercial real estate market. The yellow section represents the difference between hotel and office interest rates. This is the risk premium differential, which captures the risk of hotels relative to office properties. (Note that the other factor, the length of the loan terms, is less of an issue in comparing loans for hotels and office buildings, both of which have relatively lengthy terms.)

The relationship of hotels and office buildings. As we explained in our previous report, the reason we selected office properties as a comparison for hotels (other than they are both real estate assets) is that office space rental has an economic link with hotel demand. Several professional hotel advisory services, such as Cushman & Wakefield and HVS, have found that a historical relationship exists between occupied office space and room-night demand.[5] This relationship exists in part because corporate travelers are one of the three major sources of hotel demand, which

[3] For a general discussion of factors driving the hotel investment discount rate, see: Peng Liu and Daniel Quan, "Measuring Hotel Risk and Financing," in *The Cornell School of Hotel Administration on Hospitality: Cutting Edge Thinking and Practice,* ed. Michael Sturman, Jack Corgel, and Rohit Verma (Hoboken, New Jersey: John Wiley and Sons, Inc., 2011), pp. 333-350.).

[4] Longer-maturity credit instruments such as 10-year treasuries are better at reflecting anticipated future economic conditions one to two years ahead. See, for example: Simon Gilchrist, Vladimir Yankov, and Egon Zakrajšek, "Credit Market Shocks and Economic Fluctuations: Evidence from Corporate bond and Stock Markets," *Journal of Monetary Economics*, Vol. 56, No. 4 (May 2009), pp. 471-493.

[5] For example, Cushman and Wakefield found that for Washington, D.C. approximately 263 room-nights are generated per year on average for every 1,000 square feet of occupied office space per year. See: Cushman and Wakefield, "More Than a Guessing Game: Number Crunching and Market Comparisons Shed Light on Hotel Demand," http://valuation.cushwake.com/Valuation/documents/publications/BB_Hotel_Demand_CM_V_Aug08_EN.pdf.

Exhibit 3

The risk in the risk premium: Difference in standard deviations of hotel and office building returns
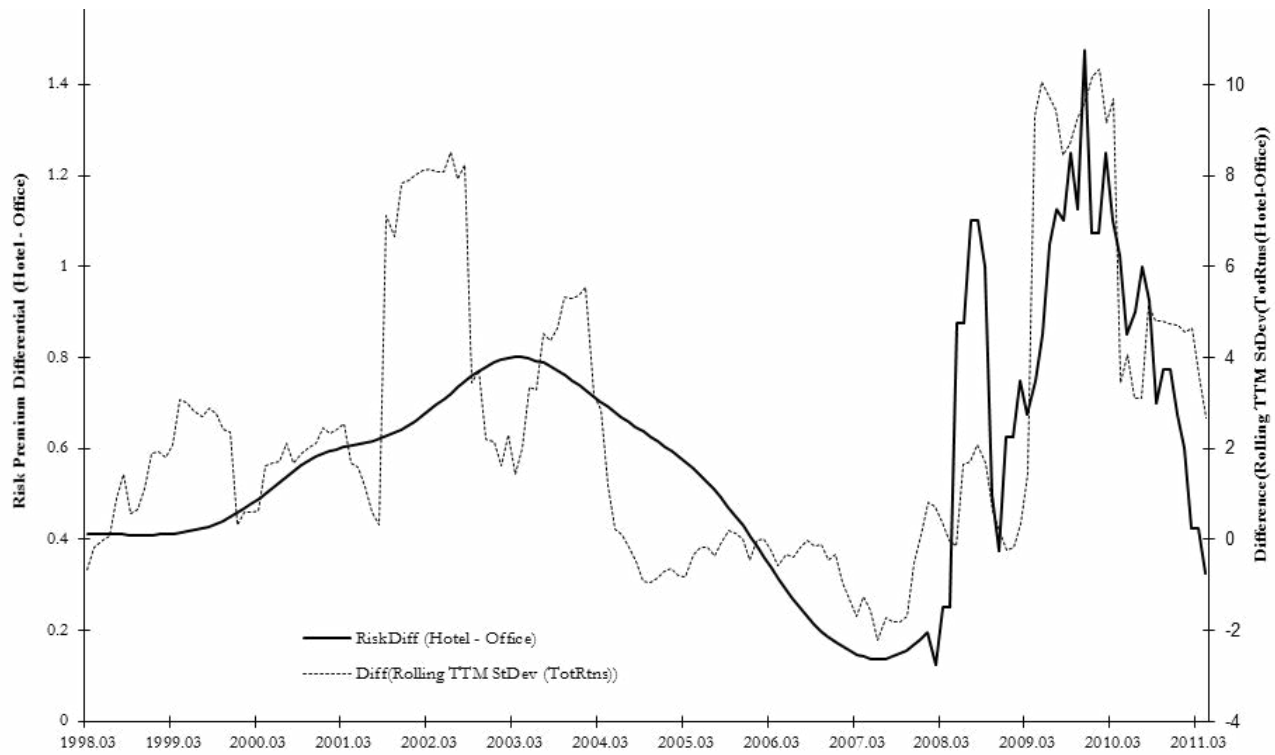
means that hotels' fortunes rest heavily on good times in the business sector.[6] The similarities end there, however, since another reason for choosing office properties as a benchmark for comparison to hotels is the difference in lease characteristics. Office tenants have lengthy, multi-year leases, in contrast to the 24-hour room "lease" typical for hotels. Because of this, hotels' future cash flows entail greater uncertainty than those of office buildings. Lenders generally require a higher risk premium for hotels, given that hotels are more prone to shocks arising from capital market changes, the general economy, and event risk. Office buildings, on the other hand, are insulated to some extent from economic event risk by their five- to ten-year leases.

Working with spreads rather than interest rate levels confers an important advantage. By looking at the differential in interest rates between hotel and office property types, we already control for factors underlying the first and second components of interest rates, such as the general real estate market risk, the capital market, and general economic conditions, regardless of whether they are observable.

Therefore, by working with measures in terms of differentials rather than absolute levels, we are better able to study traits that elicit a differential risk premium between property types. This is an important and novel feature of our study.

Data

We analyze the monthly average spread for hotel and office loans over Treasury notes at the time of loan origination (SATO). We obtain these data for mortgage loans for hotels and office properties from Lehman Brothers for the period of July 1998 through January 2008, when Lehman failed. We pick up the SATO data for February 2008 through March 2011 using Cushman Wakefield Sonnenblick-Goldman's survey of indicated spreads.[7] All data are monthly. We thus have a relatively long time series that encompasses periods of both economic growth and economic distress, and we are able to study the behavior of the spread under a variety of economic conditions.

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[6] David Fuller and Caitlin McKenna, " The HVS Employment-Hotel Growth Index: A New Tool for Projecting Hotel Room-Night Demand," HVS Consulting and Valuation Services (March 2009).

[7] To account for the fact that our data uses series from both Lehman and Cushman Wakefield Sonnenblick-Goldman, in addition to the results reported in the report, we also estimate all VARs in models that include a shift variable to account for change in the data. The results (not reported for brevity) remain the same.

As we indicated above, we subtract the SATO corresponding to offices from that for hotels to obtain the differential risk premium at time t,

$$Differential\ Risk\ Premium_t = RISKDIFF_t = SATO_{Hotel,t} - SATO_{Office,t}$$

Once again, a positive risk premium differential suggests higher risk for hotels over office buildings, including greater default (delinquency) risk, since the hotel loan is made at a wider rate spread relative to an office loan.

Driving factors. The macro-economic variables we examine include the percentage change or growth rate in expected corporate earnings per share on the S&P500 (PCTEPS) and the rate of unemployment (UNEMPL).[8] The growth rate in expected earnings per share represents Wall Street's consensus on the expected performance of the economy, as well as their assessment of management's short-term expectations.[9] Since most overnight stays are business related and corporations plan their travel in advance, we can use expected earnings as a measure of anticipated demand. Expected earnings also reflect the growth in future disposable income, which is a key element supporting leisure market demand. Finally, news about future corporate earnings also reflects corporate borrowers' anticipation of shocks to their ability to pay debt in the future.

From STR data, we draw two variables to measure hotel industry performance: **(1)** total hotel revenues (HOTREVYR), which is a year-over-year percentage change in total revenues, and **(2)** hotel demand (HOTDMNDYR), which is a year-over-year percentage change in total hotel demand.

For our measure of relative risk, we use the difference in the standard deviation of total returns on hotel REITs versus those of office REITs (DIFFSTDEV). This measures the additional anticipated riskiness in performance of hotel REITs over office REITs. Like corporate bond studies that use stock returns as a proxy for changes in a firm's health, we use volatility of REIT returns as a metric of the uncertainty about future returns on our two property types. The connection between variations in property values and the likelihood of loan default was indicated by Titman and Torous, who

indirectly show that greater variability of property values increases the likelihood of default in circumstances where the unpaid loan amount exceeds property value.[10] Because REIT returns are reported monthly, we use those values, rather than underlying property values, which are typically reported quarterly. The volatility of hotel REITs should exceed that of office REITs, given the higher frequency of rent resetting in hotels. Since hotel property values are generally based on calculations of discounted future cash flow, they should thus adjust more quickly than office values, which are subject to existing contract rents on relatively long term leases. In summary, our vector autoregression analysis involves a set of systems, each comprising at least five variables that capture the state of the economy and the demand for hotel services. Appendix A gives a description and sources of the variables, and in the next section we explain the use of VAR in this analysis.

Methodology

The VAR models that we use involve a set of equations, with one equation for each variable. This is a useful and flexible way of analyzing economic relations in time series data. This methodology allows us to examine simultaneous behavior of the variables, and it also takes into account the mutual impact of the variables on each other. The variables are mutually interdependent and affect one another, which means that a VAR model is more suitable than a single-equation linear regression for capturing their dynamic relationships.

The VAR technique is useful in examining complex relationships among variables when the variables are mutually dependent and when each variable is related to its own past values, which is a common feature of economic and business data. For example, to examine joint evolution of three economic variables (say, GDP growth, unemployment, and inflation), the following three-equation VAR system can be estimated,

$$x_t = \alpha_1 + \beta_{1,1} \cdot x_{t-1} + \beta_{1,2} \cdot x_{t-2} + \beta_{1,3} \cdot y_{t-1} + \beta_{1,4} \cdot y_{t-2} + \beta_{1,5} \cdot z_{t-1} + \beta_{1,6} \cdot z_{t-2} + u_t$$
$$y_t = \alpha_2 + \beta_{2,1} \cdot y_{t-1} + \beta_{2,2} \cdot y_{t-2} + \beta_{2,3} \cdot x_{t-1} + \beta_{2,4} \cdot x_{t-2} + \beta_{2,5} \cdot z_{t-1} + \beta_{2,6} \cdot z_{t-2} + v_t$$
$$z_t = \alpha_3 + \beta_{3,1} \cdot z_{t-1} + \beta_{3,2} \cdot z_{t-2} + \beta_{3,3} \cdot x_{t-1} + \beta_{3,4} \cdot x_{t-2} + \beta_{3,5} \cdot y_{t-1} + \beta_{3,6} \cdot y_{t-2} + w_t$$

Subscript t represents the value of the variable at time **t**, and each equation, includes two past (lagged) values of the dependent variable, one at time t-1 and an earlier one at time t-2. The system above is said to be estimated with two lags. Each regression equation also includes the lagged values of the other two variables in the system. In this example, each variable depends on its own past values, and on the past values of the other two variables. The equations are estimated statistically in a manner similar to an ordinary

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[8] Research indicates a connection between real estate returns and the macro-economy. See: Nafeesa Yunus, "Modeling Relationships among Securitized Property Markets, Stock Markets, and Macroeconomic Variables," *Journal of Real Estate Research*, Vol. 34, No. 2 (2012), pp. 127–156. We focus on the role of macroeconomic conditions in setting relative cost of capital. In equilibrium there is a direct link between cost of capital and returns. We use unemployment, but we also estimated all the models using the growth rate in total employment (EMPL) instead of unemployment and the results hold (not reported for brevity).

[9] Analysts typically form their expectations of earnings per share after conference calls with a firm's management and the announcement by management of forward looking earnings guidance.

[10] Sheridan Titman and Walter Torous, "Valuing Commercial Mortgages: An Empirical Investigation of the Contingent-Claims Approach to Pricing Risky Debt," *Journal of Finance*, Vol. 44, No. 2 (1989), pp. 345-373.

Impulse response functions for VAR models over a period of 12 months (part one)
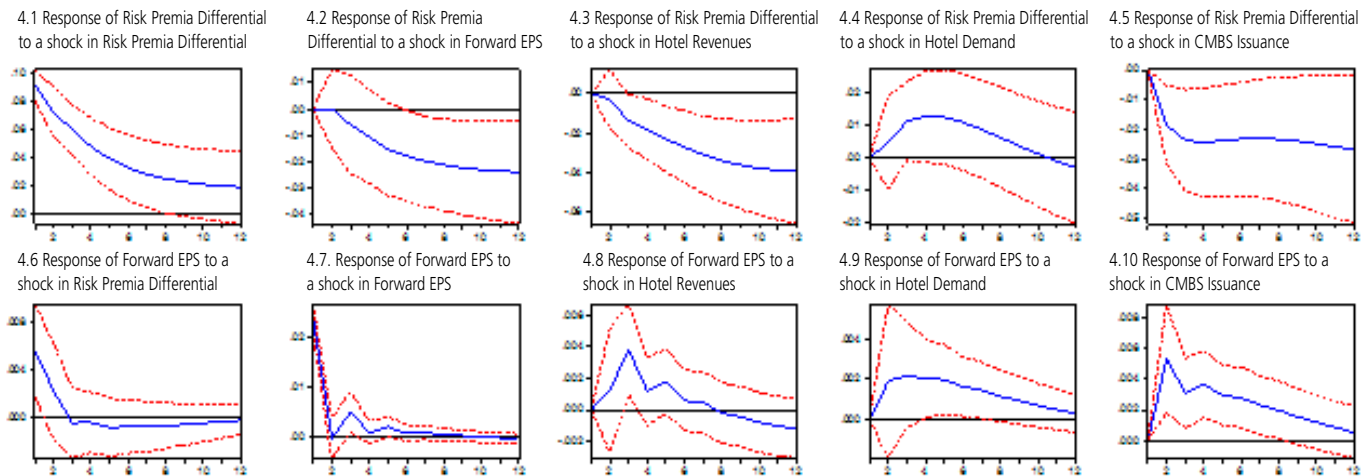
4.1 Response of Risk Premia Differential to a shock in Risk Premia Differential

4.2 Response of Risk Premia Differential to a shock in Forward EPS

4.3 Response of Risk Premia Differential to a shock in Hotel Revenues

4.4 Response of Risk Premia Differential to a shock in Hotel Demand

4.5 Response of Risk Premia Differential to a shock in CMBS Issuance

4.6 Response of Forward EPS to a shock in Risk Premia Differential

4.7. Response of Forward EPS to a shock in Forward EPS

4.8 Response of Forward EPS to a shock in Hotel Revenues

4.9 Response of Forward EPS to a shock in Hotel Demand

4.10 Response of Forward EPS to a shock in CMBS Issuance

Note: Exhibit 4 plots impulse response functions (IRFs) to a unit standard deviation change in a particular variable, traced forward over a period of 12 months. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands.

Graph	The Story (What the Graph Reveals)
4.1	The interest rate spread (relative risk premium) is not only predictable but this predictability persists for some time.
4.2	If higher earnings are anticipated, the interest rate spread narrows.
4.3	An increase in hotel revenues forecasts a lower relative risk premium (tightening interest rate spread).
4.4	A change in hotel demand does not predict a change in relative risk premium.
4.5	An increase of capital availability (an increase in CMBS issuance and the resulting inflow of funds) results in lower relative risk premium (tightening of the interest rate spread).

regression, and we obtain estimates of the coefficients α_i and $\beta_{i,j}$.

The VARs are analyzed by examining impulse response functions (IRFs), which are graphs that show how each given variable in the VAR system responds over time to a change (a shock) in any other variable in the system. For example, to analyze the effect of variable z on variable x, an IRF is created with time on the x-axis, and the response (change) is seen in variable x on the y-axis. To compute the response, a positive change to variable z is traced through the system of equations. Because the effects are considered in a system, a shock in z affects variable x both directly (x_t depends on z_{t-1} and z_{t-2}) and also indirectly, through the variable y (x_t depends on y_{t-1} and y_{t-2}, and the values of y depend on z). An impulse-response function, therefore, captures the dynamic interdependence in the variables, and is able to characterize the dynamic structure of the model. The impulse response functions do this by showing how shocks to any one variable have a ripple effect on every other variable, and eventually feed back to the original variable itself. We describe and explain the impulse response functions in more detail when we present our results. Additional details on the VAR system are provided in Appendix B.
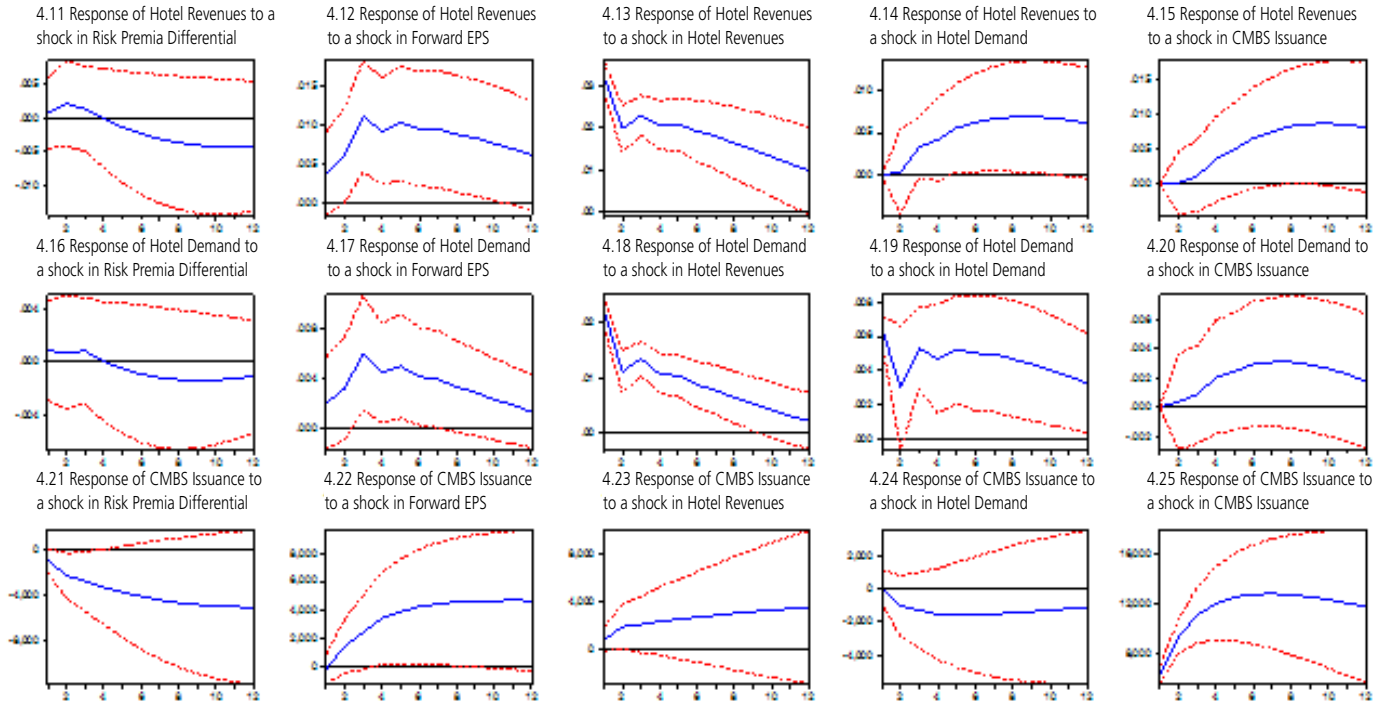
Results

Hotel Risk Premium, Industry Performance, Corporate Profitability, and Capital Supply Conditions

With that background, let's apply the VAR analysis to the relationship between risk premium differential, relative risk, industry performance, and economic and capital market conditions. This analysis is based on the idea that prices reflect market expectations of risk and return in efficient capital markets. Markets anticipate future developments and adjust the required rate of return on capital when expected conditions (such as relative risk) change.

Our main VAR system includes the following five variables, each with two time lags: **(1)** risk premium differential (RISKDIFF); **(2)** the percentage change in the forward earnings per share (PCTEPS), which is a measure of corporate profitability; **(3)** total hotel revenues (HOTREVYR); **(4)** total hotel demand (HOTDMNDYR); and **(5)** CMBS issuance, as a proxy for capital supply conditions.[11]

[11] Availability of capital through the CMBS market may impact lending rates. See: Frank Nothaft and James Freund, "The Evolution of Securitization in Multifamily Mortgage Markets and Its Effect on Lending Rates," *Journal of Real Estate Research*, Vol. 25, No. 2 (2003), pp. 91-112.

Impulse response functions for VAR models over a period of 12 months (part two)

4.11 Response of Hotel Revenues to a shock in Risk Premia Differential

4.12 Response of Hotel Revenues to a shock in Forward EPS

4.13 Response of Hotel Revenues to a shock in Hotel Revenues

4.14 Response of Hotel Revenues to a shock in Hotel Demand

4.15 Response of Hotel Revenues to a shock in CMBS Issuance

4.16 Response of Hotel Demand to a shock in Risk Premia Differential

4.17 Response of Hotel Demand to a shock in Forward EPS

4.18 Response of Hotel Demand to a shock in Hotel Revenues

4.19 Response of Hotel Demand to a shock in Hotel Demand

4.20 Response of Hotel Demand to a shock in CMBS Issuance

4.21 Response of CMBS Issuance to a shock in Risk Premia Differential

4.22 Response of CMBS Issuance to a shock in Forward EPS

4.23 Response of CMBS Issuance to a shock in Hotel Revenues

4.24 Response of CMBS Issuance to a shock in Hotel Demand

4.25 Response of CMBS Issuance to a shock in CMBS Issuance

Note: Exhibit 4 plots impulse response functions (IRFs) to a unit standard deviation change in a particular variable, traced forward over a period of 12 months. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands.

Graph	The Story (What the Graph Reveals)
4.12	An improvement in expected corporate profitability (PCTEPS) forecasts an increase in hotel revenues. This is consistent with economic intuition that hotel revenues are related to business activity.
4.13	Momentum is important: periods of higher revenues are followed by higher revenues; periods of decline tend to be followed by continued declines.
4.14	Hotel revenues are related to hotel demand, as expected.
4.16	The response of total hotel demand (HOTDMDYR) to the variables in the system shown in the middle row of Exhibit 4b (above) are similar to the results for total hotel revenues. In particular, the risk premium differential does not forecast total hotel demand.
4.17	Forward looking EPS, however, does forecast hotel demand.

The IRFs for our VAR system are shown in Exhibits 4a and 4b, which depict the response of a given variable to changes in the other variables in the system. In each case the response is traced forward for 12 months (on the x-axis). Each graph contains: **(1)** the zero effect level (horizontal black line); **(2)** the change in the risk premium differential to a unit change in the corresponding independent variable (with the response shown as a blue curve on the y-axis); and **(3)** the 95% confidence interval, shown by the red dashed lines. When the effect (blue curve) is separated from the zero level (the black horizontal line) by the standard error boundary, we conclude that the effect is significant. For example, Figure 4.2 in Exhibit 4a (previous page) shows the response in risk premium differential (hotel credit spread) to a change in forward EPS. The effect lies below zero, and beginning from month 7 the effect is separated from the zero level by the standard error boundary. This shows that an improvement in expected corporate profits results in a tightening between the interest rate on hotels and the interest rates on office buildings (that is, a lower risk premium differential and a lower interest rate spread).

Graphs 4.1 through 4.5 in Exhibit 4a depict the response of relative risk premium to shocks of the other variables, while graphs 4.21 through 4.25 in Exhibit 4b (above) depict the response of CMBS issuance to changes in the other variables. Findings from selected graphs are summarized in boxes at the bottom of the exhibits with regard to relative risk premium (Exhibit 4a) and industry performance, as measured by hotel revenues and hotel demand (Exhibit 4b):

To summarize our findings on hotel industry performance: **(1)** our forward looking corporate profitability measure (PCTEPS) forecasts demand for hotel services (HOTREVYR and HOTDMNDYR), but **(2)** the risk premium differential is unable to forecast those same hotel demand variables.

## Results

The Role of Unemployment and Risk Differential

To understand the role of unemployment and risk differential variables relative to the role of direct hotel industry performance measures we analyze two more VAR systems. In the first of these two VAR systems, we remove two variables that measure the demand for hotel services (total hotel demand and total hotel revenues) and replace them with risk differential (DIFFSTDEV) and unemployment rate (UNEMPL). (This substitution is explained in more detail in Appendix C.) The main result is that all of the existing variables in our main VAR system (Exhibit 4a and 4b) continue to behave in a similar manner and to have the same effect. The risk premium charged for hotel loans declines when the aggregate earnings environment is expected to improve and as funding becomes available through CMBS issuance and capital supply increases. The new insights gained from these VAR systems are that **(1)** the interest rate spread increases with relative risk (hotel risk increases relative to offices), and **(2)** the interest rate spread increases given an increase in unemployment.

Given these findings, we next examine the information contained in DIFFSTDEV and UNEMPL relative to HOTREVYR. Our third VAR system includes the following variables: **(1)** the difference in standard deviations (DIFFSTDEV), a measure of relative riskiness; **(2)** unemployment (UNEMPL) as a measure of economic conditions; **(3)** hotel revenues (HOTREVYR), a direct measure of the industry performance; **(4)** percentage change in forward EPS (PCTEPS); **(5)** activity in the hotel CMBS market (CMBSISSU); and **(6)** our variable of interest, the risk premium differential (RISKDIFF).

The results are consistent with our prior findings regarding the role that improving expected corporate profits and increasing CMBS issuance play in lowering the risk premium—that is, narrowing the interest rate spread for hotel loans relative to office loans. The new insight from this third VAR system is that when hotel revenues (HOTREVYR), the direct measure of hotel marketing conditions, is included in the system, the significance of the other two risk variables—risk differential (DIFFSTDEV) and unemployment (UNEMPL)—declines from the 5% level to the 10% level of statistical significance. Thus we see that this direct measure of industry performance, hotel revenues, incorporates the

Differential effect of selected variables on risk premium differential (hotel credit spread) over time
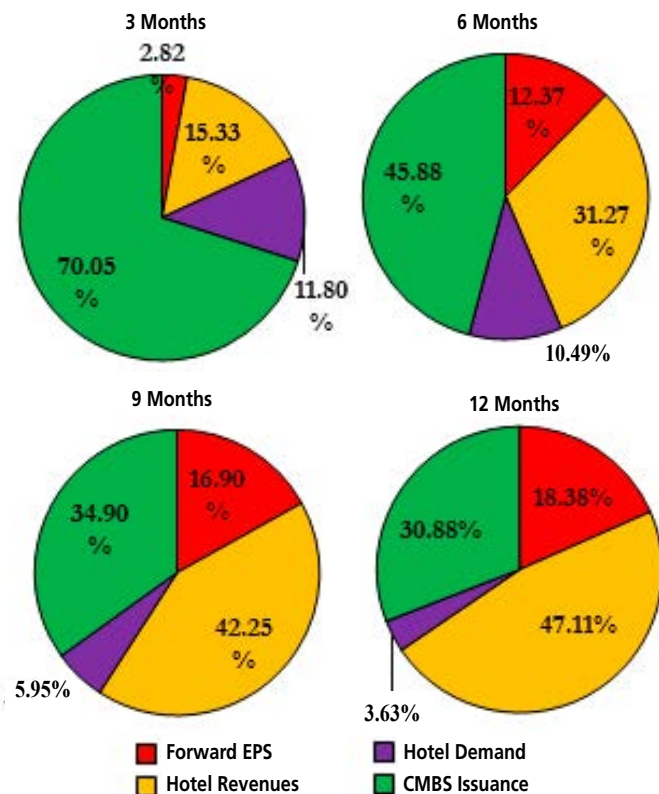
informational role of the less direct measures (risk differential and unemployment).

The behavior of the interest rate spread is consistent with economic intuition. The spread responds to financial risk (DIFFSTDEV), expected financial performance (PCTEPS), overall economic conditions, unemployment, UNEMPL), supply of hotel capital (CMBSISSU), and hotel industry performance information (HOTREVYR). These variables thus capture risk and return information embedded in the risk premium differential. Consequently, the interest rate spread represents priced systematic risk.
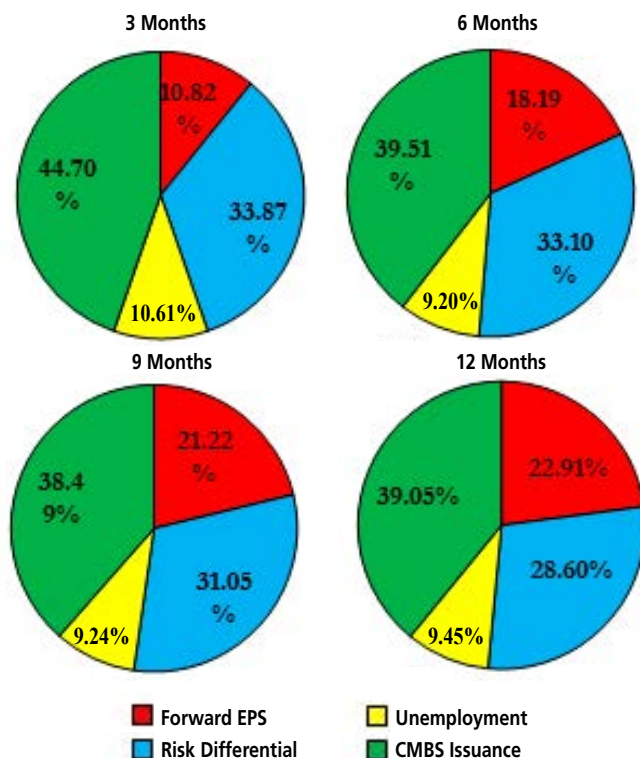
Results

The Role of Different Variables at Different Forecast Horizons

The systems of variables that we have been using so far allow us to assess the relative contribution of each catalyst by performing a variance decomposition for each of the three VARs, to see which variables exert relatively greater influence in predicting the change in hotel credit spreads. This analysis is depicted in Exhibit 5, which shows the contribution of different variables to prediction of variation in the
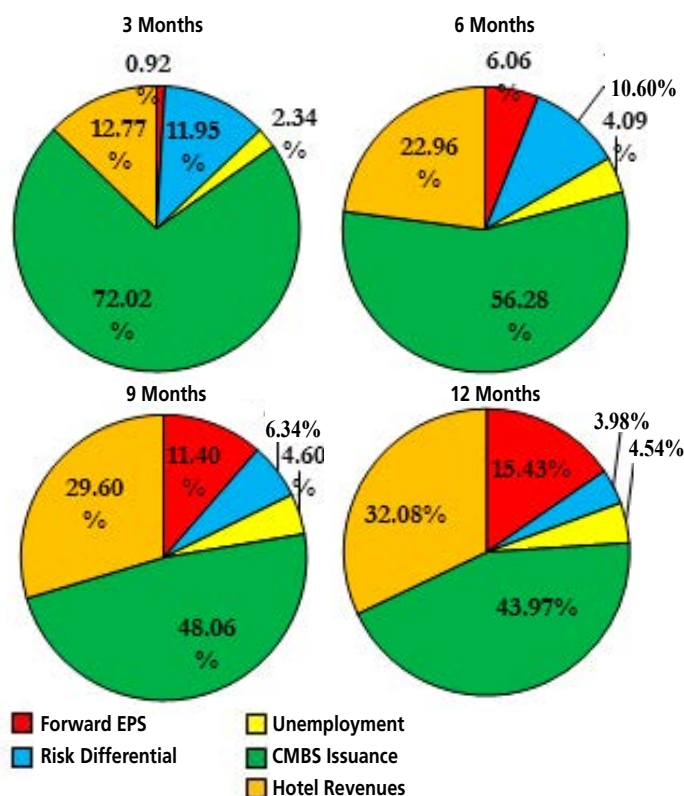
EXHIBIT 6

Differential effect of selected variables on risk premium differential (hotel credit spread) over time

3 Months

6 Months

9 Months

12 Months

- ■ Forward EPS
- ■ Risk Differential
- ■ Unemployment
- ■ CMBS Issuance

EXHIBIT 7

Differential effect of selected variables on risk premium differential (hotel credit spread) over time

3 Months

6 Months

9 Months

12 Months

- ■ Forward EPS
- ■ Risk Differential
- ■ Unemployment
- ■ CMBS Issuance
- ■ Hotel Revenues

spread for the main VAR system. Each pie chart represents a different forecasting horizon (3, 6, 9, and 12 months), while each slice of pie represents a particular variable's portion of the variation in the spread, or the weight that variable accounts for that is not explained by the hotel credit spread's own past values. So, for example, at a 3-month horizon, CMBS Issuance has the largest relative contribution to the credit spread, at 70.05%, followed by hotel revenues, at 15.33%. Hotel demand (11.8%) and forward earnings per share (2.82%) make relatively small incremental contributions. CMBS issuance continues to be the catalyst exerting the largest influence at the 6-month horizon, although its weight declines from 70.05% to 45.88%. Hotel revenues remain the next largest catalyst, with that variable's weight increasing from 15.33% to 31.27%. At the longer horizons (9 and 12 months), a role reversal occurs. Hotel revenues become the largest catalyst followed by CMBS issuance. At 9 months, hotel revenues account for 42.25% of the hotel credit spread, a figure that expands to 47.11% at 12 months, while CMBS issuance accounts for 34.9% when a 9-month forecasting horizon is used, and fades to 30.88% at 12 months. We also note that the role of forward earnings as a catalyst expands as the length of the horizon increases.

We repeat this analysis for the second VAR system. In the second VAR model, risk differential and unemployment replace hotel revenues and hotel demand. Exhibit 6 shows the contribution of different catalysts in the prediction of the variation in the hotel credit spread for the second VAR. CMBS issuance remains the largest catalyst at all horizons followed by the risk differential. The role of forward earnings becomes more important as a catalyst as the length of the horizon increases. In contrast, the role of unemployment remains relatively stable.

Exhibit 7 shows the relative influence of the six variables in the third VAR system: the risk premium differential, forward EPS, risk differential, unemployment, CMBS issuance, and hotel revenues. At all horizons (3, 6, 9, and 12 months), CMBS issuance again is the most influential catalyst, followed by hotel revenues. As the horizon increases, however, the CMBS issuance once again declines in importance as a driver of hotel credit spreads (from 72% at 3 months to 44% at 12 months), while hotel revenues become a more important driver (from 13% at 3 months to 32% at 12 months). The effects of risk differential and forward EPS are also noteworthy.

Summary and Practical Applications

Since the loan spread is a metric for forecasting a change in relative delinquency levels for hotels, we thought it would be important to see what catalysts drive the hotel credit spread. Because there are a large number of mutually related variables, this "look under the hood" used a VAR framework. We conclude that the incremental hotel risk premium (hotel interest rate minus office interest rate) is systematically priced. The analysis has identified the following four catalysts that increase the hotel risk premium differential:

- deterioration of general economic conditions;
- decline in expected corporate profitability;
- reduction in capital availability; and
- decrease in the demand for hotel services.

Thus, to mix our metaphors somewhat, if we characterize the hotel loan spread as a canary which acts as our bellwether of rough times ahead for hotel financing, we can say that the canary will gradually stop singing as one or more of these four drivers deteriorates over time.

Do we really need these statistical pyrotechnics? We believe that the VAR analysis demonstrates its value in forecasting spreads due to the complexity of the drivers of the credit spread. The VAR framework is an important departure from methods that are based on the more commonly applied ordinary least squares linear regressions. Compared to OLS regression, VARs have two important advantages. First, they allow for interdependence among the variables because all variables depend on all other variables in the system, and second, VARs examine the variables dynamically. In the impulse-response analysis, the effects of various variables can be seen for different time horizons. In the variance decomposition analysis, it is possible to see whether different variables vary in their importance depending on the forecasting horizon.

The VAR models that we build in this report not only provide a way to understand the history of hotel spreads, but are also a tool to predict the credit spread. The dynamic nature of the VAR approach we take allows us to determine which catalysts exert the most influence on our canary. The analysis identifies CMBS issuance and hotel revenue as important drivers, although the influence of these two catalysts on credit spreads depends on the time horizon (as is the case with other catalysts). CMBS issuance is a strong catalyst in the short term, but its influence fades somewhat over time (along with the role of risk differential). In contrast, the role of hotel revenues and expected earnings both increase in importance over the long term. This suggests that the weight of each driver of the hotel credit spread depends on the forecasting horizon. Sourcing and riskiness of the deal matter in the short run, but cash flow is king over the long term with respect to hotel credit spreads. ■

Appendix A

Data

Our key variable, Differential Risk Premium (RISKDIFF), is computed as the spread over Treasury rates at the time of loan origination (SATO) for hotels minus the SATO for office properties, thus:

$$\text{RISKDIFF}_t = \text{SATO}_{\text{Hotel}} - \text{SATO}_{\text{Office}}$$

As we explained in the text, we obtained SATO values for July 1998 through January 2008 from Lehman Brothers. In the wake of the Lehman Brothers collapse, we picked up the data series from the Cushman Wakefield Sonnenblick-Goldman survey of indicated spreads for conventional commercial mortgage loans over a 10-year Treasury bond, beginning in February 2008 and ending in March 2011.

Since we use data from two sources, we wanted to determine the extent to which the two series are comparable and that combining the two is reasonable. To ascertain the comparability of the two series and to investigate the continuity of our data, we collect quarterly interest rate and loan-to-value data on office buildings and hotels from the American Council of Life Insurance Companies (ACLI) publication "Commercial Mortgage Commitments—Historical Database." Because the ACLI data are reported quarterly, we cannot use them for our main analysis, but we can use them as a reality check on our combined data series. The correlation between the ACLI interest rate for offices and our data for offices is 0.88, and the correlation for ACLI data for hotels and our hotel interest rate series is 0.81. These high correlations provide support for basing our analysis on the two streams of data that we chose.

The sources of the variables are given in the table below.

Variable	Description and Source of Data
Difference in Standard Deviation (DIFFSTDEV)	The difference in the standard deviation of total returns on Hotel REITs (real estate investment trusts) and Office REITs. To calculate the standard deviation for each property type a rolling twelve-month window is used on the total return series for a given REIT property type. DIFFSTDEV = σHotel – σOffice. *Source*: National Association of Real Estate Investment Trusts
Differential Risk Premium (RISKDIFF)	Difference in the spread at time of origination (SATO) between hotel and office property types; additional risk premium associated with hotel. *Source*: Lehman Brothers; Cushman & Wakefield (http://www2.cushwake.com/sonngold/)
Percent Change (Growth Rate) in Total Employment (EMPL)	Change in the number of employed persons from period to period. *Source*: U.S. Bureau of Labor Statistics (BLS) (via http://www.economy.com/freelunch)
Percent Change in Forward Earnings per Share (PCTEPS)	PctEPS = $(\text{EEPS}_t/\text{EEPS}_{t-1}) - 1$, where EEPS is Forward Earnings per Share, analysts' estimates of earnings per share for the S&P500. This is anticipated profits in contrast to actual corporate profits (see: Corporate profits (PROFITS). *Source*: http://www.yardeni.com
Unemployment Rate (UNEMPL)	Number of unemployed persons divided by the labor force, where the labor force is the number of unemployed persons plus the number of employed persons. *Source*: U.S. Bureau of Labor Statistics (BLS) (via http://www.economy.com/freelunch)
Hotel Revenues Year-over-Year (HOTREVYR)	Year-over-year percentage change in total hotel revenues (all hotel classes). *Source*: STR
Hotel Demand Year-over-Year (HOTDMDYR)	Year-over-year percentage change in total hotel demand (all hotel classes). *Source*: STR
CMBS Issuance Trailing Twelve Months (CMBSISSU)	Trailing twelve months CMBS issuance. *Source*: CRE Finance Council, Compendium of Statistics (original source of data is Commercial Mortgage Alert)

Appendix B

About Vector Autogression (VAR)

Vector Autoregression (VAR) is a system of simultaneous equations. **In this system, all variables depend on all other ones. That is, all variables are endogenous.** Consequently, all variables can have a relationship with all other variables in a system. In the accompanying analysis, we examine a system with the following five variables, each with two time lags: **(1)** risk premium differential (RISKDIFF); **(2)** percentage change in the forward earnings per share (PCTEPS); **(3)** risk differential, measured as the difference in standard deviations (DIFFSTDEV); **(4)** unemployment rate (UNEMPL); and **(5)** CMBS issuance. This system is written as follows:

$$RISKDIFF_t = \alpha_1 + \beta_{1,1}\,RISKDIFF_{t-1} + \beta_{1,2}\,RISKDIFF_{t-2} + \beta_{1,3}\,PCTEPS_{t-1} + \beta_{1,4}\,PCTEPS_{t-2} + \beta_{1,5}\,DIFFSTDEV_{t-1} + \beta_{1,6}\,DIFFSTDEV_{t-2}$$
$$+ \beta_{1,7}\,UNEMPL_{t-1} + \beta_{1,8}\,UNEMPL_{t-2} + \beta_{1,9}\,CMBS_{t-1} + \beta_{1,10}\,CMBS_{t-2}$$

$$PCTEPS_t = \alpha_2 + \beta_{2,1}\,RISKDIFF_{t-1} + \beta_{2,2}\,RISKDIFF_{t-2} + \beta_{2,3}\,PCTEPS_{t-1} + \beta_{2,4}\,PCTEPS_{t-2} + \beta_{2,5}\,DIFFSTDEV_{t-1} + \beta_{2,6}\,DIFFSTDEV_{t-2}$$
$$+ \beta_{2,7}\,UNEMPL_{t-1} + \beta_{2,8}\,UNEMPL_{t-2} + \beta_{2,9}\,CMBS_{t-1} + \beta_{2,10}\,CMBS_{t-2}$$

$$DIFFSTDEV_t = \alpha_3 + \beta_{3,1}\,RISKDIFF_{t-1} + \beta_{3,2}\,RISKDIFF_{t-2} + \beta_{3,3}\,PCTEPS_{t-1} + \beta_{3,4}\,PCTEPS_{t-2} + \beta_{3,5}\,DIFFSTDEV_{t-1} + \beta_{3,6}\,DIFFSTDEV_{t-2}$$
$$+ \beta_{3,7}\,UNEMPL_{t-1} + \beta_{3,8}\,UNEMPL_{t-2} + \beta_{3,9}\,CMBS_{t-1} + \beta_{3,10}\,CMBS_{t-2}$$

$$UNEMPL_t = \alpha_4 + \beta_{4,1}\,RISKDIFF_{t-1} + \beta_{4,2}\,RISKDIFF_{t-2} + \beta_{4,3}\,PCTEPS_{t-1} + \beta_{4,4}\,PCTEPS_{t-2} + \beta_{4,5}\,DIFFSTDEV_{t-1} + \beta_{4,6}\,DIFFSTDEV_{t-2}$$
$$+ \beta_{4,7}\,UNEMPL_{t-1} + \beta_{4,8}\,UNEMPL_{t-2} + \beta_{4,9}\,CMBS_{t-1} + \beta_{4,10}\,CMBS_{t-2}$$

$$CMBS_t = \alpha_5 + \beta_{5,1}\,RISKDIFF_{t-1} + \beta_{5,2}\,RISKDIFF_{t-2} + \beta_{5,3}\,PCTEPS_{t-1} + \beta_{5,4}\,PCTEPS_{t-2} + \beta_{5,5}\,DIFFSTDEV_{t-1} + \beta_{5,6}\,DIFFSTDEV_{t-2}$$
$$+ \beta_{5,7}\,UNEMPL_{t-1} + \beta_{5,8}\,UNEMPL_{t-2} + \beta_{5,9}\,CMBS_{t-1} + \beta_{5,10}\,CMBS_{t-2}$$

Each equation is for one dependent variable, and there is one equation per dependent variable. For example, in the first equation the dependent variable is risk premium differential at time *t*. Each equation looks like a regular multivariate regression equation, with 10 independent variables on the right-hand side. The system accounts for the dependencies between all interrelated variables. As we also noted in the text, the equations include two past values of the dependent variable.

The VAR technique is useful in examining complex relationships among variables when the variables are serially correlated so that past values tend to persist. For example, if occupancy or ADR has been high in the prior periods it is usually also high in the current period. The *impulse response functions* used to analyze VARs are graphs that show how a given variable in the VAR system responds over time to a change (a shock) in any other variable in the system. In this way, a VAR provides a way of letting the data determine the dynamic structure of a model. Thus, after estimating a VAR, an impulse response function characterizes its dynamic structure. The impulse responses do this by showing how shocks to any one variable filter through the model to affect every other variable, and eventually feed back to the original variable itself.

The Role of Unemployment and Risk Differential Measures

As we noted in the accompanying article, we substituted two variables into one of the five-variable VAR systems: risk differential, measured as the difference in standard deviations (DIFFSTDEV), and unemployment rate (UNEMPL), with the results shown in Exhibit 1c. The other three variables of interest, that is, risk premium differential (RISKDIFF), percentage change in the forward earnings per share (PCTEPS), and CMBS issuance, remain in the system. All graphs in Exhibit 1c show the response of the relative risk premium, or the gap in the interest rates on hotel loans and office loans, to changes in the other variables in the system. For example, Graph 2 at right shows the response in the risk premium differential to a change in forward earnings per share, which is our measure of expected corporate profits. What we see is that an improvement in expected corporate profits results in a lower risk premium differential or lower interest rate spread.

Likewise, the response of relative risk premium reveals that all of the existing variables in the main VAR system (Exhibits 4a and 4b, on pages 11 and 12) continue to have the same effect, despite the addition of unemployment and relative risk in the system. The risk premium charged for hotel loans declines when the aggregate earnings environment is expected to improve and also as funding becomes available through CMBS issuance and capital supply increases. With regard to the added variables, we see the following:

- The interest rate spread increases with relative risk (hotels become riskier than offices), Graph 3; and

- The interest rate spread increases when unemployment increases, Graph 4.

Impulse response functions for VAR models over a period of 12 months

1 Response of Risk Premia Differential to a shock in Risk Premia Differential
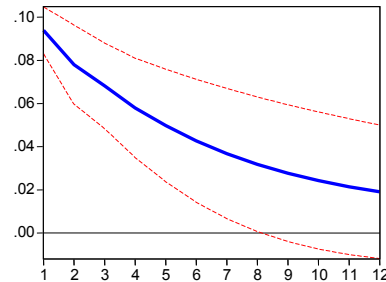
2 Response of Risk Premia Differential to a shock in Percentage Change in Forward EPS
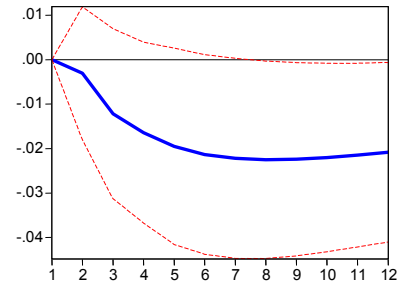
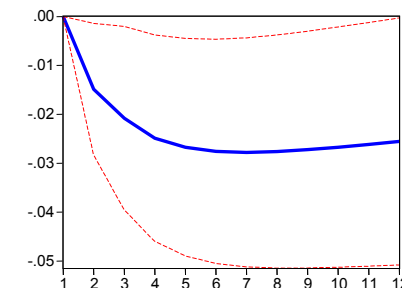3 Response of Risk Premia Differential to a shock in Risk Differential (StDev)
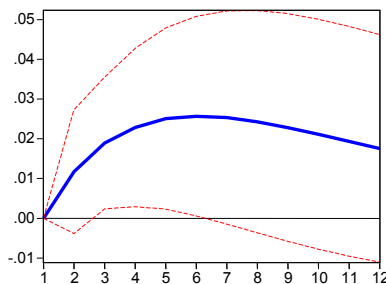
4 Response of Risk Premia Differential to a shock in Unemployment
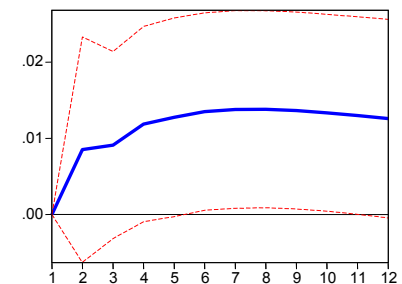
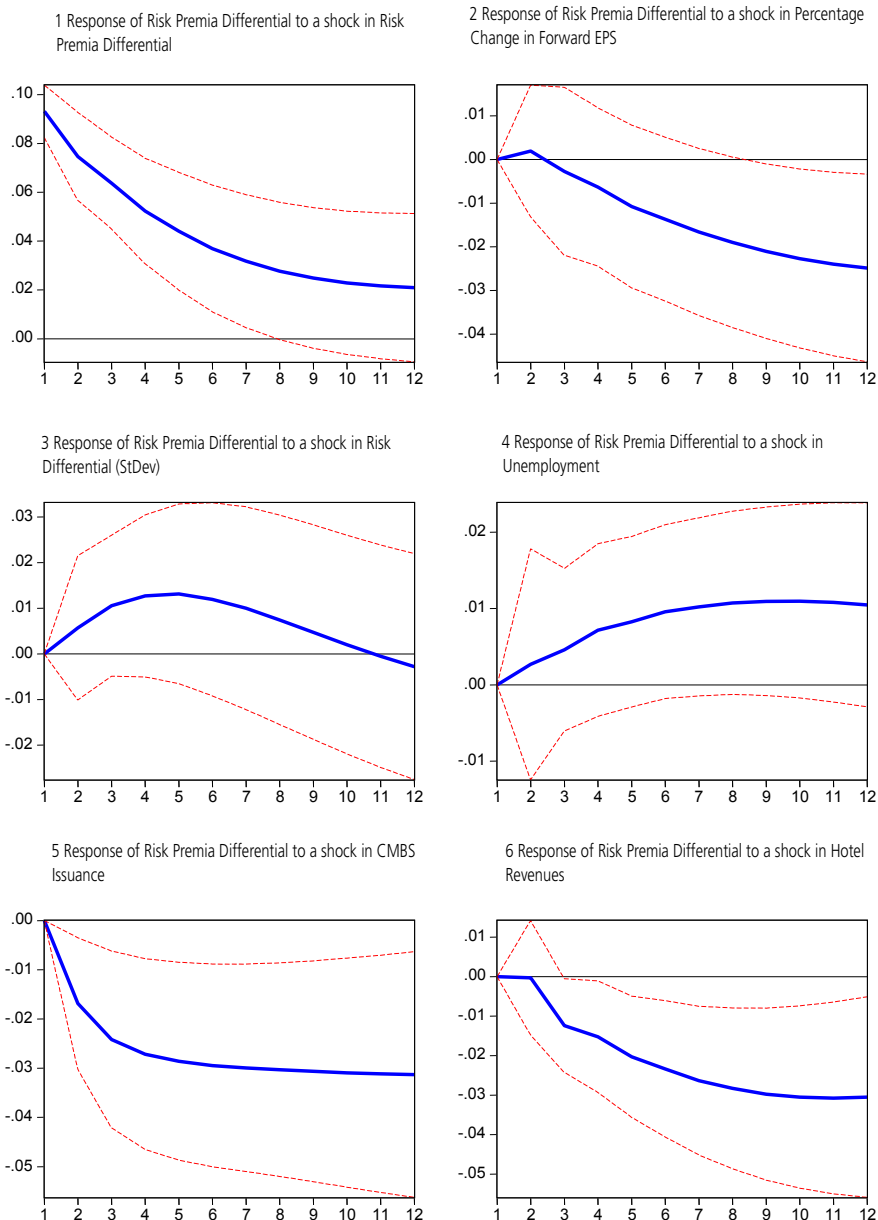5 Response of Risk Premia Differential to a shock in CMBS Issuance

Note: Exhibit 1c plots impulse response functions (IRFs) to a unit standard deviation change in a particular variable, traced forward over a period of 12 months. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands. The VAR system contains five variables: **(1)** risk premium differential (RISKDIFF); **(2)** percentage change in forward earnings per share (PCTEPS); **(3)** risk differential (DIFFSTDEV); **(4)** unemployment rate (UNEMPL); and **(5)** CMBS issuance.

Appendix C (concluded)

We can dig further to examine the effects of added hotel risk (DIFFSTDEV) and unemployment (UNEMPL) relative to annual hotel revenue (HOTREVYR), which is a direct measure of hotel industry performance. This analysis is shown in the next VAR system, which includes the following variables: **(1)** the relative risk measure, computed as the difference in standard deviations (DIFFSTDEV); **(2)** unemployment (UNEMPL), which is a measure of economic conditions; **(3)** the industry performance measure, annual hotel revenues (HOTREVYR); **(4)** percentage change in forward EPS (PCTEPS); **(5)** the measure of available capital, activity in the hotel CMBS market (CMBSISSU); and **(6)** our variable of interest, the risk premium differential (RISKDIFF). Exhibit 2c shows the response of the relative risk premium to changes in the other five variables in this system. We find that the expected earnings variable and the CMBS issuance continue to behave in the same way as before, but we also see the effects of the more direct measure of hotel market conditions. The inclusion of hotel revenues (HOTREVYR) diminishes the significance of the other, less direct risk variables—specifically, risk differential (DIFFSTDEV) and unemployment (UNEMPL), both of which decline in significance from the 5% level to the 10% level.

We also examined the impulse response functions for the risk differential (DIFFSTDEV) to a unit standard deviation change in other variables in the system, although we don't show these impulse response functions for the sake of brevity. An increase in expected profits (forward earnings) predicts a decline in the risk differential, as does an increase in hotel revenues, but an increase in unemployment forecasts an increase in the risk differential.

These results suggest that the risk differential variable contains both information on economic conditions and industry-specific information. We note again that when a direct measure of industry performance is included in the VAR system (in this case, hotel revenues), it captures the role of the less direct hotel performance measures. However, since the risk differential variable also reflects information on overall economic conditions and industry performance, we see that the inclusion of the risk differential variable represents a parsimonious way of reflecting information that is important for accounting for the variation in the interest rate spread.

Impulse response functions for VAR models over a period of 12 months

1 Response of Risk Premia Differential to a shock in Risk Premia Differential

2 Response of Risk Premia Differential to a shock in Percentage Change in Forward EPS

3 Response of Risk Premia Differential to a shock in Risk Differential (StDev)

4 Response of Risk Premia Differential to a shock in Unemployment

5 Response of Risk Premia Differential to a shock in CMBS Issuance

6 Response of Risk Premia Differential to a shock in Hotel Revenues

Note: Exhibit 2c plots impulse response functions (IRFs) to a unit standard deviation change in a particular variable, traced forward over a period of 12 months. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands.

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