The Dynamics of Credit Spreads in Hotel Mortgages and Signaling Implications

Authors

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Abstract

We use a vector autoregression framework to investigate loan pricing in a market with short-term leases (hotels) relative to longer-term leases (office properties), studying how news on the economy and capital markets are incorporated into the relative pricing of risk. We examine the impact of economic variables on the incremental risk premium and establish its informational content. Relative loan prices reflect systematic risk: an improvement in the general economy, an increase in forward looking corporate profitability, an increase in capital availability, and an increase in industry demand forecast a decline in the risk premium differential. We then examine how loan pricing adjusts to expected delinquencies. The spreads themselves contain important economic information and can help forecast delinquencies. Lenders are forward-looking in the pricing of risk and appear to set interest rates in anticipation of future delinquencies.

We take advantage of a natural laboratory offered by hotel financing to study the loan pricing in a market with short-term leases (hotels) relative to longer-term leases (office properties) with respect to how news on the economy, capital, and real estate markets is incorporated in loan pricing. In obtaining financing for hotels, the contract interest rate for hotel mortgages substantially exceeds those reported for other property types. We study whether the difference in loan pricing associated with different property types (hotels vs. office buildings) is systematically priced by fundamental factors. The argument that lenders advance is that underwriting hotel property is a cross between a business loan and a real estate loan because hotels constantly sell their rooms at the prevailing market rate (e.g., rooms are essentially marked to market on a daily basis). A question that thus arises is whether this higher interest rate contains important information regarding the market conditions. In other words, is it justified and is it informative? Further, is it possible to identify forward-looking factors of the spread in hotel interest rates that will allow hotel investors and lenders to take appropriate action in advance of the rate shift? A related question involves whether real estate lenders set hotel interest rates based on expected credit risk.[1]

Our objective in this paper is to address the informational content of the loan pricing spread.[2] Using spreads at the time of loan origination (SATO) for mortgage loans by property type from Lehman Brothers (July 1998–January 2008) and Cushman Wakefield Sonnenblick-Goldman (February 2008–March 2011) we examine the time series movements in the average spread. Our study spans a variety of economic conditions including expansions and contractions, which is important because it allows us to subsume a variety of economic events. As Shiller and Perron (1985) and Shiller (1989) show, increasing the number of observations by sampling more frequently while leaving the total time span of the data unchanged may only minimally increase the power of tests.[3]

Given the significant time variation in the credit spreads, we explore their informational content. Prior research on the role of asset prices in signaling future economic conditions and propagating economic fluctuations has emphasized the information content of corporate spreads as indicators of default risk and also future economic activity. For example, Philippon (2009) theoretically shows that as credit spreads rise, the supply of funds starts to contract, which results in falling asset prices and consequently an increase in the likelihood of default as the equity in deals narrows.

While the joint dynamics of *prices* across real estate markets has been studied (Oikarinen, Hoesli, and Serrano, 2011; Liow and Newell, 2012; Wiley and Wyman, 2012),[4] the important question of the *pricing of risk* in real estate markets characterized by different loan maturities or loan-to-value ratios (LTV) has received much less attention. We contribute to the literature on this dimension. We explore the information content embedded in the hotel credit spread including whether this risk premium is systematically priced by fundamental factors and additionally if it possesses forecasting ability for future loan performance.[5] Thus, we study the pricing in a market with short-term leases relative to pricing in a market with longer-term leases. A VAR framework is used that allows for the mutual impact of inter-dependent economic time series. The literature[6] indicates that higher credit spreads for commercial mortgages (i.e., differences between mortgage rates and Treasury bond rates with the same maturities) should exist for more volatile property types and property types with more investment flexibility (i.e., property that can be expanded or renovated). Similar results should also obtain if the differential risk premium (i.e., difference in the interest rate on hotels and office property types) is investigated in lieu of credit spreads using a transitive logic process.

Our empirical results are consistent with the literature. In particular, hotels have higher spreads relative to offices since they are not only riskier but also have greater adjustment costs (investment flexibility given higher and more frequent capital expenditures for hotels). The relatively short lease maturity associated with hotels should make them more sensitive to changes in fundamental factors, which in turn should increase the loan pricing of risk of hotels relative to that of offices. We find that this is the case with the differential risk premium systematically

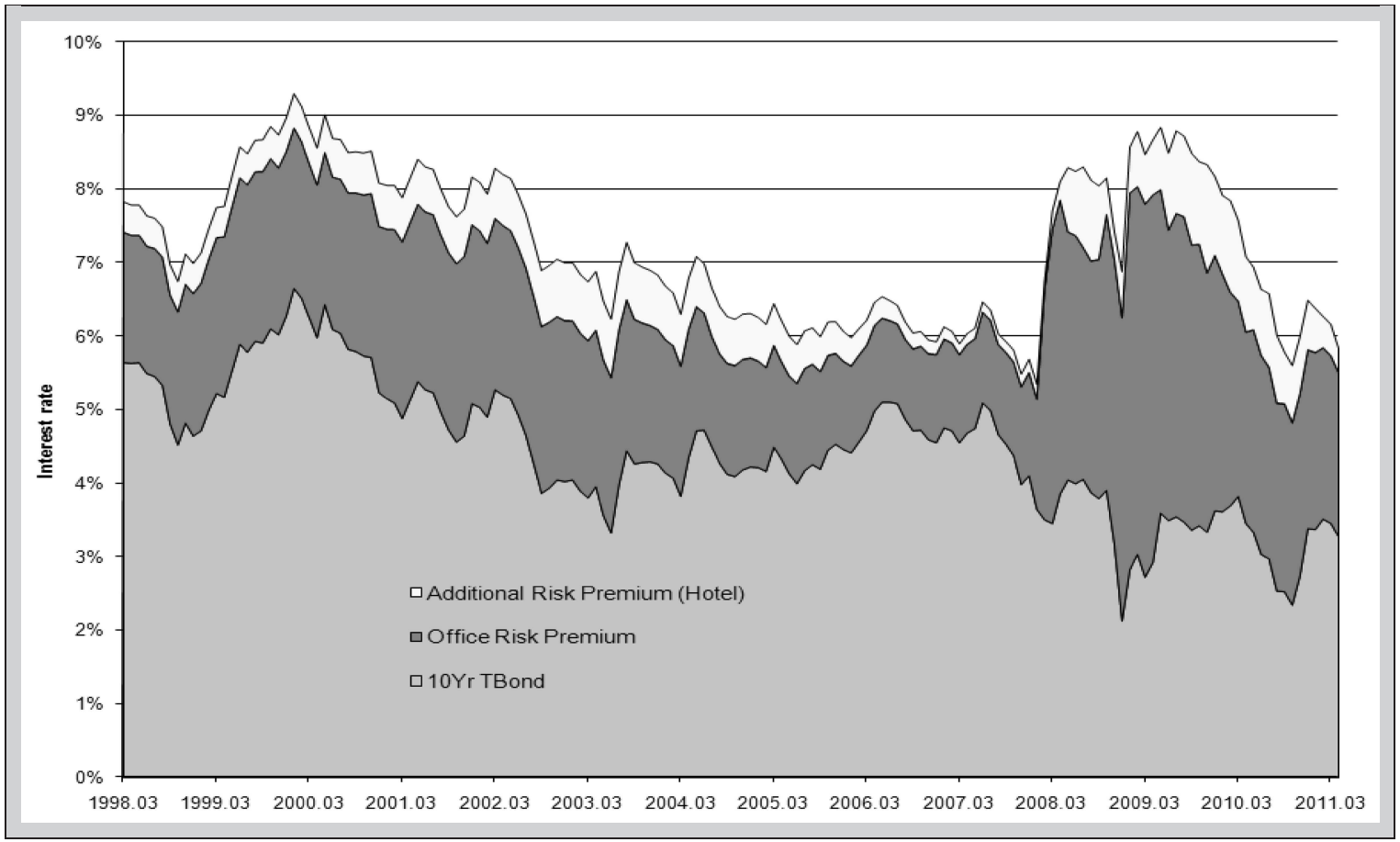
priced. In other words, loan pricing—the spread—reflects systematic risk and the compensation for systematic risk factors. This is the first distinguishing feature of our study. Fundamental factors that account for this systematic pricing of the hotel risk premium differential include general economic conditions, expected corporate profitability, real estate capital availability, and the demand for hotel services. An increase in these variables is a bellwether to a decline in the hotel risk premium differential. We also find that the interest rate spread contains important economic information for forecasting loan delinquencies.[7] An increase in the loan spread (risk premium differential) has forecasting power for predicting an increase in loan delinquencies. However, the converse situation does not hold (e.g., the risk premium differential does not increase in response to a shock in delinquencies). In addition to our main finding that the risk premium can be used to predict loan delinquencies, we also identify a parsimonious set of economic variables that has predictive power for delinquencies. We find that an increase in the risk differential (measured as the difference in standard deviation of returns on hotels and office properties) forecasts an increase in delinquencies. A positive shock to expected earnings forecasts, indicating higher expected future predictability, forecasts a decrease in delinquencies, albeit after a longer lag. Finally, an increase in unemployment, a variable that captures economic conditions, forecasts an increase in delinquencies. However, even after we control for the effect of these financial and economic variables on delinquencies in our VAR model, the risk premium differential remains an important variable for forecasting a change in delinquency levels. This is the second distinguishing feature of our study.

Why Analyze Differential Risk Premium?

Components of Interest Rates

There are several underlying factors that influence the movement of interest rates.[8] The first component is the nominal risk-free interest rate, which consists of the real rate of interest and the expected inflation premium. The second component is a market risk premium for risky assets that reflects uncertainty. Lenders require additional interest to compensate for increased risk. A third component is the term structure of interest rates. The longer the term of the loan, the higher the rate is in general. The final component is the idiosyncratic risk premium, which is specific to a particular investment, in the current study, hotel properties. Exhibit 1 shows the incremental interest rate components for hotels. The area at the bottom represents the nominal interest rate on 10-year constant maturity Treasury bond, which includes the real rate of interest and the inflation premium. Gilchrist, Vladimir, and Zakrajsek (2009) argue that longer-maturity credit instruments such as 10-year Treasuries are probably better at reflecting anticipated future economic conditions one to two years ahead. The interest rate on office properties is higher than yields on Treasuries of comparable maturities because of implicit default risk

Exhibit 1 | Incremental Interest Rate Components for Hotels



Sources: Federal Reserve, Cushman & Wakefield Sonnenblick Goldman, and Lehman Brothers.

among other factors. The spread over Treasuries also reflects the systematic factors that drive all real estate property types including the general real estate market factor (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 among others. In sum, the office risk premium can be thought of as the risk adjustment that is systematic in nature, in addition to the idiosyncratic risk associated with offices. The difference between hotel and office interest rates is the idiosyncratic risk premium for hotels or the risk premium differential (i.e., risk of hotels relative to office properties). This idiosyncratic risk premium varies by approximately 58 basis points (0.584%) on average over the course of our study.

Symbiotic Relationship between Office and Hotel Property Types

A question that arises is why the focus on the idiosyncratic risk premium for hotels relative to office properties? What is so special about office properties? Why not use some other property type, such as retail, which uses percentage leases[9] that give landlords a call option on the economy in good times and a base rent in bad times. For one, several professional hotel advisory services such as Cushman & Wakefield[10] or HVS[11] have found that a historical relationship exists between occupied office space and room night demand, although this relationship tends to vary by city. Consequently, occupied office space is a useful indicator of anticipated room night demand. We estimate that approximately 0.42 room nights are generated per year for every 1,000 square feet of occupied office space per year on average.[12] According to Fuller, Otten, and McKenna (2008), this relationship exists since corporate travelers are one of the three major sources of hotel demand.

With respect to hotel revenues, hotels generate revenues from several related sources. Revenue comes from rooms (in the form of short-term leases), food and beverage sales, and other secondary sources (such as rental of meeting space, business center services, spa services, and recreational amenities such as golf, tennis, and beach operations). To assess the relative importance of, and the degree of variation in, various revenue sources we obtained data from PKF Hospitality Research for our study period. These data are available on an annual frequency. On average, for our time period, room revenues account for 67.06% of sales (varying between a minimum of 64.60% and a maximum of 69.20%, a variation of less than $\pm$ 2.5%), food and beverage sales account for an additional 25.63% of sales (24.20% minimum and 26.70% maximum, a variation of less than $\pm$ 1.5%), and other sources of revenue account for the remaining 7.33% of sales (5.90% minimum and 8.80% maximum, a variation of less than $\pm$ 1.5%). The revenue breakdown for hotels is shown in Exhibit B1 of Appendix B. The composition of revenues is relatively stationary over time, with revenue arising from rooms, food and beverage, and other sources, each maintaining a constant proportion to total revenues over the study period.[13]

Another aspect that may be important in the hotel sector is property management. With respect to our variable of interest—the credit spread—it may be reasonable to expect that property management is an important determinant of the cost of debt in a cross-section of hotel properties. However, since we focus on the time series variation in the spread, the cross-sectional variation in management quality is averaged out in our *aggregated* time series data. To assess the extent to which the time series variation in management costs has an impact on hotel profitability, we obtain data from PKF Hospitality Research on management cost as a percentage of revenues. These data are reported on an annual frequency. The management cost shows remarkably little variation and remains near the average of 3.3% of revenues in our sample, as we illustrate in Appendix B (Exhibit B2). The variation in management cost is unlikely to affect our results.

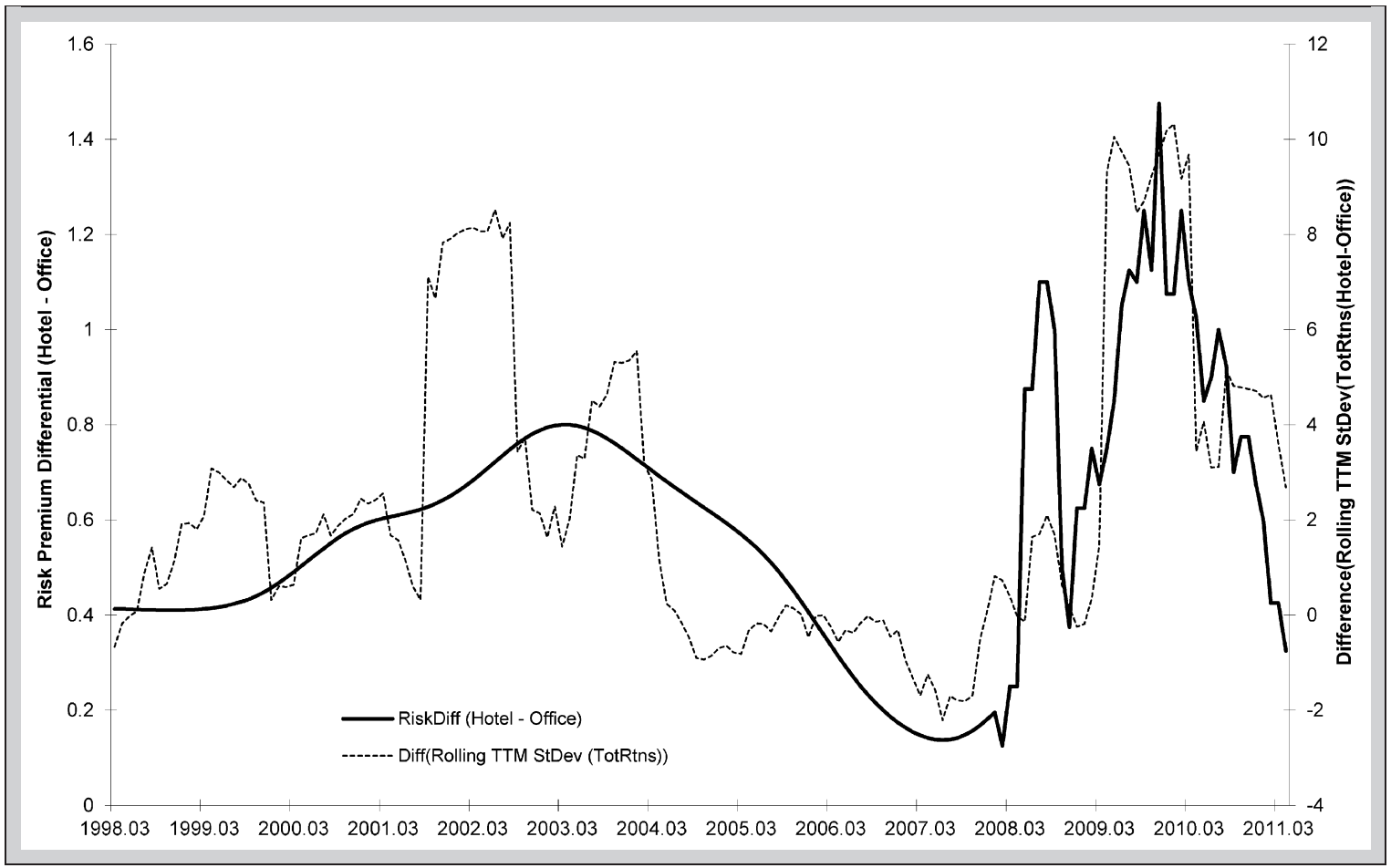
Another reason for choosing the office property type as a benchmark for comparing hotels with respect to interest rate deals are lease characteristics, a source of fixed time-invariant differences in interest rates (fixed effect[14]). Longer leases characterize office properties, while a short-term 24-hour lease is typical for hotels. Greater uncertainty of future cash flows is associated with short-term leases, which in turn require a greater premium (higher borrowing cost) to compensate for this risk. Sivitanidou and Sivitanides (1997) argue that differences in lease length could also induce different income growth expectations. In particular, smaller rental changes tend to correspond to longer leases, while a shorter lease allows owners to take advantage of rent increases as the result of improving market conditions. The short-term lease contract however also makes hotels more prone to shocks arising from capital market factors (e.g., stock returns) and the general economy. Exhibit 2 displays the risk premium differential plotted with the difference in standard deviations of hotel and office returns. The difference in standard deviations is positive, indicating that hotels have higher risk than office properties.

Another related fixed effect to consider is adjustment costs or investment flexibility (i.e., property that can be expanded or renovated). Typically hotels require higher capital expenditures (also known as product improvement programs or PIPs in hotel parlance) relative to offices given the higher tenant turnover, which is a function of the length of the lease. Thus lenders may require a risk premium to compensate for greater adjustment costs. Intuitively, the interest rate on the office property type is analogous to a risky long-term straight bond with the interest rate on hotels resembling a long term-straight bond plus an option.

Spreads Relative to Treasury

A related question is why not focus on the difference between mortgage rates and Treasury bond rates (e.g., Maris and Segal, 2002; Nothaft and Freund, 2003; and Titman, Tompaidis, and Tsyplakov, 2005)? By looking at the differential in interest rates between hotel and office property types, we already control for factors that

Exhibit 2 | The Risk in the Risk Premium: The Difference in Standard Deviations of Hotel and Office Returns



systematically impact all property types to a similar extent, such as the general real estate market (e.g., overall real estate risk premium), the capital market (e.g., credit spread of corporate bonds), and general economic conditions regardless of whether they are observable or not. Consequently, we are better able to study traits that elicit differential risk premium between property types. Working with measures in terms of differentials is an important feature of our study.

Data and Methodology

The average spread for a property type over Treasury at the time of loan origination (SATO) for mortgage loans for hotels and office property types is obtained from Lehman Brothers for the period starting July 1998 through January 2008. We update the SATO data using Cushman Wakefield Sonnenblick-Goldman survey of indicated spreads[15] for conventional commercial mortgage loans over a 10-year Treasury bond beginning in February 2008 and ending in March 2011. All data are monthly. This gives us a relatively long time series that encompasses both the times of economic growth and the times of economic distress (recessions). We therefore are able to study the informational content of the spread under a variety of economic conditions. The Lehman data are normalized for loan size and loan-to-value (LTV) to capture the true difference in SATO by property type, while the Cushman data are normalized for loan size but not LTV.[16] The Cushman data are used since the Lehman data were discontinued with the collapse of Lehman Brothers.[17]

Since we use data from two sources, Lehman Brothers (LB) in earlier periods up to January 2008 and Cushman Wakefield Sonnenblick Goldman (CWSG) starting from February 2008 onwards (given the collapse of Lehman and subsequent non-reporting of SATO), a natural question that arises is to what extent the two series are comparable and 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 LTV data on office buildings and hotels from the American Council of Life Insurance Companies (ACLI) publication *Commercial Mortgage Commitments*—Historical Database.[18] While the ACLI data are reported at quarterly frequency and thus are not appropriate for our main analysis, which we conduct at a monthly frequency, it is useful to assess our combined data series. The correlation between ACLI interest rate for office and our data for office is 0.88, and the correlation for ACLI data for hotels and our hotel interest rate series is 0.81. This indicates that our overall data series is highly correlated with the data series from one source (ACLI).

Wall Street analysts use SATO as a measure of default risk (e.g., default models use loan-specific SATO as one of the key performance drivers). The intuition for using SATO as a default metric is that the yield spreads (interest rate–risk-free rate) for various property types include two options: default risk (put option) and prepayment risk (call option). Prepayment risk for commercial mortgages is often

minimized through ''lock out'' provisions or ''yield maintenance'' requirements, which reduce the value of the call option while the value of the put option (default) remains unchanged. We subtract the SATO corresponding to office from the SATO for hotels to obtain the differential risk premium at time t ($SATO_{Hotel,t}-SATO_{Office,t}$). The differential risk premium (incremental risk premium for hotels over and above office properties, see Exhibit 1) is our variable of interest. A positive risk premium differential suggests higher risk including greater default (delinquency) risk since the hotel loan is made at a wider spread relative to an office loan.

The macroeconomic variables we examine include the percentage change or growth rate in expected corporate earnings per share on the S&P 500 (*PCTEPS*), the growth rate in total employment (*EMPL*), and the rate of unemployment (*UNEMPL*).[19] The growth rate in expected earnings per share is included since they not only represent Wall Street's consensus on the expected movements in the economy but also partly reflect corporate management's short-term expectations.[20] Since most overnight stays are business related and corporations plan their travel in advance, expected earnings are used as an anticipated demand instrument.[21] Expected earnings should also reflect future disposable income growth; the leisure demand market segment depends heavily on disposable income. Finally, news about future corporate earnings could also reflect corporate borrowers' shocks to their ability to pay debt in the future. Our rationale for including expectation variables is that if markets are efficient then credit spreads should reflect expectations in addition to realizations. A capital market variable used is the difference in the standard deviation of total returns on hotel REITs and office REITs (*DIFFSTDEV*). The difference in the standard deviations is our proxy for the additional riskiness in performance of hotel REITs over and above office REITs that stock market participants anticipate over a 12-month period. Collin-Dufresne, Goldstein, and Martin (2001) use the implied volatilities of near-the-money options on the OEX (S&P 100) index to proxy for changes in a firm's future volatility in their study of credit spreads.[22] Previous corporate bond studies have often used stock returns to proxy for changes in a firm's health. Similarly, we use the volatility of REIT returns as a metric of the uncertainty about future returns on a property type. Titman and Torous (1989) indirectly show that greater variability of property values increases the likelihood of default in circumstances where the unpaid loan amount exceeds property value. REIT returns are used given the greater frequency (monthly) of values relative to underlying property values, which are typically reported on a quarterly basis. In addition to this, REIT returns contain market expectations (are forward looking) for a given property type in contrast to underlying property values. The volatility of hotel REITs should exceed office REIT volatility given the higher frequency of rent resetting of the former due to shorter lease terms, ceteris paribus. Hotel property values should thus adjust more quickly relative to office values, which are subject to existing contract rents on longer-term leases. The real estate variable of interest is the incremental delinquency rate for hotels relative to office properties (*DELINQ*). The incremental

delinquency rate is a useful indicator of the volume of distress hotel loans percolating. In sum, we study a system with several variables capturing the state of the economy and the demand for hotel services. The variables include expected earnings per share, the unemployment rate, and/or the growth rate in employment, which are all metrics that influence either discretionary income or the perception of financial security. Appendix A gives a description and source(s) of each of these variables.

To analyze the information content of the incremental credit spread for hotels, as well as the information contained in our macroeconomic variables measuring activity in the economy as a whole, the capital markets, and the real estate markets, we employ a vector autoregression (VAR) model. A VAR is a useful and flexible way of analyzing economic relations in time series data. More specifically, the VAR allows for the mutual impact of the variables; it is thus well suited for interdependent economic time series. The technique is useful in examining complex relationships among variables when the variables are serially correlated. Typically, VARs have little serial correlation in the residuals. This is helpful for separating out the effects of economically unrelated influences in the VAR. We use the VAR model to reveal the evolution of the credit spread and the macroeconomic variables, as well as the dynamic interactions between the variables.

Results

Stage 1: Economic Dynamics of the Spread

Our initial point of departure is an analysis of the variation in the relative spread. There is a substantial time series variation in the differential risk premium (incremental risk premium for hotels over and above office properties) as seen in Exhibit 1. What economic, market, and industry variables account for the time series variation in the spread in a parsimonious model? This is an important question for understanding loan pricing in the real estate market. Our variable of interest is the relative cost of capital (spread) between the market with relatively short leases and the market with longer leases. Understanding the behavior of the spread will result in a better understanding of the connection between economic and market conditions and relative pricing in real estate markets with different effective lease durations. Our investigation proceeds in several steps, as we relate the risk premium differential to factors that can account for the sources of variation associated with a higher risk premium. We employ a sequential process to determine whether the existing variables in our VAR system remain relatively stationary and continue to forecast the spread, as well as to ascertain if our newly introduced factors contribute to the spread forecast. We start by estimating a simple VAR system that includes two variables, the risk premium differential and the risk differential, as follows:

$$RISKDIFF_t = \sum_{i=1}^{L} \alpha_i \cdot RISKDIFF_{t-i} + \sum_{i=1}^{L} \beta_i \cdot DIFFSTDEV_{t-i} + u_t. \quad (1)$$

$$DIFFSTDEV_t = \sum_{i=1}^{L} \delta_i \cdot RISKDIFF_{t-i} + \sum_{i=1}^{L} \gamma_i \cdot DIFFSTDEV_{t-i} + \nu_t. \quad (2)$$

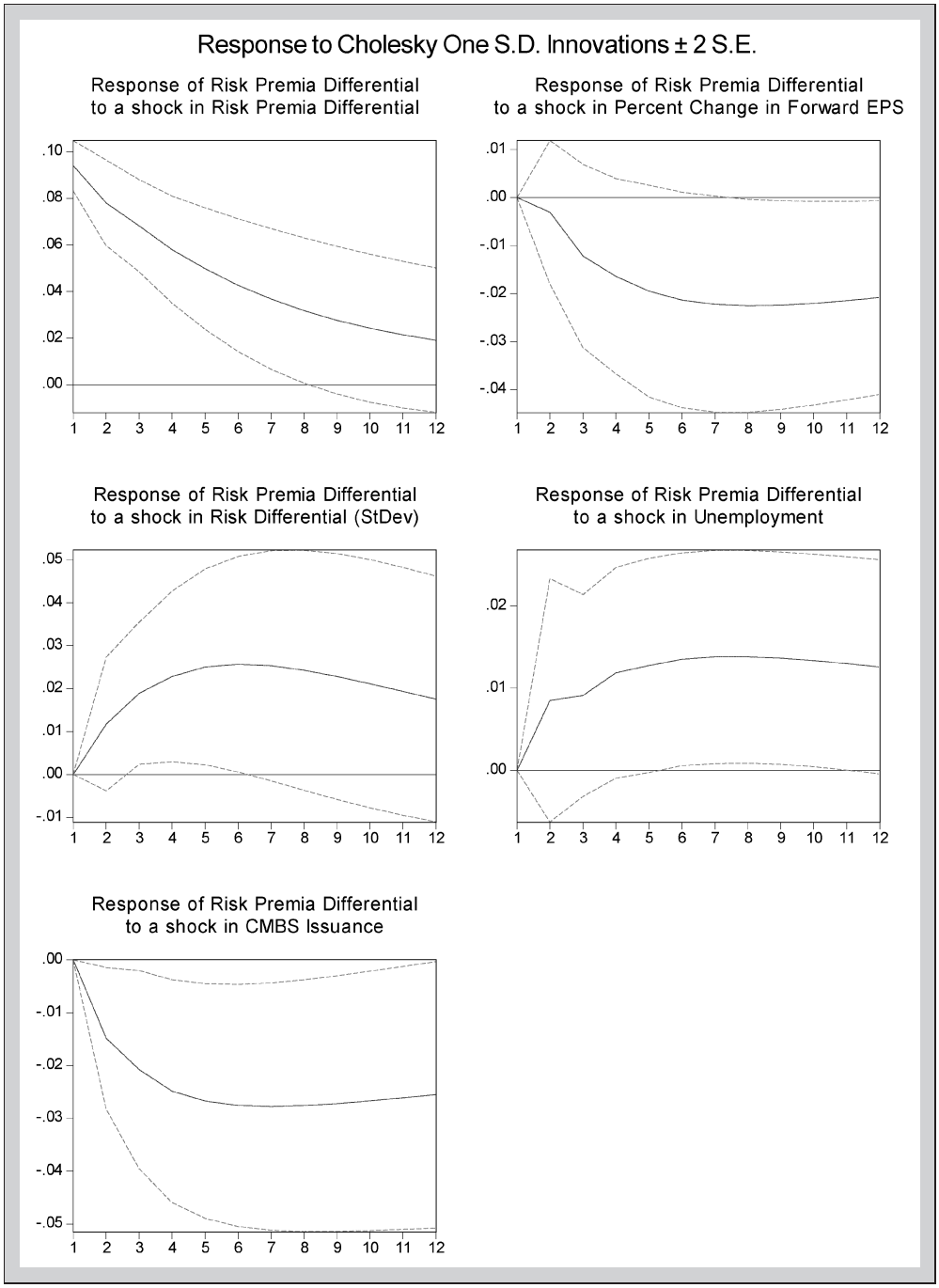
We examine the impulse response functions (not shown for brevity) for this VAR system. We find that an increase in risk differential forecasts an increase in the risk premium differential. Therefore, the risk premium responds to risk. We also find that a higher risk premium differential forecasts an increase in risk differential. A feedback loop thus exists between the risk premium differential and the differential risk metric. As a robustness check, we re-estimate the VAR by adding a measure of economic conditions, unemployment (*UNEMPL*), to our financial measure of the risk differential. The inclusion of the unemployment variable does not change the previously reported results. We find that the differential in risks and unemployment both have an important affect in the risk premium differential.

Having established the connection between the risk premium differential and several economic variables in a simple setting, we now proceed to incorporate more variables simultaneously in a parsimonious model.

We estimate a VAR system that includes five variables: (1) risk premium differential (*RISKDIFF*); (2) a measure of corporate profitability—a 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 as a proxy for capital supply conditions.[23] Exhibit 3 shows the impulse response functions for the response in the risk premium differential to a change in the magnitude of the variables in the system. The results indicate that the risk premium differential is autoregressive (first row, left graph), the risk premium differential falls when higher earnings are expected (first row, right), an increase in risk results in a higher risk premium differential (second row, left), and an increase in unemployment represents a deterioration in economic conditions and forecasts an increase in the risk premium differential.[24] We also find that a positive shock in CMBS issuance, indicating an inflow of funds through a higher CMBS issuance and increasing capital availability, results in a lower risk premium differential.

Next, we add two variables that measure the demand for hotel services into our existing VAR system. The hotel industry variables are total hotel revenues

Exhibit 3 | Impulse Response Functions to a Cholesky One Standard Deviation Innovation



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

(*HOTREVYR*) and total hotel demand (*HOTDMNDYR*). We also exclude two existing variables, risk differential (*DIFFSTDEV*) and unemployment rate (*UNEMPL*), from the system. The rationale is that *DIFFSTDEV* and *UNEMPL* could contain the same information as a more direct measure of hotel industry performance proxied by *HOTREVYR* and *HOTDMNDYR*. We will explore this relationship more fully in a subsequent VAR impulse response function analysis. The impulse response functions (IRFs) for this VAR system are shown in Exhibit 4.

Exhibit 4 reveals that all of the existing variables in our previous VAR system continue to behave in a similar manner. The risk premium differential series is still autoregressive. The risk premium charged for hotel loans declines when aggregate earnings environment is expected to improve and as funding becomes available through CMBS issuance and capital supply increases.

There are also several new insights in Exhibit 4. The third graph in the first row indicates that an increase in hotel revenues forecasts a drop in the risk premium charged. The third row of Exhibit 4 shows the response of total hotel revenues (*HOTREVYR*) to the variables in the system. The first graph indicates that a shock to the risk premium differential does not forecast a change in total hotel revenues. The second panel indicates that a shock to expected corporate profitability (*PCTEPS*) forecasts an increase in hotel revenues. This is consistent with economic intuition that hotel revenues are related to business activity. The third panel in the third row captures the autoregressive nature of hotel revenues. The fourth panel shows that hotel revenues are related to hotel demand, as expected. The fourth row of Exhibit 4 shows the response of total hotel demand (*HOTDMDYR*) to the variables in the system. The results are similar to the results for total hotel revenues. In particular we find that risk premium differential does not forecast total hotel demand; we find that forward EPS forecasts hotel demand. The fifth row of Exhibit 4 shows the response of CMBS issuance to the variables in the system. We find that our forward-looking corporate profitability measure (*PCTEPS*) forecasts demand for hotel services (*HOTREVYR* and *HOTDMNDYR*). We also find that the risk premium differential has no power to forecast the hotel demand variables (*HOTREVYR* and *HOTDMDYR*).

We next examine the information content incorporated in *DIFFSTDEV* and *UNEMPL* relative to *HOTREVYR*, a more direct metric of hotel industry performance. The new VAR system includes not only the difference in standard deviations (*DIFFSTDEV*) and unemployment (*UNEMPL*) as a measure of economic conditions but also hotel revenues (*HOTREVYR*). Other variables included in the system are the percentage change in forward EPS (*PCTEPS*), activity in the hotel CMBS market (*CMBSISSU*), and our variable of interest, the risk premium differential (*RISKDIFF*).

Plots of the IRFs associated with our new system are shown in Exhibit 5 for the risk premium differential to a unit standard deviation change in a particular variable in the system, traced forward over a 12-month period. This system

Exhibit 4 | Impulse Response Functions to a Choleskey One Standard Deviation Innovation

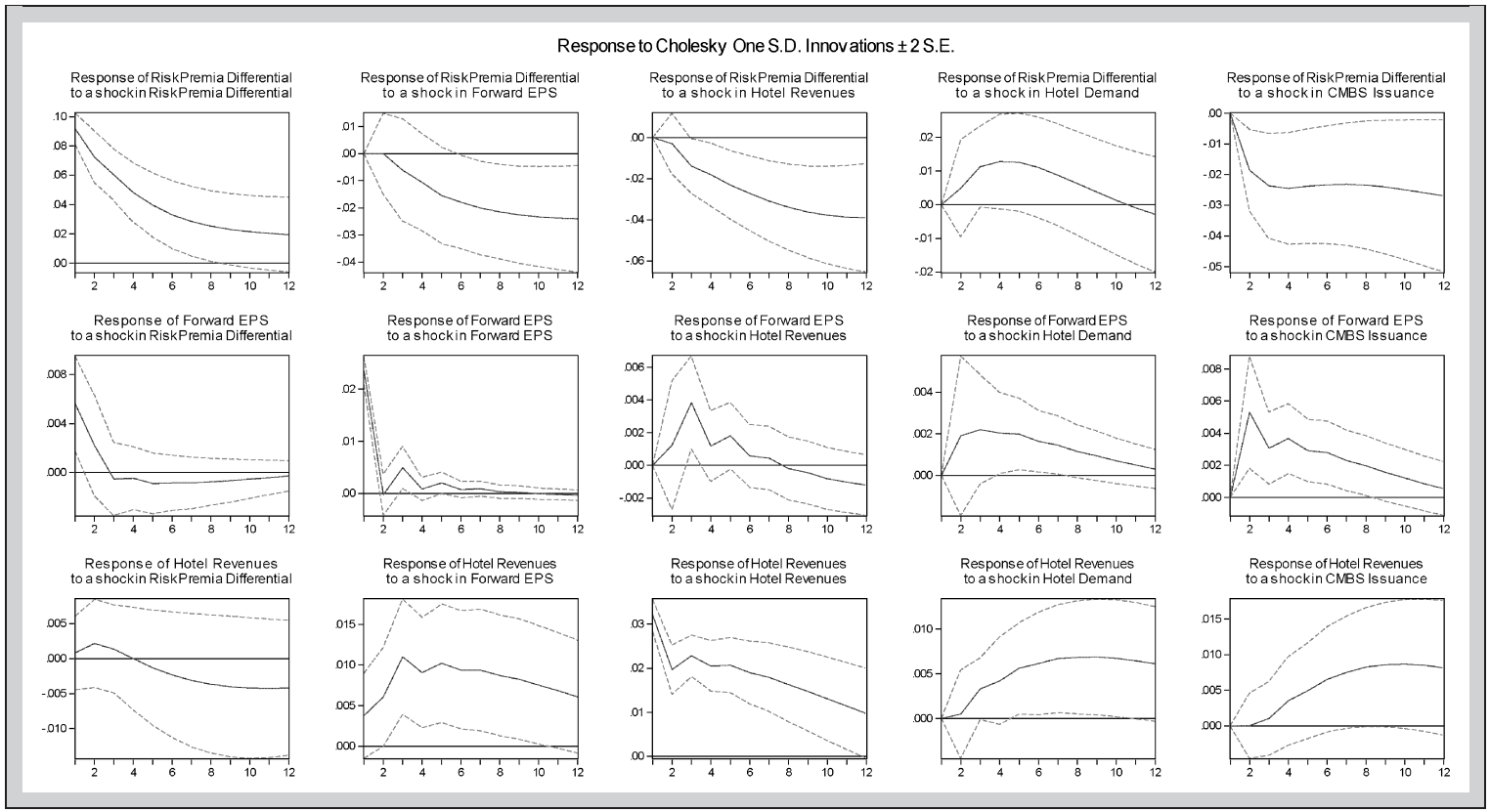
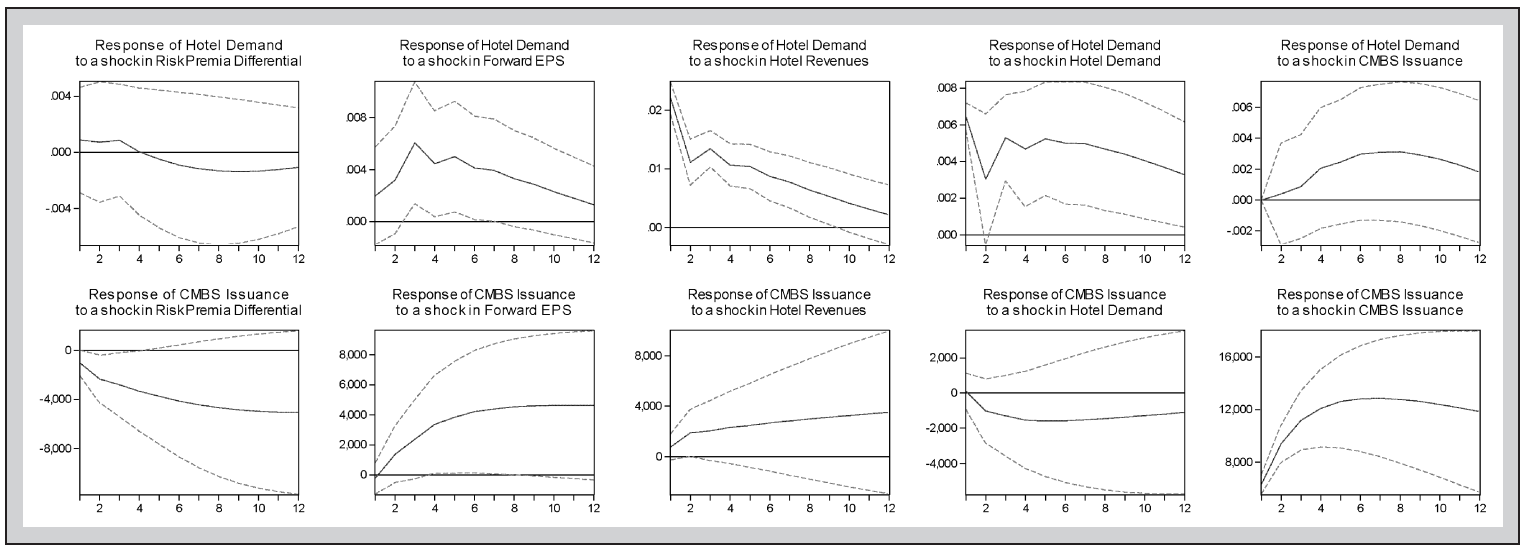


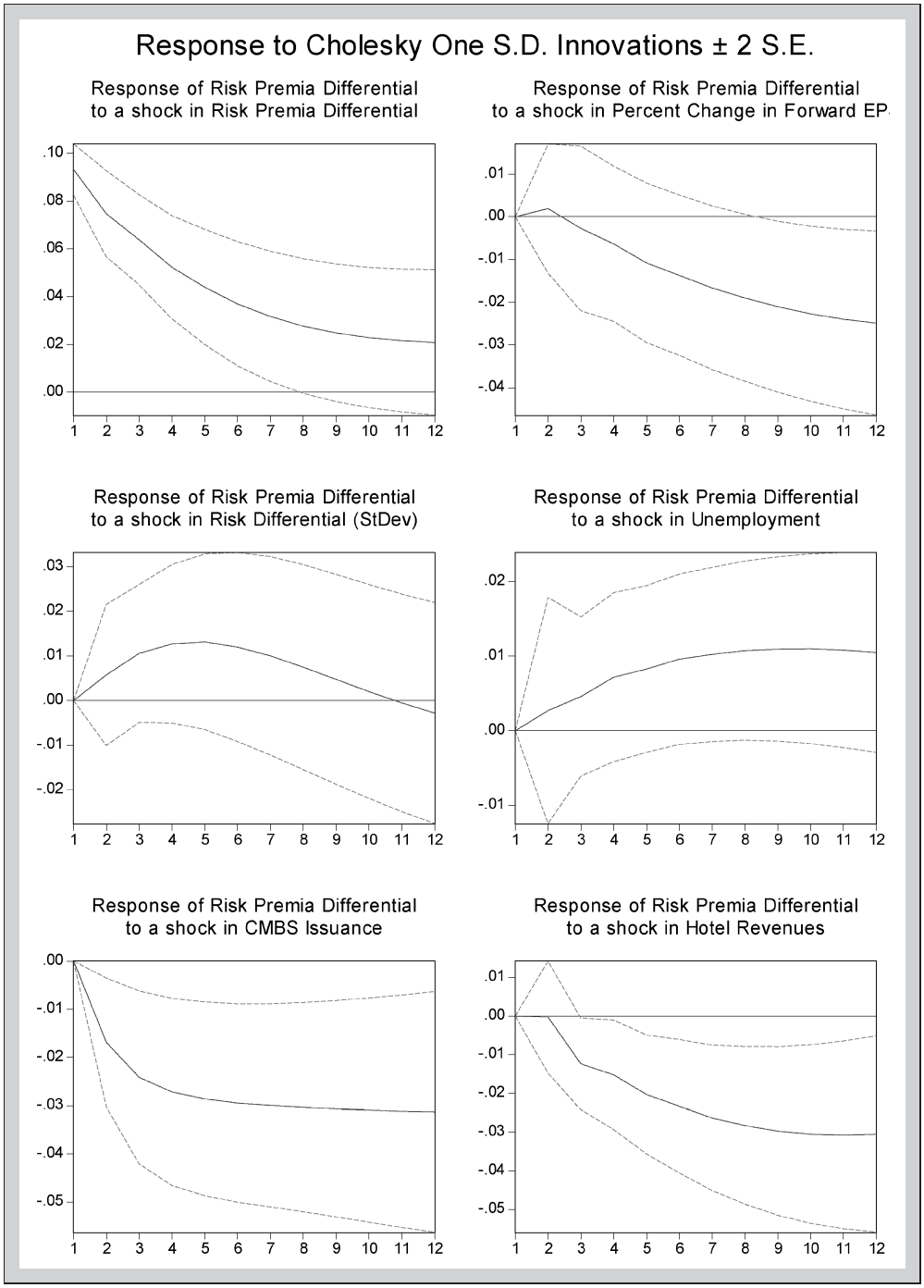
Exhibit 4 | (continued)

Impulse Response Functions to a Cholesky One Standard Deviation Innovation



In Exhibit 4, we plot impulse response functions (IRFs) to a unit standard deviation change in a particular variable, traced forward over a 12-month period. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands.

Exhibit 5 | Impulse Response Functions for the Risk Premium Differential



In Exhibit 5, we plot impulse response functions (IRFs) for the Risk Premium Differential 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.

captures the economic dynamics established through the previous analysis very well. The results are consistent with our prior findings regarding the autoregressive nature of the risk premium differential and the respective roles that improved corporate profitability and increasing CMBS issuance play in lowering the risk premium. The new insight of these plots is that when a direct measure of conditions in the hotel market—hotel revenues (*HOTREVYR*)—is included in the system, the significance of the other two risk variables declines. The risk differential (*DIFFSTDEV*) and unemployment (*UNEMPL*) are no longer significant at the 5% level (although they remain significant at the 10% level). In other words, using a direct measure of industry performance, hotel revenues, subsumes the informational role of the less direct measures (risk differential and unemployment).

We also examine the IRFs for the risk differential (*DIFFSTDEV*) to a unit standard deviation change in a particular variable (not shown for brevity). There are several results of interest. An increase in expected profitability (forward earnings) forecasts a decline in the risk differential. The risk differential picks up movements in unemployment; an increase in unemployment forecasts an increase in the risk differential. An increase in hotel revenues forecasts a significant decline in the risk differential. Overall, the results indicate that the risk differential variable contains both information on the economy (unemployment) and industry-specific information. When a direct measure of industry performance (hotel revenues) is included in the VAR system, it captures the role of less direct performance measures. The analysis indicates that the risk differential variable also captures a variety of state variables very well including information on overall economic conditions (unemployment) and industry performance. Thus, the inclusion of the risk differential variable represents a parsimonious way of reflecting information that is important for modeling the variation in the spread.

In this section we study the dynamics of the spread. We find that the behavior of the spread is consistent with economic intuition and we establish that the differential risk premium is systematically priced. The spread responds to a set of economic variables that contains a measure of financial risk (*DIFFSTDEV*), a forward-looking measure of financial performance (*PCTEPS*), a measure of overall economic conditions (unemployment, *UNEMPL*), a measure of capital supply conditions in the industry (*CMBSISSU*), and industry-specific performance information captured by hotel revenues (*HOTREVYR*). These variables thus capture risk and return information embedded in the risk premium differential (spread).

Stage 2: Informational Content of the Spread

To study the informational content of the pricing spread, we begin with univariate analysis. In efficient capital markets, prices reflect market expectations of risk and return. Markets anticipate future developments and adjust prices for risky assets (the required rate of return on capital) when expected conditions change. In this

environment, the risk premium differential may contain important information that is useful for forecasting delinquencies and foreclosures.

We begin by adopting a flexible approach and estimating a VAR system with risk premium differential (*RISKDIFF*) and delinquency (*DELINQ*) as endogenous variables. In accordance with the Akaike information criterion (AIC) and Schwarz Bayesian information criterion (SBIC), we estimate the VAR system with two lags. Impulse response functions (not reported for brevity) for this system indicate that the risk premium differential does not increase in response to a shock in delinquencies. In other words, past delinquencies do not forecast increases in the interest rate differential. The impulse response function for the delinquencies shows that a shock to the risk premium differential forecasts an increase in delinquencies with a lag of approximately three months. These results are consistent with efficient markets: market prices anticipate future deterioration in cash flows, rather than respond to them with a lag. Our findings thus indicate that the risk premium differential contains important information regarding future relative levels in delinquencies.

We also report the results of the regression of the risk premium differential (*RISKDIFF*) on the past level of relative delinquencies in the hotel and office mortgage-backed securities (*DELINQ*). Lagged values of the dependent and independent variables are included to control for serial correlation in the data:

$$RISKDIFF_t = \underset{(2.05)^{**}}{0.042} + \underset{(22.70)^{***}}{0.930} \cdot RISKDIFF_{t-1} + \underset{(1.52)}{0.018} \cdot DELINQ_t - \underset{(-1.63)}{0.019} \cdot DELINQ_{t-1}. \quad (3)$$

The Durbin-Watson statistic is 2.05. The variable of interest is $DELINQ_t$. The regression coefficient for this variable is not significant. We also estimate this regression with the lagged delinquency variable (we perform regressions with $DELINQ_{t-1}$, or $DELINQ_{t-2}$). The results are similar. These results are consistent with the results from the VAR.[25]

Next, we estimate the following regression:

$$DELINQ_t = \underset{(-2.75)^{**}}{-0.404} + \underset{(2.97)^{***}}{1.67} \cdot RISKDIFF_{t-2} - \underset{(-0.87)}{0.52} \cdot RISKDIFF_{t-3} + \underset{(37.96)^{***}}{0.92} \cdot DELINQ_{t-1}. \quad (4)$$

The Durbin-Watson statistic is 1.66. The variable of interest is the lagged measure of the risk premium differential ($RISKDIFF_{t-2}$); the other variables are included

in the regression to control for serial correlation. The results suggest that the risk premium differential is a predictor of the relative level of delinquencies. The results of this regression are consistent with the results from the VAR. We find that the risk premium differential contains important information for predicting delinquencies. To check the robustness of the above result, we include more lags and estimate the regression:

$$\begin{aligned} DELINQ_t = & \underset{(-3.02)^{**}}{-0.454} + \underset{(2.79)^{***}}{1.54} \cdot RISKDIFF_{t-2} \\ & - \underset{(-2.23)^{**}}{1.67} \cdot RISKDIFF_{t-3} + \underset{(2.43)^{**}}{1.43} \cdot RISKDIFF_{t-4} \\ & + \underset{(12.98)^{***}}{1.08} \cdot DELINQ_{t-1} - \underset{(-2.18)^{**}}{0.17} \cdot DELINQ_{t-2}. \end{aligned} \quad (5)$$

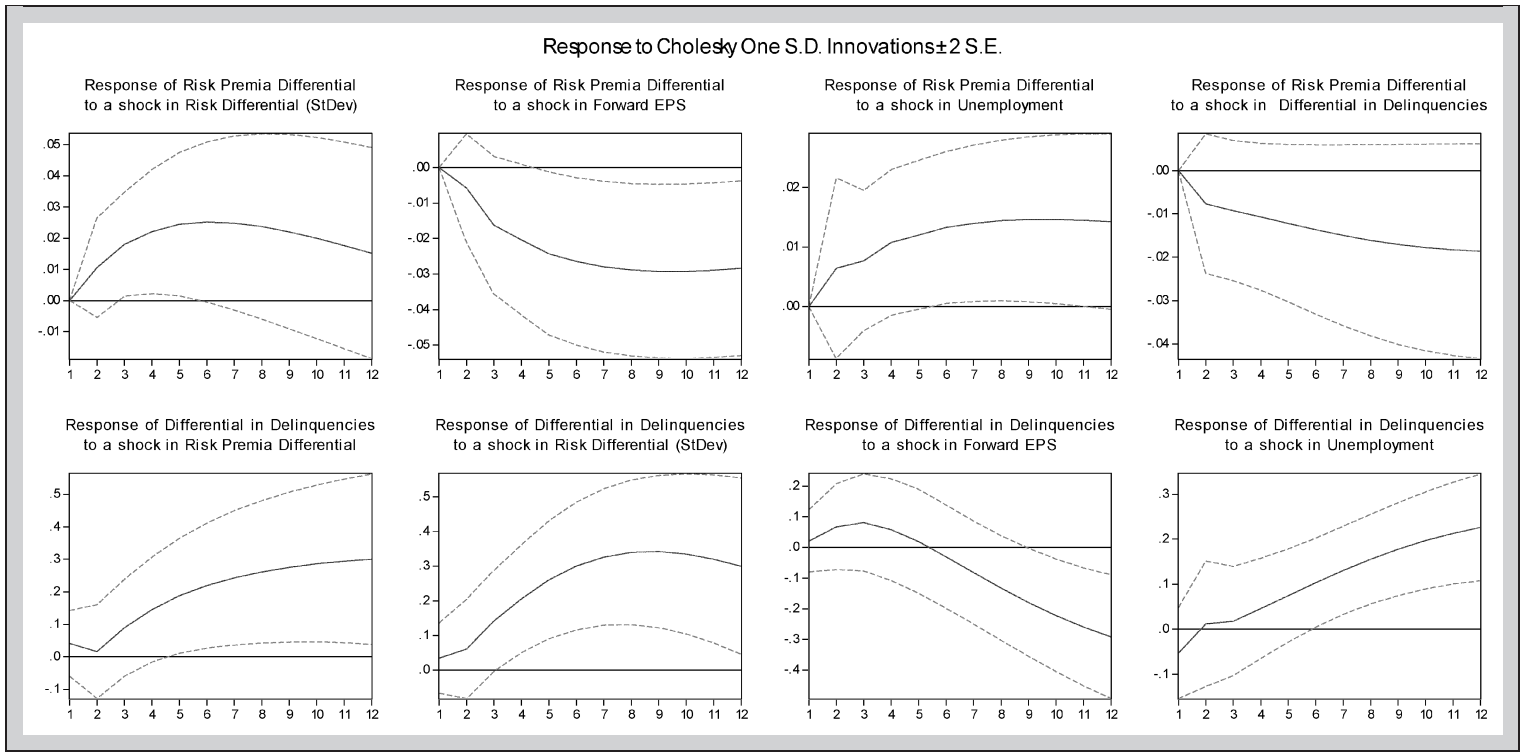
The Durbin-Watson statistic is 1.99. The variable of interest is the lagged measure of the risk premium differential ($RISKDIFF_{t-2}$). The coefficient for this variable is positive (1.54) and significant (t-stat. = 2.79), confirming our results.

Multivariate Analysis

Having established that the risk premium differential has predictive power for delinquencies in a univariate setting, we now proceed with multivariate analysis. Our goal is to explore inter-temporal associations between loan delinquencies, economic and financial conditions, and the risk premium differential. We estimate a VAR system with the following endogenous variables: risk premium differential (*RISKDIFF*), risk differential measured as the difference in standard deviations (*DIFFSTDEV*), a measure of corporate profitability—a percentage change in the forward earnings per share (*PCTEPS*), unemployment rate (*UNEMPL*), and delinquency (*DELINQ*). In accordance with the AIC and BIC, we estimate the VAR system with two lags.[26]

We now examine the IRFs for this VAR system. The top row of graphs in Exhibit 6 shows the response of the risk premium differential to shocks in the state variables. The first panel (top row, left graph) shows that a shock to the risk differential forecasts a positive change to the risk premium differential: a higher risk differential forecasts a higher incremental compensation for risk. The second graph in the top row shows that a shock to forward expected EPS results in a lower risk premium differential. This result is consistent with the view that during relatively good times—higher earnings—the spreads narrow. The next panel indicates that a shock to unemployment forecasts an increase in the risk premium differential. The last figure in the top row shows the response of the risk premium differential to a shock in relative delinquencies. The impulse response function indicates that the risk premium differential does not increase in response to past delinquencies.

Exhibit 6 | Impulse Response Functions for the Risk Premium Differential and Relative Delinquency Rate



In Exhibit 6, we plot impulse response functions (IRFs) for the risk premium differential (top row) and relative delinquency rate (second row) to a unit standard deviation change in a particular variable, traced forward over a 12-month period. Response to Cholesky 1 standard deviation. Dashed lines represent 95% confidence bands. The variables included in the VAR system are: the differential risk premium (*RISKDIFF*), difference in standard deviations (*DIFSTDEV*), unemployment rate (*UNEMPL*), percentage change in forward earnings per share (*PCTEPS*), and relative delinquency rate (*DELINQ*).

The second row of Exhibit 6 shows the IRFs for delinquencies as a response variable. The first figure indicates that in a multivariate VAR system, a shock to the risk premium differential forecasts an increase in delinquencies. This is our main result. It shows that when the effect of other financial and economic variables on delinquencies has already been taken into account in a system, the risk premium differential remains an important variable forecasting a change in delinquency levels. The next graph in the bottom row shows that an increase in the risk differential forecasts an increase in delinquencies. This result provides a connection between risk as measured by financial market variables and future delinquencies. Another financial variable in the system is forward EPS. An increase in forward EPS forecasts a decrease in delinquencies, albeit after a longer lag. Finally, the last graph shows that a shock to unemployment forecasts an increase in delinquencies.

Given our results in a VAR setting, we next perform multivariate time series regressions. Results of the regressions are reported in Exhibit 7. Each column represents a different regression specification. The dependent variable is the level of delinquencies, $DELINQ_t$. Lagged values of the dependent variable and of the independent variables are included in the regressions to control for serial correlation in the data.

The first specification includes the following explanatory variables: risk premium differential[27] ($RISKDIFF_{t-6}$), difference in risk ($DIFFSTDEV_{t-4}$), and unemployment ($UNEMPL_{t-8}$). Our findings are consistent with the VAR analysis. First, we find that the risk premium differential is an important variable for forecasting delinquencies. In the regressions, the risk premium differential ($RISKDIFF_{t-6}$) has a positive coefficient (coeff. = 1.146, *t*-stat. = 2.01), indicating that an increase in the risk premium spread forecasts an increase in delinquencies. Second, we find that an increase in risk, as captured by the difference in standard deviations ($DIFFSTDEV_{t-4}$), forecasts an increase in delinquencies. Third, we find that worsening economic conditions, as captured by the unemployment variable, predicts an increase in delinquencies.

The second specification in Table 1 differs from the first specification in two ways. We study the difference in the risk variable with a longer lag ($DIFFSTDEV_{t-6}$) and we use the percentage change in total employment ($EMPL_{t-9}$) instead of the unemployment variable. The results of this specification are fully consistent with the results from the first specification.

In the third specification (Exhibit 1, third column) we add a forward-looking financial variable to the regression. We include the percentage change in forward S&P 500 earnings per share. We find that this variable is not significant in forecasting delinquencies, but the behavior of other predictors does not change after we control for this forward-looking financial measure.[28]

Overall, the results of our time series regressions are fully consistent with the results from VAR analysis and indicate that the differential risk premium for hotels is an important variable for forecasting hotel delinquencies.

Exhibit 7 | Regressions of Delinquency Rate

	DELINQ(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)
Intercept	−0.728 (−2.35)**	0.158 (0.92)	−0.729 (−2.32)**	0.126 (0.69)
DELINQ(*t*−1)	0.899 (10.49)***	0.892 (9.98)***	0.894 (10.23)***	0.879 (9.58)***
DELINQ(*t*−2)	−0.084 (−0.99)	0.010 (0.12)	−0.080 (−0.93)	0.010 (0.12)
RISKDIFF(−6)[a]	1.146 (2.01)**	0.966 (1.74)*	1.186 (2.05)**	0.997 (1.76)*
RISKDIFF(−7)	−0.481 (−0.65)	−0.301 (−0.41)	−0.448 (−0.59)	−0.199 (−0.27)
RISKDIFF(−8)	−0.707 (−1.22)	−0.476 (−0.82)	−0.761 (−1.26)	−0.507 (−0.84)
DIFFSTDEV(−4)[a]	0.075 (1.68)*		0.072 (1.60)	
DIFFSTDEV(−5)	−0.088 (−1.48)		−0.088 (−1.45)	
DIFFSTDEV(−6)	0.127 (2.75)***		0.129 (2.74)***	
DIFFSTDEV(−6)[a]		0.138 (2.98)***		0.133 (2.80)***
DIFFSTDEV(−7)		0.007 (0.11)		0.010 (0.16)
DIFFSTDEV(−8)		−0.106 (−2.28)**		−0.104 (−2.17)**
UNEMPL(−8)[a]	0.707 (1.94)**		0.700 (1.85)**	
UNEMPL(−9)	−0.100 (−0.19)		−0.089 (−0.17)	
UNEMPL(−10)	−0.423 (−1.12)		−0.429 (−1.09)	
EMPL(−9)[a]		−98.65 (−1.89)**		−101.52 (−1.88)**
EMPL(−10)		−12.78 (−0.23)		−7.43 (−0.13)
EMPL(−11)		−27.50 (−0.44)		−34.90 (−0.54)
PCTEPS(−2)[a]			1.081 (0.50)	1.611 (0.76)

Exhibit 7 | (continued)
Regressions of Delinquency Rate

	DELINQ(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)
PCTEPS(−3)			−0.270	0.295
			(−0.13)	(0.14)
PCTEPS(−4)			−0.576	−0.168
			(−0.27)	(−0.08)
Durbin-Watson	1.89	1.89	1.89	1.89

Notes: The table shows time series regressions of relative delinquency rate, *DELINQ*, on several predictors: the differential risk premium (*RISKDIFF*), difference in standard deviations (*DIFSTDEV*), unemployment rate (*UNEMPL*), percentage change (growth rate) in total employment (*EMPL*), and percentage change in forward earnings per share (*PCTEPS*). Lagged values of the dependent and independent variables are included to control for serial correlation the data. *t*-statistics are shown in parentheses below the coefficient estimates.
[a]Variable of interest.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Conclusion

We use a two-stage process to investigate how the length of the lease contract affects the pricing of loan risk. Shorter-term leases such as those associated with hotels (a room for a night) should exhibit a greater sensitivity to changes in fundamental factors, which in turn should increase the loan pricing of risk (higher interest rates) on this property type relative to longer-term leases associated with other property types, such as office real estate where the rents are fixed over a longer time horizon say five to ten years (e.g., these leases cannot be marked to market instantaneously). We identify a parsimonious set of factors that affect the spread. Using a VAR framework, we examine the dynamics of the incremental hotel risk premium (hotel interest rate–office interest rate) to assess the extent to which fundamental factors are incorporated into the loan pricing of hotels. These factors include the state of the economy, expected corporate profitability, as well as capital market and real estate market conditions.

Next, we examine the signaling implications associated with a widening or tightening of the incremental hotel risk premium. We find that the differential risk premium for hotels is systematically priced. This is our primary contribution. In particular, a deterioration of general economic conditions, a decline in expected corporate profitability, a reduction in capital availability, and/or a decrease in the

demand for hotel services are catalysts resulting in a rise in the hotel risk premium differential. We also show that changes in the risk differential and unemployment incorporate information on the direction of hotel revenues, a direct measure of industry performance. Overall, the finding that interest rates are higher when lenders anticipate greater economic uncertainty provides evidence that lenders price *relative* risk in the market where underlying properties (hotels) have particularly short-term leases.

In addition to this, we demonstrate that the relative risk premium of hotel rates above office property rates contains relevant information for forecasting hotel delinquencies. However, the converse situation does not hold (e.g., the risk premium differential does not increase in response to a shock in delinquencies). While we do not imply causality, changes in the relative spread do have additional forecasting ability (after accounting for other variables) with respect to relative delinquencies. Hotel credit spreads widen when lenders anticipate higher hotel delinquencies and narrow during expected hotel prosperity. We also find that an increase in the volatility of hotel REIT returns or risk (as measured by standard deviation of returns) and a change in economic conditions as captured by unemployment have forecasting power for hotel delinquencies and foreclosures. More importantly, even after we control for the effect of other financial and economic variables on delinquencies in our VAR model, the risk premium differential remains an important variable for forecasting a change in delinquency levels. This is our main result in the second stage.

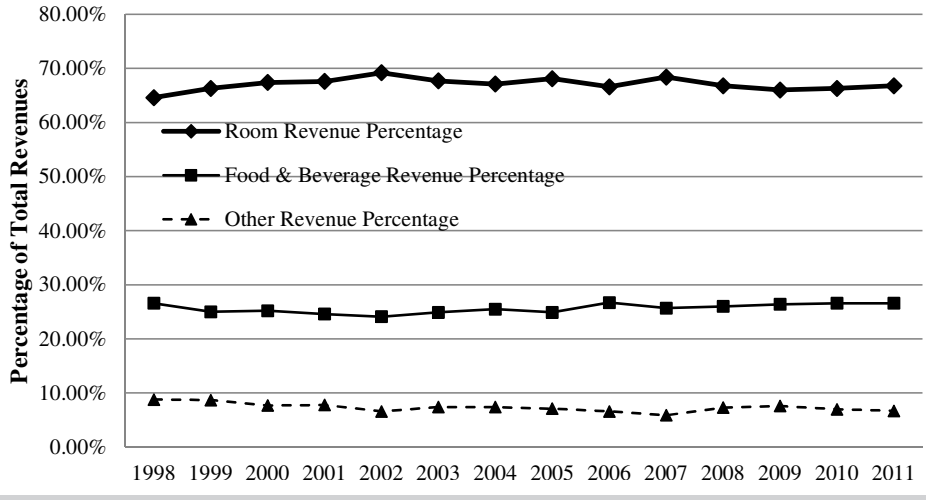
Appendix A

Variable	Description and Source of Data
Delinquency Rate (*DELINQ*)	Percentage of loans 30+ days delinquent or in foreclosure for hotels minus the percentage of loans 30+ days delinquent or in foreclosure for offices. Source: Trepp.
Difference in Standard Deviation (*DIFFSTDEV*)	The difference in the standard deviation of total returns on hotel real estate investment trusts (REITs) and office REITs. To calculate the standard deviation for each property type a rolling 12-month window is used on the total return series for a given REIT property type. $DIFFSTDEV = \sigma_{Hotel} - \sigma_{Office}$. Source: National Association of Real Estate Investment Trusts.[29]
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/).
Percentage Change (Growth Rate) in Total Employment (*EMPL*)	Percentage change in the number of employed persons from period to period. Source: U.S. Bureau of Labor Statistics (via http://www.economy.com/freelunch).

Variable	Description and Source of Data
Percentage Change in Forward Earnings per Share (*PCTEPS*)	$PctEPS = (EEPS_t / EEPS_{t-1}) - 1$. Where *EEPS* is forward earnings per share, analysts' *estimates* of earnings per share for the S&P 500. 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 (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 Global.
Hotel Demand Year-over-Year (*HOTDMDYR*)	Year-over-year percentage change in total hotel demand (all hotel classes). Source: STR Global.
CMBS Issuance Trailing 12 Months (*CMBSISSU*)	Trailing 12 months CMBS issuance. Source: CRE Finance Council, Compendium of Statistics[30] (original source of data is Commercial Mortgage Alert).
TERM	Term spread. The difference between the yield on a 10-year Treasury bond and the yield on a 3-month Treasury bill. Source: St. Louis Federal Reserve.

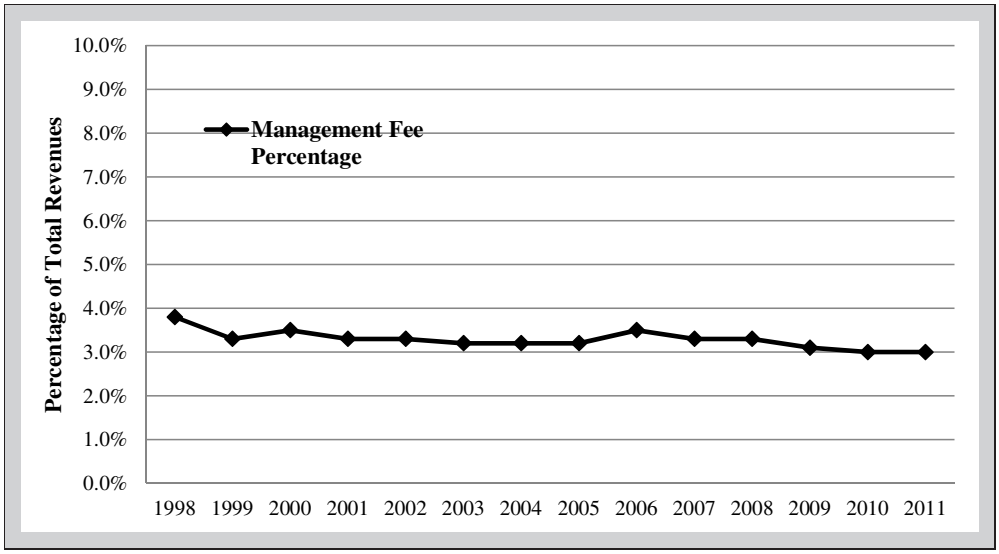
Appendix B

Exhibit B1 | Revenue Breakdown in Hotels



Source: Trends in the Hotel Industry. PKF Hospitality Research. San Francisco, CA.

Exhibit B2 | Management Fee as a Percentage of Total Revenues in Hotels



Source: Trends in the Hotel Industry. PKF Hospitality Research. San Francisco, CA.

Endnotes

[1] For example, Morgan and Ashcraft (2003) find that interest rate spreads on loans are very good predictors of future loan performance (loan default risk) and rating downgrades for banks. In other words, interest rate spreads are good forward-looking measures of risk. As a result of their findings, the authors propose that regulators should consider basing capital requirements on loan interest.

[2] Prior studies on credit spreads have focused on one of three issues: (1) the relation between the risk-free rate or its term structure and the credit spread; (2) the credit spread puzzle arising from the fact that the default risk is not as variable as the credit spread over time; and (3) do asset prices correctly reflect and in turn are impacted by fundamental economic factors. We focus on the latter issue in the current study.

[3] If two time series make relatively slow movements through time (a common feature for economic data), then a long time series (spanning many years) is needed before the true joint tendencies of the two variables can be measured reliably. Shiller (1989) stresses the argument that obtaining many observations by sampling frequently (say, through weekly or even daily observations) does not appreciably increase the power to measure the joint relationship between the two time series if the data span a total of only a few years.

[4] See also Li, Mooradian, and Yang (2009) and Chiang (2010).

[5] For a recent discussion of the importance of understanding real estate debt performance and delinquencies see, for example, Igan and Pinheiro (2010).

[6] Titman, Tompaidis, and Tsyplakov (2005) investigate what are the determinants of credit spreads for commercial mortgages. Credit spreads are defined as differences between mortgage rates and Treasury bond rates with the same maturities.

[7] Understanding variables that help predict loan performance is of broad interest to researchers and practitioners (Ding, Quercia, Li, and Ratcliffe, 2011).

[8] See Liu and Quan (2010) for a general discussion of factors driving the hotel investment discount rate.

[9] A percentage lease is a lease whose rental is based on a percentage of the monthly or annual gross sales made on the premises. Common types of percentage leases include a fixed minimum rent plus a percentage of the gross, a fixed minimum rent against a percentage of the gross, whichever is greater; and a fixed minimum rent plus a percentage of the gross, with a ceiling to the percentage rental among others.

[10] For example, Cushman and Wakefield (2008) 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.

[11] HVS finds that a strong correlation also exists between office supply and hotel supply.

[12] We use CoStar data from Smith Travel Research on occupied office space (square feet) and occupied hotel rooms to estimate quarterly ratio of occupied hotel rooms per 1,000 square feet of occupied office space for the 2007–2011 period. The average ratio is 0.42. The correlation between occupied office space and occupied hotel rooms is 0.98.

[13] See Gallagher and Mansour (2000) for a study of hotel real estate market.

[14] See Sivitanidou and Sivitanides (1997) for a more complete discussion of some of the potential fixed effects.

[15] According to Christopher Moyer at Cushman & Wakefield, the rate ranges are based on general rate indications from lenders for those asset classes, recent quotes, and closed transactions.

[16] Prior studies have also used SATO data that have not been normalized. For example, the ACLI data on loan commitments made by life insurers that Nothaft and Freund (2003) use in their study are also not standardized for changes in terms and maturities. We do not use the ACLI data in the current study since it is quarterly while the Cushman and Wakefield data are monthly. In addition, hotel loans are not necessarily made in each quarter by insurance companies. However, we do use the ACLI data to assess our combined data series (which we first convert to a quarterly series). Our overall data series for both office buildings and hotels is highly correlated with the data series from one source (ACLI). To account for possible LTV differences for the Cushman and Wakefield data, we also estimate all VARs and regressions with a control for LTV differences added to the models. The results (not reported for brevity) remain the same.

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

[18] In the few quarters where the interest rate information is not available for hotels, we use data from Trepp. We thank Jack Pong of Trepp for providing these data.

[19] Prior research indicates a connection between real estate *returns* and the macroeconomy [see Yunus (2012) for a recent study, and references therein]. 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.

[20] 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.

Exhibit 8 | Time Series Regressions of Delinquency Rate

	DELINQ(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)
Intercept	−1.166 (−2.86)***	0.179 (0.99)	−1.368 (−3.00)***	0.124 (0.62)
DELINQ(*t*−1)	0.887 (10.04)***	0.886 (9.56)***	0.881 (9.84)***	0.870 (9.15)***
DELINQ(*t*−2)	−0.091 (−1.05)	0.014 (0.15)	−0.083 (−0.95)	0.010 (0.11)
RISKDIFF(−6)[a]	1.362 (2.25)**	0.917 (1.73)*	1.463 (2.37)**	0.955 (1.73)*
RISKDIFF(−7)	−0.621 (−0.83)	−0.225 (−0.30)	−0.736 (−0.96)	−0.117 (−0.15)
RISKDIFF(−8)	−0.667 (−1.08)	−0.404 (−0.66)	−0.954 (−1.43)	−0.394 (−0.61)
DIFFSTDEV(−4)[a]	0.077 (1.74)*		0.082 (1.80)*	
DIFFSTDEV(−5)	−0.097 (−1.62)		−0.094 (−1.55)	
DIFFSTDEV(−6)	0.129 (2.76)***		0.127 (2.69)***	
DIFFSTDEV(−6)[a]		0.139 (2.90)***		0.133 (2.72)***
DIFFSTDEV(−7)		0.013 (0.20)		0.015 (0.24)
DIFFSTDEV(−8)		−0.107 (−2.23)**		−0.101 (−2.02)**
UNEMPL(−8)[a]	0.883 (2.20)**		0.888 (2.19)**	
UNEMPL(−9)	−0.057 (−0.11)		−0.042 (−0.08)	
UNEMPL(−10)	−0.533 (−1.35)		−0.476 (−1.18)	
EMPL(−9)[a]		−101.33 (−1.89)*		−104.20 (−1.88)*
EMPL(−10)		−20.44 (−0.35)		−14.45 (−0.24)
EMPL(−11)		−31.43 (−0.49)		−37.04 (−0.56)
PCTEPS(−2)[a]			−0.489 (−0.21)	1.830 (0.83)
PCTEPS(−3)			−2.015 (−0.84)	0.536 (0.24)

Exhibit 8 | (continued)

Time Series Regressions of Delinquency Rate

	DELINQ(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)	*DELINQ*(*t*)
PCTEPS(−4)			−2.120	0.009
			(−0.92)	(0.00)
TERM(−5)[a]	0.199	−0.031	0.206	−0.021
	(0.90)	(−0.14)	(0.93)	(−0.09)
TERM(−6)	−0.216	−0.146	−0.187	−0.153
	(−0.63)	(−0.43)	(−0.54)	(−0.44)
TERM(−7)	−0.047	0.126	−0.086	0.115
	(−0.21)	(0.58)	(−0.37)	(0.52)
SHIFT	−0.281	0.024	−0.459	0.061
	(−1.39)	(0.16)	(−1.71)*	(0.38)
Durbin-Watson	1.93	1.89	1.91	1.89

Notes: The table shows time series regressions of relative delinquency rate, *DELINQ*, on several predictors: the differential risk premium (*RISKDIFF*), difference in standard deviations (*DIFSTDEV*), unemployment rate (*UNEMPL*), percentage change (growth rate) in total employment (*EMPL*), percentage change in forward earnings per share (*PCTEPS*), and term spread (*TERM*). The *SHIFT* variable captures the shift in the data from Lehman to Cushman Wakefield Sonnenblick-Goldman. Lagged values of the dependent and independent variables are included to control for serial correlation the data. *t*-statistics are shown in parentheses below the coefficient estimates.

[a]Variable of interest.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

[21] Wheaton and Rossoff (1998) use GDP as their primary demand instrument. We do not use GDP in our study since it is not forward looking. Besides this, GDP is published quarterly and revised monthly.

[22] The authors use noncallable, non-puttble debt of industrial firms in contrast to our study wherein mortgages contain both a call and a put option. Further, the finding by DeLisle, Price, and Sirmans (2013) that systematic volatility is not priced in the cross-section of equity REIT returns, but idiosyncratic volatility is priced, warrants our investigation of the role of standard deviation.

[23] Availability of capital through the CMBS market may impact lending rates (Nothaft and Freund, 2003).

[24] To check the robustness of our results to the unemployment shock, we estimate the same system but replace the unemployment variable with the employment variable (percentage change in total employment). We find that our results are robust to this change. We also perform another set of robustness checks for *all* VARs reported in the paper. To account for variation in the term structure, we include a term spread—the difference between

the yield on a 10-year Treasury and the yield on a 3-month Treasury—in all estimated VARs. The results and conclusions (not reported for brevity) remain unchanged.

[25] To account for the fact that our data uses series from both Lehman Brothers and Cushman Wakefield Sonnenblick-Goldman, we also estimate the three regressions reported in this section and all regressions reported in Exhibit 7 in a model that includes a shift variable. The results (not reported for brevity) remain the same.

[26] We use our full sample of monthly data from July 1998 through March 2011 to estimate the system. We also estimate the system with a term spread, which is an endogenous variable to account for the variation in the term structure; the results (not reported for brevity) are unchanged from the results discussed in this section.

[27] The lag structure for the explanatory variables is suggested by the results of the VAR analysis, after considering the significance levels in the impulse response functions.

[28] Exhibit 8 reports estimates for the same models as in Exhibit 7, but with the term spread variable added to account for variation in the term structure, and a shift variable added to account for the shift in the data from Lehman Brothers to Cushman Wakefield Sonnenblick-Goldman. The results are unchanged from those reported in Exhibit 7.

[29] http://www.reit.com/IndustryDataPerformance/IndustryDataPerformance.aspx.

[30] http://www.crefc.org/uploadedFiles/CMSA_Site_Home/Industry_Resources/Research/Industry_Statistics/CMSA_Compendium.pdf.

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We wish to thank Jack Pong of Trepp for data on the monthly delinquency rates for office and hotel properties, Peng (Peter) Liu for the spread at time of origination data, Jack Corgel, and participants of the American Real Estate and Urban Economics Association (AREUEA) 48th Annual Conference in San Diego for helpful discussions. We also thank Ko Wang (editor) and three anonymous reviewers for their constructive comments and suggestions that improved the quality of the paper.

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