Real Estate Market Fundamentals and Asset Pricing

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In the last year we have heard much discussion of a disconnect between the commercial real estate capital and space markets. We see declines in the cap rates (yields) of property transactions, while a weakened economy has generated deteriorating real estate market fundamentals (Gordon [2003]; Kaiser [2003]).

Corcoran and Iwai [2003] argue that such a pattern could be just what an efficient asset market should produce if the space market is always mean-reverting. If fundamentals are temporarily depressed, an efficient market will keep prices firm and hence produce lower cap rates—in anticipation of a recovery. If the space market is strong, cap rates should fall in anticipation of eventual new supply and market softening.

Our objective in this discussion is an econometric examination of the historical movements in office space market fundamentals (vacancy and rental rates) in order to compare them with a similar history of office market capital movements (prices and yields). This comparison supports three conclusions:

1. In examining how market fundamentals influence asset pricing, it is crucial to control for interest rates. In fact, a better way to measure how the asset market views the space market is to look at real estate spreads over Treasuries.
2. The behavior of both spreads and cap rates—controlling for interest rates—suggests that the real estate asset market does not look forward, but rather looks myopically at current conditions.

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Instead of finding low cap rates during market downturns, we find strong evidence that they rise—or that spreads widen.

3. There is little evidence to suggest that this pattern has changed recently, or that the real estate asset market has become more efficient.

To understand the recent developments in real estate markets, it must be remembered that cap rate levels and movements are determined by both space market fundamentals and broader capital market forces (Sivitanidou and Sivitanides [1999]; Sivitanides et al. [2001]). Since these two sets of forces may exert different pressures on cap rates, the direction of cap rate movements in any particular period must be interpreted as the net effect of these opposing pressures.

In past recessions, interest rates have been high. Together with widening spreads, this has raised cap rates and lowered values. In the current recession, however, interest rates have reached record lows. Together with widening spreads, this has led to stable or even declining cap rates—the original puzzle that several articles in this issue seek to address.

We review long-term trends in office market fundamentals—vacancies and market rents—and examine the associated behavior of privately held property incomes and values and cap rates. We also examine long- and short-term trends in cap rate spreads to see if they tell a different story from cap rate levels. Our empirical methodology involves the estimation of panel-based models of office capitalization rates and spreads.

BEHAVIOR OF OFFICE SPACE MARKET FUNDAMENTALS

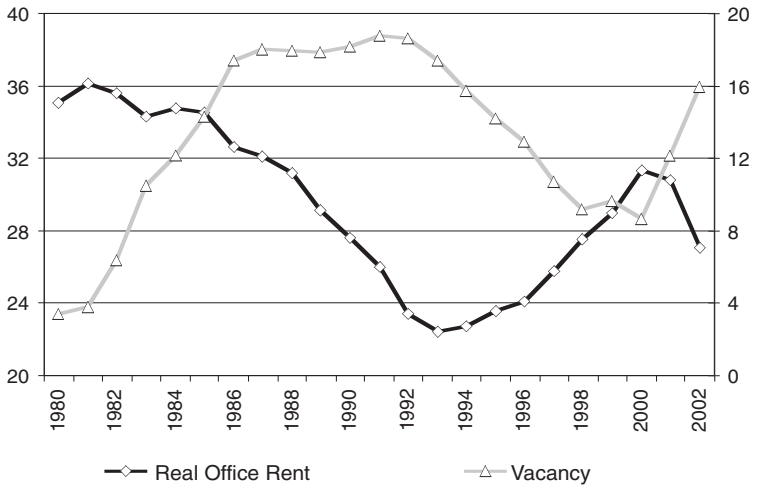
During the last 15 years, studies of office market behavior have established how slowly real estate markets adjust toward equilibrium (Wheaton [1987]; Sivitanides [1997]; Sivitanidou [2002]). It takes only one look at the historical movements in the national office vacancy rate over the past 23 years to realize how extremely long the last vacancy cycle was: 20 years (*Exhibit 1*).

The national office vacancy rate bottomed out most recently in 2000, just before the burst of the dot-com bubble and the beginning of the current recession. The bottom in 2000 ended a vacancy spike that had started exactly 20 years earlier, in 1980, as the market bottomed out just below 4%. After that it took the market 11 years to reach a peak and another 9 years to return to a trough.

After it bottomed out in 1980, the vacancy rate climbed quite rapidly. By 1986 it had reached nearly the 18% mark, but it did not stop there. It continued creeping slowly upward for another five years, hitting its peak at about 19% in 1991, when the economy took a downturn. What turned out to be a relatively mild recession for the economy proved to be the ultimate collapse for

EXHIBIT 1

Historical Behavior of Office Market Fundamentals



Weighted aggregates for 53 office markets covered by CBRE/Torto Wheaton Research.
Source: CBRE/TWR.

the nation's office market, as cash flows plummeted and the holdings of institutional investors were hit with deep write-downs.

After the market crash of 1991, office construction reached a virtual halt as the traditional sources of construction financing dried up. This helped the national office vacancy rate to start a long and uninterrupted descent that by 2000 had brought it to almost 8%, ending the cycle that had started 20 years earlier. With the 2001 recession and an unprecedented collapse of office net absorption, vacancy rates took an abrupt turn and staged a nearly vertical ascent, climbing to 16% by the end of 2002.

To measure office rental rates, we have constructed an index of actual signed leases for comparable space and then expressed it in 2002 (constant) dollars. Interestingly, office rental rates exhibit, if anything, a slight long-term downward trend—when converted to constant dollars. Thus they seem to provide at least a partial long-term hedge against an economywide inflation. Rental rates also move almost inversely with office vacancy. Finally, their pattern is again one of extremely slow and predictable movements. Of particular interest is the recent sharp drop in rents, as vacancies have suddenly increased.

Historical trends of office market fundamentals point basically to three clear patterns of behavior: a high degree of (positive) autocorrelation or sluggishness of market adjustment; strong behavioral relationships between rent and vacancy; and a pronounced mean-reverting behavior. Real estate market fundamentals are quite predictable, and intrinsically behave differently from the largely random movements of interest rates or stock prices in the broader capital markets.

Long-Term Trends in Office Property Income and Values

Movements in market rents and occupancy rates are not instantaneously reflected in the movements of property income because of long-term leases, particularly in office properties. Large office buildings have many tenants, each with a fixed rental contract. This creates a staggered pattern of renewals and hence exposure to market rent. With such contracts, property net operating income (NOI) tends to be somewhat smoother than market rent.

To convert property income into value, in the private real estate market, properties are periodically appraised, which results in an estimate of property value (P). The ratio of a property's NOI over this value is the capitalization rate (C):[1]

$$C = NOI/P \tag{1}$$

Capitalization rates represent required income returns by investors purchasing real estate. Empirical studies of historical movements in these rates have shown that they are influenced not only by real estate market fundamentals, but also by broader capital market forces (Sivitanidou and Sivitanides [1999]; Sivitanides et al. [2001]).

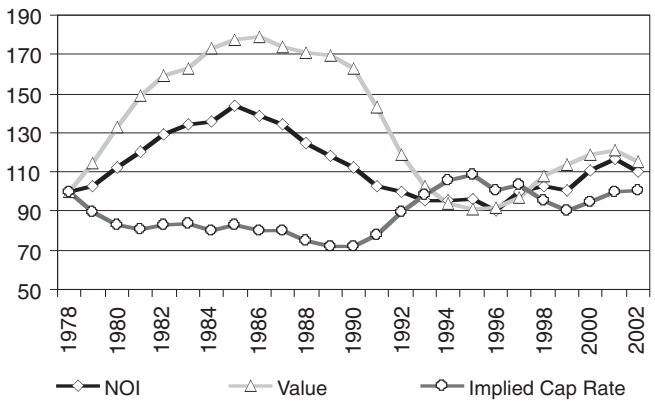
These dynamics are apparent in cash flow, cap rate, and value indexes, constructed on the basis of property-specific data for investment-grade office buildings from the National Council of Real Estate Investment Fiduciaries (NCREIF), as portrayed in Exhibit 2. As might be expected, office property cash flows and values at least partially mirror some of the space market movements shown in Exhibit 1. The linkage between the two, however, reflects both the lags caused by lease structures and the slow adjustment of private market (appraised) values to changes in market fundamentals.

Both NOI and property values rose during the first half of the 1980s, although market rents and occupancies peaked a couple of years earlier. During this period, values climbed faster than NOI, thus reducing cap rates as investors apparently felt that current income growth would continue. By 1986, NOI and values began following the downturn in space market rents and occupancies.

With the 1991 recession, the decline in values accelerated, and a recovery did not begin until 1997—several years after rents and occupancy began to recover. This

EXHIBIT 2

Historical Behavior of NOI, Cap Rates, and Values for Office Properties



Source: NCREIF, TWR.

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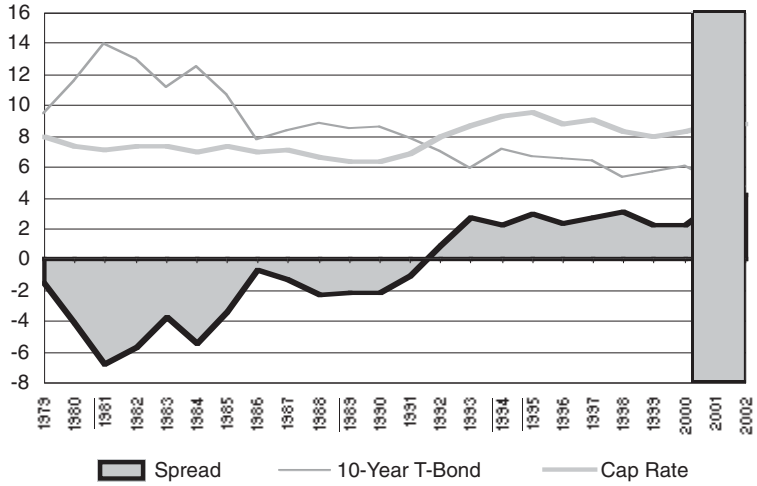
EXHIBIT 3
Movements in Cap Rate-Interest Rate Spread



Source: NCREIF, TWR, Economy.Com.

recovery was quite gradual in the late 1990s, when NOI and value again moved closely together. Values and incomes have not yet reflected the sharp downturn in rents of the past 24 months.

A problem with the trends presented in Exhibit 2 is that it is difficult to factor in the role that interest rates might play in explaining the movements in cap rates and values. Nominal rates (ten-year Treasuries) have ranged from 14% to 5% over this period, and inflation-adjusted real interest rates have moved from 6% to –2%. To better factor in the role of interest rates, it is useful to construct a spread measure of office property yields: the cap rate minus ten-year Treasuries.

Long-Term Trends in Office Property Cap Rate Spreads

The spread between an asset's income return and the risk-free rate (such as ten-year Treasuries) is widely felt to reflect two factors: 1) investor expectations of longer-term property *income growth*, and 2) the *risk or uncertainty* in that income stream. Thus, it is the best measure of how investors are viewing the likely movement of fundamentals in the office space market.

Office cap rate spreads have undergone two major trends over the last 20 years (*Exhibit 3*). The first pattern is almost 12 years of negative spreads, from 1979 through 1991. During this period, interest rates were high (because of inflation), but were steadily declining (as the inflation of the 1970s gradually ebbed). Also during this period, nominal rents (unadjusted for inflation) were rising between 2% and 10% annually, even as real rents were gradually declining. Income and value also were rising at between 5% and 10% annually—at least until 1986. The nominal growth in market fundamentals clearly gave real estate a large advantage over fixed-income assets.

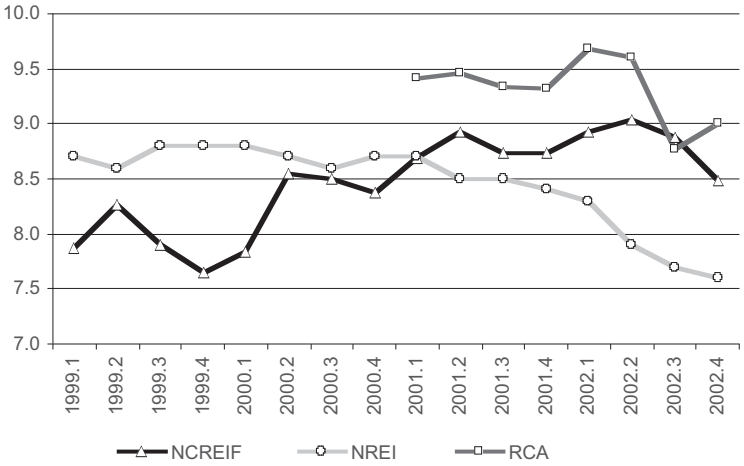
Much of the economy also experienced inflation between 1979 and 1991. Real estate is generally regarded as at least a partial hedge against inflation—certainly in comparison to any fixed-income asset. Thus during periods of high inflation and uncertainty as to the level of inflation, investors are well-advised to move assets into hedges such as real estate.

The negative spread throughout the 1980s then completely reversed itself between 1992 and 2002, becoming positive and ranging between 200 and 400 basis points. Again, this is consistent with a sharp change in office property market fundamentals. Office rents remained low and did not begin to rise substantially until 1997. Lagging somewhat behind, NOI was at historic low levels from 1992 through 1999 until it finally began its rise.

Thus, accounting for a slight lag, it does seem that investors began to believe the depressed market conditions during much of this period would continue into the future. In the 1990s, moreover, most economists came to agree that inflation was finally tamed. This reduction in inflation did eliminate one of the main investing advantages of real estate assets. This again is consistent with the

EXHIBIT 4

Recent Developments in Office Cap Rates



Source: NCREIF, NREI, Real Capital Analytics.

emergence of a significant positive spread during the 1990s between real estate cap rates and Treasuries.

Equally interesting is the further increase in spreads over the last two years. From 2000 to 2002 spreads have risen from about 230 to 400 bp. It is just during these last two years that the space market has been severely hit with rising vacancies and falling rents. Clearly, investors seem to have become more concerned about the future prospects for income growth, given the current recession in the market.

Thus throughout the last 23 years, the movements in office property spreads have been *completely consistent with investment theory*. In particular, the movements line up with both changes in office market fundamentals and the broader inflation-hedging advantages of real estate.

Have Office Cap Rate Levels Come Down Recently?

The most recent movements in cap rates are not as clear as the longer-term trends. Exhibit 4 depicts quarterly cap rates over the last three years from three different sources. In addition to the appraisal data from NCREIF, we show series from the National Real Estate Index (NREI) and Real Capital Analytics (RCA). Both these sources record and survey recently published sales transactions.

The NCREIF series has the advantage of referring to a common set of properties over time—as opposed to whatever the current mix of transactions happens to be (in the NREI and RCA series). The latter two, however, base their value estimates on actual transaction prices rather than appraised values.

In Exhibit 4, both the NREI and RCA series suggest that over the last two years cap rates have dropped 50 to 100 bp. The NCREIF series, however, shows no clear trend. We might imagine that the NCREIF series lags the transaction data by a year, but it would be premature to draw this conclusion with any certainty. Thus, if there has been a drop in cap rates, it is rather small—particularly in comparison to the much sharper decline in treasury bond rates. *This* is what explains the recent rise in spreads shown in Exhibit 3.

EMPIRICAL SPECIFICATION

This historical review of the office market suggests the need for an empirical study to examine three questions. First, do real estate cap rates and even spreads move with interest rates? Second, do space market fundamentals have an effect on the cap rate-interest rate spread that is forward- or backward-looking? Are spreads high or low when markets are currently weak? Third, was there a structural shift in the effect of space market fundamentals on the cap rate spread in 2001 and 2002 that might reflect changes in investor preferences or views?[2]

To answer these questions, we use a panel data approach for the greatest number of observations and the richest data. We use NCREIF data on metropolitan-spe-

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cific appraisal-based office cap rates for 12 markets from 1987 through 2002. Cap rates are calculated using NCREIF data on appraised values and NOI.

We choose this database for two reasons. First, both the value and the income data that underlie the cap rate calculations are consistent on a property-specific basis. Second, it provides a sufficiently large sample of cross-sectional and time series observations to ensure robust estimation of the models. In all our empirical models we also include market-specific structural effects (dummy variables: D_j).

The NCREIF database actually includes quarterly information. The problem with quarterly data is that the source of appraisals in the fourth quarter is different from that in the other three. Following Chandrashekaran and Young [2000], we use annual data, where capitalization rates are calculated as the ratio of NOI over ending market value.

The influence of office market fundamentals is captured by two variables. The first variable is *RRI*, representing a real (constant dollar) rent index, constructed by dividing each period's real rent by *that market's* historical average. In effect, this variable eliminates rent differences across markets and indicates where each market is relative to its own cycle. The second variable is *DRRENT*, representing the percent change in the real rent index. These variables are intended to capture how investor expectations of cash flow growth and risk change through time.

Previous empirical work has shown that current or past values of space market indicators shape investor perceptions in a myopic fashion (Sivitanidou and Sivitanides [1999]; Sivitanides et al. [2001]). *Weak current* market conditions lead to *higher* cap rates as investors perceive either greater risk or slower cash flow growth continuing into the future. It could be argued that since markets appear to exhibit mean reversion, true forward-looking pricing would find cap rates lower rather than higher when space markets are weak.

The empirical specifications include the inflation rate (*INF*). As we noted earlier, the perception that real estate is a good inflation hedge tends to prompt investor interest during periods of high inflation, thereby exerting downward pressures on cap rates. Its effect on spreads is also bound to be negative as an inflation hedge has greater value only when there is considerable inflation.

The influence of the broader capital market is captured by using the real ten-year Treasury bond (*RTB*) as the risk-free rate. RTB is expected to have a positive effect on cap rate levels, since in a competitive capital market increases in the risk-free rate should raise required returns on all risky investments including real estate.

To best test our research questions, three models are estimated. In the first model, the cap rate level, ($C_{j,t}$), is the dependent variable; in the other two models, the cap rate spread, ($CS_{j,t}$), is the dependent variable. This cap rate spread is calculated as the cap rate minus the ten-year T-bond. Following Sivitanides et al. [2001], a log-linear specification is adopted for the cap rate model [as in Equation (2)] and a linear specification for the spread model [as in Equations (3) and (4)]. All variables are subscripted by time (t) and/or market (j):[3]

$$Log(C_{j,t}) = a_0 + a_1 log(C_{j,t-1}) + a_2 RRI_{j,t-1} + a_3 DRRENT_{j,t} + a_4 RTB_t + a_5 INFL_{t-1} + a_6 D_j \quad (2)$$

$$CS_{j,t} = b_0 + b_1 CS_{j,t-1} + b_2 RRI_{j,t-1} + b_3 DRRENT_{j,t} + b_4 INFL_t + b_5 D_j \quad (3)$$

$$CS_{j,t} = b_0 + b_1 CS_{j,t-1} + (b_2 + b_3\, DD_t)\, RRI_{j,t-1} + (b_4 + b_5\, DD_t)\, DRRENT_{j,t} + b_6 INFL_t + b_7 D_j \quad (4)$$

The statistical specifications described by (2)-(4) are estimated using the time series cross-section model discussed by Greene [1993]. This model corrects for cross-sectional correlation and groupwise heteroscedasticity, which are detected in the structure of the error term through appropriate Lagrange multiplier tests.[4] The correction for cross-section correlation is especially important because the capital markets are nationally integrated and thereby exert common influences on all metropolitan markets. In the absence of such correction, some independent variables may appear with the wrong sign.

EMPIRICAL RESULTS

We discuss results in terms of cap rates and spreads as well as shifts in the capital market environment.

Cap Rates

Do cap rates move with interest rates? The systematic effect of the real risk-free rate is clearly evidenced in the positive and statistically significant coefficient for the real ten-year Treasury bond rate in the estimation results presented in Exhibit 5. These results suggest that the recent declines in interest rates must have exerted significant downward pressures on cap rate levels.

EXHIBIT 5
Influences on Office Cap Rate Levels

Variable	Coefficient	t-Stat
Constant	1.047	8.1
LCAPL(1)	0.607	12.2
RRIL(1)	-0.219	-4.4
DRRENT	-0.003	-4.4
INFL(1)	-0.027	-3.9
RTB	0.022	2.1
MSA1	-0.008	-0.1
MSA2	0.732	1.2
MSA3	-0.030	-1.0
MSA4	-0.001	0.0
MSA5	-0.053	-1.0
MSA6	-0.057	-1.4
MSA7	-0.057	-2.3
MSA8	0.040	1.1
MSA9	-0.016	-0.7
MSA10	-0.039	-2.3
MSA11	0.049	1.3

Note: (1) indicates that the variable is lagged by one period.
Source: TWR.

EXHIBIT 6
Effect of Market Fundamentals on Office Cap Rate Spread

	Model II		Model III	
	Coefficient	t-Stat	Coefficient	t-Stat
Constant	4.308	8.63	4.864	10.127
SPREAD(1)	0.579	13.968	0.550	14.026
RRI(1)	-0.895	-2.119	-1.718	-3.694
DRRENT	-0.024	-5.068	-0.016	-3.429
INF	-0.832	-10.203	-0.775	-9.154
BRKRRIL			0.513	1.657
BRKDRR			-0.025	-1.171
MSA1	-0.070	-0.135	-0.110	-0.215
MSA2	-0.082	-0.451	-0.112	-0.618
MSA3	-0.246	-1.144	-0.252	-1.182
MSA4	0.073	0.264	0.016	0.061
MSA5	-0.304	-0.938	-0.400	-1.228
MSA6	-0.425	-1.716	-0.520	-2.125
MSA7	-0.416	-2.023	-0.448	-2.168
MSA8	0.364	1.136	0.384	1.182
MSA9	-0.133	-0.755	-0.165	-0.914
MSA10	-0.281	-2.217	-0.307	-2.169
MSA11	0.419	1.274	0.492	1.496

Source: TWR.

The estimation results also support the systematic influences of market fundamentals on cap rate movements. In particular, *RRI(1)*, *RRI* lagged by one period, and *DRRENT* have highly statistically significant effects, as well as the negative sign expected in the presence of myopic investor behavior. We have experimented with a wide range of lags and tests, and it is always current or recent market fundamentals that negatively influence cap rates. There is no evidence that cap rates anticipate market fundamentals or predict future investment performance (Sivitanidou and Sivitanides [1999]).

Inflation, represented by *INF(1),* has the expected negative effect and is also highly significant statistically. This confirms that a high-inflation environment does indeed generate strong downward pressures on cap rate levels.

Spreads

Estimation of the first model shows that the recent decline of interest rates must have been pushing cap rates down. But have recent weak market fundamentals been pushing spreads up at the same time, as investors have demanded a greater risk premium?

The results of Model II [Equation (3)], presented in Exhibit 6, provide strong evidence that over the last 15 years weak space market fundamentals have always generated strong upward pressures on the cap rate spread. This is evidenced in the highly statistically significant and negative coefficients of *RRI(1)*, the real rent index lagged by one period, and *DRRENT*, the percent change in the real rent index. These effects are consistent with our hypothesis that poor *current* market conditions translate into a higher risk premium, lowered growth expectations, and a higher cap rate-interest rate spread.

Inflation also appears to have a very strong effect on the cap rate-interest rate spread, just as expected. Higher economywide inflation can generate negative spreads as investors find the inflation-hedging advantages of real estate to be ever more important.

Is the Current Capital Market Environment Different?

Model III in Exhibit 6 [Equation (4)] tests for a potential shift in the impact of market fundamentals on the cap rate spread during 2001-2002, which might result if market pricing has become more efficient or if investors have changed the way they view real estate.[5] This is done by adding two more variables to Equation (3) to repre-

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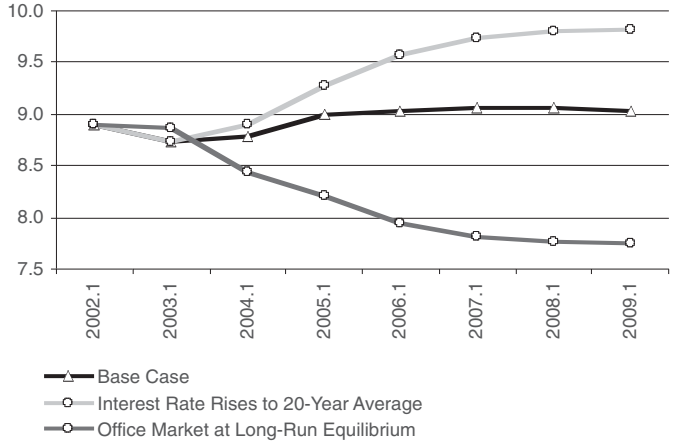
EXHIBIT 7
Alternative Scenarios for Future Office Cap Rates



Source: TWR.

sent the interactive terms of *RRI(1)* and *DRRENT* in Equation (4): *BRKRRIL* and *BRKDRR*.[6]

The point estimate of *BRKRRIL* suggests that the negative impact of the market rent index (representing stage of cycle) might have abated a bit over the last two years, but there is little significance to the result. The point estimate of *BRKDRR* has a contradictory impact, suggesting that rent growth recently has become more important (in its negative impact), but again this result has little significance either.

One would have to conclude from these tests that there has been little systematic change in the last few years—although of course the passage of time will create more opportunity to study this hypothesis with greater degrees of freedom.

CONCLUSIONS

There are at least two views about the current paradox of falling cap rates with weakening market fundamentals. The first view of Corcoran and Iwai [2003] suggests that this is a natural result of forward-looking asset market pricing. Our view is rather that one must factor in what is happening to interest rates, and hence it is better to examine the spread between real estate and Treasury bond yields. In this case, we find that asset pricing seems to be inefficient as weak current market fundamentals seem to generate wider real estate spreads.

In past recessions, interest rates have been high at the same time that market fundamentals weakened. This helped to generate a strong positive correlation between market fundamentals and real estate asset prices. The current paradox, if it is, really results from the unusual nature of the current economic weakness. U.S. monetary policy has generated a historic decline in both short- and long-term interest rates. The drop in cap rates, and firming of asset prices, seems clearly to be the result of this dramatic change. As in the past, spreads seem to be following a time-tested relationship that exhibits market inefficiency. It appears (this time) that the market is efficient only because of the unusual path that interest rates have followed.

Our results have some strong implications for the future. We predict that space market fundamentals are near their bottom, but it will take another two years before they start to recover. As economists, we have to believe interest rates will exhibit some tendency to mean-revert (they always have), and we believe a modest 200 basis point rise is reasonable (from 4% to 6% for the 20-year rate). Under this base case situation, our model suggests that cap rates should rise slightly (25 bp) and basically remain stable over the next six years (*Exhibit* 7). Asset prices would drop by more than this, however, as the reduced rents of the last several years are built into income streams.

In one alternative, if the space markets follow this same pattern, but interest rates simply move back to their 20-year average (7.5%), cap rates would increase more like 100 bp. On the other side of the risk spectrum, as a second alternative, we might ask what would happen if 1) there were a true shift in capital markets, and rates continued at their current historic lows for the next six years and 2) space market fundamentals instantly reverted to their long-run equilibrium levels (a stronger recovery

than we forecast). In this case, our model has cap rates dropping about 100 bp.

This range of outcomes is rather wide because going forward there must be some correlation between interest rates and the space market. Presumably, if interest rates move back up over the next three years, it will be because the economy recovers faster than we anticipate, so the forecast of fundamentals in the first line of Exhibit 7 will turn out to be pessimistic. Then again, it is doubtful we have truly entered the Magic Kingdom and that the Fed will allow rates to remain at record lows while an exuberant economy propels the space markets to a more speedy recovery.

ENDNOTES

[1]Cap rates represent the ratio of NOI/value, while yield is the ratio of cash flow/value. The difference between NOI and cash flow involves mainly capital expenditures.

[2]The interactive terms include the products of dummy variables that take the value of 1 in 2001 and 2002, and zero otherwise, and market fundamentals. Given that we expect a negative coefficient for market fundamentals, the correct sign for the interactive terms would be a positive one. Such a sign would be consistent with a diminished effect of market fundamentals on cap rates during those two years.

[3]Following Sivitanides et al. [2001], the first model specification is log-linear; the dependent and lagged-dependent variables are in logarithmic form, as this imposes the constraint that cap rates cannot become negative. The spread models are simple linear models. A log-linear specification for these models cannot be used because the dependent variable (the spread) takes negative values. Lagged values for dependent variables are included to account for smoothness in the series and to correct for autocorrelation.

[4]Cross-sectional correlation is present when disturbances are correlated across cross-section units. Heteroscedasticity is present when the disturbances do not all have the same variance. In the case of panel data, cross-sectional correlation and groupwise heteroscedasticity can be detected through appropriate Lagrange multiplier (LM) statistics as follows:

$$T\sum_{j=2}^{n}\sum_{i=1}^{j-1} r_{ji}^2$$

$$\frac{T}{2}\sum_{j}\left[\frac{s_j^2}{s^2}-1\right]^2$$

where T is the number of time periods; n is the total number of cross-sectional units included in the sample (markets in our case); r_{ji} is the ji-th residual correlation coefficient; s is the restricted maximum-likelihood estimator of common variance; and s_j is the variance estimate for each group (market). Both statistics follow a chi-squared distribution with $n - 1$ degrees of freedom.

[5]Limiting the test to 2002 would provide a considerably less robust test of this hypothesis because fewer observations would be available for estimation of the parameters of the relevant variables.

[6]*BRKRRIL* is equivalent to $DD_tRRI_{j,t-1}$, while *BRKDRR* is equivalent to $DD_tDRRENT_{j,t}$.

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