Some Thoughts on Real Estate Pricing

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This article focuses on two aspects of commercial real estate pricing. First, the spread between interest rates and commercial real estate pricing is dissected into its fundamental components. Although this spread is often cited as supporting an argument about how investors might consider tilting their portfolio allocations, as between bonds and commercial real estate, it is ultimately a comparison of two very different types of securities: The former represents a riskless, nominal-yield fixed-rate security, whereas the latter represents a risky, real-yield (provided real estate markets are operating at or near equilibrium) variable-rate security. The observed spread represents the market's consensus view on the future growth of real estate's (unlevered) cash flow less the differential in return premiums (i.e., real estate's expected real return less the fixed-income security's expected real return). Second, real estate pricing itself is examined. In the absence of shifting capitalization rates, real estate's (unlevered) cash-flow yield should equal the real estate market's real-return requirement grossed up for inflationary effects plus the uncompensated portion of inflationary growth in future cash flows (i.e., the extent to which the expected growth of real estate's [unlevered] cash flow lags the expected inflation rate).

The balance of this article addresses these concerns from a theoretical approach, leavened with empirical data to provide context for those theoretical assertions.

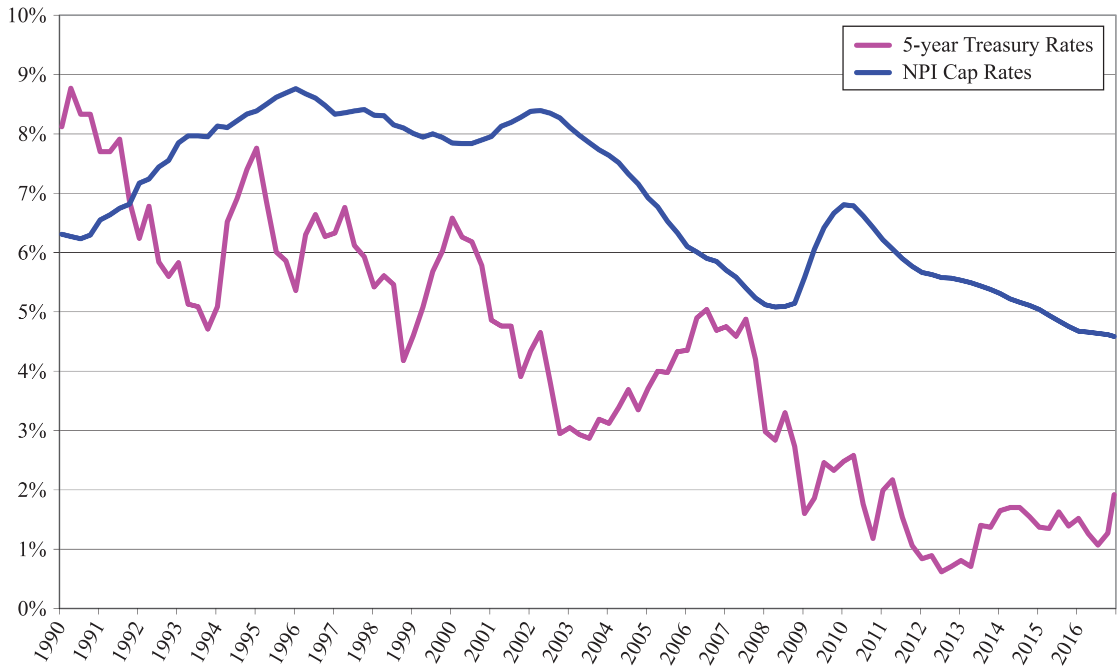
MISCONCEPTIONS IN RELATIVE PRICING

It is common practice to see a comparison of Treasury rates[1] to real estate's capitalization rates—similar to that shown in Exhibit 1, in which the interest rate on the five-year U.S. Treasury bond is compared to the capitalization rate on the National Council of Real Estate Investment Fiduciaries (NCREIF) Index. (For our purposes, the NCREIF capitalization rate is defined as the trailing four quarters of net operating income divided by the end-of-period market value.) Although this difference (or spread) is sometimes referred to as the *(real estate) equity premium*, this is not the case—as subsequent analysis will show.

A comparison such as in Exhibit 1 can give the misguided impression that interest rates and capitalization rates are inexorably linked.[2] There are two substantive problems with this perspective. First, this inexorable link is not necessarily the case; consider a longer perspective that, among other factors, incorporates a period of higher inflation rates (and higher volatility about the average inflation rate), as shown in Exhibit 2. When this longer perspective is considered, it is readily apparent that the market's consensus

EXHIBIT 1

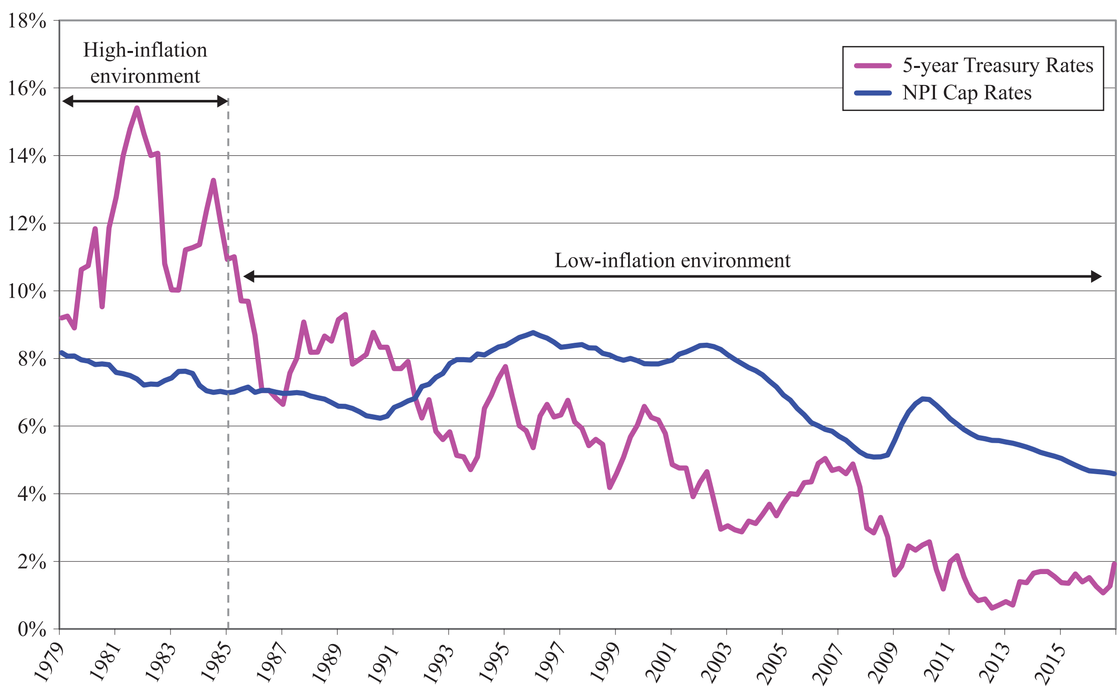
Comparison of Five-Year U.S. Treasury Rates to NCREIF Cap Rates for the Quarterly Periods 1990–2016



Sources: St. Louis Federal Reserve and NCREIF.

EXHIBIT 2

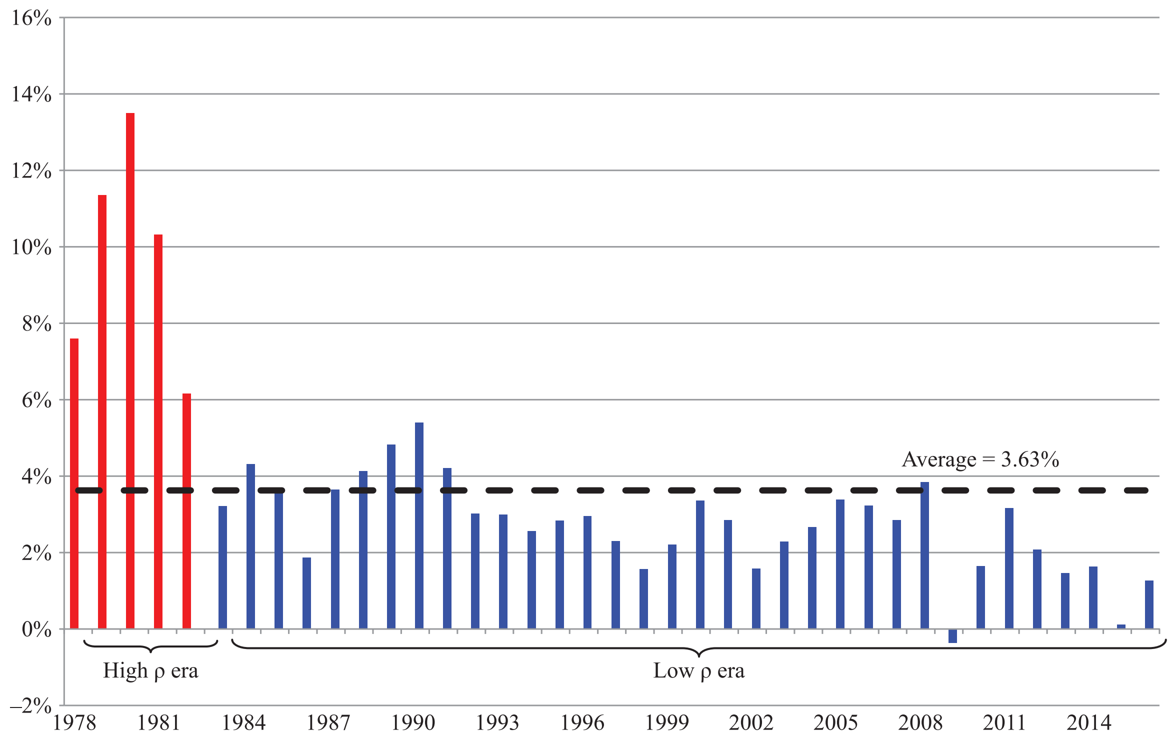
Comparison of Five-Year U.S. Treasury Rates to NCREIF Cap Rates for the Quarterly Periods 1979–2016



Sources: St. Louis Federal Reserve and NCREIF.

Exhibit 3

Annual Inflation Rates for the Period 1978–2016



Sources: Bureau of Labor Statistics and author's calculations.

anticipation of future inflation rates can have a substantial effect on the observed spread between Treasury interest rates and real estate's capitalization rates.

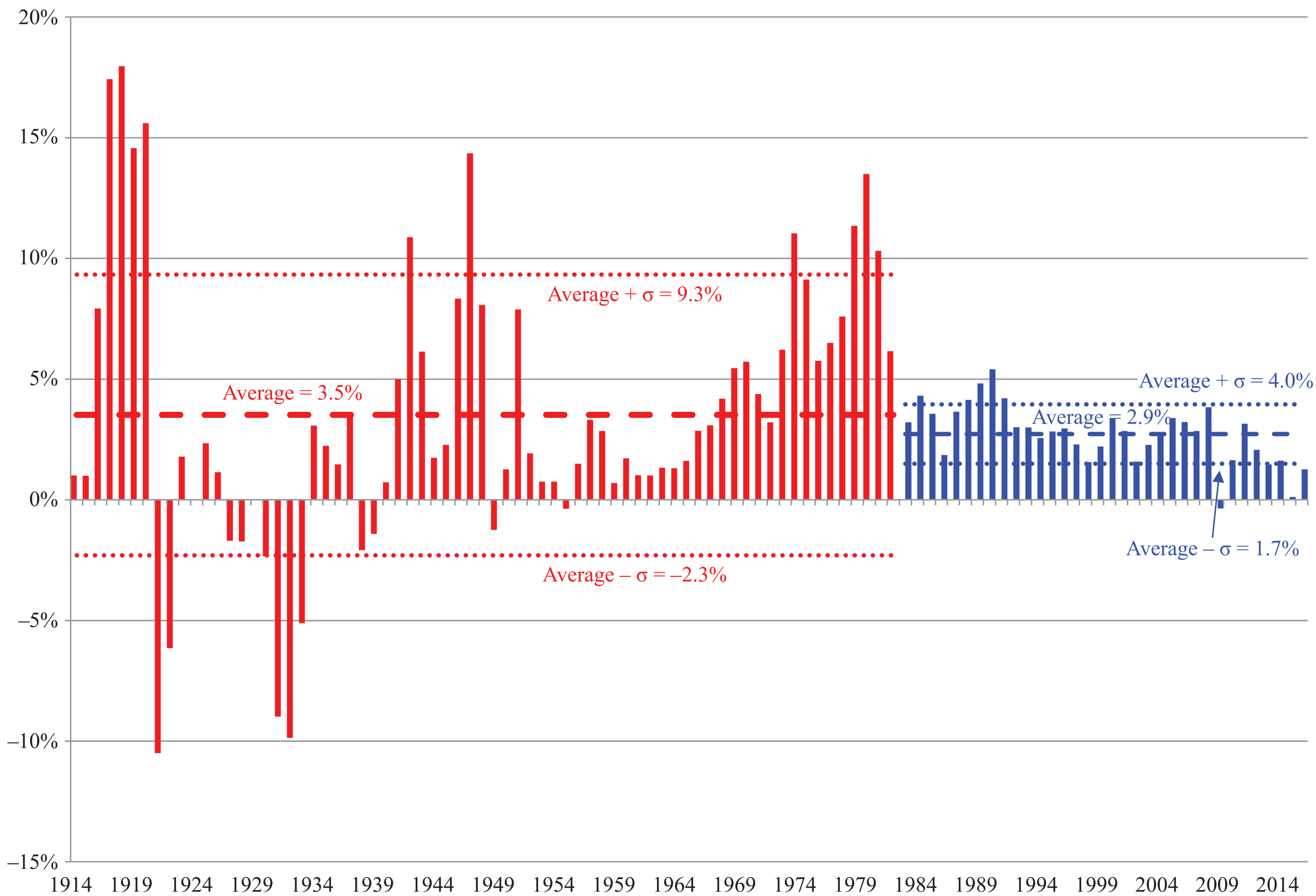
Given this longer perspective, it is apparent that there was an inflection point in the late 1980s/early 1990s with regard to long-term U.S. Treasury interest rates. With the benefit of hindsight, this inflection point seems to reflect the efforts of the Reagan administration and its central bankers, which were said to have "broken the back" of inflation (i.e., the previous administrations had witnessed double-digit inflation rates; see, e.g., Poole [2005]). Consider Exhibit 3, which illustrates the annual inflation rate (ρ)[3] realized over the history of the NCREIF Index.

Unsurprisingly, the bond market required persistent evidence of lower realized inflation rates before lower expected inflation rates were embedded in the bond market's consensus required return.[4] Consequently, the shorter-term perspective (e.g., that shown in Exhibit 1) on the spread between interest rates and capitalization rates is characteristic of a stable, low-inflation environment. Whether this is an accurate characterization of future market conditions, of course, remains to be seen. History, on the other hand, indicates a more volatile inflationary environment than that experienced since the mid-1980s—consider Exhibit 4, which displays realized inflation rates over the last century or so. The likely range of the pre-Reagan era (illustrated by the red bars) is about five times the size of the post-Reagan era (illustrated by the blue bars), defined as the era after 1982. The point to be made here is simply that the low inflation rates and the low volatility of those rates witnessed over the last 30 or so years is not evident in the preceding years.

Consequently, a robust analysis of the spread between the interest rates of bonds and the capitalization rates of real estate must consider the broader implications of anticipated future rates of inflation and the possibility that the economy may revert to higher levels of (realized and/or anticipated) inflation (along with greater uncertainty about the future rate of inflation). Given the (near) zero-interest-rate policy of the central banks

EXHIBIT 4

Annual Inflation Rates for the Period 1914–2016



Sources: Bureau of Labor Statistics and author's calculations.

in many developed countries, much concern about the role of monetary policy in the macro economy has been voiced (e.g., Ferguson [2008], Cochrane [2016], Gilder [2016], Hall [2016], and Diercks [2017]).

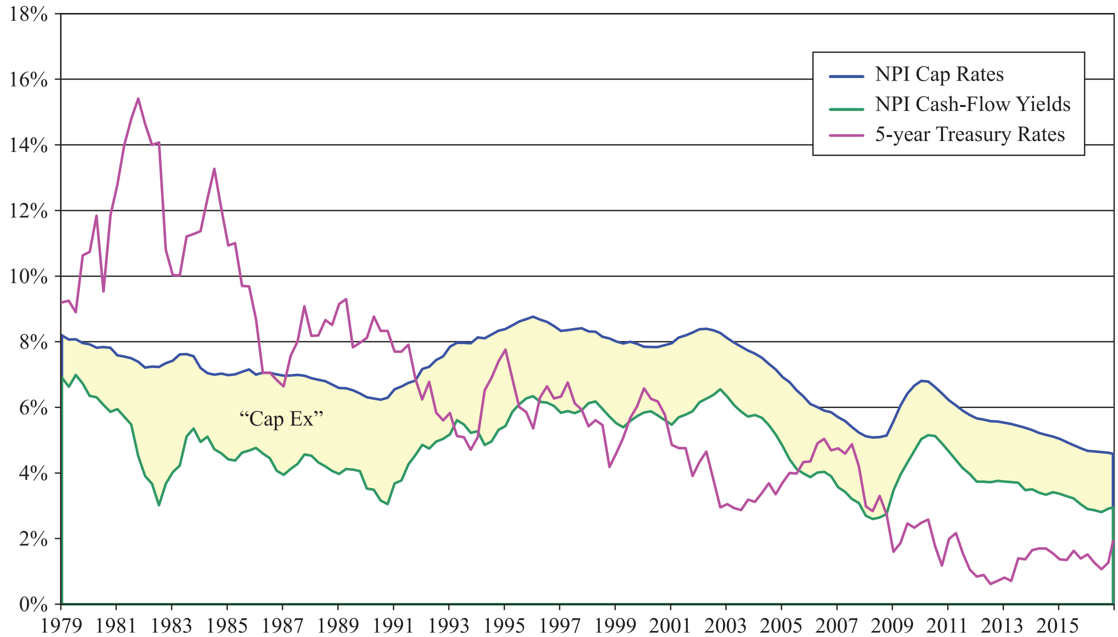
Second, the exhibits previously shown also suffer from using real estate's capitalization rate rather than its cash-flow yield. In other words, a fair-minded comparison of interest rates to real estate pricing should compare the cash-flow yield of the former to the cash-flow yield of the latter. As is seen in Exhibit 5, real estate's (unlevered) cash flow can be significantly less than its net operating income; the difference is attributable to capital expenditures (cap ex) for leasing commissions, tenant improvements, and other capital improvements.

Notice that the cash-flow yield averages approximately two-thirds of the capitalization rate over the history of the NCREIF Index and across the core property types that comprise it. Exhibit 6 provides another direct comparison of the fixed-income security's coupon yield to the real estate cash flow yield over the history of the NCREIF Index.

The vertical bars of Exhibit 6 measure the quarterly spread between the five-year Treasury rates and the NCREIF-implied cash-flow yields. The interpretation of these differences is to be explored in the next section. However, it is apparent from Exhibit 6 that no precise relationship exists between interest rates and capitalization rates (and/or cash-flow yields).[5] That is, we can observe instances of interest rates rising and capitalization rates rising and falling; similarly, we can observe instances of interest rates falling and capitalization rates falling and rising. This indeterminate relationship is also observed in the market for listed real estate investment trusts (REITs) (Giliberto and Schulman [2017]).

EXHIBIT 5

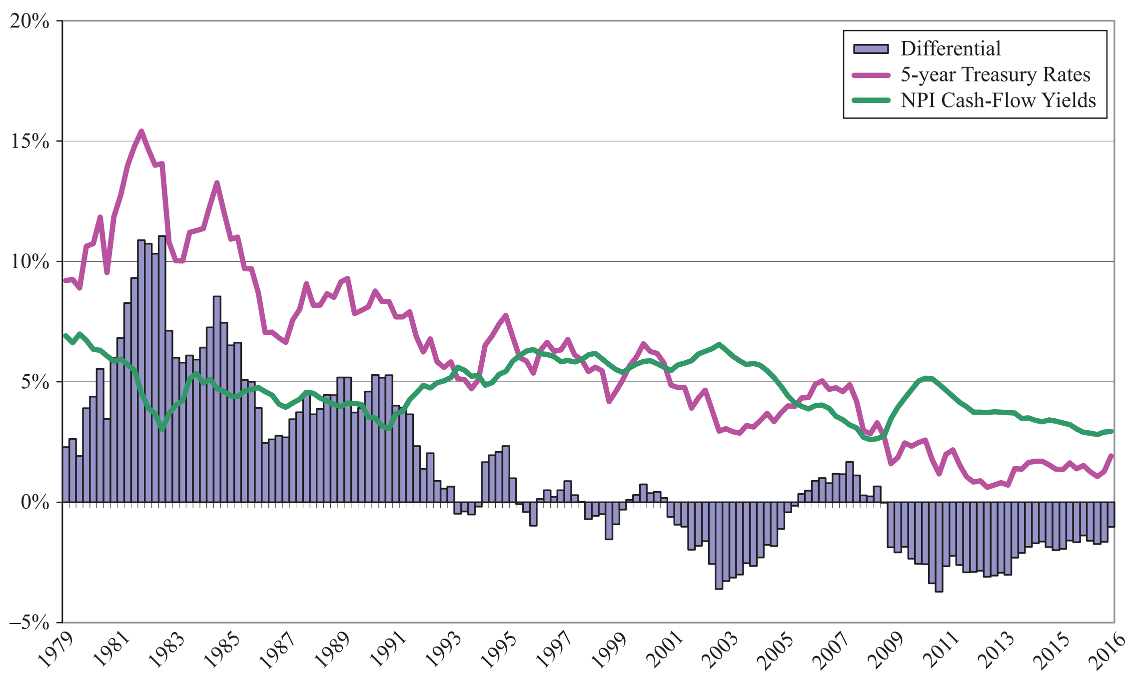
Comparison of Five-Year U.S. Treasury Rates to NCREIF Cap Rates and Cash-Flow Yields for the Quarterly Periods 1979–2016



Sources: St. Louis Federal Reserve, NCREIF and author's calculations.

EXHIBIT 6

Comparison of Five-Year U.S. Treasury Rates to NCREIF Cash-Flow Yields for the Quarterly Periods 1979–2016



Sources: St. Louis Federal Reserve, NCREIF and author's calculations.

Before moving on, a cautionary note is appropriate: Unlike the securitized market, reported market values in the unsecuritized market—for indexes such as NCREIF—are largely estimates, prepared by appraisers, of "true" prices. These appraised values are thought to (1) contain noise (or error), (2) lag the spot market (because appraisers, in part, examine past transactions of comparable properties to formulate an estimate of current market values), and (3) smooth the changes in estimated values over time (appraisers ideally use a Bayesian weighted average of contemporaneous information and historical appraised values to estimate current values). Although the first issue is generally believed to diversify away in large samples (such as the NCREIF Property Index [NPI]), the second two are believed to be persistent problems. In turn, these lagging appraised values also affect our estimates of the real estate's market capitalization rate. For an overview of the vast literature relating to appraisal lag (or smoothing), see Geltner, MacGregor, and Schwann [2003]. For the purposes of this article, we will assume that this appraisal noise is essentially eliminated in large samples and ignore the appraisal lag and smoothing because we are more concerned with a theoretical treatment of pricing issues.

A CONCEPTUAL EXAMINATION OF THE SPREAD

How can theory help shape our understanding of the spread identified in Exhibit 6? As noted earlier, these comparisons of bond yields and real estate's cash-flow yields contrast a riskless, nominal-yielding security (i.e., the long-term Treasury) with a risky, (essentially) real-yielding security (i.e., the dividend yield on the real estate investment).[6]

Given certain simplifying assumptions, the nominal return (k) on an investment is given by a restatement of Gordon's dividend discount model (DDM):

$$k = \frac{CF_1}{P_0} + g \qquad (1)$$

where CF_1 is the first period's cash flow, P_0 is the beginning-of-period price, and g is the periodic growth in cash flow. These simplifying assumptions include the absence of transaction costs, constant cash-flow growth rates, a growth rate that is less than the return on investment, and an infinite investment horizon or, alternatively, constant pricing multiples. It is also well known that the relationship between the nominal (k) and the real (r) rates of return can be expressed as follows:

$$k = (1+r)(1+\rho) - 1 \qquad (2)$$

So, let's examine the nature of the return-generating process for real estate (k_{RE}) by setting these first two equations equal to one another:

$$k_{RE} = \frac{CF_1}{P_0} + g = (1+r_{RE})(1+\rho) - 1 \qquad (3)$$

Let's also consider long-term bond returns (k_{Bds}) with constant interest rates[7] (as a special case of the DDM where the growth rate, g, equals zero):

$$k_{Bds} = \frac{i}{P_0} = (1+r_{Bds})(1+\rho) - 1 \qquad (4)$$

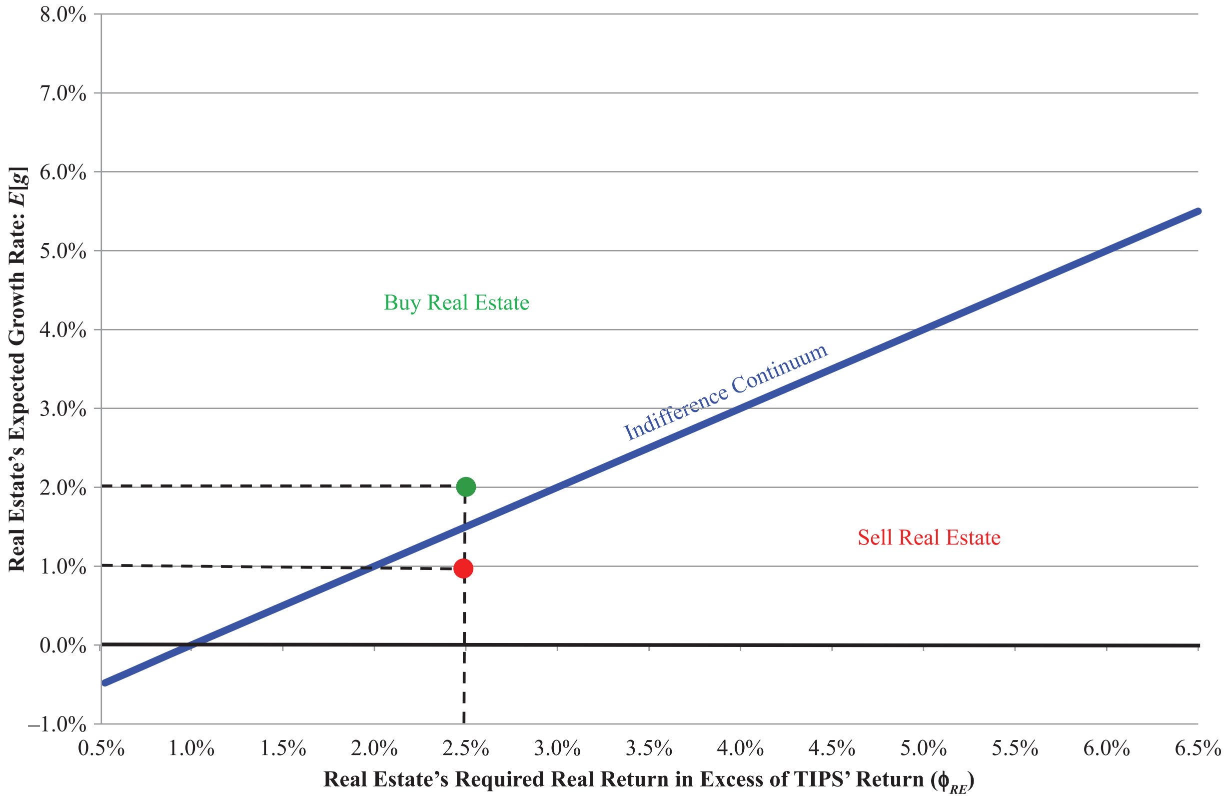
Now, let's use Equations (3) and (4) to theoretically examine the spread between the two observable measures: $\frac{i}{P_0} - \frac{CF_1}{P_0}$. Note that, given our simplifying assumptions, the observed Treasury yield equals its total return, and the observed real estate cash-flow yield is equal to its total return less the anticipated growth of future cash flows:

$$\begin{aligned}\frac{i}{P_0} - \frac{CF_1}{P_0} &= k_{Bds} - [k_{RE} - g] \\ &= [(1+r_{Bds})(1+\rho) - 1] - [(1+r_{RE})(1+\rho) - 1 - g] \\ &= [r_{Bds} + \rho + r_{Bds}(\rho)] - [r_{RE} + \rho + r_{RE}(\rho) - g] \\ &\approx [r_{Bds} + \rho] - [r_{RE} + \rho - g] \\ &= g - (r_{RE} - r_{Bds})\end{aligned} \qquad (5)$$

As is clear from this equation, the spread between Treasuries and real estate yields reflects the expected growth (g) in real estate's cash flow less the differences in their real-return requirements ($r_{RE} - r_{Bds}$).[8] In and of itself, this spread represents neither a signal about whether investors should tilt their investments toward real estate (and away from bonds) nor vice versa. (Note: There are other reasons—e.g., diversification benefits, liquidity, inflation-hedging characteristics, investor utility [or risk aversion], downside protection—why investors would continue to hold a portion of their

EXHIBIT 7

Illustration of Trade-Off between Real Estate's Expected Growth Rate vs. Return Premium Based on Observed Spread between Treasury Rates and Capitalization Rates



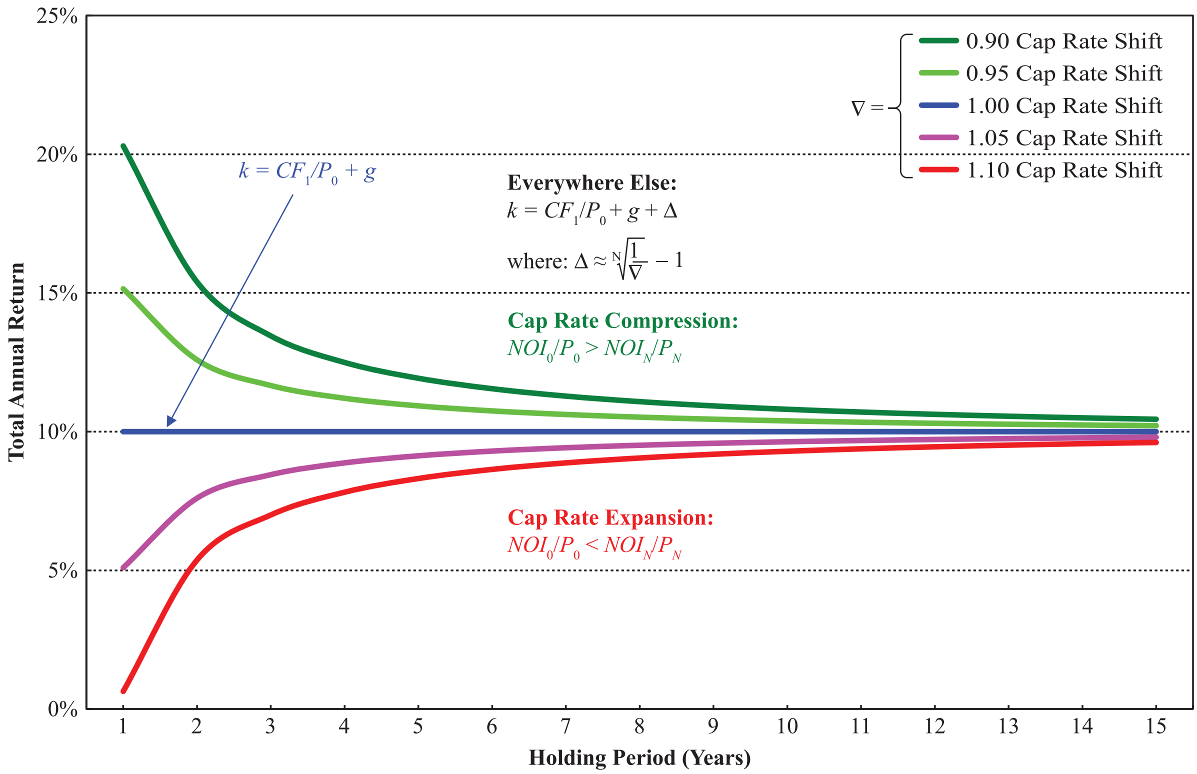
portfolios in bonds and/or real estate irrespective of the considerations provided in Equation (5).) Instead, and because the r_{Bds} is observable via the Treasury Inflation-Protected Securities (TIPS) market,[9] investors must formulate estimates of real estate's expected growth (g) and real-return requirements (r_{RE}) to make a judgment about tilting their portfolios one way or the other. Given estimates of observable market conditions $\left(\frac{i}{P_0} = 2.0\%, \frac{CF_1}{P_0} = 3.0\%, \text{ and } r_{Bds} = 0.5\%\right)$, these considerations are illustrated in Exhibit 7.

The solid blue line of Exhibit 7 illustrates the combinations of real estate's expected growth (g) and excess real-return requirement ($\phi_{RE} \equiv r_{RE} - r_{Bds}$), to which investors should be indifferent—given the observable market conditions—when considering tilting their portfolios toward or away from real estate. However, investors should tilt their portfolio allocations toward real estate and away from bonds if their beliefs about future market conditions result in a combination (of g and ϕ_{RE}) that lies above the solid blue line; conversely, investors should tilt their portfolio allocations toward bonds and away from real estate if their beliefs about future market conditions result in a combination that lies below this solid line. Continuing the illustration, the red and green icons in Exhibit 7 both represent instances in which investors require a real return on real estate that exceeds the real return on Treasury bonds by 2.5%. The green icon represents instances in which investors anticipate that real estate's future cash-flow growth will be 2% and the red icon represents instances in which investors anticipate real estate's future cash-flow growth will be 1%. In the former instance, investors should tilt their portfolio allocations toward real estate and away from bonds; in the latter, investors should tilt their portfolio allocations toward bonds and away from real estate.[10]

Finally, investors can use the current yield curve to derive expectations about future interest rates,

Exhibit 8

Total Annual Return Based on Various Capitalization Rate Shifts and Holding Periods



inflation rates, and/or real-return requirements. In this view—often referred to as the *expectations theory* (e.g., see Fama [1976, 1984, 1990] and Ang, Bekaert, and Wei [2008])—current long-term (nominal) interest rates can be viewed as the market's expectation about the future evolution of the short-term interest rate over time.[11] These forward rates can be used to inform investors' judgments about how they might calibrate forecasts of the components relating to the trade-offs between today's observed difference between bond yields and real estate's cash-flow yields.

A DIGRESSION: CHANGING CAPITALIZATION RATES AND OTHER VIOLATIONS OF THE DDM

The previous section made a number of simplifying assumptions regarding real estate's return-generating process. This section addresses these potential oversimplifications. To begin, let's expand Equation (1) to incorporate potential violations of the DDM (see Pagliari [1991]):

$$k = \frac{NOI_1}{P_0}(\bar{b}) + \lambda\rho + \Delta + \varepsilon \qquad (6)$$

where NOI_1 is the first period's net operating income, $\bar{b}$ is the dividend payout ratio (i.e., the conversion rate from net income to cash flow),[12] λ is the inflation pass-through rate (i.e., the ability of NOI to keep pace with inflation), Δ is the impact on return when the end-of-period capitalization rate differs from beginning-of-period capitalization rate, and ε is a catch-all error term.

Notice that the first two elements of the right-hand side of Equation (6) are merely restatements of the right-hand side of Equation (1): $\frac{CF_1}{P_0} = \frac{NOI_1(\bar{b})}{P_0}$ and $g = \lambda\rho$. However, the last two elements of the right-hand side of Equation (6) represent violations of the DDM. The last element, ε, represents an error term that captures a variety of violations of the DDM's underlying assumptions (e.g., certain nonlinearities, nonconstant dividend payout ratios, nonconstant growth rates[13]). However, it is generally the violation of constant

EXHIBIT 9

Annualized Components of Return by NPI Property Type for the Period 1978 through 2016

	Total		Office		Industrial		Retail	
	NPI (39 Years)	Apartment (39 Years)	CBD (39 Years)	Suburban (39 Years)	Warehouse (39 Years)	R&D/Flex (39 Years)	Shops (39 Years)	Malls (34 Years)
Components of Return:								
Initial Income Yield (NOI_1/P_0)	8.51%	8.46%	8.92%	8.53%	7.74%	8.93%	8.11%	7.76%
x Average Dividend Pay-out Ratio ($\bar{b}$)	67.1%	80.4%	64.0%	61.8%	68.5%	69.2%	74.6%	65.6%
= Dividend Yield (CF_1/P_0)	5.71%	6.80%	5.71%	5.27%	5.30%	6.17%	6.05%	5.09%
+ Earnings Growth (g)	2.42%	2.84%	2.29%	1.42%	2.98%	2.28%	2.22%	3.57%
= Fundamental Return ($CF_1/P_0 + g$)	8.13%	9.64%	7.99%	6.70%	8.28%	8.45%	8.26%	8.66%
+ Shift in Capitalization Rates (Δ)	0.54%	0.43%	0.83%	0.51%	0.41%	0.39%	0.36%	0.60%
+ Other Effects	0.62%	0.48%	0.89%	0.50%	1.08%	0.61%	0.82%	0.98%
= NCREIF Total Return – Nominal (k)	9.29%	10.55%	9.72%	7.71%	9.77%	9.44%	9.45%	10.23%
NCREIF Total Return – Real (r)	5.60%	6.83%	6.02%	4.08%	6.07%	5.76%	5.76%	7.34%
Inflationary Characteristics:								
Inflation (ρ)	3.49%	3.49%	3.49%	3.49%	3.49%	3.49%	3.49%	2.69%
NOI Inflation Pass-Thru Rate (λ)	69.5%	81.5%	65.5%	40.8%	85.4%	65.3%	63.5%	132.5%
Pricing Characteristics:								
Beginning Capitalization Rate (NOI_0/P_0)	8.19%	7.98%	8.71%	8.35%	7.42%	8.84%	7.94%	7.49%
Ending Capitalization Rate (NOI_N/P_N)	4.59%	4.48%	3.98%	4.96%	4.90%	5.50%	5.13%	4.31%
Risk Measure:								
Annual Volatility (σ)	7.62%	7.80%	11.45%	9.08%	7.38%	8.82%	6.17%	7.41%

Sources: NCREIF and author's calculations.

capitalization rates—as captured by Δ—that represents the largest impact on short-run returns. More specifically, the magnitude of Δ is an increasing function of ∇, the capitalization rate shift (i.e., the ratio of the ending capitalization rate to the beginning capitalization rate) and a decreasing function of N, the length of the holding period—as illustrated in Exhibit 8.

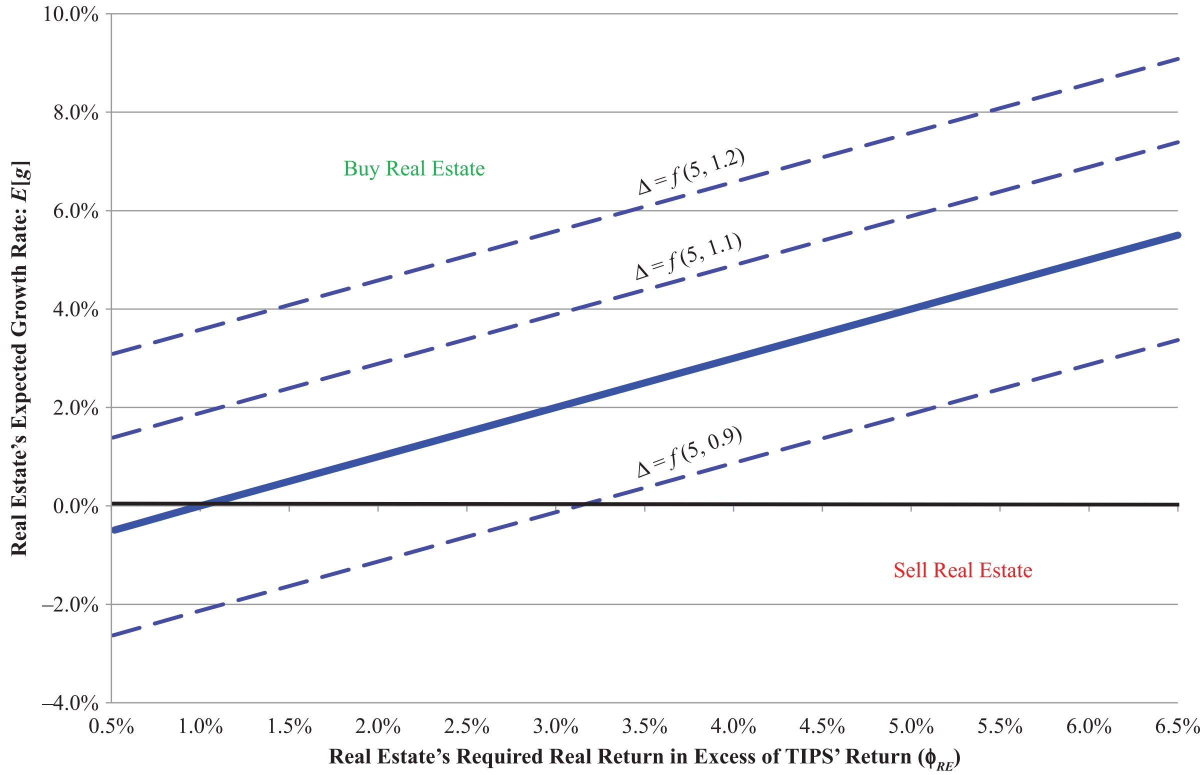
Exhibit 8 illustrates (unlevered) asset returns as a function of the capitalization rate shift and the holding period. As indicated earlier (see Equation (1)), when capitalization rates remain constant (i.e., when $\nabla = 1.0 \Rightarrow \Delta = 0$) the assumed asset-level return (10%)—provided the other simplifying assumptions of the DDM are also met—equals the sum of the assumed initial cash-flow yield (7%) and the assumed growth rate (3%), indicated by the blue line, irrespective of the holding period. However, a fall in capitalization rates—often described as *cap rate compression*—increases the return over what otherwise would have had been the case (i.e., when $\nabla < 1.0 \Rightarrow \Delta > 0$), as indicated by the green lines. Conversely, a rise in capitalization rates—often described as *cap rate expansion*—decreases the return (i.e., when $\nabla > 1.0 \Rightarrow \Delta < 0$), as indicated by the red lines. The impact of rising or falling capitalization rates is clearly a function of the holding period: Fairly short holding periods (say, less than five years) may produce significant effects, whereas fairly long holding periods (say, more than 10 years) produce largely muted effects. An approximation[14] of the impact of shifting capitalization rates is given by

$$\Delta \approx \sqrt[N]{\frac{1}{\nabla}} - 1 \qquad (7)$$

Exhibit 9 identifies the realized return-generating process for the NPI and several of its property subtypes over nearly four decades of the Index (Pagliari et al. [2001]). The long-term history of the NPI displays important information: The dividend payout ratio has averaged approximately two-thirds (i.e., for every three dollars of NOI, approximately two dollars is available as [preleverage] cash flow), and earnings (and/or cash flow) growth has averaged approximately 70% of the realized inflation rate. However, there is considerable variation

EXHIBIT 10

Illustration of Trade-Off between Real Estate's Expected Growth Rate vs. Return Premium Based on Observed Spread between Treasury Rates and Capitalization Rates



among the property subtypes. Moreover, the long-term nature of Exhibit 9 masks much of the short-term volatility in these return components—perhaps nowhere more pronounced than with regard to the impact on returns resulting from shifting capitalization rates.

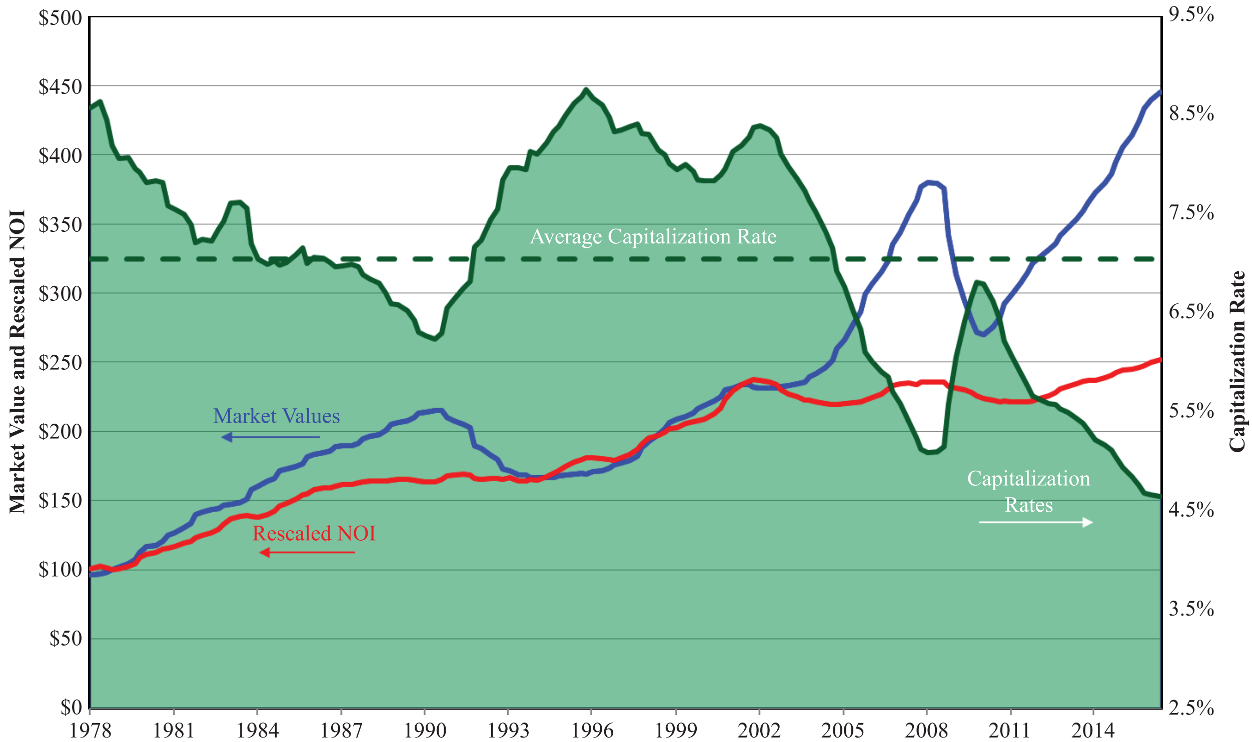
Finally, more complexity can be added to Exhibit 7 by including the effects of a potential shift in the current capitalization rate, as shown in Exhibit 10. If capitalization rates are expected to rise over the holding period, then investors must accept a lower excess real-return requirement (ϕ_{RE}) and/or forecast a higher growth rate (g) than would otherwise be the case in order to tilt their portfolios toward real estate and away from bonds. The magnitude of these potential changes is illustrated by the two dashed blue lines above the solid blue line. Merely as an illustration, the uppermost of these two lines represents the impact of capitalization rates increasing by 20% over a five-year holding period; the second of these two lines represents the impact of capitalization rates increasing by 10% (also over five years). Conversely, if capitalization rates are expected to fall over the investor's holding period, investors can accept a higher excess real-return requirement (ϕ_{RE}) and/or forecast a lower growth rate (g) than would otherwise be the case in order to tilt their portfolios toward real estate and away from bonds. The magnitude of these potential changes is represented by the dashed blue line below the solid blue line, which illustrates the impact of capitalization rates decreasing by 10% over a five-year holding period. There is, of course, a limitless set of potential combinations of ∇ and N.

HOW SHOULD CAPITALIZATION RATES BE DETERMINED?

If the spread between Treasuries and real estate yields reflects real estate's expected growth in cash flow (g) less the differences in their real-return requirements (ϕ_{RE}), this raises a question: How should real estate be priced? As MacKinnon [2016] noted, there is no such thing as a normal capitalization rate (i.e., there is no number to which they naturally revert); instead, such rates

Exhibit 11

NCREIF Index—Market Values, Rescaled NOI, and Capitalization Rates Based on a $100 Investment for the Period 1978 through 2016



Sources: NCREIF and author's calculations.

are a product of the then-current capital-market forces. Moreover, Cochrane [2011] argues that, whereas older research suggested that the bulk of variation in capital-asset prices was primarily due to time-varying differences in the expected cash flows, current research suggests that the variation is primarily due to the time-varying differences in the discount rates used to price capital assets. If accurate, and because prices vary more than incomes (e.g., see Exhibit 11), the unobserved variation in discount rates is partly reflected in the observable variation in capitalization rates (and/or cash-flow yields).

Again, let's begin by taking a simple (e.g., $\nabla = 1.0$) but theoretically sound approach, setting expanded versions of Equations (2) and (3) equal to one another and solving for the (forward) cash-flow yield (CF_1/P_0):

$$(1+r_{RE})(1+\rho)-1=\frac{CF_1}{P_0}+\lambda\rho$$

$$\frac{CF_1}{P_0}=r_{RE}(1+\rho)+\rho(1-\lambda) \qquad (8)$$

The left-hand side of the first line of Equation (8) can be thought of as the desired return on our real estate investments, and the right-hand side can be thought of as the way in which that return will be generated. The initial yield that satisfies both of these aspects has two components: (1) the real-return requirement grossed up for inflation [i.e., $r_{RE}(1 + \rho)$] and (2) the uncompensated portion[15] of inflation [i.e., $\rho(1 - \lambda)$].

In the special case of the real estate markets operating in equilibrium such that operating cash flows grow at the rate of inflation (i.e., $\lambda = 1 \Rightarrow g = \rho$), Equation (8) simplifies to

$$\frac{CF_0}{P_0}=r_{RE} \qquad (9)$$

Equation (9) tells us that, when the markets operate in equilibrium, the trailing cash-flow yield equals real estate's real return—regardless of the inflation rate[16] (and, again, making our earlier simplifying assumptions).[17] This definition of the equilibrium ($\lambda = 1$)

does not comport with the historical average ($\lambda \approx .7$); moreover, it can be argued that capital assets are generally subject to aging/obsolescence (e.g., see Hoteling [1925] and Bokhari and Geltner [2017]).

Because the real estate market generally talks of pricing in terms of capitalization rates,[18] it is helpful to convert the stabilized cash-flow yield of Equation (8) into this more conventional pricing metric (and recalling that $CF_t = (\bar{b})NOI_t$):

$$\frac{NOI_1(\bar{b})}{P_0} = r_{RE}(1+\rho) + \rho(1-\lambda)$$

$$\frac{NOI_1}{P_0} = \frac{r_{RE}(1+\rho) + \rho(1-\lambda)}{(\bar{b})} \qquad (10)$$

If real estate investors have had perfect foresight, then consensus capitalization rates would have perfectly incorporated these elements. Exhibit 11 identifies the historical path of (one-year trailing-earnings) capitalization rates for the NPI.

To help orient the reader: The blue line indicates the growth in unlevered, core property values—assuming an initial $100 investment in the NPI in 1978—over the period ending in 2016. Similarly, the red line indicates the growth in (restated) net operating income assuming $100 of income[19] in 1978 over the same period (both property values and incomes are indexed to the left-hand vertical axis). Given a time series of property values and income levels, a time series of capitalization rates is constructed; these rates are shown by the top line of the green-shaded region and are indexed to the right-hand vertical axis. The dashed green line indicates that capitalization rates have averaged approximately 7.0% over this period (the standard deviation of which was approximately 1.1%). In general, the time-series path of capitalization rates has been downward sloping. Possible explanations include a generally declining path of interest rates (as indicated in Exhibits 5 and 6) and growing acceptance of commercial real estate as an institutional asset class. Whatever the reasons, capitalization rates cannot endlessly decline—there has to be some bottom (if not a rebound). Greenspan [2010] indicated as much when describing what he considered to be the signs of a bubble:

> I define a bubble as a protracted period of falling risk aversion that translates into *falling capitalization rates* that decline measurably *below their long-term, trendless averages*. Falling capitalization rates propel one or more asset prices to unsustainable levels. All bubbles burst when risk aversion reaches its irreducible minimum, i.e., credit spreads approach zero, though analysts' ability to time the onset of deflation has proved illusive [emphasis added].

Another way to contemplate the time-series path of capitalization rates is to remove the then-current average capitalization rate from the then-current capitalization rate. These de-meaned capitalization rates[20]—as shown in Exhibit 12—provide another perspective on the level of capitalization rates relative to historical observations.

To help orient the reader: The green-shaded regions indicate the differences between the then-current capitalization rates and the then-current average capitalization rate. The green dashed lines represent the 90th and 10th percentiles about the de-meaned average. It is readily apparent that, for much of the past decade, capitalization rates lie significantly below the lower bound of the 10th percentile.

Both Exhibits 11 and 12 indicate that current (trailing-earnings) capitalization rates (≈4.6%) are at or near the lowest levels observed in the NPI. So, what are we to make of this? Let's restate Equation (10) and solve for real estate's implied real return based on estimates of the observable capitalization rate:

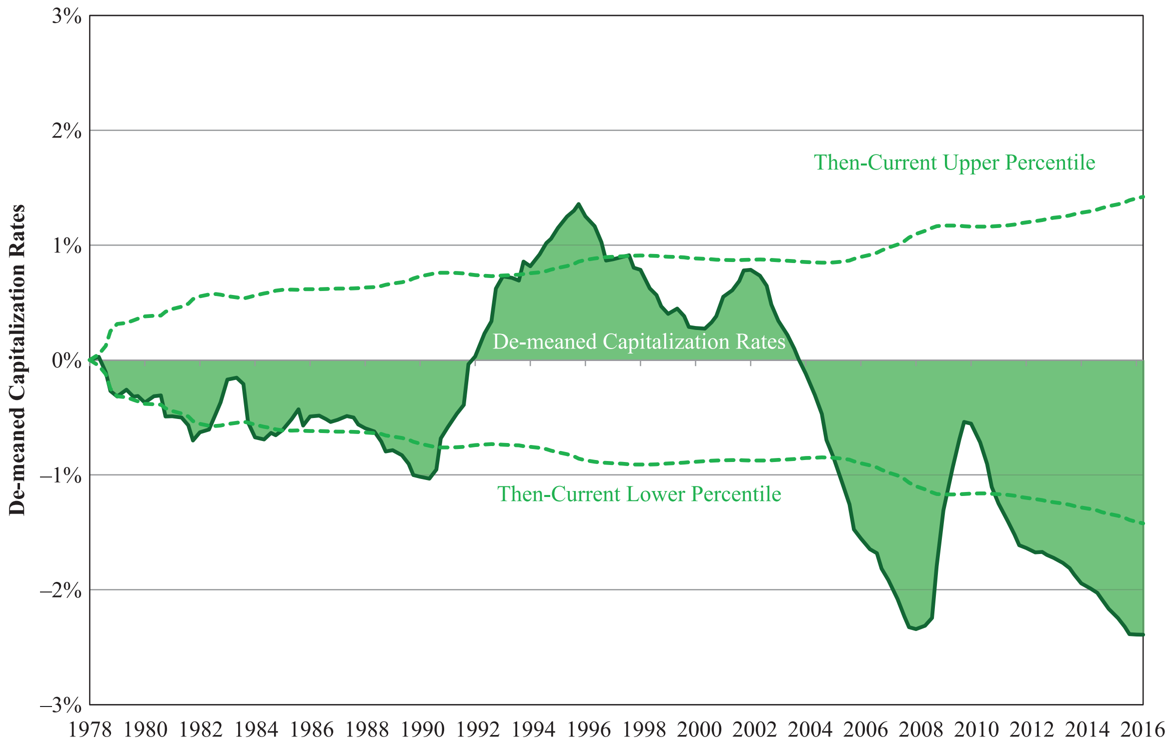
$$r_{RE} = \frac{\frac{NOI_1}{P_0}(\bar{b}) - \rho(1-\lambda)}{(1+\rho)} \qquad (11)$$

To the extent that $\bar{b}$ and λ are less than one and the ρ is greater than zero (again, see Exhibit 9 for a historical perspective on these parameters), the inescapable conclusion is that the anticipated real return is significantly lower than the historical average (≈5.8%). How much lower? According to Exhibit 11, the current capitalization rate is ≈4.6%. If one ignores future shifts in capitalization rates (i.e., $E(\nabla) = 1$), assumes the market's anticipated inflation rate [$E(\rho)$] is 1%–2% per annum, and uses the historical NCREIF-implied dividend payout ratio [$E(\bar{b}) \approx 67\%$] and inflation pass-through rate [$E(\lambda) \approx 70\%$], then the market's anticipated real estate real return [$E(r_{RE})$] is ≈ 2.5%.[21] (This figure is, however, more consistent with recent history.)

Naturally, the anticipated real return on commercial real estate should be viewed in the context of the

EXHIBIT 12

NCREIF Index—Various Measure of De-Meaned Capitalization Rates for the Period 1978 through 2016



Sources: NCREIF and author's calculations.

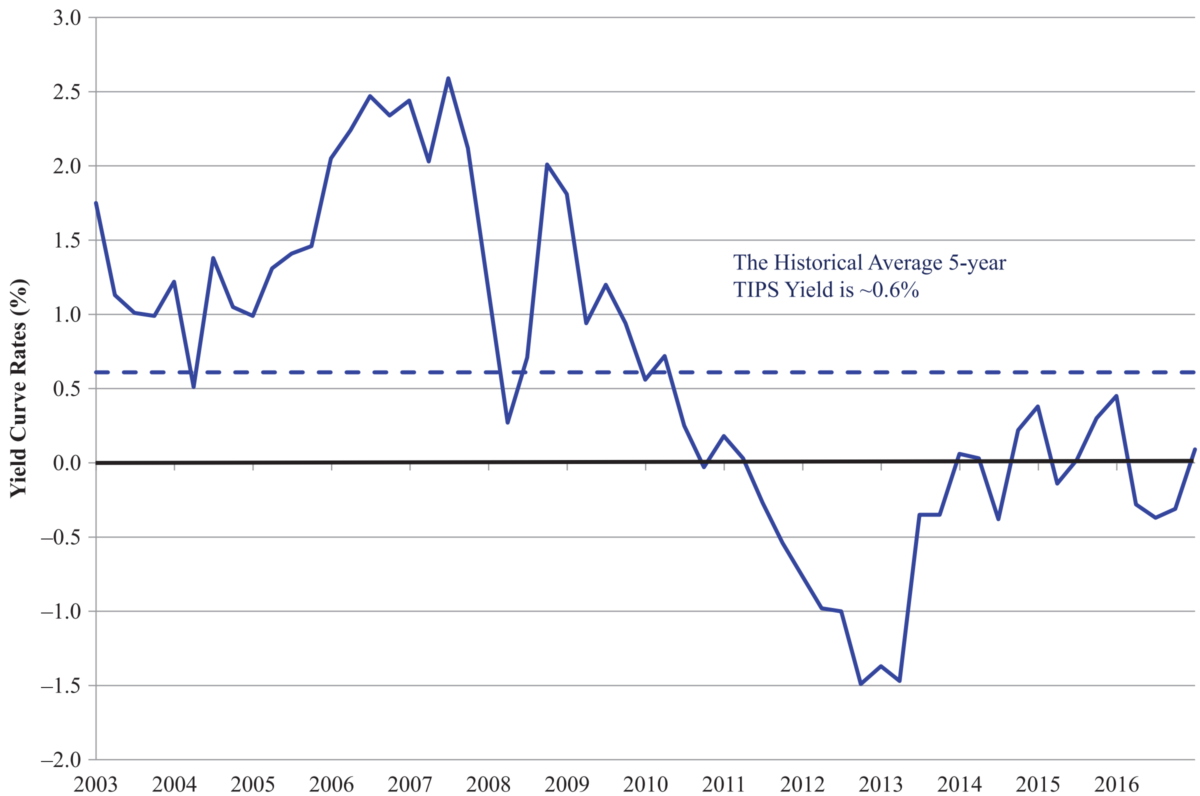
broader capital markets. One readily observable measure of the market's sentiment is the TIPS market, as illustrated in Exhibit 13. Because the TIPS market for five-year maturities was reintroduced in 2003 (after a five-year hiatus), there is not a great deal of empirical evidence (which would typically be used as the basis for framing future expectations) on real estate's excess real return (ϕ_{RE}). Moreover, a portion of that 14-year period has been significantly and perhaps unrepresentatively epitomized by the great financial crisis of 2007–2008. Nevertheless, we can say that the historical average five-year TIPS yield has been approximately 0.6% and is currently close to zero. In this light, the anticipated real return on commercial real estate—as implied by Equation (11)—may look more compelling than it does relative to its long-term average. In other words, real estate's expected excess real return ($E(\phi_{RE})$) would currently seem to be approximately 2.5% (i.e., $E(\phi_{RE}) \approx 2.5\% - 0\%$).

From yet another perspective, the excess realized real return on the NPI has varied considerably over time; consider the summary statistics provided in Exhibit 14. The near-zero excess real-return differential for real estate (ϕ_{RE}) observed over the entire 1978–2016 time period[22] would partly seem to be an artifact of the high rates of inflation experienced during the late 1970s/early 1980s (see Exhibit 3) as investors demanded a substantial premium related to the uncertainty of future inflation rates and is therefore not necessarily representative of the market's current ex ante beliefs. However, a look at 1987–2006 (a period of low inflation and before the financial crisis of 2007–2008) indicates that a negative excess real-return differential for real estate was realized. Interestingly, the excess return for the more recent 2003–2016 time period (beginning with the reintroduction of the five-year TIPS instrument) seems more in keeping with current ex ante beliefs. In any case, it would seem that the historical evidence is, at best, mixed.

These observations bring us full circle. Given today's historically low interest rates, a commonly asked question is: What happens to capitalization rates if interest rates rise?[23] To answer this question, recall that interest rates have two components: (1) the expected

Exhibit 13

TIPS Yields of Five-Year Maturities' Quarterly Data from 2003 through 2016



Source: St. Louis Federal Reserve and author's calculations.

Exhibit 14

Comparison of Realized Real Returns on U.S. Treasury and the NCREIF Property Index for Various Time Periods

	1978–2016 (Entire History)	1987–2006 (Low Inflation & Pre-Crisis)	2003–2016 (TIPS History)
NCREIF Property Index	5.79%	5.37%	7.36%
U.S. Treasury Bonds	5.70%	5.86%	4.53%
Mean Difference (ϕ_{RE})	0.09%	–0.49%	2.83%
Volatility of Difference	14.70%	12.85%	14.08%

Sources: St. Louis Federal Reserve, NCREIF and author's calculations.

inflation rate and (2) the real-return requirement. We have already seen from Equation (9) that when the markets operate in equilibrium (i.e., $\lambda = 1$), changes in expected inflation rates have no impact on real estate prices; however, when the markets operate outside of equilibrium (i.e., $\lambda \neq 1$), the initial cash-flow yield must reflect the real-return requirement grossed up for inflation and the uncompensated portion of inflation—see Equation (10). However, although changes in in expected inflation rates may or may not be benign, it is unambiguous that changes in the real required rate of return directly and inversely affect real estate prices (as well as the prices of most asset classes, including fixed-income securities and, often, common stocks). For the world's leading economies, the real-return requirement on sovereign debt reflects the marginal productivity of capital (i.e., when economic prospects are highly uncertain, real-return requirements on sovereign debt are relatively low and vice versa—see Hartzmark [2016]), as is loosely illustrated in Exhibit 13 (e.g., consider TIPS' yields before and after the 2007–2008 financial crisis).[24] Thus, if the real-return requirements on Treasury bonds were to increase and if, therefore, real-return requirements on real estate were to increase, real estate prices may fall, presuming that the forecasted increase in real estate's cash-flow growth ($g = \lambda\rho$) is insufficient to offset the increase in real estate's real-return requirement. Here, too, the impact of anticipated capitalization-rate shifts—see Equation (7)—can be incorporated into the analysis.

CONCLUDING REMARKS

Using a number of simplifying assumptions, two key aspects of commercial real estate pricing have been the focus of this article. First, the spread between interest rates and commercial real estate pricing, which is often cited as supporting an argument about how investors might consider tilting their portfolio allocations between bonds and commercial real estate, is ultimately a comparison of two very different types of securities: The former represents a riskless, nominal-yield fixed-rate security, and the latter represents a risky, real-yield (provided real estate markets are operating at or near equilibrium) variable-rate security. The observed spread represents the market's consensus view on the future growth of real estate's (unlevered) cash flow less the differential in return premiums (i.e., real estate's expected real return less the fixed-income security's expected real return). Second, real estate pricing itself is examined. Real estate's (unlevered) cash-flow yield should equal the real-return requirement grossed up for inflationary effects plus the uncompensated portion of inflationary growth in future cash flows (i.e., the extent to which the expected growth of real estate's (unlevered) cash flow lags the expected inflation rate). Accordingly, a change in interest rates may or may not affect capitalization rates. If the change in interest rates is due to a change in the expected inflation rate, then real estate pricing—provided the real estate markets are operating at or near equilibrium—will be unaffected. If the change in interest rates is due to a change in the real-return requirement, then real estate pricing—even when the real estate markets are operating at or near equilibrium—will be directly affected. In both instances, the presence of shifting capitalization rates will affect these results; the magnitude of the effect is an increasing function of the capitalization rate shift itself and a decreasing function of the length of the holding period.

ENDNOTES

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[1]It is elsewhere argued that a better comparison is made when investment-grade corporate bonds—as opposed to Treasury bonds—are used for this purpose. As subsequently shown, the spread partly reflects differences in required real rates of return on real estate versus fixed-income bonds. Whether they are Treasury- or corporate-backed bonds matters little to the conceptual analysis. However, the default-free and nonprepayable nature of the Treasury-backed bonds makes for an analytically cleaner comparison; the use of (fixed-rate) corporate-backed bonds, which are subject to default (where the credit cycle for the corporate assets underlying these debentures may differ from the real estate cycle) and often subject to prepayment, makes for a more complicated comparison.

[2]Steps in the right direction were taken by Linneman and Rubenstein [2008] and Zisler and Zisler [2016].

[3]For notational convenience, the realized inflation rate will be shown as $\overline{\rho}$ and the expected (or anticipated) inflation rate as $E[\rho]$. When the two versions can be used interchangeably, ρ will suffice. A similar convention will be used for other variables of interest.

[4]This initial skepticism on the part of the bond market can be observed by comparing forward Treasury rates to realized Treasury rates (see, e.g., Klein [2015]).

[5]It is worthwhile to note that univariate regressions of either capitalization rates or cash-flow yields against the five-year Treasury interest rates produce predicted values with significant residual variance—as exemplified by R^2 values ranging from ≈5% to ≈20%. (These results worsened when the changes in dependent and independent variables were examined.) Although the point of this article is not an econometric quest, it is interesting to note that a multivariate regression of capitalization rates against the 1-, 5- and 10-year Treasury rate as well as the spread in 10- versus 1-year rates produces an only slightly improved (adjusted) R^2 value (≈22%).

[6]This observation about the nature of these securities was made earlier with regard to Treasuries and common stocks; see, for example, Asness [2000] and Sorensen and Arnott [1998].

[7]To simplify the discussion, it is assumed that the fixed-income security is bought at par and held to maturity (or, equivalently, earlier sold at par), such that the coupon yield equals the total return.

[8]Note, that from Equation (1), $CF_1/P_0 = k - g$. Additionally, we assume—for expository purposes—that $r_{Bds}(\rho) - r_{RE}(\rho)$ is sufficiently close to zero to be safely ignored.

[9]Another attractive aspect of using the TIPS instrument is the absence of a meaningful risk premium because of the uncertainty of future inflation rates. As pointed out by Ang, Bekaert, and Wei [2008], the real-return requirement in (nominal-yielding) Treasury bonds contains a component of deferred consumption (i.e., the real return) plus another component for the variability of future inflation rates. (This latter component is not needed when investing in TIPS.) Presently, the risk premium for future inflation-rate variability is thought to be fairly small and, therefore, is ignored here (perhaps perilously so).

[10]In principle, the same sort of analysis can be extended to a comparison of the dividend yields of common stocks to commercial real estate:

$$\left(\frac{CF_1}{P_0}\right)_{RE} - \left(\frac{CF_1}{P_0}\right)_{CS} = (g_{CS} - g_{RE}) - (r_{CS} - r_{RE}).$$

[11]Similarly, current long-term real interest rates (e.g., TIPS) can be viewed as the market's expectation about the future evolution of the short-term real-return requirements over time, and the spread between the current long-term (nominal) bond yield and the current long-term real yield can be viewed as an approximation of the market's expectation about the future evolution of inflation rates over time.

[12]The notation $\overline{b}$ is used, rather than simply b, to indicate that the long-run average payout ratio is being used and that, by inference, the volatility of the annual payout ratio can be quite large. In this manner, the average payout ratio can also be thought of as deposits to either a sinking fund or a replacement reserve.

[13]The notion of constant cash-flow growth is generally best suited to property types characterized by short-term leases (e.g., apartments and hotels) and/or to portfolios of properties—including aggregate indexes like NCREIF—in which the lease turnover rate is constant. However, when these characteristics are not met, it is a fairly simple matter to arithmetically convert a long-term, fixed lease payment ($\overline{\overline{CF}}_0$) to an annual, growing lease payment (CF_0). Consider their ratio:

$$\frac{CF_0}{\overline{\overline{CF}}_0} = \left(\frac{k-g}{k}\right)\left(\frac{1}{1+g}\right)\frac{(1+k)^N - 1}{\left[(1+k)^N - (1+g)^N\right]}.$$

As the holding period lengthens, this ratio approaches

$$\frac{CF_0}{\overline{\overline{CF}}_0} = \frac{k-g}{k(1+g)}.$$

[14]The exact effect—as was used in Exhibit 8—is identified by $\Delta = k_C - k_S$, where k_C is the total return assuming constant capitalization rates and k_S is the total return assuming shifting capitalization rates. These rates of returns are found, respectively, by solving the following equations:

$$P_0 = \sum_{n=1}^{N} \frac{CF_n}{(1+k_C)^n} + \frac{\frac{NOI_{N+1}}{\frac{NOI_1}{P_0}}}{(1+k_C)^N} \text{ and } P_0 = \sum_{n=1}^{N} \frac{CF_n}{(1+k_S)^n} + \frac{\frac{NOI_{N+1}}{\nabla \frac{NOI_1}{P_0}}}{(1+k_S)^N}$$

The approximation tends to overstate the absolute value of the exact effect when the holding period is quite long (say, greater than 20 years) and when the magnitude of the shift is exceedingly large.

[15]Although it is possible, at least in the short run, that real estate markets operate at $\lambda > 1$, this is unrepresentative of the long-run history of the NPI—see Exhibit 9.

[16]Although it is also true that Equation (9) will result from Equation (8) when the inflation rate equals zero, this may be misleading given the multiplicative relationship presumed here between g and ρ (i.e., $g = \lambda\rho$). Consider, instead, an additive relationship (e.g., $g = \gamma + \rho$), which is better behaved when inflation rates approach zero. Ultimately, the choice of a multiplicative or additive relationship is an empirical one (i.e., which approach better suits the data?). Given the high rates of inflation experienced in the early years of the NPI and the low rates realized more recently, a plausible argument can be made for either approach. If an additive approach is taken, then Equation (9) will only result from Equation (8) when γ, the additive inflation pass-through rate, equals zero.

[17]Taking the partial derivative of the pricing equation

$$P_0 = \frac{CF_0(1+\lambda\rho)}{(1+r_{RE})(1+\rho) - 1 - \lambda\rho}$$

with respect to each of its elements provides the price sensitivity of each factor when operating under equilibrium (i.e., $\lambda = 1$) and when not (i.e., $\lambda \neq 1$).

When $\lambda = 1$	When $\lambda \neq 1$
$\frac{\partial P_0}{\partial \rho} = 0$	$\frac{\partial P_0}{\partial \rho} = \frac{-CF_0(1+r_{RE})(1-\lambda)}{[(1+r_{RE})(1+\rho) - 1 - \lambda\rho]^2}$
$\frac{\partial P_0}{\partial r_{RE}} = \frac{-CF_0}{r_{RE}^2}$	$\frac{\partial P_0}{\partial r_{RE}} = \frac{-CF_0(1+\rho)(1+\lambda\rho)}{[(1+r_{RE})(1+\rho) - 1 - \lambda\rho]^2}$
N.A.	$\frac{\partial P_0}{\partial \lambda} = \frac{CF_0(1+r_{RE})(1+\rho)\rho}{[(1+r_{RE})(1+\rho) - 1 - \lambda\rho]^2}$

[18]However, there is little unanimity with regard to the market's usage of the term *capitalization rates* (e.g., there are differences between trailing vs. forward earnings, before vs. after replacement reserves, projected vs. stabilized earnings, etc.). To consider just one aspect of this variation, approximately 75%–80% of the respondents to the Situs RERC [2016] survey of institutional investors indicated that they define capitalization rates based on after-reserves forecasts for residential property types (i.e., apartments, hotels, and student housing), whereas approximately 75%–80% of those same respondents indicate that they define capitalization rates based on before-reserves forecasts for nonresidential property types (i.e., industrial, office, and retail).

[19]Although a $100 property investment does not produce $100 of income, both indexes are initially set to $100 to improve the visual comparison of changes in property values to changes in income levels. Without restating the income levels, it would be difficult to visually discern the differences in changing income levels.

[20]To be more precise, let y_t equal the capitalization rate (or income yield) in period t; the de-meaned capitalization rate is then $\ddot{y}_t \equiv y_t - \overline{y}_{T-j}$, where $\overline{y}_{T-j} = \frac{1}{T-j}\Sigma_{t=1}^{T-j} y_t$ and j is the number of (annual) periods prior to the last observation (i.e., $T = 39 = 2016 - 1978 + 1$). The then-current standard deviation of capitalization rates is determined in an analogous manner. Assuming that the underlying population of (de-meaned) capitalization rates is normally distributed, Exhibit 12 then illustrates the 90th and 10th percentiles.

[21]In contrast, Van Nieuwerburgh [2017], using a version of the Campbell and Shiller [1988] log-linearization of the dividend discount model and focusing on the long-term dividend-price ratio of REITs, suggested that the current increase in values relative to cash flow is a product of the market's expectation of future cash-flow growth "that is far above the growth rates seen in the data."

[22]Said another way, the long-term U.S. Treasury bond is default-free, but not risk-free—in the sense that that the future inflation rate is unknowable (as is, therefore, the future real return)—and, in periods of high inflation and large uncertainty about the future rate of inflation, the ex ante real return on commercial real estate may—given its perceived inflation-hedging characteristics—seem a compelling alternative to fixed-income securities. In any case, each of the three sets of differences (i.e., ϕ_{RE} for 1978–2016, 1987–2006, and 2003–2016) is indistinguishable from zero at conventional statistical confidence levels.

[23]Of course, in another economic environment the question might well be: What happens if interest rates fall? The answer would mirror that which follows.

[24]Although the empirical aspects of this article have focused on the United States (largely because it is the world's largest/deepest real estate market and has extensive datasets), the theoretical aspects may be applied to most any country. That said, applications to other countries may include considerations not raised herein. One example: The real-return requirements in less-developed countries may include a premium for sovereign default; the Greek debt crisis in the aftermath of the 2007–2008 recession is but one example. Another example: Transaction costs (which, for purposes of this article, are embedded in the real-return requirements) can vary substantially from one country to the next.

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