Is There a Risk Premium Puzzle in Real Estate?

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This paper is based on my Presidential Address to the American Real Estate and Urban Economics Association delivered at Washington, D.C., in January 2003. The paper asks whether there is a risk premium puzzle in real estate. I examine this question by reporting on an empirical investigation of real estate investors' expectations over the last 15 years. The results suggest that *ex ante* expected risk premiums on real estate are quite large for their risk, too large to be explained by standard economic models. Further, the results suggest that *ex ante* expected returns are higher than average realized equity returns over the past 15 years because realized returns have included large unexpected capital losses. The latter conclusion suggests that using historical averages to estimate the risk premium on real estate is misleading.

For some time, we have known that investors are extremely unwilling to accept variations in stock returns without, on average, earning a high premium (Mehra and Prescott 1985).[1] But investors seem much less risk averse when it comes to investing in real estate, at least judging from the historical spread between real estate returns and the return on fixed-income securities over the past quarter century. This raises the questions: Which is the puzzle and which is the fact? Are investors extremely risk averse, as the risk premium puzzle implies? Or are investors more risk neutral, as the evidence in the real estate market would seem to imply?

This is an important question, but answering it is not easy. For example, it might seem natural to gauge whether investors require a large premium to invest in real estate by looking at the average return earned on real estate over a long period of time in the past. Yet there are obvious problems with this

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[1] It also turns out that the risk premium on real estate is too high to be explained by models of illiquidity in which investors accommodate large transaction costs by drastically reducing the frequency and volume of trade. In these kinds of models, a small liquidity premium is generally sufficient to compensate an investor for any lack of liquidity (Constantinides 1986).

approach. First, one needs about half a century of returns to be confident that the historical spread on an asset is unconditional mean and not luck (Jorion and Goetzmann 1999). Unfortunately, reliable data on real estate returns in the United States go back only about 25 years. Second, we know that expected returns on an asset can very easily exceed the observed return today if (1) expected future real interest rates or expected future excess returns on real estate are increasing, (2) actual cash flow growth unexpectedly low or (3) some combination of these effects occur simultaneously (Campbell 1991). So, simply using historical averages to estimate the risk premium on real estate can be misleading.

In this paper, risk aversion is analyzed from a different perspective. Using data from a longitudinal survey of real estate investors conducted at regular quarterly intervals beginning in 1988, I offer support for the hypothesis that real estate investors are extremely risk averse. I find an *ex ante* risk premium on real estate of about 6–6.75%, which is too large to be explained by standard economic models. Moreover, this *ex ante* risk premium is more than double that of equities, at least when compared to the estimates of Blanchard (1993), Wadhwani (1999), Claus and Thomas (2000), Fama and French (2002) and Jagannathan, McGrattan and Scherbina (2001).

I also find evidence in support of the hypothesis that real estate investors tend to have uniform expectations. One explanation for this result is the "normal range" hypothesis. This hypothesis asserts that investors expect future returns to tend toward a "normal level" that can be estimated on the basis of past experiences (Malkiel 1964). An alternative explanation may be that most investors (and portfolio managers) are reluctant to act according to their own information and beliefs, fearing that their contrarian behavior will damage their reputations as sensible decision makers (Scharfstein and Stein 1990, Zwiebel 1995). Still others argue that many investors make the same decision, but they do so on the basis of limited information (Conlisk 1980, Banerjee 1989, Bikhchandani, Hirshleifer and Welch 1992).

I also look at whether *ex ante* risk premia vary across different property types. This is motivated in part by a desire to know whether *ex ante* risk premia are related to observable characteristics. Here a number of interesting cross-sectional patterns can be observed. For example, I find that investors appear to price all property types in the same way, despite the fact that there are times or states of the world in which certain property types perform better than other property types. The perplexity of this result is compounded by the fact that real estate investors appear to be no more uncertain about expected future returns after a decrease in price and fall in return than after an increase in price and return.

The key result of the paper is that average expected risk premiums on real estate are higher than average realized risk premiums for the 1988–2002 period, indicating that real estate experienced unexpected capital losses. It is difficult to argue that these losses occur because expected future real interest rates or expected future excess returns on real estate are increasing. We simply do not see any evidence of this in the data. One would therefore conclude that actual returns on real estate have been lower than expected returns because cash flow growth was lower than expected, or negative. Interestingly enough, Fama and French (2002) present contrasting evidence of a large unanticipated gain on common stocks during the past half century. These two stories imply an increase in demand for stocks relative to real estate during a time period when *ex ante* expected returns on stocks were falling.

Below, I establish these results through some rather simple, but useful, comparisons. More and better data are needed to investigate these relationships with more rigorous tools.

The remainder of the paper proceeds as follows. The next section contains a description of the sample and some summary statistics. In the third section I present the aggregate risk premium estimates. It is there that I show that the *ex ante* risk premium on real estate is too large to be explained by standard economic models. The fourth section shows that realized returns on real estate over the period 1988–2002 have included large unexpected capital losses. The fifth section examines the sources of these unexpected capital losses. In the penultimate section, I study whether actual capital gains for 1988–2002 are far below expected capital gains. This is an alternative way of measuring whether real estate experienced unexpected capital losses for the period 1988–2002. A summary concludes the paper.

The Korpacz Survey
In this paper, I use data from the Korpacz survey to focus on investors' expectations. The Korpacz survey is a quarterly survey of real estate investors concerning office, retail, apartment and industrial returns. The Korpacz Organization sponsored the surveys from 1988Q1–1999Q3 and Pricewaterhouse Coopers has sponsored the surveys since 1999Q3. The sample covers the 1988Q1–2002Q3 period. The survey is conducted through questionnaires mailed to prominent real estate investment market participants in the United States. The 100-odd participants of the survey are mostly institutional investors (*e.g.*, pension plans, foundations, endowments, life insurance companies, investment banks and REITs). The institutional investors involved are not selected randomly.

The survey asks all participants to report separately their prospective rates of return (pretax) for office, retail, apartment and industrial buildings in the current quarter. These forecasts are then aggregated to produce an expected return series for the country as a whole for each property type.

The returns data pertain for the most part to institutional investment-grade properties only. This includes CBD and suburban office buildings, major retail properties, urban high-rise and garden apartment buildings as well as industrial warehouses which are completed and substantially leased, which are occupied by major business interests and which have a significant user demand resulting in a stable income flow, low leasing risk, good long-term growth potential and a fairly safe rate of return.

The returns are reported at their unlevered rate. The major reason for doing this is the belief that rates of return over time and their relationship with the market are more stable when we can abstract from all changes in leverage and get at the underlying risk of real estate.

Figure 1a–d present histograms of the Korpacz returns from 1988Q1–2002Q3. Several patterns in the Korpacz returns are of interest. The most obvious is the skewness in the individual distributions. The evidence suggests that investors only rarely expect discount rates on real estate less than 11% (in nominal terms), regardless of property type. Evidently, institutional investors prefer to invest in real estate only if the case is so obvious as to justify its undertaking.[2] This must mean that institutional investors miss many worthwhile investment projects.
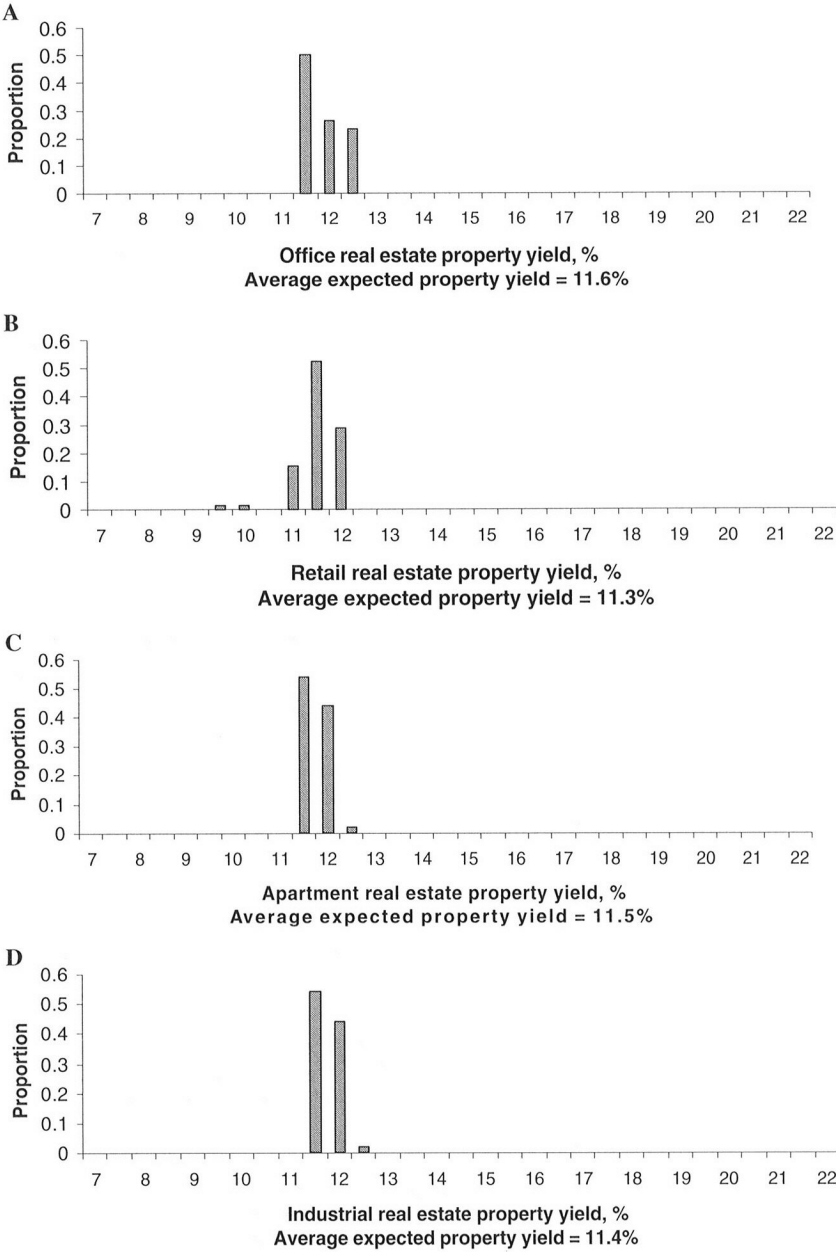
We might now ask what is the variance of the Korpacz returns. For the analysis presented here, I measure the variance of the Korpacz returns at time t by

$$Variance = ([x(1.0) - x(0.0)]/6)^2, \qquad (1)$$

where $x(p)$ denotes the p fractile of the random variable X and where $x(1.0) - x(0.0)$ is the difference between the largest and smallest return in the survey.

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[2] This evidence is similar to results found in Gitman and Forrester (1977), Schall, Sundem and Geijsbeek (1978), Gitman and Mercurio (1982), Moore and Reichert (1983) and Bruner et al. (1998). These studies provide estimates, for example, of hurdle rates (or average costs of capital) used by major U.S. firms for capital expenditure projects in the range of 11% to 14% (in nominal terms). Additionally, Gitman and Forrester (1977) report that 60% of their respondents had a nominal cost of capital between 10% and 15% and another 23% a cost of capital of 15% to 20%. In Gitman and Mercurio (1982), 65% of their respondents had a nominal cost of capital in the range of 11% to 17%. And the list continues, clearly suggestive of a hurdle rate no less than 11% to 14%. So although the time periods and emphases are different—my study covers the past 15 years only and emphasizes real estate investments only, while the other studies go back to 1977 and emphasize plant and equipment—the findings are surprisingly consistent.

Figure 1 ■ A: The distribution of the Korpacz office property yield. B: The distribution of the Korpacz retail property yield. C: The distribution of the Korpacz apartment property yield. D: The distribution of the Korpacz industrial property yield.

A

Office real estate property yield, %
Average expected property yield = 11.6%

B

Retail real estate property yield, %
Average expected property yield = 11.3%

C

Apartment real estate property yield, %
Average expected property yield = 11.5%

D

Industrial real estate property yield, %
Average expected property yield = 11.4%

Thus, if participants in 1988Q1 felt that returns on office buildings would range from a low of 9% to a high of 12%, then the variance would be $([12 - 9]/6)^2 = 0.25$, implying a standard deviation of 0.5%. Similarly, if participants felt that returns on industrial buildings would range from a low of 8% to a high of 13%, then the variance would be $([13 - 8]/6)^2 = 0.69$, implying a standard deviation of 0.83%.

The standard deviations calculated in this fashion are quite low (see Figure 2a–d). The averages of the quarterly standard deviations are in the range of 1.5% to 2%. Combined with an expected return of 11.5%, these volatility estimates imply that there is less than a 0.01% chance of generating a loss in a single year, and, assuming year-to-year independence, there is less than a 0.01% chance of generating a loss in at least 1 of the next 10 years.[3]

In unreported results, I also find little evidence of any significant association between the standard deviations of the Korpacz returns and past realized returns. In all cases, the Spearman rank correlations are insignificant at the 5% level. This result contrasts with the stock market, in which low or negative realized returns are associated with higher expected volatility (see, *e.g.*, Nelson 1992, Campbell, Grossman and Wang 1993, Glosten, Jagannathan and Runkle 1993).

A Risk Premium Puzzle in Real Estate?

As puzzling as these results are, let us now turn our attention to Table 1. Table 1 presents the average expected return over the risk-free rate for office, retail, apartment and industrial buildings over the period 1988–2002. All four expected risk premiums are in the range of 6 to 6.75%, highlighting the fact that compensating premia do not vary significantly across different property types. This outcome occurs despite the fact that certain property types like office and industrial involve more risk and are subject to wider swings in loss experience than other property types.

Another surprising result is the size of the expected Sharpe ratios for real estate. As Table 1 shows, the expected Sharpe ratios for office, retail, apartment and

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[3] To arrive at these conclusions, I convert the target return of 0% to its continuous equivalent, which equals $\ln(1 - 0.0) = 0\%$. I then standardize the difference between the continuous target return and the continuous expected return on real estate, which equals $\ln(1 + 0.115) = 10.89\%$, by dividing it by 2.0%, which is a fairly conservative estimate of the continuous standard deviation based on Figure 2a–d. The normal deviate in this case is $[0 - 0.1089]/0.02 = -5.45$ standard deviations from the mean, suggesting that there is less than a 0.01% chance of experiencing a loss in a single year. Over a 10-year horizon, the relevant normal deviate is $[0 - 0.1089 \times 10]/[0.02 \times \sqrt{10}] = -17.2$. Again, this normal deviate corresponds to a probability of less than 0.01%.

Figure 2 ■ A: The distribution of the Korpacz office standard deviation. B: The distribution of the Korpacz retail standard deviation. C: The distribution of the Korpacz apartment standard deviation. D: The distribution of the Korpacz industrial standard deviation.
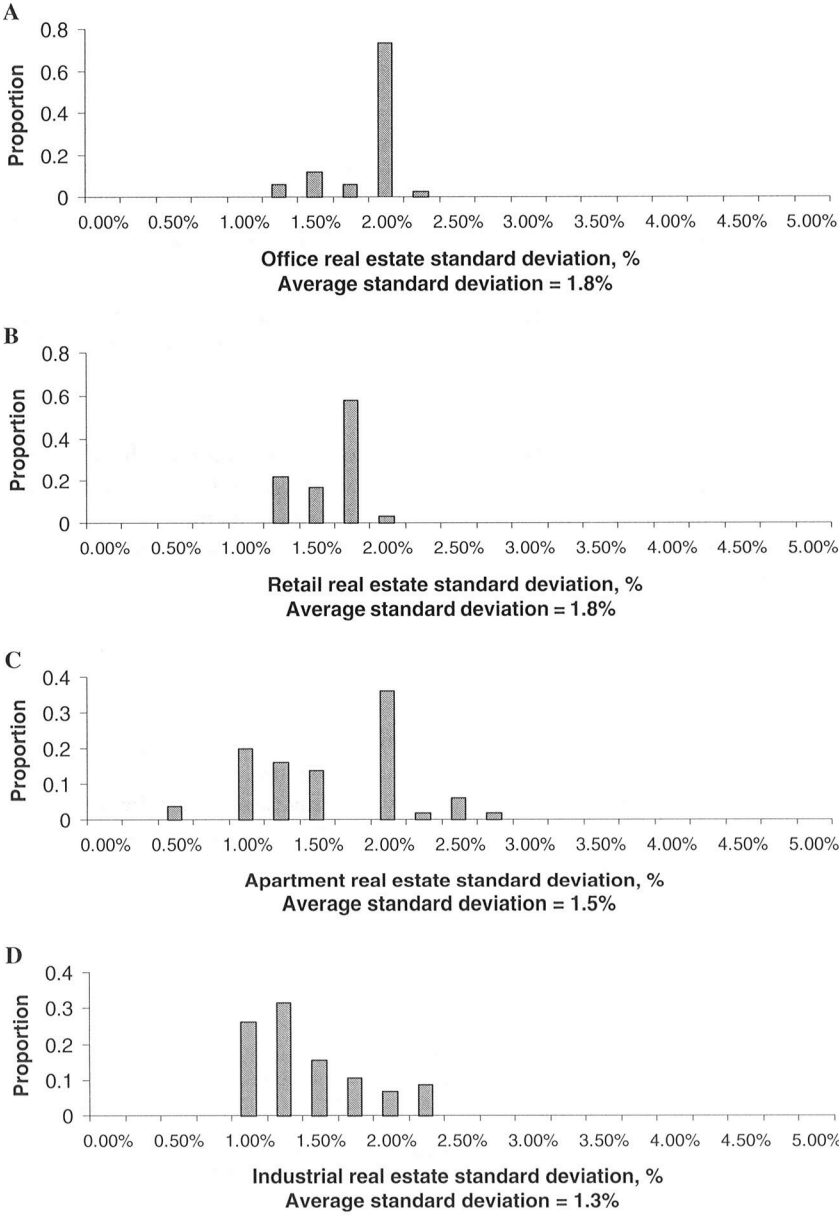
Table 1 ■ Expected returns, standard deviations and Sharpe ratios for office, retail, apartment and industrial buildings.

	Average Return	Standard Deviation	Sharpe Ratio
Office	12.02%	1.8%	3.85
Retail	11.26	1.4	4.46
Apartment	11.52	1.5	4.34
Industrial	11.44	1.3	4.95
Average	11.56	1.5	4.37

All data are from the Korpacz survey of real estate investors. Standard deviations are measured from the 100th and 0th percentile of the responses in the Korpacz survey. The Sharpe ratio is the expected return in excess of the risk-free rate, all divided by the standard deviations. The sample is period is 1988Q1–2002Q3. The risk-free rate is 5.01 (as measured by the 3-month Treasury bill rate).

An alternative method of calculating standard deviation is to use the standard deviation of the NCREIF returns. When I calculate standard deviation in this way, I find Sharpe ratios in the range of 0.7 to 1.4.

industrial buildings are in the range of 3.9 to 5.0 (unlevered). These Sharpe ratios are quite large, and they turn out to be even larger if I work with levered, rather than unlevered, excess returns.[4] An alternative method of calculating these Sharpe ratios would be to divide the expected return in excess of the risk-free rate by the standard deviation of the realized return [which I measure using returns reported by the National Council of Real Estate Investment Fiduciaries (NCREIF); see below]. When I measure standard deviation in this way, I also find large Sharpe ratios—values in the range of 0.7 to 1.4.

The problem here is that these Sharpe ratios for office, retail, apartment and industrial buildings are exceedingly difficult to explain. To illustrate, consider the intertemporal choice problem of a typical investor. When investors are behaving optimally, a marginal investment at t in any asset should yield the same expected marginal increase in utility at $t + 1$. This first-order condition implies

$$E\left[c_{t+1}^{-\gamma} r\right] = E\left[c_{t+1}^{-\gamma} r^{f}\right], \tag{2}$$

[4] To approximate levered excess returns, I make four assumptions: (1) the value of the property is always the same under different capital structures, (2) the value of equity plus the value of debt is equal to the value of the property, (3) investors who want to buy real estate and borrow can do so by issuing a commercial mortgage, and (4) there are no taxes (*i.e.*, investors are tax-exempt institutions). I approximate debt terms (borrowing rate and debt-to-equity ratio) using commercial mortgage commitment data from the American Council of Life Insurance. The results yield an expected excess return over the risk-free rate for office, retail, apartment and industrial buildings in the range of 13 to 14.5% and Sharpe ratios in the range of 9.0 to 11.0.

where $E[\cdot]$ is an expectations operator reflecting the beliefs of the investor, r denotes the return on real estate, r^f is the rate of return that is risk free, c_t denotes consumption at date t and γ is a measure of risk aversion.

Using the definition of covariance $\mathrm{cov}(M, r) = E[rM] - E[r]E[M]$, we can rewrite (2) as

$$E[r] - r^f = -\frac{\mathrm{cov}\left[(c_{t+1}/c_t)^{-\gamma}, r\right]}{E\left[(c_{t+1}/c_t)^{-\gamma}\right]}. \tag{3}$$

With lognormal consumption growth and using $E(e^z) = e^{E(z)+(1/2)\sigma^2(z)}$ and $\sigma^2(x) = E[x^2] - E[x]^2$, we can further rewrite (3) as

$$\frac{E[r] - r^f}{\sigma(r)} \approx \gamma\sigma(\Delta c)corr(\Delta c, r), \tag{4}$$

where Δc denotes the proportional change in consumption, $\sigma(\Delta c)$ is the standard deviation of the growth in consumption and $\sigma(r)$ is the standard deviation of the return on real estate. Holding all else equal, (4) says that a high Sharpe ratio is the result of a high γ or a high $\sigma(\Delta c)$ or both.

Interestingly enough, however, the right-hand side of (4) predicts nothing even close to a Sharpe ratio of 3.9 to 5.0 (or even 0.7 to 1.4) for real estate. The standard deviation of the growth rate in consumption for the 1880–1978 period is about 0.04 (Mehra 2003). The correlation of consumption growth with expected returns on real estate is found to be about 7%. Thus, with a normal risk aversion parameter of 3, we get a Sharpe ratio of $3 \times 0.04 \times 0.07 = 0.084$. So unless γ is large, a high Sharpe ratio is impossible.[5]

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[5] An alternative way to model this risk premium is provided by Hansen and Jagannathan (1991). They assume that every investor has preferences of the form $u(C) = C^{(1-\gamma)}/(1 - \gamma)$. Hansen and Jagannathan further assume that investors choose between consumption today, C_t, and consumption tomorrow, C_{t+1}. The choice is made to maximize utility subject to a wealth constraint. This leads to a first-order condition, in which any loss in utility associated with investing in one additional unit of private real estate equity is equated to the discounted expected utility of the resulting additional consumption next period, or

$1 = E[rM]$,

where M is a stochastic discount factor (i.e., $M = \beta(C_{t+1}/C_t)^{-\gamma}$). M is stochastic because it is not known with certainty at time t. Using the definition of covariance $\mathrm{cov}(M, r) = E[rM] - E[r]E[M]$, we obtain an equation for the expected return on real estate, $E[r]$,

$E[r] = r^f + \mathrm{cov}\left\{\dfrac{M, r}{E(M)}\right\}$

This expression holds unconditionally so that

$E[r] = r^f + \sigma(r)\sigma(M)corr(M, r)/E[M]$.

Table 2 ■ Comparison of expected and actual returns on office, retail, apartment and industrial buildings.

	Expected Return	Actual Return	Differences in the Means
Office	12.02%	6.34%	5.68%
			(10.6)
Retail	11.26	5.68	5.58
			(16.1)
Apartment	11.52	9.31	2.21
			(2.2)
Industrial	11.44	8.01	3.43
			(3.8)

Expected returns are from the Korpacz survey. Actual returns are from NCREIF. Tests for the differences in the means of each group are conducted using a *t*-statistic. *T*-values are reported in parentheses. All means are statistically different at the 5% level. The sample period is 1988Q1–2002Q3.

This raises the question: What level of risk aversion does it take to generate a Sharpe ratio of 4.4 (or even 0.70) for real estate? The answer is $4.4 \div (0.04 \times 0.07) = 1,571$ [or $0.70 \div (0.04 \times 0.07) = 250$], which implies that real estate investors are essentially unwilling to substitute consumption over time, regardless of the measure of standard deviation. We can also ask the question: For reasonable values of γ and $corr(\Delta c, r)$, what value of $\sigma(\Delta c)$ is needed to obtain anything like a Sharpe ratio of 4.4 for real estate? Here the answer is $4.4 \div (3 \times 0.07) = 2,095\%$, which again is off by more than an order of magnitude. The implication is that expected real estate returns are too high to be explained by standard economic models.

Comparison to Actual Returns

Table 2 compares expected and actual returns on office, retail, apartment and industrial buildings. The actual returns data that I use are the returns for office, retail, apartment and industrial buildings reported by NCREIF. These returns are compiled for a large sample of unlevered properties that are professionally

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With $-1 \leq corr(M, r) \leq 1$, it follows that

$$\left| \frac{E[r] - r^f}{\sigma(r)} \right| \leq \frac{\sigma(M)}{E[M]},$$

where $E[M]$ is the expected price of a one-period risk-free bond, which has a value of approximately 0.96. Estimates of $\sigma(M)$ are approximately 0.002 (Mehra and Prescott 2003). This yields a Sharpe ratio for real estate of $0.002 \div 0.96 = 0.002$ rather than 3.9–5.0 (or even 0.7–1.4).

Table 3 ■ Terminal value of $1,000 invested.

	Expected Value	Actual Value	Unexpected Capital Loss
Office	$5,488	$2,514	$2,974
Retail	4,955	2,290	2,665
Apartment	5,132	3,801	1,331
Industrial	5,077	3,177	1,900

Investment period is 1988–2002. Expected value is the terminal value of $1,000 invested, compounded forward at the Korpacz survey return. Actual value is the terminal value of $1,000 invested, compounded forward at the NCREIF return. Unexpected capital loss is the difference between expected and actual terminal values.

managed on behalf of institutional investors.[6] I use this data from 1988Q1 to 2003Q3. As Table 2 shows, the average realized return on real estate for the past 15 years is 7.5%. But this is well below the average expected return. Since the average realized returns are less than expected, the data therefore suggest that real estate experienced unexpected capital losses for the period 1988–2002.

The dollar value of these unexpected capital losses are shown in Table 3. The calculations assume an initial investment of $1,000. If one compounds this initial investment at 11.5%, its forecasted value 15 years hence would be $5,118; that is, $1,000 × 1.115^{15} or, equivalently, $1,000 × 5.118. By contrast, compounding at an actual rate of return of 7.5% results in a much lower ending value of $2,959; that is, $1,000 × 1.075^{15} or, equivalently, $1,000 × 2.959. The difference of $2,159 ($5,118 − $2,959) is the unexpected capital loss over that 15-year interval.[7]

Further, the data in this section show that there are substantial unexpected capital losses across all four property types. I can reject at the 1% level the hypothesis that the unexpected capital losses for each property type are zero. The largest unexpected losses are on office and retail shopping centers. The smallest unexpected losses are on industrial and apartment buildings.

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[6] One drawback of this return series is that reported values are appraised values, appraised as of one or more quarters previously. Because of this, the NCREIF return index is likely to be a smoothed time series. For a discussion of how to correct the NCREIF return index for this smoothing bias, see Ross and Zisler (1991), Geltner (1993), Fisher, Geltner and Webb (1994) and, most recently, Cho, Kawaguchi and Shilling (2003).

[7] This loss is an unexpected capital loss, because had real estate investors expected a future value of $2,959 at the end of 15 years, they would not initially have invested so much (and then the wealth increase would have been much higher).

Unexpected Capital Losses

The previous section noted the unexpected capital losses on real estate over the past 15 years. Unexpected capital losses on assets can occur for two reasons. First, if expected future real interest rates or expected future excess returns are increasing. Second, even if there were no change in future real interest rates or expected future excess returns, unexpected capital losses could occur if the expected future growth in the asset's cash flows is increasing, while actual cash flows are decreasing. My goal now is to examine which of these explanations describes the unexpected capital losses on real estate.

Were Expected Future Returns on Real Estate in 1988–2002 Increasing?

First, it is often believed that expected returns follow a first-order autoregressive process. The choice of a first-order autoregressive process stems from regressions of stock returns on forecasting variables like price ratios. Such regressions show that stock returns are predictable by variables like price–dividend ratios that are themselves characterized by highly autocorrelated behavior (Fama and French 1988, Poterba and Summers 1988 and others). Since movements in expected returns presumably reflect variation through time in such forecasting variables, expected returns should also follow a first-order autoregressive process.[8]

This means that we should be able to model the Korpacz survey returns, y_t^e, as

$$y_t^e = c + \phi y_{t-1}^e + \varepsilon_t, \tag{5}$$

where $\varepsilon_t \sim$ independently and identically distributed $N(0, \sigma_e^2)$. Using the fact that $y_{t-k}^e = c + \phi y_{t-k-1}^e + \varepsilon_{t-k}$, we can rewrite (5) as

$$y_t^e = [c/(1 - \phi)] + \varepsilon_t + \phi \varepsilon_{t-1} + \phi^2 \varepsilon_{t-2} \phi^3 \varepsilon_{t-3} + \cdots. \tag{6}$$

This process has mean $\mu = E(y_t^e) + c/(1 - \phi)$ and is stationary if $\phi < 1$.

At this point, I should interject a note of caution about estimating (6). From Figure 1a–d, we already know that the Korpacz survey returns are essentially a "level" variable over time. Thus, regardless of whether y_t^e can be described as an autoregressive process, this leads me to expect σ_e^2 to be quite small.

Tables 4 and 5 provide evidence on this issue. First, I estimate sample autocorrelation functions for the Korpacz returns on office, retail, apartment and

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[8] Conrad and Kaul (1988) employ such an approach to estimate the stochastic behavior of the expected returns on stocks.

Table 4 ■ Sample autocorrelation functions for Korpacz expected returns on office, retail, apartment and industrial buildings.

Variable	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8
Raw returns								
Office	0.904	0.807	0.728	0.650	0.574	0.499	0.415	0.208
	(0.0001)	(0.0037)	(0.0324)	(0.0898)	(0.1663)	(0.2535)	(0.3605)	(0.5071)
Retail	0.738	0.455	0.427	0.418	0.391	0.377	0.351	0.294
	(0.0001)	(0.0156)	(0.0381)	(0.0578)	(0.0943)	(0.1229)	(0.1669)	(0.2625)
Apartment	0.834	0.674	0.560	0.441	0.315	0.252	0.153	0.050
	(0.0001)	(0.0020)	(0.0293)	(0.1158)	(0.2837)	(0.4018)	(0.6153)	(0.8702)
Industrial	0.883	0.763	0.653	0.553	0.420	0.267	0.152	0.096
	(0.0001)	(0.0003)	(0.0106)	(0.0512)	(0.1643)	(0.3927)	(0.6295)	(0.7632)
First differences								
Office	−0.09	0	0.038	0.086	−0.110	0.128	0.061	0.171
	(0.6057)	(0.9980)	(0.8293)	(0.6229)	(0.5357)	(0.4758)	(0.7370)	(0.3494)
Retail	−0.175	−0.111	0.004	−0.021	−0.74	0.009	0.019	0.040
	(0.1838)	(0.4115)	(0.9761)	(0.8752)	(0.5873)	(0.9501)	(0.8930)	(0.7719)
Apartment	0.015	−0.064	0.078	−0.069	−0.218	0.176	0.023	−0.178
	(0.9156)	(0.6518)	(0.5874)	(0.6328)	(0.1321)	(0.2447)	(0.8850)	(0.2529)
Industrial	0.341	0.063	−0.017	0.177	0.240	−0.026	−0.200	−0.221
	(0.0106)	(0.6722)	(0.9104)	(0.2349)	(0.1166)	(0.8682)	(0.2085)	(0.1761)

Under the hypothesis that the true autocorrelations are zero, standard errors of the estimated autocorrelations are approximately distributed according to a normal distribution with mean 0 and standard deviation $1/\sqrt{T}$, where T is the number of observations in the series. *P*-values that a particular autocorrelation coefficient is not zero are reported in parentheses.

Table 5 ■ Estimates of the parameter of the model in which expected returns on real estate (y_t^e) follow a stationary AR(1) process:

$$y_t^e = \mu + \varepsilon_t + \varphi\varepsilon_{t-1} + \varphi^2\varepsilon_{t-2} + \varphi^3\varepsilon_{t-3} + \cdots,$$

where μ is the mean of the series (in percent). Expected returns are from the Korpacz survey. The sample period is 1988Q1–2002Q3. Standard errors are reported in parentheses.

	μ	ϕ	R^2	$S(\varepsilon)$
Office	11.79	0.99	0.95	0.009
	(0.85)	(0.03)		
Retail	11.15	0.89	0.68	0.05
	(0.25)	(0.06)		
Apartment	11.43	0.86	0.68	0.05
	(0.09)	(0.08)		
Industrial	11.45	0.95	0.86	0.01
	(0.23)	(0.04)		

industrial buildings. Given the high and slowly declining pattern of autocorrelations, I then difference the series once and recompute the sample autocorrelations for the first differences.

The most striking feature of Table 4 is the first-order autocorrelations. These sample autocorrelation coefficients are large and significant, and the higher-order autocorrelation coefficients decay across longer lags.[9] Also, as it happens, none of the sample autocorrelation coefficients of the quarterly changes in the Korpacz survey are as large as their standard errors. Furthermore, a Chi-square test shows that the hypothesis that all of the autocorrelations are zero cannot be rejected. These findings suggest that there is nothing special about real estate returns.

Next, to analyze the extent of variation in expected returns over time, I estimate an AR(1) model for the Korpacz survey returns. The estimation is done by that of maximum likelihood. The results are presented in Table 5. The results

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[9] To test whether a particular value of the autocorrelation function ρ_k is equal to zero, I use the fact that the sample autocorrelation coefficients are approximately distributed according to a normal distribution with mean 0 and standard deviation $1/\sqrt{T}$, where T is the number of observations in the series. To test the joint hypothesis that all of the autocorrelation coefficients are zero, I use the Q statistic:

$$Q = T \sum_{k=1}^{K} \hat{\rho}_k^2,$$

which is approximately distributed as Chi-square with K degrees of freedom.

suggest that a stationary AR(1) process for Korpacz survey returns appears to be well specified. The maximum-likelihood estimates of μ and ϕ are significantly different from zero. These are all in the expected, positive direction. Furthermore, the regressions give impressive R^2 statistics of 0.68 to 0.95, and the residuals from the model behave like white noise.

Also, the estimates of μ in Table 5 are just about what one would expect from inspection of Figure 1a–d. However, t-tests overwhelmingly reject the null hypothesis that the estimates themselves are very close to what investors on average earned on real estate over the past 15 years.

Finally, and most importantly, taken at face value, the evidence in Tables 4 and 5 tells us that we should see a discernible overall up-and-down pattern over time in the Korpacz survey returns for office, retail, apartment and industrial buildings. Yet, because all four AR(1) models resulted in a root-mean-squared error of only 0.01% to 0.5%, any up-and-down pattern that we should see in the data should be quite small, which is what the data actually show. So I conclude from this that there is little evidence of an increase in expected future real estate returns over the past 15 years.

Are Real Interest Rates Increasing during the 1988–2002 Period?

One might blame unexpected capital losses in real estate markets on rising real interest rates. But since 1988Q1, real interest rates in the United States have not increased. If anything, real interest rates have declined slightly. This is illustrated in Figure 3, where I simply plot the real interest rate over time (consisting of quarterly data from 1988Q1 to 2002Q3). The real interest rate is the difference between the nominal 3-month Treasury bill rate and the rate of expected inflation. I use data from the Livingston survey of professional economists as a measure of expected inflation.

Figure 3 ■ Plot of real 3-month T-bill rate.

Quarter
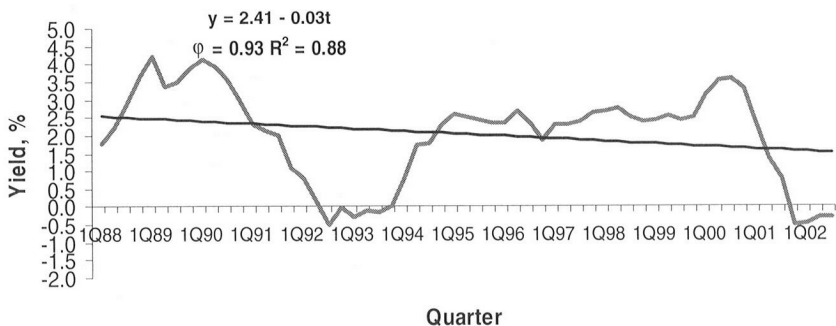
As can be seen from Figure 3, the real 3-month Treasury bill rate seems to exhibit a slight downward trend (so that the mean is not constant over time); further, the autocorrelation function (not reported here) declines very slowly. We can therefore conclude that this series has been generated by a homogeneous nonstationary process.

It is worth dwelling on this point. These results suggest that we should be able to obtain a more stationary series from first differencing. The results further suggest that we might wish to model the real 3-month Treasury bill rate as a first-order autoregressive process with drift.

Doing so, one finds that

$$i_t = 2.41 \quad + \quad 0.93i_{t-1} \quad - \quad 0.03t$$
$$\quad\quad (1.21) \quad\quad\quad (0.05) \quad\quad\quad (0.03)$$
$$\quad R^2 = 0.88 \quad DW = 1.1 \quad SEE = 0.47$$

where i_t is the real 3-month Treasury bill rate, t is the trend and standard errors are in parentheses. I conclude from this that (1) the real 3-month Treasury bill rate follows a stationary autoregressive process, (2) the estimate of the first-order autoregressive parameter is positive and significant and (3) there is a slight downward trend in the real interest rate since 1988. This trend line is illustrated in Figure 3.

Overall, I conclude that real interest rates did not increase over this time period. This leaves lower-than-expected cash-flow growth rates (or perhaps declining cash-flow growth rates brought about by a decline in inflation) as the prime source of the unexpected capital loss on real estate over the past 15 years.

Is Cash Flow Growth Unexpectedly Low?

The answer to this question is, of course, difficult to judge. Yet I believe there is some evidence out there—admittedly anecdotal evidence—to back this up. Consider, for example, the suburban office market in Chicago. Anecdotal evidence following Shulman, Axelrod and Harris (2002) indicates that net rents (in nominal terms) in 1984 in the suburban Chicago office market were about $24 per square foot (after concessions). Today, net rents to an owner of an office building in suburban Chicago are no higher than they were in 1984. Furthermore, this pattern of stagnant, or less than expected, growth in nominal rents is not unique to the suburban Chicago office market. Net rents in most other major office markets in the United States—including New York, Boston, San Francisco, Washington, D.C. and Seattle—also are no higher today than they were 15–20 years ago.

Now contrast this result with what investors actually expected the market rent change rates to be over this same time period, as reported in the Korpacz survey. The Korpacz survey asks all participants to give their self-assessment each quarter as to what is likely to happen to market rents in the future. These responses are then aggregated to produce an expected market rent change rate for the country as a whole for each property type. Figure 4a–d presents histograms of these *ex ante* expected market rent change rates for office, retail, apartment and industrial buildings. The data indicate that over the entire 1988–2002 period, expected market rent change rates were 2.73% per annum for the office market, 3.37% per annum for industrial, 3.04% per annum for retail and 3.23% per annum for apartment buildings (±0.5%).

Thus, we infer that if net office rents were $24 per square foot in 1984, at a 2.73% expected growth rate per annum (which is a geometric average rate), that $24 per square foot would have grown to $35 per square foot today. The unexpected loss over the 15-year interval is $11 per square foot ($35 per square foot minus an actual market rent of $24 per square foot). Further, this differential helps to explain more than 90% of the difference between the average realized and expected returns on real estate over the 1988–2002 period.

In sum, then, I conclude that the unexpected capital losses for 1988–2002 are largely due to a slower than expected cash-flow growth. In other words, as unex-pected bad news developed about future market rents, property values failed to rise as expected, and investors were left with lower than anticipated (rationally assessed, or true) returns. Elsewhere, Fama and French (2002) conclude that average realized equity returns were higher than *ex ante* expected returns over the past half century because realized equity returns included large unexpected capital gains. If this is true, then the evidence would seem to imply an increase in demand for stocks relative to real estate during a time period when *ex ante* expected returns on stocks were falling.
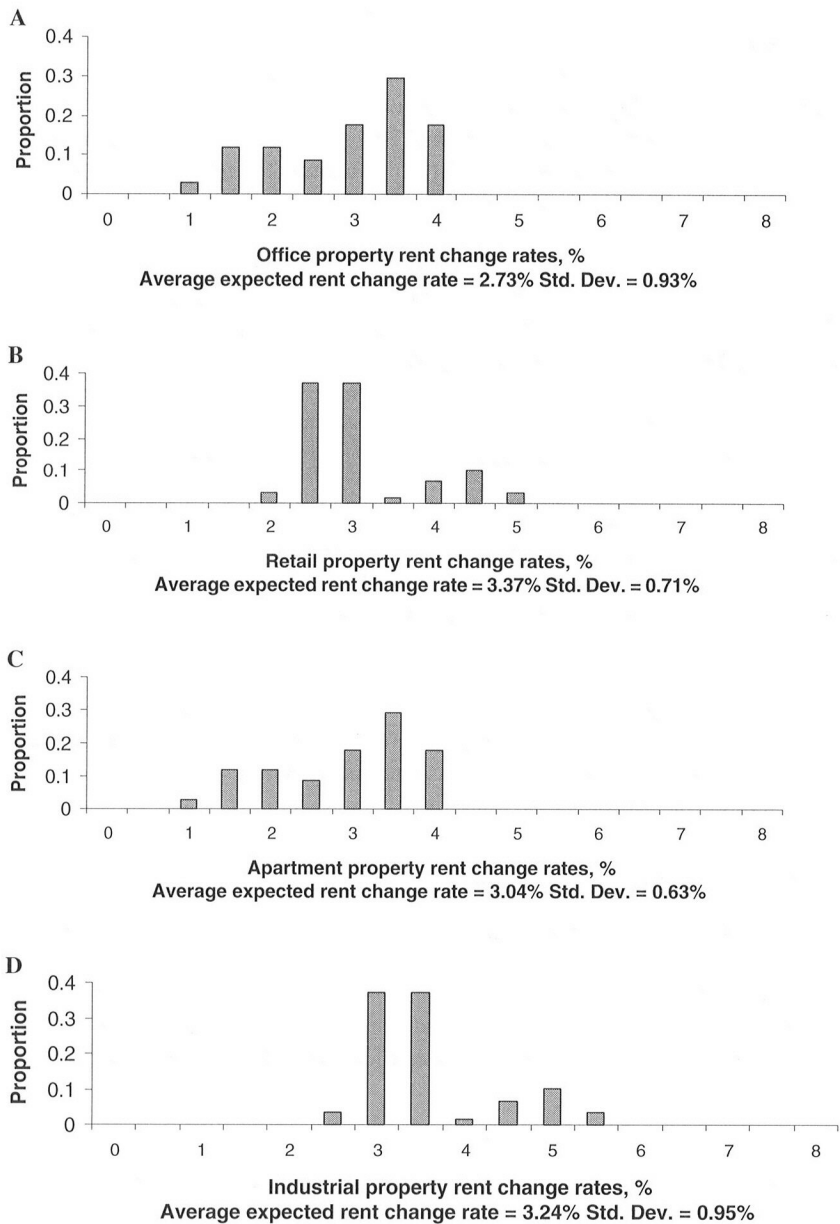
An Extension: Comparing Expected and Actual Capital Gains

In what follows, I present some descriptive analysis of the size of expected and actual capital gains for 1988–2002 on office, retail, apartment and industrial buildings. I then consider whether actual capital gains for 1988–2002 are far below expected capital gains. This is an alternative way of measuring whether real estate experienced unexpected capital losses for the period 1988–2002.

Measuring Expected Capital Gains

I should be clear about how I measured expected capital gains. The Korpacz survey does not contain information on expected capital gains. But it does ask

Figure 4 ■ A: The distribution of the Korpacz office property rent change rates. B: The distribution of the Korpacz retail property rent change rates. C: The distribution of the Korpacz apartment property rent change rates. D: The distribution of the Korpacz industrial property rent change rates.

A

Office property rent change rates, %
Average expected rent change rate = 2.73% Std. Dev. = 0.93%

B

Retail property rent change rates, %
Average expected rent change rate = 3.37% Std. Dev. = 0.71%

C

Apartment property rent change rates, %
Average expected rent change rate = 3.04% Std. Dev. = 0.63%

D

Industrial property rent change rates, %
Average expected rent change rate = 3.24% Std. Dev. = 0.95%

all participants to report their prospective rates of return (income and appreciation) and yields (going-in capitalization rates) for office, retail, apartment and industrial buildings in the current quarter. So, to estimate expected capital gains, I use the data on total return as reported in the survey and subtract the going-in capitalization rate, defined as year 1's income divided by value. If the result is a negative number, expected depreciation in overall property value is indicated. If the result is a positive number, expected appreciation in overall property value is indicated.

Figure 5a-d displays histograms of the expected capital gain for office, retail, apartment and industrial buildings from 1988 to 2002. It shows that investors were expecting property values to rise in 1988–2002 by 2.25% to 3.5% per annum, with some, but not much, variation over time. By a two-tail t-test, all four mean values test to be significantly different from zero at the 1% level.

An important question is whether actual capital gains equal expected capital gains. A lower (higher) than expected increase in overall property value means that investors will experience unexpected capital losses (gains) for the period. Further, if unexpected capital losses (gains) are large, then the realized risk premium on real estate will be low (high) whereas the expected risk premium is likely to be high (low). Insofar as this is true, then using historical averages to estimate the risk premium on real estate would be misleading.

Comparison to Actual Capital Gains

Table 6 compares expected and actual capital gains on office, retail, apartment and industrial buildings. The table also reports a t-test of the differences in the means of expected and actual capital gains for all four property groups. The actual capital appreciation return indices that I use are the capital appreciation returns for office, retail, apartment and industrial buildings reported by NCREIF.

The results in Table 6 are roughly similar to those in Table 2. Actual capital gains are well below expected capital gains, indicating large unexpected capital losses on real estate during the past 15 years. The t-statistics for all four differences in the means are significantly different from zero at the 1% level.

Relationship to Expected Inflation

Is there an upward bias in capital gains expectations for real estate? If so, why, and would this affect my conclusion that real estate experienced unexpected capital losses for the period 1988–2002?

Figure 5 ■ A: The distribution of expected capital gains on office buildings. B: The distribution of expected capital gains on retail shopping centers. C: The distribution of expected capital gain on apartment buildings. D: The distribution of expected capital gain on industrial buildings.


A

Expected capital gain on office buildings, %
Average expected risk premium = 2.36% Std. Dev. = 0.35%

B

Expected capital gain on retail shopping centers, %
Average expected risk premium = 3.42% Std. Dev. = 0.58%

C

Expected capital gain on apartment buildings, %
Average expected capital gain = 2.66% Std. Dev. = 0.25%

D

Expected capital gain on industrial buildings, %
Average expected capital gain = 2.27% Std. Dev. = 0.35%
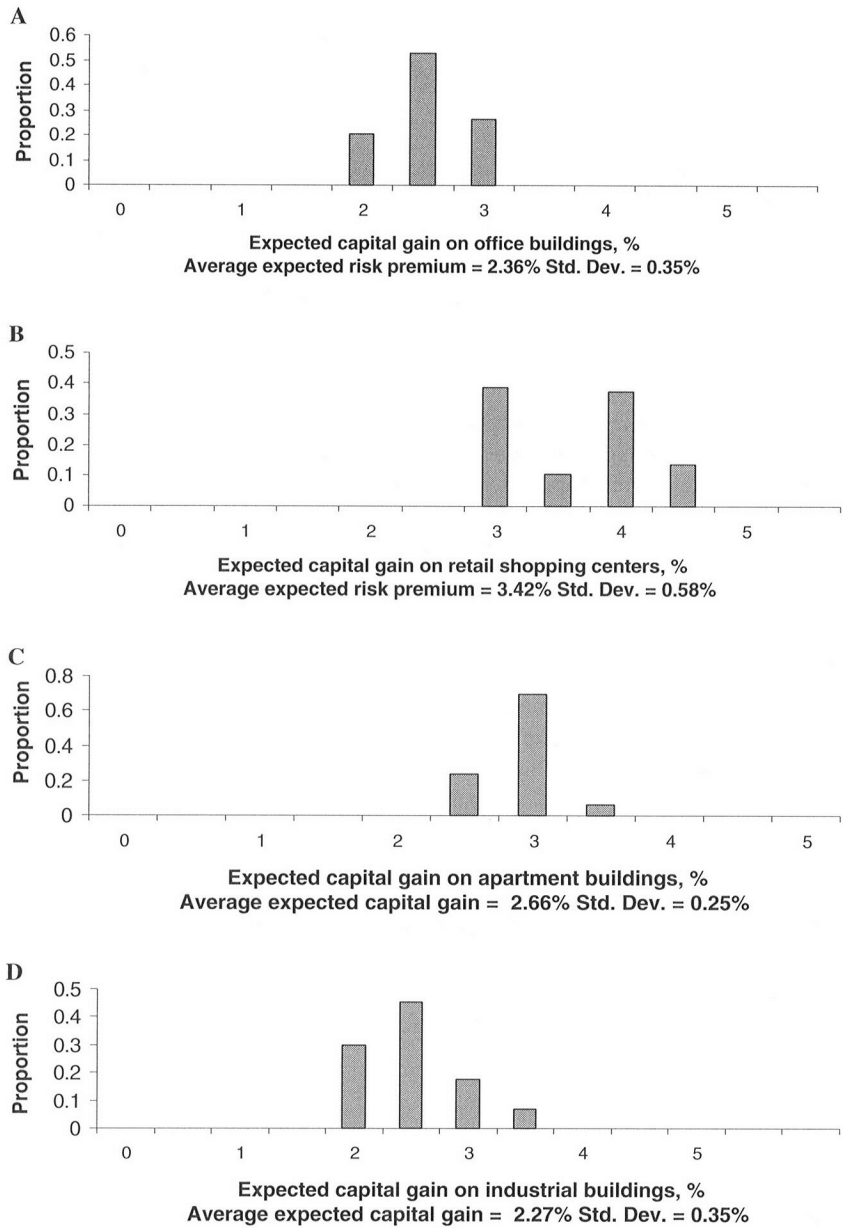
Table 6 ■ Comparison of expected and actual capital gains on office, retail, apartment and industrial buildings.

	Expected Appreciation Rate	Actual Appreciation Rate	Differences in the Means
Office	2.36%	−2.51%	4.87% (3.75)
Retail	3.40	−0.88	4.28 (5.70)
Apartment	2.66	0.92	1.74 (2.71)
Industrial	2.29	−0.86	3.15 (3.48)

Expected capital gains are measured as the difference between the Korpacz survey return and the going-in capitalization rate, defined as year 1's income divided by value. Actual capital gains are from NCREIF. Tests for the differences in the means of each group are conducted using a t-statistic. T-values are reported in parentheses. All means are statistically different at the 5% level. The sample period is 1988Q1–2002Q3.

One simple way to test whether there is an upward bias in capital gains expectations for real estate is to compare average expected capital gains on real estate (as measured above) with the average Livingston expected rate of inflation. Over a long period, property rents and value should grow at the expected rate of inflation and the averages of the two series should be equal.

Tests of this hypothesis are conducted in Table 7. The table shows the means of the expected inflation rates and also provides statistics which test for the differences in the means. All of the reported t-tests are one-tailed. Also, since direction of difference matters, the rejection region will be rather high by conventional standards. The results in Table 7 suggest that the t-tests for all four property types are high, indicating significant differences in the averages of the two series. The differences in the means are negative for office, industrial and apartment buildings and positive for retail shopping centers, revealing that most investors expect modest appreciation on real estate.

I also regressed expected capital gains on real estate on the Livingston survey data. If investors consistently expect property values to appreciate at the expected rate of inflation, the coefficient of the expected inflation rate in this regression should equal one (*i.e.*, a 1% increase in expected inflation should correspond to a 1% increase in expected capital gains on real estate). The results of these regressions are presented in Table 8. The columns report the estimated coefficients, the standard errors of the estimates, the Rs and the F-values, while the rows report the different property types.

Table 7 ■ Comparison of expected rate of appreciation on office, retail, apartment and industrial buildings and expected rate of inflation.

	Expected Appreciation Rate	Expected Inflation Rate	Differences in the Means
Office	2.36%	3.06%	−0.7% (−3.71)
Retail	3.40	3.06	0.34 (4.98)
Apartment	2.66	3.06	−0.4 (−2.68)
Industrial	2.29	3.06	−0.77 (−14.10)

Expected rate of appreciation is measured as the difference between the Korpacz survey return and the going-in capitalization rate, defined as year 1's income divided by value. Expected rate of inflation is taken from the Livingston survey. Tests for the differences in the means of each group are conducted using a t-statistic. T-values are reported in parentheses. The hypothesis that the expected rate of appreciation on office, apartment and industrial buildings is greater than the expected rate of inflation can be rejected at the 5% level. The sample period is 1988Q1–2002Q3.

Table 8 ■ Regression estimates of quarterly expected rates of capital appreciation on office, retail, apartment and industrial buildings on expected inflation.

	Constant	Expected Inflation	R^2	F-value
Office	1.30 (0.40)	0.42 (0.15)	0.20	7.60
Retail	0.69 (0.45)	0.92 (0.17)	0.48	27.5
Apartment	2.66 (0.30)	−0.03 (0.11)	0.01	0.1
Industrial	1.85 (0.17)	0.07 (0.06)	0.03	1.1

Expected rate of appreciation is measured as the difference between the Korpacz survey return and the going-in capitalization rate, defined as year 1's income divided by value. Expected rate of inflation is taken from the Livingston survey. T-statistics are reported in parentheses. The sample period is 1988Q1–2002Q3.

The evidence shows that there are some traces of a positive relation between expected capital gains on real estate and the expected rate of inflation in the overall economy, particularly in the case of office and retail shopping centers. However, in all cases, the coefficient of the Livingston expected rate of inflation is significantly less than one at the 5% level and hence does not support the conjecture that investors simply assume rents and values will grow at the

expected rate of inflation. Notice, too, that the results do not stand up in the case of apartments and industrial buildings. In both of these cases, the coefficient of expected inflation is essentially zero. Also, the Rs in these two latter cases are only between 1% and 3%, little better than random guesses.

Concluding Remarks

This paper addresses whether there is a risk premium puzzle in real estate. Considerable evidence exists to demonstrate that investors are extremely un-willing to accept variations in stock returns without, on average, earning a high risk premium. Yet investors seem much less risk averse when it comes to in-vesting in real estate, at least judging from the historical spread between real estate returns and the return on fixed income securities over the past quarter century.

One way to reconcile the evidence is to argue that if realized returns on real estate have included large unanticipated capital losses, then the expected returns on real estate can be larger than realized. The data on which I test this hypothesis are from the Korpacz survey of real estate investors concerning office, industrial, retail and apartment returns over the period 1988–2002. The survey expected returns produce an *ex ante* risk premium over the past 15 years of about 6%–6.75%, which is too large to be explained by standard economic models. Further, these *ex ante* expected returns are larger than the average realized returns on real estate, indicating that realized returns on real estate for 1988–2002 include large unexpected capital losses.

Asset pricing theory suggests three potential explanations for why the *ex ante* expected return on real estate of 1988–2002 is above the realized return: (1) Expected future real interest rates or expected future excess returns on real estate are unexpectedly high at the end of the sample period, (2) cash flow growth for 1988–2002 is unexpectedly low or (3) some combination of these effects occurred simultaneously. I argue for slower-than-expected cash-flow growth.

This conclusion is based on three results. First, *ex ante* expected returns on real estate are essentially a level variable, despite the fact that they appear to follow an autoregressive process. Second, expected future real interest rates since 1988 have not increased; instead, they have, if anything, decreased in these years. Third, over the past 15 years, investors had expected market rent change rates of about 2.75% to 3.20% per annum. Actual growth rates in market rents, however, have been quite flat, leading to large unanticipated capital losses.

I also compare expected and actual capital gains on real estate over the 1988–2002 period. I measure expected capital gains on real estate as difference be-tween the total expected return (income and appreciation) and the going-in

capitalization rate as reported in the Korpacz survey. The evidence clearly shows (to the extent that I can determine this) that real estate experienced unexpected capital losses during the 1988–2002 period. This finding buttresses the argument that using historical averages to estimate the risk premium on real estate is misleading.

The paper also provides evidence emphasizing that (1) real estate investors tend to have uniform expectations; (2) they appear to price all property types in the same way, despite the fact that there are times or states of the world in which certain property types perform better than other property types and (3) they appear to be no more uncertain about expected future returns after a decrease in price and fall in return than after an increase in price and return.

Of course, as with most empirical studies, this paper is not without limitations. The main limitation here is that survey respondents have little incentive to give thoughtful answers. To the extent this is a problem, surveys of *ex ante* expected returns on real estate may be poor proxies for actual expectations. However, keep in mind that since expectations are of the mind and not directly observable, the only bona fide way to measure return expectations on real estate is through interviews with real estate investors.

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