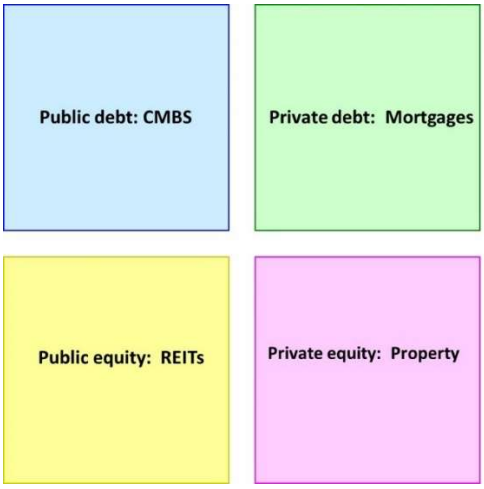
A Pragmatic Approach to Real Estate Quadrants

Intriguing, Interdependent and Complex



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SUMMARY

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Contents

I. Introduction[1]: The Tactile and the Intangible

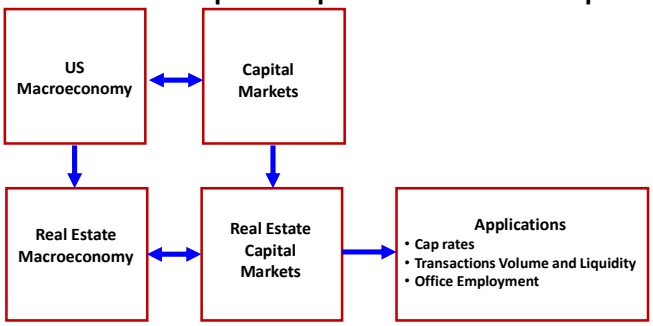
Why entitle this report, "A Pragmatic Approach to Real Estate Quadrants—Intriguingly Interdependent and Complex"? Most references to "quadrants" use the term to indicate a classification scheme; they even include "theory" to lend it respectability, but usually there is little theory. People often use the term "four quadrants", but that seems redundant like "round circles". This report asks, is there a quantifiable theory lurking within and between the quadrants? I believe there is, but dissecting the quadrants is like solving a puzzle. An important finding is that capital market variables already discount macroeconomic conditions and consequently analysts should include these variables in their models.

The relationships between quadrants are complex and highly interdependent. Therein lies one of our deepest and most important insights. I consider these relationships very intriguing. Importantly, even the most skeptical investors will find the results compelling and eminently pragmatic. (See Appendix D for sources and notes for exhibits.)

Investors like to think of property as bricks and mortar ("Bricks"), or something that is tangible or even tactile. Investing in property involves buying financial instruments collateralized by income flowing from property. While the certificates of ownership are tangible, the associated risks and expected returns are intangible. The Bricks may be spatially fixed, but capital is global, mobile, and, in bad times, fleeting. More complex and no less intangible are packages of mortgages called commercial mortgage-backed securities (CMBS). I show that the capital markets price risk and that, in equilibrium—a big assumption—risk adjusted returns equilibrate globally through capital flows. Real estate—property, mortgages, CMBS and REITs—is embedded within the overall economy. The demand for property is a derived demand. Feedbacks, lags, and expectations complicate the pricing system. Importantly, real estate is a hybrid asset consisting of debt- and options-like components, such as leveraged equity. Other embedded options include the options to lease, to abandon or to develop.

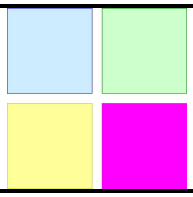
Who should read this report? Certainly, investors and operators should. This report covers new ground; it focuses on the intersection between private and public markets and the evaluation and forecasting or returns, risk and value across the quadrants. Our research fills an important gap. If you are interested in risk management or asset allocation, this paper is for you.

Exhibit 1. Our report's capital markets road map



[1] CBRE-Econometric Advisors invited Dr. Randall Zisler prepare this paper on the real estate quadrants. His approach reflects a multifaceted career as a finance and economics professor Princeton University, Wall Street research director at Goldman Sachs & Co. and Nomura Securities International, pension fund consultant partner and Pension Consulting Alliance, and head of investment banking at Jones Lang LaSalle. CBRE-EA is serializing this paper, which will be sent to CBRE's global mailing list.

II. Executive summary



1. **Linking real estate operations to value, returns and risks.** This report presents a comprehensive quantitative framework for the analysis of real estate capital markets through the lens of the real estate quadrants. My goal is to econometrically analyze the function of each quadrant and the linkages between the quadrants. I conclude that the capital markets are an integral part of the real estate economy and macro models should explicitly include capital markets variables.

2. **The quadrants—more a classification scheme than a theory**. The quadrants are distinct but interdependent. Understanding one quadrant requires an appreciation of all quadrants.

3. **Return smoothing and data intricacies**. Public and private return processes differ and the statistical characteristics of their respective returns reflect these differences. Private returns at times should be corrected statistically for serial correlation, which is an indicator of illiquidity. (See pages 8 - 11, "The Challenges of Public and Private Market Data".) I introduce the quadrants along with an analysis of information flow between quadrants. (See page 13, Exhibit 13.)

4. **Quadrant 1 CMBS returns**. BBB-rated CMBS total returns are a function of the high yield corporate bond yield, current leveraged and one-quarter lagged unleveraged property returns. (Page 14)

5. **Quadrant 2 Mortgage returns**. Mortgage returns reflect BBB CMBS returns, the BBB-rated corporate bond return, the BAA corporate bond return and the bond default premium. (Page 20)

6. **Quadrant 3 REIT returns**. REITs total returns are a function of small cap stock returns and unleveraged property returns (current and lagged). (Page 23)

7. **Quadrant 4 Property returns**. Leverage property returns reflect BBB-rated CMBS, equity REIT returns, the NOI growth rate lagged four quarters, the spread between current and four quarter lagged sales transactions volume, and leveraged property returns lagged a quarter. (Page 25)

8. **Where the rubber meets the road—Three applications**. Theory is great but what about practice? I apply my findings to an analysis of the capital markets determinants of cap rates, transactions volume, and office employment. Transactions volume helps explain property returns. (Page 36)

9. **The right tool for the job**. Our findings, which provide a better appreciation of risk, are pragmatic. For example, I advocate using Monte Carlo, not traditional deterministic, analysis when pricing complex investments with embedded options. Deals are replete with embedded options—the options to default, renew leases, redevelop, and escalate rents. These options are call options, the values of which increase with volatility. Using the wrong tools leaves value on the table and causes investors—LPs and GPs—to incur uncompensated, often hidden, risks.

III. Preliminary considerations

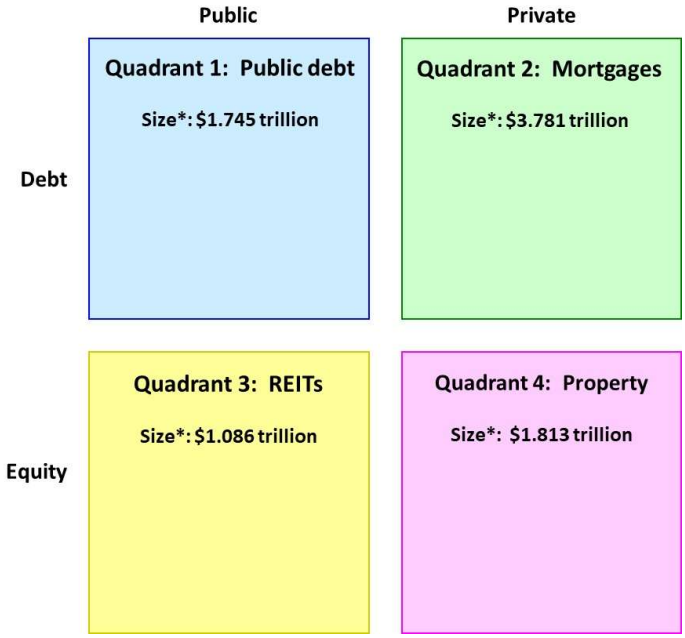
I often hear to my chagrin terms such as “four quadrants” or “four quadrant theory”. The former is redundant; the latter makes no sense. The quadrants represent a construct or classification, not a theory. Nothing inherent in “quadrant” suggests testable hypotheses or predictive modeling, which, if empirically valid, might support a theory.

This semantic excursion does not discredit in any way the importance of our topic, nor does it minimize the value of rigorously dissecting the quadrants in search of enduring relationships that truly matter.

What drives quadrant performance? This paper solves a long-standing and largely ignored puzzle by unlocking the stylized facts lurking within and between the quadrants themselves. The analysis, which straddles real estate and the capital markets, clarifies the relationships between public and private, equity and debt. Our approach is as eminently pragmatic as it is compelling.

A. The quadrants are distinct but interdependent—more than a classification scheme. The quadrants categorize real estate financial instruments; while property is just one component (or quadrant) of real estate, it is the feed stock of the other quadrants. The other quadrants represent alternative ways to package, price and trade property. Exhibit 2 reports the most recent estimated outstanding capitalizations provided by the Pension Real Estate Association.

Exhibit 2. The real estate quadrants: $8.4 trillion as of 2023:II



The quadrants are neither homogeneous nor are they independent; they are inseparably bound. Property, which comprises the fourth quadrant, is often, but not always, leveraged with senior and sometimes mezzanine debt. The second quadrant includes only private debt, primarily senior mortgages. Commercial mortgages, which populate the first quadrant, collateralize CMBS, senior

and subordinate tranches. The value of mortgage-backed securities depends on the priority with which losses and income are assigned to the various tranches or classes. The more senior is the class, the less risky are its returns. To the extent that property markets weaken or loan-to-value ratios change, for example, the performance of all quadrants, not just one, change.

Total quadrant capitalization was $8.4 trillion by 2023.II, according to the Pension Real Estate Association. Mortgage debt comprised $3.8 trillion and property (equity) was 1.8 trillion, which implies leverage of 68%. REITS account for $1.1 trillion and public debt was about $1.8 trillion.

B. The data Tower of Babel: Which cap rate is most appropriate? The Tower of Babel is a metaphor or symbol of disunity and chaotic communication, a state of affairs that resembles the proliferation of real estate data; this cacophony seems at times conflicting, if not confusing. Cap rates are an example. Proponents of technologically-enabled global real estate capital markets should eschew a Tower of Babel; consistency and transparency should be the norm. A related issue is that real estate data lack sufficient granularity, especially at the levels of MSAs and their submarkets. Another problem, which we do not pursue, is that customary analytic practices may not be up to the challenges imposed by the data and the complexity of markets. For example, traditional deterministic methods are not an adequate substitute for Monte Carlo analysis of real estate risk.

Many capital market times series reflect the longer-term proliferation of new capital markets instruments including derivatives. By comparison, the evolution of real estate capital markets has been slower, but the real estate capital markets are evolving and with this evolution we witness a significant increase in the number of real estate capital markets data series. Collection methodologies vary and many may not be rigorous.

Exhibit 3. Office cap rates: RCA, NPI appraisal equity weighted, and NPI value weighted

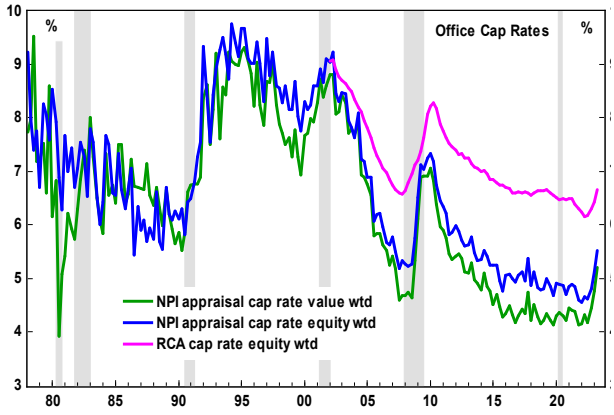
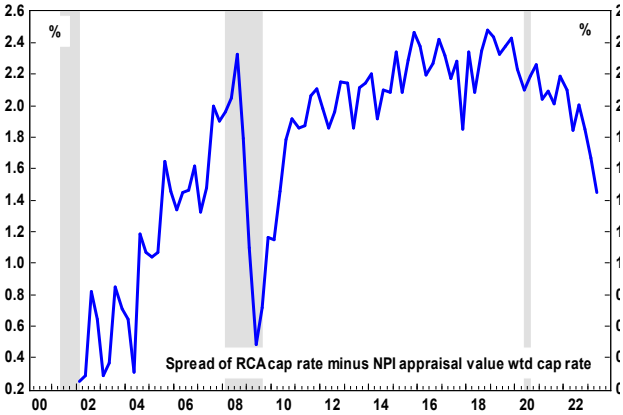


Exhibit 4. Spread between RCA office cap rate and NPI office appraisal cap rate



There are often several versions of the similar variables, such as cap rates[2], which have recently diverged, as shown in Exhibits 3 and 4. Which cap rate is most appropriate and for whom? The investors? The brokers? The academics?

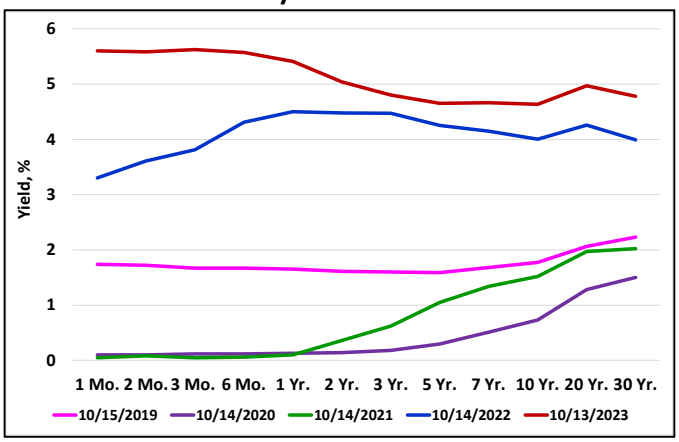
[2] Many investors, especially pension funds and their advisors, prefer the NCREIF ODCE performance index. However, they may not realize that the ODCE index is very similar statistically to the NPI unleveraged property return index, as shown below. The ODCE performance return index, NPIODCE, is highly correlated with the leveraged NPI and especially with the NPI unleveraged return indices. With regard to the regression of ODCE on the unleveraged index, the adjusted R^2 is 0.989 and the coefficient on

C. Capital markets: Equity and fixed income. I now introduce some of the more important general capital markets determinants of real estate value, return and risk. These variables are prominently featured in the econometric models that follow.

The curve, as shown in Exhibit 5, is relatively flat as of October 14, 2023. The one-month Treasury yield is 5.60% whereas the 30-year Treasury yield is 4.78. On October 14, 2021, the short- and long-horizon yields were 0.05% and 2.02%.

The yield curve affects the capital markets in a multiplicity of ways. Investors price securities, private and public, either directly or indirectly, based on the yield curve. I show that seemingly unrelated bond yields and total returns are important factors in explaining the total returns of CMBS, mortgages, REITs, and property. Baa-rated bond yields, an important predictor of property yields, are more volatile than AAA-rated bonds, as shown in Exhibit 6. Small cap stock and S&P 500 total returns are highly correlated and small cap stocks have similar volatility. (See Exhibits 7.) I show later in this report that small cap stock returns help explain equity REIT returns.

Exhibit 5. 2019 – 2023 yield curves



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the unleveraged NPI return is close to unity. Investors should not use ODCE as a benchmark for value-add or opportunistic deals; this index is more appropriate for core-like assets and portfolios.

$$NPIODCE_t = 0.368 + 0.648 * NPILEV_t \quad (1)$$

(4.383) (28.590)

Adjusted R^2 = 0.952
DW = 0.760
Mean dependent variable = 1.898
S.D. dependent var = 1.921
S.E. of regression = 0.420

$$NPIODCE_t = -0.194 + 1.070 * NPIUNLEV_t \quad (2)$$

(-4.282) (62.123)

Adjusted R^2 = 0.989
DW = 1.805
Mean dependent variable = 1.898
S.D. dependent var = 1.921
S.E. of regression = 0.197

Exhibit 6. AAA- and Baa-rated bond returns are important in explaining real estate returns and yields.

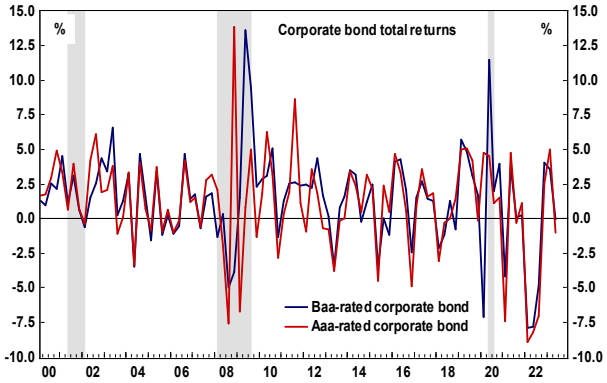
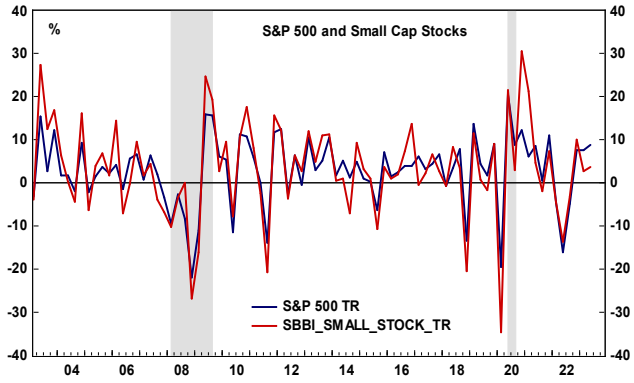


Exhibit 7. Small cap and S&P 500 stocks are highly correlated, but small cap stocks are more volatile. REITS and small cap stocks have similar coefficients of variation.



D. The challenges of public and private market data: A comparative analysis. The characteristics of private market and public market return data differ in important and material ways that affect risk and public-private analyses. Private assets do not trade in continuous auction markets as do publicly traded stocks (such as REITs) and some fixed income securities. Private market pricing is backward-looking due to appraisal and other pricing methodologies; these markets react with a lag to public market shocks. That is why the public markets, as we shall show, help us predict private asset performance. Moreover, since property returns exhibit serial correlation or smoothing, past property returns can predict to some degree future returns; such is not the case with heavily traded stocks like the S&P 500 or public REITs, which exhibit little, if any, serial correlation.

Public markets are more transparent and more liquid; by contrast, private markets are illiquid and transactions costs are higher. Private returns are serially correlated or smoothed because they are backward-looking. Public market prices, which impound information almost instantaneously, are forward looking; they exhibit near random fluctuations, as theory would suggest. The randomness of public prices does not mean, however, that public markets defy or lack causality. Quite the contrary. Public markets are just more efficient at impounding news; prices fluctuate as if they are random.

The degree to which serial correlation affects returns is an important distinction between private real estate and public real estate markets because it poses some empirical challenges, especially if we compare the risk-return performance of, say, REITs with property, or if we want to determine the optimal asset allocation in a portfolio of widely traded stocks, bonds as well as property and mortgages. Serial correlation masks risk; investors incorrectly believe that property is less risky than stocks. It is not.

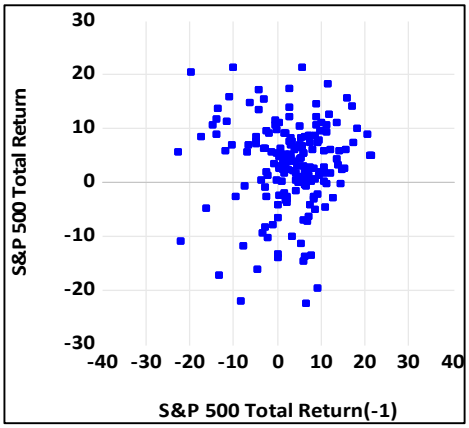
Correcting for serial correlation shows that property's true return volatility is similar to that of traded equity REITs. I compare past and current total quarterly returns of traded public shares—S&P 500 (SP) and all equity REITs (REIT)—with leveraged property (the NCREIF all-property leveraged index).

Past S&P 500 returns do not predict current returns, which is a characteristic of an efficient market. The coefficients on the lagged-dependent variables are not significantly different from zero:

$$SP_t = 3.218 + 0.021 * SP_{t-1} + 0.003 * SP_{t-2} - 0.051 * SP_{t-3} \quad (3)$$
(4.428) (0.274) (0.046) (-0.676)

Adjusted R^2 = -0.014
DW = 1.988
Mean dependent variable = 3.137
S.D. dependent var = 8.038
S.E. of regression = 8.095

Exhibit 8. Past S&P 500 returns do not predict current S&P returns.



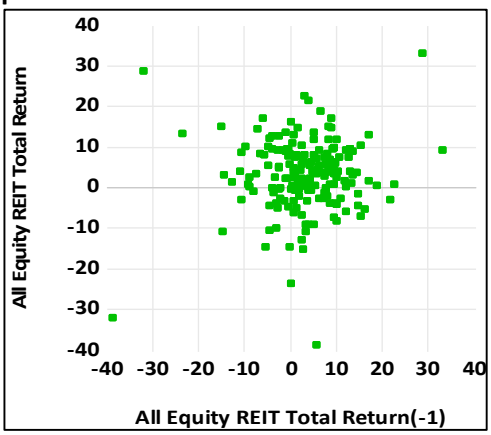
A scatter of the public assets, S&P 500 and equity REITs, indicates that there is no statistically significant relationship between past and current returns. (See Exhibits 8 and 9.) T-statistics in parentheses and adjusted R^2 are insignificant. The coefficient on each variable, lagged one quarter, is essentially zero statistically.

$$REIT_t = 3.417 + 0.088 * REIT_{t-1} - 0.112 * REIT_{t-2}$$
(4.397) (1.174) (-1.484)

$$-0.058 * REIT_{t-3} \quad (4)$$
(-0.773)

Adjusted R^2 = 0.008
DW = 2.000
Mean dependent variable = 3.159
S.D. dependent var = 8.901
S.E. of regression = 8.867

Exhibit 9. Past REIT returns do not predict current REIT returns.



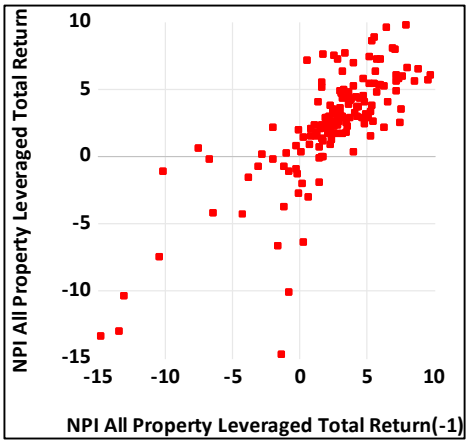
Leverage property exhibits serial correlation as indicated by the linear scatter in Exhibit 10 and the following regression. The coefficients on the lagged variables are significant.

$$NPILEV_t = 0.588 + 0.721 * NPILEV_{t-1} + 0.340 * NPILEV_{t-2}$$
(2.525) (9.452) (3.697)

$$-0.316 NPILEV_{t-3} \quad (5)$$
(-4.072)

Adjusted R^2 = 0.641
DW = 1.967
Mean dependent variable = 2.387
S.D. dependent var = 4.006
S.E. of regression = 2.401

Exhibit 10. Past serially correlated property returns predict future returns.



The coefficients on past values of NPI are statistically significant, as indicated by the high t-statistics. The past three quarters explains about 64% of the variation in current leveraged property returns. When comparing property and REIT returns, for example, then one must correct for serial correlation.

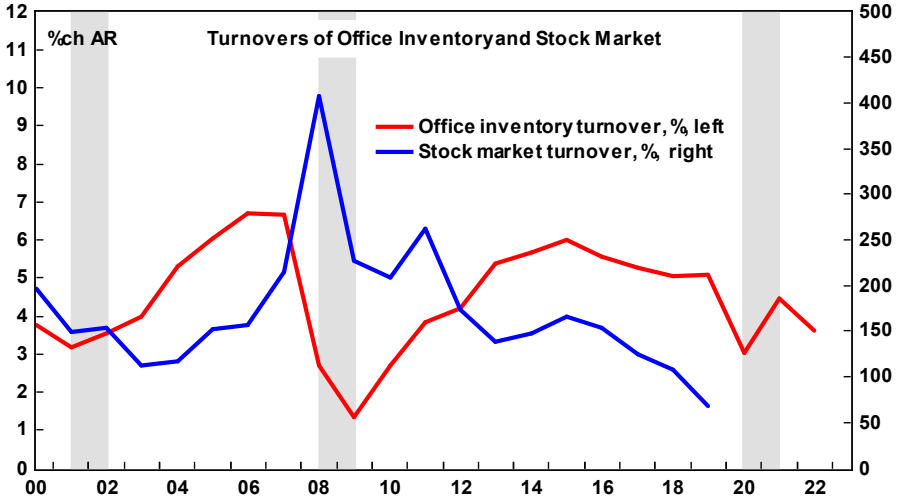
E. Turnover and liquidity. The trade ratio—the value of trades divided by capitalization—affects property returns and, in turn, capital markets factors affect turnover, as we show in "Application 2. Transactions volume and liquidity" (See page 42.)

Turnover ratios differ according to type of security, MSA, and other characteristics. For example, the speed with which prices impound new information differs, often in dramatic ways, between the stock and property markets. The trade ratio is also a measure of liquidity. If news arrives with a lag or if valuations are backward-looking, as they are in the case of appraisals, then investors hesitate until clarity improves and conviction increases.

In Application 2, we explore transactions volume, or turnover, in greater detail and show that, due to illiquidity or imperfections in information flow within the property market, property turnover is significantly lower than turnover in the stock market. During deep recessions, transactions volume craters and liquidity practically vanishes, e.g., during the GFC. Illiquidity, low turnover, and serially correlated, or smoothed, returns are an indication that property markets at their deepest level differ from continuous auction markets, such as the stock market.

Exhibit 11 shows that office property (OFFICETURN) and stock market turnover (STOCKTURN) percentages were 2.7% and 407.6%, respectively, at the onset of the GFC. The property turnover rate is now 3.6%, a small fraction of stock market turnover. Investors who are accustomed to vastly greater liquidity in the stock market should not take comfort that measured or unadjusted property returns have lower (naively) measured volatility than do stocks. Appropriate de-smoothing produces an unbiased standard deviation or property return risk measure that is comparable to that of equity REIT returns. Publicly traded REIT and property returns exhibit similar risks!

Exhibit 11. Property turnover is much less than stock market turnover.



What is the relationship between stock market and office property turnover (or liquidity), for example? Exhibit 11, and the following regression shows that the turnover in stocks leads the turnover in property markets by one year. The model says, if stock turnover increased last year, then property turnover will decrease this year. My model explains 32% of property turnover variable. Note that the coefficient on stock turnover lagged one period is relatively small.

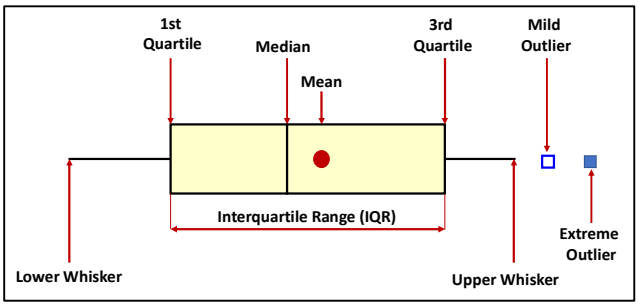
$$OFFICETURN_t = 6.653 - 0.012 * STOCKTURN_{t-1} \quad \textbf{(6)}$$

(9.195) (-3.124)

Adjusted R^2 = 0.315
DW = 0.899
Mean dependent variable = 4.560
S.D. dependent var = 1.474
S.E. of regression = 1.219

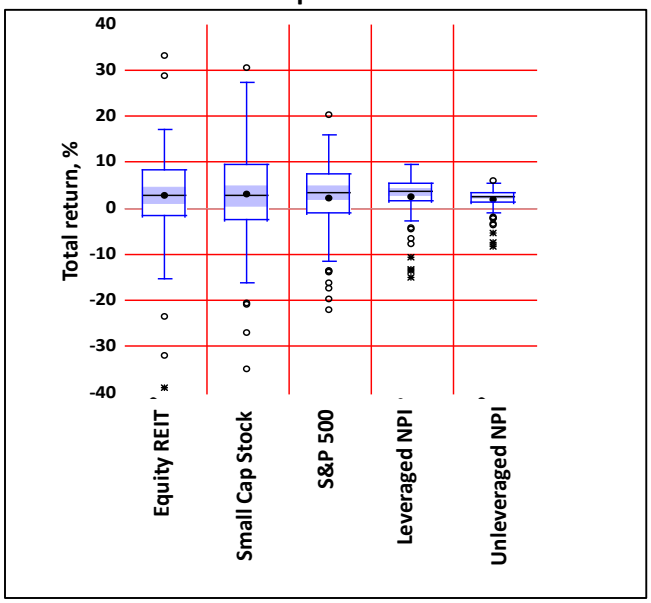
F. Descriptive statistics. Exhibit 12 shows box-whisker[3] plots of equity REITs, small cap stocks, S&P500 stocks, and the leveraged and the unleveraged NPI property returns. The plots indicate the extent to which the means and dispersions differ. Note that the two property indexes have a much lower measured spread due to return smoothing.

[3] **Definition of a box-whisker plot.** Specifically, the plot includes the interquartile range (IQR), which spans the second and third quartile. Within the IWR is the median and the mean. If the distribution is symmetrical, then the mean and the median are identical. Outliers that differ significantly from the rest of the dataset may be plotted as individual points beyond the whiskers on the box-plot. Box plots are non-parametric: they display variation in samples of a statistical population without making any assumptions of the underlying statistical distribution, which we did in the previous section. The spacings in each subsection of the box-plot indicate the degree of dispersion (spread) and skewness of the data. In addition, the box-plot allows visual inspection of various estimators, notably the interquartile range, mid hinge, range, mid-range, the mean and the median.



Source: Zisler Capital Associates, LLC

Exhibit 12. Box whisker plots



G. Applications preview: Why study the quadrants?

We show that the quadrants are interdependent. If the goal is forecasting total returns in one quadrant, then we must reach out to the other quadrants for help. For example, publicly traded REITs impound property market information faster than property prices can react.

Transactions volume is an important variable that helps explain leveraged property returns. Transactions data, which are serially correlated, impound important property market information and are useful in forecasting returns.

Cap rates reflect capital markets factors that include AAA- and Baa-rated corporate bond yields.

I apply these ideas in the following:

- **Application 1. Cap rates**. The cap rate is equal to the ratio of NOI to price, both of which are positively correlated with each other. This correlation helps explain why cap rates are less volatile than returns and more resistant to economic shocks, the long-awaited recent rise in cap rates notwithstanding. Exit cap rates are stochastic (uncertain) as are market rental growth rates.[4] (See page 39.)

- **Application 2. Transactions volume and liquidity**. I show that the rate at which the inventory turns over due to property sales is a good measure of liquidity and serial correlation. Serial correlation is also a good proxy for liquidity, and we use this proxy to measure MSA liquidity, which we model using quadrant-driven information. Liquidity, which varies by MSA, is an important variable in explaining property performance; it reflects capital markets factors. This application relates to a broader issue, which is the variation of market risk and liquidity across MSAs. I believe that the usual market research does not address this issue appropriately and, as a result, it may leave value on the table or cause investors to assume uncompensated or needless risk. (See page 44.)

[4] These findings are relevant to the pricing of highly structured transactions using Monte Carlo methods. These transactions include waterfalls, LP and GP positions, leverage and complex capital structures.

- **Application 3. Office employment**. Capital market conditions also affect the user demand for property, which is a function of the demand for office workers, or finance, insurance, and real estate (FIRE) workers. As an example, I draw on the quadrants to explain changes in FIRE employment, which is a function of NOI growth, lenders' expectations, bond yields, and transactions volume. I investigate the relationship between changes in profitability and FIRE employment. When employment increases, which represents an increase in current expenses, profitability declines. However, profits increase with growth in nominal GDP. (See page 48.)

VII. Conclusion

Few real estate topics are as neglected or as fraught with inchoate controversy as the connection between capital markets and the performance of the underlying physical assets. This state of affairs contrasts with the sophistication of public fixed income, equities and derivatives markets.

This paper has shown that the quadrants are interrelated and that the relationships are complex and fascinating. I believe our results are practical and theoretically compelling. If taken seriously by investors and their advisors, one might envision two important and beneficial developments: A closer and much more efficient link between real estate pricing and the general capital markets as well as an industry-wide, greater commitment to risk analytics. Without appropriate risk analytics, such as Monte Carlo analysis, the usual deterministic analysis too often fails to value embedded real options properly, identify and price downside risk, and quantity what is still a metaphor in waiting—risk-adjusted returns. Without a new capital markets approach that spans the quadrants, investors will likely leave value on the table and incur uncompensated risk. An enlightened appreciation of the quadrants' interplay also requires the application of advance econometrics and stochastic methods, such as Monte Carlo Analysis. Otherwise, the standard analysis is likely flawed.

Thought-provoking questions for future research. This paper has covered new ground and sets an agenda for future research. Investors in particular will benefit from papers and analysis pertaining to questions such as the following:

1. **What kind of risk metrics best connect general economic performance—vacancy rates, new construction, and rental growth—with valuation, return and risk?** Not all MSAs are alike. Cities with very low space supply elasticities—relative insensitivity of new supply to current changes in prices—generally have greater rental growth volatility, and rental growth volatility affects the value of embedded real options, such as the option to release, the option to escalate, the options to sell, and, of course, the option to develop (or redevelop). These are all call options, the value of which increases as volatility rises. Most investment analysis is deterministic and is incapable of evaluating risk in a useful way.

2. **How should we measure liquidity and how can we incorporate liquidity measures in devising risk premia across MSAs, property types, and property quality?** Serial correlation of returns, or smoothing, is a good correlate of liquidity as measured by the percentage of the property inventory that turns over due to sales in a year. Cities with the greatest liquidity are the most volatile with regard to rental rates.

3. **What drives cap rates?** Will cap rates necessarily rise when interest rates increase? Cap rates are a function of the risk-free rate, the credit spread and the expected growth rate of NOI. Research has shown that an increase in interest rates will not necessarily increase cap rates, because other factors, such as demand-supply imbalances can swamp the effect of interest rate shocks. Investors show embrace the received wisdom and recoil from the property markets due to rising interest rates should think twice.

4. **Do we overpay for growth, size, and gateway status?** Many investors do not realize that higher growth is associated with higher volatility, which begs the question: Do higher growth MSAs deliver great risk adjusted returns. If an investor and her advisor reduce leverage but invest in a riskier MSA, has the investor really reduced total risk? Do prevailing cap rates reflect true risk? How much of MSA risk is diversifiable?

5. **Is real estate including properties with short-term leases an inflation hedge?**

6. **How can we better apply risk analytics (including MSA risk metrics) to transactions with leverage waterfalls, and other embedded** options with the purpose of forecasting LP versus GP performance? (Risk analytics include Monte Carlo analysis of financial and macro data.)

7. **What are the characteristics of an ideal benchmark the recognizes the attributes found within the quadrants?** How should we measure real estate beta and alpha in practice.

8. **What is the price of liquidity and do prices reflect liquidity?** Should we apply a liquidity risk premium to MSAs according to the characteristics or each MSA? Is there a unique natural vacancy rate—the rate at which rents are neither rising nor falling and how does it relate to liquidity?

9. **Linking fundamentals to expectations for purposes of asset allocation**. How can we better integrate real estate macroeconomic forecasts within asset allocation, while accounting for assets, liabilities and shortfall constraints?

The market is like a cloud: The real estate market must come to terms with uncertainty, even when the landscape seems vaguely familiar. We can think of no better illustrative image than the following

Searching for Value and Avoiding Uncompensated Risk Is Like Shooting through a Dense Cloud