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On the Risk Measures of Real Estate Assets

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Abstract

This paper discusses the need of risk measure of real estate assets and the existing measures. Using the FTSE NAREIT monthly all REITs data from December 1971 to June 2017, this study concludes that the risk of real estate assets is indeed unmeasurable. Therefore, real estate assets performance measure should be based on absolute return or inflation-adjusted absolute return; the returns of real estate assets can be compared with meaningful benchmarks, yet the combination of risk and return does not have a valid benchmark. Prevalent indicators such as Sharpe ratio is a misleading concept that leads to biased weights of real estate assets in a modern portfolio. Furthermore, there are no standard measures of the higher moments for real estate asset returns, as the second moment measure does not deliver a solid foundation.

JEL classification numbers: G11
Keywords: Risk, Measure, Asset price, Return, Real estate, Portfolio management

1 Introduction

The real estate assets are no longer regarded as unusual components in a modern portfolio. Though they are still categorized as a subset of alternative assets, they are frequently included in the investment processes as assets that bring unique benefits. Such benefits, compared to the usual components such as equities, bonds or money market instruments in a modern portfolio, are greatly valued by asset managers and direct investors. Specifically, the advantages that real estate assets bring are widely accepted as the illiquidity premium, the absolute return that is independent from market portfolio, the potential of inflation hedging, and the

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income flow brought during the holding period.

The developments of modern financial instruments at least somehow mitigate the disadvantages real estate asset investments. The common concerns on real estate assets are their illiquidity nature, their valuation difficulty, and their lumpiness. However, securitization successfully converts the real estate assets from real assets into financial assets that are highly liquid. Passthrough assets have realized the separation of independent real estate assets with large single value. Real Estate Investment Trusts (REITs) have introduced the bond market and interest rate risk to the real estate assets. Therefore, the minimum investment hurdle that used to be influential in the involvement of real estate asset investments has disappeared.

The benefits brought by real estate assets, as well as the mitigation of their downsides, warrant the increasing volume of real estate assets in modern portfolios. These assets are still less observed in individual investor instrument pools, as they require a relatively specialized skill set in the analysis process. Yet in terms of institutional investors, the real estate asset class has been upgraded to a common configuration element. Another reason of such increasing attention is the rapid growth of the derivative market and instruments available to hedge the risk carried real estate assets, and to assemble synthetic strategies.

The real estate assets discussed in this paper include the typical settings that are adopted by the academia and industry broadly. Real estate assets are usually regarded as a general concept that houses the farmland, timberland, residential properties, commercial properties, hotels and resorts, hospitals, as well as utility infrastructures. These assets share some common features as physical assets, including illiquidity, lumpiness, income generating, inflation hedging, operation intensive, as well as depreciation. They also share some common characters as financial assets, including being interest rate sensitive, currency risk sensitive, and carrying high hurdle rate. Some of such risks and features are return rewarding: interest rate risk and illiquidity risk introduce the risk premium for real estate assets. Yet some risks are not return rewarding, such as currency risk. The need of understanding the return of real estate asset warrants the first reason of measuring the risk of it.

The second major motivation of measuring the risk of real estate assets is the consistent use of metrics that combine the returns and risks as the indicators of financial assets performance. The most frequently seen indicator in this context is the Sharpe ratio, which uses the standard deviation of the returns of real estate assets on its denominator. Sharpe ratio has been very widely adopted as the standard way of comparing and ranking the realized investments outcomes. Classic portfolio optimization theory relies on a fixed and accountable quantitative measure of asset volatility to start the computation of optimal weight of asset in the entire portfolio.

After the 2008 financial crisis, the financial industry has realized that using standard deviation as a measure of risk has its implicit downside. The calculation of standard deviation implicitly assumes that the assets return follows normal distribution. However, both researches from academia and observations from the

industry have repeatedly confirmed that asset returns in financial markets are not normally distributed. Therefore, a new measure of risk has quickly become very popular: the Value at Risk (VaR) method, which gives the threshold of loss at a given probability during a given amount of time. This risk measure is not without problem: the threshold of loss is not the expected loss, but the minimum loss. Hence, while the non-normality issue is taken care of, the investment practice still calls for a meaningful measure of maximum drawdown. Real estate assets maximum drawdown is probably the one that investors would like to learn the most, not only because it triggered the 2008 crisis, but also due to its significant impact on the value of a portfolio.

Other reasons of understating the real estate asset investment risk include the popularity of linear and nonlinear forecasting models that focus on estimating asset prices. Linear models, such as autoregressive integration moving average model (ARIMA), and non-linear models, such as artificial neural network (ANN), both require a pre-specified value of asset risk. Forecasting procedures, such as Monte Carlo simulation, take one step further: not only the second moment of asset returns is involved, but also the higher moments, with the size of distribution heads, tails, as well as their tradeoffs, are considered.

However, this study, after investigating different methods, concludes that the risk of real estate assets is indeed unmeasurable. This conclusion triggers a series of outcomes which are the propositions this paper suggests: real estate assets performance measure should be based on absolute return or inflation-adjusted absolute return; the returns of real estate assets can be compared with meaningful benchmarks, yet the combination of risk and return does not have a valid benchmark, i.e., Sharpe ratio is a misleading concept that leads to biased weights of real estate assets in a modern portfolio; there is no standard measures of the higher moments for real estate asset returns, as the second moment measure does not deliver a solid foundation.

The rest of this paper is organized as follows: Section 2 introduces the FTSE NAREIT monthly all REITs series and the regression tests. Section 3 presents the results; and Section 4 follows up with the concluding remarks.

2 Data and Methods

This paper employs the FTSE NAREIT US Real Estate Index Series data. The data source is National Association of Real Estate Investment Trusts all REIT data feed. This index is a good measure of the price levels in the investable and tradable properties. There are two types of real estate assets price quotes at the market place: appraisal based and market transaction based. The data utilized in this research falls in the latter category. The appraisal based indexes and prices suffer from data smooth problem and undermine the underlying volatility of real estate asset prices. Relatively speaking, the transaction based indices deliver a better demonstration on the asset volatility and is a potentially better indicator of

risk.

The logic of this study is that, if the market based real estate asset price index cannot implement and support a meaningful measure of implicit risk, the appraisal based series are even less capable of performing such function. This paper finds that the market based FTSE NAREIT US Real Estate Index is far from representing different key risk components embedded in the real estate asset class.

The FTSE NAREIT US Real Estate Index Series data used in this research is the unleveraged all REIT performance monthly series from December 1971 to June 2017, with the benchmark being set at 100 for December 1971. The head and tail of the data series are shown in Table 1 below.

Table 1: Data facts of the FTSE NAREIT US Real Estate Index

Date	Return	Index	Date	Return	Index
1971/12/31		100.00	2017/2/28	4.16%	6,828.41
1972/1/31	1.22%	101.22	2017/3/31	-1.39%	6,733.68
1972/2/29	0.95%	102.18	2017/4/28	0.51%	6,767.84
1972/3/31	0.25%	102.44	2017/5/31	-0.15%	6,757.90
1972/4/30	0.25%	102.70	2017/6/30	2.03%	6,894.97

This paper proceeds to the computation of the classic parameters for the test of normality of the returns of the series. Then the unit root test procedure describes the predictability of the price given the historically realized values. If the price series is confirmed to be a random walk with significant unit root, the price does not contain dominating systematic risk, and the beta of the portfolio is unstable. In this case, the idiosyncratic risk measure will be the next topic being discussed.

Most unit root tests, especially the Augmented Dickey-Fuller test, applied the series with the null hypothesis that the unit root presents, while the alternative is that the series is stationary. However, it is possible for a time series to be non-stationary, not having unit root but to be trend stationary. In other words, a series can be trend-stationary and simultaneously non-stationary nor a random walk. By nature, it is plausible to assume the REIT price series is trend-stationary, as the property prices in the U.S. has been steadily increasing in the past 40 years with the growth of population and square footage per capita due to economic growth. Therefore, this study utilizes the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) (Kwiatkowski, et al., 1992) unit root test, with the alternative hypothesis that unit root presents. Following the test is the analysis of the return distribution at higher moments.

3 Results

The descriptive parameters of the index series and the return series are listed in Table 2.

Table 2: Normality test of the FTSE NAREIT US Real Estate Index at level and first order

	REIT Index Level	REIT Index Return
Mean	1604.485	0.908065
Median	727.8749	1.105520
Maximum	7064.360	30.81282
Minimum	46.75169	-30.22584
Std. Dev.	1806.112	5.055309
Skewness	1.301631	-0.390811
Kurtosis	3.620031	10.38024
Jarque-Bera	163.2204	1253.044
Probability	0.000000	0.000000
Sum	877653.2	495.8034
Observations	547	546

Apparently, neither the index series nor its return follows a normal distribution, with the Jarque-Bera test null hypotheses being rejected at test values of 163 and 1253. This constitutes a strong argument in terms of the validity of using standard deviation, as well as Sharpe ratio to measure the performance of real estate assets. In fact, the more severe consequence of this result is the loss of support on the Capital Asset Pricing Model (CAPM), as well as the portfolio optimization procedure. This is because normality is the fundamental assumption of the data series involved in the classic finance theory.

The Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test includes intercept in the model specification. The spectral estimation method is Barlett kernel, and this paper uses the Newey-West automatic bandwidth selection procedure in the regression of KPSS model. The results are reported in Table 3. The regression shows that the REIT return is stationary without any support of existence of systematic risk.

Table 3: KPSS unit root test of the FTSE NAREIT US real estate index return

		LM Statistic
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.045514
Asymptotic critical values*:	**1% level**	0.739000
	5% level	0.463000
	10% level	0.347000
***Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)**		
Residual variance (no correction)		25.50934
HAC corrected variance (Bartlett kernel)		29.40735

With the understanding of the second moment, this paper turns to test the presence of anomaly at higher moments, namely skewness and kurtosis. A rolling two-year window is used to test the stability of the higher moments of the real estate asset returns. The skewness and kurtosis of the levels of the REIT index are not tested, as positive price indexes are naturally positively skewed. The first window includes the monthly returns of the REIT index from January 1972 to December 1973, and the last sliding testing window includes the monthly returns of the REIT index from July 2015 to June 2017. The results are reported in Figure 1.

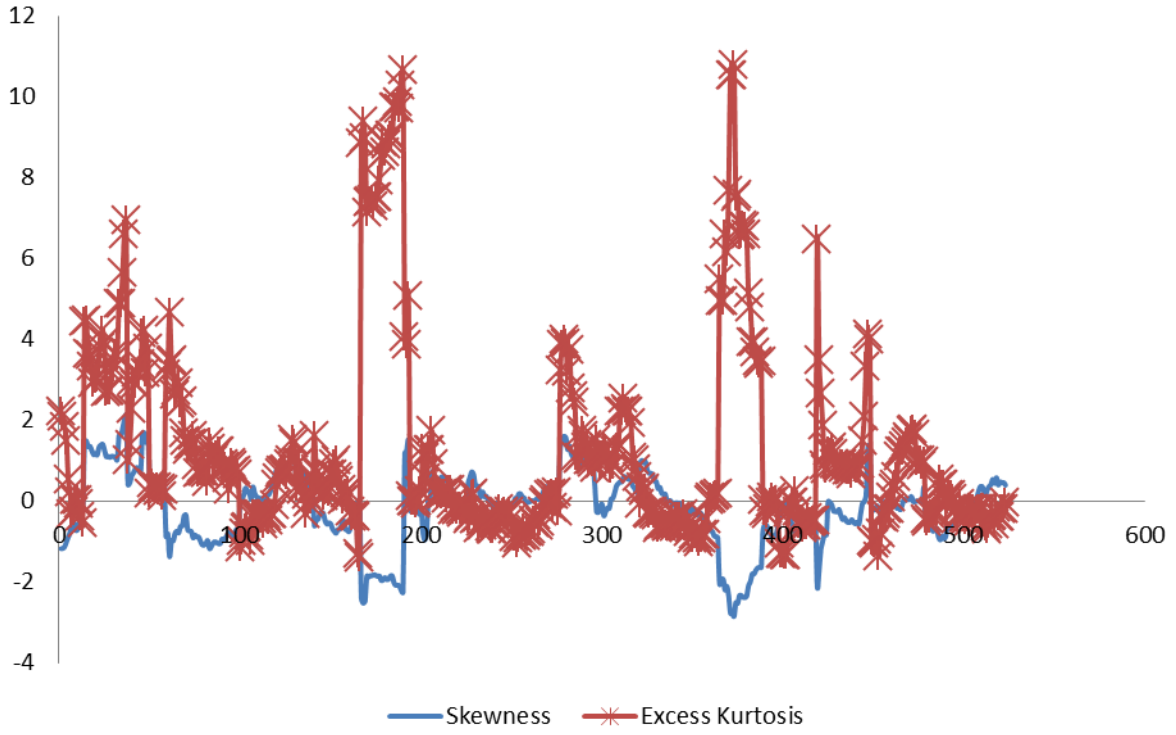

Figure 1: Higher moments of REIT monthly returns in a sliding two-year window

The higher moments are obviously not stable throughout the testing period, which includes more than 40 years of monthly data. This signals two conclusions: the return of real estate asset prices is not normally distributed, and more importantly, the distribution is not stable per se. Such result suggests that not only normal risk measures cannot be applied, but also no deterministic risk measure can be captured.

4 Conclusions

It is not completely conclusive to assert that the risk of real estate assets is not

measurable, due to the non-normality of its return, the instability of its distribution parameters, and its nature that embraces a unit root. These statistical results are in fact the byproducts of missing risk measure, not the reason of it. The missing risk measure of real estate assets has fundamental reasons caused by economic factors.

The returns of real estate assets are the net cash inflows incurred during the holding period, and the capital appreciation realized by the successful sale of the asset. The net cash inflow is compromised by the operating cost of the property, which is a unique cost that most other financial assets do not carry. Usually the success in the sale of a financial asset would not call for attention other than the controllable transaction cost. Yet for real estate assets this is not the case: the illiquidity price discount, which leads to the illiquidity return premium, could make the capital appreciation diminish. Therefore, the following factors, which is not an exhaustive list, can all potentially bring uncertainty to the real estate assets return: operating cost, commodity price, interest rates, inflation, population, regional geographical factors, local purchasing power, bid-ask spread, currency risk, the availability of risk hedging vehicles, special tax treatments and deferrals, and so on.

From the fundamental analysis perspective, some factors are usually categorized as macroeconomic indicators, such as inflation and currency risk; yet some are usually categorized as microeconomic indicators, such as regional development and operating cost that is linked to the local market demand. The factors are not syncretically affected by the business cycle. This implies that the risk embedded in the returns of real estate assets is not coherent, but chaotic.

For this reason, this paper recommends that the measure of real estate assets investment performance should avoid any risk-return combined factors such as Sharpe ratio, Treynor ratio, Sortino ratio, beta, et cetera. Relative performance is not an effective reference of asset selection, mainly because the return is not established on stable and consistent risk basis. The valid target of return for real estate assets should ideally an absolute benchmark: a required return that goes beyond the weighted average cost of capital, compensated by the erosion of inflation rate and subsidized by a profit margin.

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