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REAL ESTATE AND PORTFOLIO MANAGEMENT: EXAMINING DIVERSIFICATION PROPERTIES

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ABSTRACT

This paper examines the risk-return and diversification properties of real estate investments. In the process, we perform a variance analyses over NPI, TBI and NAREIT United States real estate indexes as well as some of the most common international investment benchmarks. The study uses data from January 1990 to March 2006. We present an optimal portfolio that could be used by financial managers and ordinary investors. Results disclose U.S. real estate with greater return than other important investment benchmarks for the fifteen-year study period. Additionally, real estate diversification benefits as constitute of a mix-portfolio are confirmed for the three used indexes. Evidence shows that direct investment in real estate is less sensitive to business cycles than is indirect investment through NAREIT and other similar Indexes. Finally, an optimal allocation of 49.6% for real estate index investing in NAREIT is identified.

Key-words: Portfolio Investment, Real Estate, Mean Variance Analyses, Real Estate Investment Trust (REIT)

1 INTRODUCTION

For many years financial managers have used real estate investments as a part of their overall investment strategy. As a result, a number of researchers have applied mathematical models in an attempt to analyze the effects of real estate investment on overall portfolio performance (Friedman, 1971; Brown, 2000; Seiler, Webb, Myer, 2001).

There are two ways of investing in real estate: direct investment and indirect investment. Direct investment refers to buying properties in the traditional sense. Indirect investment, on the other hand, refers to buying shares of real estate investment companies. Both forms of investing have various measurement indexes associated with them. The principal benchmark used to measure the performance of direct real estate investment in the

United States (U.S.) is the National Council of Real Estate Investment Fiduciaries (NCREIF) Index.

The NCREIF[1] Index, most commonly known as the NPI, is a quarterly transactions-based index of institutional real estate investment performance and includes the movements of real estate supply and demand. This benchmark is segregated by market sector and geographical region. The NPI is comprised of appraisal-based valuations of a sample of commercial properties owned by large U.S. institutions. Due to some detected problems of "smoothing" and lagging biases in this index, a new index known as the Transactions Based Index (TBI) was developed. The index represents an adjusted version of the NCREIF controlled for the smoothing and lagging biases deficiencies (Fisher, Geltner, Pollakowski, 2006).

The benchmark for indirect investment in real estate is the National Association of Real Estate Investment Trust share price (NAREIT). The NAREIT is a monthly index based on the market prices of shares owned by Real Estate Investment Trust (REIT) investors. NPI returns are based on the quarterly appraisal value of properties as estimates for the value of the property, whereas NAREIT returns are solely based on actual transaction prices. The appraisal process tends to result in smoother changes in estimates of value over time as markets change, in part due to the fact that appraisers must rely on historical information.

There are many reasons investors consider real estate as a part of their overall investment strategy: to reduce overall risk of the portfolio, to achieve returns above the risk free rate, to hedge against inflation or deflation, to help create a portfolio that is a reasonable reflection of the overall investment universe, and to deliver strong cash flows to the portfolio (Hudson-Wilson, Fabozzi, Gordon, 2005). Although investing in real estate may presents many positive benefits to the real estate investor, there are also some possible negative consequences to investing in real estate. Research has suggested that two negative consequences of real estate investment are the problems of "lumpiness" and the lack liquidity for many real state investments (Seiler, Webb, Myer, 2001). Another negative features of real-estate investment is the volatile nature of international capital flows that might expose property investors to extra investment risk (Hsien-Hsing, Jianping, 1999). Furthermore, high transactions, high management costs, product heterogeneity and the low transparency of the real estate marketplace can also result in potential asymmetric information, that ends up

[1] NCREIF stands for The National Council of Real Estate Investment Fiduciaries. NCREIF is an association of institutional real estate professionals who share a common interest in their industry. For more information on NCREIF Property Index (NPI) access https://www.ncreif.org.

providing a source of high returns only to those individuals who can obtain reliable and timely information (CISDM, 2006).

The purpose of this study is to analyze real estate investing as a part of an investment portfolio for the typical, every-day investor. In the paper, we measure the impacts, advantages and performance of real estate investment in comparison to other investment opportunities as part of a mixed-portfolio. Using data from January 1990 to March 2006, a sixty five quarters period, we create an optimal portfolio allocation. Two options of investing in real estate are considered: direct investment in real estate, which is represented here through the NCREIF Property Index (NPI) and by the Transaction Based Index (TBI), or indirect investment via REIT shares (NAREIT). Our study differentiates from previous studies in that, in this research, we have chosen international benchmarks as an investment option in addition to the recent TBI index as a proxy for the direct investment in the United States real estate market.

The remainder of this paper is structured as follows. First we present some information on portfolios construction. Second, we show some descriptive statistics for our data. Third, we analyze the performance of the main assets over the study time period. Fourth, based upon our results, we provide the design for an optimal portfolio in which we look for the optimal real estate allocation proportion. Finally, we give some conclusions based on the empirical evidence of the study.

2 PORTFOLIO MANAGEMENT

In building an investment portfolio, an investor is looking for the optimal combination of assets that financially compensate the implicit risk. Different investors with singular levels of risk aversion will choose a distinct combination of risk and return. For example, an investor that invests in a sort of risk asset might require a smaller return compared to an investor that invests in this same asset. The combination of risk and return can be found in the Sharpe Ratio described below:

$$SR = \frac{E(r_p) - r_f}{\sigma} \qquad (1)$$

where $E(r_p)$ is the expected return paid by the portfolio, r_f is the risk free rate, and σ is the volatility in basis points.

In this context, a higher sharpe ratio would imply a higher profitability for the portfolio in comparison to the assumed risk. The combination of assets in a portfolio can reduce the volatility of the pool of isolated assets. This feature would depend on the

correlation that the assets would have with each other. If the correlation (values between –1 and 1) among the assets is close to 1 it can be concluded that the assets move in the same direction. On the other hand, if the assets have a negative correlation (closer to –1), it reveals that the asset moves in a direction contrary to the other assets. In the case of zero correlation, the assets move independent from one other, and their movements are not correlated. This combination of correlation and volatility among portfolio assets can typically be seen in a variance-covariance matrix.

Markowitz (1952) laid down the foundation of modern portfolio management applied to capital markets. His theory proposed (mean-variance efficient frontier) that the intent to obtain a portfolio with a maximum Sharpe Ratio including a minimum variance for any given level of expected return is defined as the following:

$$Max \quad SR_p = \frac{E(r_p) - r_f}{\sigma(r_p)} \qquad (2)$$

Subjected to:

$$\sigma^2(r_p) = \sum_{i=1}^{n}\sum_{j=1}^{n} x_i . x_j . \sigma_{ij} \qquad (3)$$

$$E(r_p) = \sum_{i=1}^{n} x_i . r_i \qquad (4)$$

$$\sum_{i=1}^{n} x_i = 1 \qquad (5)$$

$$x_i \geq 0, \ (i = 1, 2, ..., n) \qquad (6)$$

where x_i is the weight for assets i, x_j is the weight for assets j, $E(r_p)$ is the expected portfolio return, $\sigma^2(r_p)$ is the variance, SR_P is the sharpe ratio, and r_i is the expected return for asset i.

The combination of return and risk [$E(r_p)$, $\sigma^2(r_p)$], is called the efficient frontier. The technique behind the Markowitz theory can be used to build an ideal portfolio that takes into consideration the risk aversion demands of the investor.

3 DATA

Quarterly data from January 1990 to March 2006 was used to examine U.S. and foreign indexes returns. The quarterly data source available at the NCREIF website was the source for the NPI. The TBI data was obtained at the MIT Center for Real Estate. The FTSE EPRA/NAREIT United State Price Index and S&P 500 Index, as well as, the most common global equity benchmarks FTSE, DAX and Nikkei, were obtained from DataStream. The CPI (United States Consumer Price Index) was also obtained from DataStream. The expected returns of the indexes where computed using the following equation:

$$E(r)_{j,t} = \frac{P_{j,t+1} - P_{j,t}}{P_{j,t}} \qquad (7)$$

where $E(r)_{j,t}$ is the total expected return for the asset *j*, $P_{j,t+1}$ is the subsequent last quarterly quotation of asset *j* and $P_{j,t}$ is the last quarterly quotation of asset *j*. Table 1 presents descriptive statistics of the indexes.

Over the 65 quarters that were observed in the study, the TBI index was found to have a higher mean return (0.027) followed by the NAREIT and DAX (0.025) indexes. Within the studied time frame the Nikkei 225 presented a negative return (-0.004) including the highest standard deviation. Due to the tangibility feature of the indexes, NPI and TBI are the indexes that present the lowest standard deviation. Our evidence is in accordance with previous researches. For instance, Ross and Zisler (1991) found that real estate volatility lay somewhere between the volatility of stocks and bonds.

The high kurtosis and skewness of the NPI and TBI indexes, respectively 3.21 and 4.62, –1.15 and 0.8, shows the presence of fait tails within their distributions. Some researchers have suggested that investors only make investment decisions on the basis of the first two moments of the probability distribution. Since the normal distribution is the only distribution that may be fully described by the first two moments, the finance paradigm depends heavily on the normal distribution of the returns. Brown (2000) pointed out this fact by suggesting that individual real estate investors face a probability distribution that is heavy tailed and skewed to the right.

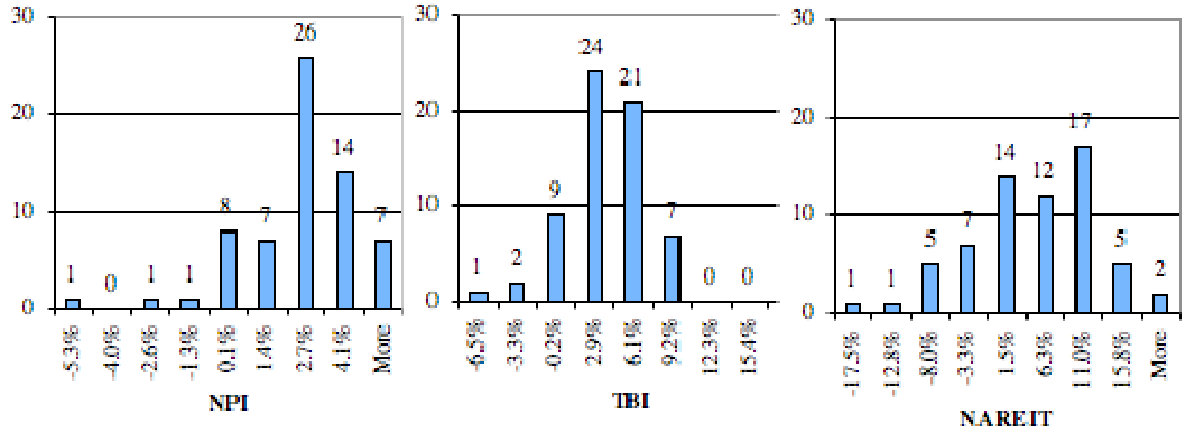
Table 1: Descriptive Statistics

	S&P 500	*DAX 30*	*FTSE 100*	*Nikkei 225*	*NPI*	*NAREIT*	*TBI*
Mean	0.023	0.025	0.018	(0.004)	0.020	0.025	0.027
Median	0.025	0.021	0.020	0.004	0.021	0.027	0.026
Standard Deviation	0.070	0.102	0.069	0.116	0.018	0.078	0.037
Variante	0.005	0.010	0.005	0.013	0.000	0.006	0.001
Kurtosis	1.014	1.315	0.083	0.550	3.211	(0.027)	4.624
Skewness	(0.166)	0.418	0.291	0.250	(1.157)	(0.262)	0.801
Minimum	(0.150)	(0.212)	(0.113)	(0.220)	(0.053)	(0.175)	(0.065)
Maximum	0.220	0.363	0.232	0.359	0.054	0.205	0.186
Test for Normality (prob>chi2)	0.233	0.071	0.555	0.383	-	0.646	0.001
Observations	65	65	65	65	65	65	65

Table 1 reports, among the descriptive statistics on the observed indexes, the presence of fat tails (kurtosis above 3) for NPI and TBI. Figure 1 illustrates the histograms for the three

real estate indexes analyzed in our research. We can observe non normal distributions for the NPI and TBI indexes. The tests of normality based on kurtosis and skewness were performed confirming that these two distributions were not normal.

Figure 1: Histograms - Quarterly Returns of Real Estate Indexes, 1990 to 2006



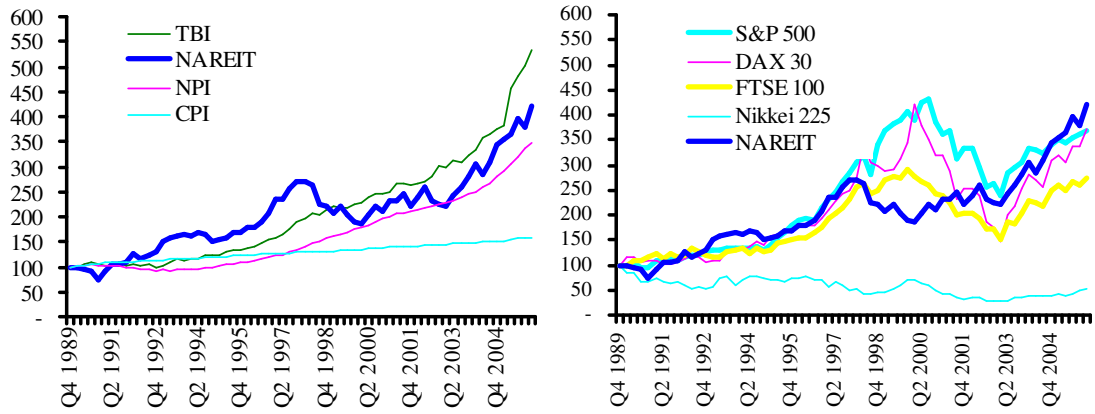
4 INDEXES PERFORMANCE

An overview of the various price series is provided on Figure 2, which illustrates the growth of the real estate indexes and the most common international benchmarks over the period from 1990 to 2006. Figure 2 (a) shows the three real estate measures, including the observed smoothness of the NPI and the adjusted version of the TBI including the higher returns. One can also notice the significant higher return offered by the NAREIT over the NPI, and the faster growth of real estate over inflation (CPI). In Figure 2 (b) the NAREIT the index is compared to three other international indexes. Even though it is not clear in the figure, during the 15-year term, the NAREIT behaves very similar to the S&P 500. The NAREIT index presents an arithmetic return of 0.10 and volatility of 0.16, while the S&P 500 had an arithmetic return of 0.09 and a volatility of 0.14. Note that a higher Sharpe Ratio is observed in the NPI.

Table 2: Index Return Analysis

	S&P 500	*FTSE*	*DAX*	*Nikkei*	*NPI*	*TBI*	*NAREIT*	*CPI*
Arit. Return	0.09	0.07	0.10	(0.01)	0.08	0.11	0.10	0.03
Geom. Return	0.08	0.06	0.07	(0.03)	0.08	0.10	0.09	0.03
Volatility	0.14	0.14	0.20	0.23	0.04	0.07	0.16	0.01
Sharpe ratio	0.35	0.22	0.29	(0.25)	0.99	0.88	0.38	-

Figure 2: Quarterly Returns of Real Estate Indexes and International Benchmarks, 1990 to 2006 (1990 = 100 bps)



Besides the standard deviation, another significant aspect of investment risk is the correlation among assets. In fact, the main issue of analyzing how asset returns are correlated to the movements of the returns of other assets and how this correlates with developments in the economy as a whole. In Table 3 we present correlation measures of the various real estate series with other variables including inflation.

Table 3: Correlation Matrix

	S&P 500	*DAX 30*	*FTSE 100*	*Nikkei 225*	*NPI*	*NAREIT*	*TBI*	*CPI*
S&P 500	1							
DAX 30	0.52**	1						
FTSE 100	0.67**	0.68**	1					
Nikkei 225	0.27*	0.22	0.17	1				
NPI	0.08	0.13	0.13	0.01	1			
NAREIT	0.31*	0.19	0.15	(0.01)	0.01	1		
TBI	0.13	0.07	0.19	0.00	0.57**	0.03	1	
CPI	(0.19)	(0.08)	(0.11)	(0.12)	(0.13)	(0.03)	0.09	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix summarized in Table 3 suggests that real estate investment is fundamentally different than other types of investments. The returns generated by the three real estate series have a weak positive relationship with international benchmarks and a weak relation to inflation.

Common-sense knowledge has held that real estate can be used as a hedge against inflation. This means that if inflation is greater than expected, the returns from real estate will compensate for the surprise and will help offset the negative response of the other assets in the portfolio. Investment in real estate fell in the 1980s due to a large crash. As such the rationale for holding real estate assets was discredited by several scholars (Hudson-Wilson, Fabozzi, Gordon, 2005). As in previous studies (Brueggeman and Fisher, 2002 p. 621), we verify that real estate indexes exceeded the rate of growth in the CPI as observed on Figure 2. Another key point of this study is the correlation of real estate indexes and CPI. Brueggeman and Fisher (2002) could not find evidence that real estate is a hedger against inflation, observing high correlation of NCREIF index and the CPI. However, our results suggest that there is only a weak correlation between the real estate indexes analyzed and CPI. However, as observed by Seiler at al (1999), the results with regards to this issue are very mixed.

Furthermore, Table 3 reports a low correlation between NPI and the S&P 500, which confirms the hypothesis that real estate is an instrument of diversifications for mixed portfolios. Nevertheless the NAREIT presented a correlation of 31%.

The correlation between real estate and the benchmark indexes suggests that real estate can play a significant role in a mixed-asset portfolio. Whenever two imperfectly related assets (correlation coefficient less than 1.0) are placed together in a portfolio, an opportunity exists to earn a greater return at each level of risk (or reduce risk for a given level of return). However, it is important to note that in spite of the general consensus on the real estate diversification benefits to firms, which would result in a lower level of systematic risk, or a higher risk adjusted return, some authors have not found evidence to support this hypothesis (Seiler, Chatrath and Webb, 2001).

We make two final points regarding the correlation among real estate indexes. First, the NAREIT and NPI indexes are particularly low correlated. This result is expected due to the different underlying structure of these two indexes. Second and less expected, is the correlation of 0.57 between NPI and TBI. The TBI index is supposed to replicate the NPI adjusting for some minor problems. Therefore, the low correlation between these indexes was somewhat surprising.

By comparing the NAREIT and the TBI performance with the performance of S&P 500's worst and best moments we tried to gather some extra information about the real estate indexes performances.

First we divided the 65-studied quarters into periods where the S&P 500 performed exceptionally well (S&P 500 returns > 0) and periods in which it performed exceptionally poor (S&P 500 returns < 0). After performing this analysis we observed 18 occurrences where the S&P performed exceptionally low (below 0) and seven occurrences where the S&P performed extremely well. We then computed the correlation among the real estate indexes and the S&P 500 divided by its' best and worst performances. We also segregated two time series, best and worst S&P 500 quarters and calculated the average quarterly return for the real estate indexes. Table 4 and Table 5 show these correlations and the quarterly returns in the best and worst quarters from 1990 to 2006.

Table 4: Correlations in Best and Worst S&P 500 quarters (1990-2006)

	All S&P 500	Worst S&P 500	Best S&P 500
Quarters	65	18	47
NAREIT	0.3122	0.3219	0.2093
TBI	0.1256	0.2216	0.0205
NPI	0.0835	-0.0464	0.1958

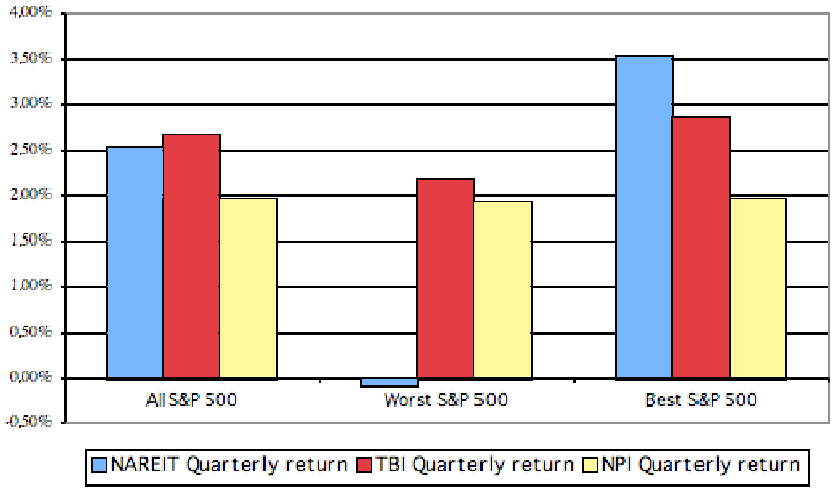
We can verify that the correlation of the NAREIT index along with the S&P 500 maintains stable (0.3219) in the index's worst performing moments and that this correlation decreases when the index is performing exceptionally well (0.2093). Regarding the returns, we can observe that in bad times the NAREIT reaches –0.08% quarterly and in good times it goes to 3.53%.

Table 5: Average Quarterly Returns in Best and Worst S&P quarters (1990-2006)

	All S&P 500	Worst S&P 500	Best S&P 500
NAREIT Quarterly return	2.53%	-0.08%	3.53%
TBI Quarterly return	2.68%	2.17%	2.87%
NPI Quarterly return	1.95%	1.93%	1.96%

Regarding to the TBI, we can perceive that the correlation of this index with the S&P 500 increases in periods of low performance (0.2216) and decreases in periods of high performance (0.0205). In addition, note that the returns of the TBI are nearly constant to the lowest and highest performing periods of the S&P 500. Figure 3 graphically summarizes the results of Table 5.

Figure 3: Average Quarterly Returns in Best and Worst S&P quarters (1990-2006)



The above results confirm the expectations that NAREIT, as a securitized asset, responds to the variations of business cycles, while the TBI, as an unsecuritized index of tangible properties, is less sensitive to these economic changes.

5 PORTFOLIO CONTEXT

In order to better understand the optimal portfolio with regards to real estate investing and this relationship to international benchmarks, we draw the efficient frontier and construct its respective portfolios.

As mentioned above, an optimal portfolio or efficient portfolio is a combination of investments that maximizes the expected return on that portfolio for a given variance of return. To derive such portfolios, we used the mean-variance model of asset choice. Harry Markowitz introduced this model. A detailed description of the process can also be found in Huang and Litzenberger (1988). Figure 4 brings out the efficient frontiers and two panels within the created portfolios. The points that compose the curve frontier represent a combination of weighted return and volatility for each of the assets.

In Table 6 Panel A, we check for direct investment in real estate as part of an overall investment portfolio. The portfolio analyzed has assets from the S&P 500, DAX and TBI. For the construction of such a portfolio we have considered the two international benchmarks with the highest sharpe ratio: the S&P 500 and DAX. In Table 6 Panel B, we measure the effect of indirect security investment in real estate, through NAREIT, as constituted by a mixed-portfolio. Hence, we used the three indexes the S&P500, DAX and NAREIT to measure the effectiveness of the portfolio. By using the mean-variance efficient portfolio we build different portfolios varying the risk aversion of different potential investors. For all the

cases we seek the exact proportion to invest in each asset that could convey the minimum variance, maximum sharpe ratio, and the weighted portfolio.

Figure 4: The mean-variance efficient frontier and Optimal portfolio Annualized return (%) vs. volatility (%)

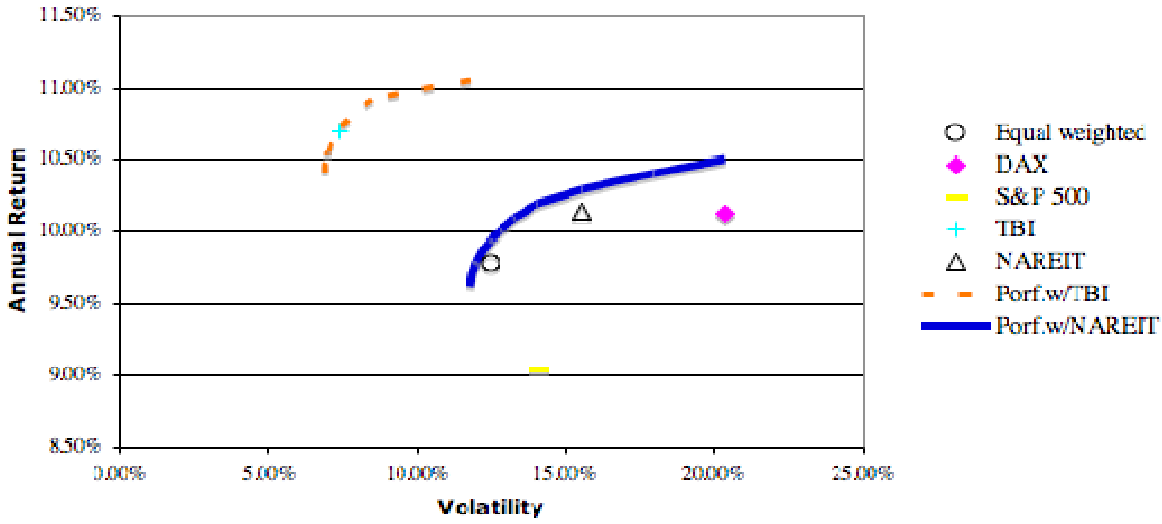


Table 6 : Portfolio Composite

Panel I				Panel II			
	Min. Variance	**Max. Sharpe**	**Equal weighted**		**Min. Variance**	**Max. Sharpe**	**Equal weighted**
	Portfolio A	Portfolio B	Portfolio C		Portfolio A	Portfolio B	Portfolio C
DAX	10,5%	18,2%	33,3%	**DAX**	3,6%	5,4%	33,3%
S&P 500	48,0%	32,2%	33,3%	**S&P 500**	15,6%	8,7%	33,3%
NAREIT	41,5%	49,6%	33,3%	**TBI**	80,8%	85,9%	33,3%
Volatility	11,8%	12,0%	12,5%	**Volatility**	6,8%	6,9%	10,6%
Return	9,6%	9,8%	9,8%	**Return**	10,4%	10,5%	10,0%
Sharpe Ratio	0,46	0,47	0,45	**Sharpe Ratio**	0,91	0,92	0,55

The preliminary result from this procedure, in relation to the NAREIT index, can be seen in the blue line (lower line) on Figure 4. A portfolio with a maximum sharpe ratio would be to allocate 49.6% in NAREIT (as shown in Panel I portfolio B). The portfolio with the minimum variance is presented in Portfolio A. This portfolio would have a standard deviation of 11.8%. Portfolio C (represented by the circle in the figure) is the equal weighted allocation of each asset (33.3%), which gives a minimum sharpe ratio and a maximum volatility. Both features indicate that this portfolio is not superior to any one of the portfolios presented earlier.

The result from the mean variance analyses with the TBI index can be seen in the red dotted line on Figure 4. Note that this frontier is superior to the efficient frontier constructed with the NAREIT index. It is a consequence of the better sharpe ratio (greater return and smaller volatility) which is observed with this asset (Figure 2). In Panel II Portfolio A, the minimum variance portfolio would be composed of 80.8% of TBI. This portfolio would have a standard deviation of 6.84%. A portfolio with a maximum sharpe ratio would allocate 85.9% in TBI (as shown in Panel II portfolio B). Portfolio C is an equally weighted portfolio that presents a return of 10.0% and a volatility of 10.6%.

6 CONCLUSIONS

This paper has shown an analysis of the risk-return and diversification properties of various real estate investments. The paper first analyzes how real estate investment compares with other equities, mainly in the form of stocks. Since properties do not frequently sale on equity exchanges as do stocks, and because of a lack of publicly available information on real estate business, we used two real estate indexes: the NPI and TBI as a proxy for the direct real estate investment within the United States.

The NPI index measures the investment performance of real estate by using appraised values (rather than actual sale prices) for properties held by institutional investors that are members of the National Council of Real Estate Investment Fiduciaries (NCREIF). The TBI index is an adjusted version of the NPI controlled for smoothing and biased deficiencies.

As a measure of the indirect investment in real estate we used the NAREIT index. This index is publicly traded. In addition, actual transaction prices are available for these stocks. The NAREIT index value reflects both the performance of properties held by the NAREIT, and the ability of the NAREIT management to operate the companies successfully.

As expected, empirical results show the diversification benefits of including real estate in investment portfolios. All three real estate indexes (NAREIT, TBI and NPI) presented returns that were not significantly correlated with observed returns for various stock exchange indexes and the CPI. Therefore we observe diversification properties in direct as well as in indirect real estate investments. The diversification benefits of real estate to a portfolio of stock indexes is unlikely to change as time goes by, since real estate returns will continue to be affected by different economic factors as do stock indexes. Thus, returns between these categories of investments will not be highly correlated.

Regarding the optimum portfolio context, it is shown that a portfolio composed with direct real estate index (TBI) seems to be the ideal asset in that it produces returns above

market with a smaller volatility. However, it is important to note that the TBI is an index over property returns that does not considers liquidity risk, administrative costs, government taxes, commissions and maintenance expenses. Therefore, when investing in the TBI an investor ought to take this into account before considering the right allocation to his/her portfolio.

Most literature that focuses on optimality of real estate allocation records allocation percentages around 20% or less. Seiler et al (1999) asserts that this number should be from 0 to 67. This goes in accordance with our created optimal portfolio with NAREIT that presents an allocation of 49.6% in real estate. As shown by Hudson-Wilson et al (2003), while some parts of the real estate universe do periodically outperform stock equities, on average real estate is not a way to earn the greatest return. This is due to the costly characteristics that we have not considered in our analysis.

It is also important to notice, that while the standard deviation is often taken as a proxy for investment risk, as has been done in this study, some authors' criticized this choice. They claim that this relationship (standard deviation versus risk) may not actually hold when assets are highly illiquid (Goetzmann, 1990) as is the case with real estate.

Furthermore, in this study it has been suggested that direct investment in real estate is less sensitive to business cycles than is the indirect investment in real estate through the NAREIT Index. Hence, the optimal mix of assets in the portfolio should vary its allocation among real estate and other assets in the long run in order to obtain the maximum sharpe ratio.

Some limitations of our study are inherent to the selected research methodology. Since the chosen real estate indexes, NPI and TBI are fat tailed, the mean variance analyses might not be the best research methodology for this sort of investment assets.

Finally, the research domain of this study is restricted to composed real estate indexes. Extension of this study to other more specific types of real estate direct investment, more particularly the segregation of indexes to different real estate asset types (i.e. apartment, industrial, office, retail) could be addressed in future research. This, certainly, could bring out some deeper understanding, for financial managers and investors, about the authentic potential of real estate asset as a composite of investment portfolios.

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