THE ROLE OF RISK MEASURES' CHOICES IN RANKING REITS: EVIDENCE FROM THE US MARKET

by

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Abstract

The increasing role of retail investors in the real estate vehicle market makes necessary to study simple return/risk measures that could be easily understood also by not financial skilled investors. Measures frequently used in the asset management industry are the Risk Adjusted Performance Measures scale independent. Studies available in the real estate literature evaluate the usefulness of this approach in order to select best investment opportunities under the simplified assumption of the normality of results achieved.

Looking at the US market, the paper studies the performance of REITs for the time period 1999-2010 and verifies that the assumption of the normality of the performance achieved is not satisfied. Demonstrated the limits of the assumption, the paper compares ranking based on Sharpe ratio with those achieved using different RAP measures constructed using different risk measures that do not assume the normality of the returns' distribution. Results demonstrate that rankings obtained by different risk measurement approaches are not always coherent even if they are correlated. RAP measures constructed using the maximum drawdown and the VaR risk measures allow to identify rakings that are more stable over time respect to the Sharpe index.

Looking at the determinants of RAP values, the general & administrative expenses, the role of the real estate investment, the debt and the volume are the main drivers of all ranking constructed. For the liabilities the main feature that affects the ranking is the mismatch between short term assets and debts while for the volume the more significant variable is the one that considers the volume adjusted for the bid-ask spread. Considering the determinants of the RAP measures, we cannot identify any significant change in the ranking determinants on the basis of the risk measurement choice.

Finally we evaluate the relevance of the RAP rankings in selecting the investment opportunities comparing the results of a naïf diversified portfolio with those achieved by a portfolio concentrated only on top REITs identified using different RAP measure. Results demonstrates that the choice to consider more complex RAP measure could increase of the performance achieved by a diversified REITs' portfolio.

Keywords: REITs, Risk Adjusted Performance, Normality of returns distribution

JEL codes: G24, L85

1. Introduction

Since the end of the last century the real estate investment vehicles industry is a fast growing market (Block, 2006) and investors are both retail and institutional ones. In the asset management industry the availability of an high number of instruments makes necessary to identify simple criteria useful for comparing the results achieved by different investment vehicles (Elton, Gruber and Black, 1996).

The Risk Adjusted Performance measures (hereinafter RAP) scale independent are the more widespread instrument used in order to give an advice about the quality of an investment also for unsophisticated investors (Rossolini and Poletti, 2009). Studies proposed in literature demonstrate, as other approaches for the portfolio optimization process, the usefulness of the RAP measures analysis in real estate portfolio construction process (Lee and Stevenson, 2005).

Return distribution of some financial instruments (like hedge funds) does not fit with the hypothesis of normality of returns and so for those instruments new RAP are proposed. Ranking based on these new measures are not always coherent with those defined assuming normality of returns and could show better qualities (like time persistence) that are highly desirable for an investor (Carretta and Mattarocci, 2008). Empirical analysis on the REITs industry demonstrate that their return distribution is asymmetric (Hutson and Stevenson, 2008) and is significantly skewned (Lizieri et al. 2007). On the basis of this evidence, the new RAPs could be useful also for evaluating this investment category.

The paper measures the risk related to mispecified risk measure for the evaluation of real estate funds looking at the US market for the period 1990-2010. The paper demonstrates the lack of normality for almost US REITs and so in order to describe better the return patter is necessary to modify the risk measurement approach respect to the standard assumption of normality. The risk measure choice affects not only the ranking but also the time persistence of the results. The determinants of the RAP measures are comparable for almost all the approaches because variables that explain the non normality of returns (debt and volume) affect also RAP that assume normality of returns. The choice of the RAP measure in constructing a portfolio of REITs portfolio could impact on the performance and so the choice of investing in constructing more complex measure of risk could have a positive impact on the performance of the investment strategy.

The paper presents a literature review about the use of the RAP measure in order to select investment and presents the main limits of the standard mean-variance framework for the real estate industry (section 2). After a brief description of the sample (section 3.1), the paper presents the methodology for constructing RAPs and for analyzing the differences among ranking and their usefulness for an investment strategy (section 3.2). Results about the differences among ranking constructed using different RAP measures are presented separately respect to the determinants of their value and the impact on the performance (respectively section 4.1 and 4.2). The last section summarize conclusions and implication of the results achieved.

2. Literature Review

The asset management industry is characterized by an high persistence of the performance over time achieved by managers due to the advantages related to the lower transaction costs and incentive fees based on the past performance. Independently respect to the reasons behind the time persistence of the performance, an investor could benefit from the information given by the past performance of an investment vehicle (Grinblatt and Titman, 1992).

Due to the time persistence of the performance, historical data could be used in order to identify the best REITs that had to be over weighted in investment portfolio in order to maximize the expected return. Empirical analysis demonstrate that this criterion allow to achieve better performance respect to a naïve diversification criterion but normally it does not represent the best asset allocation criterion due to the lack of consideration of the risk exposure related to the investment strategy (Salter, 2006).

A further development of the past performance approach considers the usefullness of the mean variance approach proposed by Markowitz in order to construct the optimal portfolio in the real estate industry on the basis of the risk-return trade-off. Empirical evidences demonstrate that the real estate market does not fit for an ex-ante portfolio valuation based on the Markowitz approach and the best real estate portfolio at time t are not those that are constructed on the basis of an historical data optimization process (Pagliari, Webb and Del Casino, 1995).

An analysis of the risk return profile of REITs could be realized easily looking a RAP measures, indexes constructed considering both the historical return and a measure of the risk exposure assumed in the yearly time horizon (Brueggman et al., 1984).

The more widespread measure used in order to evaluate the risk-return trade off is the Sharpe ratio, a measure of excess return respect to the risk free rate for unit of risk assumed (Brueggman et al., 1984). Empirical analysis of the main drivers of the Sharpe index value demonstrates that the RAP allows to better discriminate among REITs only if they are significantly diversified (Benefield et al., 2009).

The role of diversifiable and not diversifiable risk for a real estate investment vehicle is normally analysed using the Treynor index that allow to measure the return for unit of not systemic risk assumed (Ooi and Liow, 2004). Results obtained show that the exposure related to these types of investments is prevalently caused by a diversifiable risk and so the rankings based on the Treynor index allow to distinguish better among REITs (Radcliffe et al., 1974).

The Jensen alpha measure is used in order to evaluate the capability of the manager to outperform the market achieving a performance higher than the expected return defined using a CAPM or APT model (Kallberg et al., 2000). Results obtained in the REIT industry demonstrate good capabilities of funds manager to construct the optimal portfolio achieving the highest returns from the market mispricing of real estate assets (Gallo et al., 2000). Results obtained are confirmed especially if performance fees ensured to the manager are high and so there is an high incentive in creating value for the investors due to direct impact on the managers' wealth (Philpot and Peterson, 2006).

Analysis of the performance achieved by listed real estate property companies and REITS demonstrate a lack of normality in the return distribution (Lizieri and Ward, 2000). Real estate investment vehicles show frequently a returns' distribution with higher skewness and kurtosis respect to other financial instruments (Myer and Weeb, 1993).

The choice to remove the assumption of normality implies to use different and more complex approaches for evaluating the risk-return profile of the REITs and it causes also a change in the portfolio construction process (Byrne and Lee, 2004). Models constructed using more than the second moment of the distribution (like kurtosis) explain better the performance achieved by real estate investment vehicles especially if the analysis is released using high frequency data (Lizieri et al., 2007).

Despite the findings related to the non normality of performance achieved by real estate investment vehicles, literature about the risk adjusted performance measurement of this type of investments is based essentially on the standard mean-variance approach (Young and Graff, 1995). In fact RAP measures used in order to evaluate the REIT industry look only at the first and second moment of the return distribution and studies on the asset management industry demonstrate that if we remove the normality assumption the risk-return profile of an investment vehicle could significantly change (Bird and Gallagher, 2002).

3. Data and methodology

3.1 Data

In order to construct a representative sample of the US REITs industry we consider all the constituents of S&P index of US REITs. We select to evaluate a long term horizon (1999-2010) in order to encompass more phases of the economic cycle (expansion and recession)[i]. The summary statistics of the sample are presented in the following table (Table 1).

Table 1 – Sample description

Year	N° REITs	N° years available	% REITs
1999	93.00	1 year	3.88%
2000	93.00	2 years	0.78%
2001	94.00	3 years	0.00%
2002	96.00	4 years	0.78%
2003	103.00	5 years	2.33%
2004	113.00	6 years	4.65%
2005	119.00	7 years	7.75%
2006	122.00	8 years	5.43%
2007	123.00	9 years	1.55%
2008	123.00	10 years	0.78%
2009	124.00	Overall time period	72.09%
2010	129.00		

Source: Datastream data processed by the authors

The sample selection is constrained by the data because the index selected is the biggest one available on Datastream that considers only US REITs and it represents around the 89% of the U.S. REIT market capitalization. Other (larger) indexes available on Datastream are excluded in order to present an analysis that is not affect by the different dynamics that affect price dynamics in each country. The sample is not significantly affected by the survivorship bias because more than 72% of the REITs are available for all the time horizon. In order to consider the (even) small survivorship bias problem, we made only one year comparison among ranking considering for each year as existing REITs only those that are available for both the years considered in the ranking comparison.

Data collected from Datastream are daily and attain the closing price for each trading day for all listed funds and the amount of dividends paid in each trading day. We construct for each REITs a measure of the overall return for each trading day as the logarithm of the ratio between the current closing price plus dividends eventually paid and the closing price in the previous trading day. In formulas:

$$ {}_{t-1}R_t = \ln\left(\frac{P_t + D_t}{P_{t-1}}\right) \qquad (1) $$

Where P_t is the closing price a time t, D_t is the dividend eventually paid at time t and ln is the natural logarithm. Defined the measure of daily returns, the Shapiro-Wilk normality test is released in order to identify the funds for which this assumption could be considered reasonable (Shapiro and Wilk, 1965). The test applied to our sample demonstrate, as showed also by other studies available in literature, that the assumption of normality is not satisfied by almost all the REITs (Table 2).

Table 2 – Shapiro-Wilk test of normality for Italian real estate performance

Number of years that satisfy the normality distribution criterion on the overall sample			N° funds that satisfy the normality assumption of the return distribution for a given time horizon				
	N° years	%		Threshold on the S-W test			
				50%	70%	90%	100%
P=100%	4	0.30%	Only 1 year	21	10	5	4
90%≤P<100%	3	0.23%	2 years	3	2	1	0
80%≤P<90%	4	0.30%	3 years	0	0	0	0
70%≤P<80%	3	0.23%	4 years	0	0	0	0
60%≤P<70%	7	0.53%	5 years	0	0	0	0
50%≤P<60%	6	0.45%	6 years	0	0	0	0
40%≤P<50%	7	0.53%	7 years	0	0	0	0
30%≤P<40%	16	1.20%	8 years	0	0	0	0
20%≤P<30%	23	1.73%	9 years	0	0	0	0
10%≤P<20%	484	36.36%	10 years	0	0	0	0
0%≤P<10%	774	58.15%	Over 10 years	0	0	0	0
H0: Normality of the return distribution							

Source: Datastream data processed by the authors

The Shapiro-Wilk test of normality is rejected in almost all the years because considering a not selective threshold (threshold 70%) only the 1.05% of the years considered demonstrate a performance that could be assumed as normal. Considering only REITs that satisfy the normality test, more than 75% of all real estate vehicles verify the criterion for only in one year and so they are not able to demonstrate the same characteristic continuously over time.

We complete our dataset collecting yearly information about the characteristics (qualitative and quantitative) of the REIT that could affect the risk-return profile of the investment collecting them through Datastream and, when it is necessary, from the official website of each REIT.

3.2 Methodology

3.2.1 RAP measures construction

We select to start from the more widespread RAP scale independent used in the asset management industry (Sharpe index) and we test the effect of any possible change in the measurement of the risk profile of the investment[ii]. On the basis of the literature available, we are able to identify 12 RAP measures that are constructed starting from the excess return respect to the risk free rate (as in the Sharpe ratio). The RAPs considered are the following:

$$_{t_1}Sharpe_{t_2} = \frac{_{t_1}R_{t_2} - _{t_1}R_{t_2}^{Rf}}{\sigma(R_t)} \quad (2)$$

$$_{t_1}Sterling_{t_2} = \frac{_{t_1}R_{t_2} - _{t_1}R_{t_2}^{Rf}}{\sum_{i=1}^{n}\frac{1}{n}\left|_{t_1}MDD_{t_2}^{i}\right|} \quad (9)$$

$$ {}_{t_1}ROPS_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\frac{1}{\mathrm{t}_2 - \mathrm{t}_1}\sum_{t=t_1}^{t_2}\max\left|Rf - R_t, 0\right|^0} \quad (3) $$

$$ {}_{t_1}ROAS_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\frac{1}{\mathrm{t}_2 - \mathrm{t}_1}\sum_{t=t_1}^{t_2}\max\left(Rf - R_t, 0\right)^1} \quad (4) $$

$$ {}_{t_1}Sortino_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\sqrt[2]{\frac{1}{\mathrm{t}_2 - \mathrm{t}_1}\sum_{t=t_1}^{t_2}\max\left(Rf - R_t, 0\right)^2}} \quad (5) $$

$$ {}_{t_1}Kappa^{n=3}_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\sqrt[3]{\frac{1}{\mathrm{t}_2 - \mathrm{t}_1}\sum_{t=t_1}^{t_2}\max\left(Rf - R_t, 0\right)^3}} \quad (6) $$

$$ {}_{t_1}Kappa^{n=4}_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\sqrt[4]{\frac{1}{\mathrm{t}_2 - \mathrm{t}_1}\sum_{t=t_1}^{t_2}\max\left(Rf - R_t, 0\right)^4}} \quad (7) $$

$$ {}_{t_1}Calmar_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\left|{}_{t_1}MDD_{t_2}\right|} \quad (8) $$

$$ {}_{t_1}Burke_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{\sqrt{\sum_{i=1}^{n}\frac{1}{n}\left({}_{t_1}MDD^{i}_{t_2}\right)^2}} \quad (10) $$

$$ {}_{t_1}VaR\,Ratio_{t_2} = \frac{R_t - R_{rf}}{{}_{t_1}VaR_{t_2}} \quad (11) $$

$$ {}_{t_1}CVaR\,Ratio_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{{}_{t_1}CVaR_{t_2}} \quad (12) $$

$$ {}_{t_1}MVaR\,Ratio_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{{}_{t_1}MVaR_{t_2}} \quad (13) $$

$$ {}_{t_1}Sharpe\ Omega_{t_2} = \frac{{}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}}{e^{-rf}\,{}_{t_1}E\left[\max({}_{t}R_{t} - {}_{t}R^{Rf}_{t}, 0\right]_{t_2}} \quad (14) $$

In all formulas the numerator $\left({}_{t_1}R_{t_2} - {}_{t_1}R^{Rf}_{t_2}\right)$ represents the extra-return of the real estate fund respect to the risk free rate while the denominator will change in each measure. Coherently with the literature on the topic and with the characteristics of the sample, the risk free rate is the yearly rate of return of a US Treasury Bond on a one year time horizon.

Formula (1) represents the Sharpe index, a measure of the excess return respect to the risk free rate for each unit of risk assumed (Sharpe, 1994). This measure looks at the overall distribution of results and assumes the normality of returns summarizing the risk profile of the investment considering only the first and the second moment of the return distribution.

Formulas 3-7 are constructed using the lower partial moments of the performance distribution and so considering only the distribution of results lower respect to a given threshold (the risk free rate). Formula 3 defines a measure (ROPS) constructed using the lower partial moment of order 0 and it represents the excess return respect to the probability of losses (Pedersen and Rudholm-Alfvin, 2003). Formula 4 represents an index (ROAS) using the lower partial moment of order 1 and measuring the excess return respect to the mean expect loss (Pedersen and Rudholm-Alfvin,2003). Formula 5 proposes measure (Sortino) that uses the lower partial moment of order 2 and measure the excess return respect to the downside risk (Sortino and Forsey, 1996). Formula 6 and 7 consider the lower partial moment respectively of order 3 and 4 in order to define a return-risk profile of the investment (Kappa) that considers also respectively the skewness and the kurtosis of the distribution (Kaplan and Knowles, 2004)[iii].

Formulas 8-10 are constructed looking only at the maximum amount of losses (maximum drawdown) on the yearly time horizon. Formula 8 considers only the maximum losses and defines a measure (Calmar) that computes the excess return respect to worst performance achieved (Young, 1999). Formula 9 looks at the n worse performance achieved by the fund and defines an index (Sterling) as a ratio between excess return and the arithmetic mean of these n losses[iv] (Kestner, 1996). Formula 10 considers the square root of the sum of the squares of n drawdowns and defines a measure (Burke) of the excess return respect to this measure of risk[v] (Burke, 1994)

Formulas 11-13 use the Value at Risk as a proxy of risk exposure on the yearly time horizon using a level of confidence of α percentage[vi]. Formula 11 computes the ratio between the VAR and the investment at time 0 and defines a measure (VaR Ratio) as a ratio between excess return and this risk exposure (Dowd, 2000). Formula 12 considers the average loss at a given threshold, the so call conditional VaR, and compute an index (CVaR ratio) as the ratio between excess return and the mean loss (Agarwal and Naik, 2004). Formula 13 take into account the not normality of distribution also for extreme losses using the Cornish-Fisher expansion to modify the VAR estimates and define a measure (MVaR ratio) as the ratio between excess return and the maximum corrected exposure (Gregoriou and Gueyie, 2003).
Formula 14 is derived from the omega measure, a ratio between the area of returns and losses related to the investment (Shadwick and Keating, 2002). With some algebra is possible to re-write the omega using the put-call parity proposed by Black and Scholes (Kazemi et al., 2004) and so a Sharpe-Omega measure could be written as a ratio between the excess return and the value of a put option with strike price equal to R_f and a time horizon coherent with the evaluation period (one year).
Following approaches presented in literature in order to test the relevance of the choices in the construction of a risk adjusted performance measure (Eling and Schuhmacher, 2006), we perform year-by-year a correlation between rankings based on different performance measures using Spearman's rank correlation coefficient. The analysis of correlation is released considering all funds listed at time t independently to the starting listing date. This type of analysis allow us to test the sensitivity of RAP rankings to the choice of the risk measure and repeating the analysis for more than one years we obtain results that are not strictly affected by events that occurs in only one year. In order to check the robustness of the relationship identified by the spearman correlation measure, we perform also a not parametric test (χ^2) for the degree of independence among rankings.
In order to test the usefulness of the RAP measures for selecting best investment for the future and they had to define rakings stable over time over time in order to discriminate between lucky and skilled fund manager (Cucurachi, 1999). Following approaches presented in literature (i.e. Carhart, 1997), we construct a one year contingency table in order to compare ranking position at time t-1 and t for all funds listed at time t-1. Results are summarized through some statistics about the number of funds characterized by timely persistence performance in the yearly time horizon using differ definition of persistence: persistence in the same ranking position, in the same decile or in the same quartile.

3.2.2 RAP measures determinants and performance strategies

We perform a panel linear regression (random effect) in order to test the relationship of the value assigned by each RAP with REIT's characteristics. The formula applied is the following:

$$\begin{aligned} RAP_{it} &= \alpha_{it} + \gamma_{it}^{1} Leverage_{it} + \gamma_{it}^{2} IC_{it} + \gamma_{it}^{3} STA-STD_{it} + \theta_{it}^{1} VWES_{it} + \theta_{it}^{2} Amihud_{it} + \beta_{it}^{1} \ln(MarketValue)_{it} + \\ &+ \beta_{it}^{2}\, RealAdm_{it} + \beta_{it}^{3} \%\, Real\, Estate_{it} + \beta_{it}^{4} G\,\&\,A/TA_{it} + \beta_{it}^{5} PE_{it} + \beta_{it}^{6} FFO/TA_{it} + \beta_{it}^{7} SelfAdministrated_{it} + \\ &+ \sum_{k=8}^{16} \beta_{it}^{k} Sectoral\, Dummy_{it} + \varepsilon_{it} \end{aligned} \tag{15}$$

where:

$Leverage_{it}$	The ratio between the overall debt and the overall capital collected for the REIT i at the year t;
IC_{it}	The ratio between the interests expenses and the operating income for the REIT i at the year t;
$STA-STD_{it}$	The ratio between the difference of the short term assets and the short term debt (including current portion of long term debt) and the total assets for the REIT i at the

	year t;
$VWES_{it}$	The natural logarithm of one plus the weighted mean of the daily volume respect to the overall volume with weights defined as effective spreads for the REIT i at the year t;
$Amihud_{it}$	The Amihud index is computed as the natural logarithm of 1 plus the percentage price change per dollar of daily trading volume for the REIT i at the year t;
$\ln(Market\,Value_{it})$	The natural logarithm of the market value for the REIT i at the year t;
$RealAdm_{it}$	The ratio between amortization related to real estate investments and the overall amortization for the REIT i at the year t;
$Real\,Estate_{it}$	The ratio between real estate investment and total assets for the REIT i at the year t;
$G\&A/TA_{it}$	The ratio between general and administrative expenses and the total assets for the REIT i at the year t;
PE_{it}	The annual dividend yield for the REIT i at the year t;
FFO/TA_{it}	The ratio of the Free Cash Flow from Operation respect to the total assets for the REIT i at the year t;
$SelfAdministrated_{it}$	A dummy variable that assumes value one if the REIT i is self-administrated;
$\sum_{k=8}^{15} Sectoral\,Dummy_{it}$	A set dummy variables that assume value one if the REIT i works in the sector k

The leverage represents a proxy of the credit risk of the REIT because an higher value of the ratio can magnify a negative return on an investment portfolio, creating more pronounced losses when the performance of the real estate investment in not sufficient in order to make the financing repayment (Allen, Madura and Springer, 2000).

The interest coverage ratio represents a measure of the sustainability of the cost of lending on the basis of the annual EBITDA. The higher is the value, the lower is the risk that the REITs in not able to refund the financing obtained (Singh and Kwansa, 1999).

The mismatch between short term asset and debts attains the choice of the asset liability management and a surplus (deficit) of short term asset respect to short term debt allow to use the capital flows related to selling short time investments for refunding the short term debt (Giannotti and Mattarocci, 2010).

The amortization is affected by the accountancy policy adopted by the REIT that could impact directly on the yearly costs and profits. The analysis of the real estate amortization process role respect to the overall amortization process is necessary because it is difficult to identify the correct rate that is not easy to define especially for some types of investments (Shilling, Sirmans and Dombrow, 1991).

The VWES is computed considering the volume for each trading day weighted for the spread between bid and ask prices. The measure allow to study if the volume of trade is driven by a perfect matching between bid and ask price or is affected by extraordinary events (Amihud and Mendelson, 1986).

The Ahimud index is the return for unit of trade and it represents a proxy of the liquidity of the market in which the financial instrument is traded (Amihud, 2002). An higher value of the index identify a more liquid market in which the low transaction cost imply a better risk-return profile of the investment.

The natural logarithm of the market value represents a proxy if the size of the investment and normally the bigger is the REIT and the higher is its reputation in the market. The performance of the REITS could be significantly affected by the higher demand in the market for the bigger real estate vehicles (Capozza and Lee, 1995)

The real estate assets are the core business of REITs (Allen, Madura and Springer, 2000) and so the choice to concentrate the investment on these assets could allow to use better its distinctive knowledge in order to increaser the return of the investment and reducing its risk. Normally a high concentration of the investments on the real estate asset class implies higher opportunity to gain profits from the portfolio managed.

The general and administrative expenses are related to degree of complexity of the REIT and normally they imply a reduction of the wealth created for the REITs’ shareholders due to the higher cost of constructing the optimal portfolios (Benefield, Anderson and Zumpano, 2009).

The price earning represents a proxy of the relevance of the periodical payments done by the REITs in determining the performance achieved and the higher is the value the better could the risk return profile of the investment (Ooi and Liow, 2004).
The free cash flow from operation are a proxy for the REITs core business revenues and/or costs and the higher is the value the better is the risk-return profile for the investment (Benefield, Anderson and Zumpano, 2009).
Self-administration determines differences in the investment policy and normally the choice to be self-administrated impacts positively on performance and, more generally, on the RAP (Capozza and Seguin, 2000).
The specialization of the REIT in a sector causes a different risk-return profile that could be related to the main sector characteristics. In order to construct the sector dummies we consider the classification proposed by Newell and Peng (2006) that identify 8 sectors: Industrial, Office, Retail, Residential, Diversified, Hotels, Healthcare and Selfstorage.
We perform the random effect panel regression considering all RAP measures defined in the formulas (1) to (14) and we test the different relevance of the explaining variables on the RAPs constructed using different risk measurement approaches.
Following other studies available in literature (Lin and Young 2007) we use the past performance in order to identify the best REITs at time t (the top 25%) and the worst ones (the worst 25%) but differently respect to other studies we identify the winners and losers not looking only at the returns but considering the best REITs on the basis of RAPs' values. In order to evaluate the usefullness of the strategy respect to other solution available, we compare the performance of these strategies with a benchmark, the naïve diversification strategy equally weighted and naïve diversification strategy value weighted. More in detail we consider the following strategies:

1. Best performers at time t-1 – Equally weighted

We consider for each RAP the ranking defined at time t-1 and we select only the funds that are classified in the first quartile (number of funds $n_t = \frac{N_t}{4}$). The amount invested is equally allocated among all the n funds classified in the first quartile ($i_t = j_t = \frac{1}{n_t}$). Every year we update the portfolio composition and we study both the yearly performance and the compound performance achieved on a 11 year time horizon.

2. Benchmark - Equally weighted

We consider all the funds available at time t-1 and we invest the same amount of money in each of them (i=j=1/N). Every year we update the portfolio composition and we study both the yearly performance and the compound performance achieved on a 11 year time horizon.

3. Best performers at time t-1 – Value weighted

We consider for each RAP the ranking defined at time t-1 and we select only the funds that are classified in the first quartile (number of funds $n_t = \frac{N_t}{4}$). The amount invested in each REIT is defined on the basis of its market value respect to those of the n funds classified in the first quartile ($i_t = \frac{MV_{i,t}}{\sum_{k=1}^{N_t} MV_{t,k}}$)). Every year we update the portfolio composition and we study both the yearly performance and the compound performance achieved on a 11 year time horizon.

4. Benchmark - Value weighted

We consider all the funds available at time t-1 and we invest in each REIT an amount of money defined on the basis of its market value respect to those of the N funds available ($i_t = \frac{MV_{i,t}}{\sum_{k=1}^{N_t} MV_{t,k}}$). Every year we update the portfolio composition and we study both the yearly performance and the compound performance achieved on a 11 year time horizon.

For all the strategies we consider the annual performance achieved by each strategy and the overall compound performance on a ten year time horizon.

4. Results

4.1. RAP measures: Correlation and time persistence

The value assigned by each RAP measure to each fund is not strictly comparable due to the high differences among the range of variation of different risk measures used as denominator in the RAP formula (table 3).

Table 3. Summary statistics RAP measures (time horizon 1999-2010): mean and standard deviation

	Sharpe	**ROPS**	**ROAS**	**Sortino**	**Kappa (n=3)**	**Kappa (n=4)**	**Calmar**	**Sterling**	**Burke**	**VaR Ratio**	**CVaR ratio**	**MVaR ratio**	**Sharpe Omega**
1999	-6.44	-0.20	-10.78	-10.25	-2.47	-0.05	-1.87	-2.41	-2.36	-2.68	-2.17	-0.06	-10.77
	(9.37)	(0.34)	(16.20)	(14.81)	(21.21)	(0.17)	(2.77)	(3.51)	(3.45)	(3.96)	(3.16)	(0.10)	(16.20)
2000	9.93	0.23	18.01	16.63	0.11	0.04	3.17	4.06	3.98	4.53	3.66	0.1	17.97
	(11.42)	(0.4)	(21.48)	(18.59)	(2.51)	(0.08)	(3.46)	(4.41)	(4.31)	(4.98)	(3.96)	(0.16)	(21.42)
2001	12.34	0.34	22.88	19	-0.52	0.04	3.31	4.53	4.37	5.29	4.02	0.16	22.88
	(12.89)	(0.41)	(24.95)	(19.44)	(5.60)	(0.05)	(3.56)	(4.67)	(4.53)	(5.45)	(4.17)	(0.22)	(24.95)
2002	4.64	0.2	16.16	8.24	0.04	0.02	1.49	1.93	1.87	2.17	1.73	0.13	16.16
	(9.43)	(0.69)	(77.16)	(18.42)	(2.11)	(0.06)	(3.01)	(3.79)	(3.71)	(4.21)	(3.38)	(0.74)	(77.16)
2003	23.53	0.62	40.84	38.78	0.45	0.06	7.54	9.76	9.53	10.91	8.73	0.23	40.83
	(11.71)	(0.38)	(22.42)	(20.10)	(9.36)	(0.79)	(4.20)	(5.04)	(4.99)	(5.69)	(4.63)	(0.22)	(22.43)
2004	13.94	0.47	23.53	19.52	-0.24	0.07	3.65	4.82	4.70	5.24	4.18	0.17	23.53
	(8.36)	(0.38)	(24.03)	(12.92)	(1.23)	(0.31)	(2.60)	(3.41)	(3.32)	(3.56)	(2.85)	(0.13)	(24.03)
2005	5.73	0.16	9.93	9.09	-0.37	0.07	1.84	2.23	2.21	2.37	2.05	0.06	9.93
	(9.80)	(0.29)	(18.31)	(14.83)	(3.25)	(0.24)	(2.97)	(3.66)	(3.6)	(4.02)	(3.34)	(0.12)	(18.31)
2006	18.83	0.49	28.98	30.51	-1.9	0.23	6.14	7.59	7.48	8.31	6.98	0.19	28.97
	(10.19)	(0.36)	(16.12)	(16.8)	(23.63)	(0.84)	(3.68)	(4.37)	(4.32)	(4.65)	(4 .00)	(0.12)	(16.12)
2007	-11.92	-0.41	-16.37	-16.77	-1.64	-0.24	-3.26	-4.06	-3.99	-4.47	-3.7	-0.12	-16.37
	(8.86)	(0.31)	(11.78)	(12.14)	(19.39)	(0.41)	(2.42)	(2.95)	(2.91)	(3.29)	(2.70)	(0.09)	(11.78)
2008	-9.54	-0.96	-15.8	-12.15	-6.85	-0.09	-2.00	-2.78	-2.7	-3.1	-2.39	-0.22	-15.8
	(7.68)	(1.01)	(13.39)	(9.63)	(51.52)	(0.09)	(1.63)	(2.20)	(2.14)	(2.45)	(1.91)	(0.17)	(13.39)
2009	7.26	0.59	11.69	10.87	2.54	0.13	2.05	2.71	2.64	3.07	2.44	0.40	11.69
	(8.87)	(0.77)	(16.15)	(13.89)	(14.50)	(0.15)	(2.36)	(3.40)	(3.26)	(4.08)	(2.98)	(1.22)	(16.15)
2010	12.74	0.53	19.60	19.42	0.68	0.2	3.92	4.84	4.77	5.31	4.41	0.24	19.60
	(8.34)	(0.43)	(14.04)	(13.14)	(6.83)	(0.31)	(2.71)	(3.28)	(3.24)	(3.61)	(3.00)	(0.31)	(14.04)

A correlation analysis is released in order to test if, even if the values of different RAP measure are not strictly comparable, the rankings defined using different RAP measure are comparable each other. We perform both a standard pairwise correlation and a not parametric test for identifying the degree of dependence among different rankings. Results are summarized in table 4.

Table 4. Summary statistics of correlation analysis among rankings defined by different RAP measures (time horizon 1999-2010)

		Sharpe	ROPS	ROAS	Sortino	Kappa (n=3)	Kappa (n=4)	Calmar	Sterling	Burke	VaR Ratio	CVaR ratio	MVaR ratio	Sharpe Omega
Sharpe	Mean PW corr	1												
	Test χ^2 (α=0.01%)													
	Test χ^2 (α=0.1%)													
ROPS	Mean PW corr	*90.09%*	1											
	Test χ^2 (α=0.01%)	118												
	Test χ^2 (α=0.1%)	118												
ROAS	Mean PW corr	*98.03%*	*89.59%*	1										
	Test χ^2 (α=0.01%)	36	115											
	Test χ^2 (α=0.1%)	70	116											
Sortino	Mean PW corr	*98.94%*	*88.55%*	*98.54%*	1									
	Test χ^2 (α=0.01%)	25	115	7										
	Test χ^2 (α=0.1%)	57	116	8										
Kappa (n=3)	Mean PW corr	*0.86%*	*4.35%*	*2.52%*	*2.84%*	1								
	Test χ^2 (α=0.01%)	108	15	109	110									
	Test χ^2 (α=0.1%)	108	20	109	110									
Kappa (n=4)	Mean PW corr	*68.45%*	*69.18%*	*62.54%*	*66.48%*	*-2.04%*	1							
	Test χ^2 (α=0.01%)	112	31	113	117	0								
	Test χ^2 (α=0.1%)	112	45	113	117	0								
Calmar	Mean PW corr	*96.80%*	*86.15%*	*95.44%*	*98.57%*	*3.11%*	*67.81%*	1						
	Test χ^2 (α=0.01%)	101	41	110	115	55	53							
	Test χ^2 (α=0.1%)	104	66	110	115	68	77							
Sterling	Mean PW corr	*98.20%*	*88.26%*	*97.39%*	*99.51%*	*3.09%*	*66.64%*	*99.10%*	1					
	Test χ^2 (α=0.01%)	91	63	112	115	65	70	0						
	Test χ^2 (α=0.1%)	97	88	113	116	80	90	0						
Burke	Mean PW corr	*98.06%*	*87.95%*	*97.13%*	*99.48%*	*3.15%*	*66.98%*	*99.39%*	*99.96%*	1				
	Test χ^2 (α=0.01%)	93	59	111	115	65	67	0	0					
	Test χ^2 (α=0.1%)	97	86	114	117	78	91	0	0					
VaR Ratio	Mean PW corr	*98.62%*	*88.11%*	*98.01%*	*99.56%*	*2.86%*	*65.78%*	*97.95%*	*99.52%*	*99.36%*	1			
	Test χ^2 (α=0.01%)	84	74	111	115	69	77	0	0	0				
	Test χ^2 (α=0.1%)	98	91	112	117	84	97	0	0	0				
CVaR Ratio	Mean PW corr	*98.04%*	*87.23%*	*96.87%*	*99.47%*	*2.99%*	*68.74%*	*99.54%*	*99.72%*	*99.83%*	*99.21%*	1		
	Test χ^2 (α=0.01%)	95	56	112	116	61	64	0	0	0	0			
	Test χ^2 (α=0.1%)	99	81	113	116	71	86	0	0	0	0			
MVaR Ratio	Mean PW corr	*88.02%*	*94.98%*	*86.80%*	*85.62%*	*3.96%*	*70.10%*	*82.32%*	*84.21%*	*83.95%*	*85.27%*	*84.10%*	1	
	Test χ^2 (α=0.01%)	112	2	116	119	58	8	118	118	118	120	117		
	Test χ^2 (α=0.1%)	113	4	116	119	62	8	118	118	118	120	117		
Sharpe Omega	Mean PW corr	*98.04%*	*89.60%*	*100.00*	*98.54%*	*2.52%*	*62.55%*	*95.44%*	*97.39%*	*97.13%*	*98.01%*	*96.87%*	*86.81%*	1
	Test χ^2 (α=0.01%)	36	115	0	5	106	115	107	105	106	101	106	113	
	Test χ^2 (α=0.1%)	69	116	0	5	108	116	113	109	109	109	111	114	

Source: Datastream data processed by the authors

The analysis of results achieved by the correlation analysis demonstrate the ranking based on performance measure constructed using different risk measure are comparable because, except for Kappa (n=3), the correlation is almost always positive and the mean value for the time horizon considered is higher than 85%. The anomaly of identified on the Kappa constructed on the moment of order three could be ascribed to the shape of the return distribution that is not well described using only this proxy.

The analysis is released removing any assumption on the return distribution analysis using a standard χ^2 test on the degree of independence among the value of the RAP measures for each fund over time. The not parametric test shows that the Sharpe ratio value is not independent respect to other RAP measures even if high selective thresholds are taken into account (α=0.1 or α=0.01). Results obtained show that the relationship with the Sharpe index in not verified for more than the half of REITs considered and the Sortino and Sharpe Omega criteria are those that demonstrate the higher independence respect to the Sharpe criterion.

Once verified that the results obtained by different approaches are strictly correlated, we perform a persistence analysis in order to test the choice of the risk measure could affect the stability of the ranking position over time (table 5)

If we compare one by one the ranking position over a one year time horizon, they are not stable over time because, independently respect to the RAP measure select, the mean number of funds that achieve a ranking position stable on a year time horizon is less that 2% and there could be ranking change for a REIT higher than 100 (especially is the REIT is newly listed). As expected, the time persistence of the ranking is decreasing over time also due to the increasing number of funds listed in the last years that cause a growth in the probability of ranking changes in the sample.

If we consider a less strict definition of the time persistence that do not look at the specific ranking position but analyse the capability of the REIT to stay in the same bandwidth we can obtain more interesting results. Looking the decile distribution, the probability of a REIT to remain in the same cluster is normally around the 10% while the quartile distribution analysis allow to identify RAP measures that on a yearly time horizon show a persistence higher than 30%. Comparing the time persistence of RAP constructed using different risk measurement approach we are unable to identify clearly the be approach that best approach and so there is no clear advantage in selecting more complex RAP measures respect to the Sharpe ratio in raking REITs if the purpose of the evaluator is only to achieve the stability of the rankings.

Table 5. Ranking positions change on a yearly time horizon defined using different RAP measures

		Sharpe	ROPS	ROAS	Sortino	Kappa (n=3)	Kappa (n=4)	Calmar	Sterling	Burke	VaR Ratio	CVaR ratio	MVaR ratio	Sharpe Omega
	Detailed	3.23%	1.08%	3.23%	3.23%	3.23%	2.15%	4.30%	2.15%	5.38%	4.30%	3.23%	1.08%	3.23%
1999-2000	Decile	9.68%	15.05%	11.83%	15.05%	15.05%	12.90%	19.35%	15.05%	16.13%	9.68%	16.13%	12.90%	11.83%
	Quartile	26.88%	25.81%	33.33%	29.03%	31.18%	35.48%	31.18%	29.03%	29.03%	26.88%	27.96%	25.81%	33.33%
	Detailed	0.00%	0.00%	1.08%	1.08%	1.08%	2.15%	1.08%	1.08%	1.08%	1.08%	1.08%	3.23%	1.08%
2000-2001	Decile	11.83%	10.75%	7.53%	10.75%	9.68%	12.90%	9.68%	15.05%	17.20%	13.98%	16.13%	8.60%	7.53%
	Quartile	24.73%	25.81%	21.51%	25.81%	24.73%	29.03%	24.73%	25.81%	25.81%	29.03%	23.66%	20.43%	21.51%
	Detailed	2.13%	2.13%	1.06%	2.13%	1.06%	1.06%	1.06%	0.00%	1.06%	3.19%	0.00%	0.00%	1.06%
2001-2002	Decile	14.89%	13.83%	12.77%	11.70%	10.64%	14.89%	7.45%	12.77%	8.51%	10.64%	8.51%	14.89%	12.77%
	Quartile	30.85%	31.91%	29.79%	27.66%	32.98%	34.04%	28.72%	27.66%	27.66%	26.60%	27.66%	32.98%	29.79%
	Detailed	3.13%	1.04%	2.08%	1.04%	1.04%	2.08%	2.08%	3.13%	1.04%	3.13%	2.08%	1.04%	2.08%
2002-2003	Decile	16.67%	12.50%	9.38%	11.46%	25.00%	8.33%	13.54%	16.67%	14.58%	12.50%	17.71%	7.29%	9.38%
	Quartile	25.00%	31.25%	34.38%	25.00%	39.58%	32.29%	28.13%	29.17%	25.00%	30.21%	26.04%	25.00%	34.38%
	Detailed	0.00%	1.94%	2.91%	0.00%	0.97%	3.88%	1.94%	2.91%	4.85%	2.91%	0.97%	2.91%	2.91%
2003-2004	Decile	12.62%	10.68%	11.65%	7.77%	9.71%	18.45%	9.71%	8.74%	12.62%	11.65%	9.71%	10.68%	11.65%
	Quartile	26.21%	25.24%	23.30%	26.21%	20.39%	33.01%	26.21%	28.16%	30.10%	33.98%	26.21%	20.39%	23.30%
	Detailed	1.77%	0.88%	1.77%	0.88%	0.88%	0.00%	0.88%	0.88%	0.00%	0.88%	0.88%	2.65%	1.77%
2004-2005	Decile	14.16%	10.62%	15.04%	15.04%	15.93%	13.27%	13.27%	14.16%	15.04%	15.04%	12.39%	10.62%	15.04%
	Quartile	32.74%	31.86%	29.20%	31.86%	30.97%	38.05%	36.28%	35.40%	36.28%	33.63%	35.40%	32.74%	29.20%
	Detailed	1.68%	0.84%	0.00%	0.00%	1.68%	0.84%	0.00%	0.00%	0.00%	1.68%	0.00%	0.00%	0.00%
2005-2006	Decile	10.92%	8.40%	10.92%	10.08%	10.08%	10.92%	9.24%	10.08%	10.08%	10.92%	6.72%	8.40%	10.92%
	Quartile	27.73%	23.53%	26.89%	27.73%	23.53%	19.33%	25.21%	25.21%	25.21%	26.05%	25.21%	22.69%	26.89%
	Detailed	0.00%	0.82%	1.64%	0.82%	1.64%	0.00%	0.82%	1.64%	0.82%	0.82%	1.65%	1.64%	1.64%
2006-2007	Decile	9.02%	10.66%	9.02%	10.66%	10.66%	8.20%	10.66%	11.48%	12.30%	10.66%	12.40%	8.20%	9.02%
	Quartile	22.95%	26.23%	23.77%	26.23%	24.59%	22.13%	24.59%	23.77%	25.41%	25.41%	26.45%	27.87%	23.77%
	Detailed	0.00%	0.00%	0.00%	0.00%	1.63%	1.63%	1.63%	0.00%	0.00%	0.81%	0.00%	1.63%	0.00%
2007-2008	Decile	7.32%	8.13%	9.76%	7.32%	13.01%	12.20%	5.69%	4.88%	6.50%	4.88%	5.69%	10.57%	9.76%
	Quartile	26.83%	32.52%	28.46%	27.64%	31.71%	28.46%	25.20%	22.76%	23.58%	22.76%	25.20%	33.33%	28.46%
	Detailed	0.00%	0.00%	0.00%	0.81%	0.00%	0.81%	0.00%	1.63%	0.81%	0.00%	0.81%	0.81%	0.00%
2008-2009	Decile	6.50%	7.32%	4.88%	5.69%	4.88%	6.50%	5.69%	8.13%	6.50%	4.07%	6.50%	8.94%	4.88%
	Quartile	22.76%	21.14%	22.76%	20.33%	32.52%	23.58%	18.70%	19.51%	20.33%	20.33%	17.07%	19.51%	22.76%
	Detailed	0.81%	0.00%	4.03%	1.61%	0.00%	0.81%	3.23%	2.42%	2.42%	1.61%	2.42%	0.81%	4.03%
2009-2010	Decile	16.13%	10.48%	16.13%	13.71%	4.03%	17.74%	16.94%	13.71%	13.71%	12.10%	15.32%	8.87%	16.13%
	Quartile	41.94%	31.45%	36.29%	35.48%	20.16%	37.90%	34.68%	35.48%	35.48%	33.87%	34.68%	27.42%	36.29%
	Detailed	1.08%	1.09%	1.09%	1.10%	1.10%	1.10%	1.10%	1.09%	1.09%	1.09%	1.08%	1.08%	1.08%
Mean	Decile	11.64%	11.74%	11.66%	11.77%	11.52%	11.35%	11.31%	11.26%	10.92%	10.88%	10.68%	10.59%	10.51%
	Quartile	28.18%	28.27%	28.10%	28.28%	28.03%	27.52%	27.34%	27.06%	26.72%	26.53%	26.11%	25.94%	25.52%

Source: Datastream data processed by the authors

3.2.2 RAP measures determinants and performance strategies

The choice of the risk measure for evaluation REITs' performance can also impact on the predictability of the RAP value but do not change the main explain variable for the ranking constructed (table 6).

Table 6. Determinants of the value of different RAP measure

	Sharpe	ROPS	ROAS	Sortino	Kappa (n=3)	Kappa (n=4)	Calmar	Sterling	Burke	VaR Ratio	CVaR ratio	MVaR ratio	Sharpe Omega
Leverage	-12.48	-16.93	-0.41	-14.7	9.37	-0.32	-2.39*	-3.2	-3.09	-3.73	-2.85	-0.2	-16.9
IC	0.01	0.01	0	0.01	0	0	0	0	0	0	0	0	0.01
STDBT	54.4*	92.45*	2.71*	79.51*	-1.73	0.51	15.43*	19.45*	19.08*	21.51*	17.57*	1.13*	92.39*
Amihud	0.59	0.76	-0.04	0.77	0.49	0.03	0.18	0.16	0.16	0.16	0.16	-0.04*	0.76
VWES	-1.64*	-2.71*	-0.05*	-2.41*	-0.31	-0.01	-0.44	-0.58*	-0.56*	-0.65*	-0.51*	-0.01*	-2.71*
lnmv	-0.63	-1.57*	-0.04	-0.86	-0.76	-0.03	-0.13	-0.18	-0.18	-0.23	-0.16	-0.02	-1.57*
PE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FFO/TA	-14.84	-26.3	0.51	-20.76	-37.69	-0.92	-5*	-4.92	-5.05	-5.28	-4.51	-0.06	-26.11
Realestate	9.06*	16.32*	0.39*	14.13*	0.27	0.08	2.84	3.48*	3.41*	3.92*	3.14*	0.1	16.32*
RealAdm	0.58	-4.41	0.11	-3.64	-1.31	0.17	-0.47	-1.02	-0.97	-1.45	-0.79	0.08	-4.44
G&A/TA	-76.55*	-99.6	-3.44*	-108.82*	21.46	-1.44	-22.51*	-27.98*	-27.58*	-29.93*	-25.75*	-1.37*	-99.61
Sefadm	-1.06	-2.09	-0.07	-1.46	-1.81	-0.05	-0.25	-0.36	-0.34	-0.46	-0.28	-0.01	-2.1
Industrial	-4.45	-7.51	-0.19	-5.87	0.18	-0.14	-0.81	-1.16	-1.08	-1.42	-0.92	-0.05	-7.58
Office	-3.19	-5.16	-0.05	-4.26	0.24	-0.07	-0.49	-0.84	-0.77	-1.11	-0.68	-0.03	-5.14
Retail	-1.15	-0.88	-0.04	-0.96	1.22	-0.07	0	-0.04	-0.01	-0.09	0.02	-0.01	-0.86
Residential	-5.06	-7.21	-0.12	-6.07	-1.77	-0.09	-0.85	-1.25	-1.16	-1.58	-1.05	-0.05	-7.2
Diversified	-4.69	-6.58	-0.12	-6.02	0.1	-0.16	-0.95	-1.31	-1.24	-1.56	-1.13	-0.06	-6.56
Hotels	-8.78*	-13.6	-0.35	-11.84	-1.66	-0.05	-2.07	-2.62	-2.53	-2.94	-2.3	-0.13	-13.58
Healthcare	-3.56	-4.9	-0.07	-3.75	0.96	-0.07	-0.39	-0.68	-0.62	-0.88	-0.53	-0.05	-4.89
Selfstorage	-2.64	-3.72	0.02	-2.92	3.09	-0.07	-0.25*	-0.48	-0.43	-0.67	-0.3	-0.02	-3.71
Constant	11.29	25.57*	0.39	19.42*	6.88	0.12	2.83*	4.56	4.35	5.73*	3.82	0.25*	25.58*
Obs	845	845	845	845	845	845	845	845	845	845	845	845	845
Groups	105	105	105	105	105	105	105	105	105	105	105	105	105
R^2 wtn	0.1527	0.1595	0.1261	0.1365	0.0058	0.0089	0.1166	0.1302	0.1282	0.1344	0.1261	0.1078	0.1595
R^2 btw	0.2922	0.3009	0.2527	0.2762	0.017	0.1031	0.2668	0.2595	0.259	0.2587	0.2607	0.0923	0.3013
R^2 all	0.1471	0.1556	0.12	0.132	0.0094	0.0245	0.1147	0.1253	0.1236	0.1292	0.1214	0.0768	0.1556

Source: Datastream and fund reports processed by the authors

The statistical fitness of the model is not high and not all explaining variable contribute to explain the RAP rankings. Ranking constructed using ROPS, ROAS, MVaR and Sharpe Omega are better explained by the model proposed respect to the Sharpe index ranking. The lowest fitness attains to the Kappa RAP measures that defines ranking that is quite unpredictable using the model proposed (Overall R^2 lower than 1%). The lower fitness of this type of model could be justified on the basis of the lackness of standard third and fourth moment measures to describe correctly the of REITs' performance on a long term time horizon.

The analysis of the controlling variables demonstrates that real estate investment, the general and administrative expenses and the dividend yield are always the main drivers for almost all the RAP measures constructed. In the REIT industry, the real estate assets are the core business (Allen, Madura and Springer, 2000) and so the choice to concentrate the investment on these assets could allow to use better the distinctive knowledge. The general and administrative expenses are related to degree of complexity of the REIT and could reduce the advantages related to the proper investment selection and portfolio construction (Benefield, Anderson and Zumpano, 2009) implying a reduction of the wealth created for the REITs' shareholders.

Looking at the REITs' debt policy, the degree of leverage impacts prevalently negatively on the RAP value due to the higher risk of default related to the use of debt. An higher value of the interest coverage implies a lower default risk for the REITs and a better return-risk profile. Both the leverage and the interest coverage ratio are never statistical significant in explaining the REITs' performance. The matching of the duration of the debt and the duration of the asset allow to reduce the risk of the real estate investment vehicle due to the opportunity to use the value of the assets sold in order to refund the debt (Giannotti and Mattarocci, 2010). A positive mismatch between short term assets and debt could imply a reduction of the risk for the REIT due the opportunity to sell short term assets in order to avoid the renewal of the short term debt in the case of increasing cost of lending. The relationship identified between the RAP measures and this misallinement is positive and statistical significant and so every choice in the debt design could impact significantly on the value of the REITs.

Differently respect to less liquid markets like European ones (i.a. Hoesli and Morri, 2010), the volume variables represent one of the main drivers of the RAP rankings. Volume variables constructed on the basis of the volume of trades and the bid-ask spread are those that show a relationship statistical significant with almost all the RAP measures. The misallingment of the price of the day respect to the mean between the bid and ask price (VWES) implies a worse return-risk profile of the REITs due to the high difference between the final transaction price and the one requested by the two counterparties. The relevance of the bid ask spread respect to the mean value of the price offered and requested implies a lower number of transactions released due to the high mismatch between demand and supply of the title that could imply a lower variability over time of the price and so a lower risk profile of the REIT.

The comparison of the ranking determinants for the different RAP measures does not show any significant difference among the main determinants of the RAP value. The choice of the proper risk measure does not affect the drivers of risk-return profile except for the Kappa risk measures that normally define ranking that could not be explained with the same drivers identified for the Sharpe index.

Even if we demonstrate that the raking are comparable and affected by the same REITs' features, the analysis of the performance achieved by a portfolio composition strategy allow to demonstrate clearly the advantages related to adopting the new RAP measures in order to select investments (table 7).

Considering equally weighted portfolios, the choice to select investments on the basis of the RAP measures normally allow to achieve higher returns respect to the naïve strategy. Measures constructed on the probability of shortfall, the absolute shortfall and the VAR risk measures normally allow to construct portfolio that maximize the performance and beat both the benchmark portfolio and the one constructed selecting REITs on the basis of the Sharpe index. Kappa measures corrected for asymmetry represent the worst criterion for selecting REITs because the performance achieved by a portfolio of winners and loser are comparable and there is not a clear advantage in selection the top ranking REITs respect to the worst ones.

If we consider value weighted portfolios, only the ROPS and the Modified VaR demonstrate an higher capability of the Sharpe index in selecting the best investment opportunities (Table 8). If we compare the top and worst REITs the choice to consider a value weighted approach allow to maximize the difference of performances of the top and worst investing strategies. Only the Kappa corrected for the asymmetry fails to identify better investment strategy when we select to invest only on top performers at time t-1.

Table 7. Performance of the investment strategy – Equally weighted portfolios

	BMK	TOP Sharpe	TOP ROPS	TOP ROAS	TOP Sortino	TOP Kappa (n=3)	TOP Kappa (n=4)	TOP Calmar	TOP Sterling	TOP Burke	TOP VaR Ratio	TOP CVaR ratio	TOP MVaR ratio	TOP Sharpe Omega
1999-2000	16.95%	14.14%	14.23%	14.14%	14.14%	1.55%	14.06%	13.04%	14.14%	14.14%	13.18%	13.04%	14.23%	14.14%
2000-2001	21.36%	35.80%	39.70%	37.17%	36.21%	21.57%	33.80%	35.55%	36.17%	36.17%	36.74%	36.25%	39.71%	37.17%
2001-2002	16.29%	43.69%	47.87%	43.94%	44.39%	35.56%	40.44%	40.42%	45.08%	45.19%	45.22%	45.19%	47.80%	43.94%
2002-2003	32.84%	53.32%	53.66%	53.19%	53.07%	43.72%	52.22%	43.08%	52.81%	44.04%	52.99%	43.33%	53.59%	53.19%
2003-2004	23.70%	53.37%	52.76%	52.22%	50.04%	46.35%	39.79%	49.54%	48.45%	48.45%	49.73%	49.94%	51.73%	52.22%
2004-2005	11.60%	37.00%	38.66%	38.48%	36.77%	27.96%	31.72%	34.36%	36.37%	34.57%	36.76%	34.47%	39.73%	38.48%
2005-2006	27.96%	30.31%	30.65%	30.41%	30.11%	16.74%	22.91%	30.09%	30.20%	30.20%	30.23%	30.06%	30.62%	30.41%
2006-2007	-18.85%	41.80%	42.53%	42.00%	41.41%	32.54%	33.58%	41.33%	41.30%	41.30%	41.10%	41.20%	42.95%	42.00%
2007-2008	-53.07%	-1.22%	-1.16%	-1.52%	-1.39%	-29.16%	-7.12%	-1.64%	-1.37%	-1.64%	-1.32%	-1.64%	-1.21%	-1.52%
2008-2009	29.21%	-2.61%	-2.42%	-2.61%	-2.58%	-79.05%	-2.61%	-2.58%	-2.58%	-2.58%	-2.49%	-2.58%	-2.45%	-2.61%
2009-2010	27.02%	66.75%	70.90%	66.85%	66.75%	49.87%	63.95%	65.01%	65.91%	64.72%	65.67%	64.08%	72.06%	66.85%
1999-2010	**242.06%**	**2126.94%**	**2357.28%**	**2156.45%**	**2078.22%**	**155.02%**	**1462.64%**	**1798.24%**	**2045.80%**	**1885.58%**	**2062.29%**	**1865.98%**	**2378.10%**	**2156.45%**
	BMK	Worst Sharpe	Worst ROPS	Worst ROAS	Worst Sortino	Worst Kappa (n=3)	Worst Kappa (n=4)	Worst Calmar	Worst Sterling	Worst Burke	Worst VaR Ratio	Worst CVaR ratio	Worst MVaR ratio	Worst Sharpe Omega
1999-2000	16.95%	16.95%	14.14%	14.23%	14.14%	14.14%	1.55%	14.06%	13.04%	14.14%	14.14%	13.18%	13.04%	14.23%
2000-2001	21.36%	21.36%	35.80%	39.70%	37.17%	36.21%	21.57%	33.80%	35.55%	36.17%	36.17%	36.74%	36.25%	39.71%
2001-2002	16.29%	16.29%	41.87%	45.87%	42.11%	42.54%	34.07%	38.75%	38.74%	43.20%	43.31%	43.33%	43.31%	45.81%
2002-2003	32.84%	32.84%	53.32%	53.66%	53.19%	53.07%	43.72%	52.22%	43.08%	52.81%	44.04%	52.99%	43.33%	53.59%
2003-2004	23.70%	23.70%	53.37%	52.76%	52.22%	50.04%	46.35%	39.79%	49.54%	48.45%	48.45%	49.73%	49.94%	51.73%
2004-2005	11.60%	11.60%	37.00%	38.66%	38.48%	36.77%	27.96%	31.72%	34.36%	36.37%	34.57%	36.76%	34.47%	39.73%
2005-2006	27.96%	27.96%	30.31%	30.65%	30.41%	30.11%	16.74%	22.91%	30.09%	30.20%	30.20%	30.23%	30.06%	30.62%
2006-2007	-18.85%	-18.85%	43.20%	43.95%	43.40%	42.79%	33.63%	34.70%	42.71%	42.68%	42.68%	42.47%	41.20%	44.38%
2007-2008	-53.07%	-53.07%	-1.22%	-1.16%	-1.52%	-1.39%	-29.16%	-7.12%	-1.64%	-1.37%	-1.64%	-1.32%	-1.64%	-1.21%
2008-2009	29.21%	29.21%	-2.61%	-2.42%	-2.61%	-2.58%	-79.05%	-2.61%	-2.58%	-2.58%	-2.58%	-2.49%	-2.58%	-2.45%
2009-2010	27.02%	27.02%	66.75%	70.90%	66.85%	66.75%	49.87%	63.95%	65.01%	65.91%	64.72%	65.67%	64.08%	72.06%
1999-2010	**242.06%**	**2120.63%**	**2348.61%**	**2150.01%**	**2071.62%**	**154.58%**	**1457.20%**	**1793.99%**	**2038.99%**	**1879.25%**	**2055.30%**	**1841.78%**	**2369.55%**	**2150.01%**

Source: Datastream and fund reports processed by the authors

Table 8. Performance of the investment strategy – Value weighted portfolios

	BMK	TOP Sharpe	TOP ROPS	TOP ROAS	TOP Sortino	TOP Kappa (n=3)	TOP Kappa (n=4)	TOP Calmar	TOP Sterling	TOP Burke	TOP VaR Ratio	TOP CVaR ratio	TOP MVaR ratio	TOP Sharpe Omega
1999-2000	22.32%	11.70%	12.21%	11.70%	11.70%	-7.68%	11.58%	11.29%	11.70%	11.70%	11.68%	11.29%	12.21%	11.70%
2000-2001	14.39%	34.21%	37.55%	34.60%	34.38%	31.43%	36.19%	33.25%	34.26%	34.26%	34.80%	34.36%	37.49%	34.60%
2001-2002	5.70%	39.63%	41.96%	40.21%	38.47%	32.62%	36.84%	35.48%	39.11%	39.66%	36.62%	39.66%	45.50%	40.21%
2002-2003	29.88%	24.00%	24.24%	24.18%	24.01%	20.94%	23.79%	22.88%	24.04%	23.35%	24.15%	23.20%	24.57%	24.18%
2003-2004	26.50%	46.10%	47.44%	45.10%	44.70%	39.40%	35.09%	43.29%	42.78%	42.78%	44.43%	42.80%	43.73%	45.10%
2004-2005	12.22%	36.19%	37.74%	37.40%	35.03%	27.30%	32.97%	36.11%	35.12%	34.46%	35.23%	34.66%	36.00%	37.40%
2005-2006	30.09%	24.15%	24.87%	24.19%	24.86%	17.21%	20.09%	25.02%	25.22%	25.22%	25.39%	26.30%	24.67%	24.19%
2006-2007	-20.42%	40.61%	42.28%	41.75%	40.59%	30.03%	33.99%	40.26%	40.18%	40.18%	40.16%	40.16%	41.48%	41.75%
2007-2008	-62.01%	-2.49%	-2.55%	-4.76%	-2.58%	-31.31%	-6.64%	-2.67%	-2.54%	-2.67%	-2.53%	-2.67%	-2.56%	-4.76%
2008-2009	31.84%	-4.02%	-2.39%	-4.02%	-2.67%	-91.61%	-2.47%	-2.67%	-2.67%	-2.67%	-2.72%	-2.67%	-3.47%	-4.02%
2009-2010	23.83%	54.07%	60.39%	54.34%	54.07%	40.18%	44.64%	49.30%	54.58%	49.13%	54.27%	48.75%	53.60%	54.34%
1999-2010	**175.08%**	**1300.19%**	**1498.20%**	**1296.20%**	**1291.35%**	**42.52%**	**980.01%**	**1194.06%**	**1284.78%**	**1229.78%**	**1282.02%**	**1234.01%**	**1392.94%**	**1296.20%**
	BMK	Worst Sharpe	Worst ROPS	Worst ROAS	Worst Sortino	Worst Kappa (n=3)	Worst Kappa (n=4)	Worst Calmar	Worst Sterling	Worst Burke	Worst VaR Ratio	Worst CVaR ratio	Worst MVaR ratio	Worst Sharpe Omega
1999-2000	22.32%	-30.98%	-35.31%	-29.03%	-27.91%	-27.82%	-31.08%	-25.02%	-26.28%	-26.28%	-27.84%	-26.06%	-35.23%	-29.03%
2000-2001	14.39%	-7.11%	-5.79%	-6.59%	-7.11%	7.98%	0.76%	-0.43%	-7.11%	-7.11%	-7.11%	-7.11%	-5.79%	-6.59%
2001-2002	5.70%	-4.12%	-4.45%	-4.12%	-4.44%	13.66%	-4.21%	-5.55%	-4.44%	-4.44%	-4.12%	-5.18%	-1.96%	-4.12%
2002-2003	29.88%	-8.10%	-2.30%	-8.10%	-2.12%	-6.40%	-2.57%	-8.10%	-2.21%	-8.10%	-2.11%	-8.10%	-2.58%	-8.10%
2003-2004	26.50%	16.08%	16.88%	18.63%	18.45%	29.36%	18.39%	21.02%	17.46%	19.63%	18.43%	20.45%	14.12%	18.63%
2004-2005	12.22%	11.25%	11.63%	12.09%	12.12%	31.92%	13.32%	11.84%	12.24%	11.78%	12.51%	11.81%	11.12%	12.09%
2005-2006	30.09%	-3.94%	-4.19%	-4.29%	-4.19%	16.49%	-3.36%	-4.19%	-4.19%	-4.19%	-4.60%	-4.19%	-4.19%	-4.29%
2006-2007	-20.42%	13.67%	14.29%	13.71%	13.33%	28.27%	21.40%	15.46%	14.05%	14.14%	13.67%	14.07%	13.87%	13.71%
2007-2008	-62.01%	-15.00%	-38.96%	-12.53%	-37.14%	-5.38%	-27.57%	-13.64%	-37.37%	-15.29%	-37.46%	-15.26%	-38.91%	-12.53%
2008-2009	31.84%	-163.66%	-138.86%	-159.70%	-152.65%	-60.08%	-125.49%	-141.95%	-153.59%	-153.59%	-163.33%	-152.42%	-140.18%	-159.70%
2009-2010	23.83%	-5.41%	-4.51%	-4.81%	-5.41%	7.65%	-5.59%	-5.41%	-5.41%	-5.41%	-5.41%	-5.41%	-5.15%	-4.81%
1999-2010	**175.08%**	**-40.77%**	**-18.41%**	**-42.02%**	**-28.28%**	**85.98%**	**-17.78%**	**-33.26%**	**-29.27%**	**-37.77%**	**-34.06%**	**-37.02%**	**-18.77%**	**-42.02%**

Source: Datastream and fund reports processed by the authors

5. Conclusions

The assumption of normality of return distribution for US REITS are not coherent with the real distribution of results in the last years. Due to the lack of normality more complex risk measures are necessary in order to describe the risk profile of the investment.

The choice of more complete risk measures respect to the standard deviation affects not only the yearly ranking position of each fund but also the variability of rankings over time. Measures constructed on maximum drawdown and VAR risk measures allow to achieve the highest level of raking persistence over time.

The comparison among ranking obtained using different RAP measures impacts on the ranking position of the REITs but there is always a correlation (higher than 85%) among ranking defined using different risk measurement approaches. The not parametric test of independence among rankings show that the pairwise correlation represents an overestimate of the real relationship because only for a small set of funds the dependence is verified.

The predictability of the value assumed by RAP measure is driven by some REITS specific features (like Real estate investment, General and administrative expenses and dividend yield) but also debt policy and volume of trades could affect the ranking dynamics. The comparison among rakings constructed using different risk approaches demonstrates that, as shown for other types of financial instruments like hedge funds (Liang and Park, 2007), the choice to construct risk measures that do not assume normality could allow to explain better the REIT performance dynamics.

Considering a simple portfolio construction process, we demonstrate that the choice of the risk measurement approach for the REIT industry could also impact on the performance of portfolio construction approach. The relevance of constructing more complex measures is more clear when equally weighted portfolios are taken into account while the difference in the value weighted scenarios are less relevant.

A further development of the research had to consider more complex portfolio optimization rules (i.a. Lee and Stevenson, 2005) in order to test if the choice of the risk measurement approach is still relevant when complex portfolio construction rules are applied.

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[i] The choice of the time horizon is constrained due to the survivorship bias problem because time horizons longer than eleven years are too much affected by this problem.

[ii] Our analysis does not consider RAP measures like the Treynor index, the information ratio and the Jensen α and all adjustments of these measures that remove the assumption of normality of returns. This choice is also justifiable on the basis of the problems pointed out in literature for the correct specification of market indexes and benchmarks for real estate industry (i.a. Porzio and Sampagnaro, 2007).

[iii] Kappa measure could be constructed considering also higher orders but for the purpose of the analysis we select to upper limit the order to 4.

[iv] On the basis of a literature review, only the highest five losses are normally considered (Eling and Schuhmacher, 2007).

[v] On the basis of a literature review, only the highest five losses are normally considered (Eling and Schuhmacher, 2007).

[vi] All measure constructed on VaR consider the minimum threshold of 95% normally used for the evaluation of hedge funds (Guizot, 2007)