Winner *versus* Loser: Time-Varying Performance And Dynamic Conditional Correlation

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ABSTRACT

Using multi-factor models in OLS and GARCH-M methodology, this paper provides a cross-sectional and time-series investigation of conditional and unconditional expected returns of real REITs index momentum portfolios against real estate property, large-cap stock small-cap stock, and bond index in USA. The expected returns and dynamic conditional correlations between REITs and those of other financial and tangible assets vary in period 1989-2010. REITs returns exhibit a higher correlation with up move of financial market, but a lower correlation in market downturns. REITs may possibly provide diversification benefits to multi-asset investment portfolio. We find that the performances of momentum returns are different from the NAREIT index, and display asymmetric volatility as well. Additionally, we find evidence that REITs momentum returns are varying between winner and loser by Wald test. The results of regressions also indicate that REITs return exhibits the greater sensitivity to large- and small-cap stock index, and less closely with those of bond and real estate index. The results also suggest that REITs not be viewed as a complete substitute for investment in tangible property of real estate.

Keywords: REITs; Momentum return; Dynamic conditional correlation; GARCH-M model

1. INTRODUCTION

Real estate investment trusts (REITs) is a useful way to channel and structure the capital flow to the real estate market (Glascock *et al*., 2000). Historical statistics indicate that the market capitalization of the REITs industry amounted to $389.3 billion at the end of 2010, representing an increase of 260 times since 1971. REITs have emerged as means for both institutional and small investors to hold, and invest in diverse property assets after 1992. Like any other public-traded stocks, REITs are listed and traded on major stock exchanges, most listed on NYSE. REITs returns have been extensively studied in order to understand the return generating process (Li and Wang., 1995; Payne, 2003, Chui *et al*., 2003a) and time-series property of REITs during the last two decades (Liu and Mei, 1992; Vinod, 1999; Clayton and MacKinnon, 2001; Chiang and Kung, 2005; Hung and Glascock, 2008; Case *et al*., 2010; Fei *et al*., 2010).

With a better understanding about market driven-force for REITs, the REITs returns may work to better reflect its true value, and thereby a stronger correlation to the investor, as well as academics. This benefit critically relies on the correlation properties between REITs returns and market factors. Several studies reveal the fundamental relationship between REIT and real estate market returns (Clayton and Mackinnon, 2003). At the "REITs Boom" age of the 1990s, there is a high correlation between NAREIT index and NCRECF returns (Giliberto, 1990; Ghosh *et al.*, 1996), and the dramatic growth and maturation of REIT sector makes REITs seem more like real estate, and less like stock (Meyer and Webb, 1993; Liang and McIntosh, 1998). Glascock *et al*. (2000) analyzed the cointegration between the equity REIT and unsecuritized real estate. Barkham and Geltner (1995) show a co-movement between REITs with unsecuritized real estate return, suggesting the return of REITs price changes more rapidly than property value. Other studies also argue the segmentation between the unsecuritized real estate and the stock market (Liu *et al*., 1990; Gilioberto, 1990). Overall, there is still no consensus on the relationship between REITs and unsecuritized real estate (Glascock *et al*., 2000).

The empirical literature in the link between REITs and stocks is also inconclusive. Sagalyn (1990) finds that risk and return level of REITs may depend on business cycles and the trend of the market return. It has been pointed out that the stock market has a significant impact on the REITs return (Nelling and Gyourko, 1998; Clayton and MacKinnon, 2001; Stevenson, 2002; Chang *et al*., 2011), and REITs could be best described in terms of portfolios of stock and bond (Sander and Karolyi, 1998). Swanson *et al*. (2002) finds that REITs are more sensitive to maturity rate spread between treasuries and bonds. Subrahmanyam (2007) considers REITs as a substitute investment for the stock, which causes down-moves in the stock market to increase money flows to the REITs market. Additionally, the inclusion of REITs in the Standard and Poor's major indices led to the return of REITs behaving more like stocks, and particularly increased the influence of sentiment in determining REITs market (Wu and Huang, 2011). On the other hand, Goodman (2003) reveals a low correlation between REITs returns and housing price in a sample spanning from 1976 to 2001, and states that REITs are independent of market changes.

Therefore, the diversification benefit for REITs appears to be very time-dependent. Liang *et al*.(1995) used a two index (large-cap stock index and bond index) model of return generating process for REIT and found a structure break in return of equity REIT. Neilingand and Gyourko (1998) applied a multi-factor for REIT and found that the risk of equity REITs is higher in bear stock market than in bull markets. Chui *et al*.(2003a) find that return volatility and earning volatility for REIT were much greater in the 1990s than in 1980s. Fei (2010) points out REITs exhibit the character of high return when correlation between REIT and S&P500 is the lowest. However, the limitation of the previous model is that they ignore the influence of market interactions between multiple market indices with REITs (Glascock *et al*., 2002).

This research was inspired by a large number of studies that explored pattern in REITs returns, and by studies that built on those patterns to develop factor model that could evaluate the dynamic changes of return in REITs. They examine the cross-sectional sensitivity of REITs to broad asset classes including market portfolio return, large-cap stocks, small-cap stocks, bonds and real estate over the years 1989-2010, which cover both bloom and recession periods. The time-series study is taken to see if there is a pattern in volatility of REITs index and in correlation with other asset classes. In addition, this article explores the time-series behavior of REITs return to see if there are simple laws for expectation of the REITs return, and it also evaluates whether the time-varying factors could jointly explain the momentum returns of REITs. Another difference from previous literature of this study is that it extends to the range of analysis to December, 2010 with the monthly data. This paper eliminates the limitation of the quarterly property index by implication of S&P/Case-Shiller Home price monthly index, as a proxy for the unsecuritized real estate market to extend the observation. Because REITs are traded in the general exchange market and particularly composited in major stock indices, they might result in overstating the correlation between REITs and non-REITs stocks (Case *et al*., 2010). Therefore, the CRSP Cap-Based Portfolio Index that excludes REITs is introduced as a second proxy for the stock market. Jegadeesh and Titman (1993) first report the moment effect of stock portfolios by examining U.S stock market. Though similar researches are also then applied into REITs market analysis (Ling and Ryngaert, 1997; Chui *et al*., 2003b; Joseph *et al*., 2009; Hung and Glascock, 2010), recent outcomes still cannot reach a conclusive explanation of on momentum strategy.

The dynamic conditional correlations of REITs portfolios with market index are examined by Engle DCC estimator (Engle, 2002). The DCC results evidence the time-varying feature of REITs portfolio reflecting the market information, and show the different strategy of winner and loser investment. The study follows the classic Capital Asset Pricing Model (CAPM) and the multi-factor model developed from four-factor model (Clayton and MacKinnon, 2001) as the frame to investigate the link of REITs with other asset classes. The results of regressions indicate that REITs return exhibit the greatest sensitivity to market return, followed by large- and small-cap stock index, bond index and real estate index. Wald test evidenced the winner and loser portfolios display varying sensitivities to the market information. Our regressions supports the momentum effect in REITs returns outperform winner REITs portfolio over loser REITs portfolio. Given the strength of the momentum effect in the sample period, this paper also examines the time-varying changes in REITs return via general autoregressive conditional heteroskedasticity based model (GARCH-M). In fact, we find the momentum effects for returns REITs index, winner and loser are time-varying.

The rest of the paper is organized as follows. In the next section, we show data, construction of portfolio. In the Section III, we state the empirical framework and a series of regression models. In the Section IV, the unconditional and conditional analysis of REITs is discussed. Section IV reports the empirical analysis of the regression models in cross-section and time-series to characterize the sensitivity and profitability. The last section concludes this study.

2. DATA

To estimate the dynamic nature of REITs, this article uses monthly returns of REITs index and market indices from January, 1989 to December, 2010. Monthly REITs performance is proxy by FTSE NAREIT ALL-REIT index, including all three types REITs (equity, mortgage and hybrid) listed on NYSE, AMEX and NASDAQ. The Russell2000 index (*RUSL*) and S&P500 index (*S&P*) are as the proxy for the small- and large-cap stock market, respectively. Barclay Capital long-term Government/Corporate bond index (*BCLB*) is the proxy for bond market return. Because REITs are now included in general stock market indexes, the correlation between a REITs index and a general stock market index overstates the correlation between REITs and non-REITs stocks; therefore, we also use the CRSP Cap-Based Portfolio Index (*CAP*) as an alternative stock index proxy, which excludes REITs to avoid the potential data bias resulting from the inclusion of REITs (Case *et al*., 2010). Following the majority studies, we define the FAMA-FRENCE variable of market portfolio return R_m as the monthly returns on a portfolio composed of all NYSE-AMEX-NASDAQ stocks. The S&P/Case-Shiller home price index (*CSP*) is the leading measure of the property index for U.S. real estate market. The one-month Treasury bill rate from Ibbotson is used as a proxy for the risk-free rate (R_f).

The data of publically-traded REITs traded on NYSE, AMEX and NASDAQ during the period from January, 1988 to December 2010 is collected CRSP database. Under assumption of free allocating the REITs portfolio, this study does not examine the transaction costs incurred for trading these assets. The procedure of forming portfolios was followed the method described by Jegadeesh and Titiman (1993). To form the momentum portfolios, at the end of each month, we rank all REITs in our sample in ascending order based on the past 11 month cumulative return with dividend, and all sample REITs is required to survive at least 18 months. Hereby, the 15 REITs with the lowest (highest) returns are referred to as the loser (winner) portfolio.

3. METHODOLOGY

3.1 Dynamic conditional correlations

Correlations are critical approach for many of the common tasks of financial managements. As the change of correlation and volatility, the efficient allocation of assets should rapidly be adjusted to reflect new public information. The approach of conditional correlation is based on information known in the previous period in allowing the correlation matrix to be time varying. Constant Conditional Correlation (CCC) is one type of benchmark estimator (Bollerslev, 1990), and it is extended to the Dynamic Conditional Correlation (DCC) estimator by implication of GARCH model (Engle, 2002). The model imposes a useful structure on the many possible model parameters. This article uses the DCC estimator as shown in Equation (1). Engle (2002) simply states the correlation estimator by a geometrically weighted average of standardized residuals, which can be expressed as Equation (2).

$$H_t = D_t R_t D_t \tag{1}$$

$$\rho_{i,j,t} = \frac{\sum_{s=1}^{t-1} \lambda^s \varepsilon_{i,t-s} \varepsilon_{j,t-s}}{\sqrt{\sum_{s=1}^{t-1} \lambda^s \varepsilon_{i,t-s}^2}\sqrt{\sum_{s=1}^{t-1} \lambda^s \varepsilon_{j,t-s}^2}} \tag{2}$$

Where H_t is a k×k conditional covariance matrix; R_t is a k×k conditional correlation matrix; D_t is a k×k diagonal matrix of time-varying standard deviations of residual returns, $D_t = \text{diag}\{\sqrt{D_t}\}$.

3.2 Cross-sectional Analysis of REITs performance

Actively managed portfolio is typically evaluated by the return that generated in excess of expected return on a passive benchmark return as:

$$\alpha_{i,t} = R_{i,t} - R_{f,t} \tag{3}$$

Where $R_{i,t}$ denotes either the average return of i REITs index or portfolios at time t, and $R_{f,t}$ denotes the return of one-month Treasury bill. A positive $\alpha_{i,t}$ indicates the successful investment, and the negative $\alpha_{i,t}$ indicates the failure of investment.

Three reduced-form models are applied for the analysis. The first model (Equation 3) is a single-factor model in the tradition of Capital Asset Pricing Model (CAPM), in which the expected return is a function of systematic risk. The estimated version of the CAPM predicts the relationship between beta and excess return. The second model (Equation 4) is similar to the four-factor model developed from Clayton and Mackinnon (2001), including the indices of both financial assets and the unsecuritized real estate asset. In this model, the excess return of $R_{REITs,t}$ is described by the following return generating process. The third model (Equation 5) adds the excess return of Fama-French portfolio to the four-factor model to examine the behavior of REITs with respect to the broad market signals.

$$(R_{REITs,t} - R_{f,t}) = \beta_0 + \beta_m(R_{m,t} - R_{f,t}) + \varepsilon_t \tag{4}$$

$$(R_{REITs,t} - R_{f,t}) = \beta_0 + \beta_{S\&P}R_{S\&P,t} + \beta_{RUSL}R_{RUSL,t} + \beta_{CAP}R_{CAP,t} + \beta_{CSP}R_{CSP,t} + \beta_{BCLB}R_{BCLB,t} + \varepsilon_t \tag{5}$$

$$(R_{REITs,t} - R_{f,t}) = \beta_0 + \beta_m\left(R_{m,t} - R_{f,t}\right) + \beta_{S\&P}R_{S\&P,t} + \beta_{RUSL}R_{RUSL,t} + \beta_{CAP}R_{CAP,t} + \beta_{CSP}R_{CSP,t} + \beta_{BCLB}R_{BCLB,t} + \varepsilon_t \tag{6}$$

Where $R_{S\&P,t}$ is the monthly return to the S&P500 large-cap stock index, $R_{RUSL,t}$ is the monthly return to the Russell2000 small-cap index, $R_{CAP,t}$ is the return to the CRSP Cap-based portfolio index, $R_{CSP,t}$ is S&P/Case-Shiller home price index proxy for monthly unsecuritized real estate index, and $R_{BCLB,t}$ is the return to the Barclay Capital long-term Government/Corporatebond index.

3.3 Time-series analysis of REITs performance

The CAPM model provides the theoretical foundation for the trade-off relationship between risk and excess return. Indeed, risk is to be measured by the conditional covariance of returns with the market. However, risks may vary over time in practice. Previous researches find that the returns of real estate asset exhibit negative skewness and excess kurtosis (Bond and Patel, 2002). Engle (1992) creates the ARCH model, and generalized to GARCH model by Bollerslev (1986). The framework was further extended to ARCH- and GARCH-in-mean (ARCH-M and GARCH-M) by Engle *et al*. (1987), and allows for a analysis of time-varying risk premium. Therefore, an application of GARCH-M estimation to capital asset pricing model may improve the performance of estimation by permitting risk to be time-variant. More specifically, negative shocks typically increase volatility greater than positive shocks of equal magnitude (Henry, 2008). In other words, negative returns cause an upward revision of the conditional volatility, whereas positive returns cause a smaller upward or even a downward revision of the conditional volatility. In this research, we extend the CAPM model and multiple factors model with a GARCH-M model to study asymmetric volatility of momentum returns in REITs. Therefore, the fourth model is used for estimating CAPM with a GARCH-M model is as Equation (4). Volatility of portfolio returns is measured by conditional variance h_t, which is defined as a function of squared values of the past residuals, presenting the ARCH factor, and an auto regressive term (h_{t-1}) presenting the GARCH factor. The parameters, such as $\beta_i s$, γ_h , $\alpha_i s$, are estimated via regression. Next, we apply GARCH-M model to the model 5 as Equation (7). The last model (Model

6) is GARCH-M model to CAPM with Multiple factors model in model 6 as Equation (8).

$$(R_{i,t} - R_{f,t}) = \beta_0 + \beta_m(R_{m,t} - R_{f,t}) + \gamma_h\sqrt{h}_t + \varepsilon_t \tag{7}$$

$$(R_{i,t} - R_{f,t}) = \beta_0 + \beta_{S\&P}R_{S\&P,t} + \beta_{RUSL}R_{RUSL,t} + \beta_{CAP}R_{CAP,t} + \beta_{CSP}R_{CSP,t} + \beta_{BCLB}R_{BCLB,t} + \gamma_h\sqrt{h}_t + \varepsilon_t \tag{8}$$

$$(R_{i,t} - R_{f,t}) = \beta_0 + \beta_m(R_{m,t} - R_{f,t}) + \beta_{S\&P}R_{S\&P,t} + \beta_{RUSL}R_{RUSL,t} + \beta_{CAP}\ R_{CAP,t} + \beta_{CSP}R_{CSP,t} + \beta_{BCLB}R_{BCLB,t} + \gamma_h\sqrt{h}_t \tag{9}$$

$$h_t = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \tag{10}$$

$$\varepsilon_t|\Omega_t \sim iid.N(0, h_t) \tag{11}$$

These models described above are to test whether γ_h equals to zero. If γ_h equals to zero, there is no relationship between volatility and return. The γ_h is interpreted as the coefficient of relative risk aversion of investors. These authors point out that γ_h is a time-varying risk premium, and the sign and magnitude of γ_h depend on utility functions of investors. As a result, γ_h can be positive, negative or zero. A positive γ_h indicates a higher risk premium required by investors when volatility is high, while a negative γ_h means a lower risk premium required by investors when volatility is high. However, there are no consensus about the signs of γ_h because of the different relation between volatility and expected return (Campbell and Hentschel, 1992; Nelson, 1990; and Glosten *et al*., 1993). Three null hypotheses are tested in this paper. First, NAREIT index return and portfolio return display an asymmetric volatility. In other words, the higher the volatility, the higher the momentum returns. Second, winner and loser portfolios exhibit different magnitudes of risk premium (measured by the γ_h coefficient) corresponding to volatility (measured by h_t). If rational risk-return theory is held, we should find positive γ_h for both winner and loser, and the winner should have a higher γ_h than losers. On the other hand, it contradicts risk-return tradeoff theory, if γ_h is negative. Third, winner and loser portfolios display different sensitivity and strategy to the broad market signals. We, therefore, apply these cross-sectional and time-series models to returns of NAREIT index, winner and loser portfolios.

4. DESCRIPTIVE DATA ANALYSIS

4.1 Unconditional means and correlations of REITs and market indices

Table 1 gives the summary of the means and standard deviations of monthly excess return on the NAREIT index, Russell2000 index, S&P500 index, Barclay capital long-term Government/Corporate bond index, CRSP cap-based portfolio index, and S&P/Case-Shiller home price index over the period 1989-2010. It shows that the NAREIT index outperformed the other indices based on average return over the entire sample period in the two past decades. The REITs displays the characteristic of negative skewness as reported by Bond and Patel (2002). Additionally, the return of REITs holds the high volatility as well as Russell2000 index over the entire period, but the REITs index had a lower monthly standard deviation of these assets over the entire sample period as well as most sub-periods. The historical performance of the NAREIT index based on Sharpe ratio does not hold the highest position as research of Vinod (1999). Furthermore, the statistics also suggest the winner portfolio has a monthly average excess return of 1.63 with a higher Sharpe ratio 0.23, whereas the loser portfolio has a monthly excess return of 0.27 with the lowest Sharpe ratio equal to 0.03. Interestingly, neither winner portfolio nor loser portfolio display the negative skewness. The result suggests that momentum return might generate mostly from a long position in winner portfolio.

Table 1: Descriptive statistics of monthly excess returns

Statistics	NAREIT	Winner	Loser	RM	S&P	RUSL	CAP	CSP	BCLB
Mean	0.43	1.63	0.27	0.56	0.11	0.48	0.56	-0.05	0.28
Min	-30.31	-23.55	-43.26	-18.54	-4.76	-20.98	-17.07	-2.31	-3.43
Max	27.96	56.38	47.12	11.04	4.79	15.99	10.81	1.80	3.64
Std.Dev	5.30	7.01	10.10	4.49	0.90	5.61	4.45	0.84	1.11
Kurtosis	8.21	14.21	4.92	1.37	5.85	1.01	1.09	-0.03	0.44
Skewness	-0.84	1.59	0.15	-0.74	0.21	-0.57	-0.68	-0.31	-0.25
S.R.	0.08	0.23	0.03	0.12	0.12	0.09	0.13	-0.06	0.25
Beta	0.196	1.058	0.304	1.00	-0.05	1.10	0.99	0.01	0.03

Note: All mean excess return and standard deviation of excess returns are in percentage per month.

Prior to estimation, it is important to check the potential for multicollinearity among the returns of REITs, stock, bond and real estate. Table 2 displays the realized correlations of monthly excess return on the NAREIT index with the excess returns on the other financial assets and real estate assets over the entire sample period. NAREIT index shows the highest correlation with Russell2000 at 0.65. Interestingly, the NAREIT index has negative correlations with S&P500 as low as -0.25, and has a relative low correlation with the S&P/Case-Shiller home price index. The value of property is driven by the general economic conditions and correlated to the positive expected return and solid long-term performance. The lower correlations of REITs to the broader market, the alternative investment tool as REITs offered an increase hedge benefit to both institutional and small investors.

Table 2: Unconditional Correlations of monthly excess returns

	NAREIT	Winner	Loser	RM	S&P	RUSL	CAP	CSP
RM	0.58	0.56	0.57					
S&P	-0.25	-0.41	-0.26	-0.24				
RUSL	0.65	0.69	0.62	0.88	-0.54			
CAP	0.56	0.56	0.56	1.00	-0.22	0.88		
CSP	0.15	0.09	0.03	0.06	-0.05	0.07	0.06	
BCLB	0.18	0.01	0.06	0.13	0.07	0.04	0.13	-0.02

4.2 Conditional means and correlations in REITs

Let r_t denote the return on the NAREIT index in month *t* and r_{t-1} denote the return on the index in month *t-1*. Each month t is classified by whether the return in the previous month, r_{t-1}, was positive or negative. This gives rise to two sets of returns. The first set consists of the returns on the index in months following a positive return on other the indices, and the second set consists of returns on the index in months following a negative return on other indices. The summary statistics of these two sets of returns for the NAREIT index and financial assets are presented in Table 3. The standard deviation of the return on the NAREIT following down is higher than that following up months. The same pattern is also seen for the Russell2000 index, Barclay Capital long-term Government/Corporate bond index, and CRSP Cap-based portfolio index. In addition to variance, the covariance matrix is applied to test whether the correlation matrix from months following up move in the NAREIT is similar to the correlation matrix from months following down move. Table 3 presents that there is no constant correlation over the period under the vary condition. For example, the correlation of NAREIT with the S&P500 in following down move months are lower than that the correlations following up move months in overall period as well as in the sub-periods. In addition, the NAREIT shows positive correlations with Russell2000, CRSP Cap-based portfolio and Case-Shiller Home Price index, and a negative correlation with S&P500 in these indices following up and down moves, respectively. These results in mean returns, variances, and covariance in the NAREIT with other financial and tangible assets show the evidence of the momentum effect and time-varying of correlations for the implication of a predictable manner. While a statistically significant link between REITs and small-cap stock returns is observed, there is a cyclical component to this relationship, as REITs returns appear to be much more sensitive to small-cap stock returns when the REITs market is in a downturn, and less sensitive in REITs bull markets.

Table 3: Mean, Stand. Dev. and conditional of correlations of REITs returns following up moves and down moves in Indices

Index	Return Type	Statistic	Number of Months	NAREIT	Winner	Loser
S&P	Following Up Move	$\mu\ (\sigma)$	165	1.38 (4.56)	2.54 (7.11)	3.10 (11.09)
		$\hat{\rho}$		0.21	0.24	0.29
	Following Down Move	$\mu\ (\sigma)$	99	0.09 (6.24)	0.75 (6.74)	-1.22 (10.67)
		$\hat{\rho}$		0.28	0.10	0.26
RUSL	Following Up Move	$\mu\ (\sigma)$	166	1.28 (4.73)	2.72 (7.25)	3.29 (11.13)
		$\hat{\rho}$		0.18	0.11	0.26
	Following Down Move	$\mu\ (\sigma)$	98	0.20 (6.08)	0.44 (6.40)	-1.55 (10.49)
		$\hat{\rho}$		0.15	0.07	0.16
CAP	Following Up Move	$\mu\ (\sigma)$	168	1.47 (4.57)	2.72 (7.07)	3.37 (10.99)
		$\hat{\rho}$		0.18	0.23	0.28
	Following Down Move	$\mu\ (\sigma)$	96	-0.1 (6.24)	0.37 (6.70)	-1.83 (10.61)
		$\hat{\rho}$		0.23	0.05	0.23
CSP	Following Up Move	$\mu\ (\sigma)$	185	1.09 (3.97)	2.25 (7.16)	1.40 (9.16)
		$\hat{\rho}$		0.05	-0.12	-0.04
	Following Down Move	$\mu\ (\sigma)$	79	0.45 (7.52)	0.98 (6.62)	1.65 (14.78)
		$\hat{\rho}$		0.28	0.29	0.10
BCLB	Following Up Move	$\mu\ (\sigma)$	187	1.47 (4.81)	2.05 (7.23)	2.02 (11.13)
		$\hat{\rho}$		0.06	0.15	0.12
	Following Down Move	$\mu\ (\sigma)$	77	-0.50 (6.13)	1.45 (6.53)	0.08 (11.09)
		$\hat{\rho}$		0.25	0.12	0.22

Note: μ denotes the mean; σ in the parenthesis denotes standard deviation; $\hat{\rho}$ denotes the conditional correlation of REITs following up or down move in indices.

4.3 Estimator of Dynamic conditional correlation in REITs portfolio

In term of considering further details of conditional correlation, we estimate the dynamic conditional correlations REITs portfolios with broad market indices relying on approach of previous studies. To visualize the computed DCC, we have graphed them in Figure 1. Figure 1 provides individual DCC plots for pair-wise of market indices with either winner or loser portfolios over the period 1989-2010. In visual result, the winner and loser portfolios exhibit different volatility and dynamic character. To check the possible differences, we employ F-test for DCC results for all sections. As a represented by the significance of *p*-value, the tests demonstrate the winner and loser portfolios display different strategies in response to change of the market signals.

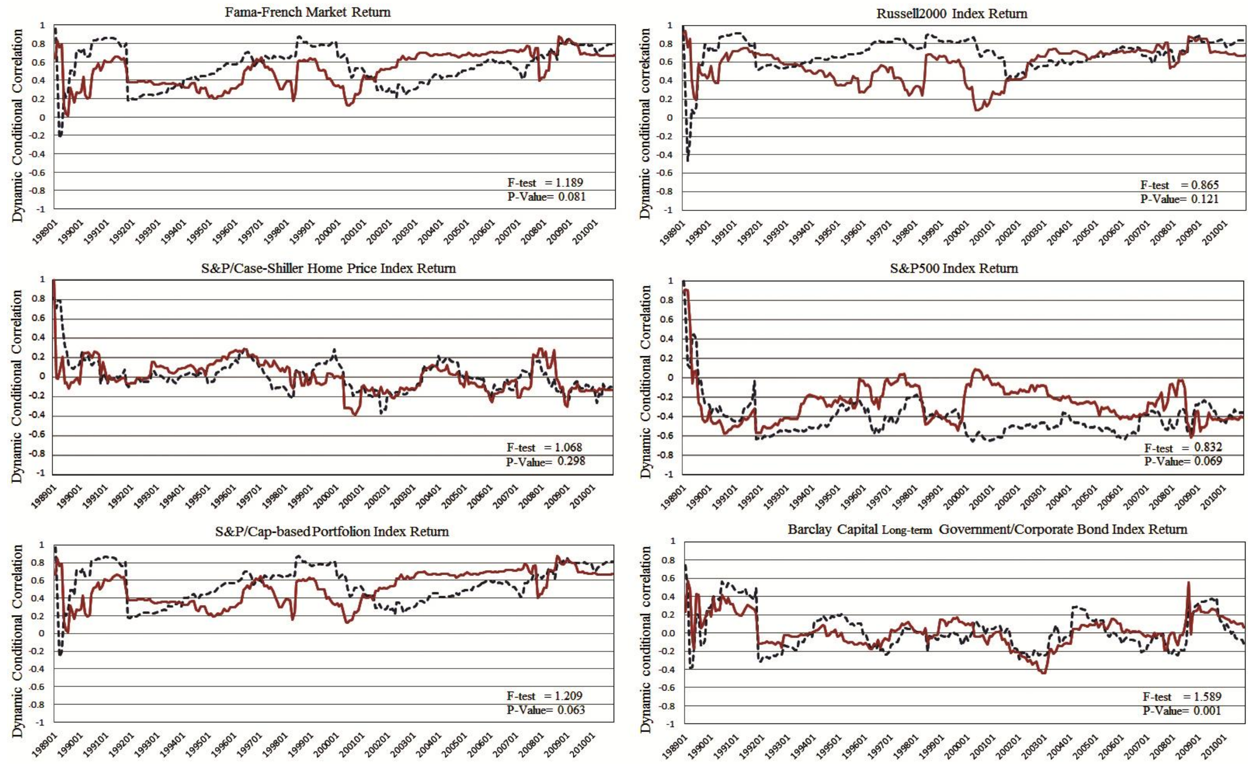

Figure 1: Dynamic Conditional Correlation of Winner and Loser Portfolios

Figure 1 displays the dynamic conditional correlations between the monthly excess returns on the winner portfolio (Blue dash line) and loser portfolio (Red solid line) portfolios with the market index returns, including the index returns of Fama-French market return, Russell200 index, S&P/Case-Shiller home price index, S&P500 index, Cap-based Portfolio index, Barclay Capital long-term Government/Corporatebond index, for the sample in period 1989-2010.

5. EMPIRICALLY REGRESSION OF REITS PERFORMANCE

5.1 Cross-sectional analysis

In this section, we are interested in exam the sensitivities of REITs to returns on four broad asset classes, such as large-cap stock, small-cap stock, bond and real estate over 1989-2010 period by three reduced form models. First, the coefficients for the interception are all positive for each period. Model 1 shows the cross sectional results in NAREIT and REITs portfolios (Table 4). As a result, it shows that both NAREIT and portfolios have a positive and significant response to the excess return of FAMA-FRENCH market return. For the winner portfolio holds the higher the coefficient for the intercept 1.058 (*p*-value=0.004), and excess return is 0.878 (*p*-value=0.000). The values of LM test for model 1 indicates the existence of feature of heteroskedasticity. In addition, Wald test shows the difference of sensitive of NAREIT index and REITs portfolios respect to the market excess return. Model 2 shows returns of NAREIT index and REITs portfolios in response to the financial index return and physical real estate index. All REITs are strongly sensitive to the S&P500 index, Russell2000 index, and CRSP cap-based portfolio index return. Additional Wald test indicates winner portfolio, and loser portfolio are not share the same pattern to the change of the S&P500 index, Russell2000 index, and CRSP cap-based portfolio index return. Further multi-factor regression is taken by model 3, which adding of excess market return to model 2, enhances the explanatory of mode by R^2. The same as last two models, the effect heteroskedasticity still exists. It is consistent with Khoo *et al*. (1993) and Clayton and Mackinnon (2001), who find that equity REITs beta undergoes a structural change in historical data, with decreasing of REITs beta (with respect to the overall equity market). In sum, the results of cross sectional models show that the REITs portfolios might have different patterns in response to the financial market index and real estate index. On the other hand, the conditional heteroskedasticity of OLS model need to be adjusted by the proper estimation of volatility.

Table 4: Linear Regression of REIT returns in cross sectional analysis

	Model 1			Model 2			Model 3		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	0.196	1.058***	0.364	0.421	1.115[a]	1.519**	1.654***	1.385***	3.868***
	(0.466)	(0.004)	(0.523)	(0.131)	(0.006)	(0.024)	(0.000)	(0.007)	(0.000)
RMRF	0.680***	0.878***	1.419***				3.846***	0.842	7.326***
	(0.000)	(0.000)	(0.000)				(0.000)	(0.394)	(0.000)
S&P				3.730***	0.857	5.449***	3.786***	0.869	5.555***
				(0.000)	(0.189)	(0.000)	(0.000)	(0.183)	(0.000)
RUSL				1.491***	1.294***	2.297***	1.377***	1.269***	2.079***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAP				-4.603***	-1.383	-6.385***	-8.394***	-2.212	-13.605***
				(0.000)	(0.081)	(0.000)	(0.000)	(0.079)	(0.000)
CSP				0.350	0.158	-1.020	0.245	0.135	-1.220*
				(0.193)	(0.683)	(0.113)	(0.333)	(0.728)	(0.050)
BCLB				0.693***	0.006	0.057	0.710***	0.010	0.091
				(0.001)	(0.982)	(0.904)	(0.000)	(0.971)	(0.843)
R-square	0.33	0.31	0.33	0.57	0.49	0.44	0.62	0.49	0.48
AIC	1525.5	1682.23	1920.69	1418.31	1610.68	1879.78	1385.84	1611.93	1860.54
LM	17.098	10.601	24.058	26.141	191.219	56.212	36.224	194.755	71.632

Note: The dependent variables are the excess return of NAREIT index in column (1), winner portfolio in column (2), and loser column in column (3). *** , ** and * indicate the significant at 99.9% confidence level, significant at 99% confidence level, significant at 95% confidence level, respectively.

5.2 Time-Series Analysis of REIT performance

The modeling of financial time-series has been enriched by the class of ARCH processes, which were introduced by Engle *et al*. (1987). But with more processes to choose from, like stochastic volatility models or heavy tail distributions, model choice has become a more complicated problem. Some of the more popular variants of models of changing volatility have proved to be various forms of GARCH models. In these models, the volatility process is time varying, and is modeled to be dependent upon both the past volatility and past innovations. These models have been widely used in many applications of stock return data, interest rate data, foreign exchange data and so forth. Taken the advantage of GARCH model for volatility estimation, we introduced GARCH-M model with maximum likelihood for multivariate time-series in this paper.

Empirical results of the momentum effect of REITs performance are test based on the models 4-6 by means of GARCH-M in Equations (4) to (10). The results of GARCH-M estimation show in the Table 5. One first interesting finding is that the α_0 in all three models are positive for NAREIT index, winner and loser, respectively. Though the α_0 in for NAREIT index is insignificant in models, the α_0 of winner and loser portfolios are statistically significant, and obviously greater than the NAREIT index.. In the model 5, the α_0 of winner portfolio is 13.36 and the α_0 of loser portfolio is 26.51. In addition, the α_0 of winner portfolio is 13.91 and the α_0 of loser portfolio is 24.32 in the model 6. The second finding of my research is that the return of NAREIT index shows that the α_1 is lower than the α_2, but the winner portfolio and loser portfolio have higher α_1.Note that the magnitude of the α_1, which shows the effect of the last period's shock, is greater than that of α_2, the effect of previous shocks. The results imply both winner and loser are more sensitive to new short-term shock than the long-term ones. This finding is consistent with momentum trading strategy, of which investment decision is more likely to depend on short-term past returns, rather than long-term past returns to forecast future returns. Next, we estimate the γ_h coefficient for the winner and loser portfolios, respectively. We find the γ_h has a positive sign for the winner portfolio, but in negative sign for loser portfolio. In models 5 and 6, the γ_h of loser are -0.10 and -0.18, respectively. A negative γ_h of losers suggests that higher conditional volatility reduces return risk premium required by investors. Glosten *et al.* (1993) provided two explanations why the relation between volatility and expected return is negative. First, time periods which are relatively more risky could coincide with time periods when investors are better able to bear particular type of risk. Second, a larger risk premium may not be required because investors may want to save relatively more during periods when the future is more risky.

Table 5: Test asymmetric volatility in time series analysis

	Model 4			**Model 5**			**Model 6**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Intercept	-0.483	1.365***	1.693**	-0.369	0.791	1.331	3.265**	0.773	2.955***
	(0.653)	(0.000)	(0.008)	(0.723)	(0.456)	(0.287)	(0.006)	(0.504)	(0.007)
RMRF	0.576***	0.876***	1.206***				3.879***	0.937	3.633***
	(0.000)	(0.000)	(0.000)				(0.000)	(0.294)	(0.000)
S&P				2.801***	1.700***	3.744***	2.941***	1.388*	3.536***
				(0.000)	(0.004)	(0.000)	(0.000)	(0.015)	(0.000)
RUSL				1.243***	1.444***	1.411***	1.115***	1.346***	1.208***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAP				-3.568***	-2.554***	-3.950***	-7.426***	-3.075***	-7.158***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)
CSP				0.206	0.735***	0.019	-0.163	0.705**	-0.191
				(0.328)	(0.001)	(0.683)	(0.509)	(0.008)	(0.604)
BCLB				0.609***	-0.113	0.019	0.582***	-0.138	0.078
				(0.000)	(0.567)	(0.949)	(0.000)	(0.520)	(0.788)
α_0	2.242	33.536***	22.826***	1.045	13.358***	26.512***	1.530	13.912***	24.321***
	(0.058)	(0.000)	(0.000)	(0.108)	(0.000)	(0.000)	(0.058)	(0.000)	(0.000)
ε^2_{t-1}	0.169[c]	0.000	0.883[a]	0.117**	0.812***	0.592***	0.135**	0.738***	0.639***
	(0.016)	(1.000)	(0.000)	(0.014)	(0.000)	(0.000)	(0.020)	(0.000)	(0.000)
h_{t-1}	0.698***	0.000	0.000	0.794***	0.000	0.000	0.715***	0.000	0.000
	(0.000)	(1.000)	(1.000)	(0.000)	(1.000)	(1.000)	(0.000)	(1.000)	(1.000)
$\sqrt{h_t}$	0.172	0.000	-0.255*	0.227	0.094	-0.099	-0.486	0.142	-0.178
	(0.547)	(1.000)	(0.005)	(0.480)	(0.694)	(0.624)	(0.178)	(0.583)	(0.279)
R-square	0.32	0.32	0.30	0.55	0.47	0.45	0.61	0.47	0.46
LL	-733.05	-838.26	-886.79	-685.73	-787.81	-872.48	-671.56	-787.82	-866.33
AIC	1478.10	1684.53	783.59	1391.46	1595.63	1762.96	1365.12	1595.63	1752.67

Note: The dependent variables are the excess return of NAREIT index in column (1), winner portfolio in column (2), and loser portfolio in column (3). *** , ** and * indicate the significant at 99.9% confidence level, significant at 99% confidence level, significant at 95% confidence level, respectively.

Table 6: Wald test of OLS and GARCH-M models

Panel A: Cross sectional Analysis by Wald test												
	Model 1	**Model 2**					**Model 3**					
	RMRF	**S&P**	**RUSL**	**CAP**	**CSP**	**BCLB**	**RMRF**	**S&P**	**RUSL**	**CAP**	**CSP**	**BCLB**
$Wald_1$	29.980***	19.723***	8.649**	16.079***	4.200	5.056	13.641***	20.903***	6.350*	29.943***	5.146	5.387
	(0.000)	(0.000)	(0.034)	(0.001)	(0.241)	(0.168)	(0.003)	(0.000)	(0.096)	(0.000)	(0.161)	(0.146)
$Wald_2$	23.938***	18.395***	8.647**	14.750***	3.885	3.580	13.369***	19.789***	6.349**	27.726***	4.867*	3.891
	(0.000)	(0.000)	(0.013)	(0.000)	(0.143)	(0.167)	(0.001)	(0.000)	(0.042)	(0.000)	(0.088)	(0.143)
Panel B: Time series Analysis by Wald test												
	Model 4	**Model 5**					**Model 6**					
	RMRF	**S&P**	**RUSL**	**CAP**	**CSP**	**BCLB**	**RMRF**	**S&P**	**RUSL**	**CAP**	**CSP**	**BCLB**
$Wald_1$	4.480	153.000***	163.130***	81.270***	3.920	16.040***	6.680*	198.540***	175.320***	97.340***	3.560	0.050
	(0.214)	(0.000)	(0.000)	(0.000)	(0.270)	(0.001)	(0.082)	(0.000)	(0.000)	(0.000	(0.313)	(0.998)
$Wald_2$	4.000	130.200***	137.530***	77.060***	2.410	15.430***	1.140	186.370***	171.570***	98.730***	0.650	0.040
	(0.136)	(0.000)	(0.000)	(0.000)	(0.299)	(0.000)	(0.565)	(0.000)	(0.000)	(0.000)	(0.732)	(0.979)

Note: $Wald_1$ tests the null hypothesis that the NAREIT, winner and loser portfolio share the same strategy and sensitivity to the broad market signals as: H_0: $\beta_i^{NAREIT,j} = \beta_i^{Winner,j} = \beta_i^{Loser,j}$;$Wald_2$ tests the null hypothesis that the winner and the loser portfolios share the same strategy and sensitivity to the broad market signals as H_0: $\beta_i^{Winner} = \beta_i^{Loser}$. *** , ** and * indicate the significant at 99.9% confidence level, significant at 99% confidence level, significant at 95% confidence level, respectively.

6. CONCLUSION

Our research and finding contribute to the existing literature by analysis the strategy of REITs in changes of the financial and physical real estate market movement. Then extended monthly data over 1989-2010 increase the reliability of explanation of relationships among Fama-French market portfolio, S&P500 index, Russell2000 index, CRSP Cap-based Portfolio index, S&P/Case-Shiller home price index as well as Barclay Capital long-term Government/Corporate bond index. Second, the conditional correlations and dynamic conditional correlations are examined to find the different magnitude of REITs sensitive to the change in NAREIT index, and REITs portfolios. These results support the time-varying characteristics of the REITs returns. Third, we have provided a simple method to assist us in understanding and measuring the time-varying feature of REITs market. The multi-factor return generating approaches are used to empirically investigate the cross-sectional sensitivity of REITs index and portfolios to large- and small-cap stock returns, bond returns and returns to unsecuritized real estate. The results show that REITs returns display the greatest sensitivity to both large- and small-cap stocks. However, there is no role for unsecuritized real estate in explaining REITs returns. We also found the GARCH-M model provide the better description of dynamic returns of NAREIT index, winner and loser portfolios. The Wald test results in Table 6 also suggest that winner and loser portfolios exhibit the different pattern of sensitivity to the market factors. The results of regressions indicate that REITs return exhibit the greater sensitivity to large- and small-cap stock index, and less closely with those of bond and real estate index. The results also suggest that REITs not be viewed as a complete substitute for investment in tangible property of real estate.

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