International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 10 (2015) pp. 27181-27189

http://www.ripublication.com

The Predictability of Korean Equity REITs Returns

Cha-Soon Choi

Department of Taxation and Real Estate Studies, Namseoul University
331707, 21 Maeju-ri, Seonghwan-eup, Seobuk-gu, Cheonan-city,
Choongnam, KOREA.,
E-mail: chasoon59@ nsu.ac.kr

Abstract

In this study, the predictability of the returns on equity REITs in Korea was analyzed with the VAR model using macroeconomic time-series data, and has verified how important the market basic value is. The results suggested that returns on equity REITs were significantly affected by macroeconomic variables such as default spreads and exchange rates. It could be confirmed that Korean REITs returns are more influenced by default spreads and exchange rates. Thus, monitoring changes in these indicators could be utilized when determining an optimal investment strategy.

Keywords: REITs, Predictability, VAR model, Impulse response function

1 Introduction

The era of indirect investment in real estate began in Korea when the real estate investment trust (REIT) system was adopted in July 2001. REITs were implemented in South Korea with the aims to facilitate corporate restructuring after the 1997 Asian Financial Crisis, to offer small investors more opportunities to invest in real estate and to create a more advanced and transparent real estate market in the country [1]. By 2014, around 98 REITs- 31 corporate restructuring REITs (CR-REITs), 56 manager-entrusted REITs (M-REITs), and 11 self-managed REITs (S-REITs) were in operation, amassing property worth KRW15 trillion. As a result, interest in the predictability of REIT returns has grown, especially with regards to portfolio management. However, a quantitative prediction system has not yet been fully established because little research on the predictability of REIT returns has been conducted in Korea. This limits rational decision-making in REIT investment and hampers the development of the REIT market. This paper thus aims to enable the accurate prediction of REIT returns by building a short-term prediction model for the REIT market in Korea.

2 Literature Review

The authors of [2] predicted stock market returns using an autoregression (AR) model with K-period overlapping returns as the predictor variable. The authors of [3] adopted an arbitrage pricing model (APM) to verify the authors of "The Predictability of Returns on equity REITs and their co-movement with other assets" [4] research, which found that the predictability of excess returns on equity REITs was higher than that of common stock returns, and found similar results. The authors of [5] identified a significantly negative relationship between exchange rates and stock returns after analyzing the effect of exchange rates on stock returns using OLS. The authors of [6] concluded that the predictability of small REITs was higher than that of mid-sized and large REITs after analyzing returns on equity REITs. The authors of [7] demonstrated the predictability of stock returns using the vector autoregression (VAR) model with dividend yield ratio as an instrument variable. The authors of [8] suggested the possibility for making a trade strategy by modeling the time variation of risk premiums.

3 Methodology and Data

3.1 Methodology

The authors of [9] first introduced the multivariate time-series VAR model. This model suggested a method to predict stochastic processes with a nonlinear regression equation, using correlation and time-correlation between variables while excluding priori-economic theory. In it, the dependent variable is the current measured value of variables with a cause-and-effect relationship, and the independent variable is the past measured value of the dependent variable itself and other variables.

The VAR model can be expressed as follows:

$$Y_t = A(L)Y_{t-1} + \mu_t = \sum_{j=1}^{k} A_j Y_{t-j} + \mu_t$$

In it, $Y_t : n \times 1$ *vector*,

μ_t : a vector of innovations

$$A(L) = \sum_{j=1}^{k} A_j L^{j-1}$$

: k-matrics (n×n) multinomial expression by lag operator

VAR model prediction should occur after unit root tests and cointegration tests. VAR model estimation is based on stationary time series. Therefore, it is important to check whether a series is stationary or not before using it in a regression. It is well known that many economic time-series are different when stationary, In general, a regression involving the levels of these I(1) series will produce misleading results, with conventional Wald tests for coefficient significance spuriously showing a significant relationship between unrelated series [10]. A unit root test should be conducted first in order to determine whether the data are stationary. The authors of [11] note that a linear combination of two or more I(1) series may be stationary, or I(0), in which case we say the series are cointegrated. Cointegration test is to check whether two or more non-stationary series exist in a linear combination or not. If such a stationary linear combination exists, we can adopt a restricted VAR(vector error correction ;VEC) model with level variables instead of different stationary variables. To select an optimal model, a likelihood ratio test, the Akaike information criterion (AIC) and the Schwarz information criterion were used to test the goodness-of-fit of the estimated model. The advantage of the VAR model is that it allows predictions to be made based on the time-difference relationships between the variables of the model. As a result, with the inclusion of impulse response functions and variance decomposition, the model has been generally adopted to predict dynamic relationships between variables and their relative importance.

3.2 Data

For the variables and the predictability test which is needed to set up the VAR model, this study used monthly data for the returns on REITs (DKRE), rate of return on common stocks (DFAA), change in exchange rates (DERG), change in term spread (DOES), change in default spread (DOET), change in the value of private construction orders received (DCHA), change in inflation rate (DFAB), and change in dividend yield (DGAA). Returns on REITs, which are not officially published in Korea, were calculated using the stock price index based on the market capitalization of the monthly final price of each REITs listed and traded in the Korea Stock Exchange (KSE). The rate of return on common stocks and dividend yield came from data released by the KSE. The term spread was calculated from the differences in the daily call rates of 5-year national bond returns, while the default spread was calculated from the differences between a 5-year national bond and 3-year corporate bond returns. Interest rate and exchange rate data were from the Bank of Korea, which also provided data for the consumer price index, from which the inflation rate was derived. The change rate of the value of private construction orders received was calculated by the data of the value of private construction orders received sector.

4 Results and Discussion

4.1 VECM Prediction Result

VAR model estimation is based on stationary time series. Given that most economic time series variables are known to be nonstationary, a unit root test should be conducted first to determine whether the data are stationary. There are several unit root test methods, such as ADF test and the Phillips-Perron(PP) test. ADF test was used in this study. As can be seen in Table 1, all data were stationary at 1% significance level.

Table 1 ADF Unit Root Test Results

	T-statistics		Critical Value		
	lag=0	lag=1	1%	5%	10%
DKRE	-10.4084***	-8.7719***	-3.4734	-2.8803	-2.57687
DOET	-6.4242***	-6.3160***	-3.4734	-2.8803	-2.5769
DERG	-8.2367***	-8.7174***	-3.4734	-2.8803	-2.5769
DFAA	-8.8977***	-8.2898***	-3.4734	-2.8803	-2.5769
DOES	-10.0845***	-8.2188***	-3.4734	-2.8803	-2.5769
DCHA	-9.7184***	-7.0530***	-3.4731	-2.8802	-2.5768
DFAB	-8.9398***	-10.3098***	-3.4734	-2.8803	-2.5769
DGAA	-12.0461***	-8.2053***	-3.4734	-2.8803	-2.5769

*Note : *** denote rejection of null hypothesis at the 1% levels respectively*

For the variables selected to be used in the VAR model, a Granger causality test indicated that REITs returns (DKRE) interacted with the default spread (DOET), the change in exchange rates (DERG) and the rate of return on common stocks (DFAA) [12]. The VAR model was constructed based on monthly data from January 2002 to November 2014. The order for setting up the VAR model was identified based on the Akaike information criteria (AIC) and the Schwarz information criteria (SIC) [13]. However, If a linear combination of two or more I(1) series may be stationary, or I(0), in which case we say the series are cointegrated. A cointegration test to determine a long-run equilibrium relationship among the variables indicated that cointegration seemed to exist (See Table 2).

As can be seen in Table 2, there was cointegration relationship among the four time series, REITs stock prices (KRE), the default spread (OET), exchange rate (ERG), and the composite price index of stocks (FAA). Thus, a vector error correction model was adopted, estimating the predictability of equity REITs returns.

Table 2. Johansen Cointegration Test Results

r	Eigenvalue	Likelihood Ratio	5% Critical Value	1% Critical Value	Hypothesized No. of CEs
0	0.3025	83.7291	53.12	60.16	None**
1	0.1252	27.5212	34.91	41.07	At most 1
2	0.0218	6.6394	19.96	24.60	At most 2

*Note: ** means that the hypothesis was rejected at a 1% level of significance.*

The estimated the vector error correction model (VECM) is presented in Table 3. Because the t-value of the cointegration and differential variables was significant and the F-value was high, the model was judged to fit the data well.

Table 3. VECM Prediction Results

Cointegrating Equations									
Variable	KRE(-1)	OET(-1)		ERG(-1)		FAA(-1)		C	
	1	76.932	(8.298)	0.152	(3.073)	-0.030	(-3.017)	-216.721	
Error Correction :		D(KRE)		D(OET)		D(ERG)		D(FAA)	
CointeEq1		-0.013	(-0.992)	-0.002	(-6.801)	-0.095	(-1.484)	0.167	(1.100)
D(KRE(-1))		0.058	(0.653)	0.003	(1.663)	-0.119	(-0.283)	2.164	(2.171)
D(OET(-1))		6.282	(2.328)	0.527	(8.366)	3.656	(0.289)	31.257	(1.044)
D(ERG(-1))		-0.045	(-2.298)	-0.001	(-3.190)	0.285	(3.083)	0.366	(1.673)
D(FAA(-1))		-0.020	(-2.526)	0.000	(1.943)	-0.051	(-1.349)	0.216	(2.409)
C		0.226	(0.462)	-0.005	(-0.455)	-0.570	(-0.248)	6.470	(1.189)
Adj. R-squared		0.073		0.513		0.137		0.088	
F-statistic		3.412		33.111		5.857		3.939	
Log Likelihood		-488.687		86.008		-724.794		-856.884	

Note: ( ) is the t-value

Meanwhile, the dynamic response, which is a measure of how an external shock influences each variable in the VECM, was analyzed using impulse response functions. The results are shown in Figure 1.

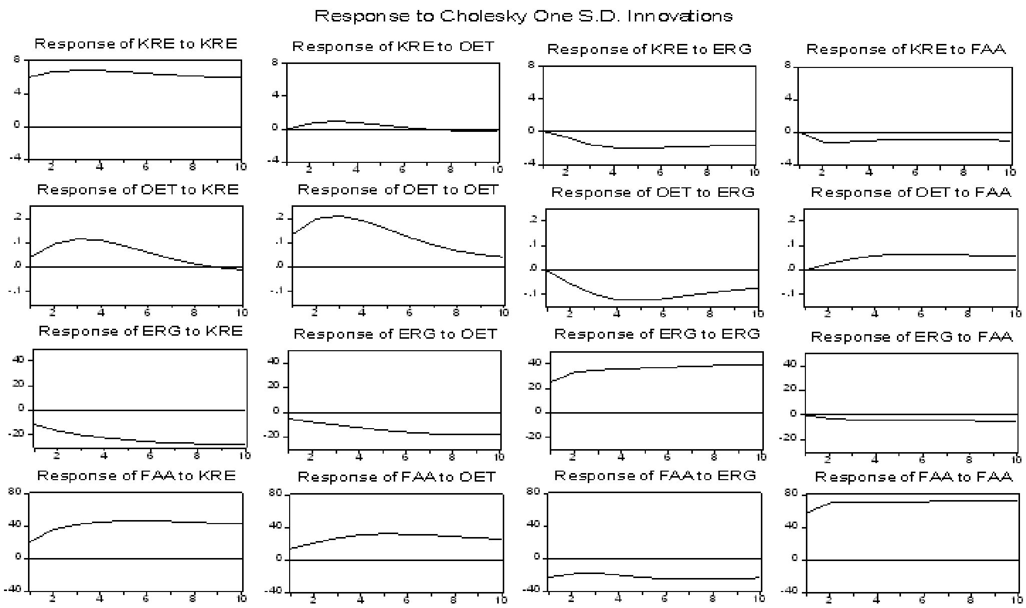

Fig 1. Impulse Response Functions for the VECM

A one standard deviation shock on the rate of return on common stocks produced changes in REITs returns of -1.1560 after two months, -1.165 after three months, and -0.932 from four to ten months after. A one standard deviation shock to exchange rates produced changes in REITs returns of -0.727 after two months and -1.765 from three to ten months after. A one standard deviation shock to default spread produced changes in REITs returns of 0.675 after two months, 0.902 after three months, a positive(+) change from four until six months after, and a negative(-) change after seven months. A one standard deviation shock to REITs returns lead to changes of between 6.0 - 6.5 from one month until ten months after.

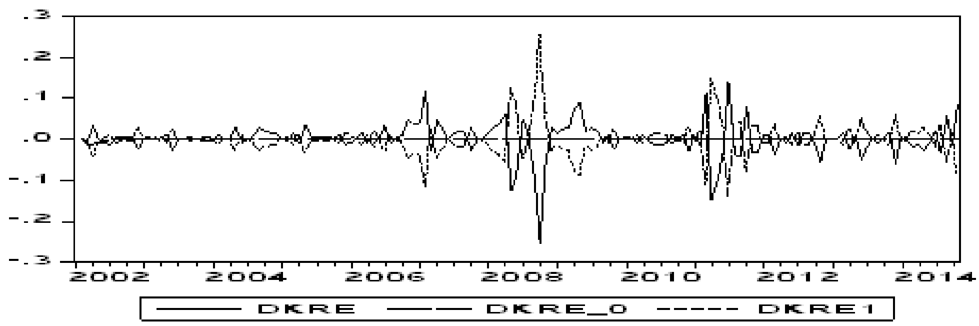

Fig 2. Predicted Results of VECM

Figure 2 displays the results produced when the changes in the past time series of REITs returns were run through the vector error correction model (VECM). DKRE represents REITs returns, DKRE_0 the past time series of REITs returns estimated by the VECM, and DKRE_1 the residual of actual value minus estimated value. When those factors in the figure are considered, the VECM appears to be an excellent fit for the data.

4.2 Prediction of REITs Returns Using the VECM

The actual values of the REITs returns and those predicted by the VECM are shown in Table 4. The margin of error for the actual and predicted values of REITs returns from December 2014 to February 2015 was 3.98%, which indicates strong predictability.

Table 4. Actual Values of REITs Returns and Values Predicted with the VECM

Section		Dec. 2014	Jan. 2015	Feb. 2015	PRMSE
Actual value		-0.0551	-0.0026	0.0255	
VECM	Predicted value	0.0072	0.0149	0.0002	3.9818
	Gap ratio	-1.1306	-6.7307	0.9921	

5 Conclusion

This study aimed to build a short-term return prediction model for the Korean REITs market using a VAR model based on macroeconomic data from January 2002 to November 2014. For the model prediction test, data from December 2014 to February 2015 were then used. The VECM performed well as the REITs return prediction model. It had strong explanation ability, the result of goodness-of-fit test was recognized, and the root mean squared error (PRMSE) was 3.98%. Its constant terms, however, were not statistically significant, which was a shortcoming. The results indicated that the default spread had a positive effect on REITs returns, which agrees with the research conducted by Fama and French (1988) and Chen, Hsieh, Vines and Chiou (1998) [1,14]. The exchange rate negatively influenced REITs returns, in accordance with Dimitrios (1998). The rate of return on common stocks appeared to have a negative effect on REIT returns [4]. This study has made two significant contributions. First, it established the relatively well-performed VECM using macroeconomic variables that predicted REITs returns in the Korean market. Secondly, it was found that REITs returns were heavily influenced by the default spread and exchange rates than the term spread and stock-dividend returns. As a result, the former pair of indexes could be utilized in the development of a sound investment strategy. It should be noted, however, that this study was limited wherein corporate and policy variables were not included. The addition of these is required to ensure an optimal returns model.

References

[1] C.S. Choi, "A Study on the Predictability of REIT Prices Using the VAR Model,"Advanced Science and Technology Letters, 87, (2015), 58-61.

[2] E. Fama and K. French, "Dividend yields and expected stock returns," Journal of Financial Economics, 22, (1988), 3-25.

[3] Y. Li and K. Wang, "The Predictability of REIT Returns and Market Segmentation," The Journal of Real Estate Research, 10, 4, (1995), 471-482.

[4] C. Liu and J. Mei, "The Predictability of Returns on equity REITs and their co-movement with other assets," Journal of Real Estate Finance and Economics, 5, (1992), 401-418.

[5] M. Dimitrios, "International Stock Return Differentials and Real Exchange Rate Change," Journal of International Money & Finance, 17, (1998), 493-511.

[6] N. Edward and G. Joseph, "The Predictability of Equity REIT Returns," The Journal of Real Estate Research, 16, 3, (1998), 251-268.

[7] P. Balduzzi and A.W. Lynch, "Predictability and Transaction Costs: The Impact on Rebalancing Rules and Behavior," Working Paper, (1999)

[8] J. Okunev and P.J. Wilson, "Predictability of Equity REIT Returns: Implications for Property Tactical Asset Allocation," International Real Estate Review, 11, 2, (2008), 32-46.

[9] C.A. Sims, "Macroeconomics and Reality," Econometrica, 48, (1980), 1-48.

[10] P.C.B. Phillips, "Time series regression with a unit root," Econometrica, 55, 2, (1987), 277-301.
[11] R.F. Engle and C.W.J. Granger, "Co-integration and Error Correction, Estimation, and Testing," Econometrica, 55, 2, (1987), 251-276.
[12] Granger Causality Test Results

Null hypothesis	F-statistic						
	lag1	lag2	lag3	lag4	lag6	lag8	lag12
SKRE does not Granger Cause SOET	**3.509****	1.797	**2.650****	**2.158***	1.758	**3.328*****	**3.064*****
SOET does not Granger Cause SKRE	**5.428****	**4.483****	**3.282****	**2.742****	1.792	1.333	**1.576***
SKRE does not Granger Cause SERG	0.346	0.622	0.743	**4.872*****	**5.167*****	**4.015****	**2.656****
SERG does not Granger Cause SKRE	**2.625***	1.715	1.147	1.420	**1.765***	1.122	1.087
SKRE does not Granger Cause SFAA	**3.408****	1.933	1.214	**3.666*****	**2.867*****	**1.998****	**1.931****
SFAA does not Granger Cause SKRE	0.183	0.679	**2.303***	1.524	1.181	1.039	**1.818***
SKRE does not Granger Cause SOES	**3.476***	**2.299***	1.686	1.271	1.137	1.139	0.850
SOES does not Granger Cause SKRE	1.355	1.367	0.946	0.821	0.719	0.956	0.884
SKRE does not Granger Cause SCHA	0.454	0.955	0.734	0.675	0.574	0.695	0.729
SCHA does not Granger Cause SKRE	1.233	0.847	0.983	1.163	1.286	1.009	1.087
SKRE does not Granger Cause SFAB	0.033	0.057	0.237	0.211	0.445	0.349	0.949
SFAB does not Granger Cause SKRE	0.014	0.565	**6.549*****	**5.776****	**4.011****	**3.388****	**2.344***

SKRE does not Granger Cause GAA	2.229	1.093	1.450	1.708	1.809	2.181	1.523
SGAA does not Granger Cause SKRE	0.055	1.298	0.869	0.614	0.509	0.309	0.313

*Note : ***, ** and * denote rejection of null hypothesis at the 1%, 5%, and 10% levels respectively.*

[13] AIC & SIC Test Results

	Lag						
	1	2	3	4	5	6	7
AIC	1.683	1.369	1.539	1.486	1.594	1.722	1.894
SIC	2.079	2.085	2.578	2.850	3.287	3.748	4.254

Note: included constant term in the VAR model

[14] S.J. Chen, C. Hsieh, T.W. Vines and S.N. Chiou, “Macroeconomic Variables, Firm-Specific Variables and Returns to REITs,” Journal of Real Estate Research, 16, 3, (1998), 269-277.