

An Inquiry into the Optimal Portfolio for Equity and Real Estate in Japan

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Abstract

This paper examines the optimal portfolio selection problems for equity and real estate in Japan. Specifically, we empirically analyze the time-varying optimal portfolio weights for the TOPIX and the J-REIT from April 2003 to June 2013 and from July 2013 to October 2023. Our findings reveal that in the more recent period, higher portfolio weights for the J-REIT are more effective in constructing the two-asset portfolio of the TOPIX and the J-REIT. In other words, our results indicate that in the more recent period, lower portfolio weights for the TOPIX are more efficient in building the two-asset portfolio.

Keywords

J-REIT, MGARCH, Optimal Portfolio Weight, TOPIX

1. Introduction

In 2003, the real estate investment trust (REIT) index in Japan, called the Japanese REIT (J-REIT), was created and began to attract investors' attention. We then ask: How should investors allocate their funds to equity and real estate in Japan appropriately?

In the existing literature, there is a lot of research on REITs overseas (e.g., Gholipour et al., 2021; Ryu et al., 2021; Coën and Desfleurs, 2022; Razak, 2023); however, previous studies on REITs in Japan seem to be insufficient. In particular, there is little existing study that focuses on portfolio optimizations, including the J-REIT. Considering this situation, there is great significance in researching the optimal investment problems of equity and the REIT in Japan.

Hence, given and motivated by these backgrounds and the above research question, this paper studies the optimal portfolio selection problems for equity and the REIT in Japan. More specifically, we empirically analyze the time-varying

optimal portfolio weights for the TOPIX and the J-REIT for our first half period from April 2003 to June 2013 and our latter half period from July 2013 to October 2023.

As a result, we find that the optimal portfolio weights for the TOPIX and the J-REIT greatly vary over time. Moreover, we clarify that in the more recent period, higher portfolio weights for the J-REIT are more effective in building the two-asset portfolio of the TOPIX and the J-REIT. Put differently, our results indicate that in the more recent period, lower portfolio weights for the TOPIX are more efficient in constructing the two-asset portfolio.

Regarding the rest of this paper, Section 2 provides a related literature review, and Section 3 describes our data and methods. After that, Section 4 explains our results, and Section 5 concludes this paper.

2. Literature Review

This section conducts a concise review of the existing related studies. More concretely, we below review the previous studies for portfolio optimization problems and REITs. First, as regards the portfolio optimization research, [Jorion \(1992\)](#) considered portfolio selection problems practically, and suggested that international diversification into foreign bonds was beneficial for US investors.

Further, [Okhrin and Schmid \(2006\)](#) theoretically analyzed optimal portfolio weights and pointed out some problems in deriving optimal portfolio weights due to their distributional characteristics. Recently, [Beliavsky et al. \(2023\)](#) applied principal component analysis (PCA) and online learning to the portfolio optimization and suggested the effectiveness of the application of PCA and online learning simultaneously.

Next, the recent existing studies of REITs are as follows. First, for US REITs, [Ryu et al. \(2021\)](#) empirically tested the weak-form efficient market hypothesis. Further, using realized volatility jump models, [Odusami \(2021\)](#) derived and scrutinized the value at risk (VaR) of US REITs. Moreover, [Gholipour et al. \(2021\)](#) empirically examined how US REIT and commercial property index prices respond to economic uncertainties. In addition, [Coën and Desfleurs \(2022\)](#) analyzed the bias and accuracy of forecasts by financial analysts and also investigated the abnormal earnings announcement returns of green and non-green US REITs.

Moreover, [Razak \(2023\)](#) investigated the Japanese real estate markets and found that the volatilities of the hotel and retail sectors were higher than those of other sectors in Japan. [Salami et al. \(2023\)](#) analyzed Turkish REITs, and suggested that during the COVID-19 pandemic, Turkish REITs showed lower returns and higher volatilities. Finally, [Lotz et al. \(2023\)](#) analyzed the US REIT market and found evidence that financial and real estate uncertainty matters for expected REIT returns.

As our above literature review shows, there are limited studies that have analyzed portfolio optimizations focused on the J-REIT. Hence, to make beneficial

contributions to the body of research, we below study the optimal portfolio selection problems for equity and the REIT in Japan.

3. Data and Methods

This section explains our data and methods. This paper uses daily time-series index data for Japanese equity and REIT. Specifically, DLTXR and DLJRR denote the daily log difference percentage returns of the TOPIX and the J-REIT, respectively. We analyze these returns in two sample periods: the first is from April 1, 2003, to June 28, 2013; and the second is from July 2, 2013, to October 13, 2023.

Figure 1 exhibits the time-series price evolution of the TOPIX and **Figure 2** presents that of the J-REIT during our overall period, and both are from March 31, 2003, to October 13, 2023. As seen, at first glance, we understand that the two price evolutions show somewhat similar movements.

Table 1 exhibits the descriptive statistics for DLTXR and DLJRR for our two sample periods. **Table 1** indicates that the mean values of DLTXR and DLJRR are slightly positive in the two periods, and the standard deviations of the two series are similar. Moreover, **Table 1** also shows that in the two periods, the skewness values of DLTXR and DLJRR are both negative and the excess kurtosis values of the two series are both positive.

We next document the methods of our analysis. Using the two return series of DLTXR and DLJRR, we first estimate a VAR(1)-bivariate GARCH model. After that, using the time-varying variance and covariance series from the model and applying the method of [Kroner and Ng \(1998\)](#), we derive and inspect the time-varying optimal portfolio weights for the TOPIX and the J-REIT for our two periods.



Figure 1. Price evolution of the TOPIX: March 2003 to October 2023. TOPIX price series are daily and displayed in points.



Figure 2. Price evolution of the J-REIT: March 2003 to October 2023. J-REIT price series are daily and displayed in points.

Table 1. Statistics for daily series of TOPIX and J-REIT returns. (a) April 1, 2003, to June 28, 2013; (b) July 2, 2013, to October 13, 2023.

(a)		
	DLTXR	DLJRR
Mean	0.014	0.013
SD	1.443	1.545
Skewness	-0.452	-0.442
Excess kurtosis	7.532	9.828
(b)		
	DLTXR	DLJRR
Mean	0.028	0.011
SD	1.159	1.143
Skewness	-0.237	-1.552
Excess kurtosis	4.469	62.870

Statistics are for daily log difference percentage returns. DLTXR denotes the return of the TOPIX while DLJRR denotes the return of the J-REIT. SD denotes the standard deviation value. Our full sample period is from April 1, 2003, to October 13, 2023, and we analyze two subsamples. The first half period is from April 1, 2003, to June 28, 2013, and the latter half period is from July 2, 2013, to October 13, 2023.

4. Results

This section explains our results for the portfolios of the TOPIX and the J-REIT. **Figure 3** exhibits the dynamic evolutions of the time-varying optimal portfolio

weights for the TOPIX in the portfolio of the TOPIX and the J-REIT for our first period, April 2003 to June 2013. **Figure 4** shows those for the J-REIT in the two-asset portfolio, also for the first period.

Moreover, **Figure 5** plots the dynamic evolutions of the time-varying optimal portfolio weights of the TOPIX in the two-asset portfolio for our second period, July 2013 to October 2023. **Figure 6** further shows those of the J-REIT in the portfolio, also for the second period. Interestingly, these graphs in **Figures 3-6** indicate that the optimal portfolio weights for the TOPIX and the J-REIT vary over time.

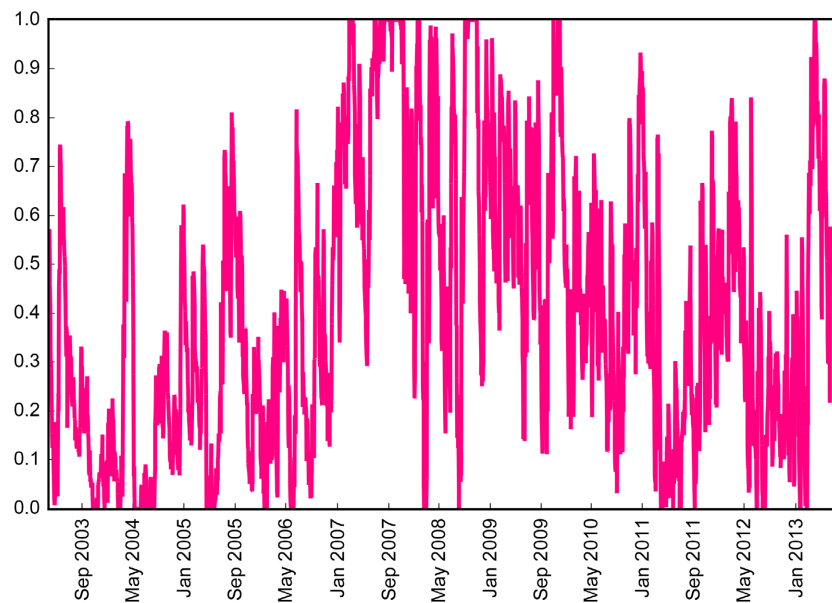


Figure 3. Time-varying optimal weights for the TOPIX: April 2003 to June 2013.

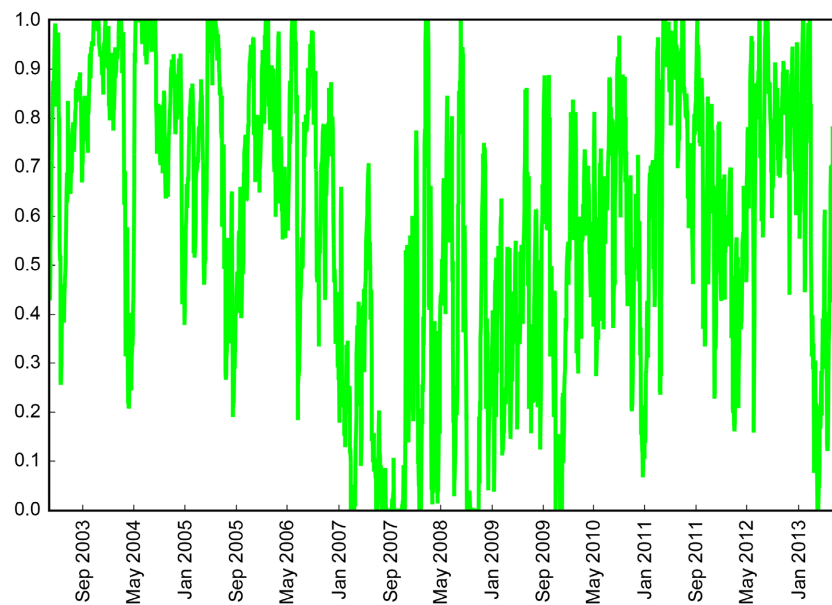


Figure 4. Time-varying optimal weights for the J-REIT: April 2003 to June 2013.

To deepen our understanding further, in **Table 2**, we provide the summary statistics for the time-varying optimal portfolio weights for the TOPIX and the J-REIT. Specifically, those for the first period are shown in Panel (a) and those for the second period are exhibited in Panel (b).

Comparing the mean values in Panels (a) and (b), we understand that in the more recent period, higher portfolio weights for the J-REIT are more effective in constructing the two-asset portfolio. In other words, in the more recent period, lower portfolio weights for the TOPIX are more efficient in building the two-asset portfolio.

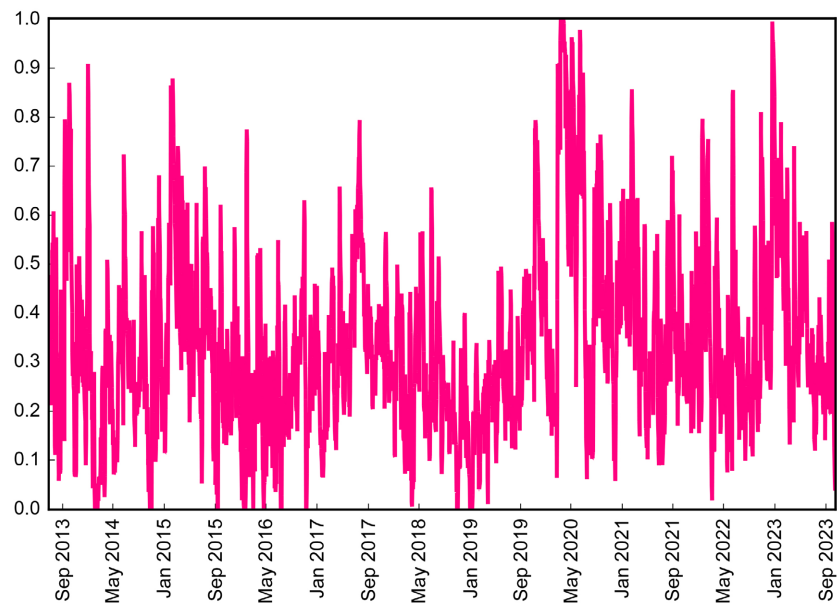


Figure 5. Time-varying optimal weights for the TOPIX: July 2013 to October 2023.

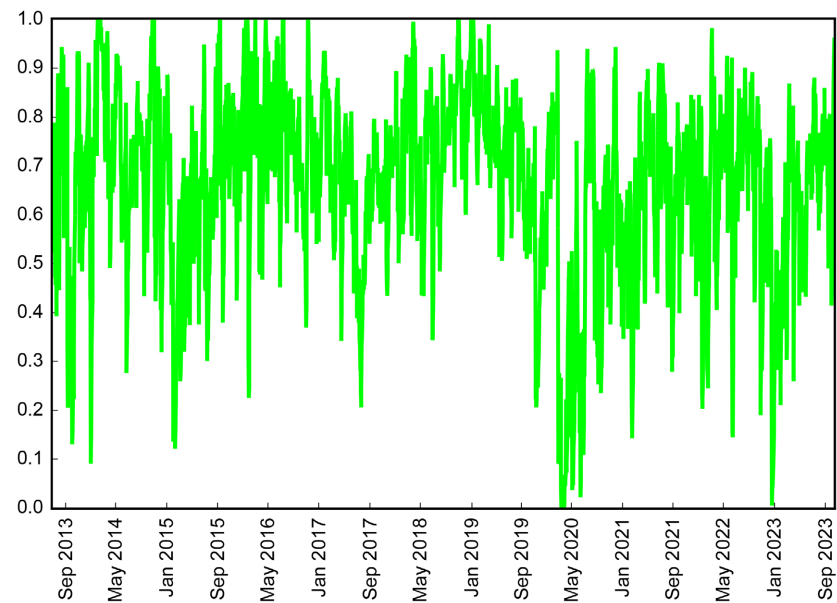


Figure 6. Time-varying optimal weights for the J-REIT: July 2013 to October 2023.

Table 2. Summary statistics for the time-varying optimal portfolio weights. (a) April 2003 to June 2013; (b) July 2013 to October 2023.

(a)		
	DLTXR/DLJRR	DLJRR/DLTXR
Mean	0.41	0.59
SD	0.29	0.29
Min.	0.00	0.00
Max.	1.00	1.00
(b)		
	DLTXR/DLJRR	DLJRR/DLTXR
Mean	0.34	0.66
SD	0.19	0.19
Min.	0.00	0.00
Max.	1.00	1.00

DLTXR denotes the return of the TOPIX and DLJRR denotes the return of the J-REIT. SD means the standard deviation value; Min. denotes the minimum value; and Max. denotes the maximum value. A/B means the weight of A in the two-asset portfolio of A and B.

5. Conclusions

This paper investigated the optimal portfolio problems for equity and real estate in Japan. More specifically, using a VAR-MGARCH model and the method of Kroner and Ng (1998), we empirically examined the time-varying optimal portfolio weights for the TOPIX and the J-REIT for the first half period from April 2003 to June 2013 and the latter half period from July 2013 to October 2023.

As a result, our investigations in this study found that the optimal portfolio weights for the TOPIX and the J-REIT varied over time. In addition, we revealed that in the more recent period, higher portfolio weights for the J-REIT were more effective in building the portfolio of the TOPIX and the J-REIT. Put differently, our results suggested that in the more recent period, lower portfolio weights for the TOPIX were more efficient in constructing the two-asset portfolio.

Since studies focusing on the optimal portfolio problems of equity and REITs in Japan are generally limited in the existing literature, the results derived from our current study will be beneficial for both academics and practitioners in this field. We believe that further related research would also be significant. Therefore, this type of research is one of our important future tasks.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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