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Dynamic Optimization for Equity and Dollar Asset: The Case of Japan

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Abstract

This article examines the time-varying optimal portfolio weights for the two assets denominated in Japanese yen—the Nikkei 225 index and the yen-dollar rate—for four different periods from 1973 to 2023. Using a VAR-bivariate GARCH model and an optimization method, we uncover that in the more recent period, higher portfolio weights for the yen-dollar rate—a dollar asset for Japanese investors—were more efficient in constructing the Japanese equity and dollar asset portfolio.

Keywords

MGARCH, Nikkei 225, Optimal Portfolio Weight, Yen-Dollar Rate

1. Introduction

On the back of financial globalization, there seems to be a growing concern about investments in foreign assets, and indeed, there are many existing studies of asset allocation, including foreign assets (e.g., Jorion, 1992; Jin & Zhang, 2012; Bellalah et al., 2023; Blanchett, 2023; Kim et al., 2023; Yang et al., 2023; Yin & Wong, 2023). However, research on the optimal way to invest in equity and dollar assets in Japan seems to be limited. Thus, given and motivated by these backgrounds, our current article inspects the time-varying optimal portfolio weights for the two assets denominated in Japanese yen, i.e., the Nikkei 225 index and the yen-dollar rate, which is regarded as a dollar asset for Japanese investors.

As a result, this article uncovers that in the more recent period, higher portfolio weights for the yen-dollar rate—a dollar asset for Japanese investors—are more efficient in building the Japanese equity and dollar asset portfolio. The derivation of this new finding is our significant contribution. Regarding the rest of this article, Section 2 documents our data and methods. Section 3 explains our results, and Section 4 provides our conclusions.

2. Data and Methodology

This section documents our data and methodology. This article uses equity and exchange rate daily time series data. Specifically, DLNKR and DLYDR means the daily log difference percentage returns of the Nikkei 225 index and the yen-dollar rate from Bloomberg. We analyze these returns over four sample periods. That is, the first is from February 15, 1973, to September 30, 1985; the second is from October 2, 1985, to March 31, 1998; the third is from April 2, 1998, to December 30, 2010; and the fourth is from January 5, 2011, to October 13, 2023.

Table 1 provides the descriptive statistics for DLNKR and DLYDR for the above four periods. From Table 1, we understand that the mean values of DLNKR and DLYDR are almost zero in all four periods, and the standard deviations of DLYDR are always lower than those of DLNKR.

Table 1. Descriptive statistics for returns of the Nikkei and the yen-dollar rate. (a) Feb. 15, 1973 to Sep. 30, 1985; (b) Oct. 2, 1985 to Mar. 31, 1998; (c) Apr. 2, 1998 to Dec. 30, 2010; (d) Jan. 5, 2011 to Oct. 13, 2023.

	(a)	
	DLNKR	DLYDR
Mean	0.030	−0.007
SD	0.769	0.588
Min.	−5.559	−5.155
Max.	4.605	6.256
	(b)	
	DLNKR	DLYDR
Mean	0.009	−0.016
SD	1.387	0.681
Min.	−16.135	−5.757
Max.	12.430	4.059
	(c)	
	DLNKR	DLYDR
Mean	−0.015	−0.016
SD	1.597	0.762
Min.	−12.111	−8.142
Max.	13.235	3.801
	(d)	
	DLNKR	DLYDR
Mean	0.036	0.019
SD	1.305	0.582
Min.	−11.153	−4.718
Max.	7.731	3.480

SD: standard deviation value; Min.: minimum value; Max.: maximum value. DLNKR: return of the Nikkei 225; DLYDR: return of the yen-dollar rate.

Figure 1 plots the time-series price evolution of the Nikkei 225, and Figure 2 shows that of the yen-dollar rate. Both are for our overall period, from February 14, 1973, to October 13, 2023.

Figure 1. Time series of the Nikkei 225: February 1973 to October 2023. Nikkei 225 price series are daily and displayed in yen.

Figure 2. Time series of the yen-dollar rate: February 1973 to October 2023. The yen-dollar rate series are daily and displayed in yen.

Figure 3 presents the time-series return evolution of the Nikkei 225, and Figure 4 plots that of the yen-dollar rate. Both are again for our overall period. These four graphs in Figures 1-4 indicate that two price and return evolutions of the Nikkei 225 and the yen-dollar rate show different movements.

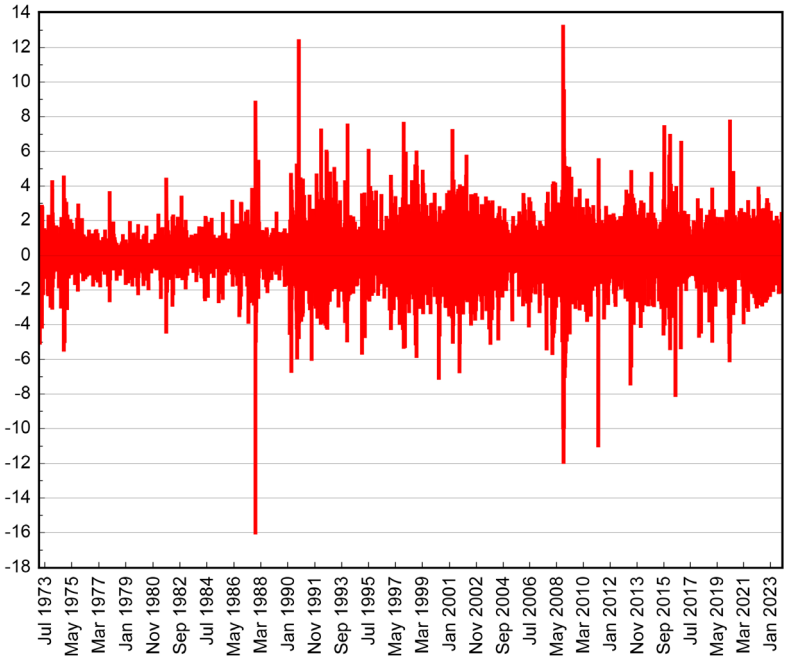

Figure 3. Time series of the Nikkei 225 daily percentage returns: February 1973 to October 2023.

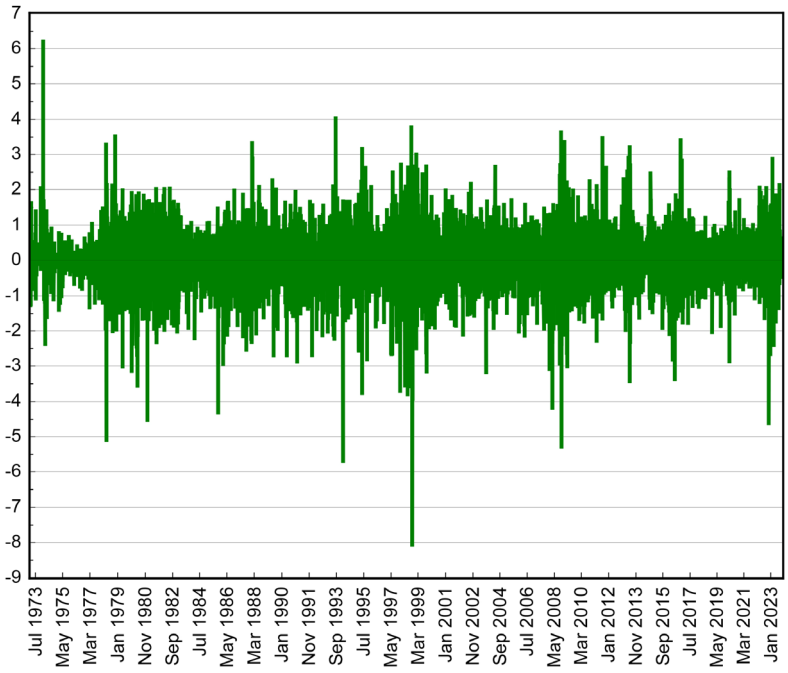

Figure 4. Time series of the daily percentage yen-dollar rate returns: February 1973 to October 2023.

We next explain our methodology. We first estimate a VAR (1)-bivariate GARCH model by using the two return series of DLNKR and DLYDR. And then, applying the method of Kroner & Ng (1998) by using the time-varying variances and covariances from the model, we examine the time-varying optimal portfolio weights for the Nikkei and the yen-dollar rate—a dollar asset for Japanese investors—for our four periods.

3. Results

This section explains our results. Figure 5 plots the evolutions of the time-varying optimal portfolio weights for the Nikkei and the yen-dollar rate in the equity and dollar asset portfolios for our first period. Similarly, Figures 6-8 present those for the Nikkei and the yen-dollar rate for our second, third, and fourth periods, respectively. Importantly, these graphs in Figures 5-8 show that for the four periods, the optimal portfolio weights of the Nikkei and the yen-dollar rate are much different.

To deepen our understanding, we show the summary statistics regarding the time-varying optimal portfolio weights for the Nikkei and the yen-dollar rate in Table 2. Panels A to D exhibit those for the first, second, third, and fourth periods, respectively. Examining the mean values in the four panels, we understand that in the more recent period, lower portfolio weights for the Nikkei were more efficient in building the Japanese equity and dollar-asset portfolios. That is, in the more recent period, higher portfolio weights for the yen-dollar rate—a dollar asset for Japanese investors—were more beneficial in constructing the two-asset portfolio.

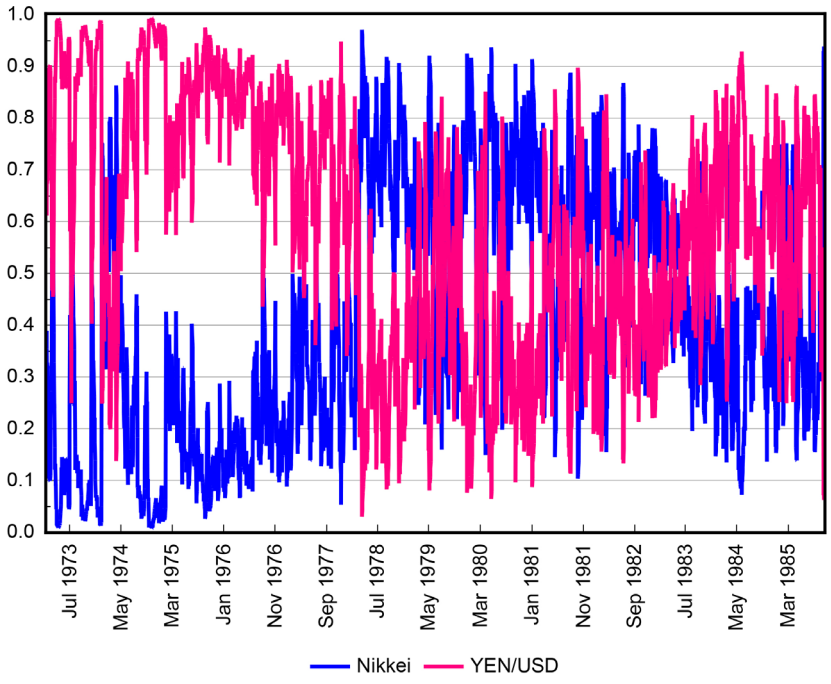

Figure 5. Time-series evolution of the optimal weights for the Nikkei and the dollar asset: February 1973 to September 1985.

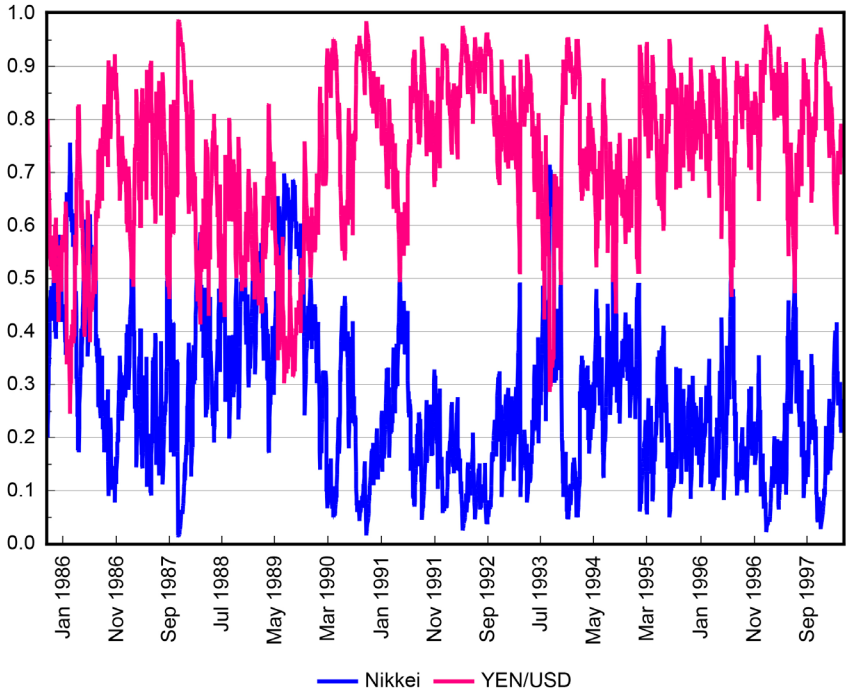

Figure 6. Time-series evolution of the optimal weights for the Nikkei and the dollar asset: October 1985 to March 1998.

Table 2. Summary statistics for the optimal portfolio weights for the Nikkei and the dollar asset: the results for the four periods from February 1973 to October 2023. (a) Feb. 16, 1973 to Sep. 30, 1985; (b) Oct. 3, 1985 to Mar. 31, 1998; (c) Apr. 3, 1998 to Dec. 30, 2010; (d) Jan. 6, 2011 to Oct. 13, 2023.

	(a)			
	Mean	SD	Min.	Max.
DLNKR/DLYDR	0.41	0.24	0.01	0.97
DLYDR/DLNKR	0.59	0.24	0.03	0.99
	(b)			
	Mean	SD	Min.	Max.
DLNKR/DLYDR	0.27	0.15	0.01	0.76
DLYDR/DLNKR	0.73	0.15	0.24	0.99
	(c)			
	Mean	SD	Min.	Max.
DLNKR/DLYDR	0.14	0.11	0.00	0.57
DLYDR/DLNKR	0.86	0.11	0.43	1.00
	(d)			
	Mean	SD	Min.	Max.
DLNKR/DLYDR	0.06	0.11	0.00	0.62
DLYDR/DLNKR	0.94	0.11	0.38	1.00

SD: standard deviation value; Min.: minimum value; Max.: maximum value. DLNKR: return of the Nikkei 225; DLYDR: return of the yen-dollar rate. A/B: weight of A in the portfolio with B.

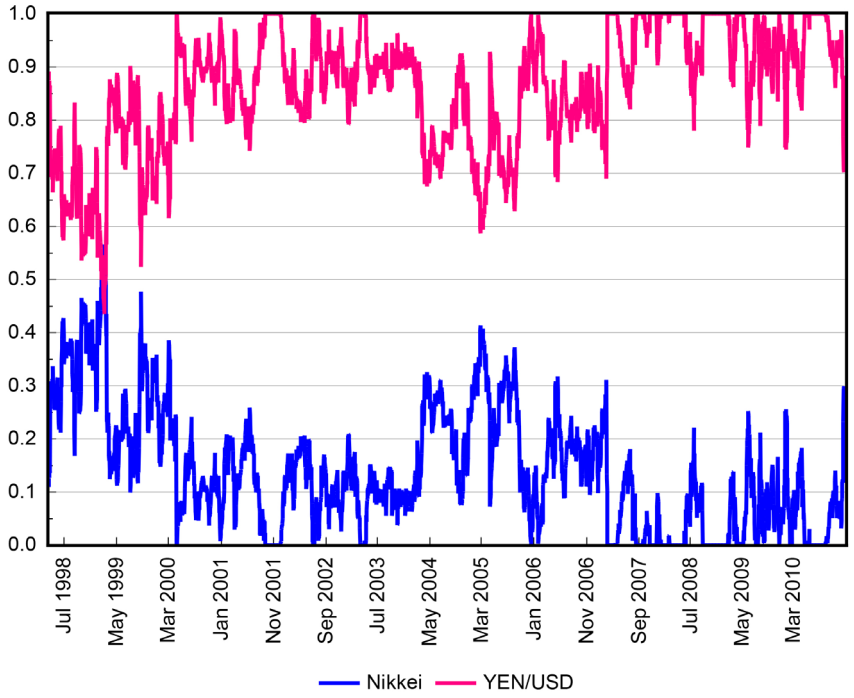

Figure 7. Time-series evolution of the optimal weights for the Nikkei and the dollar asset: April 1998 to December 2010.

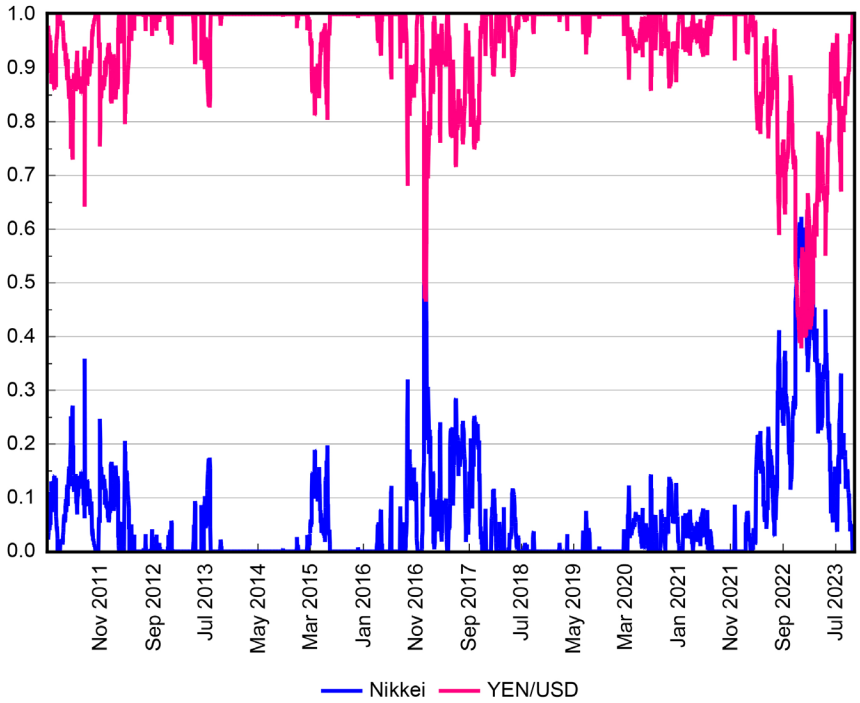

Figure 8. Time-series evolution of the optimal weights for the Nikkei and the dollar asset: January 2011 to October 2023.

4. Conclusion

This article has explored the optimal portfolio by using equity and exchange rate

returns for Japan. More concretely, we empirically inspected the time-varying optimal portfolio weights for the Nikkei 225 index and the yen-dollar rate—a dollar asset for Japanese investors—by comparing them for different four time periods.

As a result, we derived the following interesting findings: that is, in the more recent period, lower portfolio weights for the Nikkei were more efficient in building the two-asset portfolio of the Nikkei 225 and the yen-dollar rate. This means that, in the more recent period, higher portfolio weights for the yen-dollar rate were more effective in constructing the two-asset portfolio. This means that for Japanese investors, incorporating dollar assets into their equity portfolios was highly meaningful in the recent period.

The existing literature lacks research focusing on Japanese equity and dollar asset portfolios. The academic and practical results presented in this article will be beneficial for both academics and industry practitioners. We consider that more detailed further research is also meaningful; therefore, extending this line of research further is one of our 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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