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Time-varying International Effects of Japanese Stock Prices on US and Canadian Stock Markets

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Abstract

This study investigates the international linkages of growth, value, and standard stock indices of the US, Canada, and Japan. In particular, we empirically test the international effects of Japanese standard, value, and growth stock indices on US and Canadian growth, value, and standard equity indices. Our empirical analyses by using multivariate-generalized autoregressive conditional heteroscedasticity (MGARCH) models suggest the following evidence. First, this paper clarifies that both the Nikkei 225 (the Nikkei) and the Tokyo stock price index (TOPIX) show the highest time-varying correlations with the US standard equity index, while both the Nikkei and TOPIX exhibit the highest time-varying correlations with the Canadian value index. Second, we further reveal that the Japanese value and growth stock indices also have the highest time-varying correlations with the US standard equity index, while both two Japanese indices show the highest time-varying correlations with the value index in Canada.

Keywords: Growth effect, international stock market linkage, multivariate GARCH model, value effect

JEL Classification Codes: G12, G15

1. Introduction

Evaluating stock performances of value and growth stocks is one of the key research topics in finance (e.g., Capaul et al., 1993; Chen and Zhang, 1998; Fama and French, 1998; Baek and Bilson, 2015) and international stock market linkage is also one of the most important issues for financial researchers (e.g., Rangvid, 2001; Narayan and Smyth, 2004). It is pointed out that to date, value and growth effects and the issue of international stock market linkage have been separately investigated. Therefore, in order to derive new evidence, this study newly attempts a combined research as to these two issues by using US, Canadian, and Japanese growth, value, and standard equity index data.

Regarding the issue of international stock market linkage first, there are interesting previous studies such as Liu (2013), Tsai (2014), and Vu (2015), for example; however, all these studies used standard stock market indices. As to value premiums next, for instance, such studies as those by Black et al. (2007) and Fama and French (2012) also exhibited interesting analyses, while there seems to be little existing study that specifically focused on growth premiums, as we review later in detail. Again, as we documented above, these two kinds of studies have been conducted separately; and as far as we know, there is little previous study that analyzed international stock market linkages by taking into account both value and growth effects. Based on the state of past studies and our motivation explained above, this paper empirically examines the time-varying international effects of Japanese value, growth, and standard equity indices on US and Canadian value, growth, and standard stock indices. This is the objective of this paper and we consider that we are the first to conduct such a combined empirical study in connection with the two attractive topics: value and growth effects and international stock market linkages. In our empirical analyses, by using two types of multivariate-generalized autoregressive conditional heteroscedasticity (MGARCH) models, we aim to derive robust evidence.

Briefly stating the interesting findings derived from MGARCH models, they are as follows. First, we clarify that 1) both the Nikkei 225 (the Nikkei) and the Tokyo stock price index (TOPIX) show the highest time-varying correlations with the US standard equity index, while both the Nikkei and the TOPIX exhibit the highest time-varying correlations with the Canadian value index. Second, we further reveal that 2) Japanese value and growth stock indices have the highest time-varying correlations with the US standard equity index and both two Japanese indices exhibit the highest time-varying correlations with the value index in Canada.

The remainder of this paper is organized as follows. Section 2 briefly reviews the previous literature, Section 3 explains our data, and Section 4 documents our econometric methodology. Section 5 explains our empirical results and Section 6 summarizes this paper.

2. Literature Review

There are many past studies as regards the international stock market linkage; however, those studies are generally as to simple connections among standard stock indices. For example, Asgharian et al. (2013) conducted a spatial analysis of international stock market linkages by using international standard stock market returns. Similarly, by using standard equity index data, Ye (2014) examined the interactions between China and US stock markets. Vu (2015) examined their outputs' responses to stock market volatilities across 27 countries by using standard equity index data. As pointed out before, many studies used standard equity index data in analyzing international stock market linkages.

As for the studies of value and growth stocks, there are much more studies of value effects than growth effects. For example, Liu and Zhang (2008) investigated US value spreads, and they concluded that, differently from the suggestions by Campbell and Vuolteenaho (2004), for forecasting US stock returns, US value spreads seemed to be much less useful. Furthermore, using international stock return data, Fama and French (2012) examined size, value, and momentum effects in each international stock market. In addition, in the US stock market, Novy-Marx (2013) examined the value strategy and concluded that it was not always strongly effective.

There are very few studies related to the growth effect. Rytchkov (2010) examined the return predictability regarding US value and growth portfolios. Rytchkov (2010) showed that US value and growth portfolio returns were predictable, and the predictability for growth portfolios was stronger. Larsen and Munk (2012) investigated the effectiveness of growth/value tilting strategies, and they indicated that the growth/value tilt strategies were much effective. As for the Japanese stock market, Tsuji (2007) explored the priced macroeconomic factors and Tsuji (2012) examined the size- and value-premiums. However, the focuses of these studies were not on the issue of international stock market linkage with the Japanese stock market.

3. Data

This study employs 10 daily stock index data for the period from June 21, 2001 to December 5, 2014. All data we use in this research are from the QUICK Corp. As we are interested in the relationships among Japanese, US, and Canadian stock markets, we constructed four kinds of return series for Japan; three kinds of return series for the US; and three kinds of return series for Canada. Further, our return series are all daily log percentage returns.

First, regarding Japan, *dlrnk* and *dlrtpx* are the returns of the Nikkei and TOPIX, respectively. In addition, *dlrjg* and *dlrjv* denote the returns of the Morgan Stanley Capital International (MSCI) growth and value stock indices for Japan, respectively. As to the US equity market, *dlrus*, *dlrusg*, and *dlrusv* mean the returns of the MSCI US standard equity index, the MSCI US growth equity index, and the MSCI US value equity index, respectively. For the Canadian stock market, *dlrca*, *dlrcag*, and *dlrcav* denote the returns of the MSCI Canadian standard equity index, the MSCI Canadian growth equity index, and the MSCI Canadian value equity index, respectively. Using the above 10 time-series data, we inspect the international effects of the Japanese standard, growth, and value equity indices on the US and Canadian standard, growth, and value stock indices. Time difference between Tokyo and New York or Toronto is about 14-hours and thus, stock markets in Japan precede US and Canadian markets. Hence, in order to evaluate the international effects of Japanese stock markets on the other two succeeding markets, we analyze the same day data of the three countries.

Descriptive statistics as to the above 10 return variables are shown in Table 1. Table 1 indicates that the values of mean and median for all 10 index return data are slightly positive. Table 1 also shows that the Japanese equity index returns seem to be more volatile than the stock index returns of the US and Canada. Moreover, the skewness values are slightly negative for all stock return data. Furthermore, the Canadian equity index returns demonstrate slightly higher values of kurtosis than the stock index returns in the US and Japan; hence, we understand that, in our sample period, the Canadian equity returns have somewhat fatter-tail distributions than stock returns in the US and Japan.

4. Econometric Methodology

In order to inspect the dynamic linkages of the Japanese equity indices and the US or Canadian stock indices, we apply two kinds of multivariate-GARCH models. The first is the vector-half (VECH)-MGARCH model and the second is the Baba-Engle-Kraft-Kroner (BEKK)-MGARCH model. It is noted that, in order to derive robust evidence, in this study, we employ the above two kinds of MGARCH models.

Using the time-varying covariances and variances derived from the above two MGARCH models, we compute the time-varying correlation coefficients between the Japanese equity indices and the US or Canadian equity indices. By using these time-varying correlation coefficients, this paper analyzes the dynamic effects of the above four kinds of Japanese equity indices on the US and Canadian stock indices.

Table 1. Descriptive statistics of the daily log percentage returns of international equity indices: Standard, value, and growth equity index returns in the US, Canada, and Japan

Panel A. Statistics of Japanese equity indices		
	dlrnk	*dlrtpx*
Mean	0.0105	0.0042
Median	0.0451	0.0444
Maximum	13.2346	12.8647
Minimum	−12.1110	−10.0071
Standard deviation	1.5613	1.4175
Skewness	−0.4659	−0.3922
Kurtosis	9.5578	9.2869
Observations	3306	3306
	dlrjg	*dlrjv*
Mean	0.0044	0.0160
Median	0.0278	0.0496
Maximum	13.1060	13.0199
Minimum	−10.8347	−10.2409
Standard deviation	1.5016	1.4328
Skewness	−0.3527	−0.3558
Kurtosis	8.5573	9.4570
Observations	3306	3306

Panel B. Statistics of US equity indices			
	dlrus	*dlrusg*	*dlrusv*
Mean	0.0241	0.0248	0.0229
Median	0.0564	0.0535	0.0537
Maximum	10.3439	9.9577	12.0380
Minimum	−9.5039	−9.5696	−10.4788
Standard deviation	1.2825	1.2507	1.3590
Skewness	−0.2476	−0.2780	−0.1935
Kurtosis	11.7273	10.2189	12.9466
Observations	3306	3306	3306

Panel C. Statistics of Canadian equity indices			
	dlrca	*dlrcag*	*dlrcav*
Mean	0.0290	0.0269	0.0302
Median	0.0630	0.0440	0.0507
Maximum	9.7245	10.3933	10.0484
Minimum	−10.4025	−11.9663	−10.3978
Standard deviation	1.1688	1.3521	1.1234
Skewness	−0.6030	−0.7009	−0.3116
Kurtosis	13.5813	14.0310	13.6538
Observations	3306	3306	3306

Notes: This table shows the descriptive statistics with regard to the 10 return variables for the US, Canada, and Japan. The sample period investigated in this study spans June 21, 2001 to December 5, 2014.

5. Empirical Results

5.1 The Nikkei or TOPIX and the US or the Canadian Stock Market

This section explains our results from MGARCH models. First, Figure 1 shows the time-varying correlations from the VECH-MGARCH model, while Figure 2 exhibits those from the BEKK-MGARCH model. More specifically, Panel A of Figure 1 (Figure 2) exhibits the time-varying correlations between the Nikkei and the US standard equity index, which are derived from the VECH-MGARCH model (BEKK-MGARCH model); and Panel B of Figure 1 (Figure 2) displays the time-varying correlations between the Nikkei and the Canadian value stock index, which are derived from the VECH-MGARCH model (BEKK-MGARCH model). As seen in these panels in Figures 1 and 2, all the correlations between the preceding Nikkei and the following US standard or the Canadian value index fluctuate with taking positive values on average.

Further, Panel C of Figure 1 (Figure 2) shows the time-varying correlations between the TOPIX and the US standard index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model; and Panel D of Figure 1 (Figure 2) exhibits those between the TOPIX and the Canadian value index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model. From those panels in Figures 1 and 2, it is understood that, again, all the correlations between the TOPIX and the following US standard or the Canadian value index evolve with taking positive values on average.

Table 2 exhibits the test results of the average values of the time-varying correlations derived from the VECH- and BEKK-MGARCH models. This table shows that for the US, both the Nikkei and TOPIX have the highest average correlation coefficients with the succeeding US standard stock index (Panels A-1 and A-4 in Table 2) although one exception is seen in the case of BEKK-MGARCH model shown in Panel A-3 of Table 2. On the other hand, Table 2 also shows that for Canadian markets, both the Nikkei and TOPIX exhibit the highest average correlation coefficients with the following Canadian value index regardless of the model types (Panels B-3 and B-6). Further, implementing the *t*-tests, the results shown in Table 2 clearly demonstrate that all average values of the time-varying correlation coefficients are statistically significantly positive at the 1% level. Based on the above evidence derived from our two kinds of MGARCH models, it is again very robust that the preceding Japanese stock markets most strongly influence the overall stock market in the US and the value stock index in Canada.

5.2 The Japanese Value or Growth Index and the US or the Canadian Stock Market

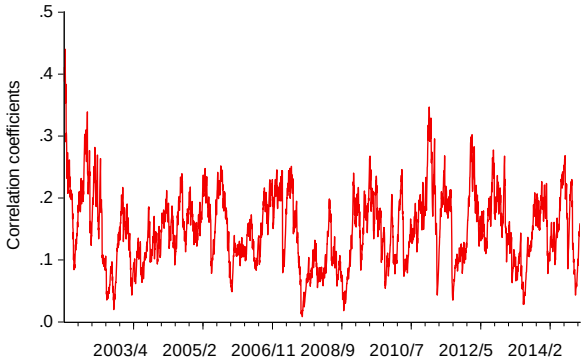
Next, Panel A of Figure 3 (Figure 4) displays the time-varying correlations between the Japanese growth index and the US standard index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model; and Panel B of Figure 3 (Figure 4) shows those between the Japanese growth index and the Canadian value index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model. From these panels of Figures 3 and 4, we understand that all the correlations between the preceding Japanese growth stocks and the following US standard or the Canadian value index vary with taking positive values on average.

Moreover, Panel C of Figure 3 (Figure 4) exhibits the time-varying correlations between the Japanese value index and the US standard index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model; and Panel D of Figure 3 (Figure 4) exhibits those between the Japanese value index and the Canadian value index, which are derived from the VECH-MGARCH (BEKK-MGARCH) model. From these panels, it is again understood that all the correlations between the preceding Japanese value stocks and the following US standard or the Canadian value index evolve positively on average.

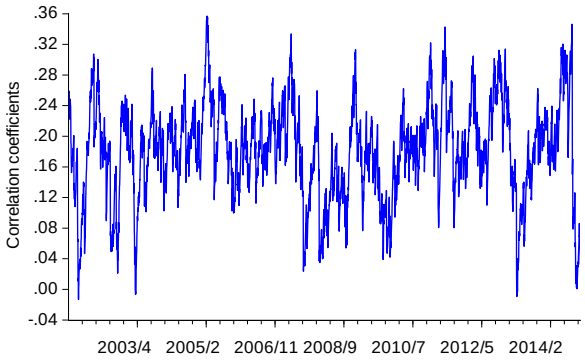
Further, Table 3 also displays that for the US, both the Japanese value and growth stocks demonstrate the highest average correlations with the succeeding US standard stock index regardless of the model types (Panels A-1 and A-4 in Table 3). On the other hand, Table 3 again suggests that for Canadian markets, both the Japanese value and growth stocks have the highest average correlations with the following Canadian value index regardless of the model types (Panels B-3 and B-6). Moreover, the *t*-test results displayed in Table 3 clearly show that all average values of the time-varying correlation coefficients are statistically significantly positive at the 1% level. According to the above evidence derived from our two sorts of MGARCH models, it is again very robust that the Japanese value and growth stocks most strongly affect the US overall equity index and the Canadian value index.

To sum up, our MGARCH analyses demonstrate that 1) the Japanese representative stock market indices, the Nikkei and TOPIX, most strongly influence the following US overall stock market and the value index in Canada; and very interestingly, 2) both the Japanese value and growth stocks most strongly affect the succeeding US overall stock market and the Canadian value stocks as well.

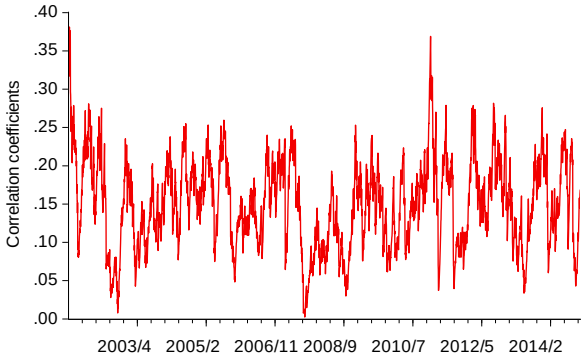
Panel A. Time-varying correlation coefficients of the Nikkei 225 and the US standard index



Panel B. Time-varying correlation coefficients of the Nikkei 225 and the Canadian value index



Panel C. Time-varying correlation coefficients of the TOPIX and the US standard index



Panel D. Time-varying correlation coefficients of the TOPIX and the Canadian value index

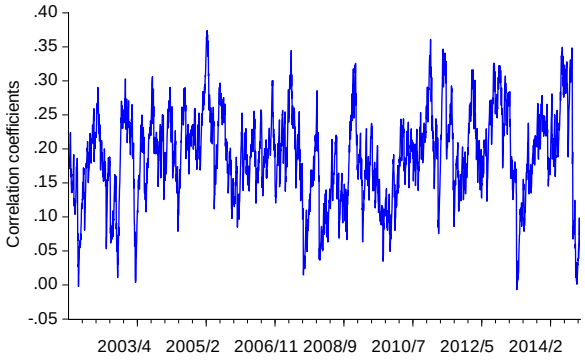
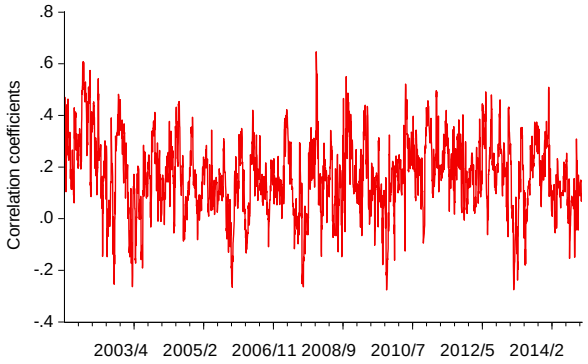
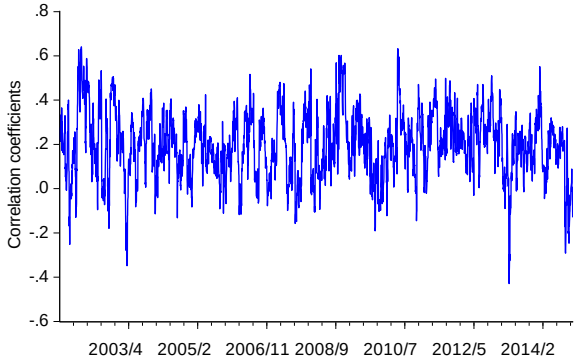


Figure 1. Time-varying correlation coefficients derived from the VECH-MGARCH models: Effects of the Nikkei 225 and TOPIX on the US standard and the Canadian value equity indices

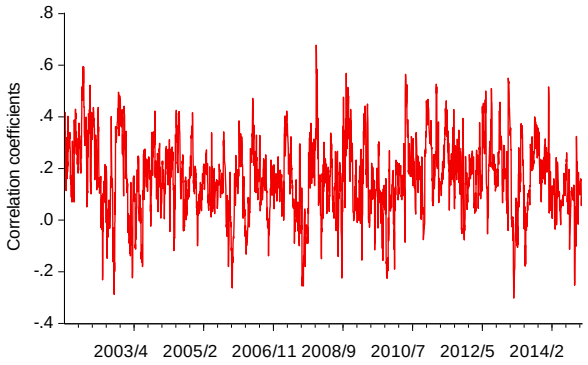
Panel A. Time-varying correlation coefficients of the Nikkei 225 and the US standard index



Panel B. Time-varying correlation coefficients of the Nikkei 225 and the Canadian value index



Panel C. Time-varying correlation coefficients of the TOPIX and the US standard index



Panel D. Time-varying correlation coefficients of the TOPIX and the Canadian value index

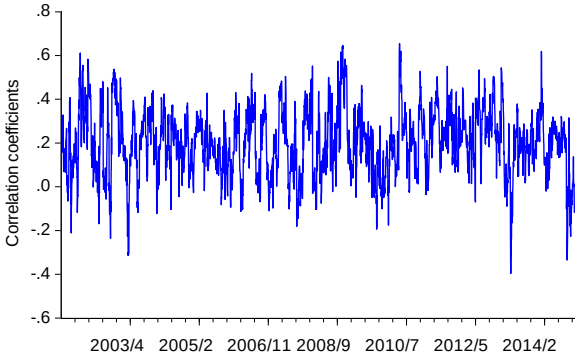


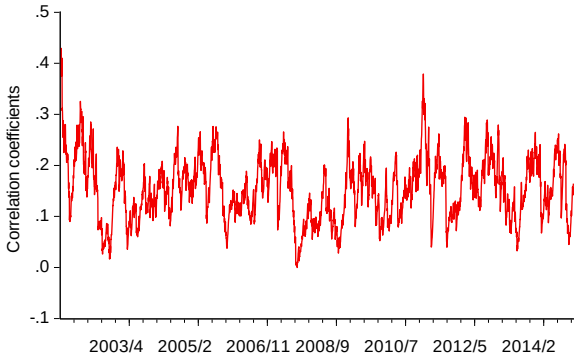
Figure 2. Time-varying correlation coefficients derived from the BEKK-MGARCH models: Effects of the Nikkei 225 and TOPIX on the US standard and the Canadian value equity indices

Table 2. Results of the *t*-tests in terms of the average values of the time-varying correlations derived from the multivariate-VECH and BEKK models: Effects of the Nikkei 225 and TOPIX

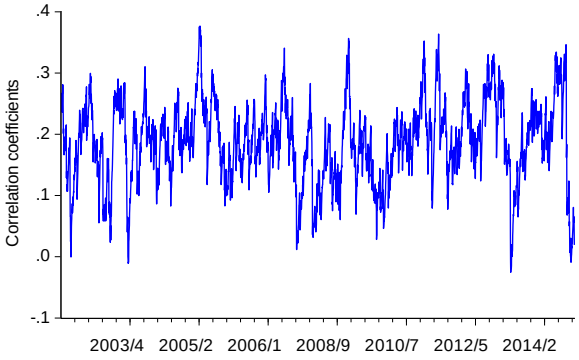
Panel A. Test results of US markets			Panel B. Test results of Canadian markets		
A−1. Results of the time-varying correlation averages of the Nikkei 225 and the US standard index			B−1. Results of the time-varying correlation averages of the Nikkei 225 and the Canadian standard index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1495***	0.1574***	Correl.	0.1799***	0.1923***
t-value	144.5453	64.4496	*t*-value	171.9941	76.3025
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−2. Results of the time-varying correlation averages of the Nikkei 225 and the US growth index			B−2. Results of the time-varying correlation averages of the Nikkei 225 and the Canadian growth index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1443***	0.1574***	Correl.	0.1563***	0.1708***
t-value	152.9016	64.4496	*t*-value	124.7640	70.9058
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−3. Results of the time-varying correlation averages of the Nikkei 225 and the US value index			B−3. Results of the time-varying correlation averages of the Nikkei 225 and the Canadian value index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1471***	0.1593***	Correl.	0.1807***	0.1955***
t-value	120.7363	60.1565	*t*-value	164.6921	73.7330
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−4. Results of the time-varying correlation averages of the TOPIX and the US standard index			B−4. Results of the time-varying correlation averages of the TOPIX and the Canadian standard index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1499***	0.1621***	Correl.	0.1875***	0.1972***
t-value	148.6077	65.4542	*t*-value	168.1098	77.7283
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−5. Results of the time-varying correlation averages of the TOPIX and the US growth index			B−5. Results of the time-varying correlation averages of the TOPIX and the Canadian growth index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1449***	0.1574***	Correl.	0.1674***	0.1758***
t-value	153.3950	63.4534	*t*-value	146.4326	71.5689
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−6. Results of the time-varying correlation averages of the TOPIX and the US value index			B−6. Results of the time-varying correlation averages of the TOPIX and the Canadian value index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1467***	0.1582***	Correl.	0.1888***	0.1998***
t-value	121.2788	61.3560	*t*-value	163.5481	75.3367
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000

Notes: This table exhibits the *t*-test results regarding the average values of the time-varying correlation coefficients derived from two kinds of multivariate-GARCH models. In this table, 'Correl.' denotes the average value of the time-varying correlation coefficients; VECH means the VECH-MGARCH model; and BEKK represents the BEKK-MGARCH model. Moreover, ***, **, and * mean that the test results statistically significantly support the positive average correlation coefficients at the 1, 5, and 10% levels, respectively.

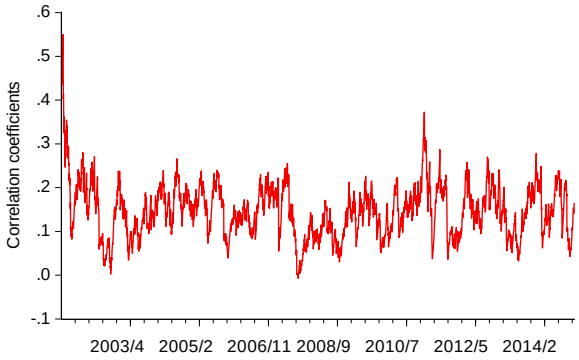
Panel A. Time-varying correlation coefficients of the Japanese growth index and the US standard index



Panel B. Time-varying correlation coefficients of the Japanese growth index and the Canadian value index



Panel C. Time-varying correlation coefficients of the Japanese value index and the US standard index



Panel D. Time-varying correlation coefficients of the Japanese value index and the Canadian value index

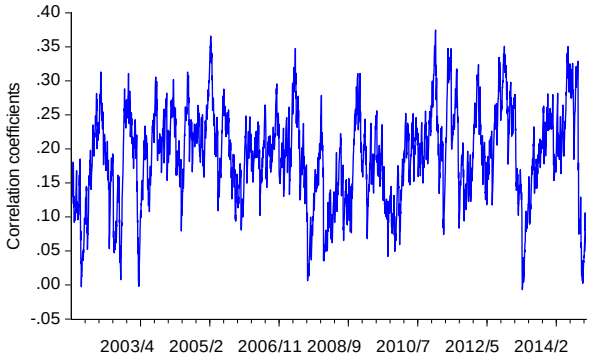
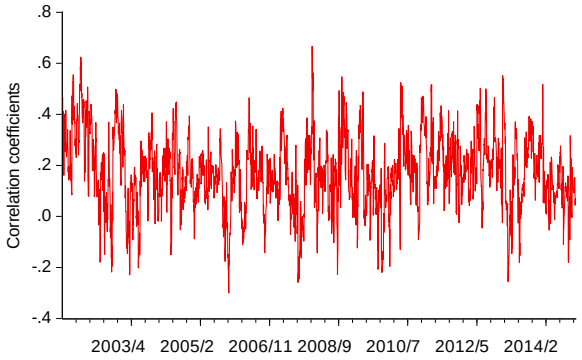
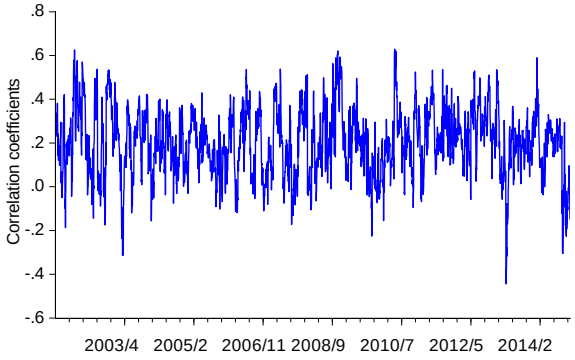


Figure 3. Time-varying correlation coefficients derived from the VECH-MGARCH models: Effects of the Japanese growth and value indices on the US standard and the Canadian value equity indices

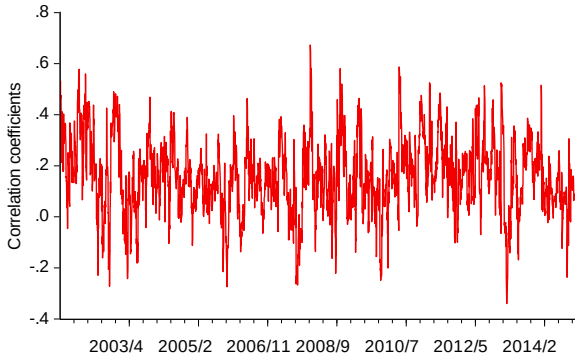
Panel A. Time-varying correlation coefficients of the Japanese growth index and the US standard index



Panel B. Time-varying correlation coefficients of the Japanese growth index and the Canadian value index



Panel C. Time-varying correlation coefficients of the Japanese value index and the US standard index



Panel D. Time-varying correlation coefficients of the Japanese value index and the Canadian value index

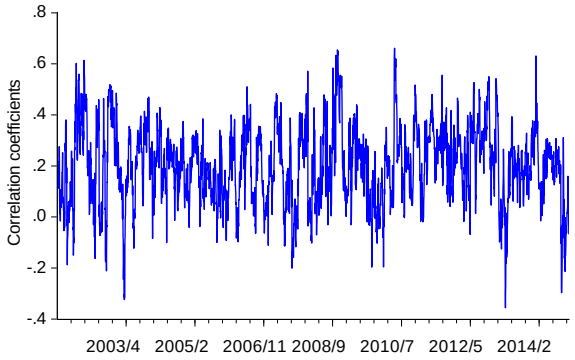


Figure 4. Time-varying correlation coefficients derived from the BEKK-MGARCH models: Effects of the Japanese growth and value indices on the US standard and the Canadian value equity indices

Table 3. Results of the *t*-tests in terms of the average values of the time-varying correlations derived from the multivariate-VECH and BEKK models: Effects of the Japanese value and growth indices

Panel A. Test results of US markets			Panel B. Test results of Canadian markets		
A−1. Results of the time-varying correlation averages of the Japanese growth index and the US standard index			B−1. Results of the time-varying correlation averages of the Japanese growth index and the Canadian standard index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1539***	0.1693***	Correl.	0.1865***	0.1983***
t-value	143.3227	67.9433	*t*-value	164.6193	77.4353
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−2. Results of the time-varying correlation averages of the Japanese growth index and the US growth index			B−2. Results of the time-varying correlation averages of the Japanese growth index and the Canadian growth index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1497***	0.1651***	Correl.	0.1668***	0.1770***
t-value	151.8021	66.9712	*t*-value	145.4492	71.8026
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−3. Results of the time-varying correlation averages of the Japanese growth index and the US value index			B−3. Results of the time-varying correlation averages of the Japanese growth index and the Canadian value index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1499***	0.1645***	Correl.	0.1868***	0.2008***
t-value	119.3337	62.7724	*t*-value	160.1109	74.9952
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−4. Results of the time-varying correlation averages of the Japanese value index and the US standard index			B−4. Results of the time-varying correlation averages of the Japanese value index and the Canadian standard index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1466***	0.1567***	Correl.	0.1862***	0.1968***
t-value	136.4499	61.9363	*t*-value	168.4922	77.3500
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−5. Results of the time-varying correlation averages of the Japanese value index and the US growth index			B−5. Results of the time-varying correlation averages of the Japanese value index and the Canadian growth index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1398***	0.1508***	Correl.	0.1648***	0.1743***
t-value	153.9174	60.3496	*t*-value	144.9202	71.1492
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000
A−6. Results of the time-varying correlation averages of the Japanese value index and the US value index			B−6. Results of the time-varying correlation averages of the Japanese value index and the Canadian value index		
	VECH	BEKK		VECH	BEKK
Correl.	0.1418***	0.1544***	Correl.	0.1887***	0.1998***
t-value	113.7662	58.1547	*t*-value	158.4166	74.7373
p-value	0.0000	0.0000	*p*-value	0.0000	0.0000

Notes: This table exhibits the *t*-test results regarding the average values of the time-varying correlation coefficients derived from two kinds of multivariate-GARCH models. In this table, 'Correl.' denotes the average value of the time-varying correlation coefficients; VECH means the VECH-MGARCH model; and BEKK represents the BEKK-MGARCH model. Moreover, ***, **, and * mean that the test results statistically significantly support the positive average correlation coefficients at the 1, 5, and 10% levels, respectively.

6. Conclusions

This study investigated the international time-series relationships of growth, value, and standard stock indices of the US, Canada, and Japan. In particular, we empirically inspected the international effects of Japanese standard, value, and growth stock indices on US and Canadian growth, value, and standard stock indices. Clarification of the effects was the objective of this paper. Our empirical analyses by using two types of multivariate-GARCH models revealed the following interest evidence.

1) First, our VECH-MGARCH and BEKK-MGARCH analyses found that for the US, both the Nikkei and TOPIX had the highest time-varying correlations with the US standard index. 2) Second, unlike the results for the US, our two kinds of MGARCH analyses clarified that in Canadian markets, both the Nikkei and TOPIX exhibited the highest time-varying correlations with the value index. 3) Third, our further inspections by using two sorts of MGARCH models revealed that in the US, Japanese value and growth equity indices again had the highest time-varying correlations with the standard index. 4) Fourth, unlike the results for the US, our MGARCH analyses also found that in Canadian markets, the Japanese value and growth indices exhibited the highest time-varying correlations with the value index.

Based on the above new findings, the academic novelty and usefulness of our present study for considering practical investments and future research can be documented as follows. First, 1) according to our evidence, watching the trends of the overall Japanese stock market is highly important for Canadian value investors since the Japanese representative stock market indices and the Canadian value index are much highly correlated. Second, 2) our results also indicate that the time-series of the overall Japanese stock market is extremely important for passive fund managers, central bankers, and government policy makers in the US because the Nikkei or TOPIX and the US standard equity index are much tightly related.

Further, 3) our results also imply that US growth- and value-style investors shall obtain better diversification effects by including Japanese stocks than passive investors since all kinds of the Japanese stock indices analyzed in this paper are less related with the US value or growth equity index than with the US standard index. Fourth, 4) our evidence further suggests that Canadian growth- and passive-style investors shall obtain stronger diversification effects by including Japanese stocks than Canadian value investors because all the Japanese stock indices investigated in this study are less tightly connected with the Canadian growth or standard stock index than with the Canadian value index. As the above findings and implication suggest, further investigations by using other international stock indices with different investment style and developing specific hypotheses related to such effects demonstrated in this paper may be our future tasks.

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