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Examining the Portfolio Diversification Benefits with Selected Developed, Emerging and Frontier Markets

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ABSTRACT

The financial market integration is important for the investors to have the portfolio diversification of their investment. The investors do the portfolio diversification to the market where they can have higher return with lower risk. **The purpose** of the paper is to analyse portfolio diversification opportunities among Asian Developed, Emerging and Frontier markets. The study is performed using various **methods** such as Correlation, Granger causality test, Johansen cointegration test, Portfolio diversification analysis using various diversification strategies. The study examines portfolio diversification opportunities by comparing non-diversified portfolio (home market) with diversified portfolios (Equal Weighted Portfolio, Minimum Variance Portfolio and Maximum Sharpe Portfolio). The gain from the portfolio diversification was also analyzed to measure the benefits of the diversification. The study found that the lack of integration among many markets proves the existence of the portfolio diversification opportunity. Study is unique in a nature that it examines the portfolio diversification benefits for the investors in developed, emerging and frontier markets, as past studies were limited to developed markets only. The study **concluded** that the investors can gain better return, lower risk and higher Sharpe with portfolio diversification in international market. The researchers can examine in future the portfolio diversification benefits with other frontier and emerging markets for the investors of the developed markets.

Keywords: international diversification; portfolio diversification benefits; Asian markets; time-varying integration; gain in Sharpe; assets allocation; market integration; investors

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INTRODUCTION

The portfolio diversification opportunities with respect to financial market integration remain an important topic for research in the field of finance. Investors are interested in financial market integration due to the potential benefits of portfolio diversification [1]. Investors look at diversification as an opportunity to get a better risk-return tradeoff and improve the performance of their portfolio. Due to globalisation, trade and investment rise, which increases the integration among financial markets. With the increasing correlation and integration among the markets, the diversification opportunities remain limited and investors find it difficult to reduce the risk. As recently reported by [2] the integration among the markets increased after the financial crisis, which narrows the diversification opportunity. Despite the integration, the frontier and emerging markets show low integration with other markets due to different economic phases. As emerging and frontier markets are in the developing and less-developed economy phase, such markets can offer diversification opportunities. According to the MSCI market classification framework 2019, Japan and Singapore are the developed markets; China, India, Korea, Pakistan, and Taiwan are emerging markets; Sri Lanka and Vietnam are the frontier markets in the Asia region. The present study focuses on all these above-mentioned markets. As per the International Monetary Fund (IMF), World Economic Outlook Database, July 2021 the share of these countries in the World GDP (PPP at current international US$) is estimated to be 43.26%. The past studies have not covered the potential gain in the diversification benefits with respect to emerging and frontier Asian markets. Hence, the present study focuses on examining the portfolio diversification opportunity and potential gain in the wealth of investors with respect to developed, emerging, and frontier Asian markets.

The rest of the paper proceeds as follows: Section 2 covers the literature review. Section 3 outlines the research methodology. Section 4 covers empirical findings. Section 5 shows the conclusion and implication of the study.

REVIEW OF PAST STUDIES

The portfolio diversification opportunities and benefits in financial markets have been studied over many years. The early studies conducted in the 1970s and 1980s reported low integration and hence a portfolio diversification opportunity existence. H. G. Grubel [3] has used the ideology of [4] and found the benefits of portfolio diversification. P. B. Kenen [5] found portfolio diversification benefits. A study conducted by [6] found increasing integration and reducing portfolio diversification opportunity. Salem *et al.* [7] found that the Middle East emerging market investors can have diversification opportunities in developed markets due to weak integration among the markets. Nguyen and Elisabeta [8] found weak to moderate integration among Asian markets from 2004 to 2014. Using the Wavelet approach, Ali, Uddin, Chowdhury, and Masih [9] found Saudi Arabia Investors could have portfolio diversification benefits in the USA, Japan, Germany, and Indian markets. Using data from 1975–2013, Lu and Vivian [10] found the portfolio diversification opportunity in developed and emerging markets for US investors.

Few researchers found that due to an increase in the market integration, the portfolio diversification opportunity reduces and hence the investors cannot get diversification benefits. Pätäri *et al.* [11] studied the emerging and frontier markets from June 2002 to December 2016 and found that the increase in the integration between the frontier & emerging markets leads to a decrease in portfolio diversification opportunities. Some researchers have found mixed results that diversification opportunity due to weak integration among the markets partially exists. Meric *et al.* [12] studied the benefits of portfolio diversification in the UK, USA, Germany, France, and Japan markets from 1997 to 2002. They found that investors could have higher benefits of diversification in the bull market and lower during the bear market period.

CONTRIBUTION TO EXISTING EMPIRICAL LITERATURE

Screening literature, I have identified certain shortcomings in the past studies. First, the majority of the past studies were conducted examining the market integration and portfolio diversification opportunities in emerging and developed markets. Very few studies were conducted on frontier markets. However, such studies (of frontier markets) are conducted for the Europe and Africa region. Second, the past studies were focusing on America, Europe and Africa region mainly. Further, the majority of such studies were limited to portfolio diversification opportunity and the examination of diversification benefits remain uncovered. Third, the majority of the past studies were done using weekly or monthly return series and not daily return series.

This study differs from the previous studies in the following manner. First, the present study is conducted on developed, emerging, and frontier markets of Asia. The past studies have focused on America, Africa, and Europe region, but the present study focuses on the Asia region. The present study is performed on 9 Asian markets (2 developed markets, 5 emerging markets, and 2 frontier markets). The markets are selected as per the MSCI market classification 2020. Second, the present study focuses on examining the portfolio diversification opportunity (through short and long-term market integration) and evaluating the portfolio diversification benefits. The study is examining the portfolio diversification benefits for the Investors of all the selected countries. The portfolio diversification benefits are examined using Equally Weighted Portfolio (EWP), Minimum Variance Portfolio (MVP), and Maximum Sharpe Portfolio (MSP). Further, the study is also examining the gain in the Sharpe ratio for international diversification with respect to the home portfolio. Third, the present study is examining the market integration using daily return series from January 2001 to December 2021.

EMPIRICAL FRAMEWORK

The present study has two objectives. 1) examining the static and dynamic integration among developed, emerging, and frontier Asian markets and 2) evaluating the portfolio diversification benefits using different portfolio diversification strategies. The study is undertaken using the daily return series covering a period from January 2001 to December 2021. Many past studies used weekly or monthly data but in order to get robust results the present study uses daily return series. Further, the study covers data until 31 December 2021 to get the latest results. The selection of the markets for the present study is done as per the Morgan Stanley Capital International (MSCI) market index 2020. The markets are reported as below:

1) MSCI Developed Asian Markets: Japan and Singapore;

2) MSCI Emerging Asian Markets: China, India, Korea, Pakistan, and Taiwan.

3) MSCI Frontier Asian Markets: Sri Lanka and Vietnam

In this study, the stock returns are calculated using the following indexes:

1. the Bombay Stock Exchange Index (BSE) for India;
2. the Colombo stock exchange All-Share (CSE) Index for Sri Lanka;
3. the FTSE Singapore Index (FTWISGPL) for Singapore;
4. the Korea Composite Stock Price Index (KOSPI) for Korea;
5. the Karachi Stock Exchange Index (KSE) for Pakistan;
6. the Nikkei 225 Index (Nikkei) for Japan;
7. the Shanghai Stock Exchange Composite Index (SSE) for China;
8. the Taiwan Weighted Index (TWII) for Taiwan; and
9. the Vietnam Ho Chi Minh Stock Index (VNI) for Vietnam.

Here, the data is collected for all the markets from January 2001 to December 2021. These indexes are selected as all the indexes are calculated based on the capitalization-weighted method. The data of daily series for all the indexes are collected from Investing.com database. As per [13], "the currency does not require to be in same currency for examining the market linkages." Hence, the present study ignores the currency issues and all the selected indexes are denoted in local currency only. All the selected markets have observed some public holidays, which leads to a missing value. The missing data affects the results and implications negatively. A study by [14], in the context of Occam's razor, has given a suggestion to use the previous day's data to fill in the missing values. Considering this, the missing data in the present study is filled with the previous day's price. All series are transformed into natural logarithms.

The short-term and long-term integration among the markets is measured using correlation, the Granger causality test, and Johnson Cointegration test. The portfolio diversification benefits are examined using three different diversification strategies, *i.e.*, Equally Weighted Portfolio (EWP), Minimum Variance Portfolio (MVP), and Maximum Sharpe Portfolio (MSP). The three-diversification strategies-based risk-return outcomes are compared with the risk-return of the home market portfolio, in order to determine diversification benefits. The equally weighted portfolio is a strategy to diversify the investment by making equal investments into different markets. The securities can hold the minimum variance portfolio when the securities hold low or no correlation with each other. The minimum variance portfolio is a well-diversified portfolio, which gives the lowest possible risk at the expected level of return. The maximum Sharpe portfolio is a well-diversified portfolio, which gives an optimal solution to maximize the Sharpe ratio. The results of the market integration and diversification benefits are reported in the empirical findings section.

EMPIRICAL FINDINGS

The empirical findings cover the 1) examination of short and long-term integration among the markets and, 2) evaluation of the portfolio diversification benefits.

Market Integration analysis

Prior to performing the integration, the normality of the data set is examined with descriptive statistics. The results of the descriptive statistics using daily return series are reported in *Table 1*.

Descriptive statistics

Table 1 shows the results of descriptive statistics for all the selected markets. The average daily returns of the markets were 0.0536%, 0.0515%, 0.0161%, 0.0356%, 0.0741%, 0.0182%, 0.0202%, 0.0261% and 0.0592% respectively for India, Sri Lanka, Singapore, Korea, Pakistan, Japan, China, Taiwan and Vietnam. All the markets have witnessed positive returns, where Pakistan witnessed the highest daily return of 0.0741% and Singapore observed the lowest daily return of 0.0161%. The average daily return standard deviation of the markets was 0.0144%, 0.0112%, 0.0113%, 0.0138%, 0.0131%, 0.0150%, 0.0154%, 0.0127%, and 0.0175% respectively for India, Sri Lanka, Singapore, Korea, Pakistan, Japan, China, Taiwan and Vietnam. Among all markets, Vietnam has the highest standard deviation of 0.0175% whereas Sri Lanka has the lowest standard deviation of 0.0112%. The financial theory on higher the risk in the market, the higher the return is failing in case of many markets. It reveals that higher risk does not gives always a higher return. The positive value of

Table 1

Descriptive statistics

Particulars	BSE	CSE	FTSE Singapore	KOSPI	KSE	NIKKEI	SSE	TWII	VNI
Mean	0.053	0.051	0.0161	0.035	0.074	0.0182	0.020	0.026	0.059
Maximum	0.173	0.200	0.0718	0.119	0.088	0.1415	0.098	0.067	0.112
Minimum	−0.1315	−0.1297	−0.2511	−0.1201	−0.0744	−0.1140	−0.0884	−0.0667	−0.1898
Std. Dev.	0.0144	0.0112	0.0113	0.0138	0.0131	0.0150	0.0154	0.0127	0.0175
Skewness	0.0600	0.092	0.0280	0.0349	0.0240	0.0195	0.0246	0.0146	0.0999
Kurtosis	13.82	12.46	18.35	9.93	6.66	9.42	7.98	6.43	5.26
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	4772	4772	4772	4772	4772	4772	4772	4772	4772

Source: author's compilation.

skewness reveals a higher probability to earn positive returns in the markets. The value of Kurtosis is more than three revealing that the data is suitable for further study.

Unit root test

A Unit root test (ADF and PP) is performed to examine the suitability of data for performing bivariate causalities. The data need to be stationary to perform further tests [15]. The ADF [16, 17] and PP test [18] are performed in EViews 9. The null hypothesis of the ADF and PP test is accepted at a 1 percent level of significance. However, the null hypothesis can be rejected at first difference which further concludes that all the series are stationary and integrated in the same order, that is, *I* (1). Hence, the data was found to be appropriate to perform the further study. Here, the table of the unit root test is not presented due to word limits.

Correlation

The short-term integration is measured with correlation. The results of the correlation are reported below (*Table 2*).

Table 2 shows the Correlation results for the daily return series of all the selected markets. India has a partial positive correlation with Singapore (0.502), Sri Lanka (0.399), Korea (0.399), Pakistan (0.425), Japan (0.519), and China (0.451). These markets are partial positively correlated with India as the coefficient is of average size in magnitude. India does not have a significant positive correlation with Taiwan and Vietnam. Sri Lanka holds positive correlation with India (0.399), Singapore (0.425), Pakistan (0.394), and Vietnam (0.415). Sri Lanka has a lower positive correlation with Korea, Japan, China, and Taiwan where the magnitude of the coefficient is very small. Singapore has a partial positive correlation with India (0.502), Sri Lanka (0.425), Japan (0.449), China (0.415), and Taiwan (0.402). Singapore has a lower positive correlation with Korea, Pakistan, and Vietnam. Korea holds a partial positive correlation with India, Japan, China, Taiwan, and Vietnam. Pakistan holds a partial positive correlation with India and Sri Lanka. Japan has a partial positive correlation with all the markets except, Sri Lanka (0.094) and Vietnam (0.058). China is correlated with all the markets except, Sri Lanka (0.073), Pakistan (0.076). Taiwan holds a very low correlation with India, Sri Lanka, and Pakistan. Vietnam is positively correlated with all the markets except India, Pakistan, and Taiwan.

Here, many markets hold a partial positive correlation with other markets, representing the average level of significance. Further, each market has a low correlation with some other markets, revealing an insignificant correlation among the markets due to the low magnitude of the coefficient. Few markets also hold no correlation (coefficient value near value 0) with other markets, revealing the lack of correlation among the markets. The majority of developed, emerging and frontier markets are not strongly correlated with each other. The insignificance and lower level of correlation reveal the lack of significant and strong integration among developed, emerging and frontier markets. This reveals

Table 2

Correlation Analysis

Markets	BSE	CSE	FTSE Singapore	KOSPI	KSE	Nikkei	SSE	TWII	VNI
BSE	1								
CSE	0.399	1							
FTSE Singapore	0.502	0.425	1						
KOSPI	0.399	0.011	0.012	1					
KSE	0.425	0.394	0.001	0.005	1				
Nikkei	0.519	0.094	0.449	0.394	0.036	1			
SSE	0.451	0.073	0.415	0.471	0.076	0.479	1		
TWII	0.093	0.008	0.402	0.408	0.010	0.423	0.515	1	
VNI	0.024	0.415	0.081	0.396	0.008	0.058	0.445	0.032	1

Source: author's compilation.

the existence of portfolio diversification opportunities among the markets.

Granger causality test

Table 3 shows the results of the Granger causality test [19]. India has a bidirectional relationship with Singapore, Japan, and China. India does granger cause to Sri Lanka, Korea, and Pakistan. Sri Lanka has a bidirectional granger cause with Vietnam. Singapore holds a unidirectional granger cause to Sri Lanka, Japan, and Taiwan. Korea holds a bidirectional granger cause with Japan and China markets. Pakistan holds a unidirectional relationship with Sri Lanka. Japan has a bidirectional granger cause with India, Korea, and China. Japan has a unidirectional granger cause with Taiwan. China holds relationships with all the markets, except Pakistan. Taiwan does granger cause to Korea.

Here, among those markets that hold the granger cause, the majority holds a unidirectional relationship. Some of the markets hold bidirectional relationships with other markets. Further, some of the markets are not integrated with each other. Each developed, emerging, and frontier market is not integrated with other markets and hence offers a portfolio diversification opportunity. Among all the markets, Pakistan (Emerging markets) and Sri Lanka (Frontier markets) are the least integrated with other markets and offer more diversification opportunities. The lack of integration among some markets provides a portfolio diversification opportunity for investors.

The Johansen Cointegration test [20] is applied to measure the long-term integration among the markets. The results of the Cointegration test are reported (*Table 4*). Here, the H0 of no co-integration among the markets is rejected at a 1 per cent level of significance for many instances. India holds long-term Co-integration with all the markets, except Taiwan and Vietnam. Sri Lanka does not have long-term Cointegration with Korea, Japan, China, and Taiwan. Singapore is integrated long-term with all the markets except Korea, Pakistan, and Vietnam. Korea has long-term co-integration with India, Japan, China, Taiwan, and Vietnam. Pakistan is the least integrated market, holding long-term integration with India and Sri Lanka. Japan holds long-term integration with all the markets, except Sri Lanka, Pakistan, and Vietnam. China is the most integrated market among all the markets. China holds long-term integration with all the markets, except Sri Lanka and Pakistan. Taiwan has long-term integration with Singapore, Korea, Japan, China, and Vietnam. Vietnam holds long-term integration with all the markets, except India, Pakistan, and Taiwan.

The market, which holds long-term integration with other markets, has a significant value of trace statistics and Maximum Eigen Statistics. In all such market integration, the trace value is more than the critical value. This reveals the existence of a long-term relationship among the markets. However, each market

Table 3

Granger causality test results

Markets	BSE	CSE	FTSE Singapore	KOSPI	KSE	Nikkei	SSE	TWII	VNI
BSE	-	→	↔	→	→	↔	↔	≠	≠
CSE	≠	-	≠	≠	≠	≠	≠	≠	↔
FTSE Singapore	↔	→	-	≠	≠	→	≠	→	≠
KOSPI	≠	≠	≠	-	≠	↔	↔	≠	≠
KSE	≠	→	≠	≠	-	≠	≠	≠	≠
Nikkei	↔	≠	≠	↔	≠	-	↔	→	≠
SSE	↔	≠	→	↔	≠		-	↔	→
TWII	≠	≠	≠	→	≠	≠	↔	-	≠
VNI	≠	↔	≠	→	≠	≠	≠	≠	-

Source: compiled by the author.

Notes: The Symbol ↔ shows bidirectional relationship among the markets. The Unidirectional relationship among the markets is indicated by →. The symbol ≠ indicates no integration among the markets.

Table 4

Johansen Cointegration test results

Markets	BSE	CSE	FTSE Singapore	KOSPI	KSE	Nikkei	SSE	TWII	VNI
BSE	-	=	=	=	=	=	=	≠	≠
CSE	=	-	=	≠	=	≠	≠	≠	=
FTSE Singapore	=	=	-	≠	≠	=	=	=	≠
KOSPI	=	≠	≠	-	≠	=	=	=	=
KSE	=	=	≠	≠	-	≠	≠	≠	≠
Nikkei	=	≠	=	=	≠	-	=	=	≠
SSE	=	≠	=	=	≠	=	-	=	=
TWII	≠	≠	=	=	≠	=	=	-	=
VNI	≠	=	=	=	≠	=	=	≠	-

Source: compiled by the author.

Notes: Here, = Indicates the integration among the markets, ≠ Indicates the no integration among the markets.

is not integrated with some of the selected markets, and hence the portfolio diversification opportunity exists for the investors. The lack of long-term integration among some markets provides a diversification opportunity for investors.

Portfolio Diversification Benefits

Table 5 shows the portfolio diversification for the investors of all the countries based on the integration analysis. The portfolio for each market is constructed using the daily return series (converted into annual returns) from January 2001 to December 2021. I then compared the non-diversified portfolio (home market) with the diversified portfolios (Equal Weighted Portfolio (EWP), Minimum Variance Portfolio (MVP), and Maximum Sharpe Portfolio (MSP). The objective of this analysis is to examine whether the diversification benefits exist or not.

The Indian Investors could not gain from the EWP strategy. The investors could earn a higher Sharpe ratio with the MVP (4.26) & MSP (4.59) as compared to the home market (3.72). The portfolio allocation as per MVP strategy consists of higher allocation in Taiwan (51.7%), India's home market (30.5%) and Vietnam (17.8%). The MSP consists of the investment holdings in India's home stocks (41.1%), Taiwan (30.7%), and Vietnam (28.2%).

The Sri Lankan Investors could gain in return for a unit of risk in the MVP (4.96) & MSP (5.32) as compared to the home market (4.60). The investors could have the lowest risk portfolio with major investment holdings in Japan (48%), Sri Lanka home stocks (18%), Taiwan (17%), and Korea (12%). The investors could achieve MSP with investment holdings in Sri Lanka home stocks (55%), Japan (21%), Korea (18%), and China (6%). Here, it is observed that Taiwan does offer the diversification opportunity to the investors of Sri Lanka but does not give the highest Sharpe ratio. The portfolio diversification could result in better return and Sharpe ratio for investors of Singapore. The Investors could earn the highest return per unit of risk with a value of 6.66 as per the MSP strategy. The Investors could have the lowest risk with the investment allocation of 46%, 34%, and 20%, in Singapore's home market, Korea and Pakistan, respectively. The investors could gain maximum Sharpe with the investment allocation in Pakistan (62.3%), Vietnam (22.2%), and Korea (15.5%).

The diversification could result in lower risk, better return, and a higher Sharpe ratio for Korean investors. The investors could have the lowest risk-based portfolio with an investment allocation in Pakistan (31%), Singapore (26%), Korea (25%), and Sri Lanka (18%). The investors could have the highest Sharpe of 9.44 with major investment holdings in Pakistan (57%), Sri Lanka (21%), and Singapore (15%). The Pakistani Investors could not gain from the EWP. However, the investors could earn better Sharpe in the diversification (MVP — 5.89 & MSP — 6.15) as compared to the home market (5.65). The investors could reduce the risk to the lowest level of 2.70% with the investment allocation in Pakistan's home market (45%), Japan (25%), China (22%), and Singapore (8%). The MSP would consist major investment holdings in Japan (42%), Singapore (23%), Pakistan home stocks (16%), Taiwan (11%), Vietnam (8%). China and Korea offer diversification opportunities to Pakistani investors but can't offer the highest Sharpe ratio.

The Japanese investors could have higher returns, lower risk, and a better Sharpe ratio on the diversification of investment. The investors could have a higher Sharpe ratio in diversification, i.e., EWP (3.56), MVP (5.68) and MSP (6.67) as compared to the home market (1.21). The portfolio allocation results of the Japanese investors show that the largest percentage of the investment holding would consist of Sri Lanka (37.7), Japan's home stocks (24.3%) and Pakistan (23.4%) in MVP. The investment holdings in the MSP consist of Pakistan (56.3%), Vietnam (22.1%), Japan's home market (8%), and Sri Lanka (21.6%).

The results reveal that Chinese investors could earn higher returns and Sharpe ratio in the diversification of investment. The equally weighted Portfolio with 17.56% could have guaranteed the highest average return. On the other hand, the maximum Sharpe portfolio would have been providing the highest return for a unit of risk as indicated by its Sharpe value of 6.23. The investors can have the maximum Sharpe ratio with investment allocation in Sri Lanka (57.7%) and Pakistan (42.3%). The portfolio allocation results for the MVP show that the largest percentage of holding would consist of Sri Lanka (57.2%), China home stocks (24.3%), and Pakistan (18.5%).

The outcome shows that Taiwanese investors could gain better in return and Sharpe ratio with the diversification of the investment. The Investors could earn higher return in the diversification strategies i.e., EWP (18.73%), MVP (10.94%) & MSP (20.59%) as compare to home market (9.53%). The investors could have the lowest risk of 1.99% as per MVP with major investment allocation in Taiwan's home market (36.1%), Sri Lanka (35.2%), Pakistan (19%), and India (9.6%). The investors could have the highest Sharpe ratio of 6.56 with major investment allocations in Pakistan (42.7%), Sri Lanka (31%), Taiwan's home market (19.2%), and India (7.10%). The Vietnam investors could gain better Sharpe in the diversification as compared to the home market. The investors could have the lowest risk of 3.00% with MVP. The portfolio allocation results show that the largest percentage of holding would consist of Taiwan (39.8%), Pakistan (35.1%), Vietnam's home market (18.3%), and India (6.8%). The diversification as per MSP could results in the highest Sharpe of 6.79, with major investment allocation in Pakistan (56.3%), Vietnam home stocks (24.3%) and Taiwan (19.50%).

The outcome reveals that the Investors could gain wealth with the diversification of investment portfolios to international markets. The investors could have better returns, lowest risk, and highest Sharpe with the

Table 5

Portfolio diversification benefits

Market	Home Market				Equally Weighted Portfolio			
	Return (%)	SD (%)	Sharpe Ratio	Portfolio Allocation (%)	Return (%)	SD (%)	Sharpe Ratio	Portfolio Allocation (%)
BSE	19.56	5.26	3.72	BSE – 100	16.73	5.38	3.10	33.33% in each market – India, Taiwan & Vietnam
CSE	18.80	4.09	4.60	CSE – 100	11.06	4.98	2.21	20% in each market – Sri Lanka, Korea, Japan, China, and Taiwan
FTSE Singapore	5.88	4.13	1.42	FTSE Singapore – 100	16.88	5.09	3.31	25% in each market – Singapore, Korea, Pakistan, Vietnam
Kospi	12.99	5.06	2.56	Kospi – 100	18.17	4.51	3.58	20% in each market – Korea, Sri Lanka, Singapore, Pakistan
KSE	27.05	4.79	5.65	KSE – 100	12.93	5.13	2.51	14.2% in each market – Pakistan, Singapore, China, Korea, Japan, Taiwan, Vietnam
Nikkei	6.64	5.49	1.21	Nikkei – 100	18.52	5.19	3.56	25% in each market – Japan, Sri Lanka, Pakistan, Vietnam
SSE	7.37	5.65	1.30	SSE – 100	17.56	4.79	3.66	33.33% in each market – China, Sri Lanka, Pakistan
TWII	9.53	4.64	2.05	TWII – 100	18.73	4.69	3.99	25% in each market – Taiwan, India, Sri Lanka, Pakistan
VNI	21.61	6.42	3.36	VNI – 100	19.43	5.27	3.68	25% in each market – Vietnam, India, Pakistan, Taiwan
Market	**Minimum Variance Portfolio**				**Maximum Sharpe Portfolio**			
	Return (%)	SD (%)	Sharpe Ratio	Portfolio Allocation (%)	Return (%)	SD (%)	Sharpe Ratio	Portfolio Allocation (%)
BSE	14.74	3.46	4.26	BSE – 30.5, TWII – 51.7, VNI – 17.8	17.06	3.72	4.59	BSE – 41.1, TWII – 30.7, VNI – 28.2
CSE	10.12	2.04	4.96	CSE – 18.0, Kospi – 12.0, Nikkei – 48.0, SSE – 5.0, TWII – 17.0	14.52	2.73	5.32	CSE – 55.0, Kospi – 18.0, Nikkei – 21.0, SSE – 6.0, TWII – 0.0
FTSE Singapore	12.53	3.01	4.16	FTSE Singapore – 46.0 Kospi – 34.0, KSE – 20.0, VNI – 0.0	23.66	3.55	6.66	FTSE Singapore – 0, Kospi – 15.5, KSE – 62.3, VNI – 22.2
Kospi	16.54	2.10	7.86	CSE – 18.0, FTSE Singapore – 26.0 Kospi – 25.0, KSE – 31.0	21.16	2.24	9.44	CSE – 21.0, FTSE Singapore – 15.0, Kospi – 7.0, KSE – 57.0
KSE	15.92	2.70	5.89	FTSE Singapore – 8, Kospi – 0, KSE – 45, Nikkei – 25.0, SSE – 22.0, TWII – 0, VNI – 0.0	17.40	2.83	6.15	FTSE Singapore – 23, Kospi – 0, KSE – 16, Nikkei – 42.0, SSE – 0, TWII – 11.0, VNI – 8.0
Nikkei	18.18	3.20	5.68	CSE – 37.7, KSE – 23.4, Nikkei – 24.3, VNI – 14.5	24.07	3.61	6.67	CSE – 21.6, KSE – 56.3, Nikkei – 8, VNI – 22.1
SSE	17.54	3.40	5.15	CSE – 57.2, KSE – 18.5, SSE – 24.3	23.56	3.78	6.23	CSE – 42.3, KSE – 57.7, SSE – 0
TWII	10.94	1.99	5.51	BSE – 9.6, CSE – 35.2, KSE – 19.0, TWII – 36.1	20.59	3.14	6.56	BSE – 7.10, CSE – 31.0, KSE – 42.7, TWII – 19.2
VNI	18.57	3.00	6.18	BSE – 6.8, KSE – 35.1, TWII – 39.8, VNI – 18.3	22.32	3.29	6.79	BSE – 0, KSE – 56.3, TWII – 19.50, VNI – 24.3

Source: compiled by the author.

Table 6

Gain in Sharpe ratio

Market	Equally Weighted Portfolio		Minimum Variance Portfolio		Maximum Sharpe Portfolio	
	Δ SR	Δ SR%	Δ SR	Δ SR%	Δ SR	Δ SR%
India	–0.62	–16.69%	0.54	14.48%	0.87	23.35%
Sri Lanka	–2.39	–51.92%	0.36	7.92%	0.72	15.75%
Singapore	1.89	132.73%	2.74	192.49%	5.24	368.27%
Korea	1.01	39.42%	5.29	206.10%	6.87	267.63%
Pakistan	–3.14	–55.58%	0.24	4.25%	0.50	8.85%
Japan	2.35	194.11%	4.47	369.26%	5.46	451.04%
China	2.36	180.62%	3.85	294.87%	4.93	377.67%
Taiwan	1.94	94.47%	3.46	168.55%	4.51	219.73%
Vietnam	0.31	9.32%	2.81	83.58%	3.42	101.70%

Source: compiled by the author.

Note: The Δ in Sharpe Ratio (SR) and the Δ% in Sharpe ratio (SR) represents the change with respect to home portfolio.

diversification of investment. During the analysis, it was observed that the market has diversification opportunities with other markets, but not all such markets could give diversification benefits. The investors could have the lowest risk and highest Sharpe with the diversification strategies but the investors do not require diversifying their investment to all the markets. In other words, few markets that offer diversification opportunities could not offer diversification benefits. The analysis of the gains from the portfolio diversifications is shown below.

Gains from the International diversifications

Table 6 shows the results of gains from the international diversification from perspective of investors. Here, the Sharpe ratio of EWP, MVP & MSP is compared with the Sharpe ratio of home markets, to examine the gains from the international diversifications.

The Indian investors could not gain from diversification by adopting the EWP strategy. The investors could have gained in the Sharpe ratio by 14.48% on adopting MVP and 23.35% on adopting the MSP strategy. The Sri Lankan investors could gain in Sharpe ratio by 7.92% and 15.75% on adopting MVP & MSP strategies, respectively. The EWP strategy leads to wealth loss (in Sharpe ratio) of –51.92% for Sri Lankan investors. The investors from Singapore could have gained significantly by adopting the diversification strategies. The Singapore investors could have increased their Sharpe ratio by 1.32, 1.92 & 3.68 times on adopting EWP, MVP & MSP, respectively. The Korean Investors could have gained the Sharpe ratio by 39.42% on adopting EWP, 206.10% on adopting MVP, and 267.63% on adopting MSP as a diversification strategy. The investors of Pakistan could have a loss of 56% in the Sharpe ratio on adopting EWP as a diversification strategy. The investors could gain in Sharpe ratio by 4.25% on adopting MVP & 8.55% on adopting MSP as a diversification strategy. Japanese investors could have gained in the Sharpe ratio by 1.94, 3.69 and 4.51 times, by adopting EWP, MVP & MSP strategies, respectively. The Chinese investors could gain in Sharpe significantly by adopting diversification as compared to investing in the home market. The Investors of China could have gained the Sharpe of their investment by 1.80, 2.94 & 3.77 times by adopting EWP, MVP & MSP diversification strategies, respectively. The Taiwan Investors could have gained a Sharpe ratio of 94.47% by adopting EWP, 168.55% by adopting MVP, and 219.73% by adopting MSP as a diversification strategy. The Investors from Vietnam witnessed an increase in the Sharpe ratio from all the strategies. However, the investors do not gain significantly from the EWP Strategy. The Investors could increase the Sharpe ratio of their investment by 83.58% on adopting MVP Strategy and 101.70% on adopting MSP Strategy.

The outcome reveals that the investors could gain from the diversification of portfolios. The EWP

remains beneficial for the investors of all the countries, except India, Sri Lanka & Pakistan. The investors of all the countries could have gained significantly in the Sharpe ratio by adopting MVP & MSP strategies. The diversification of the investment as pre-MVP and MSP strategies could result in significant gains in wealth for the investors. Diversification can result in a better risk-return tradeoff for the investors.

CONCLUSION AND IMPLICATIONS

The objective of the study was to examine the existence of portfolio diversification opportunities and measure the diversification benefits. The study is performed on 9 indexes (2 developed markets, 5 emerging markets, and 2 frontier markets) covering a period from January 1, 2001, to December 31, 2021.

Many markets hold a partial positive correlation with other markets, representing an average level of significance. Each market has a very low magnitude correlation with some other markets. Few markets do not have a correlation with some other markets. The insignificance and lower level of correlation reveal the lack of significant and strong integration among the markets, which reveals the existence of portfolio diversification opportunity. The study measured short and long-term integration among the markets. The outcome of the Granger causality and Johansen Cointegration test reveals majority of the markets are integrated with each other. However, still some of the markets do not have short and long-term integration with other markets, which proves the existence of portfolio diversification opportunities. The integration measurement reveals the portfolio diversification opportunity for the developed markets in frontier and emerging markets. The frontier market can diversify its investment to emerging markets. The emerging markets have limited diversification opportunities within emerging and frontier markets due to integration with each other.

The study has implications for the investors with respect to their investment portfolio. Based on the lack of integration among the market, the potential benefits of the portfolio diversification for the investors of all the markets are measured. The non-diversified portfolio (home market) is compared with the diversified portfolios (EWP, MVP, MSP) to measure the potential benefits of diversification. The result reveals that investors can have significant gain in wealth with investment diversification. The investors could earn better returns, lowest risk, and highest Sharpe with the diversification of investment. Investors can have diversification opportunities in many possible markets but the diversification benefits realize in certain markets only. Hence, the investors should invest in such markets where the diversification benefits can actually be realized. The diversification strategies can result in a significant gain in the Sharpe ratio and a better risk-return tradeoff for the investors. Among all, the minimum variance portfolio (MVP) and maximum Sharpe ratio strategies can give the maximum benefits to the investors. The investors can allocate their funds in a particular proportion to different markets to get the best risk-return tradeoff out of their investment.

The present study is limited to the Asian region only. The emerging and frontier markets offer better diversification opportunities due to the growing economic phase. Thus, in future, more such studies can be conducted to measure the portfolio diversification opportunity and potential benefits by adding the emerging and frontier markets of other regions.

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