

# MARKET INTEGRATION AND PORTFOLIO DIVERSIFICATION BENEFITS: A STUDY OF SELECTED DEVELOPED, EMERGING, AND FRONTIER MARKETS

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**Abstract** *The objective of the study is to examine the integration and portfolio diversification opportunities for developed, emerging, and frontier markets. The lack of long-term integration among the markets reveals the existence of portfolio diversification opportunities. Short-term integration was measured by correlation and Granger causality test, whereas long-term integration was examined by the cointegration test. The results of diversification benefits reveal that investors from Canada, France, and Switzerland experience higher returns, lower risks, and a better Sharpe ratio with the diversification of the portfolio. The US investors do not gain much from diversification, as the home market offers better returns. The maximum Sharpe ratio offers the highest Sharpe to the investors, whereas the minimum variance portfolio offers the lowest risk. The study has implications for investors in terms of investment allocation to respective markets for wealth gain in their portfolio. The investors can design their investment portfolio either to keep the risk to the lowest level or achieve a higher Sharpe ratio.*

**Keywords:** *Market Integration, Portfolio Diversification, Developed Markets, Emerging Markets, Frontier Markets*

**JEL Classification Codes:** *F15, F21, G11, G15*

## INTRODUCTION

Due to globalisation, the markets become more integrated with each other. With the passage of time, the correlation among the markets has increased, which has reduced opportunities of portfolio diversification for the investors. The investors are concerned about market integration, with respect to the portfolio diversification opportunities (Click & Plummer, 2005; Patel, 2019; Patel, 2021). Markets with trade also result in increased integration (Patel, 2019; Patel, 2017), which is a growing concern among the shareholders (Patel, 2019). Regional associations become drivers of the financial market integration (Patel, 2021; Patel, 2016; Patel & Patel, 2012). The market integration and portfolio diversification opportunities remain two of the most important topics of study in the financial markets. Investors are interested in the financial markets' integration due to portfolio diversification benefits in the international markets. However, the existence of diversification opportunities does not guarantee potential benefits from the diversification. Hence, the researchers are interested in examining the diversification benefits to determine whether diversification can result in benefit for the

investors. Apart from investors, the government and MNCs are interested in market integration as well, as it affects their decision making.

As per the MSCI market classification framework 2020, the USA and Canada are developed markets in the North American region. France and Switzerland are the developed markets in the European region. India, Brazil, and Hungary are the emerging markets in the Asian, American, and European regions, respectively. Romania, Nigeria, and Jordan are the frontier markets in the European, African and Asian regions, respectively. These markets contribute significantly to the world gross domestic product (GDP). The world GDP (PPP at current international \$) from 2009 to 2020 is shown in Fig. 1. Brazil, Canada, France, Hungary, India, Jordan, Nigeria, Romania, Switzerland, and the US contributed 30% to the world GDP from 2009 to 2020. This reveals that the selected markets contribute to one-third of the world GDP. These countries are supported by increased consumption, increased international trade, and global investments.

The present study examines the integration of developed markets (US, Canada, France and Switzerland) with

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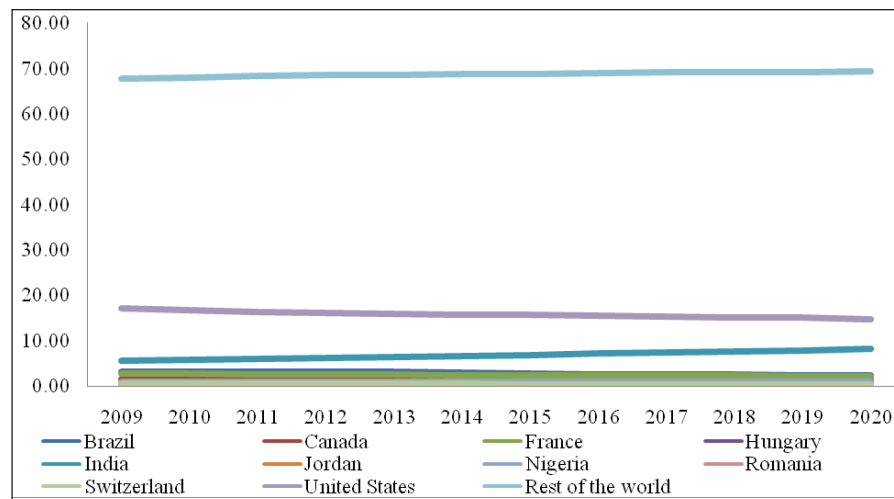


Fig. 1: GDP Contribution by Selected Countries

emerging markets (India, Brazil and Hungary) and frontier markets (Romania, Nigeria and Jordan). The study also focuses on determining the portfolio diversification opportunities for the developed markets in the emerging and frontier markets, based on market integration. The rest of the paper is structured as follows: section 2 covers the review of past studies and contribution of study to existing literature; research methodology is covered in section 3; section 4 reports the data analysis; and the conclusion and implications of the study are covered in section 5.

## LITERATURE REVIEW

### Review of Past Studies

In the past, many researchers have studied the integration among the financial market to evaluate the possibilities of portfolio diversification. In 1970s and 1980s, many researchers studied market integration and portfolio diversification. In a study, Grubel (1968) has revealed the benefits of portfolio diversification with respect to market integration. In a study, Subrahmanyam (1975) has also found a link between portfolio diversification opportunities and market integration. A lower portfolio diversification opportunity among the European markets due to strong integration was observed in a study conducted by Neal (1985). In the 1990s, researchers examined the existence of portfolio diversification opportunities. A study by Bekaert and Harvey (1995) found narrow diversification opportunities due to strong integration among the emerging markets. Due to stronger bilateral trade, the markets become more integrated, thus offering a narrowed portfolio diversification opportunity (Broker et al., 1999).

In the past, many researchers have found the existence of portfolio diversification opportunities with respect to market integration. In a study, Ibrahim (2006) found a lack of integration among the markets in the long run, and hence, portfolio diversification opportunities exist. Using the DCC-MGARCH model, Lee and Jeong (2014) studied the integration among the markets of Northeast Asia and Europe during 2000 to 2012. The study found the existence of the portfolio diversification opportunities due to weak integration among the markets. By applying the GARCH Model, Balcilar et al. (2015) found that the GCC markets (Saudi Arabia, UAE, Kuwait, Qatar, Bahrain and Oman) are not integrated, and hence, offer portfolio diversification opportunities. The study found that the investors could gain wealth with the diversification of investments.

Using correlation and cointegration test, Majdoub et al. (2016) found weak integration of the Indonesian market with the markets of France, the UK, and the US during 2008 to 2013. This further reveals the existence of portfolio diversification opportunities for the investors. In a study, Thomas et al., (2017) studied the integration among developed, emerging, and frontier markets of Asia, covering the years 2000 to 2016. The study found that the emerging and frontier markets are less integrated with developed markets, and hence, offer portfolio diversification opportunities. Using wavelet analysis, Das and Manoharan (2019) studied the integration among South Asian markets and found that India and Pakistan offer portfolio diversification opportunities due to weak integration among the markets.

Some researchers have found that the market remains integrated in the long term, and hence, portfolio diversification opportunities remain narrowed. In a study, Srivastava (2007)

examined the integration among the markets of India, Hong Kong, Indonesia, Japan, Malaysia, Korea, Singapore, Taiwan, and the USA, covering the period 1997 to 2006. The researcher found that the markets became more integrated with time, and hence, portfolio diversification opportunities are narrowed. In a study, Ansari (2009) studied the integration among the markets of Australia, Canada, France, Germany, Hong Kong, Japan, Singapore, the UK, and the USA, covering the period 1990 to 2005. The researchers applied Johnson integration test and found that due to globalisation the markets became more integrated, and hence, portfolio diversification opportunities are narrowed.

Using integration techniques, Seth and Sharma (2015) studied the integration among the US and Asian markets during 2001 to 2010. The study found that the Asian and the US market become integrated and the portfolio diversification opportunities become insignificant. Using integration techniques, Boamah (2017) studied the integration among the emerging markets of America, Africa and Asia. The study found that the emerging markets became more integrated after the 2008 global financial crisis, which narrowed the portfolio diversification opportunities. By applying the cointegration techniques, Dutta (2017) examined the integration of the US market with China and Brazil markets during 2011 to 2016. The study found that the high correlation among the markets indicates strong integration and lower opportunities for portfolio diversification. Using integration techniques, Rahman et al. (2017) examined the integration among the markets of China, Japan, Korea, Malaysia, Indonesia, Philippines, Thailand, and Singapore during 1992 to 2013. The researchers applied VAR and the VECM model and found that the markets hold strong integration, and hence, do not offer portfolio diversification opportunities.

Few researchers found that as all the markets do not hold similar levels of integration with the other markets, such markets offer portfolio diversification opportunities in a limited context. Using cointegration techniques, Tripathi and Sethi (2010) examined the integration of the Indian market with the markets of Japan, the UK, the USA, and China, covering the period 1998 to 2008. The study found that the Indian market is integrated with the US market, but not with the markets of the UK, Japan, and China. Hence, Indian investors have portfolio diversification opportunities in the UK, Japan, and China. By applying the cointegration test and VECM approach, Palamalai et al. (2013) studied integration among the emerging Asia-pacific markets during 1992 to 2009. The study found that the markets were integrated in the long-run. However, the markets were not integrated in the short-run, thus offering portfolio diversification opportunities. Using correlation and cointegration techniques, Mohti et al. (2019) examined the regional global

level integration among the Asian markets from 2009 to 2017. The study found that a majority of the markets have a long-term integration with each other. However, a few markets do not have integration with other markets, and hence, offer opportunities for portfolio diversification. Using Granger causality, Johnson cointegration, and impulse response analysis, Al-Mohamad et al. (2020) found that the BRICS markets were more integrated post-BRICS formation. However, China still remains an independent market, offering diversification opportunities in a limited context. Using integration techniques, Anyikwa & Roux (2020) studied the integration among the markets of Egypt, Kenya, Mauritius, Morocco, Nigeria, South Africa, Tunisia, France, Germany, the UK, and the US, during 2003 to 2018. The researchers applied dynamic conditional correlation and found that the markets became integrated with time and offers limited diversification opportunities.

## Research Gap

On screening past studies, some shortcomings were found, where a future study can be conducted. First, the past studies were focused on the developed and emerging markets only. Till date, a study has not been conducted on the developed markets from the North America and Europe regions, with emerging and frontier markets from Asia, Europe, and America. Hence, the present study covers India, Brazil and Hungary as emerging markets; the US, Canada, France, and Switzerland as developed markets; and Jordan, Nigeria and Romania as frontier markets. Second, a majority of the past studies were limited to the evaluation of the existence of the portfolio diversification opportunities. However, the present study also examines the benefits of portfolio diversification for the investors of all the developed markets. The study focuses on the portfolio diversification benefits for the investors of developed countries on diversifying their investment to emerging and frontier markets. In order to fulfill the research gap, the present study focuses on developed, emerging, and frontier markets from different regions of the world.

## RESEARCH METHODOLOGY

The study has 2 objectives:

- to examine the integration of developed markets (the USA, Canada, France, and Switzerland) with emerging markets (India, Brazil, and Hungary) and frontier markets (Romania, Jordan; and Nigeria); and
- to evaluate the portfolio diversification benefits for the investors of developed markets in the emerging and frontier markets.

The study is performed using a weekly returns series from 1 June 2009 to 31 December, 2020.

The study is performed using the following indexes:

- Amman SE General (ASE) for Jordan;
- Bovespa (BVSP) for Brazil;
- BSE Sensex 30 index (BSE) for India;
- Bucharest Exchange Trading index (BETI) for Romania;
- Budapest SE (BUX) for Hungary;
- CAC 40 index (CAC 40) for France;
- NASDAQ composite index (NASDAQ) for USA;
- NSE All Share (NGSEI) for Nigeria;
- S&P/TSX composite index (S&P TSX) for Canada; and
- SSM index for Switzerland (SMI).

The weekly data for all the indexes are taken from the investing.com database. The indexes are taken in their local currency value by ignoring the currency issue. In a study, Ding et al. (1999) revealed that the two indices are required to be in the same currency for applying the cointegration techniques. In order to overcome the problem of time difference when analysing international stock markets, the present study is conducted using the weekly returns. Past

studies also support the usage of weekly data for avoiding the time difference problem (Lo & MacKinlay, 1990; Burns et al., 1998; Sheng & Tu, 2000).

The integration among the markets is examined by applying correlation, Granger causality test (Granger, 1986), and Johnson cointegration test (Johansen, 1988; Johansen & Juselius, 1990). The lag length in all these tests is determined by (Akaike, 1974) the information criteria. After examining the market integration, the portfolio combinations are examined to measure the diversification benefits. The portfolio diversification benefits are measured by comparing the risk-returns in the home market portfolio, with diversified portfolio strategies (equally weighted portfolio, minimum variance portfolio, and maximum Sharpe portfolio).

## EMPIRICAL ANALYSIS

The empirical analysis covers 2 different parts. The first part covers market integration analysis to examine the existence of portfolio diversification opportunities, and the second part consists of examining the diversification benefits and gain in Sharpe ratio for the investors of all the developed markets.

### Market Integration Analysis

#### Descriptive Statistics

**Table 1: Descriptive Statistics**

Particulars	ASE	BETI	BSE	BUX	BVSP	CAC 40	NASDAQ	NGSEI	S & P TSX	SMI
Mean	0.0008	0.0020	0.0019	0.0017	0.0015	0.0010	0.0034	0.0002	0.0009	0.0013
Median	0.0008	0.0028	0.0027	0.0017	0.0030	0.0028	0.0043	0.0000	0.0027	0.0031
Maximum	0.0621	0.1095	0.1293	0.1125	0.1801	0.1078	0.1058	0.1690	0.0949	0.0680
Minimum	-0.058	-0.1880	-0.122	-0.169	-0.188	-0.1986	-0.1263	-0.134	-0.1520	-0.1406
Std. Dev.	0.0128	0.0267	0.0241	0.0277	0.0318	0.0281	0.0246	0.0287	0.0199	0.0213
Skewness	0.1421	-1.1634	-0.111	-0.762	-0.239	-0.8170	-0.5513	0.0904	-1.4529	-1.4864
Kurtosis	6.28	12.11	6.22	7.77	7.38	8.48	6.10	8.66	13.70	10.60
Jarque-Bera	266.31	2162.83	255.26	615.29	475.28	802.41	265.62	784.36	3007.37	1631.21
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	587	587	587	587	587	587	587	587	587	587

Source: Author’s calculation.

Table 1 shows the results of the descriptive statistics of the selected markets. The results are for 587 weekly returns series. Jordan, Romania, India, Hungary, Brazil, France, the USA, Nigeria, Canada, and Switzerland have weekly average returns of 0.0008%, 0.0020%, 0.0019%, 0.0017%, 0.0015%, 0.0010%, 0.0034%, 0.0002%, 0.0009%, and 0.0013%, respectively. Jordan, Romania, India, Hungary, Brazil, France, the USA, Nigeria, Canada, and Switzerland

have weekly average standard deviations of 0.0128%, 0.0267%, 0.0241%, 0.0277%, 0.0318%, 0.0281%, 0.0246%, 0.0287%, 0.0199%, and 0.0213%, respectively. Among all the markets, the USA has the highest weekly average returns and Jordan the lowest. Brazil has the highest standard deviation in average weekly returns and Jordan has the lowest risk. The theory of ‘higher the risk, higher the returns’ is proved true in the case of Jordan, where both the risk and

returns are lower. However, the theory of ‘higher the risk, higher the returns’ does not hold true for other markets (Brazil holds the highest risk and the USA offers the highest returns). The skewness value is more than zero,

which proves that the data is fit for performing further study. The kurtosis value is more than three; this proves that the data is fit for study. The data is found fit for further tests.

## Correlation

**Table 2: Correlation**

Markets	ASE	BETI	BSE	BUX	BVSP	CAC 40	NASDAQ	NGSEI	S & P TSX	SMI
ASE	1									
BETI	0.0468	1								
BSE	-0.0327	0.0713	1							
BUX	-0.0071	0.4715	-0.0081	1						
BVSP	-0.0268	0.3398	-0.0416	0.4700	1					
CAC 40	0.0110	0.4643	-0.0816	0.6042	0.5929	1				
NASDAQ	-0.0529	0.4286	-0.0093	0.4736	0.5579	0.7348	1			
NGSEI	0.0051	0.2118	0.1237	0.1206	0.1079	0.1395	0.0828	1		
S & P TSX	-0.0073	0.4444	-0.0347	0.5244	0.6494	0.7455	0.7876	0.1320	1	
SMI	-0.0073	0.4087	-0.05447	0.5201	0.4640	0.7873	0.6760	0.1302	0.6411	1

Source: Author’s calculation.

Table 2 shows the correlation analysis among the selected markets. Here, the correlation is performed to examine the short-term integration of all the developed markets with the other frontier and emerging markets. France has partial positive correlation only with Hungary (0.6042), Brazil (0.5929), and Romania (0.4643). France has very low correlation with Nigeria and Jordan, and a negative correlation with India. The USA holds partial positive correlation with Brazil (0.5579), Hungary (0.4736), and Romania (0.4286). The USA has very low correlation with

Nigeria, and a negative correlation with India and Jordan. Both Canada and Switzerland have a partial positive correlation with Brazil, Hungary, and Romania. Canada and Switzerland hold very low correlation with Nigeria, and a negative correlation with India and Jordan. Here, the developed markets hold partial positive correlation only with some markets. The developed markets have very low, negative correlation with other emerging and frontier markets, which reveals the existence of portfolio diversification opportunities for the investors of the developed markets.

## Unit Root Test

**Table 3: Unit Root Test**

Markets	ASE	BETI	BSE	BUX	BVSP	CAC 40	NASDAQ	NGSEI	S & P TSX	SMI	
Level	ADF	-42.58	-45.58	-65.43	-34.58	-54.58	-67.38	-63.5	-68.75	-65.81	-32.48
	PP	-43.52	-45.24	-65.39	-34.68	-54.67	-67.58	-63.62	-68.79	-66	-70.02

Source: Author’s calculation.

Table 3 shows the results of the unit root test. To check the stationarity of the data, augmented Dickey-Fuller test (Dickey, 1979, 1986) and Phillips-Perron Test (Phillips, 1988) are performed. The unit root test is

performed in the Eview 9 Software. The null hypothesis is rejected for all the markets. This reveals that the data is fit for performing the Granger causality test and Johnson cointegration test.

## Granger Causality Test

Table 4: Granger Causality Test

	Caused to										
	Markets	Developed Markets			Emerging Markets			Frontier Markets			
		USA	Canada	France	Switzerland	India	Brazil	Hungary	Romania	Nigeria	Jordan
Caused by	USA	-	-	-	-		≠	≠	≠	≠	≠
	Canada	-	-	-	-	→	≠	≠	≠	≠	≠
	France	-	-	-	-	→	≠	≠	≠	≠	≠
	Switzerland	-	-	-	-	→	≠	≠	≠	≠	≠
	India	↔	→	→	≠	-	-	-	-	-	-
	Brazil	→	→	→	→	-	-	-	-	-	-
	Hungary	≠	≠	→	→	-	-	-	-	-	-
	Romania	→	≠	→	→	-	-	-	-	-	-
	Nigeria	→	→	→	→	-	-	-	-	-	-
	Jordan	≠	≠	≠	≠	-	-	-	-	-	-

Source: Author's calculation.

Table 4 shows the results of the Granger causality test. The purpose is to examine the short-term integration of developed markets with the emerging and frontier markets. The table reports only the Granger cause between developed, emerging, and frontier markets. The results of the in-between Granger cause by all the developed, emerging, and frontier markets are not reported. The USA holds a bidirectional relationship with India, and a unidirectional relationship with Brazil, Romania, and Nigeria. The USA does not hold any Granger cause with Hungary and Jordan. Canada has a unidirectional relationship with Brazil,

India, and Nigeria. Canada does not hold any Granger cause with Hungary, Romania, and Jordan. France holds a unidirectional relationship with all the markets, except Jordan.

Switzerland holds a unidirectional relationship with all the markets, except India and Jordan. It is found that all the developed markets hold only a unidirectional relationship with other emerging and frontier markets. Hence, the long-term association among the markets is examined using the Johnson cointegration test.

## Johnson Cointegration Test

Table 5: Johnson Cointegration Test

Portfolio	Markets	H0	Trace Statistics	Max-Eigen Statistics	Prob.**
1	USA, Nigeria, Jordan, Romania, Hungary, Brazil	None*	681.1923	188.3275	0.0001
		At most 1*	492.8647	125.4173	0.0001
		At most 2*	367.4474	107.1904	0.0001
		At most 3*	260.2570	100.2118	0.0001
		At most 4*	160.0452	85.03098	0.0001
		At most 5*	75.01421	75.01421	0.0000
2	France, India, Nigeria, Jordan, Romania, Hungary, Brazil	None*	814.0459	165.9656	0.0001
		At most 1*	648.0803	145.7585	0.0001
		At most 2*	502.3218	128.7601	0.0001
		At most 3*	373.5617	112.0046	0.0001
		At most 4*	261.5571	95.80377	0.0001
		At most 5*	165.7533	90.03290	0.0001
		At most 6*	75.72041	75.72041	0.0000

Portfolio	Markets	H0	Trace Statistics	Max-Eigen Statistics	Prob.**
3	Canada, India, Nigeria, Jordan, Romania, Hungary, Brazil	None*	805.1434	163.6815	0.0001
		At most 1*	641.4619	146.0805	0.0001
		At most 2*	495.3814	126.7039	0.0001
		At most 3*	368.6775	107.2415	0.0001
		At most 4*	261.4361	94.60853	0.0001
		At most 5*	166.8275	91.15371	0.0001
		At most 6*	75.67382	75.67382	0.0000
4	Switzerland, India, Nigeria, Jordan, Romania, Hungary, Brazil	None*	828.5913	178.1108	0.0001
		At most 1*	650.4805	145.9583	0.0001
		At most 2*	504.5222	128.7772	0.0001
		At most 3*	375.7450	111.6381	0.0001
		At most 4*	264.1069	97.39580	0.0001
		At most 5*	166.7111	91.24098	0.0001
		At most 6*	75.47011	75.47011	0.0000

Source: Author's calculation.

\*Trace test indicates five cointegrating eqn(s) at the 0.05 level.

\*\* (MacKinnon-Haug-Michelis, 1999) p-values.

Table 5 shows the results of the Johnson cointegration test. As reported in the Granger causality test, the developed markets hold only a unidirectional relationship with emerging and frontier markets. Based on the short-term integration among the

markets, four different options are examined for the long-term integration. The USA has a bidirectional relationship with India, and hence, except India, all emerging and frontier markets are examined for long-term integration with the USA. In investment portfolio 1, the H0 of no cointegrations is accepted at 1% level of significance for Nigeria, Jordan, Romania, Hungary, and Brazil. This reveals that the US market does not hold long-term integration with these markets, and hence, the US investors have portfolio diversification opportunities in Nigeria, Jordan, Romania, Hungary, and Brazil. The investment portfolio 2 shows the results of long-term integration of France with emerging and frontier markets. Here, the H0 of no cointegrations is accepted at 1% level of significance for all the emerging and frontier markets. This reveals the lack of long-term integration of the France market with emerging and frontier markets. Hence, the French investors have portfolio diversification opportunities in India, Nigeria, Jordan, Romania, Hungary, and Brazil markets. Portfolio 3 shows the results for Canada. H0 is accepted at 1% level for all the emerging and frontier markets. This further reveals that

Canada does not hold long-term integration with India, Nigeria, Jordan, Romania, Hungary, and Brazil, and hence, offers diversification opportunities to Canadian investors in all these markets. The long-term integration of Switzerland is reported in portfolio 4. H0 is accepted at 1% level for India, Nigeria, Jordan, Romania, Hungary, and Brazil, which reveals that Switzerland does not hold long-term integration with these markets. Therefore, investors in Switzerland can diversify their investments to these markets.

It is observed that the developed markets hold some level of integration with emerging and frontier markets. However, the developed market does not hold long-term integration with the emerging and frontier markets. The lack of long-term integration among the markets reveals the existence of portfolio diversification opportunities. Hence, the benefits of portfolio diversification for the investors of developed markets is examined using three different diversification strategies: equally weighted portfolio, minimum variance portfolio, and maximum Sharpe portfolio. The results of the benefits of portfolio diversification is as follows.

## Portfolio Diversification Benefits

**Table 6: Portfolio Diversification Benefits**

Market		US	Canada	France	Switzerland
Home market	Mean Returns (%)	17.77	4.94	5.66	6.85
	S.D. (%)	1.28	1.04	1.46	1.11
	Sharpe Ratio	13.88	4.78	3.88	6.17
	Investment Allocation	100% – US	100% – Canada	100% – France	100% – Switzerland
Equal weighted portfolio	Mean Returns (%)	10.55	8.54	8.64	8.81
	S.D. (%)	1.33	1.27	1.33	1.28
	Sharpe Ratio	7.93	6.72	6.50	6.88
	Investment Allocation	16.7% each in the US, Nigeria, Jordan, Romania, Hungary, and Brazil market	14.2% each in France, India, Nigeria, Jordan, Romania, Hungary, and Brazil market	14.2% each in Canada, India, Nigeria, Jordan, Romania, Hungary, and Brazil market	14.2% each in Switzerland, India, Nigeria, Jordan, Romania, Hungary, and Brazil market
Minimum variance portfolio	Mean Returns (%)	13.19	7.97	9.16	8.99
	S.D. (%)	0.93	0.74	0.83	0.75
	Sharpe Ratio	14.18	10.77	11.04	11.99
	Investment Allocation	US – 32.3%, Nigeria – 31.0%, Romania – 15.7%, Hungary – 14.5%, Brazil – 4.4%, Jordan – 2.1%	Canada – 38.51%, India – 33.94%, Nigeria – 16.11%, Romania – 10%, Jordan – 1.45%	India – 33.33%, France – 32.28%, Nigeria – 21.68%, Romania – 11%, Jordan – 1.71%	Switzerland – 46.70%, India – 35.91%, Nigeria – 16.87%, Romania – 9.02%, Jordan – 1.51%
Maximum Sharpe portfolio	Mean Returns (%)	15.95	9.58	10.26	9.8
	S.D. (%)	1.01	0.81	0.88	0.78
	Sharpe Ratio	15.79	11.83	11.66	12.56
	Investment Allocation	US – 65.4%, Nigeria – 31.6%, Romania – 1.9%, Jordan – 1.2%	India – 39.87%, Nigeria – 27.52%, Canada – 26.75%, Romania – 5%, Jordan – 0.87%	India – 37.98%, Nigeria – 36.23%, France – 17.90%, Romania – 7%, Jordan – 0.89%	India – 37.65%, Switzerland – 30.41%, Nigeria – 28.93%, Jordan – 0.81%, Romania – 2.20%

Source: Author's calculation.

Table 6 reports the benefits of portfolio diversification. Here, the home market portfolio is compared with the diversified portfolio strategies to examine whether the diversification of fund can be beneficial to the investors or not.

The US investors could not gain in the Sharpe ratio with the diversification as per equally weighted strategy. The US investors could not gain the returns with the diversification of the investment; however, diversification can provide them with a lower level of risk. Hence, diversification results in a gain in Sharpe ratio (returns per unit of a risk) significantly. However, the investors can have a higher Sharpe ratio with the minimum variance portfolio (14.18) and maximum Sharpe strategy (15.79), compared to the home market (13.88). The US investors earn lower returns with investment diversification. However, diversification, as

per the minimum variance portfolio (MVP) and maximum Sharpe portfolio results in lower risk. The US investors can have lower risk as per the MVP, with a majority investment allocation in US home market (32.3%), Nigeria (31.0%), Romania (15.7%), and Hungary (14.5%). The diversification can be beneficial to the Canadian investors, with a significant gain in the Sharpe ratio. Canadian investors can earn higher Sharpe in diversification (EWP – 6.72, MVP – 10.77, MSP – 11.83), compared to the home market (4.78). Investors can have the lowest risk of 0.74% with investment allocation in Canada home market (38.51%), India (33.94%), Romania (10%), Nigeria (16.11%), and Jordan (1.45%). Investors can earn the highest Sharpe ratio with investment allocation in India (39.87%), Nigeria (27.52%), Canada home market (26.75%), Romania (5%), and Jordan (0.87%). Investors from France can also earn a higher Sharpe ratio in diversification



(EWP – 6.50, MVP – 11.04, MSP – 11.66), compared to the home market (3.88). Investors can earn the highest Sharpe ratio with investment allocation in India (37.98%), Nigeria (36.23%), France home market (17.90%), Romania (7%), and Jordan (0.89%). Investors can have the lowest risk of 0.83% with the minimum variance portfolio. Investors can allocate investment to India (33.33%), France home market (32.28%), Nigeria (21.68%), Romania (11%), and Jordan (1.71%), to have the lowest risk of their investment portfolio. Investors from Switzerland can also earn a higher Sharpe ratio in diversification (EWP – 6.88, MVP – 11.99, MSP – 12.56), compared to home market (6.17). Investors can earn the highest Sharpe ratio with investment allocation in India (37.65%), Switzerland home market (30.41%), Nigeria (28.93%), Romania (2.20%), and Jordan (0.81%). Investors can have the lowest risk of 0.75% on adopting minimum variance portfolio. Investors can diversify their investment to the Switzerland home market (46.70%), India (35.91%), Nigeria (16.87%), Romania (9.02%), and Jordan (1.51%) markets to have the lowest risk-based portfolio.

Overall, investors of all the developed markets could gain from diversification of the investment. The investors can allocate their investment to the respective markets to gain better returns, lower risk, and a higher Sharpe ratio. The investors could have a significant gain in the Sharpe ratio from diversification of the investment. The gain in Sharpe ratio is reported in Table 7.

## Gain in Sharpe Ratio

**Table 7: Gain in Sharpe Ratio**

Market	$\Delta$ in Sharpe Ratio HM to EWP	$\Delta$ in Sharpe Ratio HM to MVP	$\Delta$ in Sharpe Ratio HM to MSR	$\Delta$ % in Sharpe Ratio HM to EWP	$\Delta$ % in Sharpe Ratio HM to MVP	$\Delta$ % in Sharpe Ratio HM to MSR
USA	-5.95	0.3	1.91	-42.87%	2.16%	13.76%
Canada	1.94	5.99	7.08	40.59%	125.31%	148.12%
France	2.62	7.16	7.78	67.53%	184.54%	200.52%
Switzerland	0.71	5.82	6.39	11.51%	94.33%	103.57%

Source: Author's calculation.

Notes: The  $\Delta$  in Sharpe Ratio and the  $\Delta$ % in Sharpe Ratio represent the change with respect to the home portfolio.

Table 7 shows the gain in the Sharpe ratio for investors in developed markets. The Sharpe ratio of equally weighted

portfolio, minimum variance portfolio, and maximum Sharpe portfolio is compared with the Sharpe ratio of the home market, to examine the level of gain. The US investors could not gain the Sharpe ratio on adopting the equally weighted portfolio strategy. The US investors could gain in Sharpe ratio by 2.16% on adopting minimum variance portfolio and 13.76% on adopting maximum Sharpe portfolio. Canadian investors could gain in Sharpe ratio by 40.59%, 125.31%, and 148.12%, on adopting EWP, MVP, and MSP strategies, respectively. Investors from France could gain in Sharpe ratio by 67.53% on adopting EWP, 184.54% on adopting MVP, and 200.52% on adopting MSP as diversification strategies. Switzerland investors could gain in Sharpe ratio by 11.51%, 94.33%, and 103.57%, on adopting EWP, MVP, and MSP strategies, respectively. Overall, all the investors could gain in Sharpe ratio significantly through portfolio diversification. However, the US investors could not gain much from portfolio diversification.

## CONCLUSION

The present study is conducted with two objectives: to examine the integration of developed markets (USA, Canada, France, and Switzerland) with emerging markets (India, Brazil, and Hungary) and frontier markets (Romania, Jordan, and Nigeria); and to evaluate the portfolio diversification benefits for the investors of developed markets in the emerging and frontier markets. The study is performed using a weekly return series from 1 June 2009 to 31 December 2020.

The descriptive statistics reveal that the data is fit for performing further tests. The developed market has a very low, negative correlation with other emerging and frontier markets, which reveals the existence of portfolio diversification opportunities for the investors of the developed markets. The results of Granger causality revealed that a majority of the markets do not have a short-term integration with each other. The Johnson cointegration test found that a majority of the markets do not have a long-term integration with each other. The lack of long-term integration among the markets reveals the existence of portfolio diversification opportunities.

The study has implications for the investors. The investors in the US do not gain in the Sharpe ratio from the equally weighted portfolio; however, they gain from minimum variance portfolio and maximum Sharpe portfolio. On the other hand, investors in Canada, France, and Switzerland have gained significantly in the Sharpe, with the diversification of the investment portfolio. Investors in Canada, France, and Switzerland could reduce their portfolio risk with the adoption of minimum variance portfolio. The investors

can allocate their investment in the respective markets to gain better returns, encounter lower risk, and have a higher Sharpe ratio.

## SCOPE OF FUTURE RESEARCH

The present study is limited to only four developed markets' (US, Canada, France, and Switzerland) portfolio diversification benefits with three emerging markets (India, Brazil, and Hungary) and three frontier markets (Romania, Nigeria, and Jordan). In future, more such studies can be conducted by including other emerging and frontier markets to get more portfolio diversification opportunities. The diversification benefits for the investors of the developed markets can be explored at the regional-level emerging and frontier markets. Further, the diversification benefits can be explored for developed markets with respect to the economy of regional associations such as SAARC, ASEAN, BRICS, and so on.

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