The Effect of Global Linkages on Stock Market Volatility: A Study on Selected Developed and Developing Markets

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Abstract: *The increased global linkages give an investor opportunity to invest in equities across the global markets. This linkage can be the reason for spill over of the volatility from one market to the other. This paper makes an attempt to understand the effect of global linkages on the volatility of the stock market. For the purpose of study, stock index data of selected developed and emerging markets were collected and tested to see if there is variation across time, and if yes, uniformity of variation was also tested. It was found from the analysis that the variation across the countries was found to be uniform and most of the pairs of countries had a positive integration between them. It was found from examination that there is no significant difference in the extent of volatility across the countries.*

Keywords: *Spill over, Stock market volatility, Developed markets, Emerging markets*

Introduction

In the securities markets, volatility is often associated with big swings in either direction. For example, when the stock market rises and falls more than one per cent over a sustained period of time, it is called a "volatile" market. Volatility measures the extent of uncertainty associated with the size of the security.

Higher volatility means that the price of a stock or security can change drastically in a short span of time, while lower volatility means the price of the stock is relatively consistent or is fluctuating less. If the market is volatile, the degree of volatility adjusts over time.

There are actually two kinds of volatility – historical and implied. Charles H Dow proposed Dow Theory which identifies three types of movements in the market, namely, primary, secondary and minor. The primary movements are results of the changes in fundamental factors affecting performance of economy, industries and companies. This is supported by the Elliots wave theory

Minor movements are due to intraday fluctuations in share prices caused by changes in demand and supply for different shares.

Secondary movements are short term fluctuations in the market which can be measured by inter day variations in prices. This shows volatility in the stock price movements. It is a source of risk in the share market.

Each country has one or more stock exchanges where trading of shares takes place in large number. Direction of movement of share prices in a market are captured and represented as a weighted average price of group of representative share traded in market called as stock market index. Hence the movement of stock market index is a good measure of volatility of any stock market.

Developing economies' financial linkages with the global economy have risen significantly in recent decades which encourage the study of volatility interdependence among the various stock markets. It would also be necessary to know if the extent of volatility is uniform among all the stock markets chosen during a period of time.

Literature Review

Several studies have examined the interdependence among stock market of different countries.

It is found through a number of researches that there is a relative amount of interdependence between the Indian national stock markets and U.S stock market and it is found to be the most influential market in the world. There has been a substantial increase in the degree of interdependence since 1987. (**Eun and Shim** (1998); **Liu, Pan and Shieh** (1998); **Johnson and Soenon (2002**) and a unidirectional causality running from US stock market to Indian stock markets. (**K Kiran Kumar and Chiranjit Mukopadyay** (2002)

The growing linkages of national markets in currency, commodity and stock with the world markets and existence of common players have given rise to speedy transmission of volatility. Some developed countries like the US provide positive return while the developing countries like Indonesia give a negative return. (**Raju,** 2004) The correlation with the US market does not always exhibit an upward trend. (**Evans,** 2006) A bidirectional causality can be seen between China and a few countries of and not all ASEAN-5 countries. (**Sharudhin Jaquar and Anitha Johari** (2013)

Objectives of the Study

In this paper an attempt is made to understand the pattern of stock market volatility across different countries of the world. The following three research questions were posed for the study.

- Is there variation in the stock markets across time?

- If there is volatility across time, is this variation uniform across the countries?

- Is there a significant difference in the extent of volatility across countries?

- The objective of the paper is thus to understand the pattern and extent of stock market volatility across the time periods and countries.

Significance of the Study

The study of financial assets volatility is important to academics, policy makers, and financial market participants for several reasons as below.

- Prediction of financial market volatility is important to economic agents because it represents a measure of risk exposure in their investments.

- A volatile stock market is a serious concern for policy makers because instability of the stock market creates uncertainty and thus adversely affects growth prospects.

Stock return forecasting has created new job opportunities for professionals who are experts in volatility forecasting. Thus it can be seen that the study of stock market volatility is very important and can be helpful for the formulation of economic policies and framing rules and regulations related to stock market volatility.

From an investor's viewpoint, it would be immensely useful if the future stock return volatility could be predicted from the past data.

Research Design

The study considers and measures volatility in different stock exchanges in different regions of the world. The important broad based stock index is considered and data is collected for the period Jan 2017 to December 2019.

To make the data more comparable across different stock exchanges, the coefficient of variation (CV) is calculated. It is also used to measure the stock market volatility for different months in different stock exchanges.

Sample selection: The different regions of the world experience different levels of volatility. The economic development of the country is bound to influence the activities of the stock market of the country. To study the inter country variations the following countries' stock indices were considered.

Market	Country	Stock Market	Stock Market Index
Developed Market	Australia	Australian Securities Exchange	ASX
	China	Shangai Stock Exchange	SSE Composite Index
	France	French stock market index.	CAC 40
	Germany	Frankfurt Stock Exchange	DAX 30
	Spain	Bolsa de Madrid	IBEX 35
Emerging Market	Argentina	Buenos Aires Stock Exchange	MERVEL
	Brazil	Brasil Sao Paulo Stock Exchange Index	IBOVESPA
	Malaysia	Financial Times Stock Exchange	FTSE
	Mexico	Mexican Stock Exchange	BMV
	North Korea	Korea Composite Stock Price Index	KOSPI

Tools for Data Analysis

The closing values for every month were tabulated. The mean of the monthly CV values of a particular stock exchange represents the volatility analysis of the stock exchange of that month.

The Students T test is used to compare the mean CV values of different stock exchanges. The t test is used to measure the significance of inter region volatility. The uniformity or otherwise of stock market volatility across different time periods is studied with the help of Pearson's correlation coefficient between pairs of countries.

The monthly CV values of the two stock exchanges are used for calculating the correlation coefficient.

Empirical Analysis

The data set used for the study is the closing prices of different stock exchanges from Jan 2017 to December 2018. From the raw data, coefficient of variation is calculated for each stock market index.

Following graphs show the fluctuation in return from the developed and developing markets considered for the study.

Graph I : Return from the Developed Markets
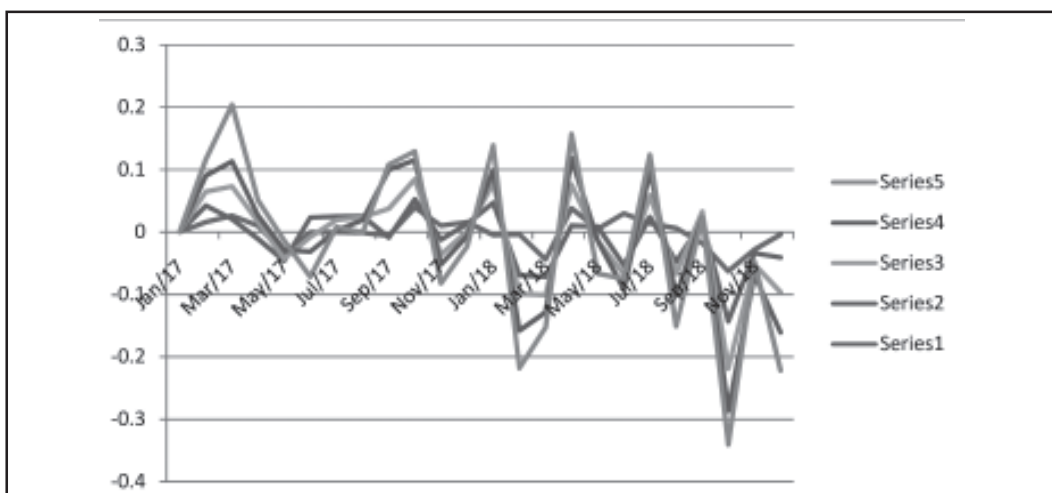
Graph II: Returns from the Developing markets
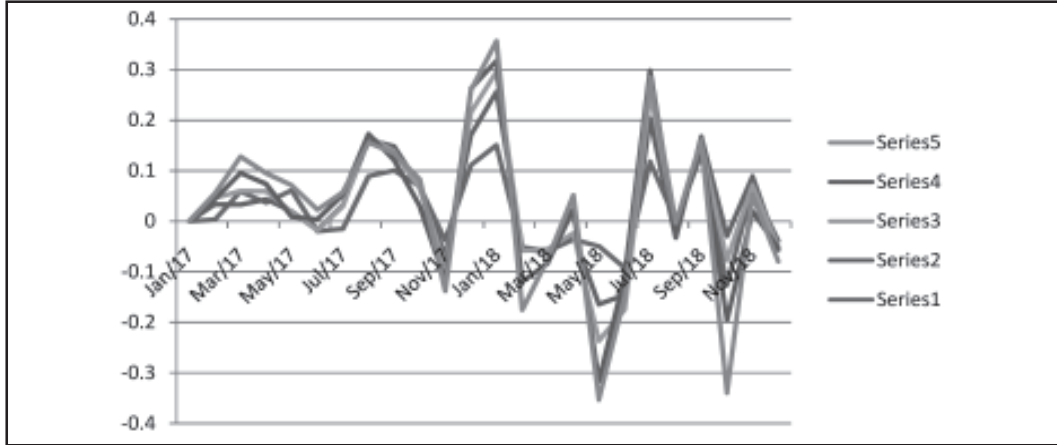
These graphs indicate that the movement of the stock exchanges in both the category is usually the same but the extent of volatility or variation is not equal. This can be further tested and the values are represented in the following tables.

Table I : Average CV Values for the Developed countries

	ASX	SSC	CAC	DAX	IBEX
2017	0.00033	0.000337	0.000718	0.000667	0.001152
2018	0.000764	0.00174	0.001474	0.001286	0.001529

Table II :Average CV Values for the Developing countries

	MERVEL	BOVESPA	FTSE	BMV	KOSPI
2017	0.002427	0.001372	0.000289	0.000664	0.000559
2018	0.007903	0.00379	0.001114	0.00284	0.002363

From the data presented in the above graphs and tables, we can see variation in all the stock exchanges. Some months show low volatility. But are these variations true across the different stock exchanges? This can be tested by calculating the coefficient of correlation between the different pairs of stock exchanges and are shown in Table-III to Table-V

Table III: Developed countries correlation coefficient for pairs of stock exchange

	ASX	SSE	CAC	DAX	IBEX
ASX	1	0.147277	0.575776	0.482768	0.393405
SSE		1	0.469513	0.536072	0.367808
CAC			1	0.926878	0.830799
DAX				1	0.770263
IBEX					1

In the developed countries, there is low to high correlation between the stock exchanges in different months. The coefficient varies from 0.14 to 0.92. All developed countries do not exhibit a uniform variation

Table IV: Developing countries Correlation Coefficient for pairs of stock exchange

	MERVEL	BOVESPA	FTSE	BMV	KOSPI
MERVEL	1	0.434495	0.588402	0.366578	0.604376
BOVESPA		1	0.465025	0.088722	-0.12043
FTSE			1	0.662802	0.465213
BMV				1	0.481471
KOSPI					1

In the developing countries, there is a negative correlation between the Brazil and the Mexican Stock exchanges. Except for this pair, all the other exchanges are positively integrated but do not have a significant strength to their relation.

Now we need to analyse how close the integration is across all the stock exchanges considered. These values are presented in the following table

Table V: Correlation coefficient for pairs of stock exchange across the samples

	ASX	SSE	CAC	DAX	IBEX	MERVEL	BOVESPA	FTSE	BMV	KOSPI
ASX	1	0.147277	0.575776	0.482768	0.393405	0.149131	-0.24701	0.306805	0.604637	0.342869
SSE		1	0.469513	0.536072	0.367808	0.715592	0.316433	0.326427	0.256133	0.575942
CAC			1	0.926878	0.830799	0.602955	0.140288	0.450203	0.53585	0.656372
DAX				1	0.770263	0.602398	0.103676	0.344133	0.413121	0.628239
IBEX					1	0.496666	0.171711	0.429646	0.547571	0.594508
MERVEL						1	0.434495	0.588402	0.366578	0.604376
BOVESPA							1	0.465025	0.088722	-0.12043
FTSE								1	0.662802	0.465213
BMV									1	0.481471
KOSPI										1

It can be seen that, even across all the stock exchanges considered, the stock exchanges mostly move in the same direction but do not exhibit a very high correlation between each pair of samples.

By checking the overall CV values, the overall volatility of the stock exchange for the period of the study can be measured. There is a variation in the overall volatility of different stock exchanges. Is this inter-exchange volatility statistically significant? Is the variation in volatility across different regions significant? The following Null Hypothesis are proposed:

- There is no significant difference in the overall volatility of different stock exchanges within the category.
- There is no significant difference in the overall volatility of different stock exchanges in different category.

These Null hypotheses can be tested by applying the paired t- test to the data of the different pairs of stock exchanges within the category or developed and emerging and as well as across these categories. The probability value indicates whether the difference in overall mean CV values is statistically significant. Where $p < 0.05$, the null

hypothesis is rejected and existence of significant difference is accepted.

Tables VI to VII present the probability values of paired t- test applied to the data of pairs of stock exchanges in different categories.

Table VI: Developed countries Probability values of paired t- test

From the above table, there is no significant difference in volatility between any of the stock exchanges considered for the study among the developed markets. Hence Null Hypothesis accepted

Table VII: Developing countries probability values of paired t- test

From the above table, it is seen that there is no significant difference in volatility between any of the stock exchanges considered for the study among the developing markets as well. Hence Null Hypothesis is accepted.

In order to understand the difference in volatility across the different regions, the paired t- test is applied to all combinations of pairs of stock exchanges considered for the study and the data is presented in the table below.

	MERVEL	BOVESPA	FTSE	BMV
MERVEL		0.655242	0.159939	0.111944
BOVESPA	0.655242			
SSE	0.233144		0.204085	0.37931
CAC	0.953271	0.204085		0.20517
DAX	0.547388	0.37931	0.20517	
IBEX	0.612539	0.469842	0.437955	0.990008

Table VIII: Probability values of paired t- test for pairs of stock exchanges across categories

	ASX	SSE	CAC	DAX	IBEX	MERVEL	BOVESPA	FTSE	BMV	KOSPL
ASX		0.233144	0.953271	0.547388	0.612539	0.230277	0.331672	0.964329	0.46616	0.931332
SSE	0.233144		0.204085	0.37931	0.469842	0.018102	0.046073	0.187693	0.632412	0.221542
CAC	0.953271	0.204085		0.20517	0.437955	0.133763	0.285372	0.926683	0.539485	0.955207
DAX	0.547388	0.37931	0.20517		0.990008	0.080023	0.183562	0.575287	0.877464	0.651917
IBEX	0.612539	0.469842	0.437955	0.990008		0.100966	0.183472	0.585097	0.859677	0.681669
MERVEL	0.230277	0.018102	0.133763	0.080023	0.100966		0.655242	0.159939	0.111944	0.12132
BOVESPA	0.331672	0.046073	0.285372	0.183562	0.183472	0.655242		0.2	0.187719	0.363286
FTSE	0.964329	0.187693	0.926683	0.575287	0.585097	0.159939	0.2		0.41435	0.897934
BMV	0.46616	0.632412	0.539485	0.877464	0.859677	0.111944	0.187719	0.41435		0.617148
KOSPL	0.931332	0.221542	0.955207	0.651917	0.681669	0.12132	0.363286	0.897934	0.617148	

SSE represents the China Stock Exchange Index, The probability values show that there is a significant difference in volatility of China Stock Exchange with Brazil and Argentina Stock Exchange indices. Apart from the two, the table shows that there is no significant difference in variation across the countries considered for the study under both the categories.

Inferences

The study has attempted to understand the pattern and extent of stock market volatility across the time periods and across the countries. From the analysis, following inferences are drawn

- The stock exchanges under a category exhibit similar variation , are closely integrated with each other and exhibit uniform movements.

- There mostly exists a positive integration between the stock markets under each category, indicating close integration of stock markets.

- There is no significant difference in volatility in stock exchanges within the category of developed and developing countries.

- There is a significant difference in volatility between Chinese Stock Exchange with Brazil and Argentina Stock exchanges.

Conclusion

The study has an important implication for investment policies and activities. Investors, both individuals and institutions seek investment opportunities beyond their national boundaries. Economic liberalization policies and globalization practices now provide a facilitating environment for equity investments in different stock exchanges across the globe.. An internationally diversified portfolio is expected to generate higher return than a domestic portfolio because of transmission of information across the stock markets in different countries.

References

CM, C., & Sharma, M.(2013) , Impact of Union elections on the Stock volatility, *JEMS*

Eun, Cheol S. and Sagdal Shim,(1998), "International transmission of stock market movements", *The Journal of Financial and Quantitative analysis,* Vol.24, No. 2, June 1998

Johnson, R. and L. Soenon, (2002), "Asian Economic Integration and Stock Market Co movement", *The Journal of Financial research,* Vol.25, No.1, 2002

K. Kiran, Kumar and Chiranjit, Mukopadyay (2002), "A case on US and India".

Liu, Y. Angela, Ming-Shiun Pan and Joseph C.P Shieh (1998), "International transmission from stock price movements: Evidence from the U.S and five Asia Pacific markets", *Journal of Economics and Finance,* Vol.22, No.1, March 1998

Raju. M. T, Ghosh. A (2004), "SMV- An International Comparison", SEBI Working paper series 8

Sharudhin Jaquar and Anitha Johari **(2013),** "An econometric Analysis and Co- movement of Stock market volatility between China and ASEAN-5", *International Journal of Business and Social Science,* Vol. 4, No. 14, November 2013.