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RESEARCH ARTICLE

STOCK MARKET LINKAGES AND CAUSAL RELATIONSHIPS: EMPIRICAL INVESTIGATION OF EM7 ECONOMIES

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Abstract

Diffusion of information in the present era has become very fast, whether it is related to natural phenomena or human activities. Due to the technological advancement and fast face globalisation and liberalisation, events happening in financial markets are no exception, especially due to electronic stock exchanges and free flow of capital and financial information across borders. The present study aims to examine return patterns and find inter linkages/integration among the stock markets of seven largest emerging economies popularly known as EM7 (India, China, Russia, Brazil, Indonesia, Mexico and Turkey) by examining the monthly return data from Jan 2010 to Dec 2019. The study used descriptive analysis, correlation analysis, regression analysis and causality test to attain its objectives. The results indicate that EM7 stock markets are not interlinked, suggesting markets are quite segmented and there is scope for fund managers and both international and domestic investors to reap the advantages of portfolio diversification and mitigate the risks associated with their investments.

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Introduction:-

One of the most impressive technical developments in the most 20 years has been the stunning reduction in the time it takes to diffuse information around the world and the huge growth in the associated market for information (Petraiki & Zalewska, 2009). The diffusion of the information is becoming so fast and accurate that within the blink of eye, the information whether related to natural phenomena or human activities happening in one part of the world is transmitted to the other part of the world. The events in the financial markets are no exception, particularly due to the emergence of the electronic stock exchanges in almost every part of the world. Today due to the concepts of the globalisation and liberalisation and introduction of new technologies and financial instruments, the stock markets around the world behave or work like a one integrated market. Markets around the world are integrated and interconnecting due to the effects of globalisation on international economic activities at very fast pace (Kumar, et.al, 2019).

Antonioni et al (2007, as cited in Ahmed, 2014) argues that international financial crisis, in the recent periods caused by localised crisis such as collapse of Russian bond market, Asian financial crisis, the more recently US financial crisis have made it important to understand the stock market integration. The area of stock market integration has been a topic of great interest among the researchers; particularly in case of development countries (see for example Kasa 1992; Kim & Wadhvani, 1990; Eun & Shim, 1989; Liu & Pan 1997; Taylor & Tonks, 1989). The study of the

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existence of inter linkages among international capital markets has serious implications for portfolio diversification as well as macroeconomic policies of individual countries (Suchismita Bose, 2005). Due to the free flow of capital across borders investors today hold securities of different multinational companies across different parts of the world to reap the benefits of diversification in mitigating various risks associated with the investments. The diversification policy will pay only in case of segmented or less correlated capital markets as Kasa, 1992 stated that, if share markets share a common trend, there will be no long term gains to international diversification. Where as if markets are segmented, the asset pricing relationships varies across countries & returns would be determined by domestic risk factors (Hedi, 2006). Much of the empirical literature on stock markets integration is hovered around development block of the world. As put by Sing & Sing, 2016), post 2008 US financial crisis period is marked by increasing capital flows to the emerging markets due to unconventional monetary policy initiatives undertaken in major emerging markets. Emerging markets provide portfolio and fund managers a new way to enrich and optimise their portfolios, and as they grow and become mature, they are expected to become more sensitive to the volatility of other stock markets.

In light of the above discussion the present study aims to explore inter linkages among seven largest emerging economies namely India, China, Russia, Brazil, Indonesia, Mexico and Turkey, as reported by the World Bank report (2018). The rest of the paper is organised as follows .Section 2 gives brief overview of EM7 economies. Section 3 gives the review of the relevant literature on stock market integration. Section 4 presents the methodology and data description. Section 5 presents empirical results and discussion and followed by the conclusion and references.

Brief overview of EM7 economies

As per the world bank report 2018, Global economic prospectus; the turning of the Tide 61-78, the seven largest emerging economies are Brazil, china, India Russia, Indonesia, Mexico and turkey collectively called EM7 economies. These economies compose 25% of Global GDP and 50% of world population. The report further says that the role of EM7 has grown rapidly since 2010 and accounted for more than 50% of Global growth, 18% of Global FDI and 19% of Global trade. On the production side EM7 command dominance among the various commodities across the world. India is the largest producer of cotton and second largest producer of fertilisers. China has dominance over coal production being the largest coal producer of the world among other metals and rice. Russia is the 3rd largest producer of oil and 2nd in terms of natural gas and aluminium. Brazil is the largest producer of sugar and coffee and has good lead in the soya bean products and bauxite. Mexico being the largest producer of silver while Indonesia dominates world in terms of tin palm oil and rubber production. On the consumption side also EM7 commands dominant share in global consumption against G7 in coal, precious metals, base metals and most food items like rice, wheat and soya bean (World Bank report, 2018).

Given their size and integration, growth in EM7 could have significant cross boarder spill over and one percentage point increase in EM7 growth is associated with 0.9 percentage point increase in growth in other emerging and frontier markets and 0.6 percentage point increase in world growth at the end of 3 years (Huidrom, Kose & Ohnsorge, 2017). Keeping in view the development the development and growth potential of the group, there is need to understand the level of market segmentation among these emerging economies. Further these economies are on the top of the list of international investors and fund managers community given their enormous growth potential and more specially for reaping the diversification benefits by shifting their capital base from developed economies to emerging economies. Assessing the level of, market integration among these emerging economies will assist global investors and portfolio managers in diversifying their portfolio investment among these emerging economies. Further policy makers and regulatory authorities in these countries could get insights about their policy response against global financial risks and economic crisis.

Review Of Literature:-

A number of studies have been conducted to examine inter linkages between different stock markets of different countries by using different methodologies.

Kasa (1992) studied the stock markets of developed countries of US, Japan, Germany, and Canada and documented that there is common stochastic trend among the stock markets of these countries and are perfectly correlated in the long run.

Using cointegration and causality analysis, **Roca & Selvanathan (2001)** accessed weekly data of Australia and three south Asian countries namely Singapore, Taiwan and Hong Kong for examining the integration among them. They however failed to find any short run and long run linkages among the stock returns of these countries.

Ratanapakoran and Sharma (2002) conducted a detailed study of 42 markets across different geographical regions of US, Europe, Asia Pacific, Latin America and Middle East. Dividing his study into pre and during Asian Crisis, he argued that there are no long run relationships for the pre crisis period while during the crisis period all the stock markets were more integrated both in long run and short run.

Chen, Firth and Rui (2002), studied Latin American markets of Argentina, Brazil, Colombia, Chile, Venezuela and Mexico to find interdependences among them. The sample period for the study was 1995 to 2000. The results of the study indicated that there is cointegration among the markets which means there is long run association among the stock markets, thus limiting the scope for diversifying risks among these markets.

Lim et al (2003) confirmed ASEAN markets are highly integrated which limits the diversification benefits among those markets.

Suchismita Bose (2003) investigated the linkages or integration of Indian stock market with that of US and Asian markets. Indian stock market was found to be highly correlated with majority of the sample countries except Japan and US. They argued that integration of Indian stock market increased to a good extent particularly after structural reforms of 1991.

Lamba (2005) examined long run relationship among south Asian stock markets of India, Pakistan and Sri Lanka and developed equity markets of us, us and Japan. The study found Indian stock markets are influenced by developed markets while Pakistan and Sri Lankan markets are segmented which means these markets are not influenced by the developed markets. He concluded that South Asian markets developing interdependencies at a slow pace.

Yang et al (2006) documented that stock market integration changes over time in terms of both degree and nature. He examined the impact of Russian financial crisis of 1998 on the stock market linkages among USA, Germany and other European markets and concluded that integration among the markets has augmented after the crisis.

Hassan et al (2008) argued that Karachi stock exchange is independent with that of UK, USA, Germany, Italy, France, Japan, Canada and Australia and hence offers diversification opportunities to the investors of those developed countries.

Kucukcolak (2008) examined daily data to explore integration of Turkish stock market with stock indices of Germany, France and Greece. By using cointegration technique, he concluded that Turkish market is not integrated with that of Germany and France; however Turkish and Greece markets were found to be interlinked.

Sharma and Bodla(2011) using VAR and Causality analysis documented the absence of any cointegration among the stock markets of India , Pakistan and Srilanka. Taneja (2012), stated that emerging stock markets like India are greatly influenced by developed stock markets particularly US, both in direction and movement.

Ahmad (2014) used cointegration technique and found no evidence of integration among money market and exchange rate markets of US and Pakistan.

Prakash and Kumar (2014) investigated the presence of dynamic linkages among SAARC countries and global economy. The study however found presence of long run and short run interdependence among the markets which limits the scope of diversification among these markets.

Singh & Singh (2016) examined dynamic linkages between the stock markets of US and BRIC by dividing study into different time frames of pre, during, and post crisis period of 2007. The study found common stochastic found only during pre and post crisis period, however crisis and full sample results were marked by the absence of any co-movement among the markets.

Panda and Nanda (2017) examined interdependence among seventeen stock markets of Western Europe over a weekly data and found that almost 58% of stock markets are interlinked and negated any diversification benefits.

Singh and Shrivastav (2017) found weak evidence of financial integration among Indian and Australian stock markets.

Kumar et al (2019) studied inter-linkages among various key stock markets of world including both developing and developed stock markets. The study used Johenson cointegration technique and found very insignificant indications of cointegration among the sample markets. The study concluded that world stock markets do not share a common stochastic trend and are driven by country specific factors.

From the above literature it is evident that there are conflicting results regarding the level of integration among the various stock exchanges of the world, particularly the developing ones. Therefore present will attempt to fill that gap.

Research Methodology:-

Data description

The present study attempts to explore return linkages or financial market integration among EM7 economies namely India, china, Brazil, Russia, Indonesia, Turkey and Mexico. The study will use time series data covering a period of ten years starting from 1st Jan 2010 to 31Dec 2019. The data consists of the monthly closing prices of the major stock indices of the sample countries. We selected one stock exchange from each country as a representative of the stock market of that country. The stock index and the source of the data for each country are presented in table 1.

Table 1:-

Country	Stock exchange	Stock index	Source
India	Bombay stock exchange	SENSEX	Yahoo finance
China	Shanghai stock exchange	SSE Composite	Yahoo finance
Russia	Moscow exchange	MOEX	Yahoo finance
Brazil	Brasil sao Paulo exchange	IBOVESPA	Yahoo finance
Indonesia	Indonesia stock exchange	JCI	Yahoo finance
Mexico	Mexican stock exchange	IPC Mexico	Yahoo finance
Turkey	Istanbul stock exchange	BIST 100	Yahoo finance

The data will be converted into log return series for subsequent analysis by using the following formula

$$R_t = \log(p_t) - \log(p_{t-1}) * 100$$

Where,

R_t = log return

P_t = closing price at the of current month

P_{t-1} = closing price at the of previous month

Log return for each country will be denoted as LRIN(India), LRCH(China), LRBR(Brazil), LRRU(Russia), LRIND(Indonesia), LRMX(Mexico) and LRTR(Turkey).

Econometric Techniques

Descriptive statistics

In order to get the idea about the basic characteristics of the data, descriptive statistics are generated for all the indices in their levels. It will provide important information on risk and return pattern among the markets and more importantly the normality check through Jerque bera statistic to see whether observations are normally distributed or not.

Unit root test

Before proceeding forward for further analysis, it is necessary for the time series data to be stationary, because non stationary data will tend to produce spurious and non reliable results, if not dealt with. In order to confirm whether the data is stationary or not two formal tests namely ADF (augumented Dickey and Fuller) and PP (Philiips and Perron) tests are performed. ADF test is developed by Dickey and Fuller (1979). The test works on the hypothesis

that the series contains a unit root i.e. Series is non stationary where alternative hypothesis is that series is stationary. If the calculated test statistic is less than the critical value, the null hypothesis is rejected and stationary of the data is confirmed. In case the null hypothesis is accepted, the series will be differenced d times in order to make it stationary which is also referred to as order as integration where $d > 1$. The PP test is developed by Peter C.B Philips and Pierre Perron (1988). Since ADF test assumes that dependent variable has no autocorrelation, PP test takes lags of the variable to absorb any sort of dynamic structure present in the dependent variable ensuring that is no autocorrelation. The PP test can work with serially correlated error terms and can handle heteroskedasticity. This test corrects test statistics by changing the t-ratio of the coefficient, making serial correlation useless. The test works on the same hypothesis as ADF test. Further analysis will be carried on stationary data.

Correlation analysis

Correlation analysis is performed as a preliminary test to see any kind of inter linkages among the stock markets of the sample countries. The study uses Karl Pearson's co-efficient of correlation. Correlation matrix is drawn to analyse any association or co movement among the indices of the developing economies. Correlation on the other hand, does not reveal anything about the cause-and-effect relationship.

Regression analysis

Multiple regression analysis is performed by regressing each stock index return on other indices to see which country's stock returns are influenced by other stock returns or impact the stock returns of other countries. In other words regression analysis will help to determine whether the returns of a particular index of a country are significantly determined by other countries of the study. For the purpose, each stock index will be treated as dependent variables and other six indices as independent variables. Seven regression models are run for seven countries under the study where each model or regression equation models the returns of one country as a function of remaining six countries' stock returns.

Granger causality Test

Granger Causality test was proposed by Clive Granger in 1969. The test is used to determine whether a prior event or occurrence causes a subsequent occurrence of a different variable. Unlike regression, the test evaluates the ability to predict future values of a time series from previous values of another series. The test is used to study causation or lead lag relationship among the variables. If the current value of Y can be described by past values of X , including past values of Y , then X is said to be the granger cause of Y . In other words, including previous X values can help forecast Y more accurately. To better predict Y , a VAR model includes not only the previous values of Y but also the past values of X . For example in case of two variables X and Y , following regression model is applied to run Granger Causality Test-

$$Y_t = a_0 + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_1 X_{t-1} + \dots + b_p X_{t-p} + u_t \quad (1)$$

$$X_t = c_0 + c_1 X_{t-1} + \dots + c_p X_{t-p} + d_1 Y_{t-1} + \dots + d_p Y_{t-p} + v_t \quad (2)$$

In case of equation 1, null hypothesis is $b_1 = b_2 = \dots = b_p = 0$, which means X does not granger cause Y . In case of equation 2, null hypothesis is $d_1 = d_2 = \dots = d_p = 0$, which means y does not granger cause X . In each case, a rejection of the null hypothesis (beta coefficients are not equal to zero) implies there is Granger causality. On the basis of causality test, three types of results can be obtained-unidirectional causality, bidirectional causality and independence (no causality).

Empirical findings

Table 2:- Descriptive statistics of return series of EM7.

	LRIN	LRCH	LRBR	LRRU	LRIND	LRMX	LRTR
Mean	0.007773	0.007922	0.004718	0.006416	0.006368	0.002276	0.006210
Median	0.005209	0.004287	0.006066	0.010602	0.011786	0.005118	0.007274
Maximum	0.110416	0.187024	0.156724	0.165326	0.127592	0.076310	0.131277
Minimum	-0.112451	-0.256814	-0.126210	-0.123421	-0.094395	-0.119174	-0.143907
Std. Dev.	0.042833	0.062764	0.056106	0.046696	0.039133	0.033930	0.063013
Skewness	-0.085847	-0.282129	0.062973	-0.189463	-0.543313	-0.382651	-0.104474
Kurtosis	3.025219	5.500225	2.893088	3.437920	3.533987	3.409648	2.251596
Jarque Bera	0.149319	32.57384	0.135325	3.868792	7.268408	4.191912	2.993681
Probability	0.928060	0.000000	0.934576	0.144512	0.026405	0.122953	0.223836
Coefficient	5.510485	7.922747	11.891901	7.278055	6.145258	14.90773	10.14702

of variation						
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Table 2 shows the descriptive statistics of the return series of EM7 countries. The average monthly return of India is 0.77%, China 0.79%, Brazil 0.47%, Russia 0.64%, Indonesia 0.63%, Mexico 0.022% and Turkey 0.62%. Shanghai stock exchange is having highest monthly return while Mexican stock exchange has least monthly return. We also calculated coefficient of variation to get better picture of risk or volatility associated with returns of different stock exchanges. The coefficient of variation is a useful statistic for assessing the degree of variation between two data series, even if the means are radically different. It indicates the ratio of the standard deviation to the mean. The better the risk-return trade-off, the lower the standard deviation to mean return ratio. Coefficient of variation is minimum(5.510) in case of India which means returns of India are more stable among EM7 while coefficient of variation is maximum for Mexico(14.90) which means returns of Mexico are more volatile among the group. China has attained both maximum and minimum return in a particular month during the study period. As per Jerque Bera normality test, returns of India, Brazil, Russia, Mexico and Turkey are normally distributed during the study period except china and Indonesia.

Unit root results

Table 3:- Unit root test of return series of EM7.

Country	ADF test (trend & intercept)		PP test (trend & intercept)	
	Level (p value)	Difference (p value)	Level (p value)	Difference (p value)
LRIN	0.0000	-	0.0000	-
LRCH	0.0000	-	0.0001	-
LRBR	0.0000	-	0.0000	-
LRIND	0.0001	-	0.0002	-
LRRU	0.0000	-	0.0000	-
LRTR	0.0002	-	0.0000	-
LRMX	0.0000	-	0.0001	-

Fig. 1:- Graphical view of EM7 returns.

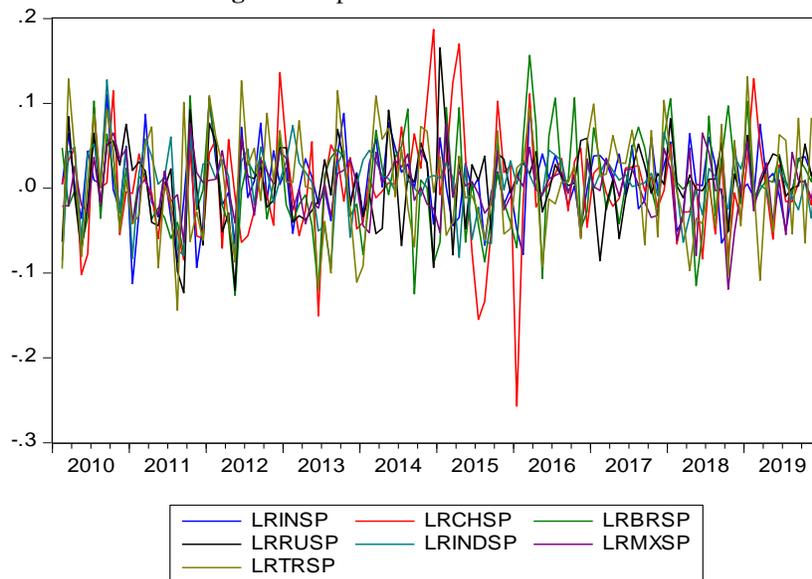


Table 3 and figure 1 indicates both formal testing and visual inspection of stationarity of data series. Since p value of all the return series of EM7 are less than 0.05 at level data, thus rejecting null hypothesis of presence of unit root in the data which in turn indicates that data is stationary at level. Further visual inspection of the figure 1 also depicts that data is of stationary nature. So there is no need to difference the data and further analysis can be carried on the data in the level form.

Correlation analysis**Table 4:-** Correlation matrix of stock returns of EM7.

Correlation	LRIN	LRCH	LRBR	LRRU	LRIND	LRMX	LRTR
LRIN	1.000000						
LRCH	0.193485	1.000000					
LRBR	0.347925	0.365317	1.000000				
LRRU	0.349300	0.161342	0.377126	1.000000			
LRIND	0.458598	0.219700	0.302881	0.282588	1.000000		
LRMX	0.374494	0.208444	0.423563	0.323738	0.381282	1.000000	
LRTR	0.382673	0.247055	0.379575	0.287781	0.443805	0.279367	1.000000

Table 4 represents the correlation matrix of monthly stock returns of EM7 countries. Construction of correlation coefficients is the simplest method or approach for analysing the inter linkages between stock markets. From the table it can be depicted that correlation among EM7 economies is low, lending less support to the theory of integration among stock returns of the sample countries. Indian and Indonesian stock returns have maximum correlation while least correlation is found between Chinese and Russian stock returns. Correlation between returns of EM7 economies is low except between (Brazil, Mexico), (Indonesia, India) and (Indonesia, Turkey), which are moderately correlated. Overall results suggest that EM7 stock markets are quite segmented which means that there is room for global diversification opportunities in EM7 due to the relatively low correlations among them.

Regression analysis**Table 5:-** Regression analysis of EM7 returns.

Dependant variable	Independent variable						
	LRIN	LRCH	LRBR	LRRU	LRIND	LRMX	LRTR
LRIN	-	0.9074	0.2836	0.0506*	0.0045*	0.1321	0.1348
LRCH	0.9074	-	0.0081*	0.9316	0.4709	0.3598	0.7603
LRBR	0.2836	0.0081*	-	0.0342	0.9215	0.0077*	0.0551
LRRU	0.0506	0.9316	0.0342*	-	0.6059	0.4189	0.2101
LRIND	0.0045*	0.4709	0.9215	0.6059	-	0.0407*	0.0030*
LRMX	0.1348	0.7603	0.0077*	0.2101	0.0407*	-	0.9792
LRTR	0.1321	0.3598	0.0551	0.4189	0.0030*	0.9792	-

*represents significant coefficients

Table 5 represents the regression analysis of the monthly stock returns. We have run seven regression equations, modelling the returns of each country as a function of returns of other countries to examine whether the returns of a particular country are significantly determined by the returns of other countries. From the table it can be seen that Russian and Indonesian stock returns are having significant impact on Indian returns. Brazilian returns are having significant impact on Chinese returns. Chinese and Mexican are having significant coefficient for determining Brazilian returns. Brazilian returns significantly impact Russian stock returns. Indian, Brazilian, and Turkish stock returns seem to have significant impact on Indonesian returns. In case of Mexico only Brazil and Indonesia are significant while in case of Turkey only Indonesian returns are significantly affecting its returns. From the regression analysis it can be seen that more than 2/3rd of the coefficients are insignificant, indicating that markets are segmented and there is scope for diversification.

Causality analysis**Table 6:-** Pair Wise Granger Causality Test of EM7 returns.

Null hypothesis	P value	Result
LRCH does not Granger Cause LRIN LRIN does not Granger Cause LRCH	0.6255 0.2367	Independence
LRBR does not Granger Cause LRIN LRIN does not Granger Cause LRBR	0.9353 0.6405	Independence
LRRU does not Granger Cause LRIN LRIN does not Granger Cause LRRU	0.0022 0.2877	Unidirectional

LRIND does not Granger Cause LRIN LRIN does not Granger Cause LRIND	0.0203 0.0424	Bi-directional
LRMX does not Granger Cause LRIN LRIN does not Granger Cause LRMX	0.0578 0.0403	Bi-directional
LRTR does not Granger Cause LRIN LRIN does not Granger Cause LRTR	0.5338 0.3392	Independence
LRBR does not Granger Cause LRCH LRCH does not Granger Cause LRBR	0.0244 0.0456	Bi-directional
LRRU does not Granger Cause LRCH LRCH does not Granger Cause LRRU	0.6373 0.7471	Independence
LRIND does not Granger Cause LRCH LRCH does not Granger Cause LRIND	0.7635 0.6143	Independence
LRMX does not Granger Cause LRCH LRCH does not Granger Cause LRMX	0.6622 0.8295	Independence
LRTR does not Granger Cause LRCH LRCH does not Granger Cause LRTR	0.1712 0.5323	Independence
LRRU does not Granger Cause LRBR LRBR does not Granger Cause LRRU	0.9196 0.7255	Independence
LRIND does not Granger Cause LRBR LRBR does not Granger Cause LRIND	0.9872 0.8766	Independence
LRMX does not Granger Cause LRBR LRBR does not Granger Cause LRMX	0.4329 0.1402	Independence
LRTR does not Granger Cause LRBR LRBR does not Granger Cause LRTR	0.0804 0.7090	Independence
LRIND does not Granger Cause LRRU LRRU does not Granger Cause LRIND	0.1868 0.6659	Independence
LRMXSP does not Granger Cause LRRU LRRUSP does not Granger Cause LRMX	0.4772 0.9514	Independence
LRTR does not Granger Cause LRRU LRRUS does not Granger Cause LRTR	0.8700 0.1637	Independence
LRMXSP does not Granger Cause LRIND LRINDSP does not Granger Cause LRMX	0.3254 0.9065	Independence
LRTR does not Granger Cause LRIND LRIND does not Granger Cause LRTR	0.0422 0.0511	Bi-directional
LRTR does not Granger Cause LRMX LRMX does not Granger Cause LRTR	0.2071 0.6804	Independence

Table 6 presents the results of pair wise granger causality analysis of the returns of EM7 countries. By looking at the P values of granger causality test, it can be seen that there is Bidirectional causal linkages among the stock returns of (India, Indonesia), (Brazil, China), (Mexico, India) and (Turkey, Indonesia). This indicates that investors of these countries have limited scope for diversification between these countries because returns in one country are caused or causing the returns of other countries. The results further indicate that there is unidirectional causality running Russian stock returns to Indian stock returns. However more than 75% of the pairs show insignificant coefficients which negates any kind of linkages among the return patterns of these countries. The results of granger causality test substantiate the results of correlation and regression analysis that there is scope for portfolio diversification among EM7 countries.

Conclusion:-

The study is part of the larger issue of growing interdependencies among stock markets across globe. Stock prices are seen to be heading in the same direction throughout global markets. It's also worth noting that the degree of market correlation varies across time and regions. In line with this narrative, the present study aims to find inter linkages among the seven largest emerging economies of the world namely India, China, Brazil, Russia, Indonesia, Turkey and Mexico. The study uses correlation, regression and causality techniques to check inter linkages among the returns of EM7 countries for the period between Jan 2010 to Dec 2019.

From the results we conclude that monthly returns among the EM7 countries range from 0.22% to 0.79% with China having maximum return and Mexico with the least return. We also found that Indian stock market provides stable return among the group with least volatility while Mexico has the highest volatility among the group. Return series of all the countries were found to be stationary at level. Correlation analysis revealed low correlation coefficients among the stock returns of the sample countries indicating that returns of these countries do not show much of the co movement which signals that investors among these countries can reap the benefits of diversification. Regression coefficients were also found to be insignificant in most of the cases, lending support to the segmentation of the markets. We further checked the short run causal linkages among the returns of the EM7 countries. Pair wise granger causality test indicates that more than 75% of the coefficients were insignificant, nullifying causal linkages among returns of the EM7 countries. However bidirectional causality was found between some markets - (India, Indonesia), (Brazil, China), (Mexico, India) and (Turkey, Indonesia), suggesting these pairs of markets are integrated. Further unidirectional causality was found to be running from Russian stock returns to Indian stock returns.

The results of the study will provide useful insights to international fund managers and global and domestic investors among EM7 countries for managing their portfolio across borders. Overall the results suggest that there is scope for reaping the benefits of portfolio diversification and mitigate the risks associated with investment and stock markets. Further the results of the study will help the policy makers and regulatory authorities of these countries in determining the policy response against global financial crisis due to the 'contagion effect' like the current Covid pandemic which wreaked havoc globally in terms of financial losses besides human loss. The future direction in the research may involve including both emerging and developed markets, smaller frequency data and more advanced econometric techniques to address the issue of integration among the world stock markets.

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