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An Analysis of Stock and Bond Returns Causality: Case Study of Emerging and Developed Countries

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Abstract—The purpose of this research is to examine the causality of bond returns of five year and stock returns in the case of two developed and two emerging countries USA, Germany, China and Russia respectively. For empirical analysis data from the year 2008 to the year 2017 has been used. The stationarity of the data has been checked with the help of ADF unit root test. The Johansen method has been applied for checking the long term correlation between the variables. Vector error correction methods have been applied for checking the causality between the variables. The results of unit root tests show that all variables are stationary at first difference. Vector error correction results shows in developed countries USA and Germany long and short term causality exists between bond returns of five year and stock returns, in emerging nations only China shows long and short term casualty exists between bond return of five year and stock return whereas in case of Russia short term and long term causality do not exist. This study found that in developing nation causality exists so investor can invest in stock as well as bond, where in emerging countries specially Russia investment in bond prefer, China is very fast growing nation that's why investment in bonds or stock both is preferable in case of China.

Keywords — bond returns, short term causality, correlation, stock returns, short term causality.

1 INTRODUCTION

IN Finance and Monetary Economics, the return is comprised of that money which someone loss or earn while making an investment during a specific time period, this return may be negative, positive and stagnant. While talking specifically about the return on stock, it is the increase in stock prices plus any dividend that creates profits for the firm. I have taken leading index of developed and emerging countries United States Dow Jones, Deutsche Boerse AG German Stock Index DAX, SSE Composite index for China , MOEX Russia (MCX) index and sovereign bond of five year. The returns from stock and bonds fluctuate negatively or positivity and even stagnant depend upon different market and macro factors [7]. There are a number of indicators which decide the stock returns, the volatility of the stock market is also a good indicator of financial market turmoil, and the bond market returns tend to be highly relative to stock market returns because of stock market volatility. So, normally the bonds and stock return have directly propositional with each other [1], highlight that the major variation in international bond returns is because of the global risk factors rather than country-specific factors.

Stocks and bonds return also fluctuate because of the economic environment and market sentiments, as bond gives companies and investors return in the form of fixed income but bonds generate less profit as compared to stocks. The credit rating agencies estimate the future risks of bond and its default value but government bonds are free from default risk because they are secured by the government. So, the volatility of the stock market is the best indicator of the financial market [7], [11].

Generally, the stock price and bond price are correlated to each other, when the bond prices begin to fall, stocks will eventually follow the same pattern and falls down. The pioneer of stock and bond return studies are Fama and Schwert [8], and Campbell and Schiller [5]. They also mention that low positive correlation between stocks and bonds; depress the other economic indicators in the economy. In some situations, the bond market can affect the stock market because they both alternatives for investors. Sometimes, the bond markets fall when investors are in panic situations and they sell everything. In a strong economy, stock market is often remained on boom and in weak economy investor chooses safer investment and likes to stay in the bond market [7], [9]. The study examines the relationship of stock returns and bond returns. This research uses five years bond returns for China, Germany, Russia and the USA. This type of study is hardly available in previous literature; this study will be a healthy contribution towards respective literature.

The USA economy is highly developed and with the mixed economic system. It is one of the biggest economy with respect to nominal gross domestic product with 2.3 percent growth rate in 2019 and 2.9 percent in 2018. The USA economy stands at the 7th largest economy in the world during the year 2016. But the net international investments in the USA have decreased in every passing year like at the end of 2018, it

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International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

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is decreased by −$9, 717.1 billion, in 2017 decreased by −$7, 725.0 billion. But the USA has the most influential and largest financial market in the world. New York Stock Exchange is the biggest exchange in the world. The total makes up of the bond market in the USA is almost $40 trillion. So, the USA has best bond market around the world. So, the USA is an interesting case to study the returns on bonds and stock.

Germany is also highly developed economy and it is the largest economy in the Europe, with respect to nominal income it is 4th largest economy of the world with 1.5 percent growth rate in 2019. Similarly, it has 52,558.7 incomes per capita in 2019, which is the 4th highest in the world. Germany is also the 3rd largest exporter in the world with 1.21 trillion euro annual trade.

China is one of the biggest emerging economies in the world. It is the 2nd largest economy with respect to nominal income and purchasing power parity and 6.6 percent growth rate. In 2015, it is the fastest growing economy in the world. Similarly, China has largest banking sector with assets $39.9 trillion (252 trillion CNY) with $26.54 trillion deposits. In 2018 China economic growth was 6.5 percent. These empirics make China an interesting case to study.

Russia is one of the largest landowner countries in the world and considered leading emerging economy of the world. In 2003, nominal income of Russia is counted $346 billion and in 2014 it is counted as $1.17 trillion. The bond market of Russia is small as compare to others and it covers 21 percent of GDP. But the bond market is steadily growing in Russia. In 2005, the economic growth rate was 6.4% percent to $741 billion. Per capita income growth rate was 6.8 percent during the same time period. The current inflation in Russia is 2.9 percent with unemployment rate 4.8 percent. So, Russia has been selected here as a case study.

2 LITERATURE REVIEW

During the past few decades, relationship between stock returns and bond returns is studied throughout the world. The stock and bond are very important in portfolio maximization; risk management and asset allocation decisions, as investors, mostly pay special attention to these before investing decisions. This part is comprised of most relevant and recent literature has been chosen as a literature review.

Ilmanen [11] investigates the stock, bond correlation. The correlation has tended to be positive but occasionally dipped below zero for extended periods. The study explains negative correlation makes government bonds excellent hedges against major systematic risks recession, deflation, equity weakness, and other financial market crises. The author explores factors that cause positive or negative co-movements across stocks and bonds. Specifically, the stock and bond market sensitivity to the business cycle, inflation, volatility, and monetary policy conditions. In this study, he focuses on four dimensions Business cycle or growth outlook, Inflation environment, Volatility conditions, the monetary policy stance. This article found that in a period of low inflation, discount rates are more stable, making stock-bond correlation lower. The study first looks at the behavior of the U.S. stock market (in terms of the S&P 500) and the bond market (20-year Treasury) over the business and monetary policy cycles. Stocks tend to outperform bonds during business cycle expansions, and bonds tend to outperform stocks during contractions. At high inflation levels, common discount rate changes dominate stock and bond volatility and induce positive correlation across asset classes.

Ohmi et al., [13] examined possible trends in bond and stock return correlations. They used data of the US VIX for all countries due to the limited availability of the VIX (volatility index) for the 2 other examined countries. The short rate (R) is the 3-month Treasury bill rate from the secondary market, data for the US and the 3-month LIBOR rate, data for Germany and UK, while the yield spread (SPR) is defined as the 10-year constant maturity. They analysis futures on the S&P 500 (US), DAX (GE) and the FTSE (UK) stock indices to calculate stock returns and each country's 10-year bond futures to calculate bond returns. They introduce a trend component into a smooth transition regression (STR) model. The results indicate the existence of significant decreasing trends in bond and stock correlations for many advanced safer countries. They find a significant increase in bond and stock correlations around the beginning of the euro crisis for riskier euro countries. Correlation parameters for Regime 1 are significantly positive, with estimated values of 0.38, 0.30 and 0.44 for GE, US, and UK, respectively, while those for Regime 2 are significantly negative, with respective values of –0.40, –0.32 and –0.36. In other words, there are two distinct regimes, one with positive average correlations and the other with negative average correlations. Therefore, correlations transform rapidly and smoothly from negative to positive and from positive to negative. Harumi et al.,[10] investigated possible trends in bond and stock return correlations. The data sample period of study lasting from January 1991 to May 2012. Their empirical measurement based on monthly data for the Germany, United States, and the United Kingdom. All data obtained from DataStream. They introduce a trend component into a smooth transition regression (STR) model. The results demonstrate the presence of significant decreasing trends in bond and stock correlations for major advanced safer countries in the world. They showed that

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

the developed and safer countries share a similar decreasing trend in bond and stock correlations; in contrast the bond and stock correlations for the riskier countries, including Portugal, Italy, and Spain have increased. The results also showed that the bond and stock correlations tend to be positive when the economy is booming. In other words, when the economy is in recession, bond and stock correlations have a tendency to be negative and the existence of a significant decreasing trend in bond and stock correlations for all three countries.

Chiang et al. [6] investigated the dynamic correlations of stock–bond returns for six advanced markets. This paper employs data with both daily and weekly frequencies, with closing observation of the day for the daily data and the Friday closing date for weekly data. The data cover six major advanced markets: Canada, France, Germany, Italy the United Kingdom and the United States for the sample period January 2, 1992 through April 20, 2011. Dynamic conditional correlation (DCC) model was employed to estimate the conditional correlation coefficient for various countries. They showed that the stock–bond relations are positively related to bond market uncertainty. The stock–bond correlations are negatively correlated with stock market uncertainty as measured by the conditional variance and the implied volatility of the S&P 500 index. The estimated conditional correlations on average show positive signs and in times of stock market uncertainty, the relation becomes negative. The positive effect of bond market uncertainty on the stock–bond correlation might stem from the fact that when the equity risk premium is relatively stable, an increase in uncertainty in the bond market affects the expected future discount rates for both stocks and bonds in the same direction.

Roopali & Kapil [14] investigated the relation between shares and bonds and comparative analysis of stock (shares) which are listed on the stock market exchange and bonds (Government Securities) which are listed in the NSE Government security index. The objective of this paper is to scrutinize the correlation and the linkage structure of stock and bond return across different time-phase horizon between stock and Bond Market Indices of Indian market. This article covers the time period from Jan 2006 to Dec 2010. Dependent variable in this study is a stock market of India and the independent variable are government securities index return, treasury bill index return, below 3-year maturity period bond index return, between 3 and 8 year maturity period index return, above 8 year maturity period bond index return and whole government NSE bond index return in correlation and regression data. The sources of the Indian stock Market data are 'S & P CNX Nifty index' and the source of the Indian Government Security Market is the Index of Indian bond market 'NSE Bond index 'of National Stock Exchange of India (NSE) web sites. Data is analyzed using tools like Correlation, Regression, T-test and Durbin Watson test and software used for the analysis is the Statistical Package for the Social Sciences (SPSS). The stock market gets boost or lift high in the condition of low interest rate. Correspondingly stock market has a tendency to go down or slips as the rising of interest rates. This paper analyses that there is any impact on the stock market on the bond market of India and vice a versa. This article concluded that, there is a positive correlation between the stock market and bond market of India.

Bunda et al. [3] worked on co-movements in emerging market bond returns and explains the roles of external and domestic factors during the period of high market volatility. The analysis covers 18 out of 33 emerging countries initially included in the Emerging Market Bond Index (EMBI) Global over the period March 1997 to end October 2008. Due to the nature of dollar-denominated emerging market bonds, trends in these assets are dependent on asset returns of mature markets, and in particular in the U.S, therefore, in this analysis they focus on the three relevant benchmarks of U.S. asset markets (US-TB, SPX and HY Indexes). The first variable is the return on U.S. Treasury bonds (US-TB) is EMBI Global (i.e. 5 to 7 years). The interest rates on Treasury bonds are commonly assumed to be the risk-free rate. US-TB is the most appropriate variable to capture the notion of investors' risk-free asset. The second variable is the return on the Standard and Poor's 500 stock index (US-SPX). Finally, they take into account the performance of the US High Yield corporate bonds (US-HY). In order to release the roles of common external and internal factors in explaining bond markets, co-movement, they perform 60-day rolling regressions of initial emerging bond returns against three external factors (US-TB, SPX and HY Indexes). They finally conclude that over the past few years and until the recent events of the fall 2008, investors seemed to have better differentiated between individual emerging countries, as confirmed by decreasing and very low average correlations and spreads, although some pairwise correlations have remained high, even during the recent period.

2.1 Problem Statement

In previous literature extensive research has been done on stock and the bond return relationship at individual country level, some studies are conducted at two economies comparison as well [15], [16]. But this study first time makes comparison of four different economies i.e. Germany, Russia, the USA and China. The USA and Germany are developed nations, whereas Russia

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

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and China are emerging nations. Similarly, previous literature has given more focus on how stock and bond return correlate with the presence of macro-economic factors [17]. But in this study the long run and short run causality between stock returns and bond returns have been examined in the case of China, Russia, Germany and the USA over the period of 2008 to 2017. This type of study is hardly available in previous literature, so this study is a health contribution towards respective literature.

2.2 Research Objectives and Significance

This study has practical significance because it has provided the comparison of developed and emerging nations and a deeper understanding of the bond and the stock return relationship. First, this study has investigated the relationship of bond five years returns and stock returns in developed and emerging countries. This study has examined the causality of stock and bond returns in the case of Germany, USA, Russia and China. As in [7], [9] have examined the relationship of stock and bond returns, but there is hardly any study which examines the relationship of stock and bond returns in the case of China, Russia, Germany and the USA. So, this study is novel in its nature.

The research objectives are classified as follows:

1. To investigate the short term causality exists between bond returns (five year) and stock returns in the case of China, Russia, Germany and the USA.
2. To investigate the long term causality exists between bond returns (five year) and stock returns in the case of China, Russia, Germany and the USA.
3. To investigate the long term correlation between bond returns of five year and ten year in USA, Germany, Russia and China.

3 Research Methodologies And Data Analysis

The population of this study includes all the developed and emerging countries. The researcher has selected four countries; the two countries are developing and two are developed. USA and Germany are selected as developed nations because these two economies have strong financial markets as well as high growth rate. For emerging nations, China and Russia are selected, because these two nations are emerging rapidly and also having good growth rates. We select a top performing index from each country that represents the true growth and performance of stock and bond of that country. For bonds sovereign bond five years return is taken, for stock returns top performing index has taken. The data are extracted from different sources, time period ranging from 2008-2017, for the bond we take five-year bond yield. We have collected data of stock of Germany from Deutsche Boerse AG German Stock Index DAX (yahoo finance) and Germany bond yield five-years from Investing.com. Data of stock of China from SSE Composite index (yahoo finance) and China bond yield five-years from Investing.com., Data of stock of Russia from MOEX Russia (MCX) (Investing.com) and China bond yield five-year from Investing.com., Data of stock of USA from Dow Jones Industrial Average (^DJI) (Yahoo finance) and USA bond yield five-years from Investing.com.

Table 1
Variables Description

VARIABLES	DESCRIPTION OF VARIABLES
Stock returns	Returns that the investors generated through the stock market. It could be in the form of profit or dividends given by any firm to its shareholders with the passage of time. Calculation: By taking percentage change in closing price to calculate returns
Bonds returns	The returns that investor realize on bond. It can be defined in several ways. The current yield is a function of price of bond and its coupon payment, which will be more accurate as compare to the coupon yield. Calculation: By taking percentage change in closing price to calculate returns

3.1 Hypothesis

H_1: Is there long term and short term causality exists between bond returns (five year) and stock returns in Germany from 2008 to 2017?

H_2: Is there long term and short term causality exists between bond returns (five year) and stock returns in Russia from 2008 to 2017?

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

H3: Is there long term and short term causality exists between bond returns (five year) and stock returns in China from 2008 to 2017?
H4: Is there long term and short term causality exists between bond returns (five year) and stock returns in USA from 2008 to 2017?
H5: Is there long term relationship exists between bond returns of five year and stock returns in the case of the USA, Germany , Russia and USA from 2008 to 2017?

4 DATA ANALYSIS TO PERFORM THE LONG TERM RELATIONSHIP AND SHORT/ LONG TERM CAUSALITY BETWEEN STOCK AND FIVE-YEAR BOND RETURN.

Augmented Dickey-Fuller unit root test has been applied for checking the stationarity of the data. Johansen method has been applied for checking the long run relationship among the variables of the models. The vector error correction model has been applied for examining the short and long run causality among the variables of the model in the case of China, Russia, Germany and the USA.

4.1 Unit Root Test

In 1982 Nelson and Plosser mention that mostly time series data have a unit root problem. They conclude that existence or non-existence of unit root helps to check the authenticity of the data generating process. Stationary and non-stationary data have some different features. The stationary time series data have temporary shocks which are disappearing over the time series and move back to their long run mean values, whereas, shocks are permanently in non-stationary time series data. As a result, the variance and mean of a non-stationary time series is depended upon the time trend and the series follow; (a) no long run mean to which the series returns (b) variance will depend on time and will approach infinity as time goes to infinity. In case if the time series data has only negative or positive shocks, the time series data is non-stationary (Dickey and Fuller, 1979). There are different unit root tests available for making data stationary. For our analysis we use Augmented Dickey-Fuller (ADF) unit root test (1981), for ADF we have to follow this procedure:

$$X_t = \phi X_{t-1} + e_t \quad \text{AR (1)} \qquad (1)$$

If

$|\phi| \geq 1$ non-stationary

and

$|\phi| < 1$ stationary

If unit root exists the variable is non-stationary;

$$X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + e_t$$

$$X_t = \phi_1 L X_t + \phi_2 L^2 X_t + e_t$$

where L is lag operator

Taking X_t common we get;

$$X_t = X_t\left(\phi_1 L + \phi_2 L^2\right) + e_t$$

Letting

$$\phi L = \phi_1 L + \phi_2 L^2$$

We get

$$X_t = \phi L X_t + e_t$$

Solving for e_t we get;

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

$$X_t - \phi L X_t = e_t$$
$$X_t = \phi L X_t + e_t$$

Let

$$1 - \phi L = 0$$
$$L = 1/\phi$$

If $L > 1$ Time series will be stationary

$$-1 < \phi < 1$$

$$X_t - X_{t-1} = \phi X_{t-1} - X_{t-1} + e_t \quad \text{AR (2)} \qquad (2)$$

$$\Delta X_t = X_{t-1}(\phi - 1) + e_t$$
$$\Delta X_t = \delta X_{t-1} + e_t \qquad (3)$$

Where

$$\delta = \phi - 1$$
$$\delta = 0 \text{ non-stationary}$$
$$\delta < 0 \text{ stationary}$$

4.2 Augmented Dickey-Fuller (ADF) Test

In 1981 Dickey and Fuller proposed the Augmented Dickey-Fuller (ADF). The general forms of the ADF can be written as:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{1t} \qquad (4)$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{2t} \qquad (5)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^{q} \phi_j \Delta X_{t-j} + e_{3t} \qquad (6)$$

X_t is a time series for testing unit roots, t is the time trend and e_t is error term having white noise properties. If $j = 0$, it represents the simple DF test. The lagged dependent variables in the ADF regression equation are included until the error term becomes white noise. For checking the serial correlation of error terms LM test is used. The null and alternative hypotheses of ADF unit roots are;

$$H_0 : \delta = 0$$ non-stationary time series; so, it has unit root problem.

$$H_a : \delta < 0$$ stationary time series

Apply OLS and compute τ statistic of the estimated co-efficient of X_{t-1} and compare with the Dickey Fuller (1979) critical τ values. If the calculated value of τ statistic is greater than the critical value then rejects the H_0. In this case the time series data is stationary. On the other hand, if we do not reject the H_0. In this case the time series is non-stationary. In this way by applying this procedure on all variables, we can easily find their respective orders of integration.

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

4.3 Johansen Co-Integration

Johansen (1988) proposed Johansen Co-integration test and Johansen and Juselius (1990) extended it for finding the long run relationship of the variables when they are stationary at some order of integration. Originally, the co-integration concept was developed by Engle and Granger (1987). Engle and Granger (1987) proposed two steps estimation for only one co-integrating vector, but Johansen (1988) and Johansen and Juselius (1990) proposed maximum likelihood test for finding the number of co-integrating vectors in demonstration of Vector Autoregressive (VAR). The common method of VAR is as below:

$$X_t = \alpha_0 + \alpha_t X_{t-1} + \ldots\ldots + \alpha_k X_{t-k} + \varepsilon_t \quad (7)$$

Where X_t is a $(n \times 1)$ vector of variables that are integrated at same order, α_0 is a $(n \times 1)$ vector of constant terms, $\alpha_t \ldots\ldots \alpha_{t-k}$ are parameters and ε_t is the residual term, for Vector Error Correction Model (VECM) the VAR can be written in following form.

$$\Delta X_t = \mu + \sum_{i=0}^{\rho-1} \varphi_i \Delta X_{t-i} + \Upsilon X_{t-1} + \varepsilon_t \quad (8)$$

Where X_t is a $(n \times 1)$ column vector of ρ variables, u is a $(n \times 1)$ vector of constant terms, ε_t is $(n \times 1)$ vector of usual error term, $\sqcup$ is difference operator and φ as well as Υ represent coefficient matrices. The coefficient matrix Υ is representing the long run equilibrium relationship for the matrix. In this analysis two types of likelihood ratio tests are utilized (trace test statistics and maximum eigenvalue test statistics) for finding co-integrating vectors. If there is long run co-integration relationship among the variables, then for finding short run relationship we use the Vector Error Correction Model (VECM). The VECM is explained as under:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (9)$$

All the variables above except ECT_{t-1} which is one time period lagged error correction term. The error correction model results indicate the speed of adjustment back towards long run equilibrium after a short run shock.

4.4 VAR Model

"Vector auto regression (VAR) is a stochastic model used to capture the linear interdependencies among multiple time series".

Equation

Yt = β1Yt-1 +β2Yt-2+…. +βk Yt-k +Ut

Here we are using restricted VAR model (Vector Error Correction Model)

4.5 Wald Test

This test is used for checking the joint significance and short-term causality of the variables.

Ho: C (3) =C (4) = 0

Hypothesis: If p-value is more than 5% I cannot reject the null hypothesis.

5 Data Analysis

5.1 Unit Root Test:

Unit root test is used to check the stationary in data series.

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

TABLE 2
Unit Root Test

	China		Germany	Russia			USA	
Variables	At Level	At first difference	At Level	At first difference	At Level	At first difference	At Level	At first difference
10 Year Bond Returns	-	-10.86379***	-	-11.88978***	-	-8.612450***	-	-12.68742***
05 Years Bond Returns	-	-11.30267***	-	-17.15056***	-	-11.82085***	-	-11.05182***
Stock Returns	-	-9.166867***	-	-9.613694***	-	-13.45494***	-	-11.20812***

Augmented Dickey-Fuller unit root test has been applied for checking the unit root issue in the selected data. The results of unit root tests of bond returns in the case of the China, Germany, Russia and USA have been given in the table. The estimated results of unit root tests reveal that stock returns and five year bond returns are stationary at first difference. So, we can reject the null hypothesis and accept alternative that there is no unit root issue in the data. Therefore, the selected data is stationary at first difference in the case selected four countries.

5.2 Johansen Co-integration test

TABLE 3
Johansen Co-integration test for stock and five year bond return in case of China

Unrestricted co-integration rank test (Trace value)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	49.84915	15.49471	0.0000
At most 1*	20.75627	3.841466	0.0000
Unrestricted co-integration rank test (Maximum Eigen value)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	29.09289	14.26460	0.0001
At most 1*	20.75627	3.841466	0.0000

The estimated trace value is greater than the critical value at one co-integrating vectors. So, there are two co-integrating vectors existed among the selected variables of the model. The estimated maximum eigen values show that maximum eigenvalue is greater than the critical value at one co-integrating vector. This explains that we have rejected the null hypothesis of no co-integration and accept the alternative hypothesis. This shows that there are two co-integrating vectors are existed among the selected variables of the model. The overall Johansen co-integration results show that both trace value and maximum eigen values explains the existence of long term relationship in stock returns and five-year bond returns in the case of China.

TABLE 4
Johansen Co-integration test for stock and five year bond return in case of Germany

Unrestricted co-integration rank test (trace)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	43.95239	15.49471	0.0000
At most 1*	17.06508	3.841466	0.0000
Unrestricted co-integration rank test (Maximum Eigen value)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	26.88731	14.26460	0.0003
At most 1*	17.06508	3.841466	0.0000

The estimated results show that trace statistic is greater than the critical value, there is two co-integrating vectors existed in the case of Germany. So, we reject the null hypothesis of no co-integration and accept alternative and conclude there is co-integration among the variables of the model. The estimates reveal that maximum eigen statistic is greater than the critical value, so the null hypothesis of no co-integration have been rejected and alternative hypothesis can be accepted. This reveals that there is co-integration among the selected variables of the model. Based upon two tests (trace and Maximum eigenvalue tests) P-value is less than five percent critical value that indicates we can reject our null hypothesis of (no co-integration and long-run

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

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association) among these variables and results suggest that there is long-run association between bond returns of five year and stock returns in the case of Germany.

TABLE 5

Johansen Co-integration test for stock and five year bond return in case of Russia

Unrestricted co-integration, rank test (trace)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	50.63730	15.49471	0.0000
At most 1*	12.25665	3.841466	0.0005
Unrestricted co-integration rank test (Maximum given value)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	38.38065	14.26460	0.0000
At most 1*	12.25665	3.841466	0.0005

The estimated results show that trace statistic is greater than the critical value, there is two co-integrating vectors existed in the case of Russia. So, we reject the null hypothesis of no co-integration and accept alternative and conclude there is co-integration among the variables of the model. The estimates reveal that maximum eigen statistic is greater than the critical value, so the null hypothesis of no co-integration have been rejected and alternative hypothesis can be accepted. This reveals that there is co-integration among the selected variables of the model. Based upon two tests (trace and Maximum eigenvalue tests) P-value is less than five percent critical value that indicates we can reject our null hypothesis of (no co-integration and long-run association) among these variables and results suggest that there is long-run association between stock returns and five years bond returns in the case of Russia.

TABLE 6

Johansen Co-integration test for stock and five year bond return in case of USA

Unrestricted co-integration rank test (trace)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	46.54252	15.49471	0.0000
At most 1*	19.07981	3.841466	0.0000
Unrestricted co-integration rank test (Maximum Eigen value)			
Hypothesized No of CE(s)	Trace statistic	(0.05) Critical value	Prob.*
None *	27.31014	14.26460	0.0003
At most 1*	12.61619	3.841466	0.0004

Trace value and Maximum Eigen value have been applied for testing the null and alternative hypothesis in the case of the USA. The estimated results show that trace statistic is greater than the critical value, there is two co-integrating vectors existed in the case of the USA. So, we reject the null hypothesis of no co-integration and accept alternative and conclude there is co-integration among the variables of the model. The estimates reveal that maximum eigen statistic is greater than the critical value, so the null hypothesis of no co-integration have been rejected and alternative hypothesis can be accepted. This reveals that there is co-integration among the selected variables of the model. These results suggest that there is long-run association between stock returns and five years bond returns in the case of the USA.

5.3 VECM Test to show short and long term causality:

For checking the causality between the variables of the model, this study has used vector error correction model. The results of VECM stock returns and five year bond returns are found, where stock returns are dependent variable and five years bond returns are independently variable. Here we get the value of t-statistics which does not explain any relation; to find relationship we generate system equation from above results:

CHINA:

The result of system equations of stock returns of five years bond returns has been presented in the. Here, C (1) presents the speed of adjustment toward long run equilibrium. It must be significant and must be negative. Here the coefficient of C (1) shows it is negative and significant, it means that there is long run causality is running from stock returns to five year bond returns. This also reveals that there is a significant relationship between stock returns and five year bond returns. So, we can

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

reject the null hypothesis of no causality and accept the alternative hypothesis. The F statistics show the overall significance of the model. In our results F statistics has a probability value less than five percent. So, we accept alternative hypothesis and reject the null. This reveals that the model of stock returns and five year bond returns is a good fit.

TABLE 7

VECM result by system equation for long term causality

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.349111	0.118302	-2.951001	0.0039
C(2)	-0.378163	0.122672	-3.082722	0.0026
C(3)	-0.178657	0.098309	-1.817310	0.0719
C(4)	-0.463965	0.194455	-2.385976	0.0187
C(5)	-0.368902	0.167086	-2.207853	0.0293
C(6)	-0.001237	0.008639	-0.143197	0.8864
R-squared	0.367639	Mean dependent var.	-0.000892	
Adjusted R-squared	0.338895	S.D. dependent var.	0.114400	
S.E. of regression	0.093017	Akaike info criterion	-1.861739	
Sum squared resid	0.951729	Schwarz criterion	-1.719312	
Log likelihood	113.9809	Hannan-Quinn criter.	-1.803922	
F-statistic	12.79023	Durbin-Watson stat	2.075812	
Prob(F-statistic)	0.000000			

The joint significance and short term causality of the stock returns and five year bond returns model has been checked with the help of Wald test. The results of Wald test have been presented in the table 8. The null hypothesis for the model of stock returns and five year bond returns in the case of China is that there is no significant relationship between variables. According to Wald test p-value is less than five percent critical value than we can reject the null hypothesis and accept alternative.

TABLE 8

Wald test for short term causality

Test statistic	Value	Df	Probability
Chi-square	2.217880	2	0.0322

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GERMANY

The estimated results of system equations in the case of Germany have been presented in the table 8. Here, C (1) presents the speed of adjustment toward long run equilibrium. It must be significant with negative sign for convergence towards long run. The estimated coefficient reveals that C (1) is negative and significant, this show that bond return (five-years) has significant impact on stock returns in the case of Germany. On the basis of estimate, we can reject the null hypothesis of no causality and accept the alternative. This show that causality is running from five years bond returns to stock returns in the case of Germany over the selected time period. In other words, there is long run causality running from five years bond returns to stock returns in Germany. The F statistics show the overall goodness of fit of the model. Our estimated F statistics have a probability value less than five percent. So, we accept alternative hypothesis and reject the null. According to the alternative hypothesis estimated model of five years bond returns and stock returns in the case of Germany is a good fist.

TABLE 9

VECM result by system equation for long term causality

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.375483	0.110108	-3.410135	0.0009
C(2)	-0.166196	0.108337	-1.534066	0.1279
C(3)	-0.293906	0.090583	-3.244608	0.0016
C(4)	0.001883	0.000534	3.528604	0.0006
C(5)	0.001464	0.000407	3.596461	0.0005
C(6)	-0.000646	0.005516	-0.117148	0.9070
R-squared	0.387547	Mean dependent var	-0.000131	

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

Adjusted R-squared	0.359959	S.D. dependent var	0.074551
S.E. of regression	0.059643	Akaike info criterion	-2.750965
Sum squared resid	0.394857	Schwarz criterion	-2.609315
Log likelihood	166.9315	Hannan-Quinn criter.	-2.693457
F-statistic	14.04770	Durbin-Watson stat	2.205808
Prob(F-statistic)	0.000000		

The joint significance and short term causality of the stock returns and five year bond returns model has been checked with the help of Wald test. The results of Wald test have been presented in the table 10. The joint significance also gives short-term causality existence or non-existence among variable in the case of Germany when stock returns is dependent variable and five year bond returns is independent variable. The null hypothesis for the model of stock returns and five year bond returns in the case of Germany is that there is no significant relationship between variables. According to Wald test p-value is less than five percent critical value than we can reject the null hypothesis and accept alternative, so there is a significant relationship between selected variables in the case of Germany.

TABLE 10

Wald test for short term causality

Test statistic	Value	df	Probability
Chi-square	15.73076	2	0.0004

RUSSIA

The estimated results of system equations in the case of Russia have been presented in the table 10. Here, C (1) presents the speed of adjustment toward long run equilibrium. It must be significant with negative sign for convergence towards long run. The estimated coefficient reveals that C (1) is positive and not significant, this show that bond return (five-years) has not a significant impact on stock return in the case of Russia. On the basis of estimate, we can accept the null hypothesis of no causality and reject the alternative. This show that there is no causality is running from five years bond returns to stock returns in the case of Russia Over the selected time period. In other words, there is no long run causality running from five years bond returns to stock returns in Russia. Our estimated F statistics have a probability value greater than five percent. So, we reject alternative hypothesis and accept the null. According to the alternative hypothesis estimated model of five years bond returns and stock returns in the case of Russia is a good fit.

TABLE 11

VECM result by system equation for long term causality

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.010521	0.064869	0.162185	0.8715
C(2)	-0.418179	0.104031	-4.019761	0.0001
C(3)	-0.309996	0.094054	-3.295944	0.0013
C(4)	0.094538	0.143887	0.657032	0.5125
C(5)	0.056682	0.106210	0.533673	0.5946
C(6)	-0.000644	0.007481	-0.086092	0.9315
R-squared	0.213618	Mean dependent var		-0.000203
Adjusted R-squared	0.178196	S.D. dependent var		0.089249
S.E. of regression	0.080907	Akaike info criterion		-2.141111
Sum squared resid	0.726601	Schwarz criterion		-1.999461
Log likelihood	131.2550	Hannan-Quinn criter.		-2.083602
F-statistic	6.030570	Durbin-Watson stat		1.993810
Prob(F-statistic)	0.000056			

The joint significance of the stock returns and bond returns of five year bond returns model has been checked with the help of Wald test. The results of Wald test have been presented in the table 12. The joint significance also gives short-term causality existence or non-existence among variable in the case of Russia when stock returns is dependent variable and bond returns of

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

five years is independent variable. The null hypothesis for the model of stock returns and bond returns of five years in the case of Russia is that there is no significant relationship between variables. According to Wald test p-value is greater than five percent critical value than we cannot reject the null hypothesis and accept alternative, so, there is a no significant relationship between selected variables in the case of Russia.

TABLE 12

Wald test for short term causality

Test statistic	Value	Df	Probability
Chi-square	0.058897	2	0.9710

USA

The estimated results of system equations in the case of the USA have been presented in the table 43. Here, C (1) presents the speed of adjustment toward long run equilibrium. It must be significant with negative sign for convergence towards long run. The estimated coefficient reveals that C (1) is negative and significant, this show that bond return (five-years) has significant impact on stock return in the case of the USA. On the basis of estimates, we can reject the null hypothesis of no causality and accept the alternative. This show that causality is running from five years bond returns to stock returns in the case of the USA over the selected time period. In other words, there is long run causality running from five years bond returns to stock returns in the USA. The F statistics show the overall goodness of fit of the model. Our estimated F statistics have a probability value less than five percent. So, we accept alternative hypothesis and reject the null. According to the alternative hypothesis estimated model of five years bond returns and stock returns in the case of the USA is a good fit.

TABLE 13

VECM result by system equation for long term causality

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.367559	0.122290	-3.005621	0.0033
C(2)	-0.296568	0.120406	-2.463066	0.0153
C(3)	-0.303564	0.099152	-3.061587	0.0028
C(4)	-0.104846	0.034813	-3.011677	0.0032
C(5)	-0.060257	0.025011	-2.409200	0.0176
C(6)	-0.000393	0.004137	-0.095018	0.9245
R-squared	0.387443		Mean dependent var	0.000219
Adjusted R-squared	0.359599		S.D. dependent var	0.055661
S.E. of regression	0.044542		Akaike info criterion	-3.334410
Sum squared resid	0.218243		Schwarz criterion	-3.191983
Log likelihood	199.3958		Hannan-Quinn criter.	-3.276593
F-statistic	13.91502		Durbin-Watson stat	2.162905
Prob(F-statistic)	0.000000			

The joint significance of the stock returns and bond returns of five year's model has been checked with the help of Wald test. The results of Wald test have been presented in the table 14.

The joint significance also gives short-term causality existence or non-existence among variable in the case of the USA when stock returns is dependent variable and bond returns of five years is independent variable. The null hypothesis for the model of stock returns and bond returns of five years in the case of the USA is that there is no significant relationship between variables. According to Wald test p-value is less than five percent critical value than we can reject the null hypothesis and accept alternative, so there is a significant relationship between selected variables in the case of the USA.

TABLE 14

Wald test for short term causality

Test statistic	Value	Df	Probability
Chi-square	9.409356	2	0.0091

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

6 FINDINGS AND INTERPRETATION:

According to Andersson (2014) relationship between stock returns and bond returns varies considerably over time among different nations. Furthermore, he explains that stock returns and bond return relationship may change substantially and may turn from positive to negative, in very short periods of time or for a longer time period. Harumi et al. (2015) mention that the existence of significant decreasing trends in bond returns and stock returns in major advanced countries has been witnessed during previous years. The results indicate that a long term and short term causality exists between bond returns and stock returns in developing countries but in emerging countries only China shows causality. This shows that if financial markets are strong, then investors prefer to invest in stock because it gives higher returns. But on the other hand, if the market is weak, then investors prefer to invest in bonds. Similarly, the investors' perception reflected by our empirical results. The stock return volatility is mostly due to volatility of future excess return news (Valckx 2004). The stock market in developing economies is more volatile, the regulatory bodies should play their part in order to make it stable. The relevant information should be provided to investors and other stakeholders. Government can stable the economy by stabilizing the stock market, which will attract more investors and firms and this will help to control the bad economic situation. In the case of Russia as there is no causality from bonds to stock market therefore, for household investors, institutional investors and countries with surplus funds to invest in the bond market of Russia instead of the stock market, as stock market of Russia is more volatile as well as there are sovereign guarantees of bonds of Russia. In developed countries, investors could invest in both stock and bond market; Furthermore, investors should invest in stock market of developing countries as it is stable and provide better returns as compared to bond markets. This section of the thesis is comprised of conclusions and policy suggestions. Many finance policymakers believe that bond markets and stock markets within and among countries tend to move together. For justifying, this study tries to examine the relationship between bonds market returns and stock market returns in the case of China, the USA, Germany and Russia over the period of 2008 to 2017. This study also makes a comparative analysis, among the selected nations. Augmented Dickey-Fuller unit root test has been applied for checking the stationarity of the data. For examining the long term relationship among variables, Johansen method has been applied. The vector error correction model has been applied for examining the causality among the variables of the model. Following indices has been selected from China, USA, Germany and Russia i.e. Stock returns German Deutsche Boerse AG German Stock Index DAX, China SSE Composite index, Russia MOEX Russia (MCX), USA Dow Jones Industrial Average.

The results of unit root rest in the case of China reveal that all selected variables are stationary at first difference. China is considered is one of big emerging nations in the world, the results of China shows that there is long run causality and short run causality exists between bond returns of five year and stock returns. China is growing very rapidly, therefore investors has some confidence in Chinese markets.

Russia is also considered another emerging nation. The results of unit root tests reveal that all variables in the case of Russia are stationary at first difference. The findings show that there is no long run and short run causality exists between bond return of five year and stock returns in the case of Russia. These findings are different from findings in the case of China.

The USA is one of the biggest developed markets in the world and has strong financial markets. This is the reason; the investor would like to invest in the USA, because the level of risk is also low in the USA. The results of unit root tests show that all the variables are stationary at first difference. The finding shows that there is short run and long run causality exists between bond returns of five year and stock return.

Germany is also one the main developed countries and there is very less risk to invest in the financial markets of Germany. The findings of this study show that all the variables are stationary at first differences in the case of Germany. The results show that there is a long run and short run causality exists between bond returns of five year and stock returns.

6.1 Policy recommendations

On the basis of empirical result and discussion there are several practical recommendations can be derived from the study. Some specific actions could be applied by the respective stock exchanges to promote their performance. The stock market in developing economies is more volatile, the regulatory bodies should play their part in order to make it stable. The relevant information should be provided to investors and other stakeholders. Government can stable the economy by stabilizing the stock market, which will attract more investors and firms and this will help to control the worst economic situations.

IJSER

International Journal Of Scientific & Engineering Research, Volume 10, Issue 11, November-2019

ISSN 2229-5518

6.2 Limitations of the study

This study has some limitations with improving or reducing these weaknesses further research can be done. Firstly, this study can be expanded to other countries also. Secondly, further studies can be held to investigate the impact of different economic, social and demographic factors on these stock and bond market.

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