Stock Market, Exchange Rate and Bond Market Integration: Evidence from Pakistan

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Abstract

This study is conducted to examine long run and short run relationship between stock market, bond market and exchange rate. The Study is conducted in Pakistani context and sample period is from July 2010 to June 2017. Johansen Cointegration and VECM tests result indicate stock market and exchange rate have long run and short run relationship with bond market. Similarly, exchange rate is also affected by stock market and bond market in short run as well long run. However, Stock market is not influenced by exchange rate fluctuations of bond market changes in short run or long run.

Keywords: Stock markets, Integration, Exchange Rate

Introduction

In recent past, financial markets have gone through various reforms and their efficiency and depth have increased. More open Stock markets,flexible exchange rates and moderate bond yields have created conducive environment for local and foreign investors. Financial markets become much more integrated and their performance relieson interdependent movements. It is therefore important to understand how financial markets are linked with each other.

Financial Markets integration have very important implication for investors because they constantly observe these markets and try to exploit every opportunity to earn excess return. If abundant capital flows from one financial market to other it could have consequences for other market and can cause exchange rate fluctuations. In turn, under or overvaluation of currencies can create impediment in investment decisions making of investors.

The relationship between stock market, bond market and exchange rate could be understood through portfolio adjustment

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mechanism. According to this approach, stock price changes force foreign investors to adjust their portfolios by increasing or decreasing the demand of currency. If stock prices are increasing, foreign investors will purchase local currency for investment which causes appreciation of local currency. But if stock prices decline foreign investors try get their money out of country which put pressure on local currency demand resulting in lower interest rates in turn which put pressure on bond yields.
Following is the brief description of the three financial markets which are used in this study.

Exchange market: Every country has domestic currency through which it prefers to pay for its local as well as foreign trade. Countries involve in exports and imports of goods and services from one country to another, each country wants to pay or receive for trade in its local currency therefore international trade require purchase and sell of currencies. It requires monetary system through which currency of one country could be bought against the currency of other.

The Exchange rate is defined as the value of one currency against the other currency and market where currencies are traded is called foreign exchange market. It provided the specialized mechanism through which currency of one country could be bought against the currency of other. The foreign exchange markets facilitate trade transactions through monetary exchange of currency from on country to other.

A multifold increase in international trade and growing number of multinational corporations have enhanced the role of foreign exchange markets. In recent years, exchange rates have fluctuated rapidly which leave traders and MNCs vulnerable to exchange rate risk. MNCs profit margin could decline due to exchange rate fluctuations and traders could be worse off in trade transaction due to change in exchange rate.

The exchange rate fluctuations could impact the financial decision making of Traders, MNCs, financial institutions, and governments. Even the profitable International business could face loses due to exchange rate fluctuations. The government exports loose its competitiveness and imports could become expensive due to change in exchange rates. Any decrease in value of local currency will decrease reserves of government and there will be increase in debt payments. Thus, changes in exchange rate have significant consequences for businesses, traders & governments

and understanding of exchange rate fluctuations have economic policy implications

Stock Market: Stock market is another medium of financing through which companies generate finances by issuing their stocks to be purchased by all types of investors. Due to high level of liquidity and over the counter availability of stocks make it most attractive to many investors. The stock market all around the world has market capitalization of $69 trillion. Pakistan stock market formerly known as Karachi Stock Exchange is one of the fastest growing market in Asia and recently it has crossed the 50000-basis points recently and on this outstanding performance it has been included in MSCI Emerging Market Index.

Bond market: The bond is type of financial instruments through which debt capital is raised by companies as well as governments. The bond market fall in between bank financing and equity market and mostly it is preferred by investors who are not risk taker and want definite periodic returns on their investment. There are various purposes of bond issuance by Governments; it may be used as tool to raise capital for infrastructure projects, to regulate currency valuation & money supply and to control inflation. Pakistani bond or debt/credit market consists of corporate bonds and Government bonds. Corporate bonds are widely known as Term financing certificates which are issued by corporate entities to meet their financial requirements. Government bonds included different bonds issued by Government of Pakistan and other Public Sector Organizations such as Pakistan Investment bonds, National Saving Bonds, Sukuk Bonds, WAPDA Bonds and USD & Euro Bonds

In this paper, we have conducted analysis on dynamic linkage between stock market, bond market and exchange rate to better understand their integration. Study is conducted in Pakistani context for the post financial crisis period from July 2010 to June 2017. Through the Johansen Cointegrationwe concluded that the stock market, exchange rate and bond markets are integrated. Granger causality results suggest that movement in stock market has profound impact on performance of exchange rate and bond yield. To check their long term and short term relationship we have applied VECM model which suggest that bond yield is influenced by stock market and exchange rate in long run and exchange rate is also influenced by stock market movements and bond yield. Whereas stock market has no long run relationship with exchange rate and bond yield. Similarly, Wald test conducted on ECM result

suggest bond yield have short term relationship with stock market and exchange rate. Exchange rate also have short term relationship with stock market and bond yield. However, Stock market has no short term relationship with bond yield and exchange rate.

The rest of the paper proceeds as follows: second sectiondescribes literature review and third section provides data and methodology fourth section summarize results of various statistical tests and discussion of result and at the end conclusion is given.

Literature Review

Himachalapathy et al. (2015) conducted study on Indian Government bond market and found that bond yield rates have positive and significant relationship fiscal, monetary and economic variables such as bank and repo rates, industrial production index GDP and price index.

Kek and Goh (2015) Conducted study in context of Malaysia and found that bond yield spread has long run relationship with economic activity and interest rate volatility.

Auret (2014) examined South African Market and compared the performance of three financial asset classesi.e cash, bonds, and equities. They observed there is no difference in performance of equities, cash and bond market in long run but after risk adjustment, bonds outperform equities and cash markets.

Gadanecz et al. (2014) conducted study on emerging markets and found that exchange rate volatility influence investors decision making and demand higher yield for holding local currency bonds.

Antwi et al. (2012) compared stock exchange and treasury bills performance and found that stock market outperforms treasury bills but both give excess returns to investors which are higher than inflation rate.

San et al. (2012) and Ahmed et al.(2009) observed that bond maturity spread is not related to stock market returns and other economic variables in Malaysian Market.

Baldacci and Kumar (2010) found that in advance economies public debts and fiscal deficits put upward pressure on bond yields over medium term.

Agrawal et al. (2010) found that in Indian market, Nifty returns are not correlated with USD/INR exchange rate but Nifty return granger cause the exchange rate

Rehman (2014) conducted analysis on exchange rate fluctuations in Pakistani market and its relationship with various economic factor. Findings of this study suggest inflation and money supply have relationship with exchange rate and there is bidirectional relationship

between reserves and exchange rate while the exchange rate does not have relationship with KSE all share index. Saleem (2013) finding suggest that there is negative relationship between stock market and inflation and there is no causality between stock market and inflation.
Tariq et al. (2016) study empirically show that exchange rate exposure is highly influenced by the Pakistan stock market. Bhat and Shah (2015) show a bi-directional relationship between PKR/USD and KSE-100 index.

Data and Methodology

This study was conducted in context of Pakistan Markets. The seven-year sample was selected for the period from July 2010 to June 2017. The Daily data of stock market, exchange rate and bond yield rate have been used in this study and it was collected from website investing.com and finance.yahoo.com. The Stock market is represented by Karachi 100-index, exchanger rate is represented by United States dollar to Pakistani Rupee (USD/PKR)and bond yield rate is represented by Pakistan Government10 year yield. The Missing values in data were interpolated through cubic spline method in EViews software. For unit root tests, Johansencointegration, Granger Causality test and VECM EView software has been used.

Methodology

In this study, long term and short term relationship between three important markets of Pakistani have been tested. In 1st step of analysis Augmented Dicky Fuller test (ADF) and Phillips Perron (PP) test of stationarity were conducted. In 2nd step JohansenCointegration were conducted to check long term relationship between three markets, in 3rd step Granger Causality test was conducted to check short term relationship.

Step 1:Stationarity Tests

To check the stationarity of daily time series data of KSE-100 index, 10 year Pakistan Bond and USD/PKR exchange rate following test have been used.

Augmented DickyFullur Test (ADF)

Augmented Dickey–Fuller test (ADF) test is used to test the stationarityof time series. The null hypothesis is that there is unit root in time series data and alternative hypothesis is that the time series data is stationary. If ADF test reject the null hypothesis it means that time series data is stationary and further analysis could be done. The higher negative

value of t-statistics indicates stronger rejection of null hypothesis.TheLag length is selected on basis of various information criteria such as Akaikeinformation criteria or Schwarz information criteria.

Phillips-Perron (PP) test (1988)

Phillips Perron is another test for testing the unit root in time series data and control for serial correlation. The PP test is very similar to ADF test but it includes non- parametric correction and make adjustment in t-statistics. The PP test show robust results while tacking unspecified autocorrelation &heteroscedasticity in the disturbance process

To check stationarity of time series data, following null and alternative hypothesis were developed:

Ho: The KSE-100 index, USD/PKR exchange rate and Pakistan 10 year Bond yield is not stationary at level.

H1: The KSE-100 index, USD/PKR exchange rate and Pakistan 10 year Bond yield is stationary at level

Step 2: Johansen Cointegration Test (1988)

The Johansen cointegration test main purpose is to find cointegration between groups of non-stationary time series and explore the long run relationship among group of variables. In this paper, cointegration test have been applied to find cointegration and long term relationship between kse-100 index, USD/PKR exchange rate and Pakistan 10 year Bond yield.

Step 3: Granger Causality Test

To check short term relationship between variables, granger causality test has been used as it is known to be useful technique to find trends in between multivariate time series. In this paper, granger causality test has been applied to find short term relationship among variables; kse-100 index, USD/PKR exchange rate and Pakistan 10 year Bond yield.

Step 4: Error Correction Model

Since the error correction model pertains to group of time series models which are helpful when used on time series data of variables which have stochastic trends in long run or in other words, variables which have cointegration. Error correction models are not only helpful in detection of long run effects but it can also detect short run effects between one or group of variables. Intuition behind ECM model is that the error correction term relates to previous period aberration from long term equilibrium and its error term effect the short term dynamics. The error correction model also measure directly the speed of adjustment at which

equilibrium will be achieved by the dependent variable with the change in independent variables.

Resultsand Discussion:

Table01

Descriptive Statistics

	BOND	EXCHANGE	STOCK
Mean	11.38011	97.87487	25342.39
Median	12.00100	100.4500	25500.50
Maximum	14.50437	108.5000	52876.46
Minimum	7.384490	84.20000	9516.420
Std. Dev.	2.175513	7.318687	11848.87
Skewness	-0.368845	-0.602234	0.376667
Kurtosis	1.660373	1.877562	2.076905
Observations	1827	1827	1827

Source: Authors' own calculation

Table01 is showing the descriptive statistics of three variables used in this study. Total number of observations for all three variables are 1827 and sample period comprised of 01/07/2010 to 30/06/2017. The Pakistan 10 year bond yield mean values is 11.380 and its maximum value is 14.504 minimum value is 7.384 and standard deviation is 2.175 which indicates that over the sample period Pakistan 10 year bond yield have remained stable and there is less fluctuation in yield of bond. The USD/PKR exchange rate descriptive statistics indicates that on average USD/PKR rate has remain around 97.874 and its touched maximum rate of 108.500 and at its lowest rate was at 84.200 and standard deviation is 7.38 which indicates that over the sample period USD/PKR exchange rate have remained moderate volatile. The KSE 100 index have jumped from its lowest point 9516.420 points to maximum points of 52876.46 and its standard deviation of 11848.87 indicate high level of change in KSE-100 index over the sample period.There is negative skewness in Pakistan 10 year bond yield and USD/PKR exchange rate indicate more data value lies on left side of meanwhile positive skewness in KSE-100 index indicate more data point lies on right side of mean.

Unit Root Tests Results

To check the stationarity of three variables, time series data is plotted individually and it is shown in Figure01.

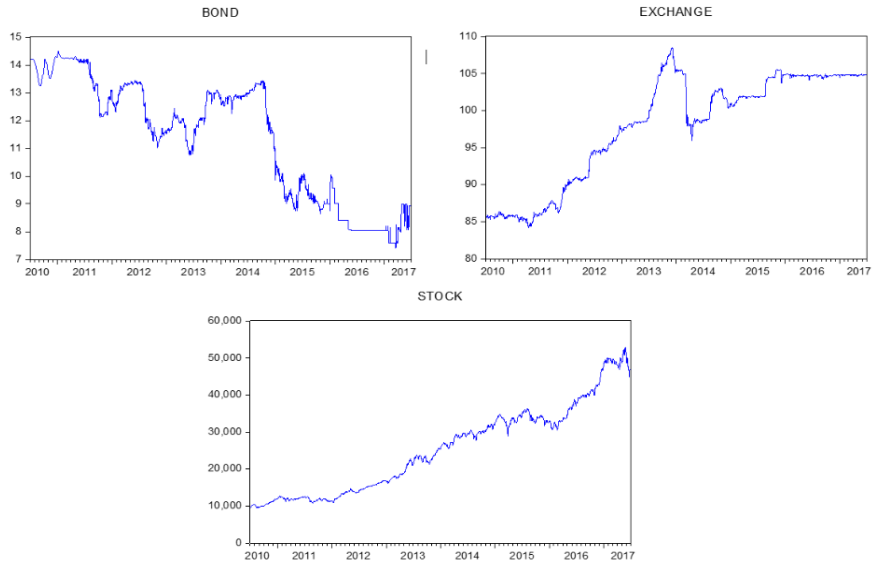

Figure01: Time series Graph of the Bond, Exchange and Stock

All three variables time series show a trend which indicates that data is not stationary however to ascertain the non-stationarity issue, ADF and PP test are conducted at level. In Table02 result of ADF & PP tests at level are shown in column 1 and 3. At level, Pakistan 10 year bond yield show ADF test result -0.925 (0.780) and PP test result -1.036 (0.742), which indicates that probability is higher than 0.05% and null hypothesis that there is unit root in data cannot be rejected. Furthermore, the ADF test result of USD/PKR exchange rate time series data is -1.376 (0.595) PP test results are -1.38 (0.593) and KSE-100 index time series data ADF results are 0.361 (0.981) and PP test results are 0.257 (0.976). At level all ADF & PP tests results show all variables have unit root problem and time series have trend and data is non stationary.

It is therefore to make further analysis, data must be made stationary by taking log first difference of each variable time series data. Figure02 show graphical representation after taking log first difference of each variable data and it appears that all data series have become stationary at log first difference I (1). Graphs also indicate volatility clustering which could be helpful in further analysis of variables

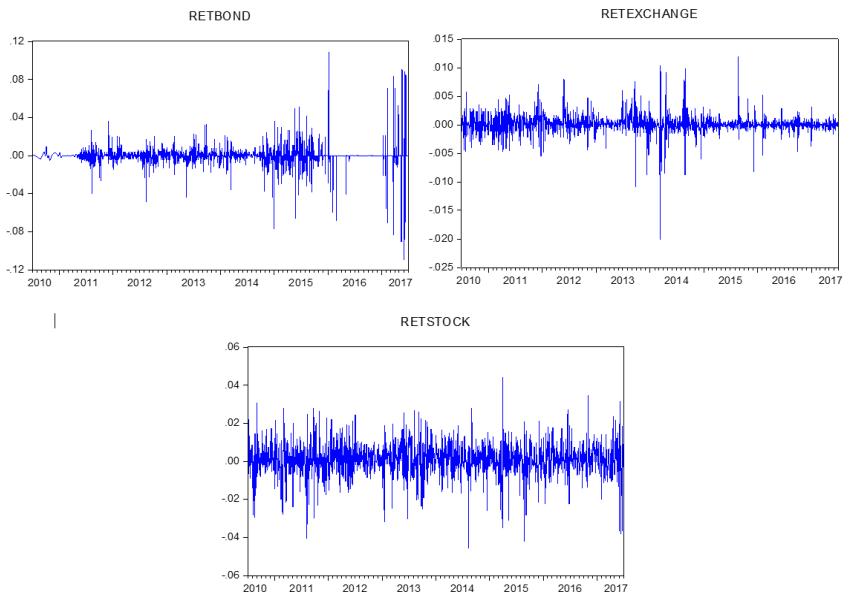

Figure02: Graphs showing volatility among the markets.

In Table02, after taking log first difference, ADF test and PP test results are shown in column 2 and 4. Pakistan 10 year bond yield data show ADF result -26.659 (0.000) and PP -50.161 (0.0001) which suggest that we can reject the null hypothesis and data is stationary at log first difference. Similarly, USD/PKR exchange rate data have ADF test value 21.550 (0.000) and PP test value -34.084 (0.000) and KSE-100 index data have ADF value -36.232 (0.0000) PP test value -36.147 (0.0000) which indicate both series have become stationary at log first difference.

Table02

	Augmented (ADF)	**Dickey-Fuller**	**Phillips-Perron (PP)**	
	At Level	Log1st Dif.	At Level	Log 1st Dif.
	1	2	3	4
BOND	-0.925 (0.780)	-26.659 (0.000)	-1.036 (0.742)	-50.161 (0.0001)
EXCHANGE	-1.376 (0.595)	-21.550 (0.000)	-1.380 (0.593)	-34.084 (0.000)
STOCK	0.361 (0.981)	-36.232 (0.0000)	0.257 (0.976)	-36.147 (0.0000)

Johansen cointegration test results

From unit root tests we found that all three variables time series data are stationary at first difference, therefore we have applied Johansen cointegration test to determine long term relationship among three variables. The results of cointegration test are presented in Table03:

Table03

Johansen Cointegration Test

Cointegration between Bond, Exchange rate and Stock

Hypothesis	**H0 :r = 0**	**H1 :r ≤ 1**	
	Trace Statistics	Maximum Eigen Statistics	Conclusion
None *	1041.615 (0.0001)***	425.717 (0.0001)***	All three markets are cointegrated
At most 1 *	615.897 (0.0001)***	355.901 (0.0001)***	
At most 2 *	259.996 (0.0000)***	259.996 (0.0000)***	

*** = 1% ** = 5% * = 10% level of significance

The result of cointegration test in first row strongly rejects the null hypothesis with trace statistics 1041.615 (0.0001) and Maximum Eigen statistics 4.25.717 (0.0001) that there is no cointegration in all three variables and atleast there is one cointegration between variables. Second row results also reject null hypothesis that there is at most one cointegration, Trace statistics 615.897 (0.0001) Max-Eigen value 355.901 (0.0001) indicate that there is more than one cointegration between variables. Last row results once again reject the null hypothesis that there are at most two variables are cointegrated with Trace statistics 259.996 (0.0000) Max-Eigen value 259.996 (0.0000). Overall Johansen Cointegrationtest results suggest that all three Pakistani markets are integrated with each other and there is long term relationship between all three markets of Pakistan.

Granger Causality test results

To understand the short run mechanism of three markets of Pakistan, the granger causality test has been used and results are shown in Table04. The six hypotheses of granger causality relationship between three variables have been tested and results indicate that out of six hypotheses, we could only reject two hypothesis. In both cases KSE-100 index have short term relationship Pakistan 10 year bond yield with F statistics 1.870 (0.100) at 10% significant level and USD/PKR exchange rate with F statistics 5.607 (0.000) at 1% significant level. It means that KSE-100

index granger because Pakistan 10 year bond yield and USD/PKR exchange rate in short term in context of Pakistan. It has important policy implication as movements in KSE-100 index or stock market may influence the exchange rate of Pakistan and also affect to the Government bond in short term.

Table04

Granger Causality (Pairwise) Test

	F-Stat	Hypothesis Rejected/ Not Rejected	Direction of relationship
Pakistan 10 Year bond yield does not Granger Cause KSE-100 index	0.058 (0.993)	Not Rejected	Bond ⇏ Stock
KSE-100 index does not Granger Cause Pakistan 10 Year bond yield	1.870 (0.100)*	Rejected	Stock ⇨ Bond
USD/PKR exchange rate does not Granger Cause KSE-100 index	0.557 (0.693)	Not Rejected	Exchange ⇏ Stock
KSE-100 index does not Granger Cause USD/PKR exchange rate	5.607 (0.000)***	Rejected	Stock ⇨ Exchange
USD/PKR exchange rate does not Granger Cause Pakistan 10 Year bond yield	1.308 (0.264)	Not Rejected	Exchange ⇏ Bond
Pakistan 10 Year bond yield does not Granger Cause USD/PKR exchange rate	0.209 (0.933)	Not Rejected	Bond ⇏ Exchange

*** = 1% ** = 5% * = 10% level of significance

Vector Error Correction Test Result:

For the conformity of cointegration test results VECM and VEC Granger Causality (Wald test) has been conducted. From Johansen cointegration test we found out that there is cointegration in all three markets of Pakistan, therefore we can apply Vector Error Correction Model. According to Schwarz criterion lag length of 2 has been selected. Table05 shows results of VECM test which indicate that there is long term relationship between Pakistan 10 year bond and KSE-100 index and USD/PKR exchange rate. The causality is running from stock market and foreign exchange market to bond market and coefficient value -1.260 indicate that speed of adjustment is 126%. The USD/PKR exchange has long term relationship with bond market and stock exchange with probability value 0.0416 but its coefficient is positive 0.015. There is no

long term causality running bond market and exchange market to stock market.

Table05

Vector Error Correction Model

Dependent Variable	Independent Variables	Coefficient	Std. Error	t-statistics	Prob.
Bond	Stock, Exchange	-1.260	0.045	-27.591	0.0000
Exchange	Bond, Stock	0.015	0.007	2.039	0.0416
Stock	Bond, Exchange	0.055	0.039	1.392	0.1639

For testing short term relationship the Wald test conducted which is given in Table06. Short run relationship results are very much similar to long run relationship of three variables. Bond market is also influenced by stock market and exchange rate in short with probability values below 5% while exchange rate is influenced by stock market and bond market in short run at 10% significance level. There is no short run causality between Stock market and bond market and exchange rate.

Table06

Wald test

Dependent variables	Independent variables		
	USD/PKR exchange rate	KSE-100 Index	Pakistan 10 year bond yield
	P-Values	P-Values	P-Values
Pakistan 10 year bond yield	0.0000 C(4)=C(5)=0	0.0003 C(6)=C(7)=0	
USD/PKR exchange rate		0.0765 C(14)=C(15)=0	0.0808 C(10)=C(11)=0
KSE-100 Index	0.1314 C(20)=C(21)=0		0.4921 C(18)=C(19)=0

*** = 1% ** = 5% * = 10% level of significance

The Table07 indicates the results of Granger causality (Wald test). The values presented in the Table07 represent Chi-square and probability values. The test results suggest that Pakistan 10 year bond yield and USD/PKR exchange rate does not cause changes in KSE-100 index in

short term. Null Hypothesis could not be rejected as p values are higher than 0.05 or 5% of significant level and causality does not run from

Table07

VEC Granger Causality (Wald test)

Dependent variables	Independent variables		
	KSE-100 Index	Pakistan 10 year bond yield	USD/PKR exchange rate
KSE-100 Index		1.4179 (0.492)	4.059 (0.131)
Pakistan 10 year bond yield	16.073 (0.0003)***		37.169 (0.0000)***
USD/PKR exchange rate	5.140 (0.076)*	5.030 (0.080)*	

*** = 1% ** = 5% * = 10% level of significance

independent to dependent variable. Pakistan 10 year bond yield is highly related to KSE-100 index and USD/PKR exchange rate. It suggests that bond market is influenced by stock exchange and exchange markets movements in short term. Similarly, at significance level of 10% USD/PKR exchange rate is influenced by the KSE-100 Index and Pakistan 10 year bond yield. Overall resultsindicate short term relationship between markets in Pakistan.

Conclusion

In this paper, we have conducted analysis on dynamic linkage between stock market, bond market and exchange rate to better understand their integration. Study is conducted in Pakistani context for the post financial crisis period from July 2010 to June 2017. ADF and PP unit root tests show that all three time series are not stationary at level therefore log first difference was taken to make series stationary. Through the Johansen Cointegration we concluded that the stock market, exchange rate and bond markets are integrated. Granger causality results suggest that movement in stock market has profound impact on performance of exchange rate and bond yield. To check their long term and short term relationship we have applied VECM model which suggest that bond yield is influenced by stock market and exchange rate in long run and exchange rate is also influenced by stock market movements and bond yield. Whereas stock market has no long run relationship with exchange rate and bond yield. Similarly, Wald test conducted on ECM result suggest bond yield has short term relationship with stock market and exchange rate. Exchange rate also have short term relationship with stock market and bond yield. Stock market has not short term relationship with bond yield and exchange rate.

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