IMPACT OF MACROECONOMIC VARIABLES AND TERRORISM ON STOCK PRICES IN PAKISTAN

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Abstract

The objective of this study is to investigate the impact of macroeconomic variables (interest rate, the exchange rate, consumer prices, oil prices, gold prices, market size, trade openness) and terrorism on stock prices of Pakistan, by employing Additive Outlier unit root (cointegration, and error correction model with a known Structural break. Time series quarterly data for the period January 2000- December 2016, consisting 68 observations of each variable, was used in this study. The cointegration reveals that there is a significant long-run relationship among the variables. The results found through an error correction model that the long-run bi-directional causality exist between stock prices, exchange rate, industrial production index, and openness. However, the results do not provide evidence of any significant short-run causality between most of the variables.

Keywords: Stock Prices, Cointegration with Structural Break, Terrorism, Macroeconomic Variables, Additive Outlier Unit Root.

JEL Classification: G310

Introduction

The understanding of the impact of stock market on the economy of any country is important as it provides the opportunity for various companies to raise their funds, enabling them to extend their business activities. It also stimulates the idle funds of the people to put in productive purpose which will lead to higher productivity and economic growth of the economy. Therefore, it is also called the barometer of the economy. The process of opening up the stock market for foreign investor in Pakistan was due to the financial reforms which were begun since the eighties and which in turn increase the portfolio investment in Pakistan, (Fazal & Qayyum, 2007). There are many market forces which cause to increase or decrease the share prices like depreciation in the exchange rate leads to fall in stock market return (Adjasi & Biekpe, 2005).

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The terrorist attack and political instability may also have an impact on stock returns. Further, the stock market will be crashed due to disturbance in the trade cycle (recession or depression) or crisis. The investors always keep in mind the political and law and order situation of the country before investing because these may have an adverse effect on the stock exchange performance.

KSE-100 index consists of 100 companies from different sectors having the highest market capitalization (90 % of total market capitalization). This index was established with a base value of 1000 points in 1991 and it reached to 18636.03 in April 5, 2013. According to the State Bank of Pakistan, KSE-100 price index increased from 1572 to 2331 points in 1990-91 to 1993-94. However, it fell to 880 points in 1997-98 as compared to 2331 points in 1993-94 due to various internal and external factors (i.e. East Asian financial crisis). KSE-100 index dropped from 1040.19 to 789.15 due to nuclear test in Pakistan on 28 May 1998. In 2007, KSE was on the sixth number as the best performer among the emerging markets as KSE-100 showed a return of 40.19%. In the mid of April 2008, KSE-100 index gained 11.6% and on 18 April 2008, it reached to the highest level of 15676 points with a gain of 1747 points as compared to the start of 2008. After reaching such a high level, it had fallen by 62% on 31st December, 2008 due to bad law and order and international capital flight. In 2008, due to political instability[3] and crisis, the index went down by more than a third from April to June 2008.

The financial crises of 2008 were worse than the Asian financial crisis 1997-1998.These were started from the last half of 2007 in the US and turn out to be more severe in 2008, and extend all over the world due to globalization and technological advancement (Ali & Zafar, 2012). Developing countries were also affected by the financial global crisis (2007-08) but the intensity was different according to their collaboration with the world markets and the structure of their economies. The exports and foreign direct investment in developing countries were much affected due to this crisis (Iqbal, 2010).

The following were the major consequences of financial crisis of 2008:

- The 2007-08 was one of the most chaotic years in the history of Pakistan because of an increase in inflation.
- Increases in interest rates by the State Bank of Pakistan increases the inflation rate in the month of May 2008, which ultimately causes a reduction in the stock prices.
- On 18th, April 2008, KSE-100 index reached at its peak having 15676 points in its history, while (due to global financial crisis, political environment of Pakistan) it was dropped by 62% in 31, December 2008 since April 2008.
- In 2007-08, KSE-100 index dropped, which was more than 10% as compared to previous years.

The performance of the stock market of Pakistan is affected from time to time due to various macroeconomic variables and terrorism attacks. If stock prices show the upward movement then it will attract the foreign and domestic investors and ultimately cause to increase investment and output of the economy. If there is any relationship among macro and non-macroeconomic variables with stock prices, then the crisis can be avoided by making efficient policies and controlling adverse fluctuations in macroeconomic variables in order to stabilize the stock market.

This study aims to explore whether there are long run and short run dynamic interactions among macroeconomic variables (exchange rates, consumer price index, interest rates, market size, trade openness, oil prices, & gold prices), terrorism, and stock prices.

Literature Review

Imran et al. (2012) used Granger causality and Johansen's co-integration (1988) techniques to check the short-run and the long-run relation between macroeconomic variables (interest rate, treasury bills, exchange rates, inflation rate) and Karachi Stock Exchange (General index of KSE of all share prices). They used monthly data from January 2005 to December 2010. The results described that there was no Granger causality between KSE, the inflation rate, and treasury bills, while one-way Granger causality exist between KSE and the interest rate. Further, bi-directional Granger causality exist between stock prices and the exchange rate.

A wave of fear had been created among the people due to terrorism and affects the economy by a number of ways: decrease in growth, investment, and stock returns (Aurangzeb & Dilawar, 2012). The terrorism also, has a negative effect on the stock market. The strategies should be diversified to decrease the impact of terrorism (Chesney et al., 2010).

Lee et al. (2012) used the monthly data consisting 240 observations from January 1992 to December 2011 to check the impact of macroeconomic variables (interest rate, money supply, crude oil prices, and consumer price index) on the Kulalumpur market composite index (consists of top 30 companies). The study used the techniques such as OLS, Johansen co-integration, Granger causality test, Variance decomposition, and impulse response function. The impact of interest rate and crude oil prices on stock market returns were negative, while money supply and inflation had a positive effect. Aurangzeb and Dilawar (2012) checked the impact of terrorism (bombing, armed isolation, assassination, and hostage) on KSE 30 index of Pakistan by taking monthly data from 2004-2010. The results found through regression and Granger causality test that a negative relation exist between them.

Hina and Naveed (2011) used co-integration and Granger causality tests in order explore the effect of the gold price on KSE-100 index. They used monthly data from December 1, 2005 to December 31, 2010. The study found a negative relation between gold prices and KSE-100 index in the short-run, while cointegration analysis showed no long-term relation between the variables.

Ali et al. (2010) studied the relation of macroeconomic variables (exchange rate, inflation, balance of trade, industrial production index, & money supply) and general price index of KSE (of Pakistan) by using monthly data from June 1990-December 2008. They concluded after applying the Johansen co integration that co integration found among stock prices with the industrial production index and inflation while money supply, exchange rate, and balance of trade had no co integration with stock prices. Using Granger causality test, they found that macroeconomic variables do not necessarily used to estimate the stock prices. They concluded that no causal relation exists between macroeconomic indicators and stock exchange prices.

Sohail and Hussain (2009) determined the short-run and the long-run relationship between stock prices of LSE (Lahore Stock Exchange of Pakistan) and macroeconomic variables (real effective exchange rate, money supply, industrial production index, CPI, and three-month Treasury bill rate). They employed the co integration and VECM on data from December 2002-June 2008. The study revealed that in the long-run, money supply, real effective exchange rate, and industrial production index had a positive impact on stock returns (LSE 25), while the impact of three-month Treasury bill rate was also positive but statistically insignificant. However, they found that stock returns negatively affected by inflation.

Rashid (2008) employed co integration and Granger causality techniques robust to structural break to check the link between stock prices and macroeconomic variables like industrial production, consumer prices, the exchange rate, and market rate of interest by taking June 1994-March 2005. He found that in the short-run, no causation exists between stock prices and macroeconomic variables. However, changes in interest rates in the short-run cause to changes stock prices. In the long-run, co integration exists among the variables. Further, error correction model reveals that bi-directional causality exists between them.

Naeem and Rashid (2002) conducted a study by taking monthly data of South Asian countries (India, Sri Lanka, Bangladesh, & Pakistan) from January 1994 to December 2000. They employed co integration, VECM, Granger causality test and concluded in India and Pakistan, there was no long-run relationship between exchange rate and stock prices but in Sri Lanka and Bangladesh, there were a long-term relation and bi-directional causality existed between the variables.

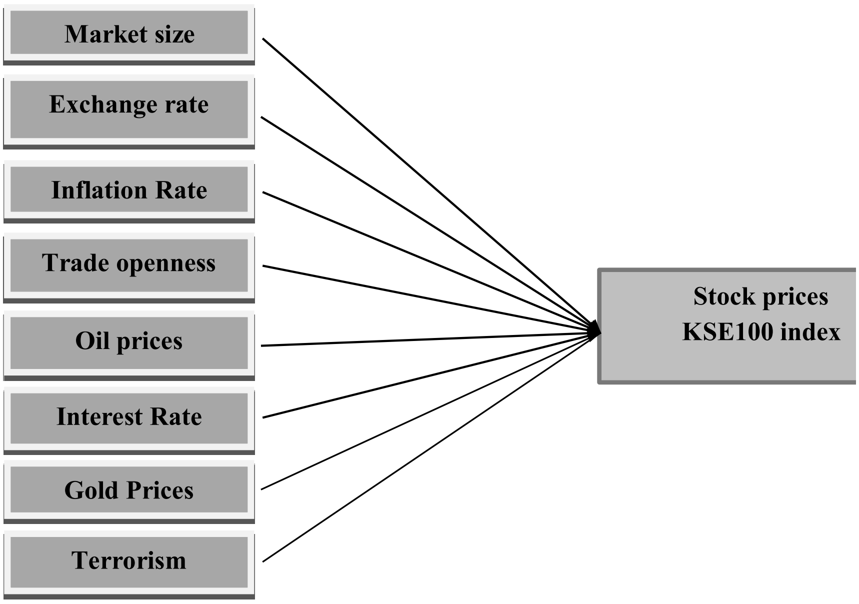

Figure1: Proposed study model

Research Methodology

The objective of this study is to check the short-run as well as the long - run relationship between macroeconomic variables, terrorism, and stock prices in Pakistan by employing Granger causality and co integration tests, robust to a structural break. In this regard, the study follows Rashid (2008), who has employed the structural break tests to examine the impact of nuclear tests on stock prices. Time series quarterly data for the period January 2000- December 2016, consisting 68 observations of each variable, will be used in this study.

Economic Function

$$LnSPt = B_0 + B_1(LnER)_t + B_2(MMR)_t + B_3(LnCPI)_t + B_4(OPP)_t + B_5(LnGP)_t + B_6(LnEP)_t + B_7(LnIPI)_t + B_8(TE)_t + e_t \quad (1)$$

Where, B_1 , B_2 , B_3 , B_4 , B_5 , B_6 , B_7 , and B_8, are coefficients and e_t is the disturbance term and all variables (except MMR and trade openness) are transformed into Ln form.

Data sources and Description of variable

Table 1
Description of variables

Variables	Proxy	Description	Unit	Source
Stock prices	KSE	KSE-100 index	Index	State bank of Pakistan (SBP)
Exchange rate	ER	Month average ER of Pakistan	Rs. Per US$	International financial Statistics (IFS)
Interest rate	MMR	Money market rate	% per annum	IFS
Inflation	CPI	Consumer prices, all items	Index, 2005=100	IFS
Trade openness	OP	(exports+imports)/GDP	In nominal domestic currency	SBP
Gold prices	GP	Gold prices	Rs. Per Troy ounce	FOREX
Energy imports	EP	Crude oil petroleum	Rs. Per barrel	IFS
Market size	IPI	Industrial production index	Index, 2005=100	IFS
Terrorism	TE	All incidents of terrorism	Bomb blast	Global terrorism data base

Statistical Techniques

The following estimation techniques will be used in this study in order to get the empirical results with the help of Eviews.

Unit root tests with structural breaks

This study considers of the 2008 financial crisis as a structural break. Hence, a series marked by stationary variation with one-time permanent change in level, in this case the standard tests of unit root may provide deceptive results. Perron (1990) described statistic to test unit root for one time change in mean. He suggested introducing a dummy in the ADF test if the breaks are known. Therefore, Perron and Vogelsang (1992) developed the Additive-Outlier test (for unit root) to examine whether the series is stationary or not when it suffers from a structural break in the data.

Additive-Outlier model

Suppose the time series is the univariate indicated by Yn and n=1, 2…. N and has a shift in mean at time Na, so 1 < Na < N, which is indicated by the following equation.

$$Y_n - v_1 = b_1 (Y_{n-1} - v_1) + \alpha_n \qquad \text{where} \qquad n \leq N_a$$

$$Y_n - (v_1 + v_2) = b_1 (Y_{n-1} - (v_1 + v_2)) + \alpha_n \qquad n > N_a$$

Here α_n is a disturbance term having zero mean and constant variance. It is assumed in this model that in all sub samples, b_1 (parameter) remains same and the effect of change is spontaneous, hence in each sub sample, the above model is conditionally formulated on first observation: Y_n and Y_{n+1}. When $|b_1| < 1$ and by $(v_1 + v_2)$ for $n > N_a$.

Hence the model can be rewritten under the null hypothesis of a unit root.

$$Y_n = b_1 (Y_{n-1} (v_1 + v_2 D_{n-1}) + (v_1 + v_2 D_n) \alpha_n \qquad \text{.....................................} (2)$$

Where $D_n = 0$ if $n \leq N_a$ and $D_n = 1$ if $n > N_a$

By rearranging the equation:

$$\Delta Y_n = \gamma_1 Y_{n-1} - \gamma_1 v_1 - \gamma_1 v_2 D_{n-1} + v_2 \Delta D_n + \alpha_n \qquad \text{.....................................} (3)$$

Since $\Delta D_n = 0$ if $n \leq N_a$ or if $n > N_a + 1$ And $\Delta D_n = 1$ if $n = N_a + 1$.

The effect of ΔD_n corresponding to Y_{N1+1} is to render the associated residual zero given the initial value in the second sub sample. Furthermore, in order to control the autocorrelation, the regression procedure (eq-3) might be included in both lags of the first difference of dependent variable and intervening dummy.

$$\Delta Y_n = \gamma_1 Y_{n-1} - \gamma_1 v_1 - \gamma_1 v_2 D_{n-1} + v_2 \Delta D_n + \sum_{i=1}^{m} \beta_1 \Delta Yn\text{-}1 + \sum_{i=1}^{m} \lambda \Delta Dn\text{-}1 + \alpha_n \qquad \text{..................................} (4)$$

Asymptotic distribution of t-statistic of the estimated coefficient of Y_{n-1} , $\hat{\gamma}_1$, the null of unit root is tabularized by Perron (1990) and Perron and Vogelsang (1992).

Co-integration with structural break

The definition of co integration due to structural break split into stochastic and deterministic co integration and usual co integration test (Engle & Granger), Johnson (1988, 1991, 1995), Philips and Ouliaaris (1990) Perror and Campbell (1993) failed to discover any co integration in the presence of structural break. Therefore, this study will use the Carrion-I-Silvestre et al. (2005) co integration test, in which L-M type statistic is used to test the null of Co-integration allowing for the possibility of a structural break in both parameters of stochastic and deterministic components. This test is a multivariate extension of one described by Kwiatkowski et al. (1992) where a change occurs at a point of time in deterministic or stochastic or both deterministic and stochastic components. As per the literature of time studies, there are two types of structural change models:

a. The change in mean model (shifting occurs in deterministic (intercept) component)
b. The change in regime model (a change occurs in both deterministic and stochastic (slope) component at a time Na)

Therefore, the data generating process is of the form:

$$Y_n = ᵽ_n + ¥n + Z'_n b_1 + \alpha_n \quad (5)$$

$$Z_n = Z_{n-1} = \alpha_n \quad (6)$$

$$ᵽ_n = f(n) + ᵽ_{n-1} + \xi_n \quad (7)$$

Here, Z_n is a K vector of 1 (1) of regressors and $\beta_n \sim$ id $(0, \sigma^2_\xi)$. The $ᵽ_0$ is an intercept and constant and f (n) represents a function of deterministic 0r/and stochastic components. The various models under study are stated through definition of function f (n).
The change in mean model

The change in Mean Model means change occurs only in deterministic components and described as follows:

Model -1 here ¥ = 0 and f (n) = θD (N$_a$)$_n$

Model -2 here ¥ ≠ 0 and f (n) = θD (N$_a$)$_n$

Model -3 here ¥ ≠ 0 and f (n) = θD (N$_a$)$_n$ + ȼDV$_n$

Here, D $(N_a)_n$ = 1 for n = N_a and 0 otherwise, DV_n = 1 for n > N_a and 0 otherwise, with Na =

ђN, 0 < ђ < 1, presenting the date of break. According to Perron (1990), from Model (1) to Model (3) the series of error term was obtained to be of the ARMA (p and q) type along p and q orders possibly unfamiliar. Hence, under co-integration null hypothesis $\sigma^2_{\xi} = 0$, therefore, the models (eq. 5, eq. 6, and eq. 7) change into:

$$Y_n = qi\,(n) + Z'_n\, b_1 + \alpha_n \quad \text{.......} \quad (8)$$

Here qi (n), i = (1, 2, 3}, exhibits deterministic function under the null hypothesis. Therefore,

For Model -1, $q1(n) = \text{ɋ} + \theta DV_n$

For Model -2, $q2\,(n) = \text{ɋ} + \theta DV_n + ¥n$

For Model -3 , $q3\,(n) = \text{ɋ} + \theta DV_n + ¥n + hDN^*_n$

Here $hDN^*_n = (n - N_a)$ for $n > N_a$ and 0 otherwise.

The change in regime models

It is likely that a change occurs in both stochastic and deterministic components because of the particular structural break. In this case, the following two models proposed by Silvestre et al. (2005) are used.

Specifically, the models are expressed as follows:

Model -4 here and $¥ = 0$ **and** $f\,(n) = \theta\, D\,(N_a)_n + Z'b_2D\,(N_a)_n$

Model -5 here and $¥ \neq 0$ **and** $f\,(n) = \theta D\,(N_a)_n + hDVn + Z'b_2D\,(N_a)_n$

Eventually, under the null hypothesis of co-integration $\sigma^2_{\xi} = 0$, therefore, the models (eq. 5, eq. 6, and eq. 7) change into:

$$Y_n = qi\,(_n) + Z'_n b_1 + Z'_n b_2\, DV_n + \alpha_n \quad \text{.......} \quad (9)$$

The null hypothesis, the deterministic function is qi (n) and i = (4, 5}

For model -4 $q4(n) = ᵽ + \theta DV_n$

For model -5 $q5(n) = ᵽ + \theta DV_n + ¥n + hDN^*_n$

If the regressors are not strictly exogenous, then following steps is taken in order to check the null hypothesis of co-integration against alternative no co-integration (Carrion-I-Silvestre et al., 2005).

Estimates

$$Y_n = qi(n) + Z'_n b_1 + \Delta Z'_n Ꮟ + \sum_{j=-k}^{k} \Delta Z'_{n-1} \lambda_j + \alpha_n \quad \text{if } i=(1, 2, 3) \qquad (10)$$

$$Y_n = qi(n) + Z'_n b_1 + Z'_n b_2 DV_n + \Delta Z'_n Ꮟ + \sum_{j=-k}^{k} \Delta Z'_{n-j} \lambda_j + \alpha_n \qquad (11)$$

Here i= (4, 5) and store the estimated residuals e^i, n, i = (1, 2, 3, 4, 5).

b) Calculation of Test statistics

$$SC^*_i(ђ) = \frac{\sum_{n=1}^{N} (S^*_{i,n})^2}{N^2 \breve{a}^2_{1,2}}$$

Where $\breve{a}^2_1$ = consistent estimator of the long-run variance (α_n) conditioned

$S^*i, n = \sum_{j=1}^{n} \alpha^{\wedge *}_{i,n}$ and i= (1, 2, 3, 4, 5)

Error correction model with structural break

Chang and Ho (2002) test is used in this study in order to check the Granger causality due to structural break. In order to capture the impact of a known structural break, a dummy was introduced in the usual VECM.

$$\Delta X_n = \text{¥}_0 + \text{ᵽ}_0 b_{n-1} + \sum_{i=1}^{p} b_{0i} \Delta X_{n-1} + \sum_{i=1}^{k} \beta_{0n} \Delta Y_{n-1} + \lambda_0 DV_n + \alpha_{0n} \quad \text{......................................} (12)$$

$$\Delta Y_n = \text{¥}_1 + \text{ᵽ}_1 b^*_{n-1} + \sum_{i=1}^{p} b_{1i} \Delta Y_{n-1} + \sum_{i=1}^{k} \beta_{1n} \Delta X_{n-1} + \lambda_1 DV_n + \alpha_{1n} \quad \text{......................................} (13)$$

DV_n = dummy equal to 1 for $n > N_b$ (structural break) and 0 otherwise. αi n = i.i.d with zero mean and variance is finite. b_{n-1} and b^*_{n-1} are lagged residuals taken from the co-integration regression (e.q 8 and 9) and Δ shows the first difference operator ($\Delta X_n = X_n - X_{n-1}$).

In eq. 12, Y cause X if ᵽ_0 is statistically significant (long-run causality). If ᵽ_0 and ᵽ_1 are statistically significant, shows bi-directional long-run causality. Regarding short-run Granger causality, the joint significance of β_{0n} and β_{1n} is examined using F test.and

Results and Discussion

Descriptive Statistics of Variables

In order to analyze the normality statistical characteristics of the variables, descriptive statistics would be presented before and after the financial crisis of 2008 (structural break).

Table 2
Descriptive statistics: Of variables before and after structural break

Variables	Before Structural Break (33 Observations)			After Structural Break (35 Observations)		
	Mean	**Std. Dev.**	**Skewness**	**Mean**	**Std. Dev.**	**Skewness**
LnKSE 100	8.381	0.8626	-0.089	9.70	0.55	0.09
LnCPI	4.29	0.09	0.15	4.69	0.12	-0.40
LnEP	7.742	0.466	0.442	8.89	0.35	-0.64
LnER	4.3512	0.1284	0.9237	4.61	0.05	0.08
LnGP	10.091	0.381	0.536	11.56	0.28	-0.99
LnIPI	4.036	0.353	-0.150	4.833	0.280	-0.559
OPP	0.791	0.269	0.939	0.72	0.13	0.09
LnTE	2.52	0.93	-0.20	5.039	0.557	0.180
MMR	9.145	6.568	1.001	8.35	2.96	2.85

Table 2 depicts that the mean of all the variables after structural break are almost greater than the mean of variables before the structural break. Similarly, the standard deviation of all the variables after the structural break is less than the standard deviation before the structural break. Further, in both the periods the values of skewedness of all the variables are not at much distance from the zero, therefore, the series are not being off from normality and are almost normally distributed.

Correlation Matrices

Correlation estimates are presented in order to examine the relationship between the variables before and after the structural break period.

Table 3 (a)

Correlation before structural break

	KSE	CPI	MMR	ER	GP	IPI	OPP	EP	TE
KSE	1								
CPI	0.93	1							
MMR	-0.86	-0.77	1						
ER	0.67	0.73	-0.34	1					
GP	0.94	0.93	-0.74	0.80	1				
IPI	0.96	0.87	-0.87	0.61	0.90	1			
OPP	0.26	-0.10	0.23	-0.25	-0.31	-0.42	1		
EP	0.92	0.88	-0.69	0.81	0.94	0.90	-0.37	1	
TE	0.55	0.56	-0.30	0.75	0.64	0.55	-0.51	0.73	1

Note: All the variables are in natural logarithmic form except money market rate and openness.

Table 3(a) shows that before structural break, KSE-100 index is strongly positively correlated with consumer price index (Lee et al., 2012), Sohail and Hussain (2011), energy prices, gold prices, and industrial production index. However, stock prices negatively correlate with the money market rate. Further, stock prices moderately positively related with exchange rate ((As shown by Sohail and Hussain (2011), Smith (1992), Solnik (1987), Aggarwal (1981)), openness (Hajra et al., 2007) and terrorism.

Table 3 (b)

Correlation after structural break

	KSE	CPI	MMR	ER	GP	IPI	OPP	EP	TE
KSE	1								
CPI	0.93	1							
MMR	0.39	0.49	1						
ER	0.04	0.03	0.26	1					
GP	0.56	0.76	0.23	-0.33	1				

(Table Continued...........)

IPI	0.91	0.88	0.32	-0.09	0.72	1			
OPP	0.41	0.61	0.31	-0.04	0.56	0.28	1		
EP	-0.03	0.10	-0.14	-0.43	0.45	0.19	0.24	1	
TE	0.36	0.54	0.28	-0.19	0.64	0.43	0.55	0.57	1

Note: All the variables are in natural logarithmic form except money market rate and openness.

The table 3 (b) shows that after a structural break, KSE-100 index strongly positively correlated with Consumer price index, market size, and weekly positive correlated with interest rate, exchange rate, openness, and terrorism and negatively week correlated with the energy prices.

Results of Unit Root test (changing mean) with structural breaks

Perron and Vogelsang (1992) proposed the additive-Outlier model to test the unit root in the series allowing one-time change in mean. The null and alternative hypotheses are as follows:

Hypotheses:

H_0: The series has a unit root (non stationary)
H_a: The series does not follow unit root (stationary)

The results of this test at both level and first difference are presented in the following table.

Table 4
Additive-Outlier Model

Perron and Vogelsang test, *n* β̂1 (*AO, Na, k*)						
Variables Series	**Test statistics**					
	At level			**At first difference**		
	K=0	**K=1**	**K=2**	**K=0**	**K=1**	**K=2**
LnKSE	-0.11	-0.12	-0.03	-11.12*	-3.16*	-6.15*
LnCPI	1.34	1.45	1.13	-9.34*	-7.13*	-3.25*
LnEP	0.36	-0.12	-0.11	-9.14*	-6.71*	-6.97*
LnER	-2.42	-2.01	-1.12	-10.18*	-6.07*	-9.42*
LnGP	0.40	1.09	1.4	-13.17*	-10.14*	-7.20*
LnIPI	-1.98	-1.39	-3.13	-10.07*	-6.12*	-7.57*
LnOPP	-1.5	-0.03	0.96	-24.14*	-10.26*	-11.12*
LnTE	-7.4*	-3.12	-4.02	-21.17*	-11.86*	-10.26*
MMR	-5.12*	-2.16	-3.14	-16.15*	-13.45*	-9.25*

Critical values determined on the no. of observations (N) and the order of Lags K. Here K is equal to 0, 1 and 2 and N is 68. *,**, *** shows significant at 1%, 5% and 10 % respectively. For critical values of this test, see Annex- A.

From Table 4, it is clear that the null hypothesis of a unit root of all the variable series, at first difference, is rejected, showing all the series are stationary at first difference. Hence, all the variables are integrated of order one. The results of unit root tests are consistent with the Rashid (2008).

Results of cointegration test with structural breaks

Due to the presence of structural break in the date, Carrion-I-Silvestre et al. (2005) co-integration test is used in this study, in which LM type statistic is used to test the co-integration allowing for the possibility of a structural break in both parameters of stochastic and deterministic components. Therefore, the hypotheses of the test are as follows:

Hypotheses:

H_0: There is co-integration among the variables.
H_a: There is no co-integration among the variables.

Therefore, the following five models are estimated in presence of structural break due to the 2008 financial crisis.

Model 1 : A change occurs in deterministic (intercept) component.

Model 2 : A change occurs in deterministic (intercept) component including linear trend.

Model 3 : A change occurs in linear trend.

Model 4 : A change occurs in both deterministic (intercept) and stochastic (slope) component.

Model 5 : A change occurs in both deterministic (intercept) and stochastic (slope) component and linear trend.

Table-5 shows the calculated test statistics for all these five models.

Table 5
Co-integration test of known structural break

Model A	Model B	Model C	Model D	Model E
		K= 0		
0.0107	0.00075	0.00066	0.00016	0.00007
		K= 1		
0.0057	0.00034	0.00035	0.00008	0.00004
		K= 2		
0.0021	0.00019	0.00021	0.00005	0.00002
		K= 3		
0.00073	0.00010	0.00001	0.00002	0.00001

Critical values of this test for 1-5 models based on the K and ђ, see Annex-B.

The understudy period is from January 2000 to December 2016, and structure break occurs on May 2008 due to the financial crisis. Therefore, Break function = ђ = Na/N, (ђ = 33/68= 0.48}. It is observed from the table that all the estimated values for Model 1, 2, 3, 4 and 5 at different lags are less than from their respective critical values. These estimated values move downward by increasing lag orders. Therefore, we accept the null hypothesis of co integration. It means the underlying variables are co integrated in the long-run. These findings are consistent with Imran et al. (2012), Sohail and Hussain (2011), Ali et al. (2010), Rashid (2008) and Raza et al. (2012).

Results of Error Correction Model with Structural Break

In order to determine the long-run and short-run association between the variables, following tables shows the estimated value of error correction model with a structural change at known date.

Table 6

Error Correction Model with Known Structural Break for long run and short run Granger causality

(a) Shift in mean

Hypothesis (H0)	Estimates of error correction term	F-statistics
KSE does not Granger cause CPI	-0.19*	2.17
CPI does not Granger cause KSE	-0.001	0.027
KSE does not Granger cause EP	-0.139*	0.58
EP does not Granger cause KSE	-0.02	2.83
KSE does not Granger cause ER	-0.19*	1.05
ER does not Granger cause KSE	-0.007	1.13
KSE does not Granger cause GP	-0.19*	0.32
GP does not Granger cause KSE	-0.013	0.27
KSE does not Granger cause IPI	-0.198*	1.43
IPI does not Granger cause KSE	-0.025	1.21
KSE does not Granger cause OPP	-0.286*	1.2
OPP does not Granger cause KSE	-0.082*	0.002
KSE does not Granger cause TE	-0.21*	1.17
TE does not Granger cause KSE	-0.27	0.20
KSE does not Granger cause MMR	-0.18*	2.19
MMR does not Granger cause KSE	-0.78	0.16

(b) Shift in mean including linear trend

Hypothesis (H0)	Estimates of error correction term	F-statistics
KSE does not Granger cause CPI	-0.21*	2.76*
CPI does not Granger cause KSE	-0.03	0.0213
KSE does not Granger cause EP	-0.16*	0.39
EP does not Granger cause KSE	-0.021	1.69
KSE does not Granger cause ER	-0.197*	0.86
ER does not Granger cause KSE	-0.012	1.04
KSE does not Granger cause GP	-0.12*	0.78
GP does not Granger cause KSE	-0.03	1.18
KSE does not Granger cause IPI	-0.14*	1.39
IPI does not Granger cause KSE	-0.04*	1.12
KSE does not Granger cause OPP	-0.19*	1.14
OPP does not Granger cause KSE	-0.15*	0.004
KSE does not Granger cause TE	-0.19*	2.19
TE does not Granger cause KSE	-0.197	0.07
KSE does not Granger cause MMR	-0.18*	2.01
MMR does not Granger cause KSE	-0.09	0.24

(c) Shift in mean and regime

Hypothesis	Estimates of error correction term	F-statistics
KSE does not Granger cause CPI	-0.31*	2.23
CPI does not Granger cause KSE	-0.04	0.005
KSE does not Granger cause EP	-0.14*	0.56
EP does not Granger cause KSE	0.108	1.023
KSE does not Granger cause ER	-0.230*	0.68
ER does not Granger cause KSE	-0.014	0.69
KSE does not Granger cause GP	-0.26*	0.056
GP does not Granger cause KSE	-0.07	0.76
KSE does not Granger cause IPI	-0.45*	1.9
IPI does not Granger cause KSE	-0.07	2.05
KSE does not Granger cause OPP	-0.18*	1.37
OPP does not Granger cause KSE	0.37*	0.053
KSE does not Granger cause TE	-0.28*	1.08
TE does not Granger cause KSE	-0.76	0.29
KSE does not Granger cause MMR	-0.21*	2.76
MMR does not Granger cause KSE	-0.56	0.09

(d) Shift in mean and regime including linear trend

Hypothesis	Estimates of error correction term	F-statistics
KSE does not Granger cause CPI	-0.190*	3.20*
CPI does not Granger cause KSE	-0.005	1.27
KSE does not Granger cause EP	-0.39*	0.17
EP does not Granger cause KSE	-0.06	0.334
KSE does not Granger cause ER	-0.345*	0.78
ER does not Granger cause KSE	-0.028*	1.28
KSE does not Granger cause GP	-0.34*	0.38
GP does not Granger cause KSE	-0.067	0.67
KSE does not Granger cause IPI	-0.409*	0.87
IPI does not Granger cause KSE	-0.028*	2.09
KSE does not Granger cause OPP	-0.49*	1.09
OPP does not Granger cause KSE	0.035*	0.45
KSE does not Granger cause TE	-0.342*	3.97
TE does not Granger cause KSE	0.034	1.25
KSE does not Granger cause MMR	-0.31*	2.98
MMR does not Granger cause KSE	-0.67	0.154

*, shows significant at 10%

Table 6. depicts the error correction model with known structural break has been applied to check the direction of causality among the variables. The results of error correction model with specification shift in mean (a) and shift in mean plus regime (c) are almost the same. This shows only in the long-run bi-directional causality exist between trade openness and stock process while all other variables have uni-directional causality which runs from stock prices to macroeconomic variables.

Further, the results of the error correction model with a shift in mean plus linear trend (b) and a shift in mean and regime plus linear trend (d) are also same. That is, long-run bi-directional causality exists which running from stock prices to the exchange rate, industrial production index, and trade openness and all other variables have a unidirectional causal link which runs with the stock prices to consumer price index, the money market interest rate, terrorism, gold prices, and oil prices. The F-values indicate that the short-run uni-directional causality exists which runs from stock prices to the consumer price index. The result of this study is consistent with Imran et al. (2012), who show, bi-directional Granger causality exists between stock prices and the exchange rate. The results are consistent with Rashid (2008), who found that in the short-run, no causation exists between stock prices and macroeconomic variables (industrial production and consumer prices).

Conclusions and Recommendations

The results of this study are based on empirical estimation. Therefore, this study can be useful for general public, policy makers, investors, Central Bank and economist, so that they can stabilize the performance of the stock market and care should be taken in designing government policies. Therefore, for growth and healthy performance of stock market, the industrial production should be increased in the country. The Government should give the incentives to the producers to increase their production, so that the impact of crisis can be reduced. Therefore, the volatility in interest rate should be controlled by the Government to build the confidence of investors.

Terrorism also has negative impact on stock prices. Therefore, it will be controlled and remedial measures should be taken by the concerned authorities to enhance the performance of stock market. The strategies should be diversified to decrease the impact of terrorism (Chesney et al., 2010). Further, trade openness should also be increased.

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Appendix -A

Percentage points of the distribution of $n\hat{\gamma}_1$ (AO, Na, k), Additive Outlier Model

		1.0%	2.5%	5.0%	10.0%	90.0%	95.0%	97.5%	99.0%
$N=50$	$k=0$	-5.0	-4.73	-4.41	-4.07	-2.23	-2.02	-1.84	-1.64
	$k=2$	-4.92	-4.54	-4.21	-3.86	-2.06	-1.85	-1.66	-1.50
	$k=5$	-4.70	-4.28	-3.96	-3.63	-1.90	-1.70	-1.52	-1.36
	$k=k^*$	-5.28	-5.02	-4.76	-4.45	-2.58	-2.35	-2.16	-1.95
	$k=k(F)$	-5.18	-4.92	-4.64	-4.35	-2.37	-2.11	-1.94	-1.75
	$k=k(t)$	-5.20	-4.95	-4.67	-4.33	-2.36	-2.13	-1.95	-1.74
$N=100$	$k=0$	-5.05	-4.73	-4.41	-4.10	-2.35	-2.14	-1.95	-1.73
	$k=5$	-4.6	-4.3	-4.0	-3.78	-2.13	-1.91	-1.69	-1.47
	$k=k^*$	-5.4	-4.9	-4.6	-4.34	-2.58	-2.33	-2.12	-1.89
	$k=k(F)$	-5.2	-4.8	-4.5	-4.22	-2.43	-2.20	-1.94	-1.73
	$k=k(t)$	-5.2	-4.8	-4.5	-4.20	-2.45	-2.23	-2.00	-1.77
$N=150$	$k=0$	-5.0	-4.7	-4.4	-4.12	-2.38	-2.16	-1.95	-1.64
	$k=2$	-4.9	-4.5	-4.3	-4.09	-2.29	-2.04	-1.86	-1.66
	$k=5$	-4.8	-4.4	-4.1	-3.89	-2.19	-1.97	-1.76	-1.57
	$k=k^*$	-5.2	-4.9	-4.6	-4.36	-2.53	-2.30	-2.08	-1.85
	$k=k(F)$	-5.1	-4.8	-4.5	-4.24	-2.42	-2.17	-1.95	-1.75
	$k=k(t)$	-5.1	-4.8	-4.5	-4.23	-2.41	-2.16	-1.95	-1.75
$N=\infty$		-4.9	-4.6	-4.4	-4.19	-2.51	-2.28	-2.10	-1.8

k is the truncation lag parameter

$k=k^*$: the is chosen such that t-statistic for testing the coefficient of the lagged is equal to one is minimized.

$k=k(F)$: the F-test is used to choose the maximum lag order, i.e., whether thmaxthfficients of -maxth lag is significant.

$k=k(t)$: the is chosen such that the coefficient on the last included area g of the first-differences of the data is significant.

Appendix-B

Asymptotic critical values for the models 1, 2, 3, 4, and 5

Model 1

	$\hbar = 0.1$	$\hbar = 0.2$	$\hbar = 0.3$	$\hbar = 0.4$	$\hbar = 0.5$	$\hbar = 0.6$	$\hbar = 0.7$	$\hbar = 0.8$	$\hbar = 0.9$
					k =1				
90%	0.19	0.15	0.13	0.12	0.12	0.12	0.14	0.16	0.19
95%	0.25	0.20	0.18	0.16	0.15	0.15	0.18	0.21	0.25
97.5%	0.33	0.26	0.23	0.19	0.18	0.19	0.23	0.27	0.32
99%	0.45	0.35	0.29	0.25	0.22	0.24	0.29	0.36	0.43
					k =2				
90%	0.1336	0.1157	0.1079	0.1020	0.1029	0.1033	0.1075	0.1179	0.1342
95%	0.1796	0.1557	0.1400	0.1306	0.1292	0.1297	0.1397	0.1566	0.1815
97.5%	0.2325	0.2007	0.1759	0.1622	0.1557	0.1600	0.1772	0.2014	0.2314
99%	0.3116	0.2631	0.2259	0.2035	0.1903	0.1998	0.2306	0.2643	0.3091
					k =3				
90%	0.1007	0.0907	0.0856	0.0847	0.0840	0.0852	0.0853	0.0911	0.1015
95%	0.1319	0.1179	0.1094	0.1063	0.1051	0.1067	0.1081	0.1174	0.1337
97.5%	0.1670	0.1490	0.1338	0.1276	0.1271	0.1301	0.1331	0.1463	0.1707
99%	0.2238	0.1989	0.1773	0.1602	0.1594	0.1624	0.1757	0.1956	0.2330
					k =4				
90%	0.0799	0.0738	0.0712	0.0704	0.0706	0.0711	0.0719	0.0731	0.0800
95%	0.1037	0.0924	0.0873	0.0878	0.0874	0.0874	0.0902	0.0927	0.1036
97.5%	0.1304	0.1151	0.1091	0.1073	0.1056	0.1060	0.1094	0.1164	0.1328
99%	0.1754	0.1502	0.1385	0.1365	0.1350	0.1355	0.1398	0.1487	0.1717

Model 2

	$\hbar = 0.1$	$\hbar = 0.2$	$\hbar = 0.3$	$\hbar = 0.4$	$\hbar = 0.5$	$\hbar = 0.6$	$\hbar = 0.7$	$\hbar = 0.8$	$\hbar = 0.9$
					k = 1				
90%	0.0827	0.0736	0.07447	0.0821	0.0840	0.0808	0.0749	0.0736	0.0819
95%	0.1028	0.0885	0.0907	0.1021	0.1060	0.0994	0.0890	0.0893	0.1011
97.5%	0.1228	0.1045	0.1062	0.1229	0.1315	0.1195	0.1035	0.1066	0.1197
99%	0.1537	0.1305	0.1251	0.1508	0.1642	0.1486	0.1219	0.1301	0.1436
					k = 2				
90%	0.0700	0.0630	0.0650	0.0690	0.0693	0.0676	0.0647	0.0638	0.0696
95%	0.0865	0.0759	0.0774	0.0852	0.08558	0.0841	0.0777	0.0778	0.0855
97.5%	0.1033	0.0891	0.0909	0.1023	0.1037	0.1023	0.0927	0.0918	0.1022
99%	0.1273	0.1095	0.1083	0.1254	0.1348	0.1255	0.1103	0.1119	0.1244
					k = 3				
90%	0.0594	0.0554	0.0571	0.0581	0.0584	0.0581	0.0566	0.0556	0.0593
95%	0.0728	0.0670	0.0692	0.0712	0.0725	0.0710	0.0677	0.0667	0.0728
97.5%	0.0871	0.0784	0.0803	0.0843	0.0877	0.0851	0.0788	0.0780	0.0873
99%	0.01064	0.0941	0.0971	0.1035	0.1103	0.1044	0.0961	0.0949	0.1074
					k = 4				
90%	0.0507	0.0490	0.0501	0.0509	0.0510	0.0502	0.0495	0.0489	0.0512
95%	0.0616	0.0588	0.0606	0.0617	0.0621	0.0614	0.0598	0.0592	0.0623
97.5%	0.0729	0.0691	0.0724	0.0728	0.0741	0.0738	0.0702	0.0699	0.0749
99%	0.0898	0.0846	0.0864	0.0886	0.0938	0.0916	0.0852	0.0845	0.0920

Model 3

	$\hbar=0.1$	$\hbar=0.2$	$\hbar=0.3$	$\hbar=0.4$	$\hbar=0.5$	$\hbar=0.6$	$\hbar=0.7$	$\hbar=0.8$	$\hbar=0.9$
					k =1				
90%	0.0842	0.0747	0.0663	0.0614	0.0604	0.0619	0.0670	0.0746	0.0849
95%	0.1059	0.0919	0.0809	0.0730	0.0729	0.0753	0.0824	0.0921	0.01061
97.5%	0.1280	0.1102	0.0973	0.0863	0.0844	0.0883	0.0986	0.1098	0.1289
99%	0.1578	0.1313	0.1197	0.1039	0.1013	0.1086	0.1195	0.1369	0.1580
					k =2				
90%	0.0723	0.0632	0.0579	0.0542	0.0533	0.0542	0.0575	0.0631	0.0714
95%	0.0892	0.0775	0.0694	0.0651	0.0639	0.0646	0.0706	0.0771	0.0884
97.5%	0.1069	0.0925	0.0825	0.0761	0.0752	0.0756	0.0842	0.0912	0.1065
99%	0.1314	0.1161	0.1019	0.0940	0.0903	0.0915	0.1021	0.1118	0.1335
					k =3				
90%	0.0602	0.0536	0.0507	0.0475	0.0470	0.0479	0.0503	0.0539	0.0593
95%	0.0740	0.0657	0.0613	0.0575	0.0561	0.0571	0.0608	0.0660	0.0728
97.5%	0.0884	0.0784	0.0724	0.0675	0.0663	0.0675	0.0723	0.0782	0.0875
99%	0.1106	0.0969	0.0888	0.0805	0.0788	0.0816	0.0881	0.0950	0.1076
					k =4				
90%	0.0523	0.0472	0.0443	0.0429	0.0421	0.0423	0.0443	0.0470	0.0520
95%	0.0638	0.0574	0.0529	0.0511	0.0498	0.0506	0.0531	0.0567	0.0637
97.5%	0.0757	0.0684	0.0626	0.0596	0.0578	0.0592	0.0622	0.0672	0.0758
99%	0.0921	0.0834	0.0756	0.0711	0.0699	0.0712	0.0769	0.0819	0.0928

Model 4

	$\hbar = 0.1$	$\hbar = 0.2$	$\hbar = 0.3$	$\hbar = 0.4$	$\hbar = 0.5$	$\hbar = 0.6$	$\hbar = 0.7$	$\hbar = 0.8$	$\hbar = 0.9$
					k =1				
90%	0.1908	0.1547	0.1265	0.1098	0.1044	0.1087	0.1276	0.1502	0.1898
95%	0.2560	0.2067	0.1670	0.1395	0.1309	0.1392	0.1682	0.2041	0.2571
s97.5%	0.3295	0.2631	0.2098	0.1729	0.1603	0.1724	0.2176	0.2657	0.3341
99%	0.4463	0.3449	0.2699	0.224	0.1941	0.2145	0.2862	0.3563	0.4449
					k =2				
90%	0.1319	0.1087	0.0885	0.0760	0.0735	0.0765	0.0878	0.1064	0.1351
95%	0.1759	0.1459	0.1163	0.0969	0.0922	0.0988	0.1141	0.1423	0.1810
97.5%	0.2288	0.1873	0.1485	0.1198	0.1123	0.1224	0.1464	0.1853	0.2349
99%	0.3068	0.2510	0.1942	0.1578	0.1419	0.1565	0.1950	0.2482	0.3261
					k =3				
90%	0.0983	0.0803	0.0664	0.0572	0.0542	0.0562	0.0648	0.0793	0.0973
95%	0.1286	0.1049	0.0851	0.0721	0.0672	0.0715	0.0824	0.1037	0.1291
97.5%	0.1638	0.1363	0.1079	0.883	0.0819	0.0894	0.1043	0.1317	0.1651
99%	0.2307	0.1816	0.1425	0.1145	0.1039	0.1127	0.1367	0.1757	0.2165
					k =4				
90%	0.0772	0.0616	0.0512	0.0451	0.0423	0.0445	0.0507	0.0620	0.0771
95%	0.0981	0.0791	0.0648	0.0548	0.0514	0.0540	0.0646	0.0799	0.0986
97.5%	0.1225	0.1002	0.0806	0.0658	0.0613	0.0660	0.0804	0.1007	0.1230
99%	0.1579	0.1312	0.1048	0.0852	0.0766	0.0837	0.1208	0.1364	0.1623

Model 5

	$\hbar = 0.1$	$\hbar = 0.2$	$\hbar = 0.3$	$\hbar = 0.4$	$\hbar = 0.5$	$\hbar = 0.6$	$\hbar = 0.7$	$\hbar = 0.8$	$\hbar = 0.9$
					k=1				
90%	0.0808	0.0654	0.0538	0.0463	00436	0.0462	0.0538	0.0648	0.0801
95%	0.1004	0.0804	0.0659	0.0552	0.0512	0.0551	0.0650	0.0799	0.0981
97.5%	0.1205	0.0974	0.0784	0.0645	0.0587	0.0633	0.0780	0.0959	0.1185
99%	0.1480	0.1223	0.0960	0.0763	0.0681	0.0765	0.0938	0.1196	0.1469
					k =2				
90%	0.0671	0.0540	0.0488	0.0387	0.0363	0.0386	0.0448	0.0536	0.0671
95%	0.0832	0.0661	0.0544	0.0462	0.0423	0.0455	0.0548	0.0668	0.0836
97.5%	0.0994	0.0790	0.0639	0.0534	0.0488	0.0535	0.0658	0.0787	0.1011
99%	0.1218	0.0980	0.0795	0.0641	0.0574	0.0636	0.0815	0.1002	0.1276
					k =3				
90%	0.0561	0.0457	0.0375	0.0323	0.0309	0.0324	0.0377	0.0458	0.0562
95%	0.0696	0.0559	0.0454	0.0379	0.0360	0.0386	0.0456	0.0566	0.0690
97.5%	0.0828	0.0658	0.0542	0.0444	0.0406	0.0448	0.0542	0.0684	0.0837
99%	0.1040	0.0821	0.0660	0.0529	0.0474	0.0541	0.0666	0.0840	0.1054
					k =4				
90%	0.0484	0.0391	0.0326	0.0282	0.0266	0.0280	0.0324	0.0397	0.0484
95%	0.0597	0.0476	0.0393	0.0329	0.0308	0.0333	0.0388	0.0483	0.0590
97.5%	0.0719	0.0572	0.0463	0.0379	0.0353	0.0385	0.0462	0.0571	0.0712
99%	0.0899	0.0703	0.0570	0.0454	0.0411	0.0462	0.0557	0.0707	0.0866