Paradigms
Print ISSN 1996-2800, Online ISSN 2410-0854
2020, Vol. SI, No. 1 Page 7-14
DOI: 10.24312/20000102

# Do Interest Rate Shocks and Monetary Policies Matter for the Volatility of the Stock Market? The Role of World Financial Crisis

**Wang PeiZhi[1], Muhammad Ramzan[2]**
**Dean at School of International Trade and Economics, Shandong University of Finance and Economics, Jinan, China**[1],
**Ph.D. Scholar at Shandong University of Finance and Economics, Jinan, China**[2]
**Corresponding author email:** ramzanmehar7@gmail.com[2]

**Cite this paper:** PeiZhi, W., & Ramzan, M. (2020). Do interest rate shocks and monetary policies matter for the volatility of the stock market? The role of world financial crisis. *Paradigms*, *SI*(1), 7-14.

The country's stock market has now become a major indicator of the direction of the nation's economy, and undoubtedly the global financial crisis has essentially destroyed all the stock exchanges. Therefore, the current study focuses on finding factors related to monetary policies that affect stock market volatility. Money market interest and other linked monetary policies determine the direction of the stock market. We consider monthly data from the period of Jan-2005 to Dec-2018 and measure the correlation, Cointegration and causality among variables. The GARCH (1, 1) model is used to generate stock market index volatility and interest rate shocks. The developed model analyzes by using trace rank test of Johansen Cointegration analysis, Granger causality analysis and Impulse response analysis with proper contemplation of all diagnostic test. The results confirm the long-run negative and significant relationship of interest rate shocks, inflation rate, financial crisis, and stock market volatility. The exchange rate and money supply associated positively and significantly with stock market volatility in the long run. All predictors and outcome variables have a causal relation with each other, but the financial crisis of the world does not show as causal relation with the stock exchange volatility. This study will help policymakers to take a closer look at these factors when making monetary and all associated policies because the study provides a realistic picture before the crisis, during the crisis and after the crisis effects of all these factors on the stock market. Since we know the growing importance of the stock market for the economy of all countries, it is imperative for authorities to look at all the factors that affect the market deeply.

***Keywords:*** Interest rate shocks; stock market volatility; financial crises; Granger cause; Pakistan

## INTRODUCTION

Indeed, the significant purposes of monetary policy remain toward control the prices in the local market and to decrease unemployment of the nation. The financial experts and policymakers complete this ultimate target with proper contemplation of interest rate & its shocks, money supply for the market and therefore forth to improve the monetary change (Ali, Mahmood, & Bashir, 2015). Financial exchange and related decisions assumed to be a fundamental job in monetary improvement and development of a nation. Meanwhile, decision making is a rational process of selecting an outcome from the available opportunities. In recent decades of global financial crises, individuals and organizations faced a crucial problem in making the best investment decision. The corporations only focus on maximizes the wealth of shareowners, so maximizing the share value by effectively allocating the resources is a great deal to make the companies profitable. The classical theory of finance based on the efficient market hypothesis (EMH) assumes investors as rational risk-averse who make the markets informational efficient in which asset returns are unpredictable. The study believes that investors should be unbiased while making investment decisions for enhancing their portfolio returns because they are not like uneducated irrigation agents. However, the information relating to the market easily accessible to all investors to make the finest investment decision because now the market is well-organized (Shleifer, 2000). Contrarily, the technical analysts are against the theory of EMH because they believe that future expectations are like past earnings, change in prices and trend of the volatility of the stock market. Behavior finance and economics rejected the prefect rationality assumption and hold that investors are affected by their sentiment in the decision-making process and which leads to a bias of irrationality in decision making (Baker & Wurgler, 2007). As assume in an economic model that human decision is not the relation but influenced by their emotions, so it's hard to determine their behavior accurately in reality (Kuzmina, 2010). This risk should manifest itself as an added price volatility of asset and market volatility as a whole effect by the action of an irrational trader.

The policymakers of the countries always ruminate deeply to manage interest rates, control the money supply for stabilizing the exchange rate because it may create a cause to push the inflation of the country. Similarly, the increase in inflation, fluctuation of exchange rate invite reasons to increase the interest rate and then it affects the stock market adversely. That is why the monetary policy and all related issues which we discussed are more highlighted issues for the developing nations. Following graph shows the trend of the interest rate, shocks of interest rate, stock market index and volatility of the stock market index of Pakistan from 2005 to 2008.

The table 1 listed below shows the trends of core interest variables for the selected period and it shows that the situation of shocks of the interest rate of Pakistan in more critical in the initial years and it is more versed in 2008-2009. The trend of the stock market of Pakistan depicts as crashed the market during 2008-2009 because of global financial crises and then its shows as

stable after some period. It also needs to observe that the fluctuations in the interest rate shock reached the top where the stock market crashed. In other words, it means that the interest rate and related monetary policies are most important for the determination of the future situation of the stock market and then the economy of the country. From the last some decades, the behavior of the stock market became a major indicator of the direction of the economy of the nations. The securities prices traded in market changes on a daily bases due to market forces and index of the market also change.

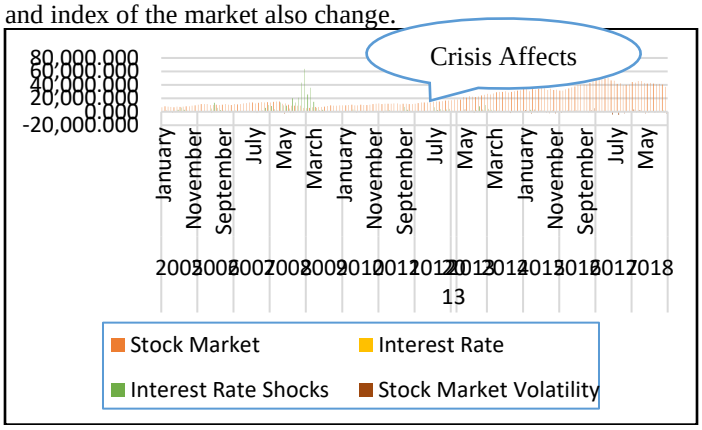


**Figure 1:** *The Interest Rate Shocks and Stock*

Therefore, the demand and supply equally affected by different indicators such as interest rate, inflation rate, and exchange rate. Likewise, the increase in interest rate becoming an attraction sign of investors for banking sectors and consequently, the demand for securities effected. Correspondingly, high inflation and fluctuation in the exchange rate weakening the buying power of investors and investment shifted to the banking investment. On the other side, the lower rate of interest pushes the demand of investors to form banking to the industry sector and then the rate of inflation and exchange rate strengthens the power of investors of the security market. This key in-depth relationship finding is most important for all investors so that is why we going to conduct this particular research study. The study mainly focuses on measures of the influence of interest rate shocks and related monetary policies on the stock market volatility of Pakistan stock exchange.

The remaining study divided into the following sections as chapter 2 is about literature review and hypotheses development, 3rd chapter will discuss the econometric tools and methodology of the study, 4th one related to results and discussion and then listed conclusion of the study.

## REVIEW OF PREVIOUS STUDIES

This section provides a concise summary of all published studies related to shocks of interest rate and stock market fluctuation with some critical review and comparison. Originally, we try to explain the related theories that are considered as a foundation of the study and then we talk about literature review and development of hypotheses of this study.

### Theoretical Foundation of the Study

The arbitrage pricing theory was produced by Ross with the choice of the available capital resource calculating model as it proposes that the cost advantage may be gained by different full rule financial variables (Ross, 1976). The theory established that the return from money related resources can be determined using the conventional capacity of different macroeconomic factors. The APT also advised the one-factor model which we can also modify with other multifactor of macroeconomics that affects the stock market and creates the valuation in it.

The fisher effect theory proposed that the interest rate in the real term, the nominal rate of interest, and the expected rate of inflation is independent of monetary measure. The real interest rate is a rate that we adjusted for the expected effect of inflation over time. The nominal rate of interest having a reverse relationship with the rate of inflation, so the monetary policy should be effective and neutralized. Practically, whenever the central bank increases the supply of money, the rate of inflation also rises, and then the interest rate should be increased by the central bank for balancing the effects of inflation and money supply simultaneously (Dimand, 2003).

The Interest rate parity theory talk about the interest rate parity situation in two different markets, the parity is the situation when there is no change to gain profit from the differential effects of two different markets (Bleaney & Fielding, 2002). When this kind of situation exists among the markets, the investors should focus on the exchange rate differential for gaining the benefits from the differential of the rate of currency which is the focal point of arbitrage theory. This situation ultimately reduces the fluctuation of stock markets because of no more other options for the investors of different markets (Karfakis & Kim, 2005).

### Interest Rate Shocks, Elements of Monetary Policies and Volatility in Stock Markets

Wang (2001) The study conducted in China to determine the different factors that affect the stock returns and they found the negative Granger-Causal connection among interbank interest rates and the stock returns. Liu & Sinclair (2008) The other scholars also established that the negative reaction of stock prices was found in the presence of high shocks in interest rates. Similarly, some researchers took monthly data in the case of Pakistan using Co-integration and Granger Causality test and founded that the stock price and interest rates depict the opposite direction in both the short and long run (Azim, Asif & Mehar, 2015). Based on the random walk model for fifteen developing and developed countries, the scholars concluded that all countries show a negative link between the rate of interest and change in the share prices. Additionally, they said the intensity of influence in South Asian Countries greater than the other countries (Uddin & Alam, 2010).

As to causal relationships, the results of the study based on Granger causality test indicate that the bidirectional causal relationship exists between and overnight interest rate (OIR ) and stock returns, which means that if interest rates fall and everything else is held constant, stock price will increase because the required rate of return has dropped. The study also shows the unidirectional causal relationship running from stock returns to the treasury interest rate. As stock returns increase investors purchase shares by borrowing, which will lead to increase interest rates due to an increase in demand for the fund. The

study points out that inflation (CPI ) does Granger caused stock returns. As inflation goes up, the nominal interest rate will increase as well, an increase in interest rate will affect stock returns, similar to the findings of other scholars (Ramzan, Asif & Mustafa, 2013). Likewise, The study also indicates stock returns do Granger cause inflation (PPI). scholars indicate both the CPI and PPI are strong risk factor candidates for the New York stock exchange. However, the other scholars' study for Turkey shows that is no causal relationship between inflation (CPI and PPI) and stock returns.

Besides the event study approach, some other methodologies have been applied to model the relationship between monetary policy and stock returns worldwide. Lee, Shleifer & Thaler (1991) and Mehar, Tahir & Nazeer (2019) the researchers used market-timing models to analyze the influence of short-term interest rates on the stock market and established that the relationship changes from significantly negative to no relationship over time. Nishat, Shaheen & Hijazi (2004) the scholars examined the effect of interest rates on stock returns from 1989 to 2012. They prove the negative effect on interest rates on stock returns outside the financial crisis period. However, they found that stock returns did not react positively to the cut of interest rates during the financial crisis. The behavior of stock investor changes owing to the worsening condition and many factors affecting the investment of the stock market. Similarly, the studies found that interest rate, exchange rate, and inflation rate proved to be major determinants of portfolio investment in stock markets (Mehar & Hasan, 2018).

Devereux & Engel (2003) and Gali & Monacelli (2005) the economists claim that the monetary policy or change in money supply is one of the most effective instruments available to the national central banks of an individual in association with influencing the actual economic activity. Many authors consider the money supply as the instrument of the monetary policy and considered money supply as the most important macroeconomic factor that influences the behavior and development of stock price. The investigators consider the stock market as the basic indicator of the condition and development of the economy because of its current strong influencing power. Moreover, these authors consider the money supply to be a strong determinant of the stock market even for the entire economy. They established that the money supply can affect stock price directly when there is more money in the economy, the interest rate dropped and then this money utilized as an investment of the stock market.

Several economists documented the impact of foreign exchange rate on stock prices during the last two decades. Aggarwal (2003), Bahmani-Oskooee & Sohrabian (1992) and Bhattacharya (2012) the scholars tried to explore the relationship between exchange rate and stock prices. The theory demonstrates that changes in the exchange rate have an important bearing on a firm's overall profits through a corporation's foreign operation which results from fluctuations in stock prices. The intensity and direction of changes in share prices depend upon the nature of the firm. Mixed results were found among industrial countries by many investigators (Aggarwal, 2003). In the case of the USA, the scholars established a positive relationship between the exchange rate and US stock prices. The other researchers found a negative correlation between these two factors. The money supply-stock market nexus was widely tested for various economies. Researchers explored the positive relationship between stock prices and money supply in the US economy while some researchers found a negative impact of money supply and the stock market in the case of Japan (Humpe & Macmillian, 2009).

**The Rationale of the Study**

Indeed, it is true that the global financial crisis is far from over. So far, the global financial crisis has gone through many different stages. The crisis began in the subprime mortgage market, primarily in the summer of 2007, and in September 2008 it became more severe as the Lehman Brothers default. As a result, financial distresses fallen into the real economy, which led to recession in almost all industrialized countries and smashed stock markets. At that time monetary policy confronted it with unprecedented power and responded with very low interest rates. Finally, the economic activities recovered in 2010, but countries that had huge public and private debt burdens like Pakistan face many problems to redounded economy and their stock market in actual position. The actual picture before, during and after crisis for Pakistan stock exchange is missing and has not received much attention in the literature. Therefore, our paper aims to fill this gap.

**Hypotheses of the study**

**H1:** There is a negative and significant relationship among interest rate shocks and stock market volatility

**H2:** There is a negative and significant relationship among inflation rate and stock market volatility

**H3:** There is a positive and significant relationship among exchange rate and stock market volatility

**H4:** There is a positive and significant relationship among money supply and stock market volatility

**H5:** There is a negative and significant relationship among world financial crises and stock market volatility

**ECONOMETRIC TOOLS AND METHODOLOGY**

The positivist philosophy of researchers to collect the secondary monthly data which covers the time span from Jan 2005 to Dec 2018 utilizing the official websites of state bank of Pakistan, investing. Come, and financial market association. Priority for the use of monthly data is suggested by the first work done by the scholars Bamrungsap, et. al., (2019). The KSE-100 index of Pakistan stock exchange is used for the stock market representation and then we calculated volatility of this index by using the GARCH (1, 1) model. The monthly on average interest rate prevailing for the selected time period was taken and then generated a series of interest rate shocks by using the GARCH (1, 1) model.

Volatility is a statistical measure of the dispersion of returns for a given security or market index. Commonly, the higher the volatility, the riskier the security. A volatile stock market of a country adversely affects investment and hence economic growth (Qayyum & Kemal, 2006). A market that liked through trade and investment, may disrupted through volatility effects because volatility increases the risk of investors. The investors

reduce their positions even withdrew capital due to increases uncertainty and reduce profitability. So, the presence of volatility clustering could be due to an increase in interest rate, an increase in dividend yields, Oil prices, margin requirements, information patterns, participants' expectations, etc. On the other hand, conditional volatility is the variance conditional on past information (the lagged value). The conditional volatility of the stock market is calculated by Autoregressive Conditional Heteroscedasticity (ARCH) and its extension version Generalized Conditional Heteroscedasticity model. GARCH (1, 1) has been applied in this study to measures conditional stock market volatility, this measure is recommended by many scholars (Adeniji, Obansa & Okoroafor, 2018; Bamrungsap, et. al., 2019). This model applied to KSE-100 using 1 lagged and then generates the GARCH residual series, this series presenting as volatility of the stock market. The similar model applied to the interest rate using 2 lagged and then generate residual series with using software outputs, this series is best for predicting interest rate shocks because similar calculations were suggested by many studies. GARCH model were developed by the Engle and Bollerslev (1986) is considered to be best for capturing time varying volatility and shocks of the factors. We captured volatility of stock market and shocks of interest rates using following equation:

$$SM_t = \beta_{0t} + \beta_{1t}SM_{t-1} + \delta\sigma^2_t + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma^2_t) \quad \textbf{(1)}$$

$$\sigma^2_t = \alpha_0 + \alpha_1\varepsilon^2_{t-1} + \gamma_1\sigma^2_{t-1} \quad \textbf{(2)}$$

Equation 1 represent mean variance and equation 2 for the conditional variance. SM and $SM_{t-1}$ denote for the stock market and 1 month lagged value of stock market respectively; $\varepsilon_t$ shows the normal distribution of stochastic term; $\sigma^2$ is for conditional variance and t represent the time period which is depend on the relevant information from $\varepsilon^2_{t-1}$ and $\sigma^2_{t-1}$ showing the garch term. The vector $\alpha_0$, $\alpha_1$ and $\gamma_1$ used for capturing the volatility transmissions changing over time and $\beta_{0t}$, $\beta_{1t}$ used for allowing time varying. The similar equation but using 2 lagged value were utilized for capturing the shocks of interest rate, this measure was proposed by Adeniji, Obansa & Okoroafor (2018).

Initially, the ADF test of stationarity were used for the examination of the variables in the model to determine their order of integration using the following equation of ADF test.

$$\Delta Y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{p} \beta i \Delta Y t - i + \mu t \quad \textbf{(3)}$$

Where, $\Delta Y_t$ is for first difference, $Y_t$ and p for the lagged length of augmented term which is suggested by Aliyu (2011). The long-run and causal relationship measured by utilizing Johansen normalized co-integrating coefficients analysis of Trace rank test and Granger causality test. The following equation used for trace rank test of Johansen co-integration analysis:

$$\Lambda_{trace}(rank) = - T \sum_{i=r+1}^{n} ln(1 - \Lambda' i) \quad \textbf{(4)}$$

Where $\Lambda$i are the estimated values of the characteristic roots obtained from the Π; T matrix is for the number of observations, this measure is suggested by Arshad & Javed (2009). The following two equations used for the causality test:

$$\Delta X_t = \alpha_x + \sum_{i=1}^{k} \beta x, i \Delta X t - i + \sum_{i=1}^{k} \gamma x, i \Delta Y t - i + \mu x, t \quad \textbf{(5)}$$

$$\Delta Y_t = \alpha_y + \sum_{i=1}^{k} \beta y, i \Delta Y t - i + \sum_{i=1}^{k} \gamma y, i \Delta X t - i + \mu y, t \quad \textbf{(6)}$$

Where: $\Delta X$ and $\Delta Y$ depict the first difference of the variables and t shows the selected time period; α, $\beta$, γ are the coefficients of the regressions to be estimated; μt is the random error term, this model adopted from the framework given by Da Silva, et. al., (2014).

Further, the impulse response analysis was also applied to detect the response of all predictive factors during a 1- shock or innovation (Adeniji, Obansa & Okoroafor, 2018). Details of all the variables, labels, and variables are listed in the table below:

**Table 1: Variables, Label, and Description**

| Variables | Label | Description |
|---|---|---|
| Outcome variable: | | |
| Stock Market Volatility | SMV | KSE-100 index used as a representative of the stock market of Pakistan and then created volatility of the index. |
| Predictor variables: | | |
| Interest rate Shocks | IRS | Interest Rate is the cost of using other's money and taken as a percentage of the principal per period and then created shocks. |
| Exchange rate | ER | An exchange rate is the value of one nation's currency against the currency of another nation or economic sector. |
| Inflation rate | IR | The inflation rate is taken as a percentage and it represents the situation of rising prices of the goods and services. |
| Money Supply | MS | M2 proxy is used for measuring the money supply. |
| World Financial Crises | WFC | This dummy variable takes to present the period of financial crises of the world by 1 and 0 for otherwise |

## RESULTS AND DISCUSSIONS

This section illustrates the complete results and discussions of outcomes according to the objectives of the study. Firstly, we listed a correlation analysis to find out the relationship between said variables. So, the following table shows the correlation result of the study:

**Table 2: Correlation Analysis**

| | SXV | IRS | IR | ER | MS | WFC |
|---|---|---|---|---|---|---|
| SXV | 1.0000 | | | | | |
| IRS | -0.1849** | 1.0000 | | | | |
| IR | -0.1444* | 0.6110*** | 1.0000 | | | |
| ER | 0.0163** | -0.1825** | -0.4238*** | 1.0000 | | |
| MS | 0.0038* | -0.2485*** | -0.5859*** | 0.9234*** | 1.0000 | |
| WFC | -0.1241** | 0.5413*** | 0.6583*** | -0.2535*** | -0.3179*** | 1.0000 |

**Source:** The Authors' Investigation ***p < 0.01, **p < 0.05, *p < 0.1

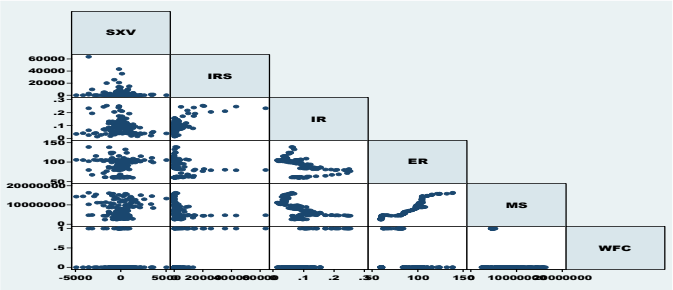


**Figure 2:** *Correlation trend among Outcome and all Explanatory Variables*

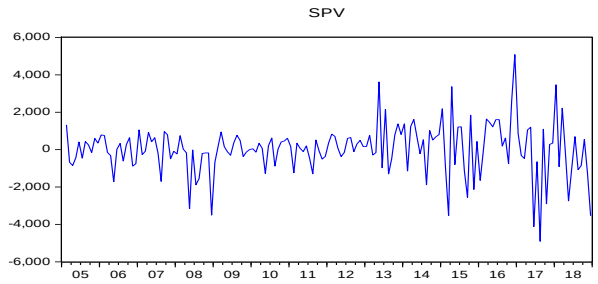


**Figure 3:** *Trend of Stock Market Volatility*

The similar results observed in both correlation and trend correlation analysis, the above-listed graph and results of the table depict that there are an inverse and significant connection among interest rate shocks and the volatility of the stock market of Pakistan. The result demonstrates that the increase in shocks of interest rate immediately causes to decreases the stock market return as we have already grasped in table 1 shown in the introduction, this finding is like the findings of other scholars. Meanwhile, the inflation rate and financial crises also associated significant and negatively with the volatility of the stock market. On the other hand, the exchange rate and money supply have a positive and significant connection with the volatility of the stock market in both the numerical and graphical findings. Logically, the results portray if the exchange rate and money supply increase in Pakistan it immediately causes to increase in the volatility of the stock market. These findings are similar to the fisher effect model as the increase in money supply causes high inflation and the stock market affected negatively if the interest rate assumes constant (Ibrahim & Alhassan, 2014).

The following table 3 shows the conditional mean equation result of KSE-100 index of Pakistan stock exchange regressed on its lagged value. The GARCH (1, 1) model was applied and then generate the variance series of model. This series serve as a volatility of stock market with neither exogenous nor endogenous as this measure was recommended by many scholars (Engle, 2002; Adeniji, Obansa & Okoroafor, 2018). All the listed variables in results are statistically significant except the value of constant. Similarly, the graphical depictions of stock market volatility show that volatility is stationary because it does not follow a random pattern.

**Table 3: The Stock Market Volatility Equation**

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | 200.3634 | 193.0869 | 1.037685 | 0.2994 |
| SP(-1) | 0.997791 | 0.008248 | 120.9689 | 0.0000 |
| Variance Equation | | | | |
| C | 33615.01 | 37465.17 | 0.897234 | 0.3696 |
| RESID(-1)^2 | 0.063300 | 0.035328 | 1.791769 | 0.0732 |
| GARCH(-1) | 0.927907 | 0.055097 | 16.84146 | 0.0000 |

The result of table 4 shows the results of interest rate as it regressed with its 2-period lagged and economically the residual series consider shocks which is generated through this process (Qin, & Gilbert, 2001). The both lagged 1 and 2 period variables in following table shown statistically significant, but the constant value is not significant. Like the above case, the graphical picture of the interest rate shocks is viewed as stationary because there is no pattern in the series.

**Table 4: The Interest Rate shocks Equation**

| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.177243 | 0.025538 | 6.940320 | 0.0000 |
| IR(-1) | 0.823135 | 0.093154 | 8.836309 | 0.0000 |
| IR(-2) | 0.144217 | 0.093567 | 1.541324 | 0.1232 |

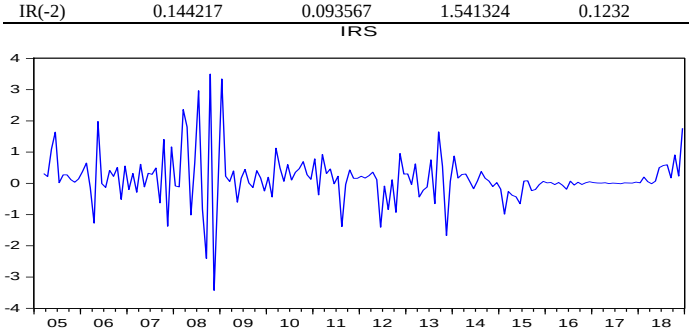


**Figure 4:** *Trend of Interest Rate shocks*

**The Test for Stationarity**

The stationarity test is like a diagnostic check of a patient to identify the disease and its intensity for recommending the prescription. Similarly, we apply this test to know the nature and condition of time series because the assumption of the classical regression model is the time series must be stationary. It measures the stationary or non-stationary of time series data at level and trend (Chen, 2007). The presence of a unit root in the autoregressive model is measured by applying the Augmented Dickey-Fuller test. The equation and results of the unit root test of stationarity listed below:

**Table 5: Unit Root Test**

| | | | Critical Value | | |
|---|---|---|---|---|---|
| Variable | Test | Test- Statistic | 1% | 5% | 10% |
| Stock Market Volatility | At Level | -0.54462 ( 0.8781 ) | -3.46969 | -2.87872 | -2.57601 |
| | First Diff. | -12.6363 (0.0000 ) | -3.46993 | -2.87882 | -2.57606 |
| Interest rate Shocks | At Level | -1.58307 ( 0.4890 ) | -3.47042 | -2.87904 | -2.57618 |
| | First Diff. | -7.33457 ( 0.0000) | -3.47042 | -2.87904 | -2.57618 |
| Inflation rate | At Level | -0.97794 (0.7604 ) | -3.47281 | -2.88008 | -2.57673 |
| | First Diff. | -6.82354 ( 0.0000 ) | -3.47281 | -2.88008 | -2.57673 |
| Exchange rate | At Level | 0.87619 ( 0.9950 ) | -3.47042 | -2.87904 | -2.57618 |
| | First Diff. | -4.08026 (0.0014 ) | -3.47042 | -2.87904 | -2.57618 |
| Money Supply | At Level | -2.36330 ( 0.1539) | -3.47281 | -2.88008 | -2.57673 |
| | First Diff. | -11.5251 ( 0.0000 ) | -3.47281 | -2.88008 | -2.57673 |
| Financial Crises | At Level | -2.02843 (0.2745) | - 3.469691 | - 2.878723 | - 2.576010 |
| | First Diff. | -12.80625 (0.0000) | - 3.469933 | - 2.878829 | - 2.576067 |

**Source:** The Authors' Investigation **Note:** The values shown in parentheses with T-statistics shows the probability values of the T-stat The results of the unit root that we obtained from the ADF test of the unit root show the all included variables have unit root problems at the level as we can observe that all variables are not significant. At 1st different, the result shows all variables are statistically significant at 1st difference, it means all factors are stationary at 1st difference. In this situation, the best technique for a long-term relationship is the Co-integration model, and the Granger causality model is appropriate for a causal relationship (Fama & Schwert, 1997; McMillan, 2010).

The Co-integration test applied to all included factors for measuring the long-term association among them. This econometric technique recommended by many scholars when we have non-stationary time series. It means if two-time series are non-stationary but the linear association among them depict as stationary, then we called as two-time series are co-integrated in the long run (Shah, et. al., 2012; Sundqvist, 2002). After that, we applied a test of selecting the lag criteria for the causality test and then applied the Granger causality test for measuring the two-way causal effect among factors.

The table 6 listed below shows the results of the lag selection criterion test and outcome direct us as 1 is the best lag value for all factors. The all diagnostic of lag selection as FPE, AIC, HQIC, and SRIC shows significance at the lag value of 1, so now we can run the Granger causality test using lag 1. The results of the Trace rank test of Johansen Cointegration and Granger causality test are listed below:

**Table 6: Test for Selection of Lag value: Selection-Order Criteria**

| Lag | LL | LR | df | P | FPE | AIC | HQIC | SRIC |
|---|---|---|---|---|---|---|---|---|
| 0 | -5836.5 | | | | 5.3e+24 | 73.956 | 74.0032 | 74.0723 |
| 1 | -4685.5 | 2302 | 36 | 0.000 | **3.9e+18*** | **59.8421*** | **60.1727*** | **60.6562*** |
| 2 | -4670.9 | 29.143 | 36 | 0.784 | 5.2e+18 | 60.1134 | 60.7274 | 61.6253 |
| 3 | -4646.1 | 49.53 | 36 | 0.066 | 6.0e+18 | 60.2556 | 61.153 | 62.4653 |
| 4 | -4623.5 | 45.238 | 36 | 0.139 | 7.2e+18 | 60.425 | 61.6057 | 63.3325 |
| 5 | -4583.7 | 79.618 | 36 | 0.000 | 6.9e+18 | 60.3768 | 61.8409 | 63.9821 |
| 6 | -4567.5 | 32.478 | 36 | 0.637 | 9.1e+18 | 60.6269 | 62.3745 | 64.93 |
| 7 | -4545.2 | 44.547 | 36 | 0.155 | 1.1e+19 | 60.8006 | 62.8316 | 65.8016 |
| 8 | -4504.5 | 81.368 | 36 | 0.000 | 1.1e+19 | 60.7414 | 63.0557 | 66.4401 |
| 9 | -4470.8 | 67.379 | 36 | 0.001 | 1.2e+19 | 60.7706 | 63.3683 | 67.1672 |
| 10 | -4443.9 | 53.881* | 36 | 0.028 | 1.4e+19 | 60.8853 | 63.7664 | 67.9796 |

**Source:** The Authors' Investigation **Note:** for the calculation of the above lag selection criteria, SXV, IRS, IR, ER, MS, and WFC taken as endogenous and _cons taken as exogenous. * shows the probability value at which lag is best.

**Table 7: Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.256562 | 141.7939 | 95.75366 | 0.0000 |
| At most 1 * | 0.199215 | 94.06222 | 69.81889 | 0.0002 |
| At most 2 * | 0.140243 | 58.29393 | 47.85613 | 0.0039 |
| At most 3 * | 0.102318 | 33.96590 | 29.79707 | 0.0156 |
| At most 4 * | 0.072467 | 16.58765 | 15.49471 | 0.0341 |
| At most 5 * | 0.027419 | 4.476149 | 3.841466 | 0.0344 |

**Source:** The Authors' InvestigationThe outcomes of the unrestricted Co-integration rank test (Trace) of analysis portray that there are all generated six equations are co-integrated at a significant level of 5%. It means all selected predictors proved as the determinant of the stock market volatility in the long run with statistical significance. The trace statistics value also greater than the Eigen and critical value, another indicator of long-term association among factors. The directions of the relationship among all the variables we already measured through the correlation analysis. This test indicates that all variables have a long-term relationship with our response variable with the same directions which we observed in the correlation analysis. Following table shows the test of Granger causality test:

**Table 8: The Granger Causality Test**

| | SXV | IRS | IR | ER | MS | WFC |
|---|---|---|---|---|---|---|
| SXV | - | | | | | |
| IRS | ✓✓ | - | | | | |
| IR | ✓ | ✓✓ | - | | | |
| ER | ✓ | ✓ | ✓✓ | - | | |
| MS | ✓ | - | ✓ | ✓ | - | |
| WFC | - | ✓ | ✓ | ✓ | ✓ | - |

**Source:** The Authors' Investigation **Note:** ✓ Represent the unilateral causal relationship, ✓✓Represent the bi-directional causal relationship, and – for no causal relationship. The above-listed table shows the results of the causality test using lag-1 if the value of probability less than 0.05 then we reject the null hypothesis as the factors have Granger cause among each other. The full results of Granger Causality test listed in appendix at the end of this paper, but the above listed table 8 only shows the summary of the outcome of this test. Results depict that interest rate shocks and the volatility of the stock market of Pakistan, interest rate shocks and inflation rate, inflation rate and exchange rate Granger cause to each other which mean they has bilateral causal relationship. The market volatility granger causes the inflation rate, exchange rate, and money supply, but granger's cause of the stock market with financial crises does not significant. The results of all the econometric tools confirm our established hypothesis of the study. We conclude this analysis and discussion chapter as outcome of correlation, co-integration and Granger causality test indorse that the negative, significant and causal long-term relationship among shocks of interest rate, inflation rate, global financial crisis and volatility of stock market. However, exchange rate and money supply have positive, significant and causal relationship with the stock index volatility.

Finally, the following graphs show the results of impulse response analysis response to Cholesky one standard deviation innovations. Below listed graphs in figure 5 depicts the response of all included variables as a result of 1% innovation or dynamics. The first graph shows the reaction of stock prices volatility as a result of 1& fluctuation, graphical picture shows a rapid decrease in volatility of stock prices in first 3 months, increases in last week of 3rd month, and thereafter it stabilizes for whole period. The response of interest rate shocks swiftly down in initial 2 months and then showing increasing trend after 2nd months to 4th month in response of 1% increase. It shows positive relationship among fluctuation and interest rate shocks. The enhancing trend of dynamics lead to increase the shocks in interest rate. Similarly, a 1% innovation or dynamics cause to increase the exchange rate, inflation rate, and money supply in country. The change or dynamics also lead to increases the probability of financial crises.

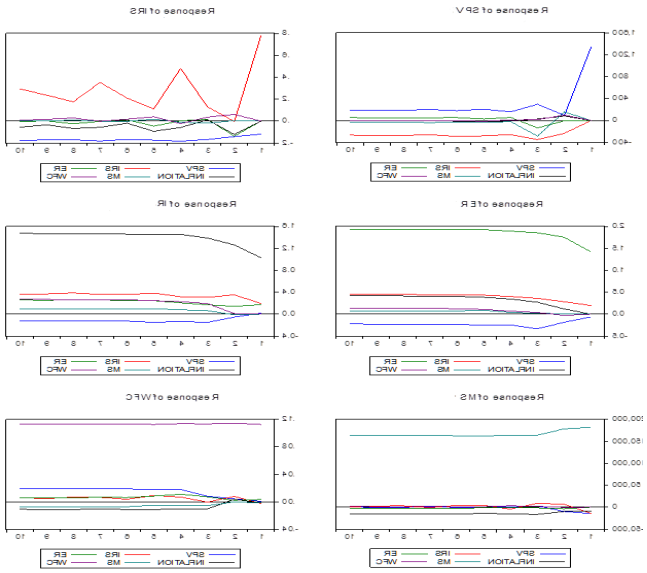

**Figure 5:** *Impulse Response Analysis Response to Cholesky One S.D. Innovations*

## CONCLUSION AND PRACTICAL IMPLICATION

This study mainly focuses on the influence of shocks in interest rates on the volatility of the stock market especially with the contemplation of world financial crises 2008-2009. Monthly statistics were used from January 2005 to December 2017 as fluctuations and shocks are easier to see in short-term data compared to long-term data. The volatility of the stock market and shocks of interest rate calculated with the help of proposed GARCH (1, 1) model. The correlation analysis and trend-correlation analysis confirm all results according to our study hypotheses, there is a negative and significant association exists among interest rate shocks, inflation rate, financial crises and volatility of the stock market. It has been clearly seen that the duration of the crisis adversely affects the stock market, and the magnitude of the interest rate shock is shown to be more negatively affected by these variables which shows that the interest rate shock is riskier to the stock markets. The test of Cointegration confirmed the long-run affection among all predictor and outcome variables which means that the direction of association depicted by correlation analysis and the term of this association confirm with the help of Cointegration analysis. The Granger causality test also confirms that the stock market volatility, interest rate shocks, inflation rate, exchange rate, and money supply Granger cause to each other but the financial crisis does not have any causal relation with market volatility. Impulse response analysis also shows a positive response of all factors resulting from 1% change or dynamics except market volatility and interest shocks. The stock market volatility and shocks of interest rate indicated continuous fluctuation in response of 1% dynamics or innovation. The overall study concluded that there is a long-term and causal relationship between predictor and outcome variables. The study will helpful for policymakers to closely concern about these factors while making money and all related policies because the study provides an actual picture before the crisis, during the crisis and after the crisis effects of all these factors on the stock market. As we all know that nowadays the stock market considers a big indicator of the economy of the country so that's why its compulsory for authorities to observe all factors that affect the market very deeply.

## REFERENCES


Adeniji S. O., Obansa, S. A. J., & Okoroafor, O. K. (2018). Monetary policyshocks and stock market prices volatility in Nigeria, *Business and Economic Quarterly*, 3, 3–26.

Aggarwal, R. (2003). Exchange rates and stock prices: A study of the US capital markets under floating exchange rates. *Review of Economics Studies, 60*(6), 813-836.

Ali, T. M., Mahmood, M. T., & Bashir, T. (2015). Impact of Interest Rate, Inflation and Money Supply on Exchange Rate Volatility in Pakistan. *World Applied Sciences, 33*(4), 620-630.

Aliyu, S. U. R., (2011) Reactions of stock market to monetary policy shocks during the global financial crisis: The Nigerian case. *In: MPRA Paper*. RePEc: pra:mprapa:35581.

Arshad Hasan & M. Tariq Javed (2009). An Empirical Investigation of the Causal Relationship among Monetary Variables and Equity Market Returns. *The Lahore Journal of Economics*, 14(1), 115-137

Azim, A., Asif, M., & Mehar, M. R. (2015). Co-integration and Granger Causality Test of Crude Oil Price, Exchange Rate, KIBOR and Consumer Price Index of Pakistan. *The International Journal Of Humanities & Social Studies, 3*(1), 319-322.

Bahmani-Oskooee, M., & Sohrabian, A. (. (1992). Stock Prices and the Effective Exchange Rate of the Dollar. *Applied economics, 24*(4), 459-646.

Baker, M., & Wurgler, J. (2007). Investor Sentiment in the Stock Markets. *The Journal of economics Perspectives, 21*(2), 129-151.

Bhattacharya, B. (2012). Causal relationship between stock market and exchange rate, foreign exchange reserves and value of trade balance in India: An empirical analysis. *The Journal of Management Business Review, 22*(4), 66-72.

Bleaney, M., & Fielding, D. (2002). Exchange rate regimes, inflation and output volatility in developing countries. *development economics, 68*(1), 233-245.

Chen, S. S. (2007). Does Monetary Policy Have Asymmetric Effects on Stock Returns? *Credit and Banking, 39*(3), 668-688.

Da Silva FM, Coronel DA, Vieira KM (2014) Causality and Cointegration Analysis between Macroeconomic Variables and the Bovespa. *PLoS ONE* 9(2): e89765. doi:10.1371/journal.pone.0089765

Devereux, M. B., & Engel, C. (2003). Monetary Policy in the Open Economy Revisited:Price Setting and Exchange Rate Flexibility. *The Review of Economic Studies, 1*(1), 36-44.

Dimand, R. (2003). Irvin Fisher on the International Transmission of Booms and Depression Through Monetary Standards. *The Journal of Money, Credit and Banking, 35*(1), 49.

Engle, R. F., and Bollerslev, T. (1986). Modelling the persistence of conditional variances. *Econometric reviews*, 5(1), 1-50.

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics*, 20(3), 339-350.

Fama, E., & Schwert, G. (1997). Asset Return and Inflation. *Journal of Financial Economics, 5*(1), 115-46.

Gali, J., & Monacelli, T. (2005). Monetary Policy and Exchange Rate Volatility in a Small Open Economy. *Review of Economic Studies, 1*(1), 223-241.

Humpe, A., & Macmillian, p. (2009). Can macroeconomic variable explain long-term stock market movement? A comparison of the USand Japan. *Applied Financial Economics, 19*(2), 111-119.

Ibrahim, M., & Alhassan, M. (2014). An Econometric Analysis of the Impact of Macroeconomic Fundamentals on Stock Market Returns in Ghana. *Research in Applied Economics, 6*(2), 47-72.

Karfakis, C., & Kim, S. (2005). Exchange Rates, Interest Rates and Current Account News: Some Evidence from Australia. *Journal of International Money and Finance, 14*(4), 575-595.

Kuzmina, J. (2010). Emotion's component of Expectations in Financial Decision Making. *Baltic Journal of Management, 5*(3), 295-306.

Lee, C., Shleifer, A., & Thaler, R. H. (1991). Investor sentiment and the closed-end fund puzzle. *The Journal of Finance, 46*(1), 75-109.

Liu, x., & Sinclair, p. (2008). Does the linkage between stock market performances an economic growth vary across Greater china? *Applied economic letter, 15*(7), 505-508.

McMillan, & G, D. (2010). Present Value Model, Bubbles and Returns Predictability: Sector-Level Evidence. *Journal of Business Finance & Accounting, 37*(5-6), 668–686.

Mehar, M. R., & Hasan, A. (2018). The Factors Effecting Portfolio Investment in Pakistan. *International Journal of Family Business and Management, 2*(1), 1-7.

Mehar, M. R., Tahir, H., & Nazeer, M. (2019). Influence of Firm's Intangible Assets Intensity on Stock Prices Volatility: Evidence from Emerging Market of Pakistan. *Indian Journal of Public Health Research & Development, 10*(1), 472-477.

Nishat, M., Shaheen, R., & Hijazi, s. t. (2004). Macroeconomic factors and the Pakistani Equity market [with comments]. *The Pakistan Development Review, 19*(2), 609-637.

Qayyum, A., & Kemal, A. R. (2006). Volatility spillover between the stock market and the foreign exchange market in Pakistan. *The Journal of Pakistan Business Reveiw, 19*(2), 44-59.

Qin, D., & Gilbert, C. L. (2001). The error term in the history of time series econometrics. Econometric theory, 17(02), 424-450.

Ramzan, M., Asif, M., & Mustafa, M. (2013). Impact of Trade Openness and Macroeconomic Variable on GDP Growth of Pakistan. *Paradigms: A Research Journal of Commerce, Economics and Social Sciences, 7*(1), 37-47.

Ross, S. A. (1976). The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory, 13*(3), 341-360.

Shah, A., Rehman, J. U., Kamal, Y., & Abbas, Z. (2012). The Interest Rates-Stock Prices Nexus in Highly Volatile Markets: Evidence from Pakistan. *Basic and Applied, 2*(3), 2589-2598.

Shleifer, A. (2000). *Inefficient Market: An Introduction to Behavioural Finance.* New York, Landon: OUP Oxford.

Sitthidej Bamrungsap, Pachara Suksumek, Raweemas Wattanasak, Sirinuch Inlakorn, Sitapa Buakase, Sitthikarn Benjasupattananun, & Thitima Chaiyakul (2019). Crude Oil Price Behavior: Random Walk, Mean Reversion, and Is there a Presage of Thailand Inflation?. *International Journal of Management and Applied Science*, 5(9), 96-100.

Sundqvist, E. (2002). An empirical investigation of the international fisher effect. *Social Science and Business Administration Programmes, 42*(1), 1-41.

Uddin, G., & Alam, M. (2010). The Impacts of Interest Rate on Stock Market: Empirical Evidence from Dhaka Stock Exchange. *South Asian Journal of Management Sciences, 4*(1), 21-30.

Wang, C. (2001). Investor sentiment and return predictability in agriculture future markets. *journal of future markets, 21*(10), 929-953.

**Appendix**

**Table 8.** The Granger Causality Test

| Equation | Excluded | Chi2 | Df | Prob > Chie2 | Decision |
|---|---|---|---|---|---|
| SXV | IRS | 5.1023 | 1 | 0.049 | Rejected |
| SXV | IR | 3.1891 | 1 | 0.074 | Rejected |
| SXV | ER | 2.7991 | 1 | 0.094 | Rejected |
| SXV | MS | 3.9328 | 1 | 0.047 | Rejected |
| SXV | WFC | .00334 | 1 | 0.954 | Accepted |
| SXV | ALL | 8.2205 | 5 | 0.144 | Accepted |
| IRS | SXV | 3.08439 | 1 | 0.041 | Rejected |
| IRS | IR | 11.737 | 1 | 0.001 | Rejected |
| IRS | ER | 1.1328 | 1 | 0.287 | Accepted |
| IRS | MS | 1.9829 | 1 | 0.159 | Accepted |
| IRS | WFC | .24507 | 1 | 0.621 | Accepted |
| IRS | ALL | 19.473 | 5 | 0.002 | Rejected |
| IR | SXV | .74495 | 1 | 0.388 | Accepted |
| IR | IRS | 7.088 | 1 | 0.008 | Rejected |
| IR | ER | 5.8511 | 1 | 0.016 | Rejected |
| IR | MS | 3.5795 | 1 | 0.058 | Rejected |
| IR | WFC | 4.2525 | 1 | 0.039 | Rejected |
| IR | ALL | 16.647 | 5 | 0.002 | Rejected |
| ER | SXV | 1.5155 | 1 | 0.218 | Accepted |
| ER | IRS | 4.2704 | 1 | 0.039 | Rejected |
| ER | IR | 8.0374 | 1 | 0.005 | Rejected |
| ER | MS | 11.789 | 1 | 0.001 | Rejected |
| ER | WFC | 1.3625 | 1 | 0.243 | Accepted |
| ER | ALL | 22.759 | 5 | 0.000 | Rejected |
| MS | SXV | .16257 | 1 | 0.687 | Accepted |
| MS | IRS | .55282 | 1 | 0.457 | Accepted |
| MS | IR | 1.6685 | 1 | 0.196 | Accepted |
| MS | ER | 1.5745 | 1 | 0.210 | Accepted |
| MS | WFC | .03418 | 1 | 0.853 | Accepted |
| MS | ALL | 3.5049 | 5 | 0.623 | Accepted |
| WFC | SXV | .09619 | 1 | 0.756 | Accepted |
| WFC | IRS | 3.8375 | 1 | 0.050 | Rejected |
| WFC | IR | 1.2422 | 1 | 0.265 | Accepted |
| WFC | ER | 5.0075 | 1 | 0.025 | Rejected |
| WFC | MS | 3.6633 | 1 | 0.056 | Rejected |
| WFC | ALL | 11.951 | 5 | 0.035 | Rejected |

**Source:** The Authors' Investigation **Note:** The above table shows the results of the hypotheses which is generated by software regarding casualty. The lag value for each hypothesis is 1 because lag selection criterion results suggested 1 lag for each variable.