Time Varying Effects of Interest Rate and the Exchange Rate on the Stock Prices in Pakistan

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Dedication

Dedicated from core of my heart to my beloved parents Mr. & Mrs. Muhammad Iqbal and my respected teacher Dr. Abdul Rashid.

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All the praises are for the Allah Almighty; the most beneficent and the most merciful; who granted man with knowledge. All salutations are upon the Prophet (P.B.U.H.) whose teachings enlighten my thought and thrives my ambitions.

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List of Abbreviation

SR	Stock Returns
SP	Stock Prices
EXR	Exchange Rate
IR	Interest Rate
CPI	Consumer Price Index
IPI	Industrial Production Index
PSE	Pakistan Stock Exchange
IV	Independent Variable
VI	Dependent Variable
SBP	State Bank of Pakistan
IFS	Institute of Financial Statistics
INF	Inflation
PSB	Pakistan Statics Bureau
CV	Control Variable
SEC	Securty Exchange Commision

Abstract

The main objective of this study is to investigate the time-varying return and volatility impact between interest rate and exchange rate on stock returns. For this purpose, we used the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model proposed by Bollerslev (1986) to calculate the conditional variance of all the variables. To investigate the time-varying return and volatility impact between variables, we employed the Gaussian state space model, in which the regression coefficients of the model vary over time. For empirical analysis, we used the monthly data of all the underlying variables from January 2000 to December 2018. The outcomes of the GARCH model explain that the past information and volatility have a significant influence on the current period volatility for all variables. The findings also show that the volatility shocks are highly persistent in all the variables except industrial production index. The results of the time-varying model illustrate that there is significant time-varying return impacts from all the variables to stock market. These findings provide the strong evidence of the time-varying behavior of the relationship between all the underlying variables. The findings of this study also show the significant time-varying volatility impacts from all the variables to stock prices. This evidence suggests that the impact of exchange rate, consumer price index, industrial production index and interest rate volatility on stock prices volatility changes over the time. The findings of our study are useful for investors, policy makers, portfolio managers, exporters, importers, financial market participants and multinational firms for investment decisions and for appropriate policies.

Keywords: *Interest rate, Exchange Rate, Inflation, Industrial Production Index, StockPrices, Stock Return, Unit Root Test, GARCH Model, State Space Model*

CHAPTER 1

Introduction

Interest rate and exchange rate are considered as the most significant macroeconomic variables of the economy and also affect the stock market performance. Financial theories describe that interest rate as well as exchange rate mainly affected by stock return or firm's value. Financial market is directly affected by interest rate: change in interest rate it enables the investor to make changes in the investment, usually from fixed securities to capital market. Pervaiz, Masih, and Zhou (2018) studied the relationship between interest rate, inflation and exchange rate with stock prices. The result shows that exchange rate has positive and significant impact on stock prices while interest rate and inflation has negative relation with stock prices.

Interest rate is the price of borrowing money or it can also be defined as the cost of money. It has a very significant role in an economy. Any change in interest rate can cause problem for the investors. Interest rate is important indicator of stock market performance. High interest rate increase borrowing cost for investment. Consumer spending and opportunity for investment shrink, which reduce the growth in economy. It is examined that there exists a negative relationship between the stock prices and interest rates (Alam and Uddin, 2009).

Exchange rate is the value of one nation's currency versus the currency of another nation. Exchange rate is another important factor of economy because increase in foreign currency or devaluation of local currency also restrain demand for stock due to high risk and uncertainty. Meanwhile, devaluation in currency lead to low price for product internationally for exported good which increase the worth of company based on export product and boosts the economy. Zivkov, Njegic, and Mirovic (2016) studied the relationship between exchange rate and stock prices. The result shows that exchange rate has greater influence on stock prices. Naeem and Rasheed (2002) studied the relationship between exchange rate and stock prices for four South Asian countries. There is no significant relationship found between variable for Pakistan and India while there is long run relationship for Bangladesh and Sri Lanka.

The industrial production index (IPI) is consider as the economic indicator that measures the real output of different industrial sectors as compared to a base year of the monthly basis. The index shows fluctuation within industrial sector which account for overall variation in growth. Sohail

and Hussain, (2009) studied the relationship between industrial production index and stock prices. They found that there is positive relationship between these variables.

Inflation is general rise of price in any economy in term of their goods and services. However this increase is on average of all goods and services not at unit level. Higher the inflation cause high prices for goods and services to customer which tend to slow down firm business and put down earning for firms. Generally increase in inflation leads to increase the discount rate and due to that the stock prices will decrease (Chen, Roll, and Ross, 1986).

A country's economic growth depends on the growth of financial sector. The stock market plays an important role in the financial sector by providing a platform for its user and providers of resources for investing in corporate stocks. It plays an active role in the economic growth and the expansion of a steady and well-ordered financial structure of an economy (Patel, 2012). Stock market is directly affected by various macroeconomic factors (interest rate, exchange rate, inflation and industrial production index) and there is complex relationship between these factors (Raza *et al.,* 2015).

Besides a number of factors stock market is greatly affected by the interest rate volatility as well as fluctuations in the foreign exchange rates. Foreign exchange rate and interest rate are important financial and economic factors affecting the value of common stocks (Joseph and Vezos, 2006). It is believed that the stock prices and interest rates are negatively correlated. An expansionary monetary policy causes the interest rate to decline. A reduction in interest rates leads to lower cost of borrowing. It has two impacts on stock market. People tend to take more loans at a lower cost to invest in stock market. Moreover, lower interest rate makes investors reluctant to invest or keep money in the bond market. So they tend to move money from the bond market to the equity market. This higher demand causes price of stock to rise.

In an open market economy, movement of capital between countries affects the prices of stock through the change of the exchange rate. The capital inflow results in the appreciation of domestic currency through supply of foreign currency which reduces the competitiveness of exporter of domestic country. This lower competitiveness of domestic production weakens the price of stock.

Multiple factors are significantly affecting the market value of firms as well as the stock prices, exchange rate fluctuation being the most important one. Although the topic has been discussed

extensively still, there exists no consensus with the stock market and exchange rate. Financial theory explains that rates of interest and exchange rates should influence a firm value. The stock prices of firm may be determined by the upward and downward movements of the exchange rates.

Similarly, the variations in stock prices have effects on the exchange rates. When there is increase in assets prices, domestic investors are willing to spend; in result there is increase in the local currency demand as well as increase in the behavior of selling the foreign assets. With an increase in the local currency demand, the interest rate is forced to increase, that will eventually increase the asset of foreign investors to make investment and acquire maximum benefit. Local currency exchange rate tends to rise against that of foreign currency and illustrates a negative relationship as proposed by the Portfolio balance strategy as well. However, according to the traditional approach a positive relationship of stock market with exchange market, moreover, there is a casual relationship from exchange rate to stock market.

Ajmair and Hussain (2017) studied the determinants of industrial sector growth in Pakistan. They concluded that Trade (% of GDP) and Personal remittances, received (% of GDP) showed positive and significant association with Industry. Ahmed and Farooq (2017) conducted a research and took the information from 37 developing markets and demonstrates that venture of firms headquartered in nations with high inflation is affected less by their stock prices than that of firms headquartered in nations with less inflation. Günay (2018) studied and employ a huge amount of domestic and global indicators to estimate industrial production growth and inflation. By applying two methods factor model and forecast combination. By concluding the factor model results are better than forecast combination.

It is recommended that with deprecation in local currency and the local firms turning out to be more competitive. A positive relation of stock prices with exchange rate resulting increases their exports. The stock prices will ultimately increases. Besides the two approaches another approach also exist i.e. Asset market approach. This approach recommends that there is either no interaction or unsustainable relation of exchange rate with stock market. This is because distinct factors can be there that drive both the variables.

As previous study examined by author, this is the first research to investigate the time-varying impacts of interest rate and exchange rate on stock returns using the State Space Model.

1.1 Problem Statement

In previous studies, researchers were unable to identify the time varying effect of interest rate and exchange rate to measure stock volatility in the Pakistan Stock Exchange. However, it is certain that these variables do not affect the stock exchange markets at the same magnitude during the whole period. The development in Pakistan's stock market combined with several structural breaks and financial crises surely change the dynamics of the relationship between the interest rate and the exchange rate with the stock prices. It is important to review the literature about the effects of the interest rate and the exchange rate volatility on the stock prices behavior in developing economies and how could significantly reflect with shaky market like Pakistan. As for Pakistani concern, interest rate and exchange rate is highly controllable by monetary policy and exchange rate policies in developed economies. Therefore, the researcher examines the dynamic relationship between interest rate and stock prices in order to identify the effect of interest rate and exchange rate changes on stock prices So, it's important "To find the time varying effect of interest rate and exchange rate on stock prices"

1.2 Research Gap

The literature is abundant on individual effect of exchange rate and interest rate on stock prices (Ahmad, Rehman and Raoof 2010; Al-Mukit, 2012; Khalid and Saifullah 2017; Khalid, 2017). Most of the studies have attempted to identify the separate relationship of both explanatory variables i.e. exchange rate and interest rate on stock prices (Naeem and Rasheed 2003; Farooq, Keung and Kazmi, 2005;Alam and Uddin 2006; Rashid, 2007; Ali, 2014). But, the recent literature is still scarce on the combined effect of these two variables on stock returns specifically in Pakistani context. The previous studies have also suggested the significant relationship even on individual basis. By considering this instant need, this study tries to fill this gap by estimating the combined effect of interest rate and exchange rate on stock prices. Moreover, this study also considers the some other determinants of stock prices i.e. inflation rate and industrial production index as control or independent variables (Farooq and Ahmed, 2017; Arouri *et al.*, 2014; Tiwari *et al.*, 2015). Very few literature found on such arrangements of variables. Another, major contribution of study is that this study employs the new methodology i.e. state space model to estimate the regression between the variables.

1.3 Research Objectives

- To examine the time-varying effect of interest rate and the exchange rate return on stock return.
- To examine the time-varying effect of industrial production index and the inflation on stock return.
- To examine the impact of the interest rate volatility and the exchange rate volatility on the stock return volatitily over a time.
- To examine the impact of industrial production index and the inflation on stock return.

1.4 Research Questions

- Is there any time-varying effect of the interest rate return and the exchange rate return on stock return?
- Is there any time-varying effect of industrial production index and the inflation on stock return?
- Does the impact of interest rate volatility and the exchange rate return volatility on stock return volatility changes over time?
- Does the impact of industrial production index volatility and the inflation volatility on stock return volatility changes over time?

1.5 Significance of the Study

Financial markets play a key role for the development of any economy. Fluctuation in the stock prices is considered as sign of efficiency for stock market. This study contributes in different ways; Firstly potential investors and financial experts use this information to get help for decision, whether changes in the interest rate and the exchange rate influence stock prices on the financial markets and to what extent macroeconomic variables influences in stock market volatility. Secondly it will help local firms to recognize periods that might be helpful for getting trading on the stock market and also help the financial investors to make different investment choices. Furthermore being valuable as a source of information for exchange rate, it might be helpful for further research in this or related areas concerning the exercises of both local and foreign investors in PSX. Third, this research also helps the investor to make the decision about the investment in equity or debt market. The association between the stock prices, interest rate

and exchange rate less constant in short term or long term. The investor must consider the volatility between different periods to utilize maximum benefit in the Pakistan stock market.

1.6 Scheme of the Study

After a brief introduction the remaining part of study is structured as follows. Chapter 2 is composed of literature review which provides enough literature justifying the association between interest rate and exchange rate on stock prices. Chapter 3 discusses data and Methodology used in study, Chapter 4 shows the results and discussion of interest rate and exchange rate on stock prices. Chapter 5 conclusion, key findings, future direction and policy recommendation.

CHAPTER 2

Literature Review

2.1 Background of the Study

There have been a number of studies examining the relationship between exchange rate and interest rate with stock returns. These studies provide mixed results. Ibrahim (2000) examined the Malaysian economy and investigated that the exchange rate and stock prices show no long-term relations. Furthermore, he concluded that in the short term, a fundamental association of stock prices with the exchange rate. Wu (2000) conducted the same research on the exchange rate and the stock prices of Singapore and show unidirectional relations of stock prices with the exchange rate. In another study, Granger (2000) conducted research on Asian economies. The result shows that changes in stock prices occurred in the Philippines as the exchange rate changes and in South Korea, there was a reverse relationship.

Jefferis (2000) conducted research on different countries Zimbabwe, South Africa and Botswana stock market in which during the exchange impact, more interest rates were presumed to reduce stock prices and maintain a high rate of a discounter, otherwise lowering outcome on the asset and anticipated an upcoming profit. Some of the researchers found the exchange rate, interest rate, and stock prices were correlated. (Gupta, Chevalier, and Sayekt, 2002).

Chinn and Meredith (2004) found that applying long term data in G-7 economies. It shows a negative relationship of the exchange rate with the interest rate. The relationship of stock prices and the exchange rate was studied by Amare and Mohsin (2000) including different Asian economies over the long-run. The results show that out of all the nine countries under study, there was long term relationship for Singapore and the Philippines.

Vardar (2008) examined the effect of the exchange rate and the interest rate on the instability of some segments of the industry and the combined index of the Istanbul stock exchange and found negative results. Aydemir (2009) examined the relationship of the exchange rate with stock prices in Turkey. The outcome explains the subsistence of the two-way connection among the exchange rate with interest rate. Out of the total five indexes there, four indexes indicated a negative connection (operating from index to exchange rate).

Al-Jafari *et al*., (2011) concluded that in the long run, no relationship among the interest rate, exchange rate and the stock prices in emerged and emerging economies. Kumar (2008)

conducted the study to found the relationship of exchange rate with stock prices on the Indian economy. The result explains there was a bidirectional linear as well as nonlinear Granger causality exists among variables.

Owusu Junior *et al.,* (2018) checked the co-movement of stock exchange indices with the exchange rate in Ghana stock exchange. The results found closely particular lead-lag association among the Ghana Stock exchange. Ferrer, Bolós, and Benítez (2016) checked the relationship of stock return with interest rate changes in European economies. The results indicate there was high interdependence among interest rate and equity return in the U.K. in different time-frequency. Ahmad, Rehman, and Raoof (2010) conducted research in Pakistani market in order to determine the relationship among the exchange rates, interest rates and the stock return. They found a negative relationship between the interest rate and the stock return. Banerjee and

Alam and Uddin (2009) found a negative relation of stock prices with interest rates. Antonakakis *et al*., (2017) was found that low impact of inflation on the stock returns in long term but in short run it was affected by the stock prices. Reboredo, Castro, and Ugolini (2016) checked the downside and upside risk spillover from stock prices to exchange rate and vice versa. The results show that there was positive relation among these two variables in developed economies.

Kanas (2003) checked the volatility spillovers in exchange rates and stock returns changing in France, Canada, Germany, the UK, the USA and Japan. The results show that except Germany in all other countries there was the support of spillovers in stock returns and exchange rates is found. The study examined the association between the cumulative inflation, exchange rate, stock prices, industrial production index and interest rate in the United States. The findings show there was a positive association between the stock prices and the industrial production index whereas a negative relationship with other variables (Kim, 2003).

Phylaktis and Ravazzolo (2005) examined the relationship between stock prices and exchange rates. The findings show a positive relationship between the variables. Kasman, Vardar, and Tunç (2011) found in theTurkish economy, the bank stock return was negative and significant on the exchange rate and the interest rate. The association among the exchange market and stock market of Pakistan was checked. There was no relationship found among the variables (Suriani *et al.,* 2015).

2.2 Theorical Background

This study is based on different theories of finance; Efficient Market Hypothesis by (Fama, 1991), Good Market Approach" or "Flow Oriented Models by (Dornbusch and Fischer, 1980), Expectation theory of interest or Valuation theory (1986) and Fisher Effect by (Fisher, 1930) are explained below.

2.2.1 Efficient Market Hypothesis

Efficient Market Hypothesis by (Fama, 1991) which discusses the stock prices reflected all the available information in the market. (Alam and Uddin, 2009) studied that rapid declined in the rate of the interest brings down the borrowing cost. Generally, additional loans are taken by the people at a lower cost to put the resources into securities exchange. In addition, bringing down financing costs makes investors hesitant to put or keep cash in the security market. Therefore they will move cash from the security market to the equity market. The higher interest makes the cost of stock rise quickly. This shows how efficient the market reflects the available information to utilize it as profit or gain.

2.2.2 Good Market Approach and Portfolio Balance Approach

Exchange rate-based theories states that the association among the exchange rate and stock prices. Multiple methods explained this association, the first being known as "Good Market Approach" or "Flow Oriented Models" to explain the impact of the exchange rate on the stock market (Dornbusch and Fischer, 1980). Flow Oriented Models flow oriented' model states that exchange rate fluctuations affect international competitiveness and then the less favorable terms of trade may affect real income and thus stock prices. Furthermore, because the value of a stock equals the discounted sum of its expected future cash flows, they react to macroeconomic events including exchange rate changes. This implies that exchange rate changes lead to stock price returns, and that they are positively correlated.

Flow-oriented" and "Stock-oriented" models might show the existence of relationship between stock prices and exchange rates. Flow models point out that the exchange rate is determined largely by a trade balance performance. Dornbusch and Fisher (1980) assumed that a country's current account and trade balance performance are two important factors of exchange rates determination in the Flow-oriented models. Stock prices and exchange rates are hence positively related. Stock price, which expresses a present value of future cash flows of firms, should be

adjusted to the economic perspectives. Thus, models of flow oriented examine a positive relationship between exchanges rates and stock prices. They show the direction of causation running from exchange rates to stock prices. For instance, domestic currency depreciation makes the local firms more competitive. It means that their costs of exports are cheaper in international trade comparison. Higher exports are leading to higher incomes and increase firms‟ stock prices. On the other hand, Stock-oriented models emphasize the capital account as the major determinant of exchange rates. These models often distinguish on the monetary models. In literature, Frankel (1983) found a negative relationship between stock prices and exchange rates with portfolio balance models.

The second theory "Portfolio Balance Approach" (Frankel, 1984) or "Monetary Model" to clarify the causal impact from the stock market to the exchange rate. The exchange rates may be influenced by the stock market development that indicates the causality effect from the stock market to the exchange rate; in Portfolio balanced approach, this causality effect is considered to be negative. Still, according to the monetary approach, no causality effect found from the stock market to the exchange rate. The exchange rate is the cost of a benefit as per the monetary approach.

2.2.3 Expectation Theory and Valuation Theory

In financial theories, the interest rate is reflected as a deciding element at evaluating stock prices. There are two financial theories that clarified the impact of interest rate on stock prices. Expectation theory of interest (1986) expresses that expectations of economic subsidence have a significant negative effect on stock prices. As per this theory, longer-term rates are controlled by investors by using short interest rates of the future. For example (Andreou, Osborn, and Sensier, 2000) show that the value of the stock returns in S&P before the recession in the US, and FTSE decreases before the recession and reaches it’s maximum after 10 weeks from a more intense period of the recession in the UK.

The valuation theory (1980) expresses that the causality impact of interest rate is negative with stock prices. Changes in both short-term and long-term rates are required to influence the interest rate in a similar way by means of their impact on the risk-free rate (Mukherjee *et al*., 1995). (Geske and Roll, 1983) showed that the real interest rate effect on stock return was significant but often small in most countries of their studies. The findings of (Asprem, 1989), (Fama, 1990),

(Bulmash, 1991) show that there is a negative relationship between interest rates and stock returns in Korea.

2.2.4 Fisher Effect

In the end, Fisher Effect (Fisher, 1930) describes the subsequent effect on stock prices as relationship of inflation between real and nominal interest rates. The relationship between the nominal interest rates and the expected inflation is of fundamental importance in financial markets. Fisher (1930) establishes the foundation of the underlying relationship between the nominal interest rate and the purchasing power of money measured by the inflation rate. The response of the nominal interest rate to the inflation rate is known as the Fisher effect in the literature and it is of paramount importance pertinent to the efficiency of the financial markets and the performance of the monetary policy. The Fisher effect predicts that the real interest rate is not affected by the changes in the expected inflation rate because it results in equal changes in the nominal interest rate. This implies the nominal interest rate responds one-for-one to the expected inflation rate, which in turn implies the long-run real interest rate is established in the real sector of the market by means of "technology and preferences". Antonakakis *et al*., (2017) has found low impact of inflation on the stock returns in the long term but in the short-run, it is affected by the stock prices. Inflation is considered a significant macroeconomic variable that is associated with the stock prices and is affected by them too.

2.3 Exchange Rate and Stock Prices

Two major hypothetical approaches are there: the flow-oriented approach Dornbusch (1980) and the stock-oriented approach Frankel (1984) which give contradictory results. The previous study maintains a positive relationship between the exchange rate and the stock prices; the exchange rate is determined by the outgoing payment of the economy. Alternatively, the exchange rate is settled by the supply and demand of economic benefits is explained by the stock oriented approach. By using this approach a new model was developed, one is a monetary model and the other is a portfolio balance model which states that a negative relationship exists among the exchange rates.

Hamrita, Abdallah, and Ammou (2009) checked the connection of interest rate with share price in India. In India fundamental and non fundamental relation among interest rate and exchange rate changes with the scale and time, at end of 1993 and the start of 1994 taking the 1-4 scale

interest rate decreasing with cycle effect from stock prices. From the period of 1998 to 2001, 8-12 scale interest rates were increasing with cycle effect on share prices. The time period of 2003 to 2005, 1-6 scale and from the end of 2006, 9-14 scale interest rates were decreasing and gaining anti-cyclical impact from share prices.

Korkeamäki (2011) studied on the euro changed firm financial markets for the euro zone corporate through the unique way. The results show that in the Western economies there was a negative association between stock prices and interest rate. Yang (2017) examined the relationship between the interest rate and exchange rate in the Asia Pacific region during the time of 1999 to 2016. Three outcomes are achieved. First, for all four economies, there was simultaneous change because of monetary policy and exchange rate, stock prices fluctuated in Singapore and Hong Kong rather than Taiwan and South Korea. Second, in Singapore and Hong Kong exchange rate effect small in short term and more effect on the long term of all four economies and taking the same time. Third, in all four economies exchange rate shock encourage spontaneous dynamics in the stock price however stock price shocks take a slow change in the exchange rate.

Adjasi, Biekpe, and Osei (2011) examined the movement of stock prices and the exchange rate in African economies. In Tunisia, there was co-integration among stock prices and the exchange rate decreases the stock prices. Tudor and Dutaa (2012) examined Granger causality of stock prices with exchange rate in the emerged as well as developing economies. The findings show that was development of exchange rate on stock market index in Brazil and Russia whereas UK equity market was considered a risk factor.

Dahir *et al.,* (2018) examine the association between exchange rate and stock prices in BRICS countries. There was a positive relationship between the exchange rate and stock prices in Brazil and Russian while there was negative relation in India. Combes, Kinda and Plane (2012) examined the connection of exchange rate flexibility, capital inflows, and real exchange rate. The findings explained government and private cash flows were associated when there was increase in effective exchange rate. Stavárek (2005) analyzed the connection of exchange rate with stock prices by including the eight EU member economies consist of four new and old countries in long term as well as in short term. There exists a strong relationship between 1993 to 2003 rather than 1970 to 1992. Bhattacharya and Mukherjee (2003) studied the relationship among the value

of trade balance, exchange rate, and foreign exchange rate reserves with the stock prices. The outcomes do not show the presence of an association with stock prices.

Balogun, Dahalan and Hassan (2019) studied the impacts of interest rate liberalization on stock market development. They indicate there was negative relationship between interest rate liberalization and stock market development. The relationship of exchange rate with the stock prices has become most discussing area due to the increment in international trade and capital movement. It attracted the interest of the investor and argued them for making the investment in the security market (Chaieb and Mazzotta, 2013). The study examined the relationship of stock market capitalization rate with interest rate in Turkey. The results show that the stock market capitalization rate and interest rate were not stationary and no relation found (Toraman and Başarir, 2014).

Adjasi, Harvey, and Agyapong (2008) checked the relationship between the stock market and exchange rate in Ghana. To estimate the change in exchange rate how much affects the stock market analyzed the Exponential Generalized Autoregressive Conditional Heteroskedasticity model. The results determined that there was negative relation stock market returns and exchange rate. In the long term when the domestic currency decreases then stock market return increases. Tsai (2012) checked the relationship between stock prices and exchange rates. the results indicate a negative relationship.

Cifter and Ozun (2007) examined the effect of interest rate on share prices in Turkey. The results show a significant effect of the bond market on the stock market in Turkey. Another research indicates that the exchange rate and the stock price instability were examined on a cluster of many developing economies. The results show high instability corresponds to the time of the disaster, Asian and Mexican financial disaster, as the United States subprime disaster 2008 and of counterattack 2001 (Walid *et al*., 2011). Delgado, Delgado and Saucedo (2018) studied the association among oil prices, stock market index and exchange rate. The data were monthly and collected from 1992-2017 by applied the VAR model. They found a negative and significant effect of the exchange rate on the stock market index.

The interest rate and stock return were considered as the monetary and non-monetary sector. It makes an asset-specific benchmark, first industry judge; interest rate risk was a significant positive reward towards Germany. Second, the benchmark of interest rate return in the case of

the monetary sector was more significant than the non-financial sector. Third, the normal interest rate of German financial sector will get a return equal to 70% of the equivalent entire stock return. Fourth, the benchmark of interest rate and risk insurance companies was significant as compared to financial sectors (Czaja, Scholz and Wilkens, 2010).

Afshan *et al.,* (2018) checked the relationship among the exchange rate with stock prices. There was strong coherence and bidirectional causality coherence. Sui and Sun (2016) examined the relationship among domestic interest rate, stock returns, exchange rate, and the United States S&P returns and BRICKS countries were used to check the effect. The findings indicate there was a strong effect of the exchange rate on stock returns. Wanling*et al.,* (2016) checked the stock market and the role of interest rate in the U.S. The results indicate that there was dissimilarity among the federal funds and inflation anticipation, the interest rate of the United States has constantly negative. Giri and Pooja (2017) checked the connection of exchange rate, stock prices and macroeconomic variables in India. They found a positive connection between exchange rate and stock prices.

Diamandis and Drakos (2011) conducted research and determined in America there was a positive relationship among stock prices and exchange rate.. Zhao (2010) studied the association among the stock prices and exchange rate and found no relationship. Dar *et al.,* (2013) checked the association of exchange rate with stock price index in Asian Countries used the simple correlation and wavelet-based correlation applying the portfolio effect. The outcome indicates a negative connection between these variables.

The financial crisis of 2007 to 2008 in Ghana measures the effect of interest rate and exchange rate and their sudden impact on firms and portfolio returns. Ghana /US dollar, Great Britain Pound and Euro. The results show that the decrease in Ghana /US decreases the returns of stocks. The financial crisis was a direct positive impact on the returns (Dwumfour and Addy, 2019).

Mishkin (1997) suggested that decreasing interest rate high stock prices which in result also increase business opportunities. Usually, a decline in the interest rate causes rises in the flow of capital to the stock market in anticipation of more return and high-interest rates promote further savings in banks and as a result lower the capital flow to the stock markets.

Jiranyakul (2012) conducted research and took the market of Taiwan and found a positive relationship exists among the exchange rate and stock prices. Bhunia (2012) analyzed causality

tests on India and found a connection in stock prices and exchange rates. Kisaka and Mwasaru (2012) observed the stock market of Kenya and observed the presence of relation of the stock market index with the exchange rate. Similarly, Stefanescu and Dumitriu (2009) examined the research on the Romanian stock market and found similar results. The research checked the connection between stock price and the exchange rate volatility. The results differentiate among two distinct regimes in the conditional mean. High mean-low variance is used to characterize the first regime whereas a low mean-high variance was used for characterization of the second regime (Walida *et al.,* 2011). Phylaktis and Ravazzolo (2005) checked the association of exchange rates with stock prices. A positive association exists among foreign exchange and stock prices.

The quarterly data were used in Nigeria form 1990- 2009 to check the association of exchange rate and stock price. There was a long term association among the variables (Okpara, 2019). Mikhaylov (2018) checked the effect of volatility spillover amongst the exchange rate market and stock market with oil-exporting countries, Russia and Brazil. The FIGARCH model was analyzed. Dynamics of volatility found in long term. The study focused on novel methods for forecasting of volatility of the FIGARCH model. World economic crisis of 2008 to 2009 the financial market more combined.

Aamd (2018) checked the association of share prices index with macroeconomic variables: money supply, consumer price index, exchange rate, and industrial production index and interest rate. The findings show that the industrial production index and interest rate highly affected the share price index of all the volatility while the share price index is significant and negative long term association with industrial production index and consumer price index. Hamrita and Trifi (2011) studied the multi-scale relationship with exchange rate, stock prices and interest rate from 1990 -2008 analyzed the wavelet transform in the United States. The outcome describes that in zero to entire scale and found no significant relationship among exchange rate and interest rate while zero to high scale there was significant relation among stock market index and interest rate and found bidirectional connection with stock return index and exchange rate index.

Salimullah (2016) examined the relationship among interest rates, the exchange rate with the stock volatility in Chicago and found positive relation. Huy (2016) studied the association of stock prices with the exchange rate. The data sample was daily from 2005 -2015. The findings

show that there was non normally distributed among variables and stationary and also founds a unidirectional test among these variables and support the traditional approach.

Akdogu and Birkan (2016) checked the connection of exchange rate and stock prices in developing economies. The findings explain there was a statistically significant causal relationship with the variables. Al-Abdalla and Abu ALjarayes (2017) examined the exchange rate, stock return and interest rate in Jordan. The data was monthly and collected from 2005 – 2010. Multiple regression models were used and found that firms were negatively correlated with interest rates and positively related to exchange rate and inflation and zero relationships with returns. Cheah, Yiew, and Hee (2017) checked the exchange rate and stock price relationship in Malaysia and the data sample was monthly during the period of 1993- 2015 used the nonlinear ARDL model. The NARDL test shows the existence of cointegration among the variables.

Ajaz *et al.,* (2017) studied exchange rate, stock prices, and interest rate relationship in the Indian economy. The findings determined the existence of stock prices asymmetric exchange rate and interest rate reaction to changes in the whole model. Rahman (2009) performed the same research for the Asian economies which included Bangladesh, India, and Pakistan and found that no relationship exists among them in Asian economies.

2.4 Interest Rate and Stock Prices

Leon (2008) studied the influence on the stock returns caused by the interest rate in Korea and weekly data from the Korean Stock Price Index from 1992 to 1998.The result shows a negative and significant association among them. Jareño, Ferrer and Miroslavova (2016) conducted the research on inflation, real interest rate and nominal interest rate in the United States market from 2003 to 2013. The findings analyzed that the stock market was significant impact on the interest rate and inflation.

The interest rate has a vibrant effect on stock returns are studied in many stages of central bank intelligibility below an asset pricing model. Including developing economies in a panel data framework, and found a negative relation with stock return and stock prices (Papadamou, Sidiropoulos, and Spyromitros 2017).

Muruki (2014) checked the relationship among interest rates, inflation rate and stock market. They found a negative relationship between the interest rate and the stock returns and positive

association among inflation and market returns. Gan *et al*., (2006) conducted research on inflation, interest rate, money supply, exchange rate, stock market and GDP in New Zealand. There exists a long term association in the variables.

First, Modigliani and Cohn (1979) examined that stock market investors not successful to identify the inflation impact on cashflow during the time period of high inflation and the valuation errors encourage an undervaluation in stock and vice versa. Second, Fama E. F (1981) studied that the opposite relationship among stock returns and inflation is generated by a positive association betweenthe equity market and output growth and negative association among inflation and economic activity. Boudoukh andRichardson (1993) examined that stock returns have positive associations for a long time, in short time there was a negative association. The research studied connection among interest rate and exchange rate in Pakistan and found a negative connection among the variables (Ali, 2014).

Zafar, Urooj, and Durrani (2018) studied the impacts of stock return and the interest rate volatility in Pakistan.The data were collected from 2002-2008 using the GARCH model. The result shows the negative connection between them. The research investigates the properties associated with the macroeconomic variables such as stock market return, cointegration residuals They found a negative association in the long run (Otieno *et al.*, 2017). Fang and Bessler (2017) examined that either interest rate predicts the stock returns in China. The outcomes show that the calibration test specifies that adding the interest rate enhances the ability of the model to point out the realistic probability of stock returns.

Martínez, Lapeña, and Sotos (2015) examined the relation among stock market changes and interest rates of the Spanish industry during the time period of 1993 – 2012 analyzed the wavelet approach. The findings show that the Spanish industry has a significant relation with the interest rate. To predict the stock returns and determine their predictive potential between the different financial fundamental a model interest rate determined model switching strategy was used. The interest rate is high then the ordinary least square regression purposes that stock returns respond more sensibly to the changes in economic fundamentals (Yi, Ma, Huang, and Zhang, 2019). Rapach, Ringgenberg, and Zhou (2016) studied the relationship between the interest rate and stock return. They found that interest probably the strongest forecaster of aggregate stock return.

Ahmad *et al.*, (2010) conducted research among the interest rate and stock market capitalization. The result does not support past studies that are conducted in emerged countries. The study

supports the research that is conducted in emerging countries and the nonbanking sectors. Therefore, when there is more investment in the stock market, market capitalization increases.. Alam and Uddin (2009) carried out a research to check the impact on the stock exchange rate caused by the interest rates considering the fifteen emerged and emerging countries. The results indicate that there exists a significant negative association among the share prices and the interest rate for emerging countries. Inflation is a major economic variable that is linked with the stock prices and as a result, it is also affected (Gupta and Inglesi-Lotz, 2012).

2.5 Different Macroeconomic Determinants of Stock Prices

Piccillo (2009) conducted the same research to examine the two ways determinant in developed countries English, German and Japanese stock market take the data of some years of the exchange rate and stock prices.

Gokmenoglu, Azin, and Taspinar (2015) found the association among oil prices, inflation, GDP and industrial production in Turkey. They found long term relationships among them. Delgado *et al.,* (2018) conducted the research on exchange rates, stock market index and oil prices. The inspected period incorporates monthly information from 1992-2017. The results indicate that there was a negative relationship. Mouna and Anis (2016) checked the relation among financial areas, interest rate, stock return, and exchange rate. The freedom of the financial sector and technology advancement has enhanced the linkage among stock returns, exchange rates, and interest rates. The association among the variables has increase creative research activity from the previous decades.

Tiryak, Ceylan and Erdoğan (2018) examined the relationship between nonlinear dynamic association among exchange rate, industrial production index and money supply, on stock returns in Turkey. The findings show that the impact of changes in stock returns, exchange rate, and industrial production are asymmetric.

Koseoglu and Cevik (2013) have observed the association among the economies of Hungary, the Czech Republic and Poland during the time of 2002 – 2011. The outcomes show that the stock prices were an effect on the exchange rate. Based on these results, another research conducted by Köse, (2010) in their research considers Istanbul to achieve that the stock prices were the Granger cause of the exchange rate. Antonakakis *et al*., (2017) has studied that in the long run, the effect of inflation on the stock returns may be very low but for the short run it is agreed to have an effect on the stock prices.

Liang (2013) applied the Pedroni 2000 panel contraction test in their research taking the five Asian economies from 2008 to 2011. The outcomes indicate the existence of association among them also found that Asian countries improved after the Asian economic disaster. Zhao (2010) checked the relationship with market index and exchange rate in China and does not found any relation. Liu (2012) analyzed the stock market of China, applied the linear and nonlinear causality tests and found that there was no association. Pan (2007) examined the seven Asian countries before the time of the Asian economic disaster and found that there exists no association between them.

Zeren and Koc (2016) examined relationship among exchange market indices and stock prices. In his research, the kafenios unit root test is used. This study found breaks numbers of series were identified. Exchange rate volatility has been considering an important determinant for many countries. The economic structure, specifically the stock market of a country, was dominated by exchange rate volatility (Funyina and Teddy, 2015). Tiwari *et al.*, (2015) conducted research on inflation and stock return. The conclusion indicates that there was a positive relationship between inflation and stock return.

Waqar (2017) checked the impact of interest rate and exchange rate on stock market capitalization. The findings indicate that by increasing a 1% interest rate it causes a decrease in exchange rate by 0.23% and it increasesstock market capitalization by 3.17%. Kennedy and Nourzad (2016) has also studied the outcomes of other aspects such as exchange rate volatility and financial volatility in the U.S during the time period of 1999- 2010. They found that when the main components of financial volatility are restrained, high exchange rate volatility exercised a positive and significant influence.

Lim and Sek (2014) checked the relation among the stock return and exchange rate volatility in developing economies of Asia and show that there is significant causality either positive or negative among them and the volatility in stock returns. Amarasinghe (2016) examined research to check the effect of the industrial production index on the division performance of Food, Tobacco, and Beverages by using the Colombia Sock Exchange of Sri Lanka. The results show that the industrial production index is significantly affecting beverage, tobacco and food and its positive relationship among these them.

Arouri *et al.*, (2014) conducted an association with inflation and stock returns. Fisher's hypothesis explains that inflation is independent of stock returns. The Fisher hypothesis mainly

analyzed stock returns to revert them on inflation. In the short run, monetary policy and exchange rates were considered there was a positive impact on the stock prices of the countries that were offering free monetary policy and floating exchange rates (Abouwafia and Chambers 2015).

Kumar and Puja (2012) studied relationship with macroeconomic variables and the stock market in India. The macroeconomic variables were the industrial production index, T-bills, money supply, exchange rate, and wholesale price index. The findings indicate that there is a positive relationship with the industrial production index and money supply and a negative relation with inflation. Hosseini, Ahmad, and Lai (2011) studied the association among macroeconomic variables and stock market indices in India and China from 1999-2009. The findings show long run and short-run linkages among crude oil, industrial production index, money supply and inflation with stock market index between China and India. Singh (2010) checked the association among stock market index and macroeconomic variables: exchange rate, wholesale price index and industrial production index The Granger causality test indicates that industrial production index has bilateral casual association with BSE Sensex. The wholesale price index has a strong association with BSE Sensex. (Acedański, 2013) studied the forecasting industrial production in Poland by using different methods. He concluded that industrial production play a significant role in the economy.

Mireku, Sarkodie, and Poku (2012) checked the intensity of inflation and the stock prices in the U.S. from 1791- 2015. The result indicates that in the U.S. there has been a dramatic increase in inflation and the stock prices. Singh, Devi, and Roy (2016) studied the relationship of industrial production index in India. The result shows that there was negative relationship. Ejaz and Iqbal (2019) studied the estimation and forecasting of industrial introduction index. They concluded that industrial sector is important in explaining aggregate fluctuations, also because some of the services activities are closely linked to the industrial ones.

Hypothesis

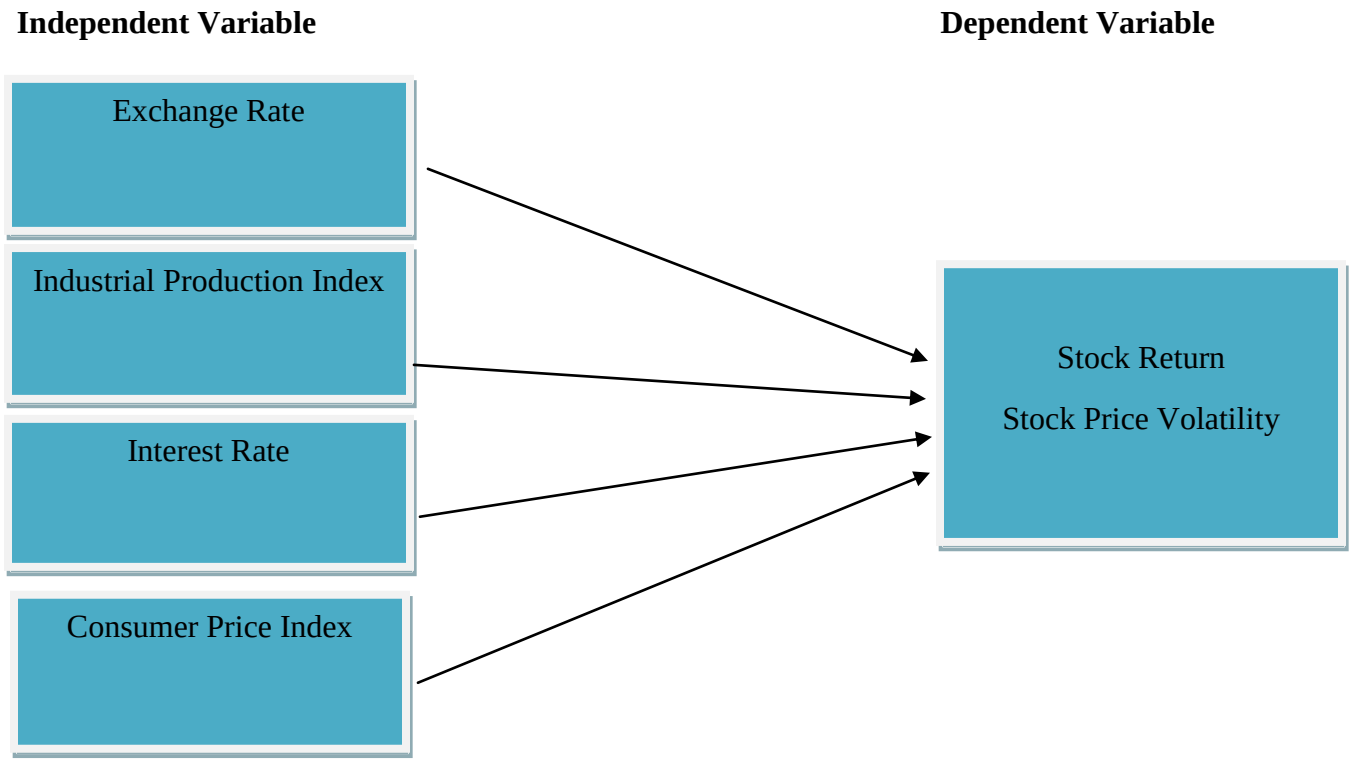
H_1 = There exists a significant time varying effect of interest rate and exchange rate return on the stock return.

H_2= There exists a significant impact of interest rate volatility and exchange rate return volalatity on stock return volatilityover a time.

H_3= There exists a significant time varying effect of inflation and industrial production index on the stock return.

H_4= There exists a significant impact of inflation and industrial production index volalatity on stock return volatility over a time.

2.6 Conceptual Framework



CHAPTER 3

Data and Methodology

3.1 Data

In this research, the relationship between the interest rate and the exchange rate is examined with stock returns in Pakistan. The index is nominated in domestic currency. Data gathered from the website of Pakistan Stock Exchange (PSX), Pakistan Economic Survey, Yahoo Finance and Institution of Financial Statistics. Interest rate and exchange rate relating data obtained from the PSX and the stock return information from the daily screen of PSX. The missing financial information at PSX collected from the other sources such as the State Bank of Pakistan and other published financial reports. The statistical data of the study is secondary in nature and monthly data has been taken from January 2000 to December 2018. The independent variables are exchange rate, interest rate, inflation and industrial production index and the dependent variable is stock return.

3.2 Discussion of Variables

Exchange rate and interest rate are taken as independent variable, stock prices is consider as dependent variable and industrial production index and inflation is taken as control variables.

3.2.1 Exchange Rate

The rate at which the conversion of local currency into foreign currency takes place is known as exchange rate. The exchange rate is positively related to stock prices and the underlying argument for this relationship is as follows:

If a local currency depreciates this will result in exports of that country to become cheap and hence the demand for exports of that country will increase. Ultimately results in exports of that country to increase. The increased exports lead the cash inflows of that country to increase. As the demand for exports is assumed to be sufficiently elastic and thus raises the revenue for the export oriented industries which ultimately results in a positive relation in the stock exchange market and leads the stock prices to increase. On the other hand the appreciation of a local currency reflects economic stability which ultimately results in increased investment both in the real as well as in the financial sector. The increased demand for local listed securities will push up the level of index of stock exchange market. Therefore there exists a positive relationship between the exchangerate and stock prices (Mukherjee and Naka 1995).

3.2.2 Interest Rate

Interest rate is considered as the cost of capital which means the price paid for the use of money for a period of time. From the point of view of a borrower, interest rate is the cost of borrowing money (borrowing rate). From a lender's point of view, interest rate is the fee charged for lending money (lending rate). Good investors always look for investing in an efficient market. In an inefficient market few people are able to generate extra ordinary profit which causes loss of confidence of the general people about the market. In such cases, if the rate of interest paid by banks to depositors increases, people switch their capital from share market to bank. This will lead to decrease the demand of share and to decrease the price of share and vice versa. On the other way, when rate of interest paid by banks to depositors increases, this in turn will force lending rate to increase. Increase in lending rate leads to decrease the level of investment in the economy which is also another reason of decreasing share price and vice versa.

The discount rate is negatively related with the stock prices (Reily and Brown 2000). The direct effect of increase or decrease in discount rates is on the profits of the companies which in turn affect the dividends and thus prices of the stocks are affected. Increase in Discount rate increases the borrowing cost of the companies where as decrease in discount rate decreases the borrowing cost of the companies and thus serves as an incentive for expansion and leads to increase the expected returns for the firm in the future and results in stock prices to appreciate.

3.2.3 Stock Prices

Stock price is the price of buying a security from the stock exchange. The stock price can be influenced by various factors including economic condition, volatility in market and company popularity. The economic theory states that the stock prices give an indication of the investor's expectation for the future income. For this reason, the profit shows the overall economic activity. The effective work of Fama (1970) and Ross (1976) has been used as hypothetical basis to observe the effect of changes in macroeconomic variables on the stock market return. A positive association exists among the stock returns and economic variables.

3.2.4 Industrial Production Index

The industrial production index (IPI) can be considered as the economic indicator that measures the real output of different industrial sectors as compared to a base year of the monthly basis. The index shows fluctuation within industrial sector which account for overall variation in

growth. The release can frequently shift the market as industrial production is the judge as an index for upcoming inflation. Gross Domestic Production and Industrial Production Index are the basic measures that economist applies to calculate economic sustainability. Industrial production is mostly collected at monthly or quarterly frequency to determine the rise and fall in the output of production. The indices are the collection of yearly data. Increase in industrial production leads to an increase in the expected cash flow which in turn increases the stock prices. The industrial production index has positive relation with stock prices (Sohail and Hussain, 2009).

3.2.5 Inflation

Inflation is general rise of price in any economy in term of their goods and services. However this increase is on average of all goods and services not at unit level. Higher the inflation cause high prices for goods and services to customer which tend to slow down firm business and put down earning for firms. Inflation is considered as major economic variable that is associated with the stock prices therefore, it is also effected (Gupta and Inglesi-Lotz, 2012). Generally increase in inflation leads to increase the discount rate and due to that the stock prices will decrease (Chen, Roll, and Ross, 1986).

3.3 Methodology

In this research, Unit root test, GARCH model and State Space model is used. This model will answer the research questions and it will also prove the hypotheses. The inflation, stock prices, interest rate, exchange rate and industrial production index will be used in this study to represent the variables. In this research, a theoretical framework will describe the methodology which will be used in this study. In this study, the regression model will use for checking the relationship between the variables.

3.3.1 Unit Root Test

The most important consideration and prerequisite before analyzing the time series data is the stationarity of the series. If we run the regression techniques on a non-stationary data set we may obtain the spurious results as demonstrated by the Getic and Griffith (2007). To testing the stationarity of the data series and keep us avoiding from such spurious regression results, we applied the Augmented Dickey-Fuller (ADF) unit root test of stationarity. The null hypothesis of the Augmented Dickey-Fuller test is that the series under inspection has a unit root i.e. the series is non-stationary, against the alternative hypothesis that the series is stationary. We used the

Schwarz Information criterion (SIC) for optimal lag length selection for the ADF equations. We reject the null hypothesis of ADF test of unit root (series is non-stationary) and accept the alternative hypothesis when the calculated test statistic value of ADF test in absolute term exceeds the critical value at chosen level of significance (1%, 5%, and 10%). The regression equation of the ADF test is as follows

$$\Delta \boldsymbol{Y} = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1 T} + \boldsymbol{\alpha_2 Y_{t-1}} + \sum_{\boldsymbol{t=1}}^{\boldsymbol{k}} \boldsymbol{\lambda_i \Delta Y_{t-1}} + \boldsymbol{\varepsilon_t}$$

where $\boldsymbol{\alpha_2}$ = p-1, Δ= the first difference operator, T = time trend and $\boldsymbol{\varepsilon_t}$ = white noise error. The lag length k is selected based on Schwarz Information criterion (SIC) so that all the residuals $\boldsymbol{\varepsilon_t}$ is white noise. The null hypothesis is that $\boldsymbol{y_t}$ has unit root (non-stationary), that is H0: α2=0, versus the alternative hypothesis that $\boldsymbol{y_t}$ is stationary or H1: α2.

3.3.2 GARCH Model

The primary objective of this study is to investigate the time-varying effect of interest rate and exchange rate returns and volatility on stock prices returns and volatility in Pakistan. To calculate the conditional variance of interest rate, exchange rate, and stock prices we used the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model proposed by Bollerslev (1986). Thus, GARCH model process is as follows

3.3.2.1 Conditional Mean Equation

The mean equation of GARCH (p, q) model is specified as follows.

$$R_t = \alpha_0 + \sum_{i=1}^{k} \theta_t R_{t-i} + \sum_{i=1}^{q} \lambda_t \varepsilon_{it-i} + \varepsilon_t \qquad (3.1)$$

where y_{it} is the dependent variable especially in our case y_{it} θ_t is the AR term coefficient, λ_j is the coefficient of moving average MA term and ε_t denotes the innovation in linear model. Equation (1), the mean equation is an autoregressive process of order k (AR(k)). Parameter α_0 is the constant, k is the lag length. R_t and Rt-1 represents the current and previous period stock

returns, θ_t is the AR term coefficient, λ_j is the coefficient of moving average MA term and ε_t. The conditional mean equation is a pure autoregressive process, AR (P).

3.3.2.2 Conditional Variance Equation

The variance equation of the GARCH (p, q) model takes the following form

$$h_t^2 = w_0 + \sum_{i=1}^{p} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \; h_{t-j}^t \qquad (3.2)$$

where h_t^2 is the conditional variance, $\sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2$ is the ARCH term and $\sum_{j=1}^{p} \beta_j \varepsilon_{t-j}^2$ is the GARCH term. The ARCH term captures the news about volatility from the previous period measured as the lag of the squared residual from the mean equation. The GARCH term measures the current period forecast variance as a function of the past period volatility. To ensure the positivity of the conditional variance the GARCH coefficients have the following constraints $w_0 > 0$, $\alpha_i > 0$, i = 1....p $\beta_j > 0$, j = 1....q and $\alpha_i + \beta_j < 1$. These parametric restrictions are necessary and sufficient conditions for the positivity of the conditional variance. The shocks to the volatility will die out over the passage of time if the sum of ARCH and GARCH terms $\alpha_i + \beta_j$ is less than one. However, volatility shocks will persist forever and do not fade away over the time period if the sum of ARCH and GARCH terms $\alpha_i + \beta_j$ is greater than one**.**

Since most of the existing studies in literature have estimated the GARCH (1, 1) model (Mishra et al., 2017; Leung et al., 2017; Jain and Biswal, 2016; Blau, 2018). In this study we also estimate a GARCH (1, 1) model for stock prices, exchange rate, inflation, industrial production index and interest rate. We obtained the conditional variance of all the variables after estimating the GARCH model, which we used for our further analysis.

3.3.3 State Space Model

To investigate the time-varying return and volatility impact of exchange rate, consumer price index, industrial production index, and interest rate on stock market we develop the time-varying Gaussian state space model, in which the regression coefficients of the model also vary over the time. The similar model is also used by the following studies (Todorov and Bidarkota, 2011; Chow et al., 2011; Koop et al., 2009: Kang W et al., 2015.

Generally, the Gaussian state-space model comprise of two equations. The first is known as the measurement or observation equation which relates the observed variables to the unobserved components. The second equation is the state or transition equation which describes the dynamics of the state variables based on the past available information. The state vector can consist of the regression coefficients and the error term. The considerable difference between this time-varying regression coefficient model and the conventional linear regression models is that this model allows the regression coefficients to vary over the time; however, the conventional regression models assumed that the nature of the state is constant not change over the time.

3.3.3.1 For Return Impact

The simple state space model in case of return impact from exchange rate, consumer price index, industrial production index, and interest rate to stock returns is specified as follows

$$Sr_t = \alpha + \beta_t Z_t + \mathcal{E}_t \qquad \mathcal{E}_t \sim \mathrm{NID}(\mathrm{o}, \mathrm{M_t}) \qquad (3.3)$$

$$\beta_t = \gamma_t \beta_{t-1} + N_t \eta_t \qquad \eta_t \sim \mathrm{NID}(\mathrm{o}, \mathrm{P_t}) \qquad (3.4)$$

the first equation is known as the is measurement or observation equation in which $y_t = Sr_t$ is the dependent variable which is (stock prices returns) and β_t is the time-varying coefficient ($\beta_t = \beta_1, \beta_2, \beta_3 \dots \dots \dots \beta_t$). In this model the Z_t is the matrix of explanatory variables such as (exchange rate, consumer price index, industrial production index, and interest rate) which links the unobserved state vector β_t with observed state vector y_t.with the and may consist of regression variables. The transition γ_t explains the dynamic development of the state vector and follows the AR (1) process. The $\mathcal{E}_t$ and η_t are the corresponding error terms of the measurement and state equation, respectively which are normally distributed with zero mean and variance-covariance.

3.3.3.2 For Volatility Impact

To examine the impact of exchange rate, consumer price index, industrial production index, and interest rate volatility on stock market volatility we estimated the state space model as follows.

$$\sigma^2_{srt} = \alpha + \beta_t \sigma Z_t^2 + \mathcal{E}_{it} \qquad \mathcal{E}_t \sim \mathrm{NID}(\mathrm{o}, \mathrm{M_t}) \qquad (3.5)$$

$$\beta_t = \theta_t \beta_{t-1} + N_t \eta_t \qquad \eta_t \sim \mathrm{NID}(\mathrm{o}, \mathrm{P_t}) \qquad (3.6)$$

the first equation is known as the is measurement or observation equation in which $y_t = \sigma_{srt}^2$ is the dependent variable which is (volatility of stock returns) and β_t is the time-varying coefficient ($\beta_t = \beta_1, \beta_2, \beta_3 \dots \dots \dots \beta_t$). In this model the Z_t is the matrix of explanatory variables such as (exchange rate volatility, consumer price index volatility, industrial production index volatility, and interest rate volatility) which links the unobserved state vector β_t with observed state vector y_t.with the and may consist of regression variables. The transition γ_t explains the dynamic development of the state vector and follows the AR (1) process. The $\mathcal{E}_t$ and η_t are the corresponding error terms of the measurement and state equation, respectively which are normally distributed with zero mean and variance-covariance.

Chapter 4

Results and Discussion

In this chapter, the results obtained from the research are explained. The collected data has run in statistical software named E-views and the followings results obtained.

4.1 Descriptive Statistics

The descriptive stats portray the overall image of responses. These responses are in the form of mean, median and standard deviation which have discussed in Table no. 4.1.

Table 4. 1 ***Summary Statistics***

	Mean	Median	Maximum	Minimum	Std.dev	Skewness	Kurtosis
SR	0.014	0.018	0.241	0.062	0.076	1.077	2.917
EXR	4.342	4.403	4.822	3.948	0.263	0.060	1.448
CPI	1.849	1.945	3.230	0.262	0.630	-0.094	2.503
IPI	4.706	4.736	5.293	4.094	0.260	-0.354	2.458
IR	9.775	9.500	15.000	6.250	2.471	0.317	2.055

Abbrevation SR= Stock Return, EXR= Exchange Rate, CPI= Consumer Price Index, IPI= Industrial Production Index, IR= Interest Rate

The descriptive stats of variables of study have been shown in table no.4.1shows that, the mean value of stock return is 0.014 and the median value of stock return is 0.018 which show where the center of data is located. The maximum value is 0.241 and minimum value is 0.062. The minimum and maximum data shows the range of the data. The value of standard deviation is 0.076 which indicates the percentage of dispersion from mean value. The value of skewness and kurtosis show the normality. The skewness and Kurtosis which shows the data pattern have values 1.077 and 2.917. These values are normally distributed and show that there is no noise in data.

The mean value of exchange rate is 4.342 and the median value of exchange rate is 4.403 which show where the center of data is located. The minimum value is 3.230 and maximum value is 0.263. The minimum and maximum data show the range of the data. The value of standard deviation is 0.263 which means that the average value can be up and down in this direction. The skewness value is 0.060 and kurtosis value is 1.448 which shows the data normality.

The 1.849 is the mean value of consumer price index and 1.945 is the median value of consumer price index which shows where the center of data is located. The 3.230 and 0.262 is the minimum and maximum. The minimum and maximum data show the range of the data. The value of standard deviation is 0.630 which means that the average value can be up and down in this direction. The skewness value is -0.094 which shows that data is symmetric. The kurtosis value is 2.503 which is the indication that no outlier exists and data is normal

The industrial production index consist the 4.706 value of mean and the median value is 4.736 which show where the center of data is located. The minimum value is 5.293 and maximum value is 4.095. The minimum and maximum data show the range of the data. The value of standard deviation is 0.260 which means that the average value can be up and down in this direction. The skewness value is -0.1363indicates that data is negatively skewed and kurtosis value is 2.048 which show that there is no outlier in data.

The mean value of interest rate is 9.775 the median value of interest rate is 9.500 which show where the center of data is located. The minimum value is15.000 and maximum value is 6.250. The minimum and maximum data show the range of the data. The value of standard deviation is 2.741 which mean that the average value can be up and down in this direction. The skewness value is 0.317 and kurtosis value is 2.055. Both the values show the pattern of data which is almost fair.

4.2 Unit Root Test

The initial and innovative work on testing for a unit root in time series was completed by Dickey and Fuller (Dickey and Fuller 1979, Fuller 1976). The essential objective of the test to make the data stationary.

Table 4. 2 Augmented Dickey-Fuller Unit Root Test

Variable	Level	
	Intercept	**Intercept and Trend**
SR	0.624	0.653
	(0.533)	(0.514)
LEXR	-0.767	-2.235
	(0.425)	(0.002)
LCPI	-1.320	0.2007
	(0.188)	(0.000)
LIPI	-1.387	-1.688
	(0.166)	(0.753)
LIR	-1.637	-1.6124
	(0.102)	(0.110)

First of all we applied the ADF test of unit root on level for all the underlying variables. The results reported in Table 4.2 explains that all the variables are not stationary at their levels .These similar findings results also hold in case when we include intercept and linear time trend in the ADF equation.

Table 4.2 shows the estimated results of the ADF unit root test results at level for stock returns, exchange rate returns, consumer price index, industrial production index, and interest rate. By using the SIC criterion the optimal lag length is selected. We estimated the ADF test for all the variables by taking into consideration only an intercept term in ADF unit root test equation as well as by including both an intercept and time trend in the ADF equation.

The results reported in Table 4.2 show that the calculated values of the ADF test statistics in absolute terms are less than the critical values at the 1%, 5% and 10% significance for all variables and also statistically insignificant.

For instance, we find that, in case of stock returns the estimated value of ADF test statistic is -0.624, while, the tabulated value is -3.455 at the 1% level of significance. Thus, we can not reject the null hypothesis of the ADF test of non-stationary against the alternative hypothesis of the

stationarity of the variable. In the same way, one can observe from the results reported given in table that the estimated absolute values of the ADF test statistics for all the remaining variables are less than the critical values any acceptable level of significance. Thus, we can conclude that all the variables are non stationary at their level.

Table 4. 3 Augmented Dickey-Fuller Unit Root Test

Variables	**First Difference** **Intercept**
SR	-6.368***
	(0.000)
LEXR	-10.455 ***
	(0.000)
LIPI	-11.095***
	(0.000)
LCPI	-7.887*** (0.000)
LIR	-7.504***
	(0.000)

Table 4.3 shows the estimated results of the ADF unit root test results at first difference of all variables. By using the SIC criterion the optimal lag length is selected. The results reported in Table 4.2 show that the calculated values of the ADF test statistics in absolute terms are higher than the critical values at the 1%, 5% and 10% significance for all variables.

In case of exchange rate the estimated value of ADF test statistic is -10.455, while, the tabulated value is -3.455. Thus, we can reject null hypothesis of ADF test of non-stationary against the alternative hypothesis of stationarity variable. In the same way, one can observe from the results reported given in table that the estimated absolute values of the ADF test statistics for all the remaining variables are greater than the critical values any acceptable level of significance. Thus, we can conclude that all the variables are stationary at their level. Therefore, we can summarize that all the underlying variables are stationary at their levels and integrated of order I (1).

4.3 GARCH Model

Bollerslev (1986) proposed generalized extension of ARCH (q) model i.e. GARCH (p,q) model. In GARCH (p, q) model the conditional variance depends upon square of past values of process and lag of conditional variance.

Table 4. 4 Estimated Results of GARCH Model For All Variables

	ΔSR	**ΔLEXR**	**ΔLCPI**	**ΔLIPI**	**ΔLIR**
Mean Equation					
Constant	0.015***	84.500	-4.326	4.611***	2.287***
	(0.001)	(0.518)	(0.787)	(0.000)	(0.000)
AR(1)	-0.179	0.999***	1.000***	0.148*	0.979***
	(0.575)	(0.000)	(0.000)	(0.056)	(0.000)
MA(1)	0.196	0.269***	0.084	0.043*	0.199
	(0.557)	(0.000)	(0.205)	(0.080)	(0.144)
Variance Equation					
C	0.000	8.06E-06***	2.42E-06	0.002*	0.000***
	(0.231)	(0.003)	(0.293)	(0.066)	(0.000)
ε_{t-1}^2	0.081***	0.167***	0.054*	0.204*	0.203***
	(0.003)	(0.000)	(0.090)	(0.056)	(0.000)
h_{t-1}^2	0.885***	0.663***	0.912***	0.433*	0.794***
	(0.000)	(0.000)	(0.000)	(0.080)	(0.000)
$\varepsilon_{t-1}^2 + h_{t-1}^2$	0.966	0.830	0.966	0.638	0.997
Log Likelihood	272.094	734.787	776.467	258.402	291.261
Akaike Criteria	-2.354	-6.421	-6.697	-2.094	-2.513

Notes: The values in the parenthesis are p-values. *** denotes the significance at 1% level, ** denotes the significance at the 5% level, and * denotes the significance at 10% level.

Table 4.4 presents the estimated results of the GARCH (1, 1) model for stock returns, exchange rate returns, consumer price index (CPI), industrial production index, and interest rate, where the upper part of the table presents the estimated results of the mean equation while the lower part explains the variance equation results.

For instance, the estimated coefficient results of the GARCH (1, 1) model for stock returns are reported in Table 4.4. The results indicate that parameters of the mean equation of stock returns, namely the constant and the AR (1) term of the stock returns (*SR*) is statistically insignificant and this implies that current *SR* does not depend upon its 1st lag. The results also show that the MA (1) term is also insignificant which shows that there is no relationship between *SR* and its lag as well as its past and current variations.

However, the estimated coefficients of the variance equation namely $\boldsymbol{\varepsilon_{t-1}^2}$ (ARCH) and h_{t-1}^2 (GARCH) terms are statistically significant at the 1% significance level with expected signs. The ARCH term implies that past period information has significant influence on the current period volatility, and the GARCH term captures the persistence of the volatility in the next period. The significant values of $\boldsymbol{\varepsilon_{t-1}^2}$ (ARCH term) and $\boldsymbol{h_{t-1}^2}$ (GARCH term) shows that the past prices behavior and past period volatility have significance influence on the currenr period volatility. The sum of both $\boldsymbol{\varepsilon_{t-1}^2}$ (ARCH term) and $\boldsymbol{h_{t-1}^2}$ (GARCH term) coefficients $\boldsymbol{\varepsilon_{t-1}^2}$ + $\boldsymbol{h_{t-1}^2}$ (volatility persistence) is (0.9666). The sum of $\boldsymbol{\varepsilon_{t-1}^2}$ + h_{t-1}^2 is greater than zero and close to unity, which indicates that volatility shocks are highly persistent.

On the other hand the estimated parameters of mean equation, AR (1) and MA (1) for exchange rate returns are statistically significant, which implies that the current *EXR* depends upon 1st lag of *EXR* as well as its past and current variations. Similarly, estimated coefficients of the variance equation, $\boldsymbol{\varepsilon_{t-1}^2}$ **(**ARCH term) and h_{t-1}^2 (GARCH term) are highly significant at 1% significance level the correct sign. The significant values of both $\boldsymbol{\varepsilon_{t-1}^2}$ and h_{t-1}^2 verify that the news about volatility from the previous periods has an explanatory power on the current volatility. We also observed that the sum of $\boldsymbol{\varepsilon_{t-1}^2}$ + h_{t-1}^2 is greater than zero but less than unity (0.8305), suggesting that volatility shocks are long lasting and do not dies out with the passage of time..

Turning to the case of consumer price index (*CPI*) which is the proxy of inflation one can observe from the results given in table that the parameter of the mean equation, AR (1) is

statistically significant at 1% significance level, but the moving average term MA (1) is statistically insignificant. However, the parameters of the variance equation are statistically significant at 1% and 10 % significance level with expected signs of both coefficients. The significant values of ARCH and GARCH terms show that the lagged error terms and volatility have significant impact on the current period volatility. The findings also show that the volatility shocks are highly persistent and do not fade away with the passage of time as the sum of both $\boldsymbol{\varepsilon_{t-1}^2} + h_{t-1}^2$ is close to unity but greater than zero (0.9662).

In case of industrial production index, we observed that the coefficients of the mean equation, namely constant, AR (1), and MA (1) are statistically significant at 1% and 10% level. Similarly, the variance equation coefficients $\boldsymbol{\varepsilon_{t-1}^2}$ and h_{t-1}^2 are also significant at 10 % level with expected positive signs. The findings also reveal that the lagged residuals and volatility has an explanatory power on the current period volatility. However, the sum of $\boldsymbol{\varepsilon_{t-1}^2} + h_{t-1}^2$ which is (0.638) implies that volatility shock not remains for a longer period and dies out over the time.

The results reported in Table (4.4) demonstrate that in case of interest rate (*IR*) the mean equation parameters constant and AR (1) are highly significant, while the MA (1) term is statistically insignificant. In the same line, the variance equation parameters are also highly significant at 1 % level. The significant values of ARCH and GARCH term imply that previous period volatility and news significantly influence the current period volatility. Further, we have also observed from the results that the volatility shocks are highly persistent and long lasting as the sum of both $\boldsymbol{\varepsilon_{t-1}^2} + h_{t-1}^2$ are greater than zero but closest to unity (0.9977). In sum, the results depicted in Table 4.3 provide clear cut evidence that the lagged residuals and volatility have a significant influence on the current period volatility, further findings also reveal that volatility shocks are highly persistent in all variables except industrial production index.

4.4 State Space Model

In this section we presented the estimated result of the time-varying return and volatility impact of exchange rate, consumer price index, industrial production index, and interest rate on stock prices. We used the Kalman filter approach to estimate the state space model and used the results of this model to estimate the time-varying coefficient value of β_s (smooth state estimates). The outcomes of the time-varying return and volatility impact are given in Tables 4.4, and 4.5,

respectively. In the tables, σ_{ε}^2 and $\sigma_{\eta}^2$are the variance of the error terms of the measurement and the state equation, which we calculated by taking the square root of the exponent of the coefficient value.

Table 4. 5 Estimated Results of Time-Varying Return Impact

	c	σ_{ε}^2	γ	σ_{η}^2	Log-likelihood	AIC	BIC
ΔLEXR	22.076***	63.139***	0.962***	0.234***	-1111.285	11.4593	11.5600
	(0.000)	(0.000)	(0.002)	(0.000)			
ΔLCPI	0.015***	0.0724***	-0.675**	0.131***	261.4517	-2.2682	-2.2079
	(0.000)	(0.000)	(0.024)	(0.000)			
ΔLIPI	0.010	0.059***	0.418	2.012***	115..4322	-0.9772	-0.9016
	(0.256)	(0.000)	(0.141)	(0.000)			
ΔIR	0.016***	0.065***	0.998***	0.051***	190.896	-1.6290	-1.5385
	(0.000)	(0.000)	(0.000)	(0.000)			

Notes: The values in the parenthesis are p-values. *** denotes the significance at 1% level, ** denotes the significance at the 5% level, and * denotes the significance at 10% level.

Table 4.5 explains the return impact results of the state space model presented in equation, (4.3) and (4.4). According to the equation (4.4), the coefficient value of σ_{η}^2 should be equal to zero, when there is no return impact of exchange rate, consumer price index, industrial production index, and interest rate on stock returns.

However, in our case, the outcomes given in Table 4.5 demonstrate that the coefficient value of σ_{η}^2 is non zero and statistically significant at 1 % significance level for all the variables, showing the presence of the return impact of exchange rate, consumer price index, industrial production index, and interest rate on stock returns. The findings also confirm the time-varying return impact in almost all variables except industrial production index. The coefficient β_t is persistent as the estimated value of AR (1) coefficient γ is statistically significant for all the variables except industrial production index (IPI). Further, the coefficient value of γ is less than one but close in all variables.

For example, In case of exchange rate, the coefficient value of γ is (0.9629) and we observed that the coefficient σ_η^2 is non-zero (0.2345), which give the strong evidence of significant return effect from exchange rate to stock returns. This finding implies that any shock in the exchange rate returns significantly effect and transmit to stock returns. In other words, the returns of both the exchange rate and stock prices are highly related and any change in exchange rate returns significantly lead to change in the stock returns.

Turning to the case of consumer price index (CPI) which is the proxy of inflation, we observed that the estimated coefficient value of γ is (-0.6759) with p value (0.000). We also find that the estimated coefficient σ_η^2 is non zero having the value (0.1318). Further, we can see that the estimated coefficients are highly significant at any significance level. These outcomes provide the clear cut evidence of the existence of time-varying return impact and transmitting from consumer price index to stock returns.

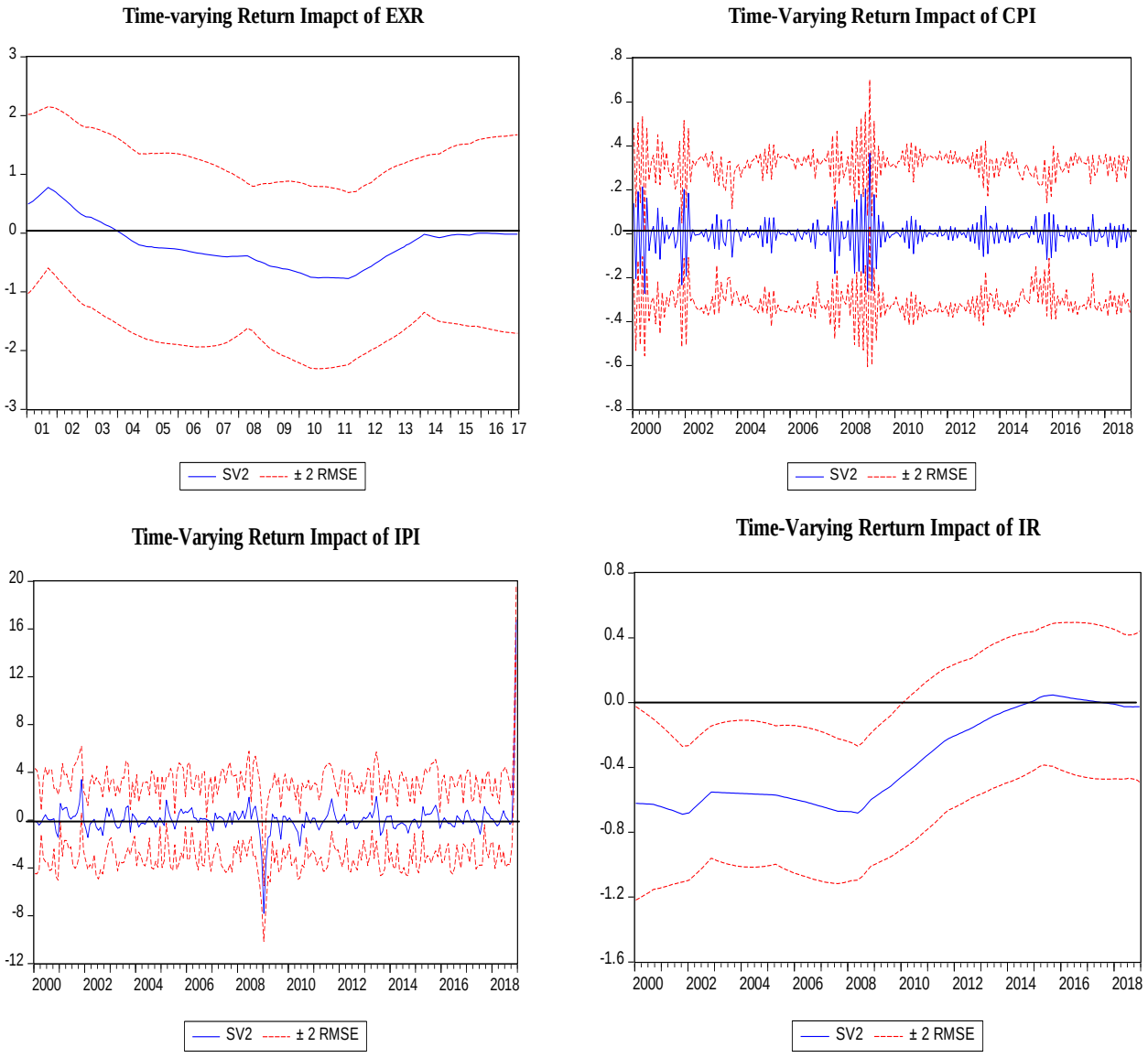
However, in case of industrial production index the estimated coefficient value of γ is (0.418) which is statistically insignificant and the coefficient value of σ_η^2 is non-zero (2.0121) and statistically significant at 1 % significance level. The insignificant value of γ implies that there is no time-varying return impact from industrial production index to stock returns. It means that any change in industrial production index not significantly transmit to stock returns.

Turning to the case of interest rate, we find that the interest rate has the highest coefficient value of γ, which is 0.9988 and it is very close to one. The higher value of γ explains that the estimator β_t is very persistent over the time. The coefficient γ is highly statistically significant at any given level of significance, which provides the strong evidence of the presence of time-varying return impact between both the variables. This implies that any shock in interest rate significantly transmit to stock returns.

In sum, the results reported in Table 4.5 provide the clear cut evidence of existence of the time-varying return impact from all variable to stock prices, expect industrial production index. However, in case of industrial production index, we did not get any significant evidence of the presence of the time-varying return impact between industrial production index and stock return over the examined period of the study.

The findings also show that the β_t coefficient is persistent as the estimated coefficient value of AR (1) term γ is statistically significant and less than one for all the variables including in the study sample. These outcomes show that any change and effect in exchange rate, consumer price index and interest rate significantly transmit to stock return. Further, these findings also suggest that the return impact vary over the time period. In other words, the relationship between exchange rate, consumer price index, and interest rate change over the time.

Figure 4.1 Graphs of the Time-Varying Return Impact



Turning to the graphical explanation of the time-varying return and volatility impact from exchange rate, consumer price index, industrial production index and interest rate to stock prices, we displayed the graphs of both return and volatility impact in Figure 4.1 and 4.2, respectively.

We used the Kalman filter approach to estimate the state space model and used the results of this model to estimate the time-varying coefficient value of β_t (smooth state estimates). The β_t shows the time-varying return and volatility impact between the said variables.

As we can see that the outcomes given in Table 4.5 and 4.6 provide the strong evidence of the existence of the time-varying return and volatility impact from all the variables to stock returns. Particularly, we find that the estimated coefficient value of γ is positive and non-zero, which gives the clear cut evidence that the β_t significantly varies over the time. Though, it would be interesting to recognize whether during any period of time between the selected time periods the estimated β_t is equal to zero. We tested this by plotting the smoothed estimates of β_t with 95% confidence interval against the time period. Thus, we plotted the β_t smoothed state estimates along with corresponding confidence intervals for the underlying variable in Figure 4.1 and 4.2, respectively to observe the time-varying impact of exchange rate, consumer price index, industrial production index and interest rate return and volatility on stock returns. Keeping in view, we separately discussed the graphs of each variable.

In case of the exchange rate and stock prices we observed that the smoothed state estimates of β_t for checking the association among the returns of both the said variables is negative for most of the examined time period. However, the smoothed state estimates β_t remains within the 95% confidence interval during the study period. As we can see from the graph that the β_t is positive at the start of the sample period, however immediately after that its started to decline and becomes negative during the sample period 2002 to 2013 and then it's started to increase but remains negative. However, at the end of the sample period it remains constant around the zero. It suggest that at the end of the sample period the shock in the exchange rate becomes less important stock market returns.

Turning to the graph of the volatility impact between exchange rate and stock market, we have plotted β_t the smoothed state parameter with 95% confidence interval against the time period. The graph display that the association between the volatility of exchange rate and stock prices is

positive at the beginning of the sample period. However, this relationship immediately decreases and becomes negative during the period 2004-2008. After the financial crises this association become positive and reached the maximum level. One can also observed from the graph that after the crises period the association between exchange rate and stock prices volatility continuously decreases and become negative. It means that after crises period volatility shocks in exchange rate negatively affect the stock market volatility.

In case of industrial production index, the results given in Table 4.5 have showed that calculated parameter σ_η^2 is statistically insignificant which provide the strong evidence of the absence of time-varying return impact from industrial production index to stock market during the analysis period. When we plotted the β_t smoothed estimates with 95% confidence intervals, the graph also portray the similar picture. Particularly, we observed that the time-varying parameter β_t is found to be remained around the zero with an only exception of during the 2007-08 financial crisis periods. Therefore, we can conclude that the impact of industrial production index on stock returns does not vary during the estimated time period.

Table 4. 6 Estimated Results of Time-Varying Volatility Impact

	c	σ_ε^2	γ	σ_η^2	Log-likelihood	AIC	BIC
ΔVEXR	0.0055***	0.0003***	0.9204***	9.6316***	12375.578	-10.8989	-10.8081
	(0.0000)	(0.0000)	(0.0000)	(0.0000)			
ΔVCPI	0.0061***	0.0008***	0.9524***	0.0636***	1112.089	-9.8061	-9.7455
	(0.0000)	(0.0000)	(0.0000)	(0.0000)			
ΔVIPI	0.0047***	0.0005***	0.9791***	0.0264***	1141.144	-10.0901	-9.9990
	(0.0000)	(0.0000)	(0.0000)	(0.0055)			
ΔVIR	0.0059***	0.0002***	0.9212***	0.0019***	1262.176	-11.1166	-11.0258
	(0.0000)	(0.0000)	(0.0000)	(0.0000)			

Notes: The values in the parenthesis are p-values. *** denotes the significance at 1% level, ** denotes the significance at the 5% level, and * denotes the significance at 10% level.

The estimated volatility impact results for the state space model presented in equation (4.4) and (4.5) are reported in Table (4.5). As we can see that he results provide clear cut evidence of time-varying volatility impact from exchange rate, consumer price index, industrial production index, and interest rate on stock returns volatility. The estimated results also provide the strong evidence of the persistence in time-varying volatility impact, we observed that the estimated value of the coefficient AR (1) term (γ) is less than one and it is statistically significant at any given significance level in β_t regression equation for all the variables. Further, one can seen from the table that the estimated coefficient value of σ_η^2 is non zero and statistically significant from zero in case of all the variables, and providing the strong evidence of the existence of time-varying volatility impact between all the said variables. These findings explain that any shock/effect that fuels volatility in the exchange rate; consumer price index and interest rate significantly transmit and increase the stock market volatility.

By looking at the results of each variable individually, we observed that in case of exchange rate, the estimated coefficient value of γ is positive 0.9344 and less than one and statistically significant at 1% level. in the same way, the estimated coefficient value of σ_η^2 is non zero and

positive and statistically significant at any acceptable significance level. These results suggest significant time-varying volatility impact from exchange rate to stock returns. Further, this implies increase in the volatility of exchange rate significantly causes the stock returns volatility.

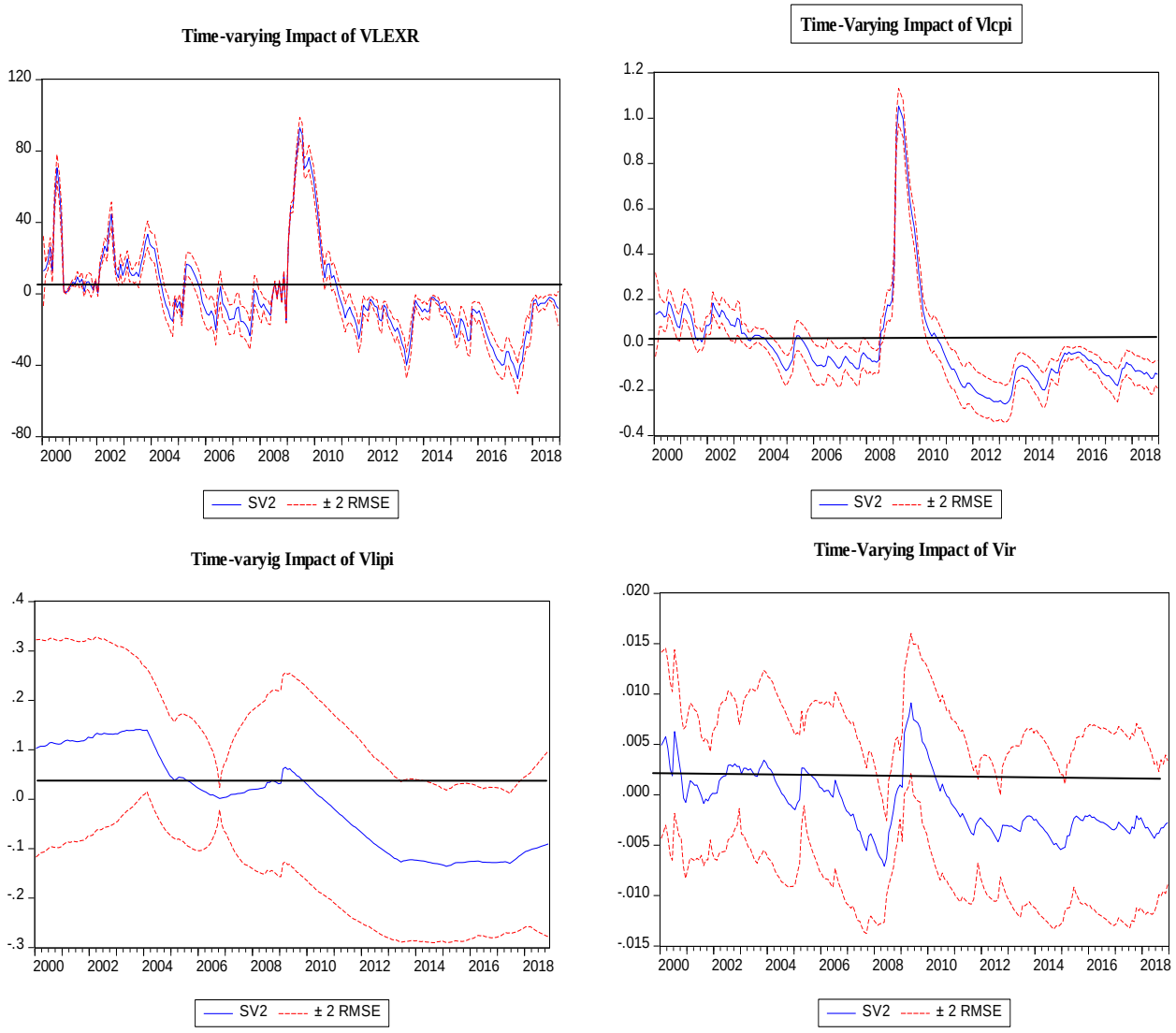
Similarly, in case of consumer price index which is the proxy of inflation, the findings reveal that the calculated coefficient value of γ is less than one (0.9524) and highly significant at 1 % significance level. This indicates that volatility impact is highly persistence. Further, the estimated coefficient value of σ_η^2 is greater than zero (0.0636) and statistically significant at 1% level, which confirms the presence of volatility impact between consumer price index and stock returns.

On the other hand for industrial production index, we find that the γ has the highest coefficient value (0.9791) as compare to other variables. This highest coefficient value implies the existence of highly persistent volatility impact during the examined period estimated coefficient value of γ is. Similarly the coefficient value of σ_η^2 is also significantly positive and non zero, which suggest the existence of the time-varying impact from industrial production index to stock returns.

Moreover, in case of interest rate, one can see from the results reported in Table 4.5 the estimated coefficient value of γ is positive close to one (0.9212) and statistically significant at 1 % significance level, showing considerable persistence in time-varying volatility impact between interest rate and stock returns during the examined period of study. Likewise, the estimated coefficient value of σ_η^2 is also positive and statistically different from zero providing the strong evidence of time-varying volatility impact transmitting from interest rate to stock returns.

In sum, the results provided in Table 4.6 suggest the following. First, there is significant volatility impact transmission from exchange rate, consumer price index, industrial production index, and interest rate to stock returns during the examined period. This outcome holds for all variables included in the analysis. Secondly, the findings also suggest that there is significant persistence in time-varying volatility impact from all the variables to stock returns. Thirdly, for all the variables, the coefficient value of σ_η^2 is statistically different from zero and highly significant. This positive and non-zero value of σ_η^2 confirms the presence of time-varying volatility impact between all the variables and stock returns.

Figure 4.2 Graphs of the Time-Varying Volatility Impact



Turning to look at the time-varying volatility impact from industrial production index to stock market we noticed that volatility impact significantly vary over the time. Specifically, we observed that the smoothed state estimate β_t is positive at the beginning of the sample period and increases and remains positive until 2004. After that it started declining and remains positive at the end of 2006. After that is started to increase during the 2007-2008 financial crises. However, after the crises period the estimate β_t subsequently decreased subsequently and become negative during the period 2009 to 2014. This outcome suggests us that the volatility of industrial production index significantly influences the volatility of stock market.

In case of consumer price index which is the proxy of inflation the results reported in Table (4.6) show that the time estimated coefficient value of γ is (-0.6759) with p value (0.000). We also find that the estimated coefficient σ_η^2 is non zero having the value (0.1318). Further, we can see that the estimated coefficients are highly significant at any significance level. These outcomes provide the clear cut evidence of the existence of time-varying return impact and transmitting form consumer price index to stock returns. However, when we plotted the graph of β_t with the confidence interval the graph of inflation variable is clearly different from the graphs of other variables. We can see that the β_t moves around the zero most of the time during the estimated period with an exemption during the financial crises of 2007-2008. This graph provides us clear cut evidence that the shocks in inflation not significantly transmit to the stock market.

On the other hand when we moved towards the volatility graph we observed that association between the consumer price index and stock market volatility is positive but continuously decreasing and become negative from 2004 to 2008. However, this association becomes positive and has the highest value after the global financial crises. Further, this β_t value become and negative after the crises period and remains constant around the zero at the end of sample period, it explains that after crises period inflation volatility negatively influence the stock market volatility.

Chapter 5

Conclusion

5.1 Background

Stock market is considered as key economic indicator for any economy. Performance of stock market directly reflects investment which is favorable economic activity. Stock prices/stock returns actually represent indication by which investment decision has made in any stock. Fluctuation in stock prices shows that free flow market performance is at its optimal. There are many variables which can affect performance of stock market but in this study we focused on interest rate and exchange rate effect on stock price with time being. Interest rate and exchange rate play an important role in any economy. These two variables are very important in the developing economies like Pakistan.

The primary objective of this study is to investigate the time-varying return and volatility impact from exchange rate, consumer price index, industrial production index, and interest rate on stock prices at Pakistan Stock Exchange. For this purpose, we used the monthly data of all the underlying variables from the period 2000 to 2018. The main sources of the data collection are Pakistan Stock Exchange and State Bank of Pakistan.

To achieve the objective of our study first of all we calculated the monthly returns of all the underlying variables by taking the first difference natural logarithm. After, that we have applied the GARCH (1, 1) model on exchange rate, consumer price index, industrial production index, interest rate and stock prices return series to calculate the conditional variance of all the above mentioned variables. After calculating the returns and estimating conditional variances of all the variables, we further used these returns series and variances series to estimate the time-varying return and volatility impact between the above said variables. For estimating the time-varying return and volatility among variables, we used the Gaussain State Space model in which the coefficients of regression equation also vary over the time. We applied the Kalman Filter approach to estimate the time-varying return and volatility impact.

5.2 Key Findings

The outcomes of the ADF unit root test show that all the underlying variables stationary at their levels in both the cases, when we included only intercept and intercept and liner time trend in the ADF equation. This implies that, all the variables are stationary and integrated of order zero. The results of the GARCH (1, 1) model demonstrate that the lagged information and volatility have significant explanatory power on the current period volatility in all the variables. The findings also illustrate that the volatility shocks are highly persistent in all the variables except industrial production index. These findings suggest that volatility shocks remains for a longer period of time and do not fade away over the time specially, in the short run. While, in case of industrial production index volatility shocks are not highly persistent and die out with the passage of time.

Further, the outcomes of the time-varying state space model prove that there are significant time-varying return impacts between the variables except industrial production index. The calculated coefficient value of σ_η^2 is positive and statistically significant and different from zero in all the variables, providing strong evidence of the existence of the time-varying return impact from all variables to stock prices over the sample period.

While, in case of industrial production index, that the estimated coefficient σ_η^2 is non-zero. Though, it is statistically insignificant which provides the evidence of no return impact from industrial production index to stock returns. The results also show that the coefficient β_t is persistent as the calculated coefficient value of AR (1) term γ is less than one and statistically significant for all the variables including in the study.

The results of our study also explain the significant time-varying volatility impact from all variables to stock markets. The estimation results provide clear cut strong evidence of the persistence in time-varying volatility impact, as the estimated coefficient value of AR (1) term (γ) is less than one and statistically significant in β_t regression for all the variables. Further, the estimated coefficient value of σ_η^2 is non-zero and statistically significant for all the variables, providing the strong evidence of the existence of the time-varying volatility impact between both the said variables markets. This piece of evidence suggests that the impact of exchange rate volatility on stock price volatility changes over time. These outcomes suggest that any shock that fuels volatility in the exchange rate, consumer price index, industrial production index, and

interest rate significantly transmit to the stock market and increases the volatility of stock market.

5.3 Policy Recommendation

Our empirical results shows that there is strong relationship between interest rate, exchange rate, inflation and industrial production index with stock return. In our findings stock returns are affected by interest rate mostly rather than other variables. In such a case, monetary authorities should have better hedging policies towards interest rates against stock prices. By encouraging domestic currency and increasing money supply, government should increase price of those goods which are trading with foreign countries. This will lead to appreciate currency as exchange rate of foreign currency in terms of domestic currency. Government should encourage their production sector so that exports increases and strengthn their economy.

5.4 Limitation and Future Recommendation

Although this study provide a comprehensive understanding of time varying effect of stock prices, but obviously it doesn't cover all other aspects. This study is limited only to the Pakistani stock market i.e. a country specific work. So, a comparative study can also be conducted by including more emerging markets in the sample size. The future researchers can add gold rate, GDP and terrorism to find the relationship with stock return. The data can also be taken for larger sample sizes to increase the generalizability of the findings. In addition, unit root test, GARCH model and state space model used in this study was taken on over all distribution. So, study other model that can also be used in near future.

References

Aamd, A. (2018). Impact of macroeconomic variables on all share price index : GARCH-X APPROACH.

Abouwafia, H. E., & Chambers, M. J. (2015). Monetary policy, exchange rates and stock prices in the Middle East region. *International Review of Financial Analysis, 37*, 14–28.

Acedański, J. (2013). forecasting industrial production in Poland- A comparasion of different method. *Ekonometrica Econometrics, 1*(39), 40--51.

Adaramola, A. O. (2014). The impact of macroeconomic variables on stock prices in Nigeria. *Doctoral dissertation*, 1-255.

Adjasi, C. K., Biekpe, N. B., & Osei, K. A. (2011). Stock prices and exchange rate dynamics in selected African countries: a bivariate analysis. *African Journal of Economic and Management Studies, 2*(2), 143-164.

Adjasi, C., Harvey, S. K., & Agyapong, D. A. (2008). Effect of exchange rate volatility on the Ghana Stock Exchange. *African Journal of Accounting, Economics, Finance and Banking Research, 3*(3), 1-20.

Adusei, M. (2014). The Inflation-Stock market returns Nexus: Evidence from the Ghana Stock Exchange. *Journal of Economics and International Finance, 6*(2), 38-46.

Afshan, S., Sharif, A., Loganathan, N., & Jammazi, R. (2018). Time–frequency causality between stock prices and exchange rates: Further evidences from cointegration and wavelet analysis. *Physica A: Statistical Mechanics and its Applications, 49*(1x), 225-244.

Ahmad, M., & Rehman, R. a. (2010). Do Interest Rate, Exchange Rate Effect Stock Returns? A Pakistani Perspective. *International Research Journal of Finance and Economics, 4*(50), 146-150.

Ahmad, M., Maochun, Z., & Sattar, A. (2019). Impact of Interest Rate and Exchange Rate on Stock Returns. *Agathos-international-review.com, 10*(1), 259-266.

Ahmad, S., Gul, M., & Saeed, D. G. (2010). Effects of interest rates on stock market capitalization . *Businees and Economic Review, 2*(1), 18-22.

Ahmed, N., & Farooq, O. (2017). Does inßation affect sensitivity of investment to stock prices? Evidence from emerging markets. *Finance Research Letters, 25*, 160-164.

Ahmet, B., & Hasan, A. (2010). The Causal Relationship between Stock Prices and Macroeconomic Variables: A Case Study for Turkey. *International Journal of Economic Perspectives; Mersin, 4*(4), 601-610.

Ajaz, T., Nain, M. Z., Kamaiah, B., & Sharma, N. K. (2017). Stock prices, exchange rate and interest rate: evidence beyond symmetry. *Journal of Financial Economic Policy, 9*(1), 2-19.

Ajmair, M., & Hussain, K. (2017). Determinants of industrial sector growth in Pakistan. *Journal of Poverty, Investment and Development, 34*, 15-23.

Akdogu, S. K., & Birkan, A. O. (2016). Interaction between Stock Prices and Exchange Rate in Emerging Market Economies. *Research in World Economy*, *7*(1), 80-94.

Al-Abdalla, S. Y., & Abu ALjarayesh, N. I. (2017). Influence of interest rate, exchange rate and inflation on common stock returns of Amman stock exchange, Jordan. *International Journal of Economics, Commerce and Management, 5*(10), 589-601.

Alam, M., & Uddin, G. (2009). Relationship between interest rate and stock price: empirical evidence from developed and developing countries. *International Journal of Business and Management, 4*(3), 43-51.

Ali, H. (2014). Impact of Interest Rate on Stock Market; Evidence from Pakistani Market. *Journal of Business and Management, 16*(1), 64-69.

Ali, M. B. (2011). Impact of Micro and Macroeconomic Variables on Emerging Stock Market Return: A Case on Dhaka Stock Exchange (DSE). *Interdisciplinary Journal of Research in Business, 5*(1), 08-16.

Al-Jafari, M., Salameh, R., & Habbash, a. M. (2011). Investigating the Relationship Between Emerging Markets. *International Research Journal of Finance and Economics, 6*(79), 6–30.

Al-Mukit, D. M. (2012). Effects of Interest Rate and Exchange Rate on Volatility of Market Index at Dhaka Stock Exchange. *Journal of Business and Technology (Dhaka), 7*(2), 1-18.

Amarasinghe, A. (2013). Dynamic Relationship between Interest Rate and Stock Price: Empirical Evidence from Colombo Stock Exchange. *International Journal of Business and Social Science*, *6*(4), 92-97.

Amarasinghe, A. (2016). A study on the impact of industrial production index (IPI) to beverage, food and tobacco sector index with special reference to Colombo Stock Exchange. *Procedia Food Science*, *6*, 275 – 278.

Amare, T., & Mohsin, M. (2000). Stock prices and exchange rates in leading Asian economies: short run versus long run dynamics. *Singapore Economic Review, 42*(2), 165-181.

Ang, J., & Ghalla, A. (1976). The impact of U.S. devaluations on the stock prices of multinational corporations. *Journal of Business Research, 4*(1), 25-34.

Antonakakis, N., Gupta, R., & Tiwari, A. K. (2017). Has the correlation of inflation and stock prices changed in the United States over the last two centuries? *Research in International Business and Finance, 42*(5), 1-8.

Apergis, N., & Eleftheriou, S. (2002). Interest rates, inflation, and stock prices: the case of the Athens Stock Exchange. *Journal of Policy Modeling, 24*(3), 231–236.

Arouri, M., Tiwari, A. K., Dar, A. B., Bhanja, N., & Teulon, F. (2014). Stock returns and Inflation in Pakistan. *IPAG, 108*, 1-24.

Asprem, M. (1989). Stock prices, asset portfolios and macroeconomic variables in ten European countries. *Journal of Banking & Finance*, 13(4-5), 589-612.

Aurangzeb. (2012). Factors Affecting Performance of Stock Market: Evidence from South Asian Countries. *International Journal of Academic Research in Business and Social Sciences, 2*(9), 1-15.

Aydemir, O. D. (2009). The Relation between Stock Prices and Exchange Rates.Evidence from Turkey". *International Research Journal of Finance and Economics, 23*(3), 207-215.

Balogun, W., Dahalan, J., & Hassan, S. (2019). Long Run Impacts of Interest Rate Liberalization on Stock Market Development. *Procedia - Social and Behavioral Sciences*, 126-133.

Banerjee, P. K., & Adhikary, B. K. (2009). Dynamic Effects of Changes in Interest Rates and Exchange Rates on the Stock Market Return in Bangladesh. *Ritsumeikan Journal of Asia Pacific Studies, 25*(2), 119-125.

Bartram, S. M., & Bodnar, G. M. (2012). Crossing the lines: The conditional relation between exchange rate exposure and stock returns in emerging and developed markets. *Journal of International Money and Finance, 31*(4), 766-792.

Bhanja, N., Dar, A. B., & Tiwari, A. K. (2012). Are stock prices hedge against inflation? A revisit over time and frequencies in India. Cent. Eur. J. Econ. Model.Econ. 4, 199–213. *Central European Journal of Economic Modelling and Econometrics, 4*(3), 199-213.

Bhattacharya, B., & Mukherjee, J. (2003). C ausal relationship between stock market and exchange rate, foreign reserves and value of trade balanve: A case study for India . *Money and Finance in the Indian Economy*, 1-24.

Bhunia, A. (2011). A causal relationship between stock indices and exchange rates in India. *Economics Bulletin, 31*(4), 1-54.

Boako, G. O.-A. (2016). Stock returns and exchange rate nexus in Ghana : A bayesian quantile regression approach. *South African Journal of Economics, 84*(1), 149–179.

Bollerslev, T. (1986)). Generalised Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics, 31*, 307-322.

Boudoukh, J., & Richardson, M. (1993). "Stock Returns and Inflation: A Long-Horizon Perspective. *American Economic Review, 83*(5), 1346–1355.

Bredin, D., & Hyde, S. (2011). Investigating sources of unanticipated exposure in. *Journal of Banking & Finance, 35*(5), 1128-1142.

Bulmash, S. B. (1991). Time–lagged interactions between stocks prices and selected economic variables. *The Journal of Portfolio Management*, 17(4), 61-67.

Chaieb, I., & Mazzotta, S. (2013). Unconditional and conditional exchange rate. *Journal of International Money and Finance, 32*(1), 781—808.

Cheah, S.-P., Yiew, T.-H., & Hee, T. (2017). A nonlinear ARDL analysis on the relation between stock price and exchange rate in Malaysia. *Economics Bulletin, 37*(1), 336-346.

Chen, F. N., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of business*, 383-403.

Cifter, A., & Ozun, A. (2007). Estimating the Effects of Interest Rates on Share Prices in Turkey Using a Multi-Scale Causality Test. *Review of Middle East Economics and Finance, 4*(2), 68-79.

Combes, J.-L., Kinda, T., & Plane, P. (2012). Capital flows, exchange rate flexibility, and the real exchange rate. *Journal of Macroeconomics, 34*(4), 1034-1043.

Czaja, M.-G., Scholz, H., & Wilkens, M. (2010). Interest Rate Risk Rewards in Stock Returns of Financial Corporations: Evidence from Germany. *European Financial Management, 16*(1), 124-154.

Dahir, A. M., Mahat, F., Ab Razak, N. H., & Ariffin, A. B. (2018). Revisiting the dynamic relationship between exchange rates and stock prices in BRICS countries: A wavelet analysis. *Borsa Istanbul Review, 18*(2), 101-113.

Dar, A. B., Billah, M., Bhanja, N., & Samantaraya, A. (2013). The Relationship between Stock Price Index and Exchange Rate in Asian Markets: A Wavelet Based Correlation and Quantile Regression Approach. *SSRN*.

Delgado, N. A., Delgado, E. B., & Saucedo, E. (2018). The relationship between oil prices, the stock market and the exchange rate: Evidence from Mexico. *North American Journal of Economics and Finance, 45*(3), 266-275.

Diamandis, P. F., & Drakos, A. A. (2011). Financial liberalization, exchange rates and stock prices: exogenous shocks in four Latin America countries. *Journal of Policy Modeling, Elsevier, 33*(3), 381–394.

Dilawar Khan, A. U. (2012). Export, import and economic growth nexus: Time series evidence from Pakistan. *Work Applied Sciences Journal, 18*(4), 538-542.

Dong, Z. X., & Zhou, B. (2007). The Empirical Research of Interest Rates' Influences to Consuming, Investment, Stock Price and Rate of Exchange. *Journal of Adult Education of Hebei University, 9*(4), 104-106.

Dornbusch, R., & Fischer, S. (1980). Exchange rates and the current account. *The American Economic Review, 70*(5), 960–971.

Dwumfour, A. R., & Addy, N. A. (2019). Interest Rate and Exchange Rate Exposure of Portfolio Stock Returns: Does the Financial Crisis Matter? *Journal of African Business, 20*(3), 1-19.

Effiong, E. L. (2016). Nonlinear Dependence between Stock Prices and Exchange Rate in Nigeria. *Munich Personal RePEc Archive, 14*(11), 1-20.

Ejaz, M., & Iqbal, J. (2019). Estimation and Forecasting of Industrial. *SBP Working Paper Series*(103), 4-23.

Fama, E. F. (1981). Stock Returns, Real Activity, Inflation, and Money. *American Economic Review, 71*(4), 545–565.

Fama, E. F. (1990). Stock returns, expected returns, and real activity. *The Journal of Finance*, 45(4), 1089-1108.

Fama, E. F. (1991). Efficient Capital Markets: II. *Journal of Finance,*, 46(5), 1575-1617.

Fang, L., & Bessler, A. D. (2017). Stock returns and interest rates in China: the prequential approach. *Applied Economics*, *49*(53), 5412-5425.

Ferrer, R., Bolós, V. J., & Benítez, R. (2012). Interest rate changes and stock returns: A European multi-country study with wavelets. *International Review of Economics & Finance, 44*, 1-12.

Fisher, I. (1930). *The theory of interest.* New York, 43.

Fowowe, B. (2015). The relationship between stock prices and exchange rates in South Africa and Nigeria : structural breaks analysis. *International Review of Applied Economics,, 29*(1), 1–14.

Frankel, J. (1984). Tests of monetary and portfolio balance models of exchange rate determination. Exchange Rate Theory and Practice. *University of Chicago Press, 84*(1), 239–260.

Funyina, & Teddy, K. (2015). The effects of exchange rate volatility on private capital inflows in Zambia, 1992-2012. *University of Zambia. Lusaka Zambia*.

Gan, C., Lee, M., Yong, H. H., & Zhang, J. (2006). Macroeconomic variables and stock market interactions: NewZealand evidence . *Investment Management and Financial Innovations, 3*(4), 89-101.

Geske, R. &. (1983). The fiscal and monetary linkage between stock returns and inflation. *The journal of Finance*, 38(1), 1-33.

Giri, K. A., & Pooja, J. (2017). The impact of macroeconomic indicators on Indian stock prices: An empirical analysis . *Studies in Business and Economics, 20*(1), 61-78.

Gokmenoglu, K., Azin, V., & Taspinar, N. (2015). 'The Relationship between Industrial Production, GDP, Inflation and Oil Price: The Case of Turkey'. *Procedia Economics and Finance, 25*, 497 – 503.

Grammig, J., Melvin, M., & Schlag, C. (2005). Internationally cross-listed stock prices during overlapping trading hours: price discovery and exchange rate effects. *Journal of Empirical Finance, 12*(1), 139-164.

Granger, C. W. (2000). A bivariate causality between stock prices and exchange rates: Evidence from recent Asian flu. *The Quarterly Review of Economics and Finance, 40*(3), 337-354.

Günay, M. (2018). Forecasting industrial production and inflation in Turkey with factor model. *Central Bank Review, 18*(4), 149-161.

Gupta, R., & Inglesi-Lotz, R. (2012). Macro Shocks and Real US Stock Prices with Special Macro Shocks and Real US Stock Prices with Special. *Applied Econometrics and International Development, 12*(2), 123-136.

Hamrita, M. E., & Trifi, A. (2011). The relationship between interest rate, exchange rate and stock price: a wavelet analysis. *International Journal of Economics and Financial Issues, 4*(1), 220 - 228.

Hamrita, M. E., Abdallah, N. B., & Ammou, S. B. (2009). The Multi-Scale Interaction Between Interest Rate, Exchange Rate and Stock Price. *MPRA Paper no 18424*, 1-10.

Hosseini, S. M., Ahmad, Z., & Lai, Y. W. (2011). The Role of Macroeconomic Variables on Stock Market Index in China and India. *International Journal of Economics and Finance, 3*(6), 233-243.

Hussain, A., Hussain, A. B., & Ali, S. (2017). The Impact of Interest Rate Volatility on Stock Returns Volatility: Empirical Evidence from Pakistan Stock Exchange. *Journal of Business and Tourism, 3*(2), 65-70.

Huy, T. Q. (2016). The linkage between exchange rates and stock prices: Evidence from Vietnam . *Asian Economic and Financial Review, 6*(7), 363-373.

Ibrahim, M. H. (2000). Cointegration and Granger Causality Tests of Stock Price and Exchange Rate Interactions in Malaysia. *Asean Economic Bulletin , 1*(17), 36-47.

Jareño, F., Ferrer, R., & Miroslavova, S. (2016). US stock market sensitivity to interest and inflation rates: a quantile regression approach. *Applied Economics , 48*(26), 2469-2481.

Jefferis, K. R. (2000). The Impact of Economic Fundamentals on Stock Markets in Southern Africa. *Development Southern Africa, 17*(1), 23-51.

Jiranyakul, K. (2012). Linkages between Thai stock and foreign exchange markets under the floating regime. *Journal of Financial Economic Policy, 4*(4), 305–319.

Kanas, A. (2003). Volatility Spillovers Between Stock Returns and Exchange Rate Changes: International Evidence. *Journal of Business Finance & Accounting, 27*(3 & 4), 0306-686.

Kasman, S., Vardar, G., & Tunç, G. (2011). The impact of interest rate and exchange rate volatility on banks' stock returns and volatility: evidence from Turkey. *Economic Modeling, 28*(3), 1328–1334.

Kennedy, K., & Nourzad, F. (2016). Exchange rate volatility and its effect on stock market volatility. *International Journal of Human Capital in Urban Management, 1*(1), 37-46.

Kim, K.-h. (2003). Dollar exchange rate and stock price: evidence from multivariate cointegration and error correction model. *Review of Financial economics, 12*(3), 301-313.

Kisaka, S., & Mwasaru, A. (2012). The causal relationship between exchange rates and stock prices in Kenya. *Research Journal of Finance and Accounting, 3*(7), 2222-2847 .

Korkeamäki, T. (2011). Interest rate sensitivity of the European stock markets before and after the euro introduction. *Journal of International Financial Markets, Institutions and Money, 21*(5), 811-831.

Köse, Y. D. (2010). On the causality between stock prices and exchange rates: Evidence from Turkish financial market. *Problems and Perspectives in Management, 8*(1), 1-9.

Köseoğlu, S., & Çevik, E. (2013). Testing for causality in mean and variance between the stock market and the foreign exchange market: An application to the major central and eastern European countries. *Finance a úvěr-Czech Journal of Economics and Finance, 63*(1), 65-86.

Kumar, M. (2008). A Bivariate Linear and Nonlinear Causality between Stock Prices and Exchange Rates. *Economics Bulletin, 29*(4), 2884-2895.

Kumar, N. P., & Puja, P. (2012). The impact of Macroeconomic Fundamentals on Stock Prices revisited: An Evidence from Indian Data. *MPRA Paper*, 1-24.

Kurihara, Y. (2006). The Relationship between Exchange Rate and Stock Prices during the Quantitative Easing Policy in Japan. *Journal of Business, 11*(4), 375-386.

Leon N, D. (2008). The effects of interest rates volatility on stock returns and volatility: Evidence from Korea. . *International Research Journal of Finance and Economics, 14*(8).

Li, Z. G., & Gao, M. S. (2007). The linkage effect of stock price and exchange rate after the recent exchange rate system reform. *Modern Finance and Economics, 10*, 7-12.

Lim, S., & Sek, S. (2014). Exploring the inter-relationship between the volatilities of exchange rate and stock return. *Procedia Economics. Finance, 14*, 367–376.

Liu, L., & Wan, J. (2012). The relationships between shanghai stock market and cny/usd exchange rate: New evidence based on cross-correlation analysis. *Structural Cointegration and Nonlinear Causality Test, Physica A,, 391*(23), 6051–6059.

Martínez, P. M., Lapeña, R. F., & Sotos, F. E. (2015). Interest rate changes and stock returns in Spain: A wavelet analysis. *BRQ Business Research Quarterly, 18*(2), 95-110.

Mgammal, M. H. (2012). The Effect of Inflation, Interest Rates and Exchange Rates on Stock Prices Comparative Study Among Two Gcc Countries. *International Journal of Finance and Accounting, 1*(6), 179-189.

Mikhaylov, A. Y. (2018). Volatility spillover effect between stock and exchange rate in oil exporting countries. *International Journal of Energy and Policy, 8*(3), 321-326.

Mireku, K., Sarkodie, K., & Poku, K. (2012). Effect of macroeconomic factors on stock prices in Ghana: A vector error correction model approach. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 3*(2), 32–43.

Mishkin, F. S. (1997). What Depressed the Consumer? The Household Balance Sheet and the. *Brookings Papers on Economic Activity, 1997*(1), 123-164.

Modigliani, F., & Cohn, R. A. (1979). Inflation, Rational Valuation and the Market. *Journal Financial Analysts Journal , 35*(9), 24-44.

Mouna, A., & Anis, J. (2016). Market, interest rat e, and exchange rate risk effects on financial stock returns during the financial crisis: AGARCH-M approach. *Cogent Economics & Finance, 4*(1), 1-16.

Muhammad, N., & Rasheed, A. (2002). Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. *The Pakistan Development Review, 41*(4), 535-550.

Mukherjee, T. K. (1995). Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error correction model. *Journal of Financial Research*, 18(2), 223-237.

Muriuki, P. K. (2014). *The effect of inflatin and interest rates on stock market returns of firm listed at the Nairobi securities exchange* . University of Nairobi, Department of Finance and Accounting. Retrieved from https://pdfs.semanticscholar.org/eb9b/e25afdb6a1ca2a3bcf682d79e9cd59c06ae5.pdf

Naeem, M., & Rasheed, A. (2002). Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. *The Pakistan Development Review, 41*(4), 535-550.

Okpara, G. C. (2019). Analysis of the relationship betwenn exchange rate and stock prices: Evidence from Nigeria . *International Journal of Current Research, 4*(3), 175-183.

Otieno, D. A., Ngugi, R. W., & Wawire, N. H. (2017). Effects of Interest Rate on Stock Market Returns in Kenya. *9*(8), 40-49.

Owusu Junior, P., Kwaku Boafo, B., Bonsu, K., & McMillan, D. (2018). Co-movement of stock exchange indices and exchange rates in Ghana: A wavelet coherence. *Cogent Business & Management, 1*(5).

Papadamou, S., Sidiropoulos, M., & Spyromitros, E. (2017). Interest rate dynamic effect on stock returns and central bank transparency: Evidence from emerging markets. *Research in International Business and Finance, 39*(2), 951-962.

Patel, S. (2012). The effect of macroeconomic determinants on the performance of the Indian stock market. *NMIMS Management Review, 22*, 117-127.

Pervaiz, J., Masih, J., & Zhou, T. J. (2018). Impact of Macroeconomic Variables on Karachi Stock Market Returns. *International Journal of Economics and Finance, 10*(2), 27-34.

Piccillo, G. (2009). Foreign exchange and stock market: Two related markets? Discussion Paper Series. *Center for Economic Studies, 9*(1), 1–44.

Rahman, M. L., & Uddin, J. (2009). Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Three South Asian Countries. *International Business Research, 2*(2), 167-174.

Rapach, D. E., Ringgenberg, M. C., & Zhou, G. (2016). Short Interest and Aggregate Stock Returns. *Journal of Financial Economics, 121*(1), 46-65.

Ratanapakorn, O., & Sharma, S. C. (2007). Dynamic analysis between the US stock returns and the macroeconomic variables. *Applied Financial Economics, 17*(5), 369-377.

Rathke, A., & Sarferaz, S. (2010). Malthus was right: New evidence from a time-varying VAR. *SSRN. Electronic Journal*, 1-32.

Raza, S. A., Jawaid, S. T., Afshan, S., & Abd Karim, M. Z. (2015). Is stock market sensitive to foreign capital inflows and economic growth? *Journal of Chinese Economic and Foreign Trade Studies, 8*(3), 142-164.

Reboredo, J. C., Rivera-Castro, M. A., & Ugolini, A. (2016). Downside and upside risk spillovers between exchange rates and stock prices. *Journal of Banking & Finance, 62*, 76-96.

Saleem, F., Zafar, L., & Rafique, B. (2013). Long run relationsbetween inflation and stock: Evidence from Pakistan. *Social Sciences and Humanities, 4*(2), 407-415.

Salimullah, A. H. (2016). Granger Causality of Interest Rate and Exchange Rate on Stock Volatility at Chicago Options Market. *Scientia et Humanitas , 6*, 35-56.

Singh, D. (2010). Causal Relationship Between Macro-Economic Variables and Stock Market: A Case Study for India. *Pakistan Journal of Social Sciences, 3*(2), 263-274.

Singh, S. S., Devi, T. L., & Roy, T. D. (2016). Time Series Analysis of Index of Industrial Production of India. *IOSR Journal of Mathematics, 12*(3), 1-07.

Śmiech, S., & Papież, M. (2013). Fossil fuel prices. Exchange Rate, and Stock Market: A Dynamic causality analysis on the European market. *Economics Letters, 118*(1), 199–202.

Smith, C. E. (1992). Stock markets and the exchange rate: a multi-country approach. *Journal of Macroeconomics,, 14*(4), 697—629.

Sohail, N., & Hussain, Z. (2009). Long-Run and Short-Run Relationship between Macroeconomic Variables and Stock Prices in Pakistan: The Case of Lahore Stock Exchange. *Pakistan Economic and Social Review, 47*(2), 183-198.

Spyrou, S. I. (2001). Stock returns and inflation: evidence from an emerging market. *Applied Economics Letters, 8*(7), 447-450.

Stavárek, D. (2005). Linkages between Stock Prices and Exchange Rates in the EU and the United States. *Czech Journal of Economics and Finance, 55*(3-4), 141-161.

Stefanescu, R., & Dumitriu, R. (2009). Impact of the global crisis on the financial linkages between the stock market and the foreign exchange market from Romania. *Economics and Applied Informatics., 2*(1), 1-16.

Sui, L., & Sun, L. (2016). Spillover effects between exchange rates and stock prices: Evidence from BRICS around the recent global financial crisis. *Research in International Business and Finance, 36*, 459-471.

Suriani, S., Kumar, M. D., Jamil, F., & Muneer, S. (2015). Impact of Exchange Rate on Stock Market. *International Journal of Economics and Financial Issues, 5*(1), 385 - 388.

Tari, R., & Gozen, M. C. (2018). Portfolio Balance Approach to Exchange Rate Determination: Testing a Model by Applying Bilateral Data of Turkey and United States. *Ege GE Academic Review , 18*(3), 423-434.

Tiryak, A., Ceylan, R., & Erdoğan, L. (2018). Asymmetric effects of industrial production, money supply and exchange rate changes on stock returns in Turkey. *Applied Economics , 51*(20), 2143-2154 .

Tiwari, A. K., Dar, A. B., Arouri, M., & Teulon, F. (2015). Stock returns and inflation in Pakistan. *Economic Modelling, 47*, 23-31.

Toraman, C., & Başarir, Ç. (2014). The Long Run Relationship between Stock Market Capitalization Rate and Interest Rate: Co-integration Approach. *Procedia - Social and Behavioral Sciences, 143*, 1070-1073.

Tsagkanos, A., & Siriopoulos, C. (2013). A long-run relationship between stock price index and exchange rate: A structural nonparametric cointegrating regression approach. *Journal of International Financial Markets, Institutions & Money, 25*(3), 106–118.

Tsai, I.-C. (2012). The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach. *Journal of International Financial Markets, Institutions and Money, 22*(3), 609-621.

Tsen, W. H. (2017). Real exchange rate returns and real stock price return. *International Review of Economics & Finance, 49*, 340-352.

Tudor, C., & Dutaa, C. P. (2012). On the Causal Relationship between Stock Returns and Exchange Rates Changes for 13 Developed and Emerging Markets. *Procedia - Social and Behavioral Sciences, 57,* 275-282.

Valcarcel, V. J. (2012). The dynamic adjustments of stock prices to inflation disturbances. *Journal of Economics and Business, 64*(2), 117– 144.

Vardar, G., & Tunç, G. (2011). The impact of interest rate and exchange rate volatility on banks' stock returns and volatility: Evidence from Turkey. *Economic Modelling, 28,* 1328–1334.

Vardar, G., Aksoy, G., & Can, E. (2008). Effects of Interest and Exchange Rate on Volatility and Return of Sector Price Indices at Istanbul Stock Exchange. *European journal of Economics, Finance and Administrative Sciences, 11,* 126-135.

Walid, C., Chaker, A., Masood, O., & Fry, J. (2011). Stock market volatility and exchange rates in emerging countries: A Markov-state switching approach. *Emerging Markets Review, 12*(3), 272-292.

Wanling, H., Varella, M. A., Huu, N. K., & Mollick, A. V. (2016). U.S. stock markets and the role of real interest rates. *The Quarterly Review of Economics and Finance, 59*(3), 231-242.

Waqar, K. (2017). Effects of Interest Rate and Exchange Rate on the Stock Market Performance of Pakistan: A Cointegration Approach. *Journal of Finance and Economics, 5*(5), 219-232.

Welch, I., & Goyal, A. (2008). A Comprehensive Look at the Empirical Performance of Equity Premium Prediction. *Review of Financial Studies, 21*(4), 1455-1508.

Wu, Y. (2000). Stock prices and exchange rates in VEC model—The case of Singapore in the 1990s. *Journal of Economics and Finance, 24*(3), 260–274.

Yang, S. P. (2017). Exchange rate dynamics and stock prices in small open economies: Evidence from Asia-Pacific countries. *Pacific-Basin Finance Journal, 46*(2), 337-354.

Yi, Y., Ma, F., Huang, D., & Zhang, Y. (2019). Interest rate level and Stock return predictability. *Review of Financial Economics.*, 1-17.

Zeren, F., & Koç, M. (2016). Time varying causality between stock market and exchange. *Economic Research-Ekonomska Istraživanja,, 29*(1), 696–705.

Zhao, H. (2010). Dynamic relationship between exchange rate and stock price: Evidence from China. *Research in International Business and Finance, 24*(2), 103–112.

Živkov, D., Njegić, J., & Mirovic, V. (2016). Dynamic nexus between exchange rate volatility and stock prices in the major East European economies. *Prague Economic Papers, 25*(6), 686-705.