

VOLATILITY SPILLOVER BETWEEN THE STOCK MARKET AND THE FOREIGN EXCHANGE MARKET INSIGHTS FROM PAKISTAN

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ABSTRACT

My study investigated that the Volatility excess amongst the stock market as well as the foreign exchange market in Pakistan. The instability or degree of variation of trade price series over time, as measured by standard deviation, is referred to as volatility. The volatility of the foreign currency market as well as the volatility of stock market returns has a strong link. This study is based on yearly data from 1980 to 2020. The selected variables are Gross Domestic Product, Money Supply, Investment, Exchange rate, Price index, and Inflation. The ADF unit root test and ARDL technique were applied to the time-series data. ADF test is used to discover the stationary of variables and ARDL is used to define the estimation of variables. According to this research, the stock market and the foreign currency market are interlinked. In the long run, the consumer price index, exchange rate, and money supply are all significant, but they are all negatively related to GDP. However, in the long run, investment and savings are positively associated, and the price index is insignificant, with a negative relationship to GDP.

Keywords: Volatility Spillover, Gross Domestic Product, Foreign Direct Investment, Exchange Rate, Pakistan.

1. Introduction

The corresponding estimate where the bond's price shifts upward and downward is known as volatility. Volatility is constructed by considering the finalized standard deviation of regular transformation in price. Unless the stock's price shifts upward and downward immediately in short time duration, then it is high volatility. If the stock's price relatively no change, then it is the low level of volatility. In economics, excess goods show a crisis of the economy in one situation that arises due to something extra in an irrelevant situation. From an economic point of view, few markets face loss; such losers can impact the act of demand and supply which disturb the members in various markets. This situation causes effects on the demand or supply of individuals in various markets. In Pakistan, there are three stock markets which are situated in Karachi, Lahore and Islamabad. All these stock markets are made in 1947, 1980 and 1997. These markets are working successfully in Pakistan. Pakistan's economy includes different governmental and commercial amend at the time of the past two decades. The basic purpose of these changes was to diminish private commercial inequality, increase the productivity and extent of the commercial markets. Starting of basic exchange and approval of complimentary formative market rates that made domestic and international exchange markets attached. The starting of basic markets emerged in acute gain in the invasion of enveloping investment. On the other side, gain in contribution support in increasing unstable assets, again on another side, its outcomes natural fluctuations in the basic market ratios. The relation among a basic market of the country and its international exchange market antiquated captive of analytical and experimental analysis for past two decades. The quality and consequence of the interrelationship among basic prices and change rates include connotations for a sum of pivotal arguments in foreign accounts. This research aims to examine the association between the volatility of the basic market and the foreign market. Minor vaporization can motivate a difference in someone else. Pakistan includes a brilliant future along and full problems that could be clear with faithfulness and responsibility. The government's view is very simple on making the laws. With confidence and fairness, everything could be ended.

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In addition, the government developed a structure of roads for encouraging the economy of Pakistan. The government can be worked in all sectors of Pakistan. Admire the achievement of government for recovering unity and durability in our country. The government wants to do its best to control terrorism in the country. The bad situation creates in stock and exchange markets due to the country's situation. The condition of a single market can affect the situation of the

whole market. Similarly, the condition of the stock market can be made responsive to the exchange market condition. The judgment has been made that there is a significant relationship between the stock market and the foreign exchange market in Pakistan. A very useful strategy for improvement was made by the State Bank of Pakistan because it is the main director of exchange rates and stock price variations in our country. This study involves the effects of inflation, price index, money supply, savings and gross domestic products. The purpose of this research is not to give any policy implementation, but the main purpose is to give the vision of these effects. First of all, we find the aspects of volatility that determine the changes of spillover in both stock and foreign exchange markets. Sympathetic the volatility aspects of charging are very significant whereas volatility points to confusion and danger. The main level is that the quality of the return to handle the changing of impact in different methods.

Product price volatility in natural engaged substantial response of buyers and sellers. Volatility structure is significant in different ways, first is that volatility organizes confusion, which has different ways to handle it. At the market level, it is very important to show the changes. Variation of all variables leads to duration is a signal of the volatility of inputs, and the fluctuation of conventional value is usually used to explain volatility. It is a measurement of fluctuation of prices of an economic apparatus lead to time. Economic volatility is significant as it is a signal of danger. The present investigation is specially organized to assess the spillover effect between the economic markets in the world. All over the world these conditions badly affect the markets. Economic prices change the situation of the markets which causes economic growth. These situations create major problems in the economy. The exchange rate is a very important factor of the markets.

2. Literature Review

Kanas (2000) analyzed volatility spillover amongst stock market returns and exchange market variations: International evidence. This study analyzed the Multi-variant EGARCH Model. In this study, the variable stock return exchange rate change, the conditional variance of stock return, the foreign exchange rate were used. The observations examined that the exchange rate returns produced no important impact on stock return. Apte (2001) looked at how the stock and foreign exchange markets interact used daily closing data in the duration 1991-2000. This article used stock indices and the exchange rates as variables. This research estimated that the exchange rate is not an important factor of the real markets. Gonzalez et al., (2002) analyzed volatility bias in the GARCH model a simulation study used time series data and used prediction, bias, and sago as keywords. This article examined that raising the parameters varies the slope of bias. The implications of outliers and model misspecification on recursive modeling of financial volatility were investigated by Guan and McAleer (2003) using sample data in the time period 1950-1999. This study used outliers and extreme observations, volatility models, model misspecification, recursive models, and structural change as variables. This article examined that raising the sample size cannot raise the volatility. In Pakistan, Özengin (2008) examined volatility spillover among the stock market and foreign exchange rate market. In this article, the methodology of Engle Granger Two step producer and spillover is modeled via Bi-Variant EGARCH methods. This study used the technology of time series data from the period (1998-2006). In this study, the variable foreign Exchange Return stock return in this study analyzed the result that a positive dynamic Relationship between these two variables.

Morales (2008) analyzed volatility spillover amongst equity and foreign exchange markets: evidence from Latin America's largest countries used sample data from 1998 to 2006. This article used Exchange rates and stock prices as keywords. After these variables, this research estimated that these factors play a pivotal act in this case and uncertainty executive. In our research involved mutual exchange rates in using two variables. Fedorova and Saleem's (2009) impact of stock and currency market volatility on each other was studied. This study analyzed the autoregressive conditional Heteroscedasticity (ARCH) in 1982. This study used time sequence data weekly return from 1995 to 2008. In this study, the variable return market & vector return were used. For Pakistan, Zia-Ur-Rehman, Shah, and Mushtaq (2011) investigated the source of return and volatility spillover. This study investigated the Exogenous Facts by using the Multi-Variant EGARCH Model. This study used Daily return time series (Panel) Data in 1989. In this study Global Index, return and FPI and FDI were used. The result is that no distant future relationship among these Markets.

In South Africa, Bonga-Bonga and Hoveni (2013) probed volatility spillover amongst equities along with foreign exchange markets. This study investigated the Multi-Step GRACH Model in 2007. In this article, the variable stock return and exchange rate were used. Throughout this study, the time sequence data of weekly returns from 1995 to 2010 was used. Kharchenko and Tzvetkov(2013) examined volatility spillover among Pakistan's stock market and the foreign exchange market. In this article, the C.GARCH method 1982 was used. This study looked out time series data from 1995 to 2013. In this study variables, returns and price indices were used. In the stock-oriented model, the link between two variables is positive, but in the flow-oriented model, it is negative. Andreou, Matsi and Savvides (2013) investigated stock and Foreign Exchange Market Linkage in developing economies. This study examined the Quarto-variant VAR-GARCH Model with BEKK representation. In this article, they used time series data from 1986 to 2008. In this study the variable local stock Market return, rate of stock Appreciates of local currency, global stock Market Return. Regional stock market return lagged local stock market return was used. The purpose of this investigation is the bi-directional return. The volatility spillover between oil prices and stock returns was explored by Gomes and Chaibi (2014). In the current study time sequence data from 2008 to 2013 have been used. In this study, variable stock returns and lagged stock returns on oil were used. This study examined the vicariate BEKK-GARCH model. The result supported the presence of bidirectional volatility spillover and unbalanced effect adjustments in the stock market to a change in the exchange rate. The result of the paper indicated that from the stock market to the foreign market, there was uni-directional volatility spillover.

3. Data and Methodology

It is most significant to be accurate although choosing the variables and applicable technique in form of attaining strong observations. The actual study determines the effect of markets on economic growth in Pakistan during 1980 - 2020. The collection of all analytical inputs is selected from the State Bank of Pakistan.

In the actual study, the effect of volatility spillover on markets was examined by calculating gross domestic product, exchange rate, inflation rate, investment, price index, money supply, and savings utilized as independent variables.

Table 1: Variables Description

| Variables Description | Variables | Measurement Units |
|--|-----------|-------------------|
| Reliant on Variables | | |
| Gross Domestic Product | GDP | % |
| Explanatory Variables | | |
| Money Supply | M2 | % |
| Exchange rate | EXH | % |
| Investment | IV | % |
| Inflation | CPI | % |
| Price Index | PIN | % |
| Savings | S | % |
| Pakistan's State Bank is the source of this information. | | |

Where, Gross Domestic Product (GDP)

GDP is reliant on the variable in that model. GDP is a financial degree of the amount of all concluding products and services composed in one year. Formal GDP evaluates are usually used to examine the financial achievement of a full country, and to compose a universal connection. It is the amount of the output of financial contain for change in prices.

Rate of exchange (ER)

The exchange rate between the two currencies is a change in the value of one currency in relation to the other in economics. The exchange rate is the amount of one currency converted into the currency

of another country. This is a feature of the foreign exchange market, that is open to a large number of different types of manufacturers and retailers, and to where the country's money is sold at all times save on weekends.

Investment (IV)

The term "investment" refers to a credit that is obtained with the expectation of earning money in the future. From a financial standpoint, it is the acquisition of items that will not be sold immediately but will be used to generate wealth in the future. From an economic perspective, investment is the commercial credit purchased with the expectation of earning money in the future, which we then sell at the highest possible price.

Money Supply (M2)

A part of money supply that involves banknote and investigate deposits M1 along near money. In near money involves savings, funds and time, which are low liquiform and not relevant as transaction tools but perhaps faster convertible. It is broader money including M1.

Price Index (PIN)

The price index for a moderately dispersed set of price siblings for a specific type of commodities and services in a liable industry over a liable time. That is a data structure that advises on how to price siblings, which is perceived as full, change over time geological district.

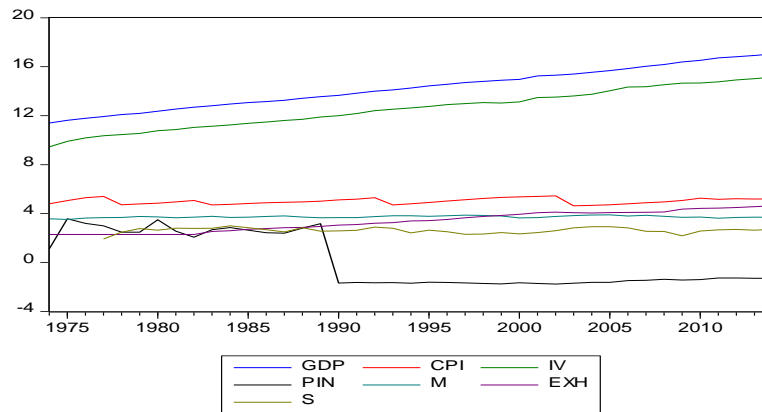
Saving (S)

That portion of disposable pay that could not be spent on customer goods but then is instead spent on basic materials, repaying a mortgage, or buying bonds inexactly. It's the money from our salaries that we don't spend on anything.

Inflation (CPI):

It's stated as a steady increase in the particular point of equipment and benefit prices. Inflation is measured as a percentage increase on an annual basis. As it rises, each dollar we spend buys a smaller amount of equipment and benefits.

Figure 1: Trend of Variables



3. Econometric Issues

The present research occupied the ADF technique to test the stationarity of the inputs. The observations of the ADF technique are compiled in the Table given below. The observations of this method show that our selected all inputs are stationary at first difference and level. Therefore, we apply the ARDL technique in our article.

Table 2: Unit Root Test (ADF)

| Variables | On Level | | | On 1st Difference | | | Outcome |
|-----------|-----------|---------------------|-------|-------------------|---------------------|--------|---------|
| | Intercept | Trend and intercept | None | Intercept | Trend and intercept | None | |
| EXH | 0.521 | -2.387 | 4.721 | -4.064 | -4.042 | -3.243 | I(1) |
| GDP | -0.653 | -3.242 | 2.368 | -6.568 | -7.423 | -0.752 | I(1) |
| IV | -1.851 | -5.145 | 7.762 | -5.263 | -6.146 | -1.567 | I(1) |

| | | | | | | | |
|--|--------|--------|--------|--------|--------|--------|------|
| M | -2.928 | -2.657 | 1.102 | -6.024 | -5.158 | -6.206 | I(1) |
| PIN | -1.301 | -2.402 | -1.431 | -8.574 | -7.326 | -7.542 | I(1) |
| CPI | -3.405 | -3.320 | 0.131 | -5.428 | -6.652 | -6.631 | I(0) |
| S | -3.231 | -4.436 | 0.301 | -7.859 | -7.622 | -7.093 | I(0) |
| Critical Values:- Intercept: -3.605 at 1%, -2.936 on 5%, -2.606 on 10% | | | | | | | |
| T&I: -4.205 at 1%, 3.527 at 5%, and -3.195 at 10%. | | | | | | | |
| None:- at 1% -2,624 5% -1.949 at 10% -1.612 | | | | | | | |
| E-views 9.5 were used to calculate values. | | | | | | | |

Model Specification

The given model can be examined to determine the connection among stock market as well as foreign currency market

$$\text{LnGDP} = \beta_0 + \beta_1 \text{LnEXH} + \beta_2 \text{LnIF} + \beta_3 \text{LnIV} + \beta_4 \text{LnM} + \beta_5 \text{LnPIN}$$

Where, The natural log of Gross Domestic Product is a dependent variable that demonstrates how it affects the natural logs of Exchange Rate, Inflation, Investment, Money Supply, and Price Index.

Auto-regressive Distributed Lag Model used to find out the relation among dependent and independent variables. Data has been collected from the State Bank of Pakistan, the money supply is collected in the form of M2. These variables can be used for showing the stock market's and foreign exchange markets' effects. Time series data from the year 1980 to 2020 is used in our research. For long run relation among given equation is determined:

$$\Delta Y_t = \beta_0 + \beta_1 \sum \Delta Y_{t-j} + \beta_2 \sum \Delta X1_{t-j} + \beta_3 \sum \Delta X2_{t-j} + \beta_4 \sum \Delta X3_{t-j} + \beta_5 \sum \Delta X4_{t-j} + \beta_6 \sum \Delta X5_{t-j} + \delta_1 Y_{t-1} + \delta_2 X1_{t-1} + \delta_3 X2_{t-1} + \delta_4 X3_{t-1} + \delta_5 X4_{t-1} + \delta_6 X5_{t-1} + \delta_7 X6_{t-1}$$

Where, $j=1,2,3, \dots, k$

The second procedure associates the variables' long-term and short-term relationships. The equation planned conclude below:

$$Y_t = \beta_0 + \sum \partial_{1j} Y_{t-j} + \sum \beta_{1j} X1_{t-j} + \sum \beta_{2j} X2_{t-j} + \sum \beta_{3j} X3_{t-j} + \sum \beta_{4j} X4_{t-j} + \sum \beta_{5j} X5_{t-j} + \epsilon_t$$

Where, $j=1,2,3, \dots, k$

$$\Delta Y_t = \beta_0 + \sum \partial_{1j} \Delta Y_{t-j} + \sum \beta_{1j} \Delta X1_{t-j} + \sum \beta_{2j} \Delta X2_{t-j} + \sum \beta_{3j} \Delta X3_{t-j} + \sum \beta_{4j} \Delta X4_{t-j} + \sum \beta_{5j} \Delta X5_{t-j} + \pi \text{ECM}_{t-1} + \mu_t$$

Where, $j=1,2,3, \dots, k$

The establishment of the ARDL model is attempted by sympathy search. The sympathy search includes the method of serial correlation. We use different techniques to determine the ARDL method. For the ARDL technique first we check the model by estimating the equation in E-views. In this portion check the value of R^2 which is equal to 0.9, which means our model has 90% variation between dependent and independent variables. Similarly, Adjusted R^2 has the same function, in our equation which is equal to 0.9. The value of Durbin-Watson is equal to 2.5, which shows no autocorrelation in the model. All these values are given in the table below:

Table 3: Equation Estimate

| | | | |
|----------------------|--------|------------------------|---------|
| R squared | 0.991 | Mean dependent Var | 14.538 |
| R squared (adjusted) | 0.991 | S.D dependent Var | 1.4845 |
| S.E. of regression | 0.027 | Schwarz Criterion | -4.0218 |
| resid sum squared | 0.017 | Hannan- Quinn Criteria | -3.3697 |
| Log likelihood | 89.422 | Durbin Watson | 2.5198 |

| | | | | |
|--|-------|--|--|--|
| F-statistic | 72.50 | | | |
| Prob. (F-statistic) | 0.000 | | | |
| E-views 9.5 were used to calculate the values. | | | | |

Now next step is involved in the ARDL technique is that to test out the existence of long-term relationships among variables. After checking the existence of long run correlation then we see the coefficients in both cases. We examine the distance future link between the variables, for this purpose check the F statistic value with the null hypothesis ($H_0: \delta_1=\delta_2=\delta_3=\delta_4=\delta_5=\delta_6=\delta_7= 0$). But the value of F statistics is greater than the table value then it shows the long run relation existence.

Table: 4 Bound Test

| | | |
|--|-------------|-------------|
| F-statistics | 10.4528 | |
| Critical value Bound | Lower Bound | Upper Bound |
| 10% Significance | 1.99 | 2.94 |
| 5% Significance | 2.27 | 3.28 |
| 2.5% Significance | 2.55 | 3.61 |
| 1% Significance | 2.88 | 3.99 |
| E-views 9.5 were used to compute this value. | | |

According to the diagnostic table, our model does not have any serial correlation, no heteroscedasticity, as well as all variables, are normally distributed. Ramsey Reset test result indicates that our model is free of specification errors.

Table 5. Diagnostic Test

| TABLE:5 DIAGNOSTIC EXAMINATION | |
|---|--------|
| Test of serial correlation | 0.2291 |
| Test of Heteroscedasticity | 0.875 |
| Test for Normality | 0.7787 |
| Ramsey Reset Test | 0.6178 |
| E-views 9.5 were used to make the calculations. | |

4. Results and Discussions

The next step shows the observations of examined the distance future coefficients of variables. Stock market and foreign exchange market affected by GDP, CPI, EXH, INV, M, PIN and S. It is clear by the observations that consumer price index, exchange rate, and money supply are significant and but negatively related with GDP in the long run relationship. But investment and savings are positively related and significant level in long run and price index is insignificant and the relationship is negative with GDP.

Table 6: Coefficients of Long Term Relationships

| ARDL (2,1,0,0,2,2,1) | | | | |
|---------------------------------|-------------|------------|--------------|-------------|
| GDP is reliant on the variable. | | | | |
| Variable | Coefficient | Std. Error | t-statistics | Probability |
| CPI | -0.1021 | 0.1605 | -0.6362 | 0.0312 |
| EXH | -0.1320 | 0.2331 | -0.5664 | 0.0768 |
| INV | 1.1042 | 0.1088 | 1.1476 | 0.0000 |
| M | -1.0200 | 0.4843 | -2.1059 | 0.0467 |

| | | | | |
|--|---------|--------|---------|--------|
| PIN | -0.0165 | 0.0243 | -0.6799 | 0.4036 |
| S | 0.1657 | 0.1241 | -1.3344 | 0.0657 |
| C | 6.1257 | 2.7602 | 2.2192 | 0.0361 |
| Source: Calculating values utilizing E-Views 9.5 | | | | |

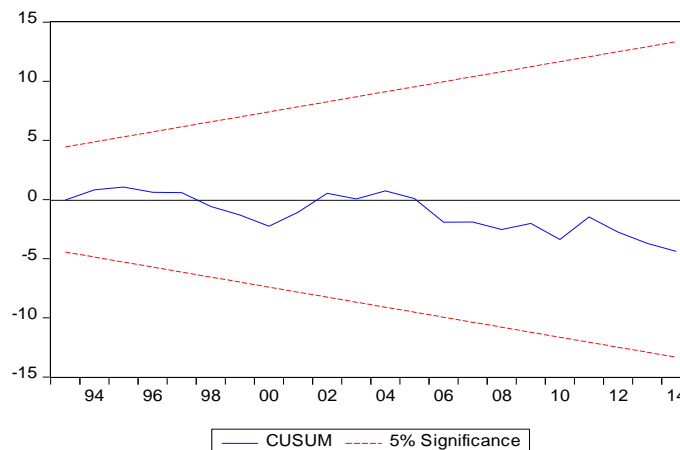
The case of short-term arrangement is checked from the ECM which exists among 0 and 1, the relationship of GDP in duration t is a portion of error in duration t-1. The co-efficient of ECM is -0.3335 significant. It signifies that the variation of GDP in the equality level in the current duration can be arranged by 33.35% in the coming duration. The effect of all variables is the same in short term. All the situation of observations in the short run are given in Table below:

Table 7. Short Term Relationship Coefficients

| Variable | Coefficient | Std. Error | t-statistics | Prob |
|--|-------------|------------|--------------|--------|
| D(GDP) | -0.5173 | 0.1099 | -4.7072 | 0.0021 |
| D(CPI) | 0.0171 | 0.0224 | 0.7644 | 0.4326 |
| D(EXH) | -0.0289 | 0.0756 | -0.3829 | 0.6043 |
| D(INV) | 0.3163 | 0.0502 | 6.3001 | 0.0124 |
| D(M) | -0.1478 | 0.0705 | -2.0963 | 0.0468 |
| D(M(-1)) | -0.1387 | 0.0735 | -1.8872 | 0.0634 |
| D(PIN) | 0.0129 | 0.0052 | 2.4976 | 0.0125 |
| D9PIN(-1)) | 0.0104 | 0.0052 | 1.9711 | 0.0514 |
| D(S) | 0.0296 | 0.0236 | 1.2545 | 0.2238 |
| ECM(-1) | -0.3335 | 0.0343 | -9.7069 | 0.0011 |
| Source: Calculating values utilizing E-views 9.5 | | | | |

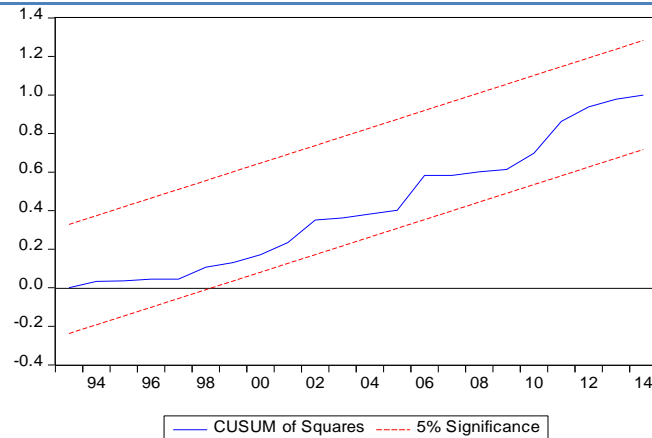
Graph of the Cumulative Sum of Recursive Residuals

To ensure the stability of our model in both periods used CUSUM. The structure of CUSUM exists in the tabulated situation of a 5% significant area. These results show that Our model has a steady short-term and long-term link between variables.



Recursive Residuals Cumulative Sum of Squares Graph

It also shows the stability of the model. In this portion apply the CUSUM square test to verify the stability in the short run and long term. It is significant at the 5% level. Our model’s estimated line exists in the red lines which shows stability in our model.



5. Conclusion

The result of this research is that brunt of volatility and spillover on market is significant in our country. Even though the matter is determined low effect on markets. The role of both markets is interlaced. The arrival of a single market is altered by another market's volatility. Similarly, the stock market has arrived. is delicate toward the arrivals perhaps the foreign exchange market's volatility. It means reacting and being changed by the excess market arrivals. Both markets are strongly related to each other. It signifies the presence of volatility spillover among the markets in our country.

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