Effect of Macroeconomic Variables on Returns and Volatility of Non-Financial Firms of Pakistan Stock Exchange

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CERTIFICATE

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Dedicated to my parents.

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"Trust in Allah with all your heart and lean not on your own understanding; in all your ways acknowledged him, and he will make your path straight."

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"ONE GOOD MENTOR COULD BE MORE INFORMATIVE THAN A COLLEGE EDUCATION AND MORE VALUABLE THAN A DECADES INCOME."

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LIST OF ABBREVIATIONS

Abbreviation	Company Name
INDU	Indus Motor Company Limited
HCAR	Honda Atlas Cars (Pakistan) Limited
PSMC	Pak Suzuki Motor Company Limited
LUCK	Lucky Cement Limited
DGKC	D.G. Khan Cement Company Limited
FCCL	Fauji Cement Company Limited
CSAP	Crescent Steel & Allied Products Limited
MSCL	Metropolitan Steel Corporation Limited
ENGRO	Engro Corporation Limited
FFC	Fauji Fertilizer Company Limited
RMPL	Rafhan Maize Products Limited
GHGL	Ghani Glass Limited
STCL	Shabbir Tiles and Ceramics Limited
BGL	Baluchistan Glass Limited
BATA	Bata Pakistan Limited
LEUL	Leather Up Industries Limited
PAKL	Pak Leather Crafts Limited
SHFA	Shifa International Hospitals Limited
TRIPF	Tri-Pack Films Limited
PSEL	Pakistan Services Limited
MARI	Mari Petroleum Company Limited
PSO	Pakistan State Oil Company Limited
PKGS	Packages Limited
CEPB	Century Paper and Board Mills Limited
MERIT	Merit Packaging Limited
SEARL	The Searle Company Limited
HUBC	Hub Power Company Limited
LOTCHEM	Lotte Chemical Pakistan Limited
UPFL	Unilever Pakistan Foods Limited
SRVI	Unilever Pakistan Foods Limited

APL	Unilever Pakistan Foods Limited
BYCO	Byco Petroleum Pakistan Limited
TICL	Thal Industries Corporation Limited
GATI	Gatron Industries Limited
IBFL	Ibrahim Fibre Limited
SGFL	S.G. Fiber Limited
PSYL	Pakistan Synthetics Limited
NAFL	National Fibres Limited
TELE	Telecard Limited
IDYM	Indus Dyeing Manufacturing Company Limited
FZCM	Fazal Cloth Mills Limited
GADT	Gadoon Textile Mills Limited
DINT	Din Textile Mills Limited
KAPCO	Kot Addu Power Company Limited
ZTL	Zephyr Textile Limited
PAKT	Pakistan Tobacco Company Limited
PIAA	Pakistan International Airlines Corporation
PNSC	Pakistan National Shipping Corporation Limited
PIAB	Pakistan International Airlines Corporation (B Class Shares)
PICT	Pakistan International Container Terminal Limited
POML	Punjab Oil Mills Limited
MOIL	Morafco Industries Limited
BNWM	Bannu Woollen Mills Limited
ATRL	Attock Refinery Limited
NRL	National Refinery Limited
JKSM	J.K. Spinning Mills Limited
SEPL	Security Paper Limited

ABSTRACT

Change in the macroeconomic variables translates in to change in either cash flows of firms or change in the subjective discount rate which ultimately leads to change in the stock returns. Presence of mediocre players in the market in huge number and low corporate governance tends to make room for volatility triggered by macroeconomic variables. This study is focused on identifying the role of macroeconomic variables (Interest rate, money supply, gold prices, oil prices, exchange rate, inflation, foreign exchange reserves, and industrial production) in conditional return & volatility at firm level by using GARCH type models in order to capture ARCH effect. The data span for stock prices of firms from the non-financial sector and macroeconomic variables covers the period from July 1998 to June 2016. The study concludes that macroeconomic variables have a role in determining the stock returns.

On average interest rate, oil prices, inflation, exchange rate are negatively related to the stock returns whereas money supply and gold prices are positively related to stock returns. Interest rate, exchange rate, and money supply are negatively related to volatility along with foreign exchange reserve and gold prices. Results suggest that macroeconomic variables are important in determining the conditional return and volatility. The implication for investors is that they need to allocate their resources in the most efficient way so that they can avoid the negative response of capital market to changes in macroeconomic variables.

CHAPTER I

INTRODUCTION

Stock price is the present value of expected cash flows. The expectation about cash flows of a firm vary from individual to individual and this expectation is influenced by macroeconomic variables. The critics on Sharpe (1964) CAPM model in 1970 which is, "there are number of other factors that can affect the return of specific asset" due to which many large number of stocks are mispriced and investor earn abnormal profit and this gives rise to Arbitrage portfolios, which has given the name of APT by Ross (1976) which said that "return generation is the function of kth many factors" but Ross neither identified the number of factor nor the name of any factor, so after this researchers started identifying those factor and this led to the development of macroeconomic factor model to check the performance of stock market.

For example, a firm having oil as an input and covering the major components of cost will have its cash flows dependent upon oil price. Similarly, the discount factor also varies from individual to individual and is influenced by macroeconomic variables. For example, change in the money supply contributes to change in the interest rate and subsequently the discount rate which happens to be in the denominator of present value of expected cash flows.

Stock prices follow trend and that's why it cannot be used in a method involving forecasting. So, we construct the return series in order to achieve stationarity. The return series tend to be leptokurtic having heavy tails. The return series exhibits volatility clustering as well. For these reasons GARCH type models are applied because it models the volatility clustering in the conditional variance equation.

Pakistan Stock Exchange was formed on January 11, 2016 under the Stock Exchanges Corporatizations, Demutualization, and Integration Act, 2012 by merging the three

Stock Exchanges of Islamabad, Lahore, and Karachi. Earlier these stock exchanges fell under the category of company limited by guarantee. Now Pakistan Stock Exchange is limited by share. 40% stack belongs to the Chinese consortium, 40% to brokers, and 20% to general public.

The stock market as the secondary market provides liquidity to the primary market. It helps in mobilization and distribution of savings. When firms use equity finance for expansion of their operations the savings of individuals are accessed by initial public offerings. Those individuals are interested in the stocks being offered for the first time because they know that they can sell in the stock market at a later stage. The cash flows or subjective discount rate of firms changes in response to the change in macroeconomic variables and this change determines how much the individual will get if s/he needs to exit the market. So macroeconomic variables are important for individuals in this regard. Similarly, firms can go into subsequent offering of shares for expansion. If the stock price is high only then the firms can get huge amount of cash. So, the macroeconomic variables are important in determining the time of subsequent offering in order to enable firms in getting the maximum benefit.

Looking towards the last decade of Pakistan stock market it shows that it remained a highly volatile market. The stock market observed three very powerful/intense shocks, market crash of March 2005, a collapse detected in the 2nd quarter of 2006 and the last, and the biggest crash from May 2008 to January 2009. In view of this discussion we can say that macroeconomic variables plays a very important role for stock return and volatility.

There is abundant literature available which describes the association among the macroeconomic variables and stock returns e.g Chen, et.al, (1986), Hamao (1988) Nishat and Saghir (1991), Hussain and Mehmood (2001), Saleem (2007), Mollick and

Assefa, (2013), Gurloveleen & Bhatia, (2015). This study emphasis on the association among macroeconomic variables with stock returns and volatility.

The capital structure of a firm is a certain combination of debt and equity. The capital structure of the companies in financial sector is relatively changed from companies in non-financial sector, Shah and Hijazi (2004) and on the foundation of it. In this study we are just using the nonfinancial firms of Pakistan stock exchange.

1.1 Literature Gap

In case of Pakistan there are numerous studies that emphasis on the effects of macroeconomic variables on stock return and volatility. A common characteristic of these studies is that they focus on the whole market. There are only few studies in Pakistan which tried to check impact of macroeconomic variables on few sectors of stock market but they used panel data analysis to find the relationship Zaighum (2014), the uniqness of this study is that we are going to check the impact of set of macro-economic factors on firm's stock returns and volatility, a sectorial study of non-financial firms listed on KSE 100 index which is now become the part of Pakistan stock exchange through the new improve GARCH type modeling as the firms are subject to ARCH effect.

1.2 Objective of Study

The objective of the study is to find the effect of macroeconomic variables on returns and volatility of nonfinancial firms of Pakistan stock exchange employing contemporary GARCH type model.

1.3 Significance of Study

Several studies emphasis on the stimuluses of macroeconomic variables on stock performance. A common characteristic of these studies is that they emphasis on the

whole market. This study efforts to provide a deeper understanding in a way how macroeconomic variables effect stock performance of numerous industries by using latest data. An exact understanding of the macroeconomic factors can assist investors to proactively control risk in the face of macroeconomic variations. With this in mind, investors could change their portfolios to alleviate risk as a consequence of the probable effects that macro economy can have on industries' equity.

1.4 Scheme of Study

The scheme of the study is that in the 1st Chapter of introduction we have introduced our study and its literature gap along with its objective and significance of the study in the next chapter literature related to the stock market and macro variable has been discussed. The 3rd chapter is related to the macroeconomic variables that are used in the study how they affect the stock market and their various channels are explained, in the next chapter data and methodology of the study is explained and 5th chapter is related to the results and discussion and last chapter is related to the conclusion of the study.

CHAPTER II

LITRATURE REVIEW

Association between stock returns and macro-economic features is an important region of analysis for the capital market's financial experts and academicians. Numerous studies have been accompanied to study the behavior of altered macroeconomic aspects and stock returns. This segment of the study is trying to have an intuition into some of the studies completed in this field. One such initial study is done by N. F. Chen et al. (1986). They have observed that the effect of macroeconomic factors such as industrial production, inflation, risk premia, term structure, index, Oil Prices, and Consumption on return of Value weighted NYSE index. Industrial production, and fluctuation in risk premia has a significant impact on the stock returns, however there is a weak connection between inflation and stock returns. While consumption, market indices and oil prices are insignificant in illustrating the stock returns.

Dornbusch and Fisher (1980) determine with a stream situated model. They contend that a devaluation in the currency improves the aggressiveness of local organizations and their fares and future money streams. This will bring about growing stock prices, as a reaction to the growth in expected money streams. Then again, a valuation in the currency will diminish the remote request of a sending out organization. This will prompt a decrease in the benefit, as would the stock returns.

Liljeblom and Stenius (1997) observed the association between macroeconomic volatility and stock market volatility for Finland. GARCH model was used for the valuation of conditional volatility at stock market. This study establishes a significant association between macroeconomic volatility and stock market volatility and an analytical power in both course.

Mussa (2000) examined a range of channels through which increased oil prices suffer the global economy. Initially, there will be some decline in demand and hence a shift of income from energy consumers to energy producers. Additionally, there will be a rise in the cost of production and a burden on return margins. Lastly, an increase in oil price will effect the price intensities and the level of inflation. This will diverge with the notch of monetary contraction. The expected period of the increase in price levels will make reasons for oil suppliers to enlarge the production and investments. Besides, this all will have both direct and indirect effect on the financial markets.

Maghayereh (2003) study the long-run association between certain macroeconomic variables and the Jordanian stock prices by using monthly data. He establish that macroeconomic variables that is, interest rate, inflation, industrial production foreign reserves and exports are imitated in stock prices in the Jordanian capital market.

Rahman, et al., (2009) examined the relationship between stock prices and chose macroeconomic variables in Malaysia. They indicated that fluctuations in Malaysian stock market index do achieve a cointegrating association among changes in money supply, exchange rate, reserves, industrial production index, and interest rate. The study focused that interest rates, reserves, and industrial production index were positively associated however money supply and exchange rate were negatively correlated to Malaysian stock market return in the long-run. Their causality test indicates a bi-directional association among stock market return and interest rates.

Sumner et al. (2010) determine an influence from gold to stock returns. Though, this is not very strong which limits the forecasting power of gold. However, the slightly negative relation among them remains as a positive opinion from the portfolio diversifier viewpoint.

Hosseini et al. (2011) inspected the associations among stock market indices and four macroeconomics variables named as industrial production (IP), money supply (M2), inflation rate (IR) and crude oil price (COP) in India and China. They used the vector autoregressive (VAR) model and exhibited that in both long-run and short-run there are connections between four nominated macroeconomic variables and the stock market index in India and China

Hasanzadah and Kiavand (2012) studied the effect of macroeconomic variables such as nominal effective exchange rate, gold coin price, investment in housing sector, money supply and gross domestic product on stock market index in Iran using quarterly data. They have used the co-integration and vector error correction model (VECM) and found that Iran's stock market index is positively associated with money supply, the growth rate of GDP. And negatively affected by the gold price, the nominal effective exchange rate, and the private sector investment in housing sector. Our study is an improvement on this research as we take a different study area and theoretical approach[1]

Çiftçi (2014) has been investigated the influence of four macroeconomic variables: crude oil, interest rate, exchange rate, and gold on stock returns of ten U.S. industries. The findings of the study show that the impact of macroeconomic variables are different among the industries. The study suggests that the interest rate affect stock returns. The exchange rate has a heterogeneous effect on the industries that depend on imports or exports of goods. Some sectors exhibit an increase in stock returns when the domestic currency depreciates. The negative impact of crude oil on stock returns is confirmed for few industries and not only industries which are oil sensitive, also industries which do

[1] Ali, U. A., Abdullah, A., Sulong, Z., & Ahmad, T. A. (2015). The review of stock returns and macroeconomic variables. *International Journal of Academic Research in Business and Social Sciences*, *5*(5), 154-181.

not use oil at all are influenced by movements in the crude oil returns. No relation between gold and stock performance was found for any industry during the post-crisis period, significantly negative results were found for the consumer services, financials and industrials sectors which could be a result of a substitution effect from shares to gold.

Gurloveleen & Bhatia, (2015) has checked the impact of macroeconomic variables on the manufacturing sector of Indian Stock Market, to check this ADF test along with multiple regression and granger causality has used. The monthly data of ten macroeconomic variables have taken in which only two macroeconomic variables foreign institutional investor and exchange rate have been found significant. It has been extracted that these variables have no unidirectional and bidirectional relationship with closing prices of BSE 500 manufacturing firms. It is found that Indian Stock Market was a weak form efficient because no relationship was found amongst the variables during the study period.

2.1 Literature on Pakistan

Ataullah (2001) empirically observed APT in the Pakistan stock market by using pre-specified macroeconomic factors. He found in the results that four macroeconomic factors i.e. trade balance, unexpected inflation, oil prices and exchange rate effect the equity returns in Pakistan.

Nishat and Shaheen (2004) empirically examined the influence of money market rate interbank market rate as proxy for interest rate, industrial production index (IPI) proxy for output, money supply (M1) Consumer price index proxy for inflation on KSE equity prices. The result indicates that inflation is negatively and industrial production index is positively associated with the stock prices.

Rashid (2008) accounts that stock prices index and interest rate output index were mostly volatile in post-break time period as comparatively pre-break time period. This paper furthermore explain that share prices have associated with exchange rate, output, CPI and the rate of interest. Moreover, there is long run association between variables and overall variation occurs due to alteration in structural change deprived of any time trend. The purpose for long run association among macroeconomic variables and share prices is described in such a way that it supports the economy, which leads to increase the share prices

Shah, et al. (2012) used Auto Regressive Distributed Lag technique, Vector Error Correction technique and Ordinary Least Square for the analysis of the long and short-run association amongst the Macroeconomic variables that is interest rate, exchange rate, inflation and Karachi Stock Market. They show the long-run and short-run relations among them. They also check the presence of long-run association. The overall macroeconomic environment does not disturb the movement in the stock market.

Zaighum (2014) tried to investigate the impact of pre-specified set of macroeconomic factors on firms' stock returns for nine nonfinancial sectors listed in Karachi Stock Exchange. By applying the Panel data analysis using pooled OLS which shows that all studied sectors firm's stock returns have negative relationship with consumer price index, money supply and risk free rate. Whereas industrial production index and market returns indicates a positive relationship.

Naurin, and Qayyum (2016) target to explore the impact of oil price and its volatility on stock market index in Pakistan. The finding of bivariate EGARCH model suggested that there is a direct association between oil prices and stock market index.

In the light of above literature we come to conclude that there has a lot of work been done by the researchers on checking the relationship between overall stock market and macroeconomic variables by using different methodologies but there is no work found on checking the effect of macroeconomic variables on firm level by using the contemporary GARCH type modeling so in this study we will study the gap found by the literature and we will check the effect of macroeconomic variable on the return and volatility of nonfinancial firms of PSX.

CHAPTER III

MACROECONOMIC VARIABLES AND STOCK MARKET

3.1 Theoretical Background

The theoretical foundation of the association among macroeconomic variables and stock performance is described by models for example the capital asset pricing model established by Sharpe (1964) and Lintner (1965) and the arbitrage pricing theory established by Ross (1976). These models explain how variations in the macro economy can effect stock performance. Investors embrace risky assets only if the probable return rewards its risk (Hillier, et.al 2010). According to Sharpe (1964) it is conceivable to escape from all risk, excluding the risk follow-on from fluctuations in economic movement. This risk leftovers even in the most effective portfolios and cannot be evaded by modification. Chen, Roll, and Ross (1986) add to this account that the biggest part of stock returns is from unpredicted events from the broad economic environment. To elucidate, these models explain how any new evidence about macroeconomic features will effect stock performance through its influence on the predictable future dividends, discount rate, or both.

Chen et al. (1986) persistent to use the APT framework and provide indication that macroeconomic variables are significantly inducing stock returns by using the arbitrage pricing theory. They say that five macroeconomic variables significantly effect stock performance. Industrial production, variations in defaulting risk premium and fluctuations in the yield curve among long and short term interest rates are measured to be extremely significant. The unexpected inflation and variations in expected inflation are also significant, then have a smaller statistical significance when elucidating stock returns.

3.2 Definition of the Variables

3.2.1 Interest Rate

Financial theories discussed that changes in interest rates effect both the expected future cash flows for firms and the discount rate to value these cash flows and therefore the value of the company as well. (Martinez-Moya, et.al, 2013)

Interest rate has a negative relation with the stock market. The increase in interest rate leads to increase the discount rate and due to which the present value of expected cash flow decrease and once the cash flow of a company decreases it leads to decrease the share prices vice versa.

Interest rate variations also effect the value of non-financial firms by three channels. Initially due to increase in the cost of loan, increment the premium costs of an exceedingly indebted firm which leads to decrease the dividend and have a negative impact on the cash flow of a company and its share prices. An increased interest rate have a negative impact on the investor's investment behavior Bartram, et.al (2002). Secondly, loan fee changes can have an effect on available estimation of the money related resources and liabilities of the nonfinancial organization. Third, uncertainties in loan costs impact the open door expenses of speculations. An expansion in loan cost makes bonds all the more interesting because of their hazard return nature and inspires speculators to change their portfolios by purchasing bonds and offering shares and in this manner discourage share costs (Bernanke and Kuttner, 2005). In addition, an expansion in the market interest cost can make government securities more eye-catching since they are seen as more secure venture/project openings.

3.2.2 Exchange Rate

The present value of expected cash flow of a firm involve two things: one is the revenue and the other one is expense. Now if Pakistan's currency depreciated then there will be two types of effect if this depreciation increase the revenue/return then the expected cash flow of a company will increase and will lead to increase the share prices and on the other hand if this depreciation leads to increase the cost of a company then the expected cash flow of a company decreases which will lead to decrease the share prices Dornbusch and Fisher (1980)

Basically exchange rate have no stereotype effect it is related to the cash flow and cash flows are directly related to the share prices.

3.2.3 Money Supply

In the short run increase in money supply will lead to increase the liquidity in the market which increase the short term prices but in the long term due to increase in the discount rate prices of the shares will decrease. Because increase in money supply leads to increase the inflation and due to that the nominal interest rate will increase so the discount rate will also increase and increased discount rate will lead to decrease the share prices.

Agreeing to the monetary portfolio theory, the volatility in money supply varies the equilibrium position of money, therefore changing the arrangement and assets price in an investor's portfolio (Rozeff, 1974). Moving further novelties in money supply may disturb the real economic variables which might lead to an insulated positive effect on stock returns (Rogalski and Vinso, 1977).

Money supply is probable to upset stock market index through at least three approaches: first, novelties in the money supply may be interrelated to unexpected rises in inflation

and future inflation uncertainty and therefore, negatively linked with the stock market index. Secondly, improvements in the money supply may positively distress the stock market index through its outcome on economic movements and finally, portfolio theory declares a positive connection to be existent, since it relates an increase in the money supply to a portfolio modification from non interest deportment money to financial assets with equities.

3.2.4 Industrial Production

Increase in industrial production leads to an increase in the expected cash flow which in turn increases the share prices so it has positive relation with share prices Sohail and Hussain (2009)

3.2.5 Oil Prices

Huang, Masulis, and Stoll (1996) describe the theoretical relation between crude oil and stock returns using economic linkages at a broad level the stock valuation of a company is centered on the discounted values of expected future cash flows.

Oil prices have also two perspectives just as exchange rate had. If increase in the oil prices leads to increase the revenue of company then the expected cash flow of a company increases and also share prices will increase, But if the increase in oil prices leads to increase the cost of a company then the expected cash flow will also decrease and due to that share prices will decrease Kilian (2007).

One more study by Nandha and Faff (2008) showed that rise in oil price have negatively influence the stock returns for utmost sectors excluding the mining and some associated industries for example oil and gas industries. In addition, Sadorsky (2008) revealed that increases in firm size or oil prices decrease stock market price returns, and rises in oil prices have additional effect on stock market returns than decrease in oil prices do.

3.2.6 Inflation

Inflation is basically related to market structure that can be monopoly, oligopoly and imperfect market. In case of monopolistic and oligopolistic market the increase in inflation has a negligible effect on the share prices because monopolists have the power to transfer this increase to end users but if the market is imperfect then they are effected. Generally increase in inflation leads to increase the discount rate and due to that the share prices will decrease Chen et al. (1986)

3.2.7 Gold Prices

Gold is additionally used for hedging to minimize the risk factor, investor hedge their risk by swapping shares with gold which brings about a lower demand for shares and leads to the volatility of stock market. Therefore, getting a better understanding of this linkage will help investors and firms to diversify their portfolios and reduce their risks.

Kolluri (1981) described that gold prices are related with inflation rate and these inflationary fluctuations are eventually imitated in interest rates. Variations in interest rates finally became the cause of volatility in equity market prices. The outcomes of the Mahdavi and Zhou (1997), Blose and Shieh (1995), found that gold is now dependent on inflation pressure.

Moore (1990) examined that there is opposite relationship among gold prices and capital markets from 1970 to 1988. Büyüksalvarcı, A. (2010) described the similar results and stated that interest rates, , CPI, industrial production, gold prices, exchange rate money supply and oil prices are interconnected. His study proposed that in Turkey Gold investment is an eye-catching investment prospect. In Turkey Gold prices were inversely associated with stock market returns.

3.2.8 Foreign Exchange Reserves

In a country the central bank and other monetary institutions keep the reserves of different currencies such as US Dollar, Pound Sterling, Euro, Japanese Yen etc. and used to play a role in the unexpected economic shocks. Foreign exchange reserves has a positive impact on the stock prices Kurihara (2016). The investor would like to invest more if a country has good position in foreign exchange reserves. The more is the reserves in an economy the more will be faith so it will lead to more investments by domestic and foreign investors.

CHAPTER IV

METHODOLOGY AND DATA

In this chapter we discuss the methodology of ARCH and GARCH modeling and its specification to assess the effect of macroeconomic variables on the return and volatility of nonfinancial firms of Pakistan Stock Exchange. The estimation of conditional mean return seems futile in the presence of ARCH effect however some theoretical tools deal with estimation of conditional variance/volatility and the conditional variance is modeled by GARCH type modeling (Proposed by Engel 1982, & generalized by Bollerslev, (1986).

4.1 Methodology Specification

To define the variation of conditional variance with reference to time, Engle (1982) suggested Autoregressive Conditional Heteroscedastic (ARCH) model. Even though ARCH model is an important involvement in econometric tools, there are some issues like long lag length and non-negativity constraint on parameters. Bollerslev (1986) presented generalized autoregressive conditional heteroskedastic (GARCH) model, which progresses the exclusive description with the addition of lag value of conditional variance, which acts as a smoothing term.

There are lot of univariate and multivariate (ARCH) type of model. To escape from any non-convergence issue in this study we use appropriate univariate GARCH type model to estimate volatility of nonfinancial firms of Pakistani Stock markets. The ARCH (q) and GARCH (p, q) Univariate models are adept of discovering better volatility dynamics.

4.1.1 ARCH (q) Model

Robert F. Engle in (1982) presented the autoregressive conditional heteroscedastic (ARCH) model. This model overwhelms all short comings which are in prior models. In this model Engle, presented conditional mean and conditional variance equations. Empirically the conditional mean equation is following ARMA (p, q) process and the conditional variance rests upon the square of past values of error process εt.

The general depiction of ARCH model is

Conditional mean equation

$R_t = \alpha_0 + \beta X_t + \varepsilon_t$ .....(4.1)

Where $\varepsilon_t \sim N(0, \sigma_t)$

Conditional variance equation

$\sigma_t^2 = \theta_0 + \Sigma_{i=1}^{q} \theta_i \varepsilon_{t-1}^2$ .....(4.2)

Where $\theta_0 > 0$, $\theta_i \geq 0, = 1, 2 \ldots q$

In conditional mean equation R_t denotes the return which is linear function of X_t. $where$ β shows the vector of parameters. Empirically βX_t demonstrates ARMA (m, n) process with diverse conditions. In some cases it may be ARMA (0, 0). According to the "Efficient Market Hypothesis (EMH)" R_t denotes mean reversion behavior and it is capricious. In conditional variance equation the restraint on coefficients is that they need to be non-negative. σ_t^2 Denotes conditional variance, which depends upon lags of squared past value of εt process.

4.1.2 GARCH (p, q) Model

Linear ARCH (q) model has some difficulties initially, sometime taking long lag length 'q' due to this number of parameters are going to rise as a result loss of degree of

freedom. Secondly, obligation of non-negativity condition on parameters of conditional variance equation. Bollerslev (1986) represented generalized extension of ARCH (q) model Generalized autoregressive conditional heteroscedastic (GARCH) model.

The general explanation of GARCH model is

Conditional mean equation

$R_t = \alpha_0 + \beta X_t + \varepsilon_t$ .....(4.3)

Where $\varepsilon_t \sim N(0,\sigma_t)$

Conditional variance equation

$\sigma_t^2 = \theta_0 + \Sigma_{i=1}^{q} \theta_i \varepsilon_{t-1}^2 + \Sigma_{i=1}^{p} \varphi_j \sigma_{t-1}^2$ .....(4.4)

Where $\theta_0 > 0$, $\theta_i \geq 0$, $\varphi_j \geq 0$

In GARCH (p, q) model the conditional variance influenced by square of past values of process ε_t and lag of conditional variance σ_{t-1}^2. The state of non-negativity of parameter as well applied in this model.

4.1.3 Basic Model

The GARCH specification will vary from one firm to other because general to specific approach will be followed and to account for heavy tails the assumption about the distribution will be student-t.

The conditional mean and variance equation in general form including macroeconomic variables of the study are as follow:

Conditional Mean Equation

$$r_t = c + \sum_{i=1}^{m} \delta_i r_{t-i} + \sum_{i=1}^{n} \varphi_i \varepsilon_{t-i} + \emptyset_1 GP_t + \emptyset_2 OP_t + \emptyset_3 Irt_t + \emptyset_4 ER_t + \emptyset_5 IP_t + \emptyset_6 FER_t + \emptyset_7 M2_t + \emptyset_8 Inf_t + \varepsilon_t$$

Conditional Variance Equation

$$\sigma_t^2 = c + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 + \gamma_1 GP_t + \gamma_2 CO_t + \gamma_3 Irt_t + \gamma_4 ER_t + \gamma_5 IP_t + \gamma_6 FER_t + \gamma_7 M2_t + \gamma_8 Inf_t + \varepsilon_t$$

Here in the conditional mean equation r_t represents the return of firm with respect to time t, while GP_t are the gold prices, OP_t represent the oil prices, Irt_t represent interest rate, ER_t represent exchange rate, IP_t represent industrial production, FER_t represent foreign exchange reserves, $M2_t$ represent money supply M2, and Inf_t represent inflation with respect to time t.

While in the conditional variance equation σ_t^2 represent the volatility of the non-financial firm and α_i represent the coefficient ARCH and β_j represent the coefficient of GARCH.

4.2 Data Description

The statistical data of the study is secondary in nature monthly data has been taken from July 1998 to June 2016. The independent variables are Gold prices, Gasoline prices as a proxy of Crude Oil prices, Call money rate as proxy of interest rate, Exchange rate, Foreign Exchange Reserves, Manufacturing Production index as a proxy of industrial production, Inflation and Money Supply (M2). While the dependent variables are the return and volatility of nonfinancial firms of Pakistan stock exchange.

The reason of choosing nonfinancial firms is that as the capital structure of the firms in financial sector is quite different from the firms in non-financial sector, we exclude all firms in financial sector like banks, insurance companies and investment companies. The firm selection criteria is that top five firms has been selected from each sector on

the basis of their market capitalization whereas market capitalization is the market value of a company's outstanding shares and can be obtain by multiplying share prices into number of shares outstanding.

(Market Capitalization = Share prices x Number of shares outstanding)

Now after choosing the top five firms from each sector we have selected those firms which are having ARCH effect e.g if we look towards the first sector in the table 4.3 i.e Automobile Assembler out of the top five firms only three are remaining because they are having ARCH effect and so on.

4.3 List of Nonfinancial Sectors

List of Nonfinancial Sectors is as following:

Nonfinancial sectors	**No of firms**	**Nonfinancial sectors**	**No of firms**
Automobile Assembler	3	Pharmaceuticals	1
Cement	3	Power Generation & Distribution	2
Chemical	1	Refinery	3
Engineering	2	Sugar& Allied Industries	1
Fertilizer	2	Synthetic & Rayon	5
Food & Personal Care Products	2	Technology& Communication	1
Glass & Ceramics	3	Textile Spinning	5
Leather & Tanneries	4	Textile Weaving	1
Miscellaneous	3	Tobacco	1
Oil& Gas Exploration Companies	1	Transport	4
Oil & Gas Marketing Companies	2	Vanaspati Alied Industry	3
Paper & Board	4	Woolen	1

4.4 Sources of Data

The data for macroeconomic variables has been collected from State Bank of Pakistan Publications i.e. State Bank of Pakistan Monthly Reports various issues, Handbook of Statistics on Pakistan Economy and also from Pakistan Bureau of Statistics and (IFS) international financial statistics. Stock data is collected from business recorder.

CHAPTER V

RESULTS AND DISCUSSIONS

In this chapter we will discuss different sections. In the first section we will estimate the descriptive statistics or stylized properties for checking the ARCH effect in the nonfinancial firm series. In the second section we will discuss the results obtained by checking the effect of macroeconomic variable on the return of nonfinancial firms by modeling ARCH and GARCH with mean. The next section consists of the results obtained by checking the effect of macroeconomic variables on the nonfinancial firm's volatility by modeling ARCH and GARCH with variances. We followed the ARCH (p,q) and GARCH (p,q) econometric techniques.

5.1 Stylized Properties of Financial Time Series:

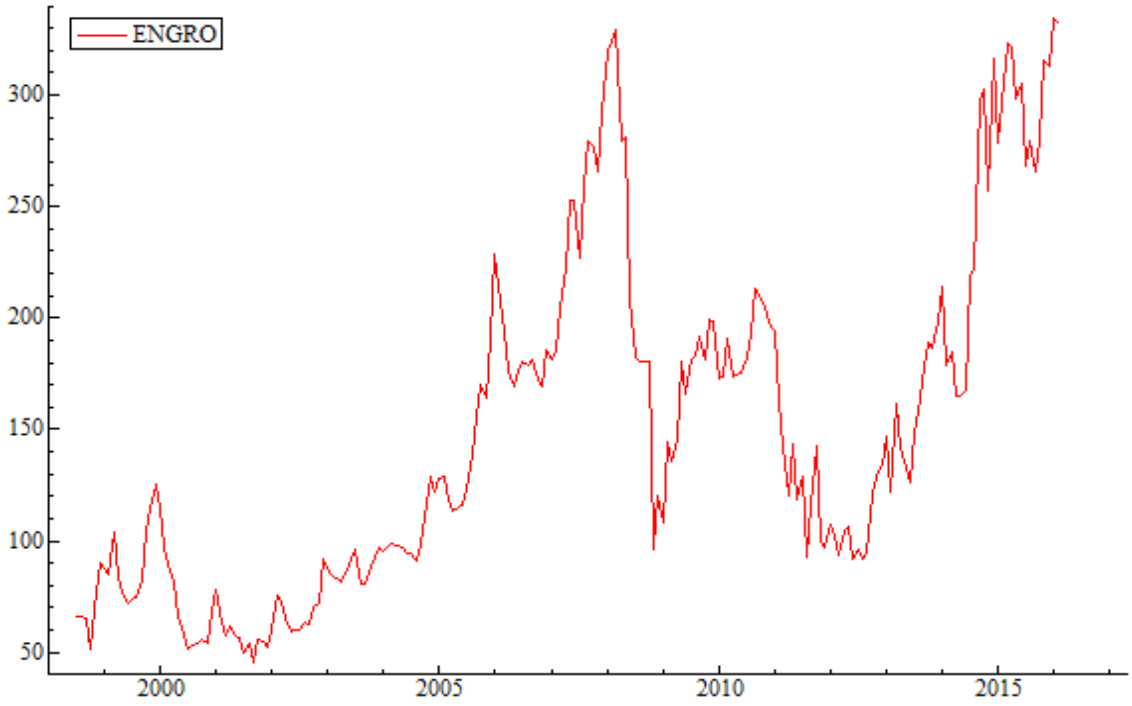
Now modeling the relationship through ARCH and GARCH technique first of all we will make the visual inspection to take a tentative idea about the data we are modeling and that is the first step of checking the stylized property of the financial time series. Such as the financial time series must be trendy, having mean reverting behavior and leptokurtic with having heavy tails.

Now for this we take a firm (ENGRO) series of stock prices and plot it. The plot shows that the series is following a trend now we check the firm stock return whether it is having the mean reverting behavior or not and we found that the return series follow mean reverting behavior and having low and high volatility clusters and this gives us tentative idea about the presence of ARCH (Autoregressive conditional heteroscedasticity) effect, and then we have checked the distribution of the return series which is leptokurtic and having heavy tail and at the end we checked the ARMA (Autoregressive and moving average) process through the PACF (Partial

Autocorrelation function) and ACF (Auto correlation function) plot and it shows the structure of the series.

5.1.1 Firm Stock Prices at Level:

Figure: 1 Firm Stock Prices at Level

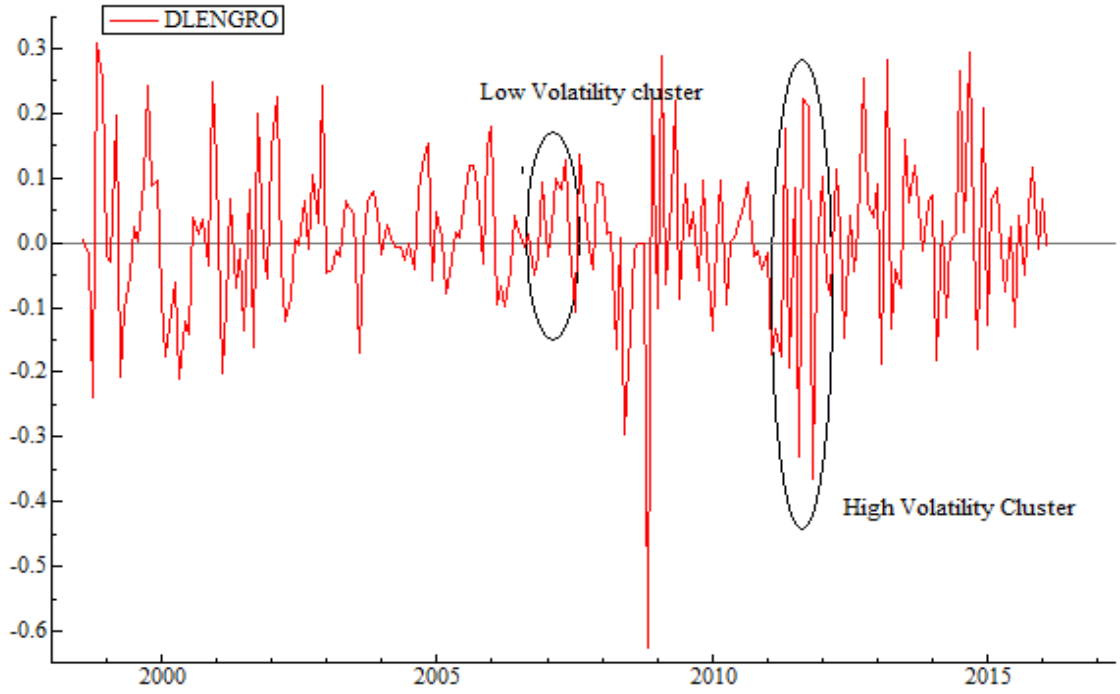


The graph (figure 1) shows that the stock prices of the firm ENGRO at level is trendy. It means that series has not reverting to its mean so we cannot use this series for forecasting as for that the series must be stationary so we move to take the return series of that firm.

5.1.2 Firm Return Series:

Empirically the stock return series is mostly found to be stationary. The graph in figure 2 shows that the return series of ENGRO is stationary and have high and low volatility clusters[2] which means the series is present to ARCH effect

Figure: 2 Return Series of the firm

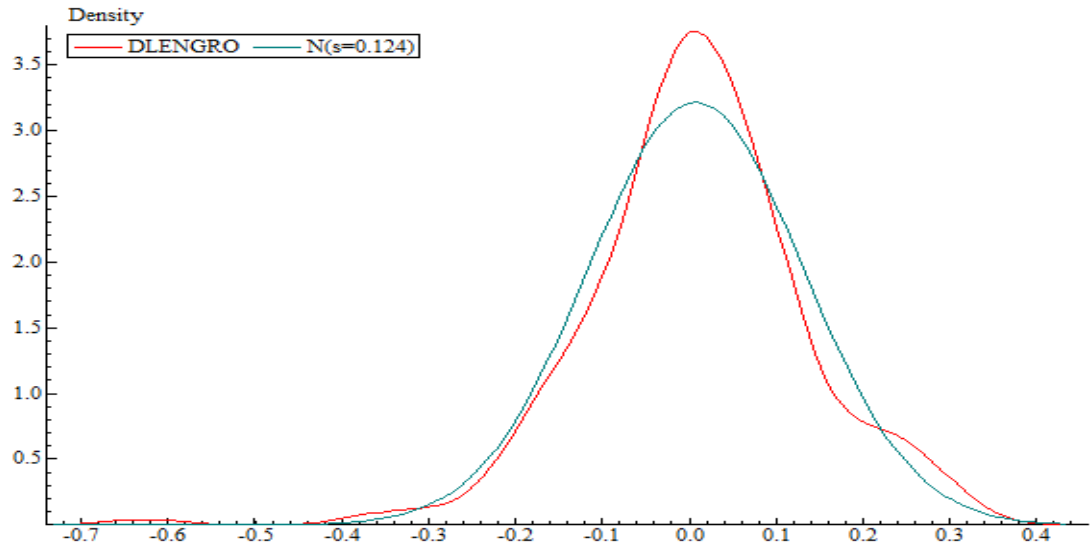


5.1.3 Density Plot of the Return Series:

The return series is empirically found to be leptokurtic and has heavy tails and the figure 3 shows the density plot of distribution of the ENGRO return series with a normal reference line and the plot shows that the series is leptokurtic.

[2]. These are the value of asset returns' periods in which their prices show a wide swing for an extended time period followed by the period in which there is relative calm seen)

Figure: 3 Density Plot of the firm



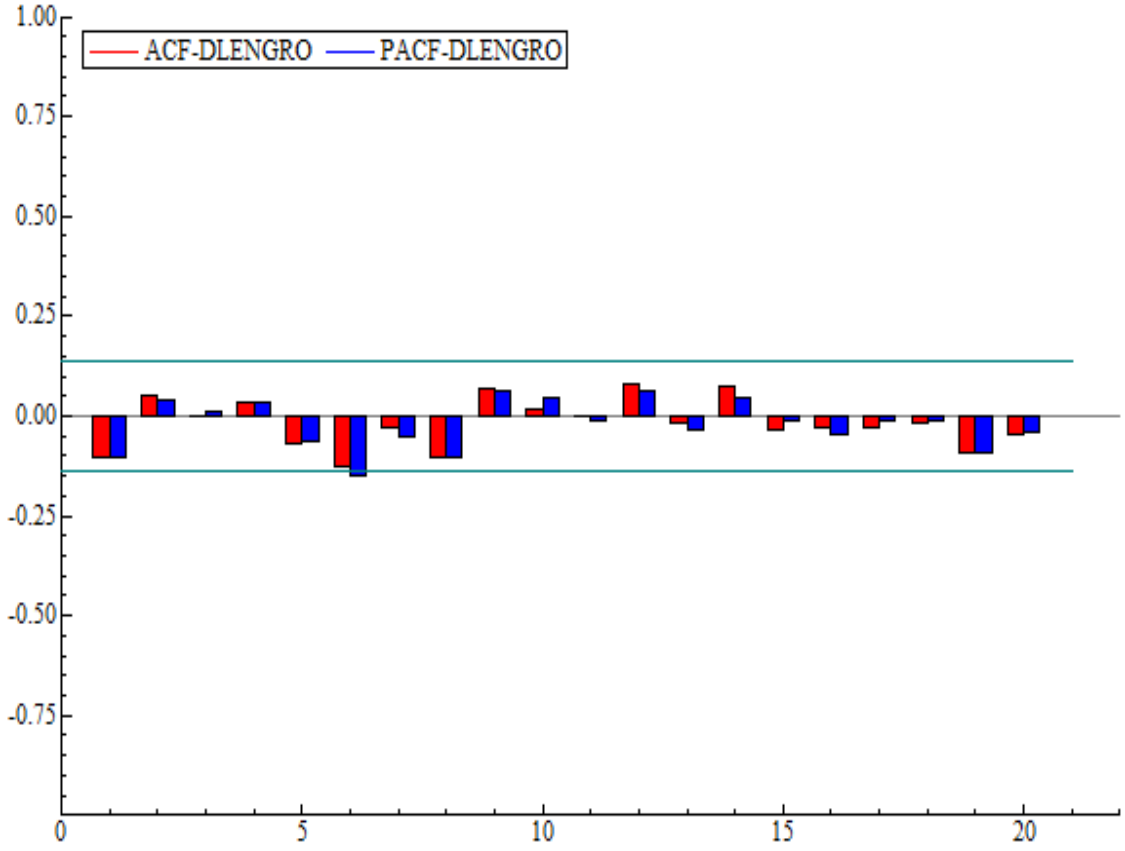
5.1.4 PACF and ACF Plot for the Return Series:

It is important for GARCH type modeling to specify the structure of the mean equation, so for this we look towards the PACF and ACF plot which give us the tentative idea about the AR[3] and MA[4] process respectively.

Figure 4 shows the PACF and ACF plot of the firm ENGRO, the black(red) spikes shows the ACF and the grey(blue) spike shows the PACF plot. The plot shows the results up to 20 lags with an upper and lower bound. If the spikes of ACF and PACF are out of this band then this will tell us about AR and MA process. Now this plot for ENGRO shows that no spike of ACF and PACF is out of the band this give us the tentative idea that the conditional mean equation has the ARMA order of (0, 0).

[3] The series current value depends on its previous value.
[4] The current deviation from mean depends on previous deviation

Figure: 4 PACF and ACF Plot of the firm



5.2 Descriptive Statistics

Visual inspection gives us idea that the financial time series that we are using in over analysis is leptokurtic with having heavy tails, also stationary with having volatility clustering as well. Now the same observation needs to be explained through statistics for that we have calculated the descriptive statistics which are as following

Table 5.1 The Descriptive Statistics:

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
DLINDU	0.0223	0.1385	0.367 (0.028)***	446.84 (0.000)***	7.091 (0.000)***	2.533 (0.771)	31.367 (0.000)***	6.692 (0.000)***	4.876 (0.000)***	0.132
DLHCAR	0.0049	0.6811	-6.1330 (0.000)***	36826. (0.000)***	65.676 (0.000)***	71.810 (0.000)***	26.510 (0.000)***	5.401 (0.000)***	2.668 (0.004)***	0.272
DLPSMC	0.0127	0.1406	0.742 (0.000)***	2.805 (0.000)***	83.142 (0.000)***	6.940 [0.225)	19.658 (0.001)***	3.894 (0.002)***	2.461 (0.008)***	0.191
DLLUCK	0.0250	0.1509	-0.109 (0.515)	38.529 (0.000)***	2.082 (0.000)***	3.254 (0.660)	35.552 (0.000)***	7.385 (0.000)***	3.970 (0.000)***	0.079
DLDGKC	0.0186	0.1722	0.349 (0.036)**	129.18 (0.000)***	3.768 (0.000)***	9.655 (0.085)*	24.626 [0.000)***	4.622 (0.000)***	2.339 (0.012)***	0.147
DLFCCL	0.0106	0.1613	1.338 (0.000)***	539.68 (0.000)***	7.363 (0.000)***	10.155 (0.070)*	17.182 [0.004)***	3.195 (0.008)***	1.702 (0.082)*	0.107
DLLOTCHEM	0.0026	0.1404	0.215 (0.244)	234.66 (0.000)***	5.689 (0.000)***	5.144 (0.398)	25.367 (0.000)***	5.356 (0.000)***	3.295 (0.000)***	0.114
DLCSAP	0.008	0.139	-0.467 (0.005)***	106.22 (0.000)***	3.347 (0.000)***	3.056 (0.691)	10.688 (0.057)*	2.040 (0.074)*	1.537 (0.128)	0.113
DLMSCL	0.006	0.297	-0.143 (0.394)	2546.4 (0.000)***	17.016 (0.000)***	15.8699 (0.007)***	43.7824 [0.000)***	14.023 (0.000)***	7.2138 (0.000)***	0.040
DLENGRO	0.007	0.124	-0.570 (0.000)***	89.307 (0.000)***	2.9762 (0.000)***	4.127 (0.531)	10.977 (0.051)**	2.043 (0.074)*	1.296 (0.235)	0.077
DLFFC	0.004	0.107	-0.664 (0.000)***	252.55 (0.000)***	5.192 (0.000)***	24.726 (0.000)***	29.096 (0.000)***	5.546 (0.000)***	2.875 (0.002)***	0.097
DLRMPL	-0.064	1.633	0.992 (0.005)***	244.72 (0.000)***	11.382 (0.000)***	-	-	1.937 (0.114)	0.717 (0.700)	0.009

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
DLUPFL	0.015	0.972	-0.389 (0.101)*	7289.8 (0.000)***	41.207 (0.000)***	23.702 (0.000)***	25.778 (0.000)***	5.644 (0.000)***	3.910 (0.000)***	0.081
DLGHGL	0.016	0.247	-0.164 (0.325)	27397.6 (0.000)***	55.823 (0.000)***	41.965 (0.000)***	51.558 (0.000)***	23.406 (0.000)***	12.661 (0.000)***	0.591
DLSTCL	-0.001	0.232	0.074 (0.658)	19335.0 (0.000)***	46.896 (0.000)***	31.221 (0.000)***	51.480 (0.000)***	25.458 (0.000)***	13.728 (0.000)***	0.178
DLBGL	0.004	0.230	0.160 (0.337)	304.57 (0.000)***	5.877 (0.000)***	15.894 (0.007)***	27.207 (0.000)***	7.033 (0.000)***	3.176 (0.000)***	0.029
DLBATA	-0.010	0.625	-0.091 (0.630)	32923.4 (0.000)***	69.411 (0.000)***	42.824 (0.000)***	41.213 (0.000)***	15.218 (0.000)***	10.103 (0.000)***	0.079
DLLEUL	-0.006	0.231	0.113 (0.550)	1039.7 (0.000)***	12.333 (0.000)***	26.861 (0.000)***	36.360 (0.000)***	13.989 (0.000)***	6.622 (0.000)***	0.077
DLPAKL	0.006	0.241	0.195 (0.303)	108.43 (0.000)***	3.964 (0.000)***	5.523 (0.355)	26.184 (0.000)***	5.192 (0.000)***	3.204 (0.001)***	0.120
DLSRVI	0.022	0.804	0.182 (0.337)	24933.3 (0.000)***	60.775 (0.000)***	39.916 (0.000)***	40.114 (0.000)***	20.919 (0.000)***	11.318 (0.000)***	0.071
DLSHFA	0.020	0.170	0.869 (0.000)***	632.05 (0.000)***	8.298 (0.000)***	12.011 (0.034)**	13.449 (0.019)**	1.500 (0.191)	1.639 (0.098)*	0.071
DLTRIPF	0.013	0.113	0.209 (0.211)	14.189 (0.000)***	1.199 (0.000)***	1.837 (0.871)	5.646 (0.342)	1.148 (0.336)	1.885 (0.049)**	0.076
DLPSEL	0.015	0.424	0.156 (0.350)	36063.1 (0.000)***	64.046 (0.000)***	39.877 (0.000)***	51.612 (0.000)***	29.759 (0.000)***	16.497 (0.000)***	0.067
DLMARI	0.018	0.147	0.091 (0.585)	31.110 (0.000)***	1.872 (0.000)***	7.544 (0.183)	13.214 (0.021)**	2.566 (0.028)**	1.777 (0.067)*	0.107
DLPSO	0.007	0.126	-0.351 (0.035)	200.76 (0.000)***	4.726 (0.000)***	3.669 (0.597)	14.872 (0.010)***	2.312 (0.045)**	1.341 (0.211)	0.447

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
DLAPL	0.008	0.104	-0.362 (0.085)	62.540 (0.000)***	3.293 (0.000)***	13.747 (0.017)**	44.757 (0.000)***	7.180 (0.000)***	3.177 (0.001)***	0.111
DLPKGS	0.013	0.284	-0.133 (0.423)	41089.2 (0.000)***	68.364 (0.000)***	34.738 (0.000)***	54.142 (0.000)***	26.709 (0.000)***	14.887 (0.000)***	0.124
DLCEPB	0.007	0.170	-0.136 (0.415)	3171.7 (0.000)***	18.992 (0.000)***	13.347 (0.020)**	55.796 (0.000)***	28.966 (0.000)***	14.294 (0.000)***	0.155
DLSEPL	0.008	0.213	-1.191 (0.000)***	24530.0 (0.000)***	52.768 (0.000)***	30.815 (0.000)***	47.870 (0.000)***	22.422 (0.000)***	10.863 (0.000)***	0.065
DLMERIT	-0.003	0.218	-0.627 (0.000)***	11639.1 (0.000)***	36.363 (0.000)***	26.637 (0.000)***	47.753 (0.000)***	20.638 (0.000)***	10.192 (0.000)***	0.074
DLSEARL	0.017	0.222	0.301 (0.403)	9.909 (0.007)***	2.273 (0.001)***	-	-	2.833 (0.031)**	1.471 (0.215)	0.103
DLHUBC	0.010	0.118	0.469 (0.005)***	113.36 (0.000)***	3.466 (0.000)***	7.640 (0.177)	25.764 (0.000)***	4.146 (0.001)***	3.227 (0.000)***	0.070
DLKAPCO	0.004	0.076	-0.382 (0.070)*	33.224 (0.000)***	2.345 (0.000)***	3.755 (0.585)	10.201 (0.069)*	2.459 (0.036)**	1.436 (0.173)	0.120
DLATRL	0.007	0.156	-0.044 (0.789)	59.671 (0.000)***	2.603 (0.000)***	6.484 (0.261)	37.008 (0.000)***	7.158 (0.000)***	3.814 (0.000)***	0.048
DLNRL	0.016	0.129	-0.018 (0.910)	207.70 (0.000)***	4.860 (0.000)***	8.318 (0.139)	16.420 (0.005)***	3.119 (0.009)***	2.045 (0.030)**	0.154
DLBYCO	0.005	0.186	0.191 (0.314)	59.115 (0.000)***	2.925 (0.000)***	7.033 (0.218)	16.210 (0.006)***	4.001 (0.001)***	2.835 (0.003)***	0.096
DLTICL	0.010	0.201	-0.179 (0.619)	104.49 (0.000)***	7.628 (0.000)***	-	-	2.715 (0.037)**	2.003 (0.083)*	0.076
DLGATI	0.007	0.203	-0.298 (0.074)*	8256.5 (0.000)***	30.639 (0.000)***	19.911 (0.001)***	50.131 (0.000)***	19.255 (0.000)***	9.924 (0.000)***	0.292

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
DLIBFL	0.011	0.187	-0.207 (0.214)	7092.1 (0.000)***	28.399 (0.000)***	18.980 (0.002)***	49.177 (0.000)***	21.520 (0.000)***	11.656 (0.000)***	0.215
DLSGFL	0.003	0.231	-0.024 (0.885)	19182.3 (0.000)***	46.710 (0.000)***	12.221 (0.031)**	11.990 (0.034)**	2.580 (0.027)**	1.237 (0.269)	0.324
DLPSYL	0.008	0.164	0.020 (0.901)	271.30 (0.000)***	5.554 (0.000)***	20.293 (0.001)***	67.319 (0.000)***	14.983 (0.000)***	8.398 (0.000)***	0.059
DLNAFL	-0.000	0.079	-0.049 (0.766)	28509.1 (0.000)***	56.945 (0.000)***	24.420 (0.000)***	17.470 (0.003)***	3.403 (0.005)***	20.560 (0.000)***	0.043
DLTELE	-0.006	0.201	0.487 (0.003)***	34.800 (0.000)***	1.734 (0.000)***	14.270 (0.013)***	16.843 (0.004)***	2.767 (0.019)**	2.969 (0.001)***	0.138
DLIDYM	0.023	1.175	0.279 (0.124)	5203.2 (0.000)***	26.481 (0.000)***	18.886 (0.002)***	33.706 (0.000)***	10.631 (0.000)***	5.916 (0.000)***	0.088
DLFZCM	-0.018	0.473	-0.588 (0.001)***	6097.4 (0.000)***	28.649 (0.000)***	30.187 (0.000)***	38.637 (0.000)***	12.800 (0.000)***	7.700 (0.000)***	0.141
DLGADT	0.011	0.203	-0.211 (0.244)	7516.4 (0.000)***	31.832 (0.000)***	18.263 (0.002)***	42.891 (0.000)***	18.448 (0.000)***	8.9913 (0.000)***	0.194
DLDINT	0.013	0.197	0.322 (0.076)*	409.11 (0.000)***	7.399 (0.000)***	5.173 (0.395)	22.675 (0.000)***	6.693 (0.000)***	5.739 (0.000)***	0.254
DLJKSM	0.005	0.299	-0.124 (0.493)	213.65 (0.000)***	5.361 (0.000)***	22.347 (0.000)***	27.889 (0.000)***	4.850 (0.000)***	4.850 (0.000)***	0.231
DLZTL	-0.001	0.248	-0.010 (0.960)	707.54 (0.000)***	11.563 (0.000)***	27.957 (0.000)***	31.544 (0.000)***	10.276 (0.000)***	4.881 (0.000)***	0.134
DLPAKT	-0.013	1.042	-11.595 (0.000)***	1.723 (0.000)***	147.32 (0.000)***	0.800 (0.977)	0.013 0.999)	0.867 (0.504)	2.104 (0.026)**	0.134
DLPIAA	0.003	0.187	0.538 (0.001)***	188.71 (0.000)***	4.506 (0.000)***	9.094 (0.105)***	25.794 (0.000)***	6.138 (0.000)***	3.340 (0.000)***	0.172

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
DLPNSC	0.017	0.236	-0.041 (0.805)	4257.6 (0.000)***	22.006 (0.000)***	11.264 (0.046)**	46.954 (0.000)***	22.115 (0.000)***	10.886 (0.000)***	0.123
DLPIAB	-0.004	0.201	0.399 (0.017)**	3798.9 (0.000)***	20.772 (0.000)***	31.364 (0.000)***	23.690 (0.000)***	3.960 (0.001)***	7.155 (0.000)***	0.317
DLPICT	0.022	0.252	-0.358 (0.071)*	7989.7 (0.000)***	35.867 (0.000)***	12.199 (0.032)**	37.937 (0.000)***	19.304 (0.000)***	10.708 (0.000)***	0.189
DLPOML	0.019	0.218	0.057 (0.730)	3375.7 (0.000)***	19.595 (0.000)***	12.602 (0.027)**	52.538 (0.000)***	22.432 (0.000)***	11.042 (0.000)***	0.108
DLSURAJ	0.001	0.062	2.379 (0.000)***	10946. (0.000)***	34.962 (0.000)***	20.185 (0.001)***	11.568 (0.041)**	2.503 (0.031)**	1.215 (0.283)	0.317
DLMOIL	-0.004	0.165	0.081 (0.625)	2572.9 (0.000)***	17.106 (0.000)***	15.795 (0.007)***	20.166 (0.001)***	3.338 (0.006)***	1.778 (0.066)*	0.317
DLBNWM	0.004	0.250	-0.092 (0.798)	286.49 (0.000)***	12.644 (0.000)***	-	-	6.132 (0.001)***	2.410 (0.041)**	0.048
DLGLD	0.010	0.052	1.280 (0.000)***	6023.6 (0.000)	25.804 (0.000)***	10.031 (0.074)*	36.847 (0.000)**	11.861 (0.000)***	5.702 (0.000)**	0.257
DLM2	0.011	0.016	0.326 (0.049)**	3.842 (0.146)	0.058 (0.860)	27.468 (0.000)**	20.998 (0.001)**	5.518 (0.000)**	11.598 (0.000)**	0.129
DLFER	0.013	0.072	1.0392 (0.000)	224.82 (0.000)	4.558 (0.000)	7.577 (0.181)	33.885 (0.000)**	12.769 (0.000)**	3.206 (0.001)**	0.402
DLER	0.005	0.089	0.264 (0.110)	40.265 (0.000)	2.053 (0.000)	37.536 (0.000)**	15.255 (0.009)**	4.333 (0.001)**	2.385 (0.011)*	0.044
DLIP	0.005	0.089	0.265 (0.110)	40.265 (0.000)	2.053 (0.000)	37.536 (0.000)**	15.255 (0.009)**	4.334 (0.001)**	2.385 (0.011)*	0.044
DLOP	0.006	0.116	-0.783 (0.000)	80.538 (0.000)	2.557 (0.000)	11.723 (0.038)*	25.005 (0.000)**	4.745 (0.000)**	2.680 (0.004)**	0.139

Variable	Mean	Standard Deviation	Skewness	Jarque-Bera	Excess Kurtosis	Q-stat-(5)	Q2-stat-(5)	ARCH (1-5)	ARCH (1-10)	KPSS
Inf	0.006	0.008	0.508 (0.002)	11.851 (0.003)	0.538 (0.102)	43.331 (0.000)**	133.125 (0.000)**	17.640 (0.000)**	9.005 (0.000)**	A
Irt	0.086	0.033	-0.429 (0.009)***	7.169 (0.027)**	0.246 (0.455)	614.758 (0.000)**	491.071 (0.000)**	98.963 (0.000)**	60.085 [0.000]**	B

Note: P-values are in parenthesis. *** Significant at 1 percent ** significant at 5 percent * significant at 10 percent
KPSS test statistic asymptotic critical values are [1% (0.739), 5% (0.463), 10% (0.347)]. **Skewness:** H_0**:** The series is symmetric (Skewness = 0)], **JB:** H_0: The series is Normal, **Excess Kurtosis:** H_0**:** The series is meso kurtic (EK =0), **LM-ARCH** H0: there is no ARCH effect.

A: The result of Bealieu and Miron seasonal unit root for interest rate reject both the hypothesis of π_1 and π_2 as t-calculated is less then t-tabulated i.e for π_1, -4.094 is less than -3.24 and for π_2, -3.1245 is less than -1.83 so the hypothesis of unit root is said to be rejected and hence we concluded that the interest rate series is I (0) means stationary at level.

B: Same results are found for Inflation, the results for π_1, t-calculated is less then t-tabulated i.e -4.237 is less than -3.19 and for π_2, t-calculated is also less then t-tabulated i.e -3.112 is less than -2.65 so in that way the hypothesis of unit root is said to be rejected and we concluded that the inflation series is I (0) stationary at level.

Note: $H0{:}\pi_1 = 0$ (Seasonal Unit root at zero frequency), $H1{:}\pi_1 < 0$ (No Seasonal Unit root at zero frequency)

$H0{:}\pi_2 = 0$ (Seasonal Unit root at bi-annual frequency), $H1{:}\pi_2 < 0$ (No Seasonal Unit root at bi-annual frequency)

The Table 5.1 provides the descriptive statistics for all the firms under the study. The mean return of all the firms is around zero. As shares are traded in market and market tend to be bearish or bullish, the return observations can be above or below the mean return. Skewness is positive for some of the firms indicating the bearish behavior for the stocks of such firms. Similarly, it is negative for some of the firms indicating the bullish behavior for the stocks of such firms.

The excess kurtosis is positive for all the firms indicating the return series of all the firms being leptokurtic. Q-Statistics on raw series and Q-Statistics on square raw series of the return series indicates the presence of autocorrelation and serial correlation. The possibility of ARCH effect is further calibrated by the LM-ARCH test. The stationarity of all the variable is checked both through Kwiatkowski-phillips-schmidt-shin (KPSS) and Bealieu and Miron (BM) tests, both test results show that all the series are I (0) only the result of inflation and interest rate showing conflict so therefore for these two variable we incorporate the result of BM test.

P-values are given in parentheses. The results of skewness and excess kurtosis are significant leading us to reject the null hypothesis of skewness and excess kurtosis being zero respectively. The return series is not distributed normally for most of the firms as evident from the Jarque-Bera test.

5.3 Results and Discussion for checking the effect of macroeconomic variables on the Return of Non-Financial Sectors:

In this sections we are going to discuss the conditional mean of different firms in the nonfinancial sector and how the selected macroeconomic variables in our study affect their returns.

The table 5.2 shows the impact of macroeconomic variables on the return of non-financial firms of the PSX. This table includes three sector i.e **Automobile Assembler, Cement and Engineering**. If we look towards the first sector Automobile Assembler Most of the macroeconomic variables are insignificant but some of the variables are significant such as exchange rate is effecting the Honda Atlas Cars (Pakistan) Limited (HCAR) negatively. The value of the slope coefficient i.e. -1.014 show that, if we increase the exchange rate by 1 percent then the conditional return of HCAR would decrease by 1.01 percent and the coefficient is significant at 1 percent significance level. Inflation is effecting both Honda Atlas Cars (Pakistan) Limited and Pak Suzuki Motor Company Limited negatively with 3.8 percent and 2.3 percent respectively, it means that the exchange rate and inflation both are effecting the cash flows negatively which lead to decrease the share prices.

Coming towards the Cement sector the results are showing that inflation is effecting both the Lucky Cement Limited (LUCK) and Fauji Cement Company Limited (FCCL) negatively with 2.1 and 2.5 percent respectively, while interest rate is only effecting the D.G Khan Cement Company Limited (DGKC) negatively. The increase in interest rate lead to increase the discount rate and due to which the present value of expected cash flow decreases and once the cash flow of a company decreases it leads to decrease the share prices and vice versa (Martinez-Moya, et al 2013).

Money supply is significant only in case Lucky Cement Limited (LUCK) and has a positive impact on the conditional return of the company, The reason is that whenever the money supply increases in short run it leads to increase the share prices, While industrial production is effecting the conditional return of Fauji Cement Company Limited (FCCL) negatively.

Table 5.2 Effect of Macroeconomic Variables on the Returns of non-financial firms

Sector	**Automobile Assembler**			**Cement**			**Engineering**	
Parameters **Series**	**DLINDU** ARMA(0, 0) GARCH(1,1)	**DLHCAR** ARMA (0, 1) GARCH(1,1)	**DLPSMC** ARMA (0, 1) GARCH(1,1)	**DLLUCK** ARMA (0, 0) GARCH(1,1)	**DLDGKC** ARMA (1, 1) GARCH(1,1)	**DLFCCL** ARMA (4, 4) GARCH(1,1)	**DLCSAP** ARMA (0, 0) GARCH(1,1)	**DLMSCL** ARMA (0, 0) GARCH(1,1)
Constant(M)	0.033 (0.207)	0.064 (0.059)**	0.030 (0.393)	0.047 (0.111)	0.083 (0.028)**	0.054 (0.070)*	0.033 (0.124)	-0.001 (0.987)
Constant(V)	0.003 (0.077)*	0.002 (0.189)	0.003 (0.096)*	0.000 (0.298)	0.003 (0.298)	0.006 (0.012)***	0.009 (0.482)	0.000 (1.000)
DLGLD(M)	-0.181 (0.242)	0.032 (0.840)	0.278 (0.165)	0.014 (0.944)	0.222 (0.218)	0.327 (0.159)	-0.057 (0.767)	-0.053 (0.836)
DLM2(M)	-0.120 (0.845)	0.529 (0.365)	0.027 (0.967)	0.961 (0.025)**	-0.250 (0.715)	-0.301 (0.662)	-0.016 (0.976)	-0.057 (0.780)
DLFER(M)	0.1518 (0.334)	-0.153 (0.285)	-0.000 (0.998)	-0.244 (0.201)	-0.194 (0.293)	-0.108 (0.283)	-0.062 (0.674)	0.005 (0.973)
DLER(M)	-0.152 (0.334)	-1.014 (0.025)**	-0.635 (0.139)	-0.082 (0.906)	0.154 (0.794)	-0.812 (0.116)	0.290 (0.787)	-0.076 (0.953)
DLIP(M)	-0.005 (0.961)	0.051 (0.570)	-0.055 (0.589)	0.043 (0.703)	-0.005 (0.969)	-0.201 (0.104)*	0.099 (0.371)	-0.011 (0.929)
DLOP(M)	0.069 (0.374)	0.062 (0.445)	-0.012 (0.860)	0.097 (0.285)	-0.051 (0.674)	-0.082 (0.376)	-0.013 (0.848)	0.002 (0.957)
Inf(M)	-1.446 (0.223)	-3.741 (0.007)***	-2.280 (0.109)*	-2.128 (0.097)*	-1.882 (0.157)	-2.491 (0.018)***	-1.753 (0.201)	0.039 (0.914)
Irt(M)	-0.015 (0.958)	-0.259 (0.445)	-0.163 (0.587)	-0.130 (0.635)	-0.555 (0.096)*	-0.330 (0.268)	-0.204 (0.299)	0.026 (0.974)
ARCH(Alpha1)	0.348 (0.034)**	0.117 (0.181)	0.022 (0.747)	0.122 (0.081)*	0.219 (0.108)*	0.262 (0.172)	0.164 (0.450)	0.416 (0.658)
GARCH(Beta1)	0.348 (0.033)**	0.797 (0.000)***	0.845 (0.000)***	0.863 (0.000)***	0.646 (0.002)***	0.517 (0.000)***	0.648 (0.006)***	0.678 (0.527)
Student (DF)	-	4.580 (0.002)***	3.248 (0.001)***	7.310 (0.015)***	5.538 (0.009)***	3.623 (0.039)**	2.527 (0.029)**	2.214 (0.002)***
Residual Diagnostic Test								
Q-stat(5)	2.717 (0.743)	2.620 (0.623)	2.647 (0.618)	3.746 (0.586)	5.691 (0.127)	2.722 (0.256)	1.747 (0.882)	0.055 (0.999)
Q^2-stat (5)	5.265 (0.153)	2.564 (0.463)	20.328 (0.000)**	4.705 (0.194)	13.516 (0.003)**	9.786 (0.020)*	6.262 (0.099)	0.031 (0.998)
LM-ARCH **(1-5)**	0.260 (0.770)	0.817 (0.443)	4.061 (0.001)**	0.813 (0.541)	2.360 (0.041)*	1.812 (0.112)	1.134 (0.343)	0.006 (1.000)

Null Hypotheses(All Null Hypotheses are for nth order) , Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** significant at 5 percent * significant at 10percent**.

In Table 5.3, the results for firms from three sectors (**Fertilizer, Glass and Ceramics, and Leather and Tanneries)** has been provided. GOLD is significant in determining the conditional return for Engro Corporation Limited (ENGRO) only while industrial production is significant for Engro Corporation Limited (ENGRO) and Fauji Fertilizer Company Limited (FFC) in Fertilizer sector. Both of the macroeconomic variables affect the Conditional return positively. All the macroeconomic variables are insignificant in case of Glass and Ceramics except inflation and interest rate which are significant for Baluchistan Glass Limited (BGL) and Shabbir Tiles and Ceramics Limited (STCL) respectively. Both the variables (inflation and interest rate) affect the conditional return negatively.

In the Leather and Tanneries sector all macroeconomic variables are insignificant for Pak Leather Crafts Limited, Leather Up Industries Limited and Unilever Pakistan Foods Limited (PAKL, LEUL, and SRVI). Inflation and interest rate is significant for Bata Pakistan.

The results of diagnostics show that ARCH and GARCH models in mean for the following sectors: Automobile Assembler, Cement, Engineering, Fertilizers, Leather and Tanneries and Glass and Ceramics, are identically and independently distributed.

Table 5.3 Effect of Macroeconomic Variables on the Returns of non-financial firms

SECTOR	Fertilizer				Glass And Ceramics		Leather And Tanneries		
Parameters Series	DLENGRO ARMA (0, 0) GARCH(1,1)	DLFFC ARMA (1, 1) GARCH(1,1)	DLGHGL ARMA (0, 2) GARCH(1,1)	DLSTCL ARMA (2, 2) GARCH(1,1)	DLBGL ARMA (1, 1) GARCH(1,1)	DLBATA ARMA (4, 4) GARCH(1,1)	DLLEUL ARMA (0, 1) GARCH(1,1)	DLPAKL ARMA (0,0) GARCH(1,1)	DLSRVI ARMA(0,0) GARCH(1,1)
Constant(M)	0.002 (0.889)	0.021 (0.325)	0.036 (0.174)	0.027 (0.071)	-0.010 (0.752)	0.105 (0.000)***	-0.006 (0.843)	0.003 (0.259)	0.008 (0.907)
Constant(V)	0.002 (0.102) *	0.002 (0.404)	0.009 (0.126)	0.228 (0.012)	0.048 (0.457)	-0.046 (0.694)	0.002 (0.276)	0.000 (0.000) ***	0.002 (0.856)
DLGLD(M)	0.291 (0.002)***	0.122 (0.299)	0.125 (0.338)	-0.227 (0.716)	0.006 (0.983)	-0.046 (0.694)	0.095 (0.848)	0.120 (0.040) **	0.965 (0.011)***
DLM2(M)	0.745 (0.115)	0.385 (0.247)	-0.214 (0.781)	-0.227 (0.716)	0.760 (0.197)	-1.035 (0.242)	0.158 (0.872)	0.054 (0.324)	1.280 (0.524)
DLFER(M)	-0.015 (0.909)	0.050 (0.634)	0.034 (0.745)	-0.009 (0.939)	-0.104 (0.526)	0.055 (0.746)	-0.044 (0.791)	-0.022 (0.056)*	-2.493 (0.069)*
DLER(M)	-0.601 (0.128)	-0.310 (0.449)	0.148 (0.786)	0.315 (0.770)	0.282 (0.813)	-0.601 (0.221)	0.523 (0.363)	-0.121 (0.182)	-0.146 (0.989)
DLIP(M)	0.146 (0.103)*	0.134 (0.080)*	0.004 (0.957)	0.026 (0.778)	-0.008 (0.949)	-0.011 (0.889)	0.008 (0.951)	0.020 (0.174)	-0.052 (0.941)
DLOP(M)	-0.009 (0.896)	0.010 (0.870)	0.087 (0.203)	0.077 (0.132)	-0.108 (0.387)	-0.110 (0.101)*	0.076 (0.520)	0.005 (0.290)	0.378 (0.242)
Inf(M)	0.770 (0.493)	-0.110 (0.896)	-1.596 (0.125)	-0.722 (0.468)	-2.206 (0.104)***	-7.115 (0.000)***	0.301 (0.863)	0.032 (0.697)	-3.600 (0.578)
Irt(M)	-0.058 (0.752)	-0.218 (0.367)	0.087 (0.203)	-0.308 (0.015)***	0.097 (0.787)	-0.947 (0.000)***	0.073 (0.834)	-0.037 (0.256)	-0.230 (0.769)
ARCH(Alpha1)	0.194 (0.021)**	0.281 (0.133)	0.272 (0.294)	0.098 (0.425)	1.000 (0.205)	1.000 (0.000)***	0.241 (0.044)**	0.881 (0.000)***	1.000 (0.000)***
GARCH(Beta1)	0.688 (0.000)***	0.569 (0.055)**	0.360 (0.055)**	0.852 (0.071)*	0.709 (0.001)***	0.321 (0.005)***	0.748 (0.000)***	0.471 (0.000)***	0.486 (0.001)***
Student (DF)	5.027 (0.006) ***	3.288 (0.001) ***	3.105 (0.002)***	2.011 (0.000)***	2.080 (0.000)***	-	-	3.159 (0.000)***	-
Residual Diagnostic Test									
Q-stat(5)	1.347 (0.929)	4.972 (0.173)	4.090 (0.251)	9.238 (0.002)**	5.086 (0.165)	16.514 (0.000)***	8.177 (0.085)	0.535 (0.990)	1.960 (0.854)
Q^2-stat (5)	10.810 (0.013)*	1.872 (0.599)	0.099 (0.991)	2.307 (0.511)	1.293 (0.730)	1.587 (0.662)	1.809 (0.612)	0.044 (0.997)	0.300 (0.959)
LM-ARCH (1-5)	2.101 (0.066)*	1.872 (0.599)	0.017 (0.999)	0.443 (0.817)	0.234 (0.946)	0.308 (0.907)	0.310 (0.906)	0.008 (1.000)	0.054 (0.998)

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect. P-values are in the parenthesis.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

Table 5.4, includes **Chemical, Miscellaneous, Paper and Board** sector's all the macroeconomic variables are insignificant in determining the conditional return for Lotte Chemical Pakistan Limited (LOTCHEM) in the Chemical sector. In the group of Miscellaneous firms only exchange rate is significant for Shifa International Hospitals Limited (SHFA) and affects the conditional return negatively with 65 percent. All macroeconomic variables are insignificant for the remaining firms in that group.

In Paper and Board sector gold prices are significant and affects the conditional return positively for Packages Limited (PKGS) and Merit Packaging Limited (MERIT) with 16 and 11 percent respectively. FER is significant for PKGS only and affects the conditional return negatively. ER is significant for SEPL and MERIT affects the conditional return negatively. The effect of exchange rate on the return of SEPL is more than the MERIT by 29 percent. Industrial production is significant for MERIT only. It affects the conditional return negatively. Inflation is significant for SEPL, Century Paper and Board Mills Limited (CEPB) and MERIT and affects the conditional return negatively. Interest rate is significant for MERIT only and affects the conditional return negatively with the value 0.3118, it shows that if we increase the interest rate by one percent the conditional mean for the MERIT firm would decrease by 31 percent.

In the above table the conditional return of all the sectors i.e chemical, miscellaneous and paper & board satisfy the property of identically independently distribution of the financial data. The data of PKGS firm in the paper & board sector is non-confirmative with the null hypothesis of **Q-stat (5)** and **Q^2-stat (5).**

Table 5.4 Effect of Macroeconomic Variables on the Returns of non-financial firms

	Chemical	Miscellaneous			Paper and Board			
Parameters Series	**DLLOTCHEM ARMA (1,1) GARCH(1,1)**	**DLSHFA ARMA (0,0) GARCH(1,1)**	**DLTRIPF ARMA(0,0) GARCH(1,1)**	**DLPSEL ARMA (0, 0) GARCH(1,1)**	**DLPKGS ARMA(1,1) GARCH(1,1)**	**DLSEPL ARMA (1,1) GARCH(1,1)**	**DLCEPB ARMA(0,1) GARCH(1,1)**	**DLMERIT ARMA (1,1) GARCH(1,1)**
Constant(M)	0.001 (0.961)	0.002 (0.901)	0.022 (0.380)	0.0122 (0.2160)	0.0447 (0.0012) ***	0.0384 (0.0608) *	0.0377 (0.0645) *	0.0317 (0.0027) ***
Constant(V)	0.0014 (0.490)	0.0386 (0.5295)	0.0012 (0.0349) **	0.0067 (0.2351)	0.0028 (0.0038) ***	0.0035 (0.3051)	0.0080 (0.0605) *	0.0000 (1.0000)
DLGLD(M)	-0.0992 (0.427)	0.1233 (0.1727)	0.1534 (0.2662)	-0.0439 (0.4511)	0.1556 (0.0200)**	0.1016 (0.2482)	0.0893 (0.4810)	0.1112 (0.0807) *
DLM2(M)	0.5609 (0.262)	-0.1588 (0.7392)	-0.2627 (0.6313)	-0.1129 (0.7350)	0.4026 (0.2182)	-0.3788 (0.7366)	-0.5892 (0.3995)	0.0774 (0.7344)
DLFER(M)	0.0526 (0.860)	0.1157 (0.3945)	-0.1130 (0.3418)	0.0205 (0.6145)	-0.3064 (0.0001) ***	-0.1494 (0.2242)	-0.0795 (0.6294)	-0.0051 (0.8654)
DLER(M)	-0.3251 (0.678)	-0.6550 (0.0784) *	-0.4854 (0.2729)	-0.0585 (0.6199)	-0.0921 (0.7895)	-1.8613 (0.0108) **	-	-0.5727 (0.0839) *
DLIP(M)	0.1107 (0.471)	-0.0078 (0.9424)	-0.1246 (0.2117)	0.0064 (0.8834)	-0.0713 (0.1279)	-0.0342 (0.7039)	0.1139 (0.2459)	-0.0452 (0.0002) ***
DLOP(M)	-0.026 (0.820)	-0.0005 (0.9928)	0.0011 (0.9881)	0.0169 (0.5971)	-0.0641 (0.1639)	0.1296 (0.1259)	0.0404 (0.6345)	0.0007 (0.9751)
Inf(M)	-0.613 (0.6410)	-0.6550 (0.4436)	-1.1487 (0.3616)	0.5931 (0.4157)	-1.3195 (0.1125)	-7.2734 (0.0000) ***	-2.0290 (0.0791) *	-2.3692 (0.0342) **
Irt(M)	-0.1251 (0.7367)	0.1244 (0.5238)	0.0037 (0.9847)	-0.1204 (0.2264)	-0.3496 (0.0279) **	0.2275 (0.1001) *	-0.2226 (0.3508)	-0.3118 (0.0010) ***
ARCH(Alpha1)	0.1205 (0.4311)	1.0000 (0.2029)	0.0459 (0.5213)	1.0000 (0.0199) **	1.0000 (0.0119) **	1.000 (0.0441) **	0.1660 (0.3283)	1.0000 (0.0187) **
GARCH(Beta1)	0.7950 (0.000)***	0.2784 (0.0215) **	0.8562 (0.0000) ***	0.1944 (0.0984) *	0.1512 (0.0684) *	0.2746 (0.0277) **	0.4679 (0.0032) ***	0.7655 (0.0000) ***
Student (DF)	3.6461 (0.0035) ***	2.1673 (0.0000) ***	5.2079 (0.0002) ***	2.2891 (0.0000) ***	-	-	3.422 (0.0007) ***	2.1515 (0.0000) ***
Residual Diagnostic Test								
Q-stat(5)	1.8515 [0.6037]	3.97082 [0.5536]	2.9681 [0.7048]	0.732 [0.9811]	15.8876 [0.0011]**	1.4329 [0.6978]	2.787 [0.5939]	2.2998 [0.5125]
Q^2-stat (5)	3.1300 [0.3719]	1.3660 [0.7135]	6.6657 [0.0833]*	0.08221 [0.9938]	7.5068 [0.0573]*	1.2915 [0.7311]	6.0051 [0.1113]	0.4497 [0.9297]
LM-ARCH (1-5)	0.58023 [0.7151]	0.2011 [0.9617]	1.4891 [0.1950]	0.0159 [0.9999]	1.457 [0.2057]	0.26202 [0.9333]	1.2850 [0.2718]	0.0911 [0.9936]

Null Hypotheses(All Null Hypotheses are for nth order) , Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect. Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

The above table 5.5, in **Food and personal care** sector all the macroeconomic variables are insignificant for Rafhan Maize Products Limited (RMPL). Gold prices (GLD) are significant and affect conditional return of Unilever Pakistan Food Limited (UPFL) positively while Exchange rate and Interest rate are significant and affect the conditional return negatively. In **Power Generation** sector money supply (M2), exchange rate (ER) and Inflation are significant and affect the conditional return of Hub Power Company Limited (HUBC) negatively. Interest rate is significant and affects the conditional return positively for HUBC with the percentage 0.31. All the macroeconomic variables are insignificant for Kot Addu Power Company Limited (KAPCO) in Power Generation sector.

In **Refinery** sector, FER, ER and IP affect the conditional return negatively for Attock Refinery Limited (ATRL) with 26, 75 and 24 percent respectively. Among the significant macroeconomic variables, ER has more effect on the conditional return of ATRL. Similarly, Gold prices (GLD) and Interest rate are affecting the conditional return of National Refinery Limited (NRL) negatively. Other macroeconomic variables for these firms are insignificant. All the macroeconomic variables are insignificant for Petroleum Pakistan Limited (BYCO) in this sector.

In Oil and Gas Marketing, only FER affects the conditional return of PSO negatively with other macroeconomic variables being insignificant. ER has a significant and negative effect of 57 percent on the conditional return of APL while other macroeconomic variables being insignificant.

Table. 5.5. Effect of Macroeconomic Variables on the Returns of non-financial firms

Sectors	**Food and personal care Product**		**Power Generation**		**Refinery**			**Oil & Gas Marketing Companies**	
Parameters Series	**DLRMPL ARMA (1, 1) GARCH(1,1)**	**DLUPFL ARMA(0,0) GARCH(1,1)**	**DLHUBC ARMA (1,1) GARCH(1,1)**	**DLKAPCO ARMA(0,0) GARCH(1,1)**	**DLATRL ARMA (0, 0) GARCH(1,1)**	**DLNRL ARMA(0,0) GARCH(1,1)**	**DLBYCO ARMA (2, 2) GARCH(1,1)**	**DLPSO ARMA(0,0) GARCH(1,1)**	**DLAPL ARMA(0,0) GARCH(1,1)**
Constant(M)	0.017 (0.090)*	0.288 (0.036)**	0.007 (0.319)	0.043 (0.109)	0.013 (0.593)	0.0471 (0.0529) **	0.0309 (0.4348)	0.0248 (0.2376)	-0.0042 (0.9235)
Constant(V)	0.010 (0.326)	0.009 (0.003)***	0.000 (0.201)	16.889 (0.707)	0.003 (0.098) *	0.0063 (0.0095)	0.0148 (0.2747)	0.0024 (0.1365)	15.8468 (0.1175)
DLGLD(M)	-0.015 (0.806)	1.712 (0.073)*	-0.225 (0.128)	0.093 (0.559)	-0.069 (0.804)	-0.1066 (0.0618)**	0.1054 (0.5782)	0.1861 (0.3598)	-0.1559 (0.2055)
DLM2(M)	0.396 (0.168)	-0.205 (0.854)	-0.669 (0.092) *	-0.146 (0.764)	-0.339 (0.577)	0.0829 0.8665	-0.5298 (0.4826)	-0.0239 (0.9605)	0.1536 (0.7748)
DLFER(M)	-0.082 (0.261)	0.126 (0.481)	0.034 (0.747)	-0.066 (0.551)	-0.256 (0.008)***	0.0282 (0.7816)	-0.0037 (0.9760)	-0.2217 (0.0515)**	0.0372 (0.7150)
DLER(M)	0.159 (0.599)	-9.304 (0.001) ***	-0.836 (0.037) **	-0.762 (0.341)	-0.747 (0.054) **	-0.4240 (0.4194)	0.1974 (0.8805)	-0.4594 (0.3180)	-0.5753 (0.0599) *
DLIP(M)	0.011 (0.872)	-0.247 (0.473)	0.007 (0.923)	-0.078 (0.274)	-0.214 (0.017) **	-0.0078 (0.9149)	0.1721 (0.2933)	-0.0154 (0.8503)	0.0483 (0.5648)
DLOP(M)	0.045 (0.400)	0.281 (0.117)	-0.057 (0.154)	0.067 (0.250)	-0.1184 (0.2266)	0.0490 (0.5031)	0.0231 (0.8152)	0.0131 (0.7927)	0.0489 (0.4288)
Inf(M)	-0.711 (0.479)	0.734 0.782	-1.776 (0.009) ***	-0.530 (0.502)	-0.9930 (0.4647)	-0.0991 (0.9400)	0.2363 (0.8637)	-0.8838 (0.4267)	0.3801 (0.5774)
Irt(M)	-0.091 (0.437)	-2.605 (0.037) **	0.315 (0.000) ***	-0.298 (0.221)	0.0582 (0.8408)	-0.3891 (0.0863)*	-0.2912 (0.5139)	-0.1552 (0.4407)	0.1270 (0.7636)
ARCH(Alpha1)	0.010 (0.326)	1.000 (0.000) ***	0.196 (0.077) *	0.165 (0.452)	0.8733 (0.0318) **	0.2306 0.0937*	0.2855 (0.2852)	0.2221 (0.2226)	0.4777 (0.0788) *
GARCH(Beta1)	0.278 (0.001)***	-0.000 (0.997)	0.779 (0.000) ***	0.549 (0.567)	0.3734 (0.0082)***	0.4929 (0.0000)***	0.4493 (0.0685)**	0.6760 (0.0000)***	0.5402 (0.0000)***
Student (DF)	2.276 (0.000)***	-	3.743 (0.000) ***	3.423 (0.000)***	3.7709 (0.0361)**	3.067695 (0.0000)***	2.7234 (0.0041) ***	0.0024 (0.1365)	2.7909 (0.0000)***
Residual Diagnostic Test									
Q-stat(5)	0.309575 [0.9582]	1.9308 [0.8586]	2.07702 [0.5565]	2.5743 [0.7652]	1.6198 [0.8988]	6.2739 [0.2804]	2.2109 [0.1370]	0.0024 [0.1365]	8.6783 [0.1226]
Q^2-stat (5)	0.0270 [0.9988]	0.8390 [0.8400]	1.16613 [0.7611]	1.5385 [0.6734]	1.8543 [0.6031]	5.1720 [0.1596]	1.0622 [0.7861]	1.5908 [0.6614]	1.9139 [0.5904]
LM-ARCH (1-5)	0.005 [1.0000]	0.1419 [0.9819]	0.2142 [0.9562]	0.1188 [0.9880]	0.3747 [0.8656]	0.9247 [0.4660]	0.1944 [0.9644]	0.57997 [0.7153]	0.30443 [0.9094]

Null Hypotheses(All Null Hypotheses are for nth order), Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect. Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

In table 5.6, there are four sectors: **Oil and gas exploration company, Pharmaceutical, Sugar & allied industry and Synthetic and Royon**. In the Oil and gas exploration company GLD is significant and affects the conditional return of MARI positively with 22 percent. In Pharmaceutical sector, Money supply (M2) affects the conditional return of SEARL positively with the value 0.93. This shows that if we increase the money supply in the economy by 1 percent, the conditional return of the SEARL would increase by 93 percent, the slope coefficient is statistically significant at 5 percent significance level.

In Sugar and Allied industries sector all the macroeconomic variables are insignificant. In synthetic and Royon sector, all the macroeconomic variables are insignificant for Gatron Industries Limited (GATI) and Pakistan Synthetics Limited (PSYL). The conditional return of Ibrahim Fiber Limited (IBFL) is positively and significantly affected by the money supply by 17 percent. For S.G. Fiber Limited (SGFL), the variables of IP and Inflation are significant and affect the conditional return positively whereas Oil prices (OP) is significant and affects the conditional return negatively.

For National Fibers Limited (NAFL) only the variable of Interest rate is significant and affects the conditional return positively with 1 percent. The diagnostic test on the residuals of conditional return series of all the above sectors in the table 5.6 are i.i.d. except the firm TICL and GATI.

Table 5.6 Effect of Macroeconomic Variables on the Returns of non-financial firms

Sector	**Oil and gas exploration company**	**Pharmaceutical**	**Sugar and allied industry**	**Synthetic and Royon**				
Parameters Series	**DLMARI ARMA (1, 1) GARCH (1,1)**	**DLSEARL ARMA (0,0) GARCH (1,1)**	**DLTICL ARMA(2,2) GARCH (1,1)**	**DLGATI ARMA(0,0) GARCH (1,1)**	**DLIBFL ARMA (1,1) GARCH (1,1)**	**DLSGFL ARMA (0,1) GARCH (1,1)**	**DLPSYL ARMA (0,0) GARCH (1,1)**	**DLNAFL ARMA (0, 0) GARCH (1,1)**
Constant(M)	0.046 (0.086)***	0.011 (0.659)	-0.0004 (0.4952)	0.0122 (0.6003)	-0.0085 (0.1316)	-0.0000 (0.5388)	-0.0139 (0.6858)	-0.0005 (0.0000)***
Constant(V)	0.004 (0.875)	0.004 (0.1186)	0.0000 (1.0000)	0.3103 (0.8146)	0.0000 (0.0000)***	0.0068 (0.0183) **	0.0035 (0.4595)	0.0009 (0.0002)***
DLGLD(M)	0.228 (0.009) ***	0.118 (0.169)	-0.0051 (0.4922)	0.2575 (0.1443)	0.0687 (0.2336)	-0.0003 (0.1134)	-0.0240 (0.7298)	-0.0000 (0.9861)
DLM2(M)	0.258 (0.680)	0.927 (0.017) **	0.0172 (0.5903)	-0.4975 (0.4783)	0.1740 (0.0675)*	-0.0000 (0.8800)	0.5257 (0.2739)	-0.0013 (0.4306)
DLFER(M)	-0.025 (0.819)	-0.137 (0.297)	-0.0002 (0.9516)	0.0474 (0.5799)	-0.0237 (0.3782)	0.0000 (0.4912)	-0.1823 (0.2532)	0.0000 (0.9065)
DLER(M)	-0.136 (0.9233)	-0.249 (0.536)	0.0029 (0.7300)	0.5746 (0.2957)	-0.0222 (0.7860)	0.0004 (0.5799)	-0.6955 (0.1894)	-0.0007 (0.4280)
DLIP(M)	-0.0552 (0.6241)	0.012 (0.885)	-0.0018 (0.6470)	-0.2014 (0.1157)	0.0043 (0.8622)	0.0007 (0.0000)***	-0.0405 (0.6901)	-0.0000 (0.9556)
DLOP(M)	0.0048 (0.9606)	0.037 (0.646)	0.0006 (0.7207)	0.0664 (0.4391)	-0.0198 (0.5375)	-0.0003 (0.0052)***	-0.0390 (0.6235)	0.0000 (0.8719)
Inf(M)	-1.9263 (0.1710)	-0.079 (0.937)	0.0524 (0.6205)	-0.7279 (0.5709)	-0.0919 (0.7006)	0.0038 (0.0000)***	-1.2563 (0.2682)	-0.0092 (0.1645)
Irt(M)	-0.3803 (0.1310)	-0.144 (0.588)	0.0024 (0.7324)	-0.2151 (0.3654)	0.0738 (0.2530)	-0.0002 (0.3383)	0.2002 (0.5631)	0.0060 (0.0000)***
ARCH(Alpha1)	0.5599 (0.8456)	0.885 (0.030) **	1.0000 (0.0085)***	1.0000 (0.4881)	0.5273 (0.0000)***	0.9316 (0.0021)***	0.3066 (0.2628)	0.5149 (0.0809) *
GARCH(Beta1)	0.8834 (0.0000) ***	0.243 (0.075) *	1.0000 (0.0000)***	0.7588 (0.0007)***	0.4928 (0.0000)***	0.0568 (0.6164)	0.6207 (0.0603) *	0.5272 (0.0000)***
Student (DF)	2.1269 (0.0074) ***	4.009 (0.011) ***	2.0008 (0.0000) ***	2.0113 (0.0000) ***	2.8831 (0.0000)	2.0110 (0.0000)***	3.5022 (0.0006) ***	2.0823 (0.0000)***
Residual Diagnostic Test								
Q-stat(5)	4.2550 [0.2352]	4.55797 [0.4721649]	15.6504 [0.0000]**	6.4497 [0.2648]	2.2637 [0.5195]	0.0057 [0.9999]	6.7710 [0.2382]	2.7473 [0.7388]
Q^2-stat (5)	2.2389 [0.5243]	0.988965 [0.8039]	16.5393 [0.0008]**	16.7450 [0.0007]**	0.6889 [0.8757]	0.2202 [0.9742]	3.0780 [0.3797]	0.1204 [0.9892]
LM-ARCH (1-5)	0.3449 [0.8850]	0.17875 [0.9703]	3.7776 [0.0027]**	3.6891 [0.0033]**	0.13351 [0.9845]	0.0437 [0.9989]	0.80564 [0.5469]	0.9076 [0.4771]

Null Hypotheses(All Null Hypotheses are for nth order),
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The above table 5.7, shows the results of the conditional returns of different firms of four sectors: **Technology & Communication, Textile Spinning, Textile Weaving, and Tobacco.** All the macroeconomic variables under study are insignificant for Telecard Limited (TELE) in Technology & Communication sector, Indus Dyeing Manufacturing Company Limited (IDYM) and J.K. Spinning Mills Limited (JKSM) in the Textile Spinning sector.

In the Textile Spinning sector, FER is significant and affects the conditional return of Fazal Cloth Mills Limited (FZCM) negatively with 13 percent. Inflation is significant and has negative affect on the conditional return of Gadoon Textile Mills Limited (GADT) and Din Textile Mills Limited (DINT). The conditional return of DINT is positively affected by exchange rate (ER) and is significant as well.

In the Textile Weaving and Tobacco sector, the ER affect the conditional return of Zephyr Textile Limited (ZTL) and Pakistan Tobacco Company Limited (PAKT) negatively with the value 1.25 and 1.64 respectively. The effect of the exchange rate on the Tobacco sector is greater than the Textile Weaving sector.

The results of the residual diagnostics full-fill the property of i.i.d. for all the firms under four sector except TELE firm in the Technology and Communication sector.

Table 5.7 Effect of Macroeconomic Variables on the Returns of non-financial firms

Sector	**Technology & Communication**	**Textile Spinning**					**Textile weaving**	**Tobacco**
Parameters Series	**DLTELE ARMA (0,0) GARCH (1,1)**	**DLIDYM ARMA (0,1) GARCH (1,1)**	**DLFZCM ARMA (1,1) GARCH (1,1)**	**DLGADT ARMA (1, 1) GARCH (1,1)**	**DLDINT ARMA (1,1) GARCH (1,1)**	**DLJKSM ARMA (1,1) GARCH (1,1)**	**DLZTL ARMA(0,0) GARCH (1,1)**	**DLPAKT ARMA(0,0) GARCH (1,1)**
Constant(M)	-0.0082 (0.8407)	0.0264 (0.2688)	-0.0132 (0.4167)	0.0172 (0.0741) *	0.0215 (0.2802)	0.0002 (0.6242)	0.0136 (0.7502)	0.0137 (0.8476)
Constant(V)	0.0501 (0.5763)	0.0127 (0.3887)	0.0082 (0.5476)	0.0033 (0.8203)	0.0336 (0.2201)	0.0000 (0.0000)***	0.0443 (0.2536)	0.3646 (0.8461)
DLGLD(M)	-0.1331 (0.7088)	-0.0370 (0.6193)	-0.1402 (0.1357)	-0.1916 (0.1152)	-0.1319 (0.2070)	-0.0019 (0.7213)	0.3125 (0.4138)	0.1483 (0.3565)
DLM2(M)	1.2605 (0.1067)	0.253 (0.6328)	0.3312 (0.3786)	-0.4315 (0.5092)	-0.5778 (0.2265)	-0.0398 (0.5380)	0.8610 (0.1144)	0.7009 (0.4506)
DLFER(M)	-0.1559 (0.4699)	-0.0548 (0.5796)	-0.1280 (0.0983)*	-0.2047 (0.1430)	0.1023 (0.1784)	-0.0024 (0.4414)	-0.1897 (0.1663)	-0.1567 (0.5696)
DLER(M)	-0.8273 (0.7095)	-0.2243 (0.4114)	0.403 (0.6744)	-0.1808 (0.6629)	1.6773 (0.0000)***	-0.0006 (0.8915)	-1.2501 (0.0001)***	-1.6399 (0.0000)***
DLIP(M)	0.0690 (0.7298)	-0.1460 (0.1897)	0.0276 (0.6822)	-0.0013 (0.9930)	0.0502 (0.5709)	-0.0005 (0.8749)	-0.0569 (0.6178)	-0.1284 (0.2286)
DLOP(M)	0.0212 (0.9042)	0.0088 (0.9078)	-0.0077 (0.8881)	-0.0720 (0.5028)	0.0304 (0.6268)	-0.0036 (0.4867)	-0.1217 (0.1046)	0.0132 (0.9054)
Inf(M)	-0.0676 (0.9795)	-1.6937 (0.2243)	-1.3626 (0.2749)	-3.2437 (0.0000)***	-1.9327 (0.0401)**	-0.0513 (0.2333)	0.1490 (0.8988)	0.0330 (0.9855)
Irt(M)	-0.1816 (0.6582)	-0.0921 (0.7098)	0.267 (0.1317)	-0.1960 (0.1141)	-0.0156 (0.9441)	0.0000 (0.9975)	-0.3127 (0.4629)	-0.1528 (0.8297)
ARCH(Alpha 1)	0.0000 (1.0000)	0.1332 (0.5615)	1.0000 (0.4579)	0.0685 (0.7620)	1.0000 (0.0582)*	1.0000 (0.0024)***	1.0000 (0.0416)**	0.0000 (1.0000)
GARCH(Beta 1)	0.9116 (0.0000)***	0.9266 (0.0000)***	0.8006 (0.0000)***	0.9450 (0.0000)***	0.0000 (1.0000)	0.3965 (0.0002)***	0.0000 (1.0000)	0.4798 (0.4326)
Student (DF)	2.0501 (0.0000)***	2.0442 (0.0000)***	2.0697 (0.0000)***	2.1449 (0.0000)***	2.3657 (0.0000)***	2.3314 (0.0000)***	2.4354 (0.0000)***	2.0214 (0.0000)***
Residual Diagnostic Test								
Q-stat(5)	31.2982 [0.0000]**	10.2035 [0.0371]*	8.7383 [0.0329]*	5.9520 [0.1139]	3.6959 [0.2962]	0.0273 [0.9988]	0.6893 [0.9835]	4.5948 [0.4672]
Q^2-stat (5)	25.6334 [0.0000]**	6.3988 [0.0937]	0.3307 [0.9541]	4.7773 [0.1888]	2.1163 [0.5486]	0.1274 [0.9883]	0.1447 [0.9859]	0.1814 [0.9805]
LM-ARCH (1-5)	5.3674 [0.0001]**	1.2855 [0.2725]	0.058828 [0.9977]	0.9416 [0.4556]	0.3674 [0.8703]	0.0247 [0.9997]	0.0284 [0.9996]	0.0322 [0.9995]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

Table 5.8, shows the results of the conditional mean of the last three non-financial sectors, which includes **Transport, Vanaspati & Allied Industries, and Woolen sector**.

Gold prices has positive and significant effect on the conditional return of Pakistan International Airlines Corporation (PIAA) in the transport sector. Similarly Money supply has positive significant effect on the conditional return of PIAA and Pakistan National Shipping Corporation Limited (PNSC). FER and IP has negative and significant effect on the conditional return of PIAA. Interest rate has a significant negative effect on the conditional return of PNSC and Pakistan International Airlines Corporation (B Class Shares) (PIAB). All the macroeconomic variables are insignificant for Pakistan International Container Terminal Limited (PICT) in the Transport sector.

In the Vanaspati & Allied Industries sector, for Punjab Oil Mills Limited (POML) interest rate is positively and highly significant with the value 0.0002, it means that as interest rate increases by 1 percentage the share prices of POML would decrease by 0.002 percent. M2 is statistically significant and effect the conditional return of SURAJ and MOIL positively with the value 0.003 and 0.002 respectively. OP is statistically significant for the SURAJ and affects its returns negatively with the value 0.001 while inflation affects positively. The conditional return of the MOIL is negatively affected by the interest rate.

In the Woolen sector, the interest rate affects the conditional return of BNWM negatively and significantly. The results of the residual diagnostics full-fill the property of i.i.d. for all the firms under three sectors which means that the results are valid.

Table 5.8 Effect of Macroeconomic Variables on the Returns of non-financial firms

Sector	**Transport**				**Vanaspati and allied industries**			**Woolen**
Parameters Series	**DLPIAA ARMA(1,1) GARCH (1,1)**	**DLPNSC ARMA(0,0) GARCH (1,1)**	**DLPIAB ARMA (1,1) GARCH (1,1)**	**DLPICT ARMA (0,0) GARCH (1,1)**	**DLPOML ARMA(1,1) GARCH (1,1)**	**DLSURAJ ARMA (0,0) GARCH (1,1)**	**DLMOIL ARMA(1,1) GARCH (1,1)**	**DLBNWM ARMA(0,1) GARCH (1,1)**
Constant(M)	-0.0413 (0.2483)	0.0550 (0.1275)	0.0001 (0.0041)	0.0022 (0.9650)	-0.0000 (0.8133)	-0.0000 (0.0057)	0.0000 (0.2556)	0.0234 (0.5196)
Constant(V)	0.1404 (0.5371)	0.2291 (0.0447)**	0.0055 (0.0020)***	0.0034 (0.8761)	0.0000 (0.0000)***	0.0197 (0.0565)*	0.0000 (0.0008)***	0.0071 (0.3795)
DLGLD(M)	0.4093 (0.0526)*	0.2256 (0.2064)	0.0001 (0.5015)	-0.1063 (0.7446)	0.0000 (0.8849)	-0.0001 (0.1854)	-0.0000 (0.9418)	-0.0422 (0.8391)
DLM2(M)	1.9091 (0.0037)***	1.2427 (0.0580)*	0.0011 (0.4020)	-0.4483 (0.6425)	-0.0002 (0.2148)	0.0026 (0.0024)***	0.0022 (0.0206)**	0.0405 (0.9810)
DLFER(M)	-0.3375 (0.0552)*	-0.1191 (0.5167)	0.0001 (0.7560)	-0.0075 (0.9678)	-0.0001 (0.2232)	0.0001 (0.3918)	-0.0000 (0.6358)	0.0381 (0.7875)
DLER(M)	-1.1763 (0.4390)	-2.4329 (0.0493)**	-0.0010 (0.7990)	0.5932 (0.6011)	-0.0001 (0.1491)	0.0007 (0.1275)	0.0004 (0.4505)	0.8486 (0.0765)*
DLIP(M)	-0.2361 (0.0241)**	-0.0579 (0.7473)	-0.0003 (0.2044)	-0.0048 (0.9529)	-0.0000 (0.6431)	0.0005 (0.0014)***	-0.0000 (0.4265)	-0.1483 (0.4176)
DLOP(M)	0.0850 (0.3343)	-0.0015 (0.9895)	0.0001 (0.2333)	-0.0478 (0.6275)	-0.0001 (0.1774)	-0.0001 (0.0397)**	0.0000 (0.5749)	0.0979 (0.5082)
Inf(M)	-0.4497 (0.7511)	-0.4067 (0.8028)	0.0052 (0.0122)**	0.7288 (0.5554)	-0.0004 (0.1798)	0.0057 (0.0009)***	-0.0000 (0.9554)	-2.8088 (0.2982)
Irt(M)	-0.0805 (0.8311)	-0.6713 (0.0648)**	-0.0018 (0.0000)***	-0.0184 (0.9647)	0.0002 (0.0002)***	0.0001 (0.3689)	-0.0014 (0.0000)***	-0.0698 (0.7860)
ARCH(Alpha1)	1.0000 (0.1434)	1.0000 (0.0649)**	0.1946 (0.0029)***	1.0000 (0.7018)	1.0000 (0.0000)***	1.0000 (0.0200)**	1.0000 (0.0000)***	1.0000 (0.0305)**
GARCH(Beta1)	0.0000 (1.0000)	0.0000 (1.0000)	0.1486 (0.2024)	0.2994 (0.0939)*	0.0391 (0.0000)***	0.0000 (0.0005)***	0.3501 (0.0046)***	0.0000 (1.0000)
Student (DF)	2.1059 (0.0000)***	2.1067 (0.0000)***	2.0028 (0.0000)***	2.6307 (0.0000)***	2.1842 (0.0000)***	2.0072 (0.0000)***	2.1819 (0.0000)***	2.5586 (0.0000)***
Residual Diagnostic test								
Q-stat(5)	3.9263 [0.2695]	2.7240 [0.7424]	0.0033 [0.9999]	1.8057 [0.8753]	0.0053 [0.9998]	1.6394 [0.8964]	0.0363 [0.9981]	NA
Q^2-stat (5)	0.5016 [0.9185]	6.2240 [0.1012]	0.0745 [0.9947]	0.2562 [0.9680]	0.0504 [0.9970]	0.2702 [0.9655]	0.0366 [0.9981]	NA
LM-ARCH (1-5)	0.0881 [0.9940]	1.1137 [0.3551]	0.0142 [0.9999]	0.0513 [0.9983]	0.0096 [1.0000]	0.0511 [0.9984]	0.0068 [1.0000]	0.13093 [0.9841]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

5.4 Results and Discussion of Macroeconomic Variables on the Volatility of Non-Financial Sectors:

In this sections we are going to discuss the conditional variance of different firms in the nonfinancial sector and how the selected macroeconomic variables in our study affect their volatility.

The table 5.9 shows the impact of macroeconomic variables on the conditional volatility of non-financial firms of PSX. There are three sectors in the table that are **Automobile Assembler, Cement, and Engineering**. In the Automobile Assembler sector, Gold Prices are affecting Indus Motor Company Limited (INDU) and Honda Atlas Cars (Pakistan) Limited (HCAR) negatively with the value of 0.03 and 0.08 respectively while money supply is affecting HCAR and Pak Suzuki Motor Company Limited (PSMC) negatively. Foreign Exchange Reserves show a positive effect on INDU, HCAR, and PSMC. Exchange Rate affects the conditional volatility of PSMC negatively. Interest Rate affects the conditional volatility positively for INDU and HCAR and PSMC negatively. Oil prices are also significant for INDU and HCAR.

In Cement sector, the interest rate affects the conditional volatility of Lucky Cement Limited (LUCK) and Fauji Cement Company Limited (FCCL) positively with the same value. Industrial Production has positive affect on conditional return of FCCL with the value of 0.089.

In engineering sector, the conditional volatility of Crescent Steel & Allied Products Limited (CSAP) and Metropolitan Steel Corporation Limited (MSCL), is affected negatively by the interest rate, while oil prices and industrial production are also positively significant for MSCL. The results of the residual diagnostics full-fill the property of i.i.d means for all the firms under three sector.

Table 5.9 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sector	**Automobile Assembler**			**Cement**		**Engineering**	
Parameters Series	**DLINDU ARMA(0,0) GARCH (1,1)**	**DLHCAR ARMA(0,1) GARCH (1,1)**	**DLPSMC ARMA(0,1) GARCH (1,1)**	**DLLUCK ARMA(0,0) GARCH (1,1)**	**DLFCCL ARMA(0,0) GARCH (1,1)**	**DLCSAP ARMA(0,0) GARCH (1,1)**	**DLMSCL ARMA(0,0) GARCH (1,1)**
Constant(M)	0.030 (0.000)***	0.029 (0.058)*	0.009 (0.628)	0.032 (0.111)	0.026 (0.285)	0.008 (0.734)	0.009 (0.015)**
Constant(V)	0.001 (0.000)***	0.003 (0.000)***	0.004 (0.000)***	0.001 (0.000)***	0.002 (0.000)***	0.005 (0.000)***	0.002 (0.996)***
DLGLD(V)	-0.035 (0.027)**	-0.084 (0.000)***	0.041 (0.127)	-0.006 (0.802)	-0.005 (0.931)	0.007 (0.750)	0.001 (0.370)
DLM2(V)	-0.059 (0.198)	-0.065 (0.009)***	-0.154 (0.033)***	0.001 (0.990)	-0.003 (0.954)	0.001 (0.994)	0.001 (0.812)
DLFER(V)	0.009 (0.000)***	0.054 (0.000)***	0.014 (0.030)***	-0.013 (0.430)	-0.031 (0.173)	-0.009 (0.343)	0.001 (0.459)
DLER(V)	-0.017 (0.248)	0.011 (0.732)	-0.070 (0.000)***	-0.012 (0.741)	-0.004 (0.950)	0.002 (0.913)	0.001 (0.873)
DLIP(V)	0.031 (0.000)***	0.043 (0.002)***	-0.006 (0.642)	0.013 (0.260)	0.018 (0.089)*	0.008 (0.395)	0.001 (0.001)***
DLOP(V)	0.021 (0.000)***	-0.026 (0.002)***	0.019 (0.902)	0.006 (0.523)	-0.012 (0.346)	-0.008 (0.148)	0.001 (0.052)**
Inf(V)	-0.021 (0.168)	-0.005879 (0.8988)	0.019 (0.902)	0.000 (0.999)	-0.002 (0.995)	-0.000 (0.998)	0.001 (0.881)
Irt(V)	0.001 (0.000)***	0.000 (0.000)****	-0.001 (0.000)***	0.001 (0.000)***	0.001 (0.000)***	-0.000 (0.000)***	-0.000 (0.000)***
ARCH(Alpha1)	0.078 (0.025)**	.0817 (0.121)	0.082 (0.269)	0.096 (0.343)	0.098 (0.087)*	0.096 (0.473)	0.099 (0.015)***
GARCH(Beta1)	0.720 (0.000)***	0.746 (0.000)***	0.676 (0.000)***	0.791 (0.000)***	0.793 (0.000)***	0.786 (0.003)***	0.799 (0.000)***
Student (DF)	5.999 **(0.000)*** **	6.000 (0.000)***	0.676 (0.000)***	6.004 (0.000)***	6.000 (0.002)***	5.999 (0.000)***	5.999 (0.000)***
Q-stat(5)	7.289 [0.121]	6.640 [0.084]	1.623 [0.654]	5.313 [0.256]	7.627 [0.106]	8.287 [0.505]	4.791 [0.309]
Q^2-stat (5)	5.345 [0.148]	1.757 [0.624]	2.639 [0.450]	1.290 [0.731]	6.722 [0.081]	1.765 [0.622]	4.791 [0.309]
LM-ARCH (1-5)	0.779 [0.462]	0.417 [0.660]	0.319 [0.727]	0.214 [0.807]	0.776 [0.4639]	0.163 [0.849]	0.290 [0.748]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The table 5.10 shows the impact of macroeconomic variables on the volatility of firms in three sectors (**Fertilizer, Glass and Ceramics, Leather and Tanneries**). In the fertilizer sector Money supply and foreign exchange reserves affect the conditional volatility of Engro Corporation Limited (ENGRO) negatively with the value of 0.097 and 0.025 respectively while interest rate has positive affect on ENGRO.

In the Glass and Ceramics sector, gold prices, foreign exchange reserves, and interest rate has negative affect on the conditional volatility of Ghani Glass Limited (GHGL), Shabbir Tiles and Ceramics Limited (STCL) and Baluchistan Glass Limited (BGL). Money supply and industrial production are significant and affecting the conditional volatility of GHGL and BGL negatively. Oil prices is significant and has negative affect on STCL with the value of 0.027 and positive affect on BGL with the value of 0.011.

In the sector of Leather and Tanneries, the money supply, foreign exchange reserves, and interest rate affect the conditional volatility of Bata Pakistan Limited (BATA), Leather up Industries Limited (LEUL), Pak Leather Crafts Limited (PAKL), and Unilever Pakistan Foods Limited (SRVI) negatively. Exchange rate affects the conditional volatility of BATA, LEUL, and SRVI positively. Gold is significant for BATA and SURVI having negative affect on their conditional volatility with the value of 0.064 and 0.044 respectively. Industrial production is significant for all the four selected firms in this sector, in which the conditional volatility of BATA and LEUL is effecting positively by IP while PAKL, SRVI is effecting negatively by IP. Inflation has a positive effect on the conditional volatility of BATA and LEUL while negative effect on the conditional volatility of SRVI.

Table 5.10 Effect of Macroeconomic Variables on the Volatility of non-financial firms

	Fertilizer	Glass and Ceramics			Leather and Tanneries			
Parameters **Series**	**DLENGRO** ARMA (0,0) GARCH (1,1)	**DLGHGL** ARMA (0,0) GARCH (1,1)	**DLSTCL** ARMA (2,2) GARCH (1,1)	**DLBGL** ARMA (1, 1) GARCH (1,1)	**DLBATA** ARMA(4,4) GARCH (1,1)	**DLLEUL** ARMA(0,0) GARCH (1,1)	**DLPAKL** ARMA(0,0) GARCH (1,1)	**DLSRVI** ARMA(0,0) GARCH (1,1)
Constant(M)	0.014 (0.000)***	0.017 (0.000)***	0.003 (0.256)	0.004 (0.167)	0.013 (0.000) ***	0.011 (0.000)***	0.004 (0.000)***	0.006 (0.000)
Constant(V)	0.002 (0.000)***	0.005 (0.000)***	0.004 (0.000)***	0.010 (0.000)***	0.029 (0.000)	0.005 (0.000)***	0.004 (0.000)***	0.023 (0.000)
DLGLD(V)	0.028 (0.313)	-0.017 (0.000)***	-0.006 (0.000)***	-0.025 (0.000)***	-0.064 (0.000)***	0.000 (0.735)***	0.009 (0.473)	-0.044 (0.000)***
DLM2(V)	-0.097 (0.000) ***	-0.011 (0.008)***	-0.001 (0.239)	-0.230 (0.000)***	-0.115 (0.000)***	-0.141 (0.000)***	-0.003 (0.068)*	-0.098 (0.000)***
DLFER(V)	-0.025 (0.000)***	-0.023 (0.000)***	-0.033 (0.000)***	-0.023 (0.000)***	-0.193 (0.000)***	-0.049 (0.000)***	-0.023 (0.000)***	-0.049 (0.000)***
DLER(V)	-0.011 (0.913)	0.006 (0.845)	0.043 (0.181)	0.120 (0.259)	0.169 (0.000)***	0.182 (0.000)***	0.005 (0.908)	0.034 (0.000)***
DLIP(V)	0.009 (0.094)*	-0.021 (0.000)***	0.0187 (0.000)**	-0.044 (0.000)***	0.004 (0.000)**	0.002 (0.000)**	-0.009 (0.000)***	-0.002 (0.000)***
DLOP(V)	-0.005 (0.199)	-0.006 (0.187)	-0.027 (0.000)***	0.011 (0.000)***	-0.004 (0.000)***	-0.038 (0.000)***	0.016 (0.000)***	0.029 (0.000)***
Inf(V)	-0.021 (0.612)	-0.003 (0.947)	0.013 (0.753)	0.004 (0.885)	0.178 (0.000)**	0.217 (0.000)***	0.003 (0.973)	-0.051 (0.000)***
Irt(V)	0.008 (0.000)***	-0.031 (0.000)***	-0.019 (0.000)***	-0.033 (0.000)***	-0.139 (0.000)***	0.004 (0.000)***	-0.015 (0.000)***	-0.144 (0.000)***
ARCH(Alpha1)	0.099 (0.215)	0.095 (0.000)***	0.094 (0.000)***	0.088 (0.000)***	0.056 (0.000)***	0.110 (0.000)***	0.102 (0.000)***	0.038 (0.000)***
GARCH(Beta1)	0.797 (0.000)***	0.788 (0.000)***	0.785 (0.000)***	0.789 (0.000)***	0.747 (0.000)***	0.756 (0.000)***	0.793 (0.000)***	0.460 (0.000)***
Student (DF)	5.999 (0.000)***	5.999 (0.000)***	5.996 (0.000)***	5.892 (0.000)***	-	-	-	4.3222 (0.000)***
Q-stat(5)	3.972 [0.553]	11.542 [0.042]**	11.187 [0.001]**	6.937 [0.073]	8.406 [0.015]*	23.410 [0.000]**	5.608 [0.346]	2.849 [0.723]
Q^2-stat (5)	11.393 [0.009]**	0.349 [0.950]	0.908 [0.823]	2.200 [0.532]	0.893 [0.827]	5.432 [0.143]	4.041 [0.257]	0.039 [0.998]
LM-ARCH **(1-5)**	2.226 [0.053]	0.065 [0.997]	0.169 [0.973]	0.388 [0.856]	0.168 [0.974]	1.064 [0.382]	0.742 [0.593]	0.007 [1.000]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent**.

The Table 5.11 shows the impact of macroeconomic variables on the conditional volatility of firms in the following three sectors (**Oil & Gas, Miscellaneous, and Paper & Board**). Gold prices, exchange rate, and interest rate affect the conditional volatility of Mari Petroleum Company Limited (MARI) in Oil & Gas sector negatively with the value of 0.038, 0.014, and 0.060 respectively. All other macroeconomic variables have positive affect on the conditional volatility of MARI.

In the Miscellaneous group, the variable of oil prices, and interest rate are significant and affect the conditional volatility of Shifa International Hospitals Limited (SHIFA), Tri-Pack Films Limited (TRITF), and Pakistan Services Limited (PSEL). Gold Prices, money supply, foreign exchange reserves, and exchange rate affect the conditional volatility of TRITF and PSEL negatively while the same variable effect the conditional volatility of SHIFA positively. Inflation is significant and affect the conditional volatility of TRIPE, and PSEL positively and SHIFA negatively.

In the sector of Paper & Board, gold prices affect the conditional volatility of Security Paper Limited (SEPL), Packages Limited (PKGS), and Century Paper and Board Mills Limited (CEPB) is negatively with the value of -0.439, 0.025, and 0.018 respectively. Money supply is significant and affect the conditional volatility of SPEL, and CEPB negatively and PKGS positively. The other macroeconomic variables i.e foreign exchange reserve, exchange rate, industrial production, oil prices, Inflation, and interest rate are significant and affect the conditional volatility of all firms in this sector with positive and negative values that are shown in the table. The results of the residual diagnostics full-fill the property of i.i.d means identically independently distribution for all the firms under three sectors.

Table 5.11 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sector	**Oil & Gas Exploration Co**	**Miscellaneous**			**Paper and Board**			
Parameters Series	**DLMARI ARMA (1,1) GARCH (1,1)**	**DLSHFA ARMA (0,0) GARCH (1,1)**	**DLTRIPF ARMA(1,1) GARCH (1,1)**	**DLPSEL ARMA (0,0) GARCH (1,1)**	**DLSEPL ARMA(1,1) GARCH (1,1)**	**DLMERIT ARMA(0,0) GARCH (1,1)**	**DLPKGS ARMA(1,1) GARCH (1,1)**	**DLCEPB ARMA(0,2) GARCH (1,1)**
Constant(M)	0.026 (0.000)***	0.001 (0.023)***	0.000 (0.000)***	0.001 (0.549)	0.005 (0.728)	-0.005 (0.621)	0.021 (0.000)***	0.008 (0.000)***
Constant(V)	0.005 (0.000)***	0.023 (0.000)***	0.002 (0.000)***	0.009 (0.000)***	0.078 (0.000)***	0.004 (0.000)***	0.004 (0.000)***	0.003 (0.000)***
DLGLD(V)	-0.038 (0.000)***	0.032 (0.000)***	-0.005 (0.000)***	-0.002 (0.000)***	-0.439 (0.000)***	-0.005 (0.354)	-0.025 (0.000)***	-0.018 (0.000)**
DLM2(V)	0.224 (0.000)***	0.211 (0.000)***	-0.051 (0.000)***	-0.002 (0.000)***	-0.742 (0.102)*	-0.003 (0.955)	0.034 (0.000)***	-0.079 (0.000)***
DLFER(V)	0.039 (0.000)***	0.026 (0.000)***	-0.006 (0.000)***	-0.029 (0.000)***	0.196 (0.000)***	-0.018 (0.000)***	0.015 (0.000)***	-0.021 (0.000)***
DLER(V)	-0.014 (0.000)***	0.361 (0.213)	-0.078 (0.000)***	-0.042 (0.000)***	-0.403 (0.000)***	-0.003 (0.921)	0.258 (0.000)***	0.099 (0.074)***
DLIP(V)	0.009 (0.000)***	-0.052 (0.000)***	0.002 (0.000)***	-0.005 (0.000)***	0.289 (0.000)***	-0.019 (0.000)***	0.003 (0.000)***	0.026 (0.000)***
DLOP(V)	0.005 (0.000)***	-0.084 (0.000)***	-0.014 (0.000)***	-0.002 (0.000)***	0.123 (0.000)***	-0.017 (0.000)***	0.006 (0.000)***	-0.023 (0.000)***
Inf(V)	0.441 (0.000)***	-0.012 (0.000)***	0.016 (0.000)***	0.062 (0.000)***	3.186 (0.000)***	0.002 (0.849)	0.395 (0.000)***	0.374 (0.000)***
Irt(V)	-0.060 (0.000)***	-0.049 (0.000)***	-0.009 (0.0000)***	-0.069 (0.000)***	-0.533 (0.000)***	-0.022 (0.000)***	-0.053 (0.000)**	-0.013 (0.000)***
ARCH(Alpha1)	0.198 (0.000)**	0.309 (0.000)***	0.101 (0.0000)***	0.017 (0.000)***	0.571 (0.248)	0.095 (0.000)***	0.060 (0.000)***	0.092 (0.000)***
GARCH(Beta1)	0.628 (0.000)***	0.122 (0.000)***	0.801 (0.000)***	0.752 (0.000)***	0.602 (0.000)***	0.788 (0.000)***	0.781 (0.000)***	0.709 (0.000)***
Student (DF)	-	2.703 (0.000)***	-	2.767 (0.002)***	2.056 (0.000)***	5.999 (0.000)***	-	-
Residual Diagnostic Test								
Q-stat(5)	2.712 [0.438]	4.243 [0.515]	0.646 [0.886]	7.309 [0.198]	4.1237 [0.248]	6.777 [0.238]	5.956 [0.114]	0.878 [0.831]
Q^2-stat (5)	7.555 [0.056]*	2.746 [0.432]	3.154 [0.368]	0.408 [0.938]	0.175 [0.981]	0.353 [0.949]	5.150 [0.161]	3.388 [0.335]
LM-ARCH (1-5)	1.168 [0.326]	0.058 [0.998]	0.648 [0.663]	0.075 [0.996]	0.032 [0.999]	0.063 [0.997]	1.026 [0.403]	0.713 [0.615]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The table 5.12 shows the impact of macroeconomic variables on the conditional volatility of firms in five sectors that is **Power Generation & Distribution, Pharmaceutical Chemical, Refinery, and Food & personal care Product**. In the power generation & production sector, oil prices, and inflation affect the conditional volatility of Kot Addu Power Company Limited (KAPCO) and Hub Power Company Limited (HUBC) negatively whereas money supply and exchange rate have positive affect on the conditional volatility of these two firms. FER, IP, and Interest rate are significant and effect the conditional volatility of KAPCO positively and HUBC negatively. In Pharmaceuticals sector, gold prices, money supply, and interest rate affect the conditional volatility of The Searle Company Limited (SEARL) negatively with the value of 0.025, 0.001, and 0.023 respectively. In chemical sector, the conditional volatility of Lotte Chemical Pakistan Limited (LOTCHEM) is affected by exchange rate, oil prices, inflation, and interest rate negatively whereas gold prices, foreign exchange reserves and industrial production are positively affecting the conditional volatility of LOTCHEM. In refinery sector, the conditional volatility of Byco Petroleum Pakistan Limited (BYCO) and National Refinery Limited (NRL) is affected negatively by gold prices and interest rate. Industrial production has positive affect on the conditional volatility of BYCO, NRL, and Attock Refinery Limited (APRL) whereas exchange rate and Interest rate affect the conditional volatility of these firms negatively. In the sector of Oil & Gas Exploration companies, the conditional volatility of Rafhan Maize Products Limited (RMPL) and Unilever Pakistan Foods Limited (UPFL) is affected by gold prices, money supply, foreign exchange reserves, inflation, and interest rate negatively. Both IP and OP has negative affect on the conditional volatility of RMPL and positive on UPFL.

Table 5.12 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sector	**Power Generation & Distribution**		**Pharmaceutical**	**Chemical**	**Refinery**			**Food and personal care Product**	
Parameters Series	**DLKAPCO** ARMA (0,0) GARCH (1,1)	**DLHUBC** ARMA (1,1) GARCH (1,1)	**DLSEARL** ARMA(1,1) GARCH (1,1)	**DLLOTCHEM** ARMA (0, 0) GARCH (1,1)	**DLBYCO** ARMA(0,0) GARCH (1,1)	**DLNRL** ARMA (0,0) GARCH (1,1)	DLATRL ARMA(0,0) GARCH (1,1)	**DLRMPL** ARMA(1,1) GARCH (1,1)	**DLUPFL** ARMA(1,1) GARCH (1,1)
Constant(M)	0.003 (0.006)***	0.014 (0.000)***	0.019 (0.000)***	-0.004 (0.806)	0.001 (0.797)	0.004 (0.267)	0.005 (0.000)***	0.061 (0.269)	0.013 (0.000)***
Constant(V)	0.012 (0.864)	0.001 (0.000)***	0.004 (0.000)***	0.003 (0.000)***	0.001 (0.000)***	0.002 (0.000)***	0.005 (0.000)***	0.015 (0.000)***	0.022 (0.000)
DLGLD(V)	-0.015 (0.000)***	0.006 (0.000)***	-0.025 (0.000)***	0.000 (0.000)***	-0.060 (0.000)***	-0.041 (0.000)***	0.011 (0.000)***	-0.022 (0.080)*	-0.018 (0.003)***
DLM2(V)	0.041 (0.000)***	0.009 (0.000)***	-0.001 (0.000)***	-0.004 (0.495)	-0.172 (0.000)***	0.008 (0.101)*	0.001 (0.000)***	-0.054 (0.024)**	-0.043 (0.191)
DLFER(V)	0.003 (0.000)***	-0.011 (0.000)***	-0.018 (0.318)	0.014 (0.000)***	0.032 (0.000)***	0.007 (0.000)***	-0.018 (0.000)***	-0.061 (0.000)***	-0.045 (0.000)***
DLER(V)	0.054 (0.000)***	0.025 (0.000)***	-0.008 (0.800)	-0.001 (0.000)***	0.075 (0.108)	-0.052 (0.000)***	-0.005 (0.000)***	-0.009 (0.982)	0.145 (0.000)***
DLIP(V)	0.001 (0.000)***	-0.001 (0.000)***	-0.004 (0.719)	0.003 (0.000)****	0.071 (0.000)***	0.022 (0.000)***	0.020 (0.000)***	-0.032 (0.000)***	0.029 (0.000)***
DLOP(V)	-0.004 (0.000)***	-0.003 (0.000)***	-0.005 (0.648)	-0.007 (0.000)***	0.011 (0.010)***	-0.007 (0.000)***	-0.012 (0.000)***	-0.015 (0.000)***	0.028 (0.000)***
Inf(V)	-0.012 (0.000)***	-0.011 (0.000)***	-0.003 (0.977)	-0.000 (0.000)***	0.421 (0.000)***	0.234 (0.000)***	0.001 (0.975)	-0.028 (0.000)***	-0.262 (0.000)***
Irt(V)	0.002 (0.000)***	-0.009 (0.000)***	-0.023 (0.008)***	-0.023 (0.000)***	-0.022 (0.000)***	-0.021 (0.000)***	-0.039 (0.000)***	-0.105 (0.000)***	-0.130 (0.000)***
ARCH(Alpha1)	0.095 (0.000)***	0.178 (0.000)***	0.093 (0.000)***	0.099 (0.000)***	0.030 (0.000)***	0.095 (0.000)***	0.102 (0.000)***	0.096 (0.000)***	0.027 (0.094)*
GARCH(Beta1)	0.776 (0.000)***	0.721 (0.000)***	0.775 (0.000)***	0.797 (0.000)***	0.937 (0.000)***	0.764 (0.000)***	0.799 (0.000)***	0.779 (0.000)***	0.607 (0.000)***
Student (DF)	5.948 (0.000)***	5.785 (0.000)***	5.984 (0.084)*	5.999 (0.000)***	4.057 (0.000)***	5.944 (0.000)***	-	5.996 (0.000)***	2.626 (0.000)***
Residual diagnostic tests									
Q-stat(5)	1.397 [0.924]	1.578 [0.664]	3.5468 [0.315]	1.859 [0.868]	4.182 [0.523]	4.464 [0.484]	1.360 [0.928]	1.786 [0.617]	1.574 [0.665]
Q^2-stat (5)	2.553 [0.466]	5.956 [0.114]	1.213 [0.749]	7.311 [0.063]	2.512 [0.473]	1.785 [0.618]	7.498 [0.058]	0.027 [0.999]	0.063 [0.996]
LM-ARCH (1-5)	0.249 [0.939]	1.011 [0.412]	0.228 [0.949]	1.423 [0.219]	0.482 [0.7891]	0.341 [0.887]	1.468 [0.202]	0.005 [1.000]	0.011 [1.000]

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The Table 5.13 shows the impact of macroeconomic variables on the conditional volatility of firms in four sectors i.e **Oil & Gas Marketing companies, Sugar & Allied Industry, Synthetic & Royon, and Technology & Communication**. In the Oil & Gas marketing sector Money supply, foreign exchange reserves, exchange rate, oil prices, and interest rate affect the conditional volatility of Pakistan State Oil Company Limited (PSO) negatively while industrial production and inflation has a positive effect on the conditional volatility of PSO.

In sugar and allied industries sector, all macroeconomic variables affect the conditional volatility positively except money supply which affects the conditional volatility negatively. In synthetic and Royon sector, the interest rate affects the conditional volatility of Ibrahim Fibre Limited (IBFL), Pakistan Synthetics Limited (PSYL) negatively and GATI and NAFL positively. Gold prices, industrial production, and oil prices has negative impact on the conditional volatility of GATI but positive impact on the IBFL.

In the technology and communication sector, the conditional volatility of Telecard Limited (TELE) is affected by money supply, exchange rate and industrial production positively whereas gold prices, foreign exchange reserves, oil prices and inflation affects the conditional volatility negatively. The results of the residual diagnostics full-fill the property of i.i.d means identically independently distribution for all the firms under three sectors except the Telecard Limited.

Table 5.13 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sectors	**Oil & Gas Marketing companies**	**Sugar & Allied Industry**	**Synthetic & Royon**				**Technology & Communication**
Parameters Series	**DLPSO** ARMA(0,0) GARCH (1,1)	**DLTICL** ARMA (1,1) GARCH (1,1)	**DLGATI** ARMA(0,1) GARCH (1,1)	**DLIBFL** ARMA (0, 0) GARCH (1,1)	**DLPSYL** ARMA(0,1) GARCH (1,1)	**DLNAFL** ARMA(0,1) GARCH (1,1)	**DLTELE** ARMA(0,0) GARCH (1,1)
Constant(M)	0.004 .NaN	0.001 (0.061)	-0.005 (0.992)	0.006 (0.002)***	0.002 (0.966)	0.008 (0.000)***	-0.021 (0.000)***
Constant(V)	0.002 (0.000)***	0.018 (0.000)***	0.000 (0.657)	0.002 (0.000)***	0.002 (0.000)***	0.011 (0.877)	0.200 (0.000)***
DLGLD(V)	-0.004 (0.935)	0.005 (0.000)***	-0.028 (0.000)***	0.001 (0.073)**	0.031 (0.833)	0.000 (0.302)	-1.014 (0.000)***
DLM2(V)	-0.029 (0.000)***	-0.042 (0.000)***	0.077 (0.000)***	-0.005 (0.001)***	0.043 (0.964)	0.000 (0.174)	5.498 (0.000)***
DLFER(V)	-0.012 (0.000)***	0.004 (0.000)***	0.057 (0.000)***	-0.003 (0.000)***	0.007 (0.575)	0.000 (0.389)	-1.766 (0.000)***
DLER(V)	-0.063 (0.178)	0.077 (0.000)***	0.290 (0.367)	-0.002 (0.848)	0.059 (0.837)	0.001 (0.134)	3.039 (0.000)***
DLIP(V)	0.005 (0.000)***	0.011 (0.000)***	-0.061 (0.000)***	0.013 (0.000)***	-0.007 (0.9563)	0.000 (0.206)	1.604 (0.000)***
DLOP(V)	-0.021 (0.000)***	0.005 (0.000)***	-0.015 (0.019)**	0.005 (0.000)***	0.008 (0.524)	0.000 (0.000)***	-2.367 (0.000***)
Inf(V)	0.124 (0.054)***	0.138 (0.000)***	0.144 (0.419)	0.001 (0.903)	0.039 (0.982)	-0.000 (0.789)	-10.305 (0.000)***
Irt(V)	-0.001 (0.000)***	0.007 (0.000)***	0.023 (0.037)**	-0.022 (0.000)***	-0.000 (0.000)***	0.000 (0.000)***	0.878 (0.000)***
ARCH(Alpha1)	0.211 (0.000)***	0.089 (0.000)***	0.009 (0.441)	0.097 (0.000)***	0.057 (0.895)	0.095 (0.045)**	0.000 (0.367)
GARCH(Beta1)	0.678 (0.000)***	0.718 (0.000)***	0.834 (0.000)***	0.784 (0.000)***	0.715 (0.244)	0.761 (0.000)***	0.774 (0.000)***
Student (DF)	-	2.423 (0.000)***	3.066 (0.903)	5.999 (0.005)***	5.996 (0.000)***	5.414 (0.000)***	2.037 (0.000)***
Residual Diagnostic Test							
Q-stat(5)	2.465 [0.782]	7.728 [0.052]	1.802 [0.772]	5.067 [0.408]	2.489 [0.288]	0.093 [0.999]	29.551 [0.000]***
Q^2-stat (5)	1.256 [0.739]	1.577 [0.664]	11.557 [0.091]	0.381 [0.944]	4.314 [0.229]	0.026 [0.998]	25.645 [0.000]**
LM-ARCH (1-5)	0.485 [0.787]	0.286 [0.920]	2.430 [0.316]	0.073 [0.996]	0.607 [0.547]	0.005 [1.000]	5.311 [0.000]***

Null Hypotheses(All Null Hypotheses are for nth order)
Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.
Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The Table 5.14 shows the impact of macroeconomic variables on the conditional volatility of firms in three sectors i.e **Textile Spinning. Textile spinning, and Tobacco.** In the Textile spinning sector Gold prices, money supply, and foreign exchange reserve affect the conditional volatility of Indus Dyeing Manufacturing Company Limited (IDYM), Fazal Cloth Mills Limited (FZCM), and Din Textile Mills Limited (DINT) negatively. FER is significant and has negative effect on the conditional volatility of IDYM, FZCM, GADT, and DINT. Exchange rate is significant and affect the conditional volatility of IDYM, FZCM, and DINT positively. Oil prices have positive affect on the conditional volatility of IDYM and FZCM, and GADT. Interest rate is significant and affect the conditional volatility of IDYM, FZCM, GADT, DINT, and JKSM negatively with the value of 0.036, 0.040, 0.034, 0.004, and 0.029 respectively.

In textile weaving sector, the conditional volatility of Zephyr Textile Limited (ZTL) is positively affected by gold prices, money supply, and industrial production with the value of 0.113, 0.28, 0.035, and 0.203 respectively whereas oil prices, inflation, and interest rate affect the conditional volatility of ZTL negatively with the value of 0.022, 0.295, and 0.203 respectively.

In Tobacco sector, the conditional volatility of Pakistan Tobacco Company Limited (PAKT) is affected negatively by gold prices, foreign exchange reserves, exchange rate, oil prices, inflation, and interest rate and positively by industrial production. The results of the residual diagnostics full-fill the property of i.i.d means identically independently distribution for all the firms under three sectors.

Table 5.14 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sector	**Textile Spinning**					**Textile weaving**	**Tobacco**
Parameters Series	**DLIDYM ARMA(0,1) GARCH (1,1)**	**DLFZCM ARMA (1,1) GARCH (1,1)**	**DLGADT ARMA(1,1) GARCH (1,1)**	**DLDINT ARMA (0, 1) GARCH (1,1)**	**DLJKSM ARMA (1, 1) GARCH (1,1)**	**DLZTL ARMA(0,2) GARCH (1,1)**	**DLPAKT ARMA(0,0) GARCH (1,1)**
Constant(M)	0.013 (0.008)***	0.009 (0.000)***	0.011 (0.097)*	0.002 (0.918)	-0.004 (0.187)	-0.015 (0.001)***	-0.017 (0.190)
Constant(V)	0.009 (0.000)***	0.006 (0.000)***	0.005 (0.000)***	0.003 (0.000)***	0.004 (0.000)***	0.028 (0.000)***	0.008 (0.000)***
DLGLD(V)	-0.044 (0.000)***	-0.010 (0.000)***	-0.002 (0.864)	-0.027 (0.000)***	-0.002 (0.900)	0.113 (0.001)***	-0.053 (0.000)***
DLM2(V)	-0.082 (0.000)***	-0.013 (0.000)***	-0.011 (0.851)	-0.037 (0.000)***	-0.008 (0.000)***	0.280 (0.068)**	-0.016 (0.956)
DLFER(V)	-0.021 (0.000)***	-0.037 (0.000)***	-0.033 (0.000)***	-0.016 (0.000)***	-0.007 (0.158)	-0.004 (0.960)	-0.025 (0.000)***
DLER(V)	0.187 (0.000)***	0.012 (0.000)***	0.003 (0.894)	0.225 (0.000)***	-0.009 (0.737)	0.089 (0.539)	-0.015 (0.478)
DLIP(V)	0.078 (0.000)***	-0.018 (0.000)***	0.001 (0.850)	0.035 (0.000)***	0.012 (0.669)	0.035 (0.000)***	0.018 (0.000)***
DLOP(V)	0.022 (0.000)***	0.004 (0.000)***	0.006 (0.039)***	-0.001 (0.902)	0.001 (0.000)***	-0.022 (0.000)***	-0.028 (0.000)***
Inf(V)	0.075 (0.479)	0.000 (0.000)***	0.002 (0.937)	-0.236 (0.000)***	-0.005 (0.964)	-0.295 (0.000)***	-0.016 (0.639)
Irt(V)	-0.036 (0.000)***	-0.040 (0.000)***	-0.034 (0.000)***	0.004 (0.000)***	-0.029 (0.000)***	-0.203 (0.000)***	-0.035 (0.000)***
ARCH(Alpha1)	0.086 (0.000)***	0.082 (0.000)***	0.094 (0.082)*	0.089 (0.000)***	0.097 (0.006)***	0.051 (0.047)***	0.075 (0.736)
GARCH(Beta1)	0.594 (0.000)***	0.768 (0.000)***	0.788 (0.000)***	0.736 (0.000)***	0.791 (0.000)***	0.617 (0.000)***	0.749 (0.000)***
Student (DF)	5.817 (0.000)***	5.998 (0.000)***	5.999 (0.000)***	5.899 (0.071)*	5.999 (0.000)***	3.092 (0.000)***	5.953 (0.000)***
Residual Diagnostic Test							
Q-stat(5)	4.3365 [0.3623]	9.6977 [0.2131]	3.4507 [0.3272]	5.0408 [0.2831]	1.4275 [0.6990]	0.2917 [0.9615]	2.7655 [0.7360]
Q^2-stat (5)	0.5274 [0.9128]	0.7626 [0.8583]	0.2869 [0.9624]	2.5480 [0.4666]	0.3829 [0.9437]	0.1302 [0.9879]	0.1434 [0.9861]
LM-ARCH (1-5)	0.0944 [0.993]	0.1358 [0.9838]	0.0521 [0.9983]	0.48689 [0.7857]	0.0673 [0.9968]	0.0253 [0.9997]	0.0268 [0.9997]

Null Hypotheses(All Null Hypotheses are for nth order)

Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.

Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

The Table 5.15 shows the impact of macroeconomic variables on the conditional volatility of firms in two sectors i.e **Transport,** and **Vanaspati and Allied Industries**.

In the Transport sector Oil prices and foreign exchange reserve affect the conditional volatility of Pakistan National Shipping Corporation Limited (PNSC) and Pakistan International Container Terminal Limited (PICT) negatively. Interest rate affects the conditional volatility of Pakistan International Airlines Corporation (PIAA), Pakistan International Airlines Corporation (B Class Shares) (PIAB) and PICT negatively with the value of 0.072, 0.03, and 0.0001 respectively. Industrial production is significant affect the conditional volatility of PIAA, and PICT with the value of 0.073, and 0.012 respectively. Money supply, and gold prices are significant and affect the conditional volatility of PIAA negatively. While exchange rate is only significant for PICT and affect its conditional volatility negatively with the value of 0.034.

In Vanaspati and allied industries, interest rate is significant and affect the conditional volatility of Punjab Oil Mills Limited (POML) and Morafco Industries Limited (MOIL) negatively. Oil prices are significant and affect the conditional volatility of POML positively and MOIL negatively with the value of 0.001, and 0.008 respectively. FER and IP both are significant and affect the conditional volatility of MOIL in which FER affects it negatively with the value of 0.009 and IP affect it positively with the value of 0.019. The results of the residual diagnostics full-fill the property of i.i.d means identically independently distribution for all the firms under these two sectors.

Table 5.15 Effect of Macroeconomic Variables on the Volatility of non-financial firms

Sector	**Transport**				**Vanaspati and Allied Industries**	
Parameters **Series**	**DLPIAA** **ARMA(1,1)** **GARCH(1,1)**	**DLPNSC** **ARMA(0,0)** **GARCH(1,1)**	**DLPIAB** **ARMA (1,1)** **GARCH(1,1)**	**DLPICT** **ARMA (0,0)** **GARCH(1,1)**	**DLPOML** **ARMA(1,1)** **GARCH(1,1)**	**DLMOIL** **ARMA(1,1)** **GARCH(1,1)**
Constant(M)	-0.003 (0.126)	-0.022 (0.000)***	0.009 (0.511)	0.006 (0.577)	0.009 (0.028)**	0.001 (0.796)
Constant(V)	0.007 (0.000)***	0.003 (0.000)***	0.006 (0.999)	0.007 (0.000)***	0.003 (0.998)	0.005 (0.000)***
DLGLD(V)	-0.136 (0.000)***	0.001 (0.985)	0.001 (0.857)	0.034 (0.847)	0.001 (0.940)	0.007 (0.951)
DLM2(V)	-0.273 (0.000)***	-0.003 (0.984)	0.002 (0.955)	-0.012 (0.997)	0.001 (0.000)***	0.001 (0.992)
DLFER(V)	0.101 (0.000)***	-0.032 (0.000)***	0.000 (0.986)	-0.028 (0.000)***	0.001 (0.158)	-0.009 (0.000)***
DLER(V)	-0.012 (0.928)	-0.004 (0.989)	0.001 (0.987)	-0.034 (0.000)***	0.001 (0.981)	0.000 (0.907)
DLIP(V)	0.073 (0.059)**	-0.005 (0.712)	-0.000 (0.964)	0.012 (0.000)***	0.001 (0.169)	0.019 (0.000)***
DLOP(V)	-0.055 (0.352)	-0.023 (0.067)*	-0.001 (0.661)	-0.032 (0.000)***	0.001 (0.000)**	-0.008 (0.000)***
Inf(V)	1.035 (0.000)***	-0.004 (0.995)	0.001 (0.979)	-0.001 (0.999)	0.001 (0.986)	0.001 (0.986)
Irt(V)	-0.072 (0.000)***	-0.000 (0.670)	-0.003 (0.000)***	-0.0001 (0.000)**	-0.000 (0.000)***	-0.0002 (0.000)***
ARCH(Alpha1)	0.000 (1.000)	0.098 (0.270)	0.099 (0.303)	0.056 (0.586)	0.099 (0.396)	0.099 (0.254)
GARCH(Beta1)	0.922 (0.000)***	0.789 (0.000)***	0.799 (0.000)***	0.739 (0.000)***	0.799 (0.000)***	0.798 (0.000)***
Student (DF)	2.673 (0.000)***	5.999 (0.000)***	5.999 (0.000)***	5.866 (0.004)***	5.999 (0.000)***	5.999 (0.009)***
	Residual Diagnostic Test					
Q-stat(5)	2.833 [0.418]	3.1293 [0.372]	0.306 [0.958]	0.662 [0.882]	3.225 [0.358]	4.273 [0.233]
Q^2-stat (5)	0.430 [0.934]	4.308 [0.230]	0.177 [0.981]	0.111 [0.990]	0.057 [0.996]	0.548 [0.908]
LM-ARCH **(1-5)**	0.075 [0.996]	0.306 [0.737]	0.030 [0.970]	0.024 [0.976]	0.009 [0.991]	0.181 [0.834]

Null Hypotheses(All Null Hypotheses are for nth order)

Q2-stat (square return series) H0: there is no serial autocorrelation. LM-ARCH H0: there is no ARCH effect.

Note: P-values are in the parenthesis. * Significant at 1 percent ** Significant at 5 percent * Significant at 10 percent.**

CHAPTER VI

CONCLUSION

6.1 Summary:

In this study we have checked the relationship between macroeconomic variables and the return and volatility of nonfinancial firm of PSX. The study is beneficial for the analysis of diversifying risk by viewing through these macroeconomic variables.

What is the effect of macroeconomic variable on the stock returns and volatility of different firms in the non-financial sector of PSX?

Eight macroeconomic variables and the stock returns of 58 firms selected from 24 sectors in the nonfinancial sector of Pakistan stock exchange are examined. For this study monthly data has been taken from July 1998 to June 2016 and the GARCH type modeling has been used for estimation as the firms are present to ARCH effect. The result of this study shows that the effect of macroeconomic variables vary from firm to firm and from sector to sector however there are variables which have similar impact.

6.2 Conclusion:

As there are two parts of our results so starting with the effect of macroeconomic variable on the returns of the nonfinancial sector. On the basis of prior studies as we know that changes in interest rate effect both the expected future cash flows of the firms and the discount rate to value these cash flows, and therefore the value of the company as well. (Martinez-Moya, et al. 2013). Now if we look towards the result on average a negative impact of interest rate has found on the return and has confirmed for 8 sectors. The results show that the return of Automobile Assembler, Cement, Glass & Ceramics, Paper & Board , Food & Personal Care Product, Power Generation & Distribution, Refinery, and Transport sectors reveal a negative and significant response towards the

interest rate, While Synthetic and Royon on average has a positive relation with interest rate and Vanaspati & Alied is the only sector which reveals on average some mix responses (equal no of firms has positive and negative relation) towards the interest rate.

A negative relation between stock return and oil prices mean that the increase in oil prices leads to decrease the cash flow of the firms and which leads to effect their share prices Kilian (2007).If we look toward the result of Oil prices on average there exists a negative relation between the stock return and macroeconomic variables which is confirmed by the two sectors.

A negative relation among inflation and stock return means that increase in inflation leads to increase the discount rate and due to that the share prices will decreases Chen et al. (1986). We found that on average there is an inverse relation exists between inflation and the return of nonfinancial firms and is significantly confirmed by the six sectors. Also on average there found a positive relation between inflation and the stock return of some sectors.

If our currency depreciated against the dollar and it leads to increase the cost of a company then that means exchange rate is effecting cash flow of the company negatively Dornbusch and Fisher (1980). Exchange rate on average is showing a negative impact on the return of the nonfinancial firms and is confirmed by seven sectors. On the other hand the Textile spinning and woolen sector on average is positively and significantly affected by the exchange rate which means that a depreciation in the currency against dollar leads to increase their revenue which leads to increase their stock returns and this could be a reason of their export oriented behavior.

Increase in money supply will leads to increase the liquidity in the market and which increase the short term prices, i.e investment will shift towards the financial securities like share and as a result the share prices will increase. Now looking towards the result of Money supply on average it has a significantly positive impact and has been confirmed by the five sectors.

Gold prices on average has a positive and significant effect on the returns of nonfinancial firms and is confirmed by the seven sectors. Foreign exchange reserves on average has a negative impact on the six sector. Industrial production on average has positive impact on the returns of nonfinancial firms and is confirmed by two sectors.

Corporate governance is weak in Pakistan, Ameer (2013) and any change in the macroeconomic variables tend to make the shareholders panic due to possible adverse effect on shareholder's value due to agency problem. Stock market in Pakistan is not efficient, Akber & Muhammad (2014) and institutional ownership is low. The number of shareholders who panic for slight negative return is huge. The negative return lead by change in macroeconomic variable tend to increase the debt to equity ratio (calculated using market based equity) and as shareholders have residual claim on the assets of the company, mediocre shareholders tend to go short which increases volatility.

Now starting with effect of macroeconomic variable on volatility of the nonfinancial sector. Lower interest rate and increased money supply creates liquidity which acts as a catalyst for increase in volatility. We found that on average interest rate, money supply along with gold prices has a negative impact on the volatility of nonfinancial firms and is confirmed by the thirteen sectors.

We found mix results for inflation. On average inflation is negatively related to volatility as evident by the sectors of Power Generation & Distribution, Chemical, Food & Personal Care Product, Technology & Communication, Textile Spinning, Textile Weaving, and Tobacco. While positive relation exists for six sectors. The results of exchange rate are inconclusive as for some sectors the coefficient is positive and for some sectors it is negative. The coefficient of foreign exchange reserve is positive for six of the sectors and negative for 10 sectors. Oil prices are related to volatility positively in six sectors and negatively in 8 sectors and also have mixed responses in 5 sectors.

For more understanding the study can be conducted by using different spam of data (quarterly, annually) also by using other advance techniques i.e Wavelet analysis. Furthermore the study can be extended to the financial sector firms by checking their response towards the macroeconomic variables. Also the study can be conducted for only a single sector such as manufacturing or energy sector.

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