STOCK MARKET DYNAMICS: TRADING IRREGULARITIES AND INVESTOR SAFEGUARD: CASE OF PSX LISTED COMPANIES

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DEDICATION

I dedicated this thesis to my parents, who have been a great support in my life and their love, prayers and encouragements that enable me in completing this PhD thesis in the area of finance.

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ABSTRACT

The motivation of this research is to capture the dynamic properties of the Pakistan Stock Market. Stock market dynamics examine stock return fluctuation to provide some plausible explanation for returns. This study discusses trading irregularities under the dynamic behavior of stocks and provides plausible explanations of such irregularities. It also examines investor safeguards, focusing on calendar anomalies. This study seeks to find the answer of following questions: How to locate irregularities in the Pakistan Stock Market? What are some acceptable reasons for the anomalies and what is the long- and short-run behavior of an anomaly? We obtained the research data from the Pakistan Stock Exchange (PSX) from 2008 to 2017, covering 10 years of daily continuous returns.

This study has contributed in the existing body of knowledge by exploring the long as well as short term association of risk and return under the vector error correction model (VECM) environment and identification of the anomalies through volatility clustering in the long run. Volatility clustering is also an indication of anomalies and justifies the application of the ARCH and GARCH models.

The results show strong evidence of the weekday effect, as Monday returns seem to be negative and Friday returns, positive. ARCH and GARCH estimation is also significant in explaining the volatility of stock returns. Finally, the VECM model can best explain the dynamics of anomalies in the short as well as long run.

Keywords: EMH, Volatility Tests, GARCH, ARCH, Vector Error Correction Model (VECM)

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LIST OF ABBREVIATION

ARMA	Autoregressive Moving Average
AMEX	American Stock Exchange
ANOVA	Analysis of Variance
ARCH	Autoregressive Conditional Heteroskedasticity
CAPM	Capital Asset Pricing Model
CDC	Central Depository Company of Pakistan Limited
CPI	Consumer Price Index
DOW	Day of the week
D/P	Dividend Payout
DJC	Dow Jones Corporate
ECM	Error Correction Model
EMH	Efficient Market Hypothesis
EGARCH	Exponential GARCH
Fri	Friday
GARCH	Generalized Auto Regressive Conditional Heteroskedastic
GPI	Genuine Progress Indicator
GLS	Generalized Least Square
IMF	International Monetary Fund
ISE	Islamabad Stock Exchange
KATS	Karachi Automated Transaction System
MDH	Mixture of Distribution Hypothesis`
MON	Monday
NASDAQ	National Association of Securities Dealers Automated Quotations
ND	Nikkei Dow

NCCPL	National Clearing Company of Pakistan
NYSE	New York Stock Exchange
OTC	Over the Counter
P/BV	Price to Book Value
PGARCH	Power GARCH
P/E	Price Earning
PIN	Probability on Informed Trade
PSX	Pakistan Stock Exchange
SAT	Saturday
S&P 500	Standard & Poor's 500
SUN	Sunday
TGARCH	Threshold GARCH
T+3	Transaction Plus Three Days
TSE	Tokyo Stock Exchange
THU	Thursday
TUE	Tuesday
WED	Wednesday
VAR	Vector Autoregressive (VAR) Models
VECM	Vector Error Correction Model (VECM)

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CHAPTER 1

1. DESCRIPTION OF TOPIC

1.1 AREA OF STUDY

The stock market has riveted researchers for many decades. A perennial topic of research is to understand the behaviour of stock returns and its dynamics. Stock market dynamics deal primarily with the fluctuating behaviour of stock returns in different environments. It also explains how stock market returns will react under uncertain conditions. One prominent property of stock market dynamics is its prevalence in empirical studies and its emergence in behavioural finance.

We can examine the stock market dynamic from coupe of diverse standpoints: first, from the standpoints of behavioural finance, and second, from the empirical perspective. Under the former, any deviation in the stock return can be attributed to investor behaviour, which may or may not be rational. Later empirical studies attempt to describe the behaviour of security returns. Examining the stock return and its fluctuation in different environments and settings is the key area of interest in studying stock market dynamics.

Trading irregularities is a primary topic in stock market dynamics. The traditional framework believes that investors are rational and can understand the fundamental value of stocks. Thus, investors can calculate the current worth of potential cash stream and can understand the return fluctuation based on some empirical analysis. An investor can also

process all the available information to determine his investment preferences. The Efficient Markets Hypothesis (EMH) argue that all the evidence was immersed into the market and stock values reflect fundamental values.

However, in behavioural finance, trading irregularities are not attributed to some empirical analysis; rather, any deviation in stock value is because of the behaviour of investors, who are not fully conversant with the fundamental price of security and act on the perception of the firms in which they are investing.

Since the early 1960s, the concept of EMH has been the key area of discussion in asset pricing. As highlighted by Fama (1995) and Malkiel (1962, 2003), EMH states that the value of the underlying security must incorporate all the existing evidence instantaneously. Putting it differently it says that during a brief period, the security marketplace should obey a random walk as described by (Malkiel, 2003). Nonetheless, the EMH has some limitations, such as markets having to be perfectly economical, and partakers in the market being risk-averse. Moreover, their sole objective is to maximise profit (Reilly & Brown, 2011).

The notion of EMH is related to the idea that the random walk model can be influenced (Fama, Fisher, Jensen, & Roll, 1969; Malkiel, 2003). The problem is, so long as the markets are efficient, we can predict the prices and impact of information. However, in a risky and volatile market, no one can predict the impact of information; this becomes even more difficult if there is uncertainty in the market. Therefore, according to Fama (1970), the equilibrium price can never be determined accurately in the time of uncertainty. Fama states that sudden corrective adjustments of the EMH can cause sequential price changes, indicating that market prices observe the random walk model. (Malkiel, 2003) defines this phenomenon.

‘There will be no modification in the current day cost of the stock if the evidence is absorbed in the present price and tomorrow price of the stock will only be affected by the news of tomorrow, hence making the EMH work’.

According to Fama (1970), past statistics is incorporated in the contemporary value of an asset and it has no value when judging the circulation of forthcoming returns. This simply means that in the short run, prices are imprudent, having all the existing information. However, Malkiel (2005) believes that in the long run, market prices follow a trend, and are predictable.

Although these assumptions are imperative for the EMH, however they do not represent the actual ground realities. Researchers and policymakers have disapproved the validity of the random walk hypothesis (Ball, 2009).

In substance, it is very unlikely to come up with a standard way of testing the EMH clearly (Fakhry, 2015). However, we can test the assumption that there exists a random walk configuration in the short term. Checking the random walk hypothesis in the context of weak-form of the EMH could be done using the deviation from the mean test, run tests, unique root, and serial correlation (Lo & MacKinlay, 1988). The bedrock of EMH is the crucial postulation that the values of the underlying assets must immediately reflect the available information in the market. Hence, the prices must not stray from the primary value of an asset for an extended period and the deviation should not be considered. As impulsiveness is one of the measures of movement in price from its fundamental value, another key test of market efficiency would be to check if the market is overly unpredictable to be efficient, using a variation divergence test recommended by Le Roy and Porter (1981). Another method to check the market efficiency is to use the conditional variance approach of the ARCH family, as explained by Poon and Granger (2005).

As discussed, the random walk hypothesis is closely linked with the weak form of EMH. It stipulates that yields of the assets are unpredictable and independent of the information, and hence, monitor a solely random walk process. In other words, there is no seasonality in the asset prices because the prices of stocks or any financial assets are completely random. However, it is not possible that markets are efficient all the time and many researchers have documented that the market can exhibit some degrees of inefficiency around certain calendar points (Brown, Crocker, & Foerster, 2009).

Since the formalisation of the EMH, many researchers have examined the efficiency of capital markets. The literature documents various forms of calendar irregularities, such as the weekend anomaly, the holiday anomaly, January anomaly, and the DOTW effect. The most common is the DOW effect. It shows that the market follows a systematic pattern on certain days, and the mean first day return is negative, while the Friday return is positive.

At the beginning of the twentieth century, financial economists presumed that stock return is homogenous across the week and no anomaly exists. However, over time, studies discovered non-random behaviour in stock prices. Cross (1973) points out the that the security return anomalies are a function of the DOW effect. Cross (1973) finds a systematic pattern on Friday, when Standard and Poor's Index advanced 62% on Friday, and the Monday return was negative. Ross (1976) also confirms these findings. Further studies on market efficiency incorporated more findings on the DOW effect. These price anomalies require an explanation, because the investor seeks predictability in the market. Previous studies define this inefficiency of the market as an anomaly (Branch & Evans, 2011; Dimson & Mussavian, 2000), and document it as predictable behaviour of asset returns. Such anomalies pertains to classified as various main groupings of anomalies: nominal, fundamental, and calendar. The firsts couple of the anomalies fall under domain within weak form of efficiency. They focus on the information around certain calendar points, information flow, and its impact on the underlying asset. However, fundamental anomalies relate to the semi-strong form of efficiency.

1.2 RESEARCH GAP

Many researchers have tested the efficiency of the weak type of security market in Pakistan (Akbar & Baig, 2010; Ali, Mustafa, & Zaman, 2001; Iqbal, Kouser, & Azeem, 2013; Mustafa & Nishat, 2010; Nawaz & Mirza, 2012; Tahir, 2011). The literature documents that the PSX is inefficient in a weak and semi-strong form. Most studies in the context of Pakistan recommend investigating the anomalous behaviour of stock returns further, and finding the causes of these anomalies (Iqbal et al., 2013). In this study, we

bridged this gap and discover the long- tem as well as short term association of risk and return under the VECM environment as well as determine the speed of adjustments towards these equilibria. We also identified the anomalies through volatility clustering in the long run. Volatility clustering is also an indication of anomalies and justifies the use of Auto-RCH and General-ARCH models. Using the ARCH/GARCH specification, we not only located the anomaly but also identified a component of the model, which reflects the information index of the market.

According to Fama (1970), the current price of an asset incorporates past information and there is no use of dissemination this information when judging the distribution of imminent returns. This in other words means that in the short run, prices are impulsive, given all the on hand information; however, Malkiel (2005) believes that in the long term, market prices follow a trend and are predictable. We developed our analysis on the same grounds and examined the long-run analysis of return and risk at the PSX.

We discussed investor safeguard by exploring some of plausible explanations of the Monday anomaly. This will help investors in developing their portfolios. We found that high beta stocks cause the Monday anomaly.

1.3 PROBLEM STATEMENT

There are two primary categories of studies addressing stock market anomalies. The first are studies that document the existence of anomalies (Boudreaux et al., 2010; Maghyereh, Al-Zoubi, & Al-Zu'bi, 2007; Ziemba & Hensel, 1994), and second, studies that attempt to find the causes of such anomalies (Lee & Chang, 1988). A plethora of studies has documented the existence of seasonal anomalies within different timeframes and in different contexts. Various explanations, ranging from market microstructure (Bagehot, 1971), seasonal sentiments (Mandelbrot, 1997), tax-related trading patterns (Ali et al., 2001) and event studies, have attempted to shed light on these irregularities. Nonetheless, in the context of Pakistan, it is necessary to find if the anomaly appears, its short-run and long run behaviour, how it behaves at the portfolio level and the relationship of risk and return in driving these anomalies?

Market efficiency anomalies have been well documented in Pakistan (Akbar & Baig, 2010; Ali et al., 2001; Sultan, Madah, & Khalid, 2013; Tahir, 2011), and even calendar anomalies have been confirmed (Ali et al., 2001; Iqbal et al., 2013). One area of further research as noted by researchers (Sultan et al., 2013; Tahir, 2011) is exploring the major sources of irregularities in general and the specific sources that apply on Pakistan Security market.

Hence, in the background of anomalies, the problems are as follows:

1. Investors in the PSX are reluctant to invest on Monday because of the perception of negative market returns. Investors believe that any investment decision on Monday will not yield return. It is necessary to examine this problem and understand why the market is negative on Monday.

2. Investors are keen to explore some plausible reasons for DOW anomalies. In this context, further questions need attention, for example,

   a. It is necessary to examine the reliability of the anomaly, that is, if the anomaly arises on Monday, is this pattern consistent, or is it just a correction in the market?
   b. If confirmed, is the anomaly present at the portfolio level or is it the characteristics of individual-level stocks?
   c. If confirmed, is the anomaly for a short period or is it persistent?

1.4 RESEARCH OBJECTIVES AND QUESTIONS

This study has two basic research objectives, as follows:

1. To investigate trading irregularities in the given stock market dynamics in the PSX;
2. To find risk associated measures for investors in the PSX.

To address the first part of the research objective, the key questions are as follows:

a) Does the stock return remain the same across the week for individual and portfolio of stocks?

b) How do we locate irregularities in the PSX?
c) Does the volatility of return remain the same across the week for individual and portfolio of stocks (No Anomaly)?
d) What are the major sources of irregularities in the Pakistan Stock market?
e) What are the short term and long-term behaviours of the anomaly?
f) How can investors safeguard their interests in the short or long term?

The risk will be the dependent variable. We consider the lagged form of risk as an independent variable, while other variables are firm specific. Moreover, we also treat the DOW effect as an independent variable.

The literature contains various causes of anomalies, ranging from non-trading period in Rogalski (1984), the tax loss hypothesis of Branch and Evans (2011), settlement procedure by Boudreaux, Rao, and Fuller (2010) and Solnik (1990), behavioural finance, by Bruce, Jacobs and Levy (1988), and cash flow prior to or after the anomalous period and institutional investments (Ziemba & Hensel, 1994).

The key questions in the second part of the research objectives are as follows:

a) How can investors safeguard their interests in the time period stretched to smaller and longer periods?

Considering the study question and objectives, we test the following hypotheses:

1. H○: Return from Monday to Friday follows random walk
2. H○: Average return from Monday to Friday on portfolio level follows random walk. Portfolios can be:
    a) Beta sorted
    b) Size sorted
    c) Market cap
3. H○: Volatility (Risk) of return follows random walk
4. H○: Anomalies (Beta, Size, and Volume) follow random walk in long-run

1.5 IMPORTANCE AND SIGNIFICANCE OF THE STUDY

The EMH has essential implications not only for the individual investors but also for portfolio management firms. If the security market is effective, overall information randomly coming into the market will be absorbed in the asset return and reflected in the stock prices. Hence, any publicly announced information will not help investors earn returns beyond the expectations and supersede the arcade. Furthermore, any new information will become part of the security prices that make the stock price a true and fair reflection of returns. Therefore, firms cannot yield abnormal profits by misleading investors in the market.

The practical concept of market efficiency varies across markets and countries. It is difficult to believe that the robust type of market efficiency persist and most believe that the anomalies are short-run and may disappear in the long run (Sias & Starks, 1995). This means that all markets are efficient at different levels and anomalies can be witnessed at some point in time, which can hinder efficiency and fade over time.

1.6 SIGNIFICANCE OF STUDY

This thesis has significance for regulators, as they need to ascertain the market deviation, on average, from the efficiency, and impose appropriate policies to enhance market efficiency.

This thesis has significance also for day traders and short-term investors, as the VECM component tests the short time and long-time behaviour of the DOW effect and allows investors to make sensible choices. Historical studies on the PSX were limited to the confirmation of anomalies. Whereas, this thesis not only investigates the presence of calendar anomalies but also documents the dynamic of trading irregularities, along with suggestions for investors to mitigate risk. The data entails of the daily final prices of PSX 100 index companies with a range of ten years of observations.

1.7 PLAN OF THE STUDY

Based on the discussion, the topic under consideration and its importance in the perspective of Pakistan Security Market, we explain the objectives of this study and the queries to be resolved.

1.8 ORGANIZATION OF THE PAPER

To investigate trading irregularities and investor safeguards, we divided this paper into various chapters; the following paragraphs give details.

Chapter 1: This chapter explains the concept of EMH in reference with benchmark studies. It first elaborates the random walk hypothesis, followed by its limitations and assumptions. The chapter then defines the inefficiencies in the market because of the refutation of the random walk hypothesis. It then explains the inefficiencies in the market and defines their categorization. The chapter also explains the anomaly under consideration and demonstrates its global behavior. It describes the substance of the study in the context of the Karachi Stock Exchange.

Chapter 2 & 3: These chapters describe the extensive literature on the history of market efficiency in the context of the DOW effect. It explains the historical prospective of market efficiency and the current state, as defined by recent studies. The chapters argue the concept of an anomaly, followed by the classification of anomalies. The literature is organized by categories covering market efficiency, its type, and the area of current study, which is the DOW effect. Chapter 3 explains the status and role of the PSX in Pakistan's financial market. It then highlights the performance and landmark years of the PSX. The chapter describes the PSX in the context of emerging markets. It also explains volatility, and its relationship with the bearish market.

Chapter 4: This part shapes the proposed framework for the inquiry based on the literature reviews presented in chapter two of the study. It identifies experimental analyses associated to the planned context and explains the determinants of the proposed framework with the model studies. While building the theoretical framework, we also considered the

models, dataset and the variables in previous studies. On the basis of literature review and landmark studies, we attempted to find a relationship between the portfolio return (built on beta, size and volume) and the calendar anomalies, especially the DOW effect. A theoretical framework for the current study discusses the portfolio return and DOW effect followed by various studies, which explain the relationship between volume, size and CAPM and the DOW effect. To explain the risk (volatility) in return, we provided evidence and explanation of the ARCH and GARCH models. Finally, we explained the error correction models to discuss the dynamic relationship of risk and return study.

Chapter 5: This section describes the methodology of this current study. It explains the criteria for selecting the paradigm of the study. It then explains the testable models for the empirical framework of the study, with the support of literature review and discusses the criteria for selecting the sample. We provided a list of selected companies based on the given criteria. We used data and estimation techniques based on the variables highlighted in the chapter on theoretical framework.

Chapter 6- This chapter contains details of the data analysis. It explains the conformation of the anomaly followed by the rationale for developing the portfolios, and describes the regression examination with dummy variables. It documents ARCH and GARCH specification for volatility clustering and finally utilizes the VECM framework to check the long span and short span link of risk and return. This chapter also contains the explanation for the results, with the link between the research question and the findings.

Chapter 7- This last section addresses the conclusions of the research, considering the research question, study objective and the problem statement. The study attempts to establish whether the DOW effect persist in the PSX, and attempts to identify the sources of these irregularities. Finally, it investigates the short run and long run association between risk and return.

1.9 SUMMARY

This chapter explains the concept of market efficiency and its importance in finance. We discussed the global perspective in this field of study and emphasise its current and

future implication. We explained the problem statement from a wider perspective and in the context of Pakistan and describe the logical flow of the arguments from the research objective to research question. We documented some of the benefits of the current research in relation to the individual and the institutional investor. This chapter leads to the literature review. This will help us identify the work in the selected area of research and explore theories. The theoretical and methodological gaps will pave the way for the current study. The literature review will also help us identify the variable in the current research.

CHAPTER 2

2. LITERATURE REVIEW

This part explains the extensive literature covering the history of market efficiency and the DOW effect. It examines the definition of market efficiency historically and the current understanding of this concept. It also discusses the concept of an anomaly, followed by the classification of anomalies. Considering the research questions to find the major sources of irregularities, we identified five major themes in the role of risk in finding anomalies and the short and long run behaviour of anomalies. First, the literature review covers a critical review of studies on fundamental anomalies, focusing on trading volume, asset pricing, and ratio analysis. Portfolio return and trading irregularities follow, with a review of the studies including the role of portfolio formation and trading anomalies.

To observe the affiliation of variance and return in the context of market efficiency, we reviewed a set of studies related to stock return volatility and market efficiency. The objective is to see whether past information can affect the current stock prices. To apprehend the long and short term behaviour of anomalies, we reviewed literature relating to Vector Error Correction models. Finally, we discussed seasonal anomalies covering the Weekend Effect, Holiday Effect, First Month Effect, and the DOW effect. We put special emphasis to seasonal anomalies in Pakistan, and readings on the DOTW effect. The chapter ends by identifying the gaps in previous studies and the scope of future research.

2.1 MARKET EFFICIENCY DEFINED

Few topics in finance have flickered such intense discussion among practitioners and financial researchers as financial market efficiency. Moreover, very little has been debated on the issues in financial economics and undergone comprehensive research such as the concept of EMH. Predominantly, the phrase ‘efficiency in the market’ is used to define where the relevant information is impounded in the underlying stock. An efficient market is where the security prices at a point in while mirror all the existing information (Reilly & Brown, 2011); hence, the current price of a traded shares displays actual value of the underlying asset. This concept is important because for two reasons; the first is the stock market should be transparent, that is, all investors have equal opportunity to access information regarding the underlying stocks, and none of them can earn abnormal returns based on some non-publicly available information. Second, security prices are fair, which states that the security values prevailing in the marketplace are purely random and adjust to the new information rapidly, because many investors are competing in the market.

We can trace the concept of market efficiency to nearly a century ago, when Bachelier (1900), a mathematician, highlighted these phenomena in his PhD dissertation. Bachelier concluded that the stock process fluctuates randomly; these findings paved the way for subsequent work on the random walk hypothesis and effective market.

Similarly, we can trace the concept of the random to a century ago, when Pearson (1905) in his study on mosquitoes’ migration in a jungle that were affecting the region. Although in a different context, Pearson’s seminal work opened the window of debate on random walk.

The early work of Kendall (1953) postulated the EMH. Kendall’s work was on British stocks and confirmed that price change follows a random walk. Kendall work set the tone for the subsequent study on market efficiency by (Cootner, 1964; Mandelbrot, 1997), and finally, by (Fama, 1970).

An article by Fama (1970) formalised the random walk theory and proposed the EMH. Fama proposed three forms of efficiency, by categorizing market efficiency into three types based on the information reflected in the underlying stocks and the speed at which this information is absorbed in the asset return. He named them ‘weak type of security efficiency’, ‘semi-strong type of security efficiency’ and ‘strong type of security efficiency’.

In the first type of market efficiency, information related to historical events such as dividend announcements and trading volume is contained within in the prevaling stock prices. New information can increase or decrease the current price; however, this information will have no systematic pattern and is purely random. Therefore, it is not possible to yield abnormal return based on the historical price movements in the form of technical analysis. Random walk hypothesis is relevant for the weak form of EMH, which declares that the stock return follows the random walk process and on the basis of historical price future returns cannot be predictable.

In the second type of the stock market irregularity, the proposition shows that all the widely accessible evidence in the form of financial statements, and all the technical information presented in the weak form, has already simulated in the security prices. Hence, it is futile to allocate the over/under rated shares established on these two sets of information.

Finally, the last type of the market efficiency postulates that all the evidence highlighted in the weak form and semi-strong form is included in the security prices and no information is out of bound for the investors to yield abnormal return.

Various anomalies are documented under the umbrella of market efficiency, one of which is calendar anomalies. Calendar anomalies are the most prominent and researched types of anomalies. Calendar irregularities comprise of a wide range of pricing irregularities. An anomaly exists if a systematic pattern of security return can be observed around certain calendar points. The literature to date has documented many such empirical irregularities. Some are as follows: The January effect (prices surge during the month of January as compared to any other any other Month); Holiday effect (stock market

performing well on any day that precedes a holiday); weekend effect (stock prices fall on Friday and rise on Monday); DOW effect (stock prices decline on opening day and rise on closing day) and January small firms (small market cap stocks outstrip large cap stocks in January).

Similar to other economic and financial theories, the EMH has undergone various tests with mixed results. On one hand, many studies confirm that the market is efficient (Banz, 1981; Fama, 1970), while other studies reveal that markets are inefficient and they present some anomalies related to the EMH (Akbar & Baig, 2010; Ali et al., 2001; Avramov & Chordia, 2006; Brounen & Ben-Hamo, 2009; Stein, 2009; Ziemba & Hensel, 1994).

2.2 CLASSIFICATION OF ANOMALIES

Anomaly is any irregular behaviour of stock that violates the random walk hypothesis. Anomaly leads to unexpected risk adjusted return; hence, it opens a window of opportunity for superior return for some investors. Anomaly is difficult to test because it is context oriented. It is very difficult to come up with the list of anomalies that prevail to date, as the list is endless. However, there are two main types: I) fundamental anomalies II) seasonal anomalies.

2.2.1 Market efficiency and behavioural finance

The literature discusses market efficiency in the view of behavioural finance. Researchers believe that the psychology and behaviour of investors has much do with market efficiency. Behaviour finance explains why the market is inefficient because of investor moods and behaviour. Proponents of behavioural finance believe that any anomaly in the market can be attributed to the psychology of investors rather than being examined through empirical analysis.

In 1993, Plous published a book on the psychology of decision-making. He discusses investor behaviour and explains the social aspect in making investment decisions. He argues that social pressure is an important factor in investment decisions. Lakonishok and Maberly (1990) explain value strategies that investors use to buy the cheapest stock,

irrespective of the fundamental worth of the share or any analysis. The value strategy shows that in the long run, value stocks outperform stocks picked on fundamental analysis.

In a survey on behavioural finance and stock return, Loughran and Schultz (2004) argue that the stock returns often vary from the fundamental values of stocks, and such deviation is not because of fundamental or technical analysis, rather the perception of a large number of investors causes this behaviour. In another study, Pheelo, Wsaner, Neploni, and Wenhenger (2011) show any anomaly in security stock return is attributable to the overall perception of investors regarding the future price of the stock.

Literature shows that Nigeria, in past has done a remarkable job in identifying trading anomlies and shows that conduct produce a significant part in deriving the anomalies. In 2003 Nigerian Stock Market documented an index of 278.5 base points and raised serious concern regarding the capacity of the department. Immediately after that, a committee was formed to bring legislative reforms including organizational restructuring, the enactment of a National Tax Policy, improved dispute resolution mechanism, and improved refund mechanism, etc. These reforms proved successful and in the 2011 Nigerian revenue department recorded a surplus of nearly one trillion nairas at Nigerian stock exchange.

Based on the literature on behavioural finance and market efficiency, no one can argue that not all the investors in the market are rational and the irrational investor can influence trading strategies.

2.2.2 Review of studies related to fundamental anomalies

As per fundamental analysis, every stock and an aggregate stock market have an intrinsic value, which is based on the underlying economic factors. Any anomaly arises when a stock or overall market prices differ from the intrinsic value. Studies that measured the cross section of future return suggest that fundamental analysis can be used to predict future return. Fundamental anomalies suggest that the investor does not give the full attention to the firm’s financial statements while investing (Dimson & Mussavian, 2000).

Fundamental anomalies embrace trading volume, dividend income, price to book, market capitalisation, price to incomes, earnings and surprises, mean reversion effects, asset pricing anomalies, and so on. The hypothesis tested in these studies is whether value, size, and momentum can yield an abnormal profit.

Brown et al. (2009) study the S&P 500 with large data of 1,500 security prices and measure the exchange volume and revenue for a 16-year interval from April 1991 to March 2007. The report finds that portfolios consisting of S&P 100 index and large capitalisation securities are usually produce higher yield in comparison to those with a lesser trading capacity. Brown et al. (2009) also reveal that trading volume proxy more than liquidity and measure the investor interest and information content. Their study also shows that profoundly exchanged stocks have greater returns. The findings of Brown et al. (2009) also reveal that trading size and turnover are linked to market capitalisation. The study confirms that the anomaly in the stock market can be because of fundamental reasons, such as trading volume. Therefore, fundamental anomalies such as trading volume must be considered before constructing a winning portfolio.

Juergens and Lindsey (2009) have conducted another significant study in this area. Their study examines the trading volume for the stocks traded on NASDAQ. The study raises the question of information in the form of increased volume. The study finds that the information source matters and the issuing firm may be rewarded for releasing information. The authors also find that increased volume for a particular stock is a proxy for an increase in the trading commission. The authors conclude that the volume is an indicator for investors and some investors trade by only keeping this indicator in mind.

Suominen (2001) explores the impact of volume on the underlying stock traded on NASDAQ for 1980-2000. Their sample contained 144 companies with a uniform selection from 10 industries. This study used mathematical modelling to incorporate the stochastic information that changes over time due to changes in the source of uncertainty in the asset returns. The findings reveal that speculators and liquidity traders proxy trading volume for the availability of private information. On the notion of an increase in volume, liquidity

traders start taking positions in a limit order. Their findings conclude that trading on volume can yield an abnormal return.

Karpoff (1987) also reveals a sturdy positive association among trading volume and volatility of stock return. The data for their research covers a 30-year interval, from 1948 to 1978. However, the methodology used by this study cannot be generalised, as the models consumed in this study assumed asymmetry in the market information, and the availability of information regarding the bid-ask spread, which is difficult to find in major developing stock markets. Another factor in these studies is that they are context-oriented and limited to the stocks traded on the NASDAQ.

Philpot, Brusa, Hernandez, and Liu (2011) examine the volume and liquidity of individual level firms and their impact on seasonal anomaly. They discover that the abnormality is spread extensively among big firms; moreover, volume and liquidity only partially explain that anomaly.

Another set of fundamental anomalies constitutes the return of stocks with higher price-to-book ratios. These studies show that one can construct a trading strategy yielding an abnormal return based on fundamental variables such as book-to-market ratio. Chung, Kim, and Lee (1999) observed a connection between the price-to-book ratios and the stock return in the Korean Stock exchange. To investigate fundamental ratios on abnormal return, this study incorporates samples of all the firms listed on the PSX for the entire data period, 1981–1994. All the sectors were included in the sample, covering oil and gas, insurance, banks, pharmaceuticals, and more. The study concludes that abnormal profits can be yielded based on the buy and hold strategy on the bases of vital variables such as book-to-market ratio.

Avramov and Chordia (2006) employed pricing assessments finding that conditional mean and factor loading of the models may vary with the capitalisation of firms and other market ratios, such as book-to-market. The data consisted of monthly yields for securities operated on the NYSE, NASDAQ and AMEX, covering 19 years, from 1964 to 1983. The results of this study reveal a confirmed affiliation amongst book-to-market ratios

of stocks and the asset return using CAPM. These results are not in confirmation with the EMH and confirm that abnormal returns can be earned based on fundamental factors.

Daniel and Titman (1997) congruently establish that security features such as book-to-market ratio can influence the cross section of shares return. Their finding does not provide support to the theory of EMH. They also disclose a positive link between the cross section of stock returns and the book-to-market ratio.

Various studies on market efficiency paired the CAPM approach to pin down the cause of market anomalies. Since its inception, researchers have been using the CAPM approach to understand the market efficiency anomalies.

Sharpe (1964) introduced a model to assess the pricing of securities. Although the model faced criticism from researchers, it remains one of the most discussed and used models when in security valuation. On the basis of his work, other researchers such as Lintner (1965) and Mossin (1966) have also carried forward the research. Later, Black (1972) also examined security valuations. In the model, Sharpe (1964) recommended that market risk is the risk of the overall market, represented by beta of the stock. Furthermore, we must value the asset to identify the risk-free rate and the market risk premium. If a security beta is high, the underlying security is risker than the market. If it is 1, the risk is equal to the market, and if it is less than 1, the stock is less risky than the market.

To understand the link between empirical anomalies and the risk, return relationship Cadsby (1992) uses CAPM of the data of US stocks. This covers 1963-1985 on 874 selected stocks. The study reveals that when measuring through CAPM, risk is important throughout the sample period. Moreover, for every calendar anomaly of stock return, there exists a reciprocal calendar anomaly within the framework of risk and return correlation; specifically, CAPM risk premium is positive during the DOW anomaly, end of the month anomaly and the end of the year anomaly. These findings prove the CAPM and confirm market efficiency anomalies. The study concludes that the importance of the calendar to portfolio seems to be precisely related to the market variance (CAPM) related with that portfolio and the stocks.

Avramov and Chordia (2006) examine how using a single security CAPM can explain firm-level, size, the book to market value, and momentum anomalies. The study uses both the static as well as the dynamic version of the CAPM to capture market anomalies. Using the data of NYSE, AMEX and NASDAQ listed companies from 1964 to 2001, the study has demonstrated that when a static version of the model is used, it fails to capture the market anomalies in the form of market to book value, size, and momentum. When beta in CAPM is acceptable to change value and size effects are commonly explained; however, the expressive effect of the historical yield persists robustly. The study also found that the Fama-Fench model is robust enough to denote the firm size and B/V ratio on the individual stock return in cross-section analysis. The study demonstrates that the assumption of EMH looks very unnatural and are not applicable to real life scenario and monetary policies of capital markets.

Lau, Quay, and Ramsey (1974) in a study on TSE i.e., Tokyo Stock Exchange, found that the asset return can be measured using the CAPM. They argued that beta is a reliable measure of risk and can well be proxied for the overall risk of the market. To check the applicability of CAPM they used the data covering five years from 1964-1969. The study focuses on measuring the robustness of the standard CAPM model in explaining efficient market phenomena. Uniform with the finding of Avramov and Chordia (2006) static form of the CAPM fails to incorporate the stock market anomalies.

In order to summarize, it was concluded the dynamic version of assets pricing models best explain the stock market anomalies. Consistent with this study, Bodurtha and Mark (1991) use different types of capital asset models to test the capacity of CAPM. He employed the data taken from the US stock market over the time of 59 years and found that the conditional models where there we put conditions on some of the model specifications have performed better than the model where no condition was put to the test. To check the compatibility of beta with the mean-variance approach, he used ARCH models in the equations. In the data from 1926-1985 he proved that conditional CAPM is more robust in explaining the returns of the securities.

CAPM was criticized by Ang and Bekaert (2003) because they think it shows a linear relationship with the overall market portfolio. They argue that it is not always possible to have this sort of relationship and it can be exponential also. In their study data for 25 years from 1976-2001 was used covering the European and American stock markets. They conclude that CAPM is a powerful tool to explain the risk associated with individual security as well as return within different regimes. The results show that significant seasonal anomalies persist in the data even CAPM is stretched to incorporate explicit risk. Moreover, nonlinearities in the market where the correlation between risk and the return is present.

Another study by Tinic and West (1984) highlights a more puzzling relationship between CAPM and calendar. Incorporating a large sample of NYSE from 1953-1982, the study found that CAPM can capture the January anomaly. However, the same anomaly cannot be captured around the year by using the CAPM model. The study concludes that calendar anomaly cannot be explained using the relationship between risk and return. Moreover, the causes of the irregularities are calendar associated differences in the yields themselves are causing this anomaly.

The studies, as mentioned earlier, explain that the calendar anomalies can be attributed to the CAPM. Moreover, beta in the model proxied for the anomaly. It is therefore essential to investigate the reasons behind the anomalies. An investigation is needed to understand either low beta stocks or calendar-related variations themselves are causing the anomaly.

In the technical analysis, the emphasis is on historical data. This historical data is then used to forecast the trends, and based on these trends; projections are made. The primary technique used in the technical analysis is the moving averages and observing the pattern of resistance and support. The weak form of market efficiency affirms that the past information is embedded in the security prices, and any analysis that involved predicting the future prices on the basis of historical information is useless. In other words, technical analysis is futile in predicting future prices. However, some researchers have documented that technical analysis can be used in finding the anomalies.

The two main techniques of technical analysis are relocating means and transaction discontinuation of the activity. In the moving averages, the analysis shows that signals of buying and selling stocks are created after the short duration moving averages bypasses the consistent and far most ratios of the stock and the reverse is true for same. The concept is when the means average returns of the stocks outwits its counterparts in the loner span it means that there is a bullish trend in the market and the sell signal is generated, and where the long affecting averages intersects the small affecting average it means there is a bearish trend in the market and buy signal is generated. Similarly, in the trading range break, the concept of technical analysis says that at a given point in time there is an overall value of the market and investors usually aware of that.

So when the investor thinks that the market is overvalued, he sells the stocks and generates the selling pressure for other investors. This selling behavior creates the resistance level, and the market makes a correction to come to the previous level. Similarly, when all the investors are selling their share, there comes the point when investor thinks that market is undervalued and this leads to purchase of the stocks. In this way, market is always correcting itself either at the support or resistance level.

Many researchers believe that the technical analysis is useless as it is rare to knock the market on the basis of technical analysis; however, there are some anomalies documented in the literature concerning the behavior of the market. One thing which has come out from the technical analysis is to see the long term behavior of the prices. Many researchers believe that the technical analysis is only applicable to short term periods, and in long-run technical anomalies does not persist. The current thesis covered this behavior of the anomalies by using the VECM models that capture the long term behavior of stock returns.

2.2.3 Review of studies related to portfolio return and day of the week effect

Tkac (1999) not only replaced the study of Daniel and Titman (1997) for 1981-1994 but also extended their research by adding omitted risk factors and using the portfolio approach. The findings reveal the significance of Jensen’s alpha, and shows that when the performance of the portfolio is evaluated on the bases of an omitted risk factor, higher

abnormal return can be generated. Based on certain limitations, this study emphasises further research on the abnormal return on the bases of fundamental variables. Other studies have found the impact of ratios that relates to book value and the market value on the return of underlying stock (Rosenberg, Reid, & Lanstein, 1985). They conclude that based on the data sample of 120 firms, comprising 80 that have high book-to-market ratio.

To understand the effect of portfolio return on the stock return, Papanastasopoulos, Thomakos, and Wang (2013) used the data of non-financial firms from 1962-2003, with 105,896 observations in total. The focus of this study was to inspect the connection between value/growth anomalies by incorporating the value/growth indicator: book-to-market ratio. Using portfolio-level and cross-sectional regression, the study confirms that firms with high book-to-market ratios experience stronger returns than firms with low ratios.

Despite all this, not everyone supports this phenomenon. The findings of Bali, Demirtas, and Hovakimian (2009) reveal that only value/growth firms that repurchase shares experience strong performance. They also find that low growth/value firms without repurchase options fail to yield any abnormal return. These findings suggest a close relationship between the value/growth anomaly and return of the stock at the portfolio level.

The current study follows the methodology of (Chung et al., 1999) Kim and Chang (1999), in developing the portfolios. In their study, seven different portfolios were constructed on the basis of past return, unexpected earnings, firm size, and different ratios. The objective was to see if it is possible to extract the excess return in specific periods or months. Lee and Chang (1988) and Schwert (1989) also developed portfolios based on beta-sorted stock using fixed effect model. Fama and French (1992) has also used beta in the market model to construct portfolios. For the current study, we developed three portfolios on the basis of firm size (represented by market capitalisation), volume (represented by daily volume of stocks), and beta (using the fixed effect model).

2.2.4 Review of studies related to risk and ARCH effect

The volatility of stock returns is one of the widely discusses and researched phenomena when it comes to studying the behavior of stock under EMH introduced by Fama (1970). These hypotheses called as the weak, semi and strong form of EMH stresses on the impact of the past security vales, volume of share traded, fiscal and political update, firm-specific news and all other security micro/macro market information on the current stock prices but find no relationship with the future rates of return. The hypotheses have restricted itself to the past impact of stock prices and have left the gap to identify the forecastability of the stock returns with time-varying beta. Interestingly, from the beginning of the model many researchers have identified the fat-tailed distribution pattern in the security return, which can be characterized as leptokurtyic allocation and the dissimilarity from the averge is time varying. Many researchers like Bollerslev (1986) have worked on the nature of issues that changes in response to the time and establish that the systematic has time fluctuating properties of the risk inherited in the system and is commonly known as beta(β) and find the sample standard deviation to be an inefficient measure of the time varying property of beta and is best captured by the conditional variance of the ARCH family as explained by (Poon & Granger, 2005; Poon & Granger, 2003).

Various researchers argue that time has an essential role to play when looking at the volatility of an asset return. Moreover, there are many factors that contribute to this volatility (Gospodinov, Jiang & Gavala, 2006; Brailsford & Faff, 1996). The study concludes that the risk associated with the portfolio return is time dependent. Two major approaches have been used by the researchers to forecast the volatility of asset return. One is to measure the absolute return, and the second is to check it through squared returns. Researchers like Franses, Van Der Leij, and Paap (2002) have measured volatility using the absolute value approach and as a consequence, capture it with a blaring estimator. However, in the standard procedure used by Engle (1982) squared residual method was incorporated, and that captured the volatility using techniques that produce a less noisy estimation of stock return.

Many researchers have tried to check if volatility can be captured using other models besides the GARCH family of models. In a study by Rashid and Ahmad (2008), using the linear model, found that the results of the model were less robust as compared to GARCH estimation. Other approaches, like the quantile regression approach used by Kang and Yoon (2007) and the logical acceptance equilibrium approach by Kurz (1996), have also produced similar results. Using the mean-variance approach for efficient portfolio Marquering and Verbeek (2004) found that the results are accurate but less dynamic as compared to GARCH patterns in order to forecasts the volatility of equity yeilds. Barclay and Hendershott (2003) using the data of 10 years also conclude that the Gaussian vector approach is less significant in explaining the future volatility of stock return. Kovačić (2007) also produce such findings.

The researchers have widely supported ARMA Models because of its ability to forecast volatility. The reason for to use of these models is because they provide the best way to evaluate, investigate and gauge forecasting performance and presentation in the form of equity return unpredictability principally in the setting under the GARCH and ARCH environment. The experiential literature underneath explains innumerable pricing models of assets and various thoughts which were introduced in the historical works to probe and observe the volatility of stock return using external factors such as trading volume, event studies (return before and after an event), business variable (return during different business cycles), etc.

ARCH family of models have been incorporated in the current study because due to the leptokurtic dissemination in the security returns, the Volatility gathering is the common characteristic of the security returns and the approach to use the standard deviation is inacceptable to analyze and evaluate the portfolio return volatility and their forecast ability (Yu, 2002). Without adding risk premium into a standard beta model that shows the risk compensation for the investor the model is incomplete and provide less accurate results as evident from the capital asset pricing model (CAPM) recommended by (Sharpe, 1964). Therefore, this study also focuses on incorporating the ARCH family of models; making them the ARCH family of models to study the risk premium.

Based on the researches of Poon & Granger (2005) and also by Poon & Granger (2003), many pieces of research have worked on the volatility models to check the volatility foresting ability of proposed models. In 2008 an analysis by Bollerslev (2008) had incorporated beyond 120 models of ARCH/GARCH to check what are the time fluctuating properties in asset retune as well as to check the volatility clusters in the profits. Knowing to its pertinence to observe that most of the simulations where moving averages are employed like Yu (2002), autoregressive ranges are used Wan (2006) or value at risk in autoregressive conditional models are used have more or less same properties used in standard GARCH family of models.

A study by Khawja (2005) also documented the stock market anomalies at PSX. He argued that the Pakistan stock market is inefficient and one of the reasons for this inefficiency is the high volatility because of inside trading. He developed a model to incorporate the trading done by the brokerage houses. He showed that the brokers artificially increase the volatility in the market, and this will result in the high cost of trading. When there is a high cost in trading, the profit margin of investors reduces, and this will discourage the foreign as well as a local investor to participate in the market activity. He used the GRCH specification to capture the effect of high volatility at the Pakistan Stock Market.

The volatility is defined as the total expected return from the government verses actual return. It arises when the broker overstates its deductions and understate its income either to avoid or evade taxes due. Many reasons can be attributed to the volatility, but usually, it arises because of compliance deficiencies by the investor. Globally there is an increasing trend in the volatility studies to enhance the compliance management power of revenue establishments. Volatilities in developed countries is usually lower than those of developing countries. In 2005 Bangladesh, South Africa and Thailand recorded tax gaps of 33%,28% and 45% respectively. For the same time period tax gaps for Australia, UK, and USA were 24%, 23%, and 8%.

The weak form of the behavior of the market against the news was tested in a report by Hussain, Zakaria, and Raza (2015). The data used for the study was from 2008-2012.

The study intended to explore how conditional variance in the stock return can be checked. The study recommended that the GARCH (1,1) is pertinent and suits the data and documented the presence of variance in return and high volatilities. He believes that the instabilities are adversely affecting investor confidence and the reasons what are the causes of extra volatilities at PSX must be explored further.

Nawaz and Mirza (2012) empirically tested the type two arrangement of market efficiency at PSX. They studied the volatility patterns at the market to see if the volatility of returns is time-varying. Further, if the investor invests in the risky market, are the returns consistent with risk, (i.e., high the risk higher the returns). The data set was used, comprising the daily return of 100 listed companies from 2006-2011. ARCH-M is used where the conditional variance in assets return is estimated using the conditional mean equation. They found that there is solid indication of instability clustering at PSX during the observed period. The hypothesis of mean-variance was rejected as it was documented that investor is not rewarded for taking an extra risk at PSX.

Using the data of the Islamic equity market of Pakistan, Jebran and Chen (2017) checked the DOTW effect on PSX. They used the Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) model to test the seasonality in the return and volatility of the stock market. GARCH (1,1) was used correctly to capture the volatility of return in the previous periods. Packham and Papenbrock (2017) recommended GARCH over the other models because of its robustness in measuring the volatility.

2.2.5 Review of studies related to DOW effect and VECM settings.

In view to discover the link into the behavior and nature of yields in the security market researchers have used co-integration analysis. Many studies have employed Co-integration in the context of VECM. Keim and Stambaugh (1984) were the first ones to provide insights into the VECM models. They argue that there persist a long span association between the stock return and the risk in the form of economic variables. In the late eighties, Granger (1987) argued that this long-run relation could be explored by using the co-integration tests. Two series are said to be co-integrated when the integration

between them is of the same order, and there exists a stationary relationship between their liner combination.

If two sequence are co-integrated of the same order, this points out that there is a long-span connection amid them. The main benefit of using the co-integration approach is by using this; we can develop an error correction model, which will shed light on the dynamics of co-movement among the underlying variables and can also explain the process of adjustments in achieving the equilibrium. Many studies have used VECM to explore the long and short term behavior of the stock. One of the motivations of this study to use the Vector Error Correction Model is to find both the short term dynamics and long term adjustment of return in response to the arrival of new information.

Most of the researchers, when estimating the long and short term relationship of return, has used the granger causality test. However, one limitation of this test is that it is not very common to use it when there is a need to explore the long-run relation. Many researchers believed that when it comes to examining the long term relation between stock prices and economic variable, the Error Correction Model provides a robust solution, and they dominate the alternative econometric models.

Ohemeng, Sjo, and Danquah (2016) explored the relationship between the different stock market in South Korea, Japan, Singapore, and the USA individually as well as collectively. The objective was to check the Efficient Market Hypothesis. The study used the VECM model proposed by Granger (1987) and found that the stock market in Asia is efficient in the weak form.

As one of the goal of this research paper is to find the dynamic and static relationship of the equity return using all available vectors of price and return. Data of PSX shows that the series of returns and risk are non-stationary, but there is a possibility that they might be integrated. In this way, using the VECM model of Engle and Granger (1987) might help us to see the long term relationship between risk and return.

In a study by Hussain, Zakaria, and Raza (2015) market efficiency and co-integration asymmetry were checked on the South Asian Stock Markets. The data covered

in the analysis was from 1998-2013. The study showed that south Asian markets are efficient in weak form. The research used the co-integration and error correction approach to study the dynamic relationship between various stock markets of Asia, including Pakistan. VECM method was used to see if the stock market understudy can affect each other. The results show that Pakistan and Indian stock markets are co-integrated in the long run. Moreover, the speed of adjustments in response to the good news is quicker than in response to bad news.

A study by Ohemeng, Sjo, and Danquah (2016) checked the market efficiency on cash and future prices using the VECM approach. The study argued that there is a chance that there might be a possibility of seasonal factors; hence, the dummy for each season has been incorporated in the model. The test of Johansen's cointegration was used with three dummy variables to obtain a model fit. The study concludes by exploring the possibilityies in ejecting the null hypothesis that is to assume that existing prices encompass the relevant information about the future prices completely.

Co integration approach for testing the EMH was also used by Peng (2004). The study found that Australian property market is unique in a way and forthcoming prices are not foreseeable on the basis of historical price movements. VETCM was used as there was a presence of long run co integration between return and the property prices.

Engle and Granger (1987), in their study, shows that two co-integrated series are error-correcting in nature. In their representational theorem, they argue that two or more integrated series are co-integrated and have error correction demonstration.

Lot of the literature talked about the long-term affiliation among the risk and the benefit. The reason we have used the automating divergence enquiry to establish time bard properties and relationship amid risk and return at PXE. Moreover, we have used the Vector Equilibrium Correction Model (VECM) for testing the DOTW effect prevailing in short-run only, or it will extend to the long run.

A Common way for forecasting the return for the long run is to use vector autoregressive Var (e.g., Taylor, 2002). However, if the variables are cointegrated, we can

use Vector Error Correction Model (VECM), which is a robust way of looking into a short run as well as the long-period interaction between variable (see Engle 1982).

2.2.6 Review of studies related to seasonal anomalies

The calendar anomalies can be defined as any irregularity in stock return in a calendar year around some calendar date. Calendar anomalies are also flagged as seasonal anomalies in many studies. Four main categories have been reported in the literature regarding the seasonal anomalies. The weekend effect; where a stock exhibit considerably lower returns on Monday than those of the immediately preceding Friday. January effect; stock return in January exceeds the stock return in any other Months. Flip of the Month effect; a slight increase in the stock return during the close of the Month and the first week of new Month, and finally holiday effect; a boost in stock price before any public holiday.

2.2.6.1 The Weekend effect

Boudreaux et al. (2010) documented the stock return uniformities as a function of the weekend effect. Boudreaux et al. (2010) examine a sample of 10,000 observations (1987-2009) of return data from NASDAQ and S&P. The objective was to check the scope of anomalies I volume and tendency of price change within dissimilar days and index performance on the weekend. The study also incorporated the bear and bull market to check the regularities. The study finds that there is no change in the yields among the return on weekends and during the week in a bear market. However, considerable variations have been found in the bull market. The statistical proof thus aids the weekend effect, but only during the markets which are not bearish in nature. The study does not see the conclusive causes of weekend effect and attributes this anomaly of physiological factors and the distribution of wealth between the mases. The study stated that the consumer spends more on the bullish market, and hence, the weekend effect arises.

Keim and Stambaugh (1984) examine the validity of EMH in the presence of over the counter (OTC) stocks and stocks of companies including the top ranked firms. The purpose of the study was to identify firms with insider activities. Moreover, the study intended to find the behavior of firms involved in the specialist’s activities. This study has

scrutinized the soundness of EMH under the circumstances of individual-level stock for 55 years (1928-1982). The study found that the average correlation is positive between Monday and Friday. However, the study also finds that the possible explanation for the weekday effect is not the market makers' activities. The study found no weekend effect in the OTC market. Thus, the study concludes that the weekend effect is not because of the methodical variances amongst the opening values and the closing prices recorded in the stock market — the study emphasis on investigating the weekend further with robust modeling techniques.

(Jacobs & Levy, 1988, 1989) Presents a detailed survey on the causes of weekend anomaly. Various reasons for the anomalous behavior have been highlighted from negative news release at the end of a week, cash flows on the weekend, and market supply and demand balance. The study concludes that human psychology has more to offer regarding the possible explanation of the weekend anomaly.

Lakonishok and Maberly (1990) re-examine the EMH and attempt to find the causes of the endweek effect. The study highlights that in the absence of any formal theory that explains the possible description of the anomaly effect, the individual behavior of the traders on the weekend might explain the part, the causes of the weekend effect. The unique data set was selected by this study and constitute the daily NYSE transaction size of odd-lot share, sale, and purchase from 1962-1986. The study simultaneously checks the buying and selling if individual as well as the institutional investor. The study determines that partially, the weekend effect is because the institutional investors trade less on Monday.

Hoque, Depenchuk, Compton, and Kunkel (2010) reviewed the EMH and used parametric as well as on-parametric tests on bond indices to collect the indication for the persistence of calendar arrangements in the daily returns. Hoque al. (2010) used an in-depth enquiry of the existence of the calendar effect. On the same indices, study finds no January effect, but the persistence of Monthly pattern. He indicates that the Monday effect may not be present even if the strong support is identified for the weekday seasonality. Further, the validity of EMH holds even the bond market is taken into consideration. They conclude about Russian security market that in their concept was not following the efficiency further

it encompass strong seasonal patterns. The study, however, did not find any evidence for the causes of daily and weekly patterns in the indices.

Compton, Kunkel, and Kuhlemeyer (2013) replicated the Hoque et al. (2010) study using the N-parametric test, including T-tests and Wilcoxon sign tests in the Ukrainian money and equity markets. The analysis of the data of two Ukrainian indices from 2003-2007 reveals no sign of a first month influence including weekend anomaly outcome in the Ukrainian debt and equity markets. The non- parametric t-test displays the normal daily return is more than the average return on Monday (across the year). Moreover, almost 65 percent of the time Monday's return was negative. End of the Month effect has been confirmed by using the dummy variable. The study empirically does not provide any causes of the January anomaly but attributes these behaviors to the reliance of Ukrainian equity and debt markets on the global market, including the USA.

2.2.6.2 Holiday Effect

While studying securities rates of return, many studies have empirically tested anomalous regularities. One of the most widely discussed and reported anomaly is o find the presence of extraordinary yields just before the holiday.

Kim and Park (1994) incorporated size effect to examine the presence of size effect in size decile portfolio. They found occurrences of holiday effect across exchanges regardless of the differences in the settlement procedure and trading mechanism. Kim et al. (1994) provided additional insight into the holiday effect and finds that the holiday outcome occurs in all the stock markets of the USA, including NASDAQ, AMEX, and NYSE. Going into the details of how might be some of the causes of the weekend effect, the study rejects the idea of institutional arrangements and the weekend effect. The study finds that the holiday influence is present in all the stock markets within the same country as well as among different countries, even though these trading mechanisms are different. The study emphasized finding the alternative causes of the weekend effect as institutional factors such as clearing mechanism, trading method, bid, ask spared, or even settlement procedure fail to support the link between the holiday effect and its causes. The study also investigates the additional causes of the weekend effect. The study concluded that the

Anticompetitive Dedicated Arrangement vs. Compound Dealership Market (the characteristics of market microstructure) has an insignificant impact on the weekend effect.

Kim et al. (1994) recommended reconsidering the rapport among holiday outcome and firm size as their study after incorporating the DOTW effect and New Year's Day effect did not find a significant size effect on the mean return on the post-holiday. Their research shows that the holiday effect and firm size are not correlated. The study concluded to investigate the puzzle further, causing calendar anomalies in the broader perspective, especially in the context of less developed stock markets.

Loughran and Schultz (2004) explored investor behavior and market efficiency. They examined the weekend effect in NASDAQ stocks in the context of Yom Kippur; Jews holiday. They observed that on holidays, the affiliation among the holiday effect and the trading volume varies among different cities within the same county. The study investigated further the potential causes of the weekend effect. Loughran and Schultz (2004) found that if the Yom Kippur falls on the trading day, the cities where the Jewish population is higher, observed a significant regression in the transacting movement of stocks. In the data of 25 US main cities, the trading activity was 17% less on the day after the holiday in Jewish high population cities. The limitation of this finding was it was based on the developed stock market like NASDAQ and moreover, in most of the countries, holiday effect cannot be attributed to Yom Kippur.

In an extensive review of the literature survey, Ziemba and Hensel (1994) show that six basic reasons can cause the anomaly. The study shows that it is crucial to understand why the anomaly appears? Is it consistent and reliable and finally, how can we identify some of the causes of anomalies? The study finds that there are six principal causes of an anomaly — first is the increase in cash flow before or after the anomalous period. Second is institutional investments; the third one is investor sentiments because of any unexplained reason. The fourth is the flow of the information regarding the particular security of interest — fifth is activities by the market makers by using the bid-ask spread and finally the year-end earnings announcements.

The author concludes that the anomalies are provocative, hard to quantify, and vary across time over investor feelings and future expectations. The study is exciting and interesting, and it is valuable in various extents of portfolio management. The study also emphasized that future research should be done to find the multiple causes of anomalies through empirical methods.

Pettengill (2003), in a literature survey, documented various causes of the weekend effect anomaly. He argues that financial specialists know that the first day effect is existent in the stock return since early as 1930 (Kelly, 2003). However, the study finds that the researchers have identified no conclusive evidence in the data to empirically support their claims, especially in the context around weekend effect. The study highlights various arguments and counter-arguments to find the reasons for the weekend anomaly. The study found that the attribution of the weekend effect due to misspecification on statistical methods couldn't be ignored. A survey by Gibbes and Henss (1981) concludes that heteroscedasticity has nothing to do with the substantial influence on the weekday effect. Another argument in favor of the weekend effect is the market microstructure.

Settlement float has also been considered to cause the weekend effect, Lakonishok and Levi (1982) argued that buyers are willing to buy on Friday because they get more calendar days to settle their payments as compared to if they purchased on the weekend allowing them only five days. They attribute this phenomenon to a high price on last day and small yields on first day. At the same time, this argument was not supported by many other studies on the bases that the settlement procedure explains the weekend effect partially.

Information flow has also been put to the test to explain the cause of the weekend effect. Efficient market hypotheses state that the information is embedded in the stock, and the market responds rapidly to the entrance of new information. If the information coming has a noticeable weekly pattern, one will identify a weekly pattern in security returns. Researchers have noticed the weekly trend at both at the largescale and small scale. On the micro-level researchers have included earning announcements and dividend yields, and on micro-level, they relate the weekend effect to the Monetary policy.

French (1980) argues that one of the motives for the probable interpretation of the weekend effect is that the big corporations delay their bad announcements until the weekend to avoid market disruption. French (1980) also supported the finding of the study by Kross and Schroeder (1984) in which they link the institutional information and the weekend effect. These studies show that there is a link between the weekend effect and market announcements. However, the study also concludes that the institutional announcement only partially explains the weekend effect.

Cornell (1985) presented an alternative approach to recognize the causes of the weekend effect. The data of S&P from 1982-1984 was selected to check if the weekend effect was present in cash as well as in the future market. The study finds that there is a weekly effect in the stock return and yield on Monday is considerably dissimilar from other days. Weekly pattern is visible only in the cash market; however, in the future market, there is no evidence that future prices deviate from the predictions of the EMH. A similar study was conducted by (Chamberlain, Cheung, & Kwan, 1990). The reason for this behavior is difficult to explain and generalize because, in the future market, the cost of the transaction is less. Although in the historical studies, it is shown that to estimate the market price, future data can determine prices. This conclusion states that there is a need to study the causes of the weekend effect.

2.2.6.3 January effect

Several studies have recorded the correlation concerning the January effect and the stock return. Cadsby (1992) measured the US security market using Tinic and West (1984) model. His research incorporated a sample of 874 stocks covering the phase of 1963-1985. The purpose of the study was to find tradeoff amongst risk and return in January. Further, the study intended to explore the relationship between returns and January anomaly. Standard CAPM was used to check the January effect. Stocks were divided into portfolios; the division was estimated on the beta size calculated during the six-year portfolio construction period. The study finds that the January effect is the yearend effect and not January anomaly itself. The study correlates the cause of a January effect to small firms as

they record substantially better yields in January as contrasted to the remaining of the year. The study concludes that the interaction among the firm size and January effect provides additional insight into the close link between them.

In another study, Compton et al. (2013) in Russia explored the relationship of bond markets and January effect, by choosing firms registered on the Russian stock market. Data for the time 2003 to 2008 was selected by adopting the model of (Brounen & Ben-Hamo, 2009; French, 1980; Jacobs & Levy, 1988, 1989; C. P. Jones & Bublitz, 1987). Their study also included the US bond market to test the significance of the outcomes.

. The critical variables for the study were returns of the indices of the primary Russian bond market and the US stock market. The result surprisingly shows that the Monthly effect is contemporaneous in the Russian bond market; however, the January effect was not found. The study emphasizes that future research should be done to check the causes of this uneven pattern in the Russian bond market. Consistent with this study, Khaled and Keef (2012) studied the January effect in a real estate investment trust. This study incorporated a considerable amount of data covering 14 countries. Panel data models were used to measure the in-country differences. The study also found that the possible cause of the January anomaly may be small-sized firms.

Hoque et al. (2010) studied factors affecting the January anomaly in the Ukrainian money and forex markets indices. The index, namely the UKR Bond index, and the Dow-Jones Cops, (DJC) Equity Fund, were selected. The data for the study was from 2003-2007. The effect of January was checked using the dummy variable. They found no significant results of the January effect.

Moreover for the same period (in other Months, especially the June) return was consistently dissimilar across the average yield differ for the rest of the fiscal year. The study, however, did not shed light on the causes of this unusual June effect. More or less same findings have been reported by Lakonishok and Levi (1982) using mathematical modeling. The study concludes that the calendar effect does not change over time, but the two things may happen. First, the frequency of the seasonal pattern may revert from weekly

to Monthly and secondly, the Month effect may shift from January to other Months of the year.

Jordan and Jordan (1991) explored cyclical outlines in mutual fund returns using the American top Mutul fund Index i.e. Jones Composite Mutual Average. The data for the study was taken from daily annotations on the Jones Compound Fund Price series from January 1963 to December 1986. The data were collected from the American famous security places including WS Journal as well as DJ means .Using one-way analysis of variance on the bond market, seasonal effects were investigated emphasizing the January anomaly. The results show January's mean return on each index was generally large relative to the remaining Months.

Moreover, the overall January return is positive during the period of study. The study concludes that impact of the anomaly is stronger in the equity market as compared to the loan market. The study suggested that this effect maybe because of the institutional features of the equity market rather than the index type. The study emphasizes the fact that most of the results have become weaker advocates that whatever is liable for them in the first place may be disappearing. The work wrap up that studying the January effect is an exciting topic for future research.

2.2.6.4 Day-of-the-week effect

A growing literature in latest years shows that there have been many analyses representing that stock return varies according to the DOTW. Many studies have shown that on standard first day returns are negative. French (1980) conducted a survey of Standard & Poor's 500 composite indexes and establish that Monday stock returns are lower than Friday's closing return, and overall Monday returns are negative. Demirer and Karan (2002) observe the happening among in the market an DOTW impression under Istanbul Stock Exchange. To check the possible causes of the DOTW effect concluding index return, excess index returns (over the risk-free rate), and overnight interest rates (in this case inflation) were analyzed. The data used in the study consists of daily values from January 4, 1988, of March 29, 1996. The study discovers no indication of the Monday anomaly; however, the Friday returns seem to be high and significant. The probable clarification for the DOTW effect was not highlighted; however, investor's behavior has been suggested to cause this anomaly.

Raj and Kumari (2006) conducted a study on the Indian Security Market. Two main indices, the Bombay Stock Exchange Index and the National Stock Exchange Index, were used to check the hypotheses of trading weakness under the notion of DOTW effect. The study comprises monthly data for the time covering 1967-1988 and daily data for the time 1997-1999. In the study using the multiple regression and dummy variable techniques, the study found no evidence of negative Monday effect. Many possible explanations have been given for the absence of Monday effects, such as settlement period hypotheses, information flow hypotheses, and tax-loss selling hypotheses. The study concludes that the DOTW effect could be due to settlement period hypotheses because in India settlement period is 14 days. Therefore, prices that tends to follow downward stream on the last day of trading in conjunction with high trends of returns on the beginning trading period could have been the potential first day yield. A similar analysis was conducted by Solnik (1990) to check the causes of the DOTW. The study found that the clearance method may explicate the anomaly as a settlement procedure causes return not to be identically distributed.

Rystrom and Benson (1989) in a study, try to unleash the causes of the Day-of-the-week effect. The study finds that the origins of the effect are more complex than expected. The study found the data may explain the effect. However, investor psychology must be studied to see the real cause of this phenomenon. The study argues that the decision making of the individual investor influenced by actual figures and objectivity is not more than assumptions. The study concludes that psychological factors may not be the only cause of the DOW effect. Moreover, institutional factors like delaying announcements of good or bad news till the end of the week may cause this anomaly.

Kato (1990) empirically investigated the market efficiency theory for the Japanese and United States stock market, for the period 1968-1987. The Value Weighted Index of the Tokyo Stock Exchange was consumed to inspect the DOW effect. The study rejects the notion of random walk hypotheses in the case of Japanese as well as in the US stock market. The study further revealed that both markets fall under the domain of the theories described in the second form in the market proficiency. The study found minor Thu and high Wed returns. The study attributed this DOW effect to firm size in the United States security market as the size of the firm increases weekly pattern tends to decrease. No conclusive evidence has been presented though to explain the DOW outcome anomaly in the Japanese stock market.

Liano and Gup (1989) in a similar study constructed a portfolio of small and large firms. The data set from 1963 to1986 was used for the study. The study employed standard statistical techniques to test whether this nature of the behavior existed through contractions and expansions during the Stock trading sessions. The study found that for little firms, the yields were negative and meaningfully dissimilar from zero on Mon and progressive and highly significant on Wed. The study concludes that size has a significant role to play in defining the DOW effect.

Several reasons to cause the DOW effect has been checked by (Gibbons & Hess, 1981) and the existence of the DOW effect was documented. The study found similar results presented by previous studies where Monday returns are negative. Several explanations have been put to the test to explain the anomaly; however, no conclusive

evidence was found. The study concludes that it is imperative to study this anomaly further and discover its exact cause.

Jones, Fu, and Tang (2008) revealed a focus on whether the DOW effect persists in a seasonal equity offering. The study was conducted on NYSE, Amex, and NASDAQ exchange, covering the period of 1980 to 2004. Descriptive statistics, along with regression analysis was used to determine the impact of seasonal equity offering over the DOTW effect. Mon was also related to the other DOW effect. To check the causes of DOWT effect anomaly various dummies were constructed, including financial industry dummy, medical company dummy, NASDAQ stock market, dummy from the information technology, IPO volatility, and the market capitalization sing the natural log the firm. Two more dummies for the proxy of market microstructure, Rule 10C-28 and short selling were added. The study discovered that the Mon yield was considerably diverse from other DOTW effects and found that Rule 10C-28 which causes long positions has created uncertainty associated with the weekend and caused the anomaly.

Admati and Pfleiderer (1989) observed a positive link between the endogenous variables and the DOTW Mean Effects. The study argues that most of the studies show that the return of most of the stocks on the weekend is negative. However, the research also indicates that traditional asset pricing models are unable to predict negative returns on a varied category of assets. The study found the literature is silent on the reasons why investors should buy risky assets on weekends when the return on them will be negative. This study developed a mathematical model in which market microstructure variables like sell volume, order imbalances, and the probable worth variates endogenously. The study concludes that pricing rules for liquidity traders have an impact on the market makers. The study found that the way private information is coming into the market is short-lived, and market makers use this information to their advantage. The study emphases that endogenous factors, rather than exogenous factors, are the leading cause of market anomalies.

While trying to find the exact cause of the DOW effect, Jaffe and Westerfield (1985) conducted a research on the United States and Japanese stock markets. The data

from Jan 1997 to April 1983 for the Tokyo Stock Exchange (TSE) Index, Nikkei-Dow (ND) Index, and the S & P 500 Stock Price Index were used. A total of 225 companies was selected. The drive of the research was to check the affiliation among the Japanese and US stock markets in the context of the DOW effect. The study witnesses a robust sign of the weekly seasonal impact in Japan. The study found that the smallest mean returns on the JSM occur on Tues, but not on Monday. Moreover, the weekend effect was present in the US market, but it has no impact on Japanese stocks. The study concludes that there is no underlying connection between the US and Japanese stock markets.

Jaffe and Westerfield (1985) also tried to find that either, the settlement process or the measurement error problem are causing the DOW effect. The study established that settlement on United States exchanges occurs on the fifth business day and in Tokyo Stock Exchange it is done on the third day. Hence the settlement methods have no impact on the DOW effect. The study also ignores the notion that the clearance method can explain the DOW effect in Japan. Measurement error was also taken into account. However, it fails to explain the DOW impact as a negative correlation between returns on Saturday and the following Monday would suggest a random type of measurement error. The study found the relationship between Saturday and Monday performance is 0.294 for the Tokyo Stock exchange and 0.141 for the US. Thus the study found no conclusive support that the measurement error is the cause of the DOW effect. The study concludes that even the stock markets around the globe exhibit strong weekly seasonal trends, no theoretical explanation has been found.

The role of institutional investors was analyzed by Sias and Starks (1995) with the focus to discover the cause of the DOW effect. Market capitalization was taken into account. To check the hypotheses that whether it is professional investors or the single investors are the cause of weekend effect, the study compared institutional positions of small companies. The data for the study consisted of institutional holdings, volume, daily returns, and market equity capitalization of firms listed on the NYSE from 1977 to 1991. Based on the market capitalization deciles portfolios were made, average deviation among the extreme and low organized fraction portfolios were considered, as well as the F-statistic

linked with a test of equality of the difference overall days of the week was calculated. Contrary to previous studies, the study found that the DOW effect anomaly is caused by the institutional stockholders.

Chang, Pinegar, and Ravichandran (1993) found some contradictory, even puzzling findings regarding the DOW effect and the role of institutional investors. Their analysis was piloted keeping in the mind international security markets. Their study inspected the robustness of the global DOW effect using daily returns on 22 different indices and the U.S from 1986 to 1992. The study found that institutional details of stocks fluctuate from country to country and are incapable of explaining the DOW effect.

Al-Khazali (2008) explored the impression of block trading on the DOW effect, in the evolving equity market of the United Arab Emirates. The study found that the use of parametric tests is not pertinent for the securities that have un equal distributed returns. The review instead uses the stochastic dominance approach to check the effect. The daily data from 2001 to 2006 show that when biases from the indices are corrected for statistical biases, the DOW effect hypotheses can be rejected.

The DOTW effect has also been checked in a different context and on different assets. Numerous studies have tested the DOTW effect on Treasury markets, Money market, Mutual Funds, and Bond Markets. Ferri, Goldstein, and Oberhelman (1984) have checked the existence of the DOW effect in the Treasury bill market from 1973 to 1981. Using the Box-Jenkins time-series techniques, the study found the presence of the DOWT effect in the Treasury bill market. However, the review was unable to find any logical rationale for the DOTW effect.

The Money market has also experienced a DOW effect. Philpot, Waser, Nipaii, and Winder (2011) documented the DOW consequence in the Canadian Money market for the period 1980 to 2009. Using the parametric t-test, Wilcoxon Sign Rank Test and regression model, the study confirms the DOW effect in the Canadian Money market. The study found that the Mon effect is not steady over the period of time and during 2000 and onward the effect disappears. No logical reason was found in intermittent behavior. The study,

however, found that yield spreads may be causing this behavior. The study concluded that further research should be done to find the exact source of the irregularity.

Miller, Prather, and Mazumder (2003) analyzed the DOW effect in ten open-end mutual funds. The data of 2,739 daily returns observations from 542 mutual funds revealed that the mutual funds exhibit the DOW effect, and bid and ask spreads with commission could explain these irregularities.

2.2.7 Seasonal anomalies and Pakistan

Various studies have documented the market efficiency theory in the context of Pakistan. Nishat and Mustafa (2002) using the data from 1991 to 1997 on Pakistan Stock Exchange, shows that the DOW effect is present at PSX. The study documented the existence of orthodox first day influence is not established; rather, the Tuesday and Wednesday effect was found. The study attributed this effect to the information flows and argued that at the weekend the information accumulates and that effect is reflected on Tuesday.

Numerous studies in the context of Pakistan have shown that Pakistan Stock Market is inefficient (Akbar & Baig, 2010; Ali et al., 2001; Iqbal et al., 2013; Nawaz & Mirza, 2012; Nishat & Mustafa, 2002; Tahir, 2011). However, it is yet to explore the dynamic relation of anomalies that is, do the DOW effect still prevail. If yes, is it related to mean return only or the volatility of stock has an effect on the DOW effect? Finally, is the anomaly consistent or reliable or it has different behavior in the short and long term. These are some questions we seek to answer in this research.

2.3 SUMMARY

The existing literature regarding the market efficiency hypothesis has defined market anomalies in various ways. However, three main categories define market anomalies: fundamental anomalies (Brown et al., 2009; Dimson & Mussavian, 2000; Juergens & Lindsey, 2009; Suominen, 2001) asset pricing models anomalies (Ang & Bekaert, 2003; Avramov & Chordia, 2006; Cadsby, 1992; Lau et al., 1974), and seasonal anomalies (Boudreaux et al., 2010; Compton et al., 2013; Hoque et al., 2010; Jacobs &

Levy, 1988; Keim & Stambaugh, 1984). Some pioneer studies in the context of return regularities as a function of the DOW effect include Cross (1973), who showed that the Standard & Poor Index advances 62 percentage on Friday and on average Monday return was 12 percentages negative; Ross (1976) employed parametric techniques and confirmed the DOW effect anomaly. Many researchers (Al-Khazali, 2008; French, 1980; Gibbons & Hess, 1981; Raj & Kumari, 2006) have employed standard dummy variable techniques and non-parametric tests. Similarly, in the framework of Asian stock markets, several studies have shown the inefficiency of stock markets (Akbar & Baig, 2010; Ali et al., 2001; Iqbal et al., 2013; Nawaz & Mirza, 2012; Nishat & Mustafa, 2002; Tahir, 2011).

The present study is unique because it builds its framework on the portfolio level. As the literature highlights many causes of anomalies, such as size, and book-to-market ratio (Fama & French, 1993), bid ask spread (Nawaz & Mirza, 2012), high vs. low beta firms (Cadsby, 1992), and market microstructure (Krishnamurti, 2009). In this study, we followed a portfolio approach to see how the DOW effect responds on the portfolio level and building portfolios on the fundamental variables highlighted in literature. To confirm the anomaly, we employed standard dummy variable techniques, following previous studies (Boudreaux et al., 2010; Cadsby, 1992; Demirer & Karan, 2002). To investigate the possible relationship between the DOW effect and the anomalies relating to fundamental and asset pricing, we followed the methodology of Kim and Park (1994).

We explored the long- and short-run relationship of risk and return under VECM environment, and determine the speed of adjustments towards these equilibria. Another contribution of this study is our identification of the anomalies through volatility clustering in the long run. Volatility clustering is also an indication of anomalies, which justifies the use of ARCH and GARCH models. Using the ARCH/GARCH specification, we not only located the anomaly but also the ε component of the model employed reflects the information index of the market. We found that conditional heteroskedasticity means that volatility is conditional upon the availability of market information.

CHAPTER 3

3. ENVIRONMENT AND FEATURES OF STOCK EXCHANGES IN PAKISTAN

The chapter examines the Pakistan financial market and the work done on the Karachi Stock Exchange. It highlights economic changes and their impact on stock performances. It also explains the performance of PSX landmark years in terms of market capitalisation and volume. The chapter describes the PSX in the context of emerging markets. Further, the chapter explains volatility and its relationship with the bearish market. The chapter also highlights various regional exchanges and their links with the PSX. The chapter explains how PSX functions in terms of market orders, market makers and the expected changes over the next decade.

As there is always a need to regulate the system to make the system work without any problems, the Pakistan's Leadership has done remarkable job to ensure the money market works properly. The government established two main bodies to control and supervise the stock exchanges in Pakistan: The Security commission and the CDC of Pakistan Limited (CDC) in 1997 and 1993, respectively. The role of the SECP is to make the PSX work efficiently. For this, it introduced a state-of-the-art trading system in 2000 called the Karachi Automated Transaction System (KATS). Similarly, to work internationally and to compete in the international market, it introduced a settlement system

for financial transactions called T+3, in 2002. The NCCPL is responsible for clearing inter-account financial transactions.

The PSX is the main stock market of the county representing 80% of the trading activity of the financial market. However, two more stock exchanges have been in operation in Pakistan since 1971. One is the Lahore Stock Exchange (LSE), which represents the trading activity of Punjab and main areas of northern Punjab. Incorporated in 1971, unlike the 100 index of the PSX, it comprises 25 index companies. Besides the PSX and LSE, the Islamabad Stock Exchange represents a small portion of shares and constitutes only 10 indexes. It was established in 1989.

Since 1998, there has been rapid improvement in the trading activity of the PSX. After observing bearish trends in 1998-1999, the stock market started showing recovery trends in 1998-2001, with cumulative market capitalisation of PKR 399.6 billion in comparison to previous year's summative market capitalisation of PKR 289.2 billion, where the PSX index of shares remained between 1000-1400 points. However, the persistence of selling pressure was witnessed in one year, from August to June 2001-2003, where the aggregate market capitalisation declined to 12.9% against growth of 89.6% in the previous year. However, the PSX share index remained stable between 1600-1300 points (Arshad, Rani, & Shaikh, 2012; Khaled & Keef, 2012).

Although the financial markets in Pakistan are developing markets, they have made are some achievements already. In 2001-2002, in an article in 'Business Week', the PSX was considered the best performing market in the Asia region. This achievement was mainly because of stable economic policies, sustainable growth, social political certainty, stable balance of payment, and the listing of new companies on the Karachi Stock Market. In addition, regulatory bodies have also helped achieve the tag of 'best performing market' by providing liquidity to the market. Following the trend from 2001-02, the PSX retained its momentum in future years by showing unprecedented performance in 2003-04, recording a growth of 92.6%, with 80% growth in market capitalisation. Studies on the performance of PSX shows that the 100 index had a bull run of almost five months and

recorded the highest value of 5340 points, an increase of 60% from the previous year (Arshad, Rani, & Shaikh, 2012; Khaled & Keef, 2012).

However, 2004-05 saw bearish markets with a peak performance of the PSX-100 index (benchmarked index) at 98%. During one year, from July 2004 to March 2005, the index showed incredible growth and doubled from 5120 to 10131, and increased aggregated market capitalisation by 81.9% to PKR 2414.9 billion rupees. However, as volatility is the key factor shaping up the stock market, the PSX-100 index recorded a severe decrease after mid-March 2005 of 32.7%, or 3364 points. These volatile effects were mainly attributable to suspension in the privatisation of public limited companies, withdrawal of funds, and extreme futures trading.

Resuming its landmark performance, the PSX-100 index attained 12274 points for the first time in the history of its capital market in April 2006, indicating a growth of 64.7% over June 2005.

Another year of good performance for the Karachi stock exchange was 2016, with the market considered the best in Asia. Overall return on investment was 45% on equities, the highest in the last five years. This increase boosts the confidence investors in the equity market. In comparison to the last year, almost 20% new investors entered the market, hoping that this trend will continue in the next year.

The start of 2017 was not very promising. In the beginning of the year, equity mutual funds reported drop in returns of up to 15%. This drop was unexpected and its major cause was the decrease in the volume of shares. The margin of the brokerage houses reduced, and as a consequence overall security market plunges into negativity.

By the completion of 2017, the PSX decreased by almost 20%, which is a massive decrease in the last 10 years, only rivalled by the plunge in 2008, during the global financial crisis. Stock analysts reported two major reasons for these losses: First, the market was volatile because of uncertainty in the political regime, and second, the volume of stock traded had decreased.

As discussed, volatility was the key factor in the poor implementation of the PSX, as it was recorded on the last week of the calendar year that the index gone down from 52,714.6 in May to 40,874 in December, a decrease of approximately 24%. During this time, there were many low and high values of the index, with a climate of uncertainty among investors.

The lowest value of the index was in March, at 37,199; this was a decrease of 21% from its record value high in December 2016. However, the correction saves the market from falling further and hype in the last week of April saved the market, and the index returned to the 40,000 mark.

Market capitalisation was also very low in 2017. It was USD 93 billion at the end of 2016 and dropped to 73.8 billion in 2017, shedding 21 billion in market capitalisation. However, during the end of financial year 2017, the market recovered slightly in terms of market capitalisation and the share value closed at USD 77.89 billion on 29 December 2017.

There is much discussion regarding the causes for this poor performance of the stock market. First, and most importantly, it is the political situation. It began with the disqualification of Prime Minister Nawaz Sharif, which triggered the fall of the equity markets, compounded by the estranged civil-military relationship. Another reason is that the market has failed to attract foreign investors. In 2016, foreign investors invested USD 4.5 billion and sold almost USD 5 billion of worth securities, for a net income of USD 490 million.

In 2017 however, this had reduced to 377 million $ a decrease of 5%. Daily volume of stock traded on PSX has also gone down in 2016 May the average volume per day was 239 million shares, and at the same time the it was % less to 223 in May 2017. This volatility and the change in the volume is the key characteristic of Pakistan stock exchange. The current study takes the data from 2008 to 2017 however the recent changes in the stock market have not helped the market to bring stability in the prices and the data taken will represents the behavior of Pakistan stock market.

3.1 VOLATILITY AND PSX

There has been a growing interest among the portfolio managers in the dynamics of emerging markets and the investments in the small and developing stock exchanges. The reason behind this interest is there is more room for growth in the developing market rather than in the developed market. Moreover, to see the effect of financial development and the steps to uplift the stock market can be easily traceable through empirical studies. International investors are always keen to invest in the developing market because of the high volatility in return provides the opportunity to earn extra profit, and inefficiency in the market can provide the opportunity for developing growth portfolio strategies. Nonetheless the developing markets are more unstable and volatile relative to the developed economies because of the unstable financial reforms, the fluctuating exchange rates, the higher cost of capital and the higher reserve requirement and ultimately the higher rates of return demanded by the investors (Aggarwal, Inclan, & Leal, 1999; Nazir et al., 2010).

As per the Pakistan Economic Survey 2016-2017, the agriculture stock Market contributes almost 2% to the GDP of the country. The growth rate of the industry is also stable, and in the last ten years, it remained around 2.5%. However, like other developing countries tax revenue generated by this sector is very low. Literature has highlighted many reasons for this low revenue, but political will is key among all reasons.

PSX, being the market of the developing country, is more exposed to fluctuating stock price movements due to environmental (political, social, economic) forces. For example, due to the free and fair elections of 2013, the PSX skyrocketed with a total equity capitalization of Rs. 4.99 trillion (which is equal to US$ 61.4 billion roughly). The market remained high for almost six months. In the last two decades, a lot of empirical research is conducted on Pakistan Stock Exchange by local researchers at the stock level, market level, firm-level and economic level with different frequencies of data varying from yearly data to daily data. Kanasro, Jalbani, and Junejo (2009) studied the effectiveness of the security market based on its liquidity position of the yearly data. Another study on the impact of gold prices on Pakistan Stock Exchange based on five-year Monthly data is studied by

Shahzadi and Chohan (2012); hence making it palpable to see Pakistan Stock Exchange is the main area of research for local as well as foreign researchers to study its influence at micro (e.g. liquidity position) and at macro (e.g. gold prices) level.

The use of information technology plays a pivotal role in stock market. It can improve every aspect of Stock Market, including account opening, verification, debt collection, and other revenue processes. Revenue authorities have used ICT to improve their overall operations like audit and arrear collections. Moreover, some tax administrations across the world have collaborated with other state divisions such as the Imposts Office, Terrestrial and Business Listing Bureaus, and municipal Governments to share the information for tax purposes.

Similarly, the volatility behavior of PSX was tested by various researchers e.g., Arshad et al. (2012) recorded that the variance in return at Pakistan equity markets is because of the variation in performance of previous days as well as the difference in the residuals of error terms. Nazir et al. (2010) establish a strong attachment among the volatility of the security market and the dividend policy of the firms of PSX 100 index.

3.2 MARKET CAPITALIZATION

The PSX's market capitalization was estimated to be about 46% of the estimated GDP of the financial year 2006, indicating a growth of 70% with an increase of Rs. 3419.4 billion in the previous year's market capitalization of Rs.2013.2 billion. This remarkable performance of the stock market led due to the economic and financial policies that remain consistent for a couple of years.

In the year 2000 to 2007, the stock market remains on the high side, where overall exchange capitalization rose to 4196.7 Billion. This raise was because of a couple of reasons, first because of the investor confidence, and second, due to foreign direct investment. But, as mentioned earlier stock markets are vulnerable to domestic and environmental shocks.

In the fiscal year 2007-08, there have been some bad performances in terms of low market volume and reduced market capitalization. The main reasons behind this bad

performance were the instability of the political situation. Moreover, some restructuring in the stock like mergers and acquisitions has led to declining the index by 5%. Market capitalization reduced by 6.4% during the three years that is 2008-10. The stock market remains unstable, and there have been patches of highs and lows during a short time. High volatility was recorded during that time, and the 100 index rose to 15000 and plunges back to 12000 in just eight months' time. The instability within the month and days were also very high during 2008-10. The main reasons attributed to this unstable market was due to the uncertainty in the political situation and the rumors that the government will be dismantled. However, some good news gives the push to the market, and 100 index recovered at the close of the year.

In the beginning of the year, (the year 2011) market witnessed a bullish trend. Government favorable policies in terms of tax waivers, giving protection to foreign investors and stable political conditions were some of the reasons for this bullish trend. PSX index rose to 12822 from 11686, and total market capitalization recorded an increase of 14% and became 3471 Billion rupees.

3.3 PSX AND TURNOVER OF SHARES

In terms of turnover of shares, PSX has also witnessed some bearish and bullish trends. Turnover is clculated as the trading volume of the shares at 100 index level. Due to the gain of trading volume at the beginning of 1999, the volume was increased to 47% and the volume increase to 48.6 million shares in 1999 from 24.9 million in 1998.

A considerable recovery and growth was documented in 2003-04 in terms of the turnover of shares at PXE. From 48 million, the turnover reached 54.9 billion showings an increase of 20%. PSX remains in the spotlight with outstanding performance in terms of not only the exchange volume but also the market capitalization. By the end of the year 2004, the turnover was recorded at 71.6 billion shares. In the year 2005-2006, the performance of PSX remain stable with a few recording of bearish trends, but the market recovered quickly. In 2007 however, because of some internal and external factors PSX index dropped and shares amounting 56.8 billion was reportedly decrease the volume. The

volume dropped because of some adjustments in the market, and some news on the tax reporting from the investors were reported.

In strengthening the stock market business cycle has a role to play, as shareholders are keen to participate in a stable security market and want to invest in long term ventures. One of the main factors of stock market stability is an overseas investment. Literature illustrate that there is a positive influence of overseas investment in the growth of the stock market. In the year 2003-04 foreign direct investment has an increase of 27% as compared to previous years that have resulted in the stability of PSX 100 index.

In previous years the foreign reserve remains low because of the country's situation and some imposition of economic sanctions. By the end of the year 1999, the reserves were 1325 million dollars. However, at the beginning of 2000, the financial situation improved, which causes an increase of 5%, and by the end of the year, it was 1370 million. In 2001 the reserve again goes down and record a decline of 16% and stood at 1132 million dollars.

The year 2007-2008 witnessed an increase in the foreign reserve and its impression on the security market. An increase in the foreign reserve was witness and caused the foreign reserve to increase by 8000 million $ and stood at 15,464 million $. By the end of the year 2008 budget report, a deficit causing the reserve to decline and stock market recorded a selling pressure. During the four years that are 2008-2011, an unprecedented increase in the foreign reserve was witnessed due to the inflow of foreign aid in the economy. Two international donor fund has led to this increase as the International Monetary Fund (IMF) and the fund developed for the natural calamities fund dealing with preparedness and response to the emergency control and operations has make available 452 million dollars and 744 million dollars respectively.

In 1999 the market underwent a change consistent with the fluctuation in foreign exchange amount. The government of Pakistan introduced a floating exchange rate among the Money place, especially in the market dealing with the foreign currencies exchange fluctuations. This method was taken keeping in mind the international practices of the Money market and base on the functions of demand and supply. These steps help Pakistan to bring the balance of payment and trade competitiveness in the international market. In

the fiscal year, 2000-2002 the Pakistan exchange rate exhibited a reward of 5% in the global market, however, this increment was temporary, and debt obligation as well as payment of import bills against petroleum products causes a decline of 14.5%. Many countries are working on the stock market dispute resolution system to protect investor rights. Various institutional arrangements are in place to deal with the trading dispute before the judicial stage. In Indonesia, dispute settlement agency works to settle the conflicts before the judicial proceeding. In Korea, the local tax review committee was formed in 2008, and in China, the administrative reconsideration committee is in charge of hearing investor grievance.

The years 2007-2008 was the years of instability in Pakistan Money market as well as in the political, economic situation. This has led to a decrease in the exchange rate by 6.3% after the stability of the last four years. Appreciation in Pakistani rupees to the dollar witnessed in the year 2009-2010 by approximately 11% as compared to the despeciation of 0.4% in the year 2008-09. In 2011 the rupee further devalued by 2% because of the less demand of dollars in the international markets.

One of the essential features that is documented to have an impression on the trade cycle is crude oil that continually showed a bullish and bearish trend in the energy market. An upward drift has been detected in the fiscal year 2000-2001. Oil production went to 57,064 barrels per day as compared to the relative output in the previous financial year of 56,141 barrels per day. Following an upward trend, the fiscal year 2002-2003 has shown an incremental production of crude oil by 64,905 barrels per day, but fell to 62,139 barrels per day in the fiscal year 2003-2004 because of the usual reduction in the production of oil fields of Pakistan, development company dealing with oil exploration, and petro companies including Orient Petroleum.

An increase of 7% was observed in the fiscal year 2004-2005 amounting to 66,508 barrels per day due to the increased production in OGDC and Orient Petroleum Incorporation. Again a decrease of 1.23% was observed in the fiscal year 2005-2006 of 65,385 barrels per day due to a 10% reduction in the southern region oil field of Pakistan. An incremental gain of 5.54% of crude oil production was recorded in the fiscal year 2007-

2008 amounting to 70,166 barrels per day due to current production in the northern and the southern oilfields of Pakistan. Volatility again played its role in the fiscal year 2009-2010 with a downward trend of the crude oil production of 1.9%, amounting to 62,547 barrels per day relative to previous year's production of 65,422 barrels per day due to less production in the southern part of Pakistan. The fiscal year 2010-2011 ended with a gain of 1.15% of crude oil production amounting to 65,996.50 barrels per day.

The market returns remained positive for the extended period of 1998-2011. The turnover of shares was 9.3% higher based on the volatile movements of the PSX-100 index. Moreover, as mentioned in the dataset of the financial variables market, it remained bullish throughout that period. The bullish and bearish trends of the economic and business cycle variables explained above provide evidence of volatility in the price movements.

CHAPTER 4

4. THEORETICAL FRAMEWORK OF THE STUDY

This segment presents the theoretical framework developed from the literature review. The models for the current study consider the various variables of landmark studies. This study identifies datasets and possible methods using previous studies. While developing the theoretical framework of the models, we also considered the datasets and variables of previous studies. On the foundation of a literature review and landmark studies, this study finds a relationship between the portfolio return (built on beta, size, and volume) and the calendar anomalies, especially, the DOW effect. A theoretical framework for the current study discusses the portfolio return and the DOW effect, followed by various studies that explain the relationship between volume, size and CAPM and the DOW effect. To explain the risk (volatility) in return, we provided evidence and explanation of the ARCH and GARCH models. Finally, we explained the error correction models to discuss the dynamic relationship of risk and return.

4.1 EXPERIMENTAL FINDINGS ASSOCIATED TO PLANNED FRAMEWORK

Preceding reports argued that given the return irregularities, the related calendar effect in the context of risk, return connection is coherent with capital asset pricing models (Bodurtha & Mark, 1991; Brennan & Xia, 2001; Cadsby, 1992; Chakravarty, Gulen, & Mayhew, 2004; Keim & Stambaugh, 1984; Na et al., 1995). The DOW effect has also been

attributed to firm size (Brockman & Michayluk, 1997; Brounen & Ben-Hamo, 2009; Jacobs & Levy, 1988; Lee & Chang, 1988; Loughran, 1997) and finally volume (Al-Khazali, 2008; Chordia, Roll, & Subrahmanyam, 2001; Jain & Joh, 1988; Lakonishok & Maberly, 1990; Loughran, 1997; Loughran & Schultz, 2004; Mustafa & Nishat, 2010; Nishat & Mustafa, 2002; Pagano, Girard, & Omran, 2009; Suominen, 2001).

Many studies in the literature review chapter provide a theoretical basis for the present study. We now focus on some previous studies explaining the relationship between volume, size, CAPM and the calendar anomalies.

4.2 SIZE EFFECT AND STOCK RETURN

This is evident after reviewing the voluminous works that cross sectional differences exist in return distribution, according to firm size. A pioneering study provides theoretical support (Cross, 1973; French, 1980). Cross et al. find that the average yield starting on the beginning of the new is significantly lesser when doing a comparison with remaining days in the week with varying magnitude. Keim and Stambaugh (1984) have also confirmed seasonal anomalies and the relationship between firm size and the DOW effect. They found that 63% of the size effect occurs on Friday.

The DOW effect seems to be most palpable among small and young firms, which have very few institutional investors. Brounen and Ben-Hamo (2009) confirm that in the absence of any plausible explanation of the DOW anomaly, it can be assumed that the size effect may be the possible explanation. In another landmark study, Fama and French (1992) documented that size can provide an effective yet very relevant indication about the cross sectional return of the equity and debt market during 1965-1997. They concluded that size is a valuable proxy for the stock return that are cross sectional in nature. They further argue that their findings have imperative consequences for portfolio construction and investor size could be a dominant factor in deciding portfolio evaluation.

Keim and Stambaugh (1984) also emphasise the importance of size in defining stock market anomalies, especially the DOW effect. He recommends that methodical pattern in shareholder purchasing and selling behaviour could elucidate the unusual high

yields on the transacting days prior to holidays. Keim and Stambaugh (1984) argue that official aspects such as settlement procedures, trading methods, bid-ask spreads and clearing mechanisms are not a good proxy for the possible explanation of the DOW outcome, because these features contrast across states and suggest that firm size could explain the seasonal patterns of stock returns.

Various studies have used the portfolio technique to check the relationship between the DOW effect and firm size (Kim & Park, 1994; Lee & Chang, 1988; Rogalski, 1984). The portfolio was constructed according to firm size, which ranked firms by their market value of equity, and each portfolio consisted of equal numbers of securities. The market worth was calculated by reproducing the last closing price of the previous year with the quantity of shares unsettled of common stock. The compositions of the size portfolios were updated annually.

Rogalski (1984) provides strong evidence in favour of firm size and the DOW effect, finding that the returns of small capitalisation stock were significantly different from large capitalisation stocks (0.4607% for small capitalisation stocks vs. 0.2692% for the largest). He also concludes that the post-holiday returns were significantly different from the DOW effect on the bases of portfolio size.

Having discussed the relevant studies on the connection amongst size effect and stock return, it is evident that size rank portfolios may help in understanding the behaviour of the DOW effect. Therefore, we developed a portfolio based on size (market capitalisation). Three portfolios are constructed based on high, mid-and small-size firms.

4.3 VOLUME AND STOCK RETURN

We also explored the link between the DOW anomaly and trading volume. Various researchers have documented that the volume of stock may contain information regarding the possible cause of the DOW effect. Researchers found that at least the volume could explain the anomaly partially, if not fully.

Osborne (1959), in a study on the volume of stock return, incorporated the Brownian motion in predicting the predictable yield of the stock market. He explored that

the variance in the return shadows a random walk. He found that the trading volume might give information regarding the behaviour of investors. High trading volumes indicates that investors are taking interest in the stock and vice versa. In another financial theory, various researchers explored that good and bad news has implications on security prices (Bollerslev & Jubinski, 1999; Tauchen & Pitts, 1983). When the market receives good news, the volume of stock increases and goes into a slump in case of bad news. He also found that the new equilibrium comes into play after the news, whether good or bad. He also found a definite link between trading volume and returns.

Lokansihok and Mebarly (1990) examined the NSE covering a 25-year period, showing that trading size was lower on Mon than alternative days of the week. The study shows that the mean size on first day in every week was 32.67 mil stocks, in comparison with a mean of of 38.17 million shares with in the whole week and 32.23 mil shares form from second day to last day in the week. This was evidence of the almost 10% decrease in volume on Monday. Moreover, the study finds that the trading volume can also explain the behaviour of peculiar and functional investors, as they documented that the tendency of people to trade on Mon is the highest, while institutions generally do not trade on Monday, and their contribution is the lowest. Moreover, individual investors usually prefer selling on Monday. The study concludes that this phenomenon might explain at least part of the DOW anomaly.

Tkac (1999) also documented the importance of trading volume and the anomalous trading behaviour. The study finds that the average excess volume of the stock is directly related to institutional ownership. By means of an immense sample of NYSE/AMEX, the study finds that the volume of stock may contain information that will help unleash the DOW effect. The study concludes that the trading volume can proxy for more than the type of traders and volume can entail various event announcements such as earning, dividend policy changes, and corporate control events.

Loughran and Schultz (2004) emphasised the importance of volume in relation to market efficiency. They found that the inclination of stock return to be negative on Mon and optimistic on Fri has much to do with investor behaviour rather than the settlement

procedure and other fundamental variables. They argued that volume contains the information regarding investor behaviour and sentiments. The volume of stocks may be helpful in finding the causes of the DOW effect. Dimson and Mussavian (2000) also document the role of volume and investor behaviour. Using the GARCH model, the author finds that traders in the stock market estimate the availability of private information. He also finds that trading volume contains useful information regarding investors during the weekend and on weekdays.

Nishat and Mustafa (2002), in a study on the PSX, documented the effect of trading volume and the DOW effect. Nishat and Mustafa (2002) found a significant positive variance in trading volume on Tuesday and Wednesday. The study found that the volume must be considered while studying the PSX, as it witnessed a strong connections and coefficient of determination amongst the trading days and quantity. The study empirically demonstrated that Mon has the least trading volume, whereas Tues has the maximum trading volume. The study concluded that the process of information is incorporated in the trading volume.

Al-Kahazali (2008) demonstrated the effect of trading volume on the DOW outcome. The study shows that thin trading or trading with little volume can affect the DOW effect. The finding was based on the phenomenon that the return from the published indices is corrected from the less frequent volume and the DOW effect could be rejected. They conclude that volume must be considered when examining the causes for the DOW effect.

In a study on the Cairo Stock Exchange (CSE), Pagano et al. (2009) documented the affiliation amongst shares volatility and the trading volume of stock return. The sample was 80 companies traded on the CSE. The intention of their research was to investigate the positive and negative association between returns of stock and the associated volume. The sample for the study was chosen for a seven-year period from 1999 to 2006. Further, the data was organised to incorporate mergers and acquisitions after 2002. The paper presumes that there is substantial positive association among stock return and volatilities. GARCH estimation was incorporated for this purpose, which provided robust results.

Kovačić (2007) explored the affiliation between day trading and stock volatility on the Finnish Stock Exchange. For vigorous estimation, the author divided the data into two classes. The first incorporated the quantity of dealings and the second considered the size of trading activity. Detailed data was acquired from the Finnish Central Securities Depository (FSCD) for five years. The detailed data was incorporated for insight on the price of transaction, type of transaction, its quantity, day of transaction, date of transaction, broker information and trader identification. Regression and correlation were applied to examine the bond among volatility and volume. Correlation analysis showed no correction between the volume of trade and number of trades, which are independent of each other. However, the regression analysis shows a strong connection among stock return volatilities and the trading volume. Moreover, the study found that if the number of transactions is taken as a alternate for trading volume, the results are even more significant. The study concludes that trading volume and volatility has a direct relationship.

Trading volume, the flow of information, and spread differences have been questioned by (Chakravarty et al., 2004). The study was conducted on three stock exchanges, including the New York Stock exchange, Berkley Options Database, and Chicago Exchange Institute for Securities Markets. The data consist of the daily return of 65 companies traded from 1988 to 1993. The objective of the research was to explore the price discovery mechanism and found that how trading volume and bid-ask spread is related to price discovery. Using the T-GARCH methodology, the study found that trading volume is a relevant indicator to discover the price mechanism. The study also strong proof of a relation between trading volume and spread differences at the NY trading platform and Chicago Stock arena.

In another study by Barclay and Hendershott (2003), the relation between the price discovery and trading volume was explored. Continuous data of 212 companies were selected for the analysis. The data was split to pre and post-trading hours to check the relationship. They tested that if the price discovery is prominent during the day hour or after the post-trading hours. The study found that information flow is high during the trading hours rather than after the trading hours. The data for the study were chosen from

2000 to 2002, consisting of 212 companies traded on NASDAQ. Different times were selected, one is from 8 in the morning to 6.30 in the evening and include the after-hour trading and second from 9.30 in the morning to 4 in the evening and included the trades and quotes. The authors have also taken a sample of 250 highest volume stocks. In these stocks, they have not included the American Depository Receipts. Out of these most top volume stocks, 75% trade in the after-hours which usually trade in the NASDAQ stocks. EKO Easley, Kiefer, and O'Hara model have been used to see the behavior of trading in pre and post-trading hours. Moreover, post-close trading day periods were also incorporated using the probability approach on the trade information. The author finds that the market is efficient and the data, either public or private is usually absorbed in the share price after the trading hours and before the pre-opening of next trading hours.

But this information is not worth as it does not have a remarkable effect on the price discovery. It was further analyzed that discovery of the price usually starts from the stocks with high volume. Further its goes to less traded stocks and then it finally effects the lowest volume stocks. It was also observed that trading cost raised because of the high risk.

Based on these finding, we have developed three more portfolios based on high volume, mid-volume, and low volume stocks to see how the Day-of-the-week effect respond to the portfolio level — moreover the influence of each portfolio on the anomaly.

4.4 CAPM AND THE CALENDAR

Another way to look at the DOTW effect is through the window of CAPM. Tinic and West (1984), in their landmark study, show that the calendar effect can be paired with CAPM. They found that tradeoff between risk and return can be witnessed in January. Although they found no effect of CAPM in the other Months, but their findings provide the way forward to check that CAPM could explain the DOW effect.

In another study, Cadsby (1992) argues that, because of the return anomalies, the conforming calendar effects on the risk-return association are align with the CAPM. He found that risk is rewarded on various days of the week like on Wednesdays it was compensated, similarly on Thursdays as well on Fridays it was present; however it was not

rewarded at the beginning of the week like Mon and in the mid-week like Tuesday. In fact, the data indicate that the risk is severely penalized on Mondays.

Based on the finding of Tinic and West (1984), we have constructed our last three portfolios based on beta shorted stocks. High beta stock represents the risky stocks, and low beta portfolios consist of less risky stocks.

So far we have discussed all the studies concerning the return, but it will be unfair to ignore the risk factor; therefore the underlying inquiry addressed the volatility capturing techniques in explaining the volatility of stock return at PXE.

4.5 PORTFOLIO RETURN AND DUMMY VARIABLES

The current study follows the methodology of (Chung et al., 1999) Kim and Chang (1999), in developing the portfolios. In their study, seven different portfolios were constructed on the basis of past return, unexpected earnings, firm size, and on the basis of different ratios. The objective was to see if it is possible to extract the excess return on a specific period or specific Months. Lee and Chang (1988) and Schwert (1989) also developed portfolios based on the beta sorted stock using fixed-effect model. Fama and French (1992) have also used beta using the market model to construct the portfolios. For the current study we have developed three portfolios on the basis of firm size (represented by market capitalization); Volume (represented by daily volume of stocks); and beta (using the fixed-effect model).

4.6 RISK AND ARCH EFFECTS

Volatility, perceived as a risk, means a change in underlying security price by responding against adjustment in risk. The price remains high because the prices of the underlying security return demonstrate sharp movement. These sharp movements phased away if the volatility of the return is low.

The stocks interchangeably called as shares are thought to be the safe investment as it gives some sense of ownership in the company according to the percentage of shares issued by the respective company. Irrespective of this ownership, the investors are exposed

to the fluctuations in the price movement of stocks termed as volatility. That is why; the finance practitioners and the economic and the people who develop policies keep a close eye on the variability of stock yield as they may act as a proxy of risk in the security markets and consider volatility to be the important factor to judge the risk in the financial sector especially security markets. For instance, the relation between the interest rates and the stock market has been well explored. An increase in the interest rates causes the return to slow down because of two reasons. First, because the cost of capital increases and that causes a return to decline and secondly investor demand premium for paying more for the security. This unanticipated increase in interest rates immediately affects the stock market, where investment slows down, and gradually the overall growth of the economy goes into a slump. This sharp movement either upwards on downwards in the prices of the stock is called volatility.

A practical description of few of the ARCH as well as the GARCH family of models that have time-varying characteristics of the return and risk conditions is described as under;

4.6.1 Autoregressive conditional heteroskedastic (ARCH) family of models:

A representation by Engle (1982) shed light on the point to point changing properties of the equity market in the UK and the inflationary insecurity extracted as;

$$Y_t \mid F_{t-1} \sim Niid(x_t^{'}\beta, \sigma_t^2) \quad (1)$$

Where F_{t-1} describes the data cluster at time $_t$-$_1$, Y_t specifies the regression model,

$$\sigma_t^2 = f(e_{t-1,} e_{t-2}, ...e_{t-P}; \phi) \quad (2)$$

The equation above defines p as the conditional variance in the lagged terms;

$$\varepsilon_t = y_t - x_t^{'}\beta \quad (3)$$

One of the other model recommended by Engle (1982) is;

$$\sigma_t^2 - \varpi + \sum_{t-1}^{q} \alpha_t e_{t-1}^2 \quad (4)$$

The equation above undertakes ω to be a progressive value and except for that the remaining values of α_i's as non-confirmative.

4.6.2 GARCH family of models:

Bollerslev (2008) in a recommended model explain chain of other models with the GARCH(p,q) specification and it can be explained as;

$$\sigma_t^2 = \quad + \sum_{t-1}^{q} \alpha_t e_{t-1}^2 + \sum_{t-1}^{p} \beta_t \sigma_{t\text{-}1}^2$$

(5)

In the equation mentioned above p lags are included in the conditional variance. Moreover, these equations can be changes into ARMA models by incorporating square residuals as;

$$e_t^2 = \varpi + \sum_{t-1}^{Max(p,q)} (\alpha_t + \beta_t) e_{t-1}^2 - \sum_{t-1}^{p} \beta_t v_{e-t} \qquad (6)$$

Where $v_t = e_t^e - \sigma_t^2$ described as $E_{t-1}(v_t) = 0$. This is a simplified GARCH (1,1) model and it is considered as the best fit to apply the parametric tests. It could be explained as;

$$\sigma_t^2 = \varpi + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \qquad (7)$$

The model explained earlier says. that If $\varpi > 0, \alpha \geq 0$ and $\beta \geq 0$ among the volatility specified equation, it could be hypothesized that in the simplified GARCH(one,one) model the conditional variance is not only positive but also very structural. Moreover this model can also take the value of ARCH(∞) only if covariance the general model turn out to be static and the unqualified adjustment converts as $\sigma^2 = \varpi / (1 - \alpha - \beta)$. Here ARCH (∞) can be modeled as ;

$$\sigma_t^2 = \omega (1 - \beta)^{-1} + \alpha \sum_{t=1}^{\omega} \beta^{t-1} \varepsilon_{t-t}^2 \qquad (8)$$

The GARCH (1,1) has also ability to capture the different time period volatility in the forecasts as;

$$\sigma_{t+h|t}^2 = \sigma^2 + \left(\alpha + \beta^{h-1} \left(\sigma_{t+1}^2 - \sigma^2\right)\right) \qquad (8a)$$

Here we can see that h≥2 indicates the time differences in the forecast.

The other models Bodurtha and Mark (1991) uses the exponential properties of the return and best suited to model the irregular originations in security return and its risk. The model EGARCH (1,1) can be explained in a form:

$$\log\left(\sigma_t^2\right) = \omega + \alpha\left(z_{t-1}\right|)\right) + \gamma z_{t-1} + \beta \log\left(\sigma_{t-1}^2\right) \quad (9)$$

The notation $z_t = \varepsilon_t \sigma_t^{-1}$ mentioned in the equation above has innovation in it that is standardized. It simply states that the news either positive or negative has an impact on the risk of security. However, in case of bad news the risk is high as it is followed by high volatility as compared to good news where it is followed by low volatility. This is explained by $\gamma \leq 0$ in the model. By putting this condition in the model allow the model to capture only that information that meet the criteria and in this way it allow the model i.e. EGARCH to correctly apprehend the leverage effects in the security returns.

Power GARCH (PGARCH) model shows different parameters in the estimation and can be explained as;

$$\sigma_t^8 = \omega + \sum_{t=1}^{\omega} \alpha_t (|e_{t-t}| - \gamma_t e_{t-t})^5 + \sum_{t=1}^{p} \beta_t \sigma_{t-1}^8 \quad (10)$$

AL-Najjar (2016) introduces the threshold models in the GARCVH terms, and they are the chain of other similar models like ZARCH, and ZGARCH. In these models, the standard deviation was used to capture the positive and negatives news in the squared residuals.;.

$$\sigma_t = \omega + \alpha |\varepsilon_{t-1}| + \gamma |E_{t-1}| \left(e_{t-1} < 0\right) + \beta \sigma_{t-1} \quad (11)$$

In this equation the same concept has been highlighted as proposed in the ICR-Volatility alteration that was first used by (Glosten,1993).

Mustafa and Nishat (2010) has done a research on the Pakistan security market and demonstrate how the event can affect the return and risk. They have chosen the event like nuclear news and divide the data into the post and pre-information. They have chosen that data covering ten years from the period 1991-2001. Data was subdivided into categories covering the good and bad news. There finding was that the impact of the event was

significant, and the change in the stock return was not only significant, but there was a weak change in the movement of stocks. They believe it is important to use not only the ARCH family of models but also to incorporate the vector autoregressive models to explain the long and short term relationship of risk best and return under the event study environment.

In a different research, the existence of ARCH influence in the return residuals of variance is determined by (Yoon & Kang, 2007). Data for ten years of was used. In this study, the author used the data of 21 stock covering two years. The aim was to see the presence of ARCH effect and the conditional variances.

4.7 ERROR CORRECTION MODELS

Vector Error Correction models have been consumed widely to capture the stock market anomalies. (Kellard, Newbold, & Rayner, 2010; Peng, 2004; Ohemeng, Sjo, & Danquah, 2016; Marc, Chan, & Kwok, 2016). In a study by Marc, Chan, and Kwok (2016) price discovery mechanism was discussed in reply to the reform notices in the security market. The study found that the market adjusts to the information flow and that can be captured by using the Vector Error Correction Model. Furthermore, the research establish that there is a long-time affiliation between the price of cross-listed stocks.

4.8 DEFINITION OF DEPENDENT AND INDEPENDENT VARIABLES

The relationship between the dependent and independent variables are explained in the following sections. This relationship is described based on the theoretical framework defined in the literature review chapter. The relevant hypothesis is also mentioned.

4.8.1 Return of PSX 100 index and portfolio returns: The dependent variables

As per the literature plethora of studies have defined the return of an index as a dependent variable (Brounen & Ben-Hamo, 2009; Cadsby, 1992; Demirer & Karan, 2002; Keim & Stambaugh, 1984; Philpot, Washer, et al., 2011; Raj & Kumari, 2006) and many other studies. In the context of Pakistan and specifically on PSX 100 index (Ali et al., 2001; Mustafa & Nishat, 2010; Nishat & Mustafa, 2002) have used PSX 100 index return as a

dependent variable. These studies also simultaneously use PSX 30 index and other Pakistan security indexes as the dependent variables. The current study follows the same approach and uses the return of the PSX 100 index as the dependent variables. However, as the present study intends to find the behavior of the anomaly at the portfolio level we have been made different portfolios on the stock market characteristics like size, volume and beta sorted stocks, and their return is also considered as the dependent variable.

4.8.2 Return within the different Days-Independent variable

The independent variable for the current study are the dummy variable for each DOTW. Thus each dummy represents the day starting from Monday to Friday. As per the equation 1.1 Coefficients $\beta_1 \ldots \beta_5$ here depicts the average return on each day, and representation of the dummy for respective day is denoted by $D_1 \ldots D_5$. in other words, if the average yield happens on the same day it will be 1 and if it falls any other day it will be 0, and 1_t in the equation is the error term. The hypothesis of equivalence of mean yields throughout days for a particular portfolio can be written as:

Hypothesis $(H_o) = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$

If the results show that the hypothesis is rejected, it will mean that the average daily yields are expressively dissimilar from each other and there is chance of seasonal pattern in returns within diverse days of the week.

4.9 SUMMARY

This section is crucial to the underlying thesis. The variables relating to calendar anomalies have extended the findings of leading studies (Brounen & Ben-Hamo, 2009; Cadsby, 1992; Demirer & Karan, 2002; Keim & Stambaugh, 1984; Philpot, Washer, et al., 2011; Raj & Kumari, 2006), among many others. In the context of Pakistan, and specifically, on the PSX 100 index, literature support is robust for developing the variables (Ali et al., 2001; Mustafa & Nishat, 2010; Nishat & Mustafa, 2002).

As the literature review shows that the behaviour of the DOW effect has a strong relationship with stock characteristics such as volume, size and risk, we provided

theoretical support for the construction of portfolios and its impact on the DOW effect. Size and volume are two important factors we considered in developing portfolios. Finally, this chapter shows the importance of beta-sorted portfolios and calendar anomalies. Based on the theoretical framework, the next chapter explains the methodology and testable models for the study.

CHAPTER 5

5. METHODOLOGY OF THE STUDY

This bit depicts the procedure and schemes adopted to conduct the current research. It explains the positivist paradigm considering the scope of the current study. It also explains the approaches to collect the data, bases of data gathering, time span for data gathering, unit of analysis as well as the statistical procedures. It then explains the testable models of the current study with the support of the literature review. Moreover, it deliberates the reasons for using a specific method.

5.1 RESEARCH DESIGN AND PARADIGM

Since current study aims to observe the dynamics of the security market, we assumed PSX data has provided us with strong evidence to test the market efficiency. We believe the current study falls under the positivist paradigm. We tested various hypotheses, such as efficient markets, the role of volatility in security yield as well as and the long run affiliation among risk and return at the PSX. We used robust quantitative econometrics techniques to test the hypothesis for the current study.

5.2 SAMPLE DESIGN AND DATA

This study targets the companies listed on the PSX (i.e. companies incorporated as PSX 100 index companies within the tested period of 2008-2017). Data from the PSX 100 index is selected because it is similar to other economic pointers that track the performance of the country, such as the genuine progress indicator (GPI) and consumer price index (CPI). The PSX 100, as the name indicates, encompasses 100 firms selected based on their representation of sectors and the highest market capitalisation. The PSX 100 index represents the market capitalisation of 90% companies registered on it. From 33 sectors, 32 companies were chosen and each sector was represented; however, some sectors were excluded, such as mutual funds and open-ended funds. The main companies were chosen on the yardstick that their market capitalisation and the remaining 63 companies in descending order.

Note that the data must be arranged so that it represents the whole population for the companies listed on the PSX during 2008-2017. The data requirement for the present study was limited to ten years because of the research design. Different portfolios were constructed from within the PSX 100 index; therefore, it was necessary that the chosen company must be within the 100 index for a specific time. As new companies are listed on the 100 index every year, and many companies are delisted, it was necessary that the company selected must be present in the PSX 100 index for the entire period of ten years, when developing the portfolio of the stock level characteristics.

There were mergers between companies during the study period. To keep the sample size sufficient to answer the research questions, we considered all the companies listed on the PSX. However, before making the sample selection, we considered the following:

a) All selected companies for portfolio formation must be listed on the PSX 100 index.
b) Companies should represent all 30 sectors; if a company is delisted from one sector in 2008-2017, it will be considered, but it must be listed for a consecutive four years.

c) As the data needs to be arranged by date, for purposes of dummy variable and panel data regression, we arranged matching data regarding the mandatory variables.
d) The firm selected for portfolio formation must be listed for four consecutive years in 2008-2017.
e) Companies delisted for consecutive two years will not b////e considered.
f) The financial statements of companies are considered when calculating the market capitalisation of each stock.

As explained in the selection criteria for analysis, we obtained ten-year data for 95 companies listed on the PSX, either for ten years or at least four years during the period under consideration. Table A4 in Appendix A contains the final sample.

The literature shows that the convenience sample technique may be suitable for the analysis. We used this technique as it enabled us to select the companies that represent the entire population. The criteria finally adopted was the PSX 100 index of the data selected covering the 10-year period from 2008-17. From the specified criteria, we selected 95 companies.

We pooled the dataset of all the nominated firms, given the defined benchmarks previously, in the selection period of 2008-2017. We selected stocks that represent all the sectors. In all, we covered 30 sectors, including oil and gas, forestry and paper, industrial metal industrial engineering and mining, electricity, non-life insurance, fixed line communication, food products, tobacco, financial services, personal goods, chemical, pharmaceutical, travel and leisure, general industries, equity and investment, gas and water, banks, life insurance, automobile and industrial transportation.

5.3 TESTABLE MODELS FOR THE EMPIRICAL FRAMEWORK

To conduct the empirical study, testable models have been discussed in the current section. As most of the studies employed dummy variable techniques, this study also tests the DOW effect using dummy variables. Few other models employed in current research are panel data models, CAPM, ARCH models, and Vector Error Correction models. All the

models for the current study have been used to keep in mind the theoretical framework of previous researches. The model is chosen based on the type of variable used

in the abstract models. The present study also takes care of the variables, and their limitations showed in earlier studies.

5.3.1 Qualitative variable model

In this study, variables under the context are reflected a qualitative variable. The rationale is to discover their implications in the context of size, volume, CAPM beta, and the DOW effect. These variables are:

a. The size of the firm is considered in the current study because in the earlier studies it was measured an important factor (Brounen & Ben-Hamo, 2009; Cross, 1973; Fama & French, 1992; French, 1980; Keim & Stambaugh, 1984). The current study incorporated size, consistent with the Fama & French study, where the equally weighted portfolio was developed based on the size.
b. The volume is considered another important factor in deciding the DOTW effect anomaly. Volume factors are incorporated in the patterns on (Lakonishok & Maberly, 1990; Loughran & Schultz, 2004; Tkac, 1999).
c. The CAPM has been used following the methodology of (Cadsby, 1992; Tinic & West, 1984). The econometric methodology has been developed by following the patterns of (Asteriou & Hall, 2015; Gujarati, 2009).
d. We used the ARCH family of models because we found the leptokurtic dissemination within the stock yields at PSX. Furthermore, the congregating of variances is the common characteristic of the security yields, therefore using normal standard deviation measures turn out to be invalid to analyze and evaluate the portfolio return volatility and their forecast ability (Yu, 2002).
e. To see how Pakistan security market reacts to calendar anomaly i.e., DOTW effect VECM models are suggested. In this way dynamic properties of risk and the return at PXE can be studied.

To identify the DOTW affect almost all the studies mentioned in the literature, reviews have employed the dummy variable technique. The current study follows the same pattern and uses qualitative variables or dummy variables. The test of the DOTW effect is recommended by using the dummy variable (Asteriou & Hall, 2015; Gujarati, 2009). This method is helpful in two ways firstly it will help us to find the slope that changes in the variables, and secondly it tells us the intercept that is the constant value or the initial value of the variables. The result we will get by this process reveals that the mean returns on, Wednesday, Tues, Thu and Fri are considerably diverse from Mon. The importance and consequence of the dummy variables are enlightened in the succeeding paragraph that will help us understand the theoretical context.

This study employs qualitative variables to discover the causes of the DOTW effect anomaly. The reason for including these variables in qualitative nature is because it measures the relationship among variables without strict assumptions. The method has another benefit that is in this method slope of the curve shows the relationship with the independent variable. This is common methodology used in the previous studies. The effect acquired by this methodology disclose Monday and Friday anomaly on the portfolio level. A total of nine portfolios have been identified representing low, medium and high beta, volume, and market capitalization stocks respectively.

Consistent with the methodology of Compton et al. (2013), we have used second regression equations. Equation 12 is run to test the alternative hypothesis i.e., DOW effect is common characteristic at the security market.

$$R_i = \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + u_i \qquad (12)$$

Here the equation shows the link between return and the dummy for each day. $R_t$here represents the yield of PSX 100 index for the sample period selected. Coefficients $\beta_1 \ldots \beta_5$ symbolize an average daily returns within the week and on the individual day, moreover the dummies are included representing by D_1 to D_5 and shows the value of 1 in case average return happens on particular instance, and it will be zero on the other hand, and *ut* is considered as an error-term. In case we accept the alternative hypothesis, the meaning will be that average daily returns are not identical throughout the week and the

DOW anomaly calendar anomaly exists. The figure shows how the dummy variable will look like in case the coefficient value is positive. The line moves upward as proportionate to the intercept shows higher value, and is denoted by 'D'. Similarly, 'D' in figure 2 represents the negative value of the dummy coefficient.

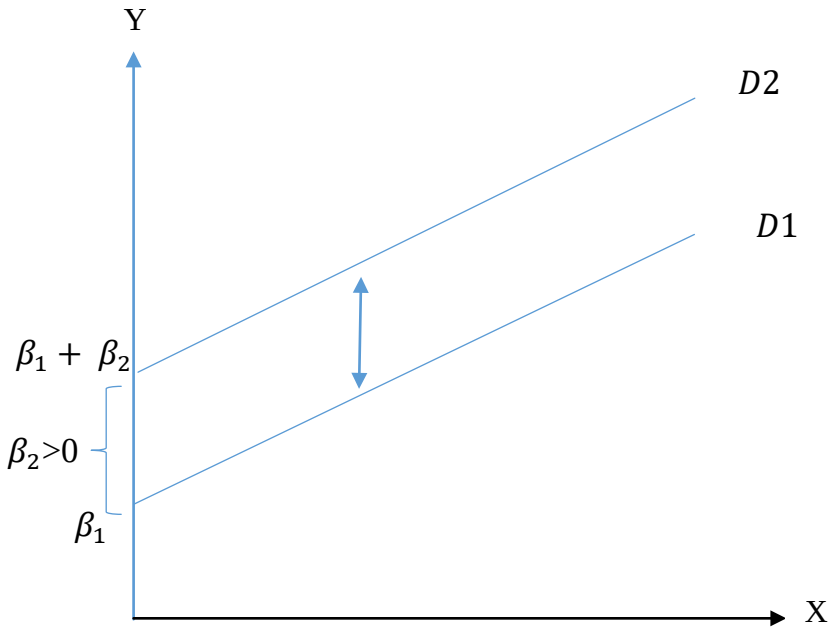

Figure 5.1 the the step wise dummy variable model ussing regression . The line labeled D1 is for Monday; and the line considered D2 is for Tuesday.

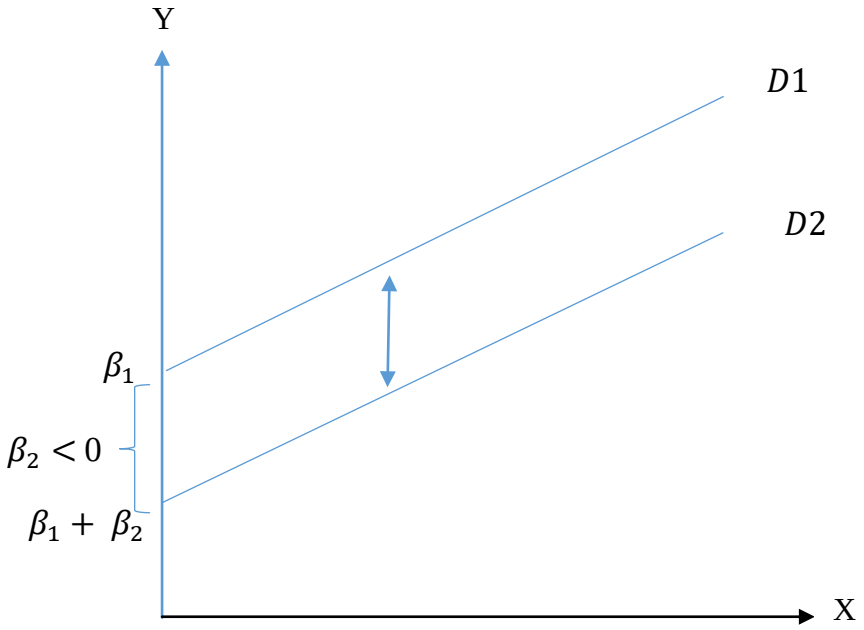

Figure 5.2 is the step wise dummy variable model ussing regression . The line labeled D1 is for Monday; and the line considered D2 is for Tuesday.

The reference group in each dummy variable represents the cut off term, and it is consumed as a location group. We have used this group because, in this way, we can avoid the dummy variable trap. In this research, the Monday stock yield is documented as a benchmark. To trial the weekend effect, we have estimated another regression to check that if the mean yield on the first day-of-the-week i.e., Mon is unrelated from mean daily returns compared to the rest of the week.

$$R_{it} = \beta_0 + \beta_1 D_{1t} + \beta_2 D_{2t} + \beta_3 D_{3t} + \beta_4 D_{4t} + u_t \quad (13)$$

In this equation R_i is the return of PSX 100 index, as well as the return of different portfolios based on the size, volume, and beta measures. The intercept β_0 is the average return on Mon, and the coefficients β_1 to β_4 captures the variances among the mean yield on Mon and the mean yield for the rest of the week. Tues, Wed, Thu, and Fri are coded with the value of 1 if the return is on the specified day, and otherwise. If the null hypothesis of the same average return is rejected, it means that the DOW anomaly exists.

After checking the DOTW effect using the dummy variable, we investigated the role of volatility in the Day-of-the-week. Since we have already discussed that ARCH and GARCH specification is pertinent to explain the volatility, we have used these specifications with the dummy variables.

5.3.2 ARCH and GARCH specifications

Since the inception of the asset pricing models, the security yield unpredictability has become the focus of consideration in the finance literature. The time-varying characteristic of the security yields returns and the presence of the predictable component in the variance of the equity returns have made the unconditional standard deviation invalid in estimating and analyzing the stock return volatility. Since auto repressiveness and heteroskedasticity are the shared belongings of the stock yeilds Engle (1982); thus, the ARMA simulations are the efficient models to guesstimate, analyze, and project the stock return volatility.

The time-varying nature of the autoregressive-conditional-heteroskedastic model (ARCH) estimations presented by Engle (1982) and the generalized-autoregressive conditional-heteroskedastic makes the estimation of the stock returns efficient and also useful in predicting the disparity in the stock yields.

In developing the ARCH and GARCH provisions, we have provided four different provisions. First for conditional mean equation i.e., portfolios return, second for conditional adjustments and third to include the error term. In this model, there is one ARCH and one GARCH term. We began with a simple GARCH (1, 1) specification:

$$R_t = X_t^{'} + \varepsilon_t \tag{14}$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \tag{15}$$

Here equation 14 is mean equation written as a function of independent variable with an error term. R_t is the return of portfolio since σ_t^2 is one stage forward estimated adjustment, based on the historical information and it is denoted by conditional variance. The conditional equation 15 is the functions of three terms.

1. A constant term ω
2. Volatility from the former phases is captured as a lag of squared residuals from the average estimates i.e. ε_{t-1}^2. This is ARCH term. It means that preceding intervals squared residuals derived from average equation. In simple words it previous day portfolio return information about return volatility.
3. σ_{t-1}^2 captures last period forecasts variance and hence it is a GARCH Term. It means today's fluctuation is influenced by yesterday fluctuations.

As we are checking DOTW effect each specification were tested with the lag of one minus one I both the volatility clusters selected was estimated by suing the simulated variables as a part of conditional variance equation. The model becomes:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \sum_{i=1}^{n} \beta_n \sigma D_n + u_t \tag{16}$$

Where

$$D_n = D_1, D_2, D_3, D_4 \quad (17)$$

$$u_t | \Omega_t \sim iid\ N(0. h_t) \quad (18)$$

$$h_t = \gamma_0 + \gamma_1 u^2{}_{t-1} \quad (19)$$

Where R_{pt} is the return of portfolio; D_n represents the dummy variable and β_n is the k x 1 vector in the coefficients. We accept that u_t is unconventionally distributed with a constant variance and zero mean. h_t that is variance depends upon one lagged period of square error terms. We use ARCH and GARCH (1,1) because literature shows that calendar anomalies can be identified using GARCH 1,1 estimations.

The objective is to check the volatility of portfolio return in context of DOTW effect. That means if σ_t^2 is volatility of portfolio return and independent variables are dummy variables for each day, which day is effecting most the volatility. Is it ARCH term or is it GARCH term?

5.3.3 Capital Asset Pricing Models

To develop the beta sorted portfolios current study uses the methodology on the patterns of the classic study of CAPM by (Fama & MacBeth, 1973). Stock is separated into different portfolios on the basis of the beta size estimated over ten years of estimation. This method is helpful in avoiding the data snooping that may be confronted if the stocks are sorted based on size (Lo & MacKinlay, 1990). Betas are estimated using the following equation.

$$R_i = \alpha + R_f + \beta_i (R_m - R_f) \quad (20)$$

R_i = shows the asset *i* return in period *t*

R_m = Security yield of the market

R_f = market rate without risk

β_i = relevant security beta

($R_m - R_f$) is the risk compensation which can be calculated using the differential of return of prevailing returns and the risk free factor.

These estimated betas are then calculated to put the stock in ranks by diminishing order and to divide them into various (three) portfolios according to their ranking. These betas are only used to form the portfolios as the literature review shows that the portfolio's betas are precise in estimation than the beta of individual securities.

The panel data technique is recommended to arrange the data for beta estimation. This technique is suitable for the study as per the research design; only ten years of daily data have been used. The panel data will allow the sample size to be increased; hence, a much better estimation can be obtained on the data of PXE.

5.3.4 Vector Error Correction Model

The co-integration concept was introduced by Granger in 1987, which deals with the relation among the non- static sequence running a shared stochastic movement. Let us assume two unique time series have unit root. Apparently, these two-time series are independent of each other and may move randomly; however; some economic factors may establish long term relationships among them, and there may be equilibrium in the long run. This type of relationship is very common in time-series data, and researchers have documented such relations between income and expense of households, GDP, and the savings. Modeling this long term affiliation by econometric techniques and offering an integrated structure for assessment and analyzing is the unique practical input from Clive Granger. In this paper, we have used the methodology used by Granger.

As this study along with other objectives tries to find the dynamic and static relationship of the equity return using all available vectors of price and return. Data of PSX shows that the sequence of returns and risks are non-static however there is a possibility that they might be integrated. In this way, using the VECM model of Engle and Granger (1987) might help us to see the long run correlation between volatility and yields.

Our objective is to develop an ECM Model under error correcting and reverting mechanism environment to check whether the risk has a positive impact on return moreover to check if the risk varies across different Day-of-the-week, so we have incorporated dummy variable. The reason to use the dummy variable is to apprehend the outcome of each day on the risk. So Monday dummy =1 when Friday is having a significant impact on the risk and 0 when it has no effect, and all the dummy through Tuesday to Friday has been created in the same fashion.

Given that return and risk of portfolios are co-integrated a V.E.C.M is consumed to scrutinize their long term and short term relations. The model specification then summarized as:

$$\Delta X_t = \sum_{i=1}^{p} \Gamma_i \Delta X_{t-1} + \Pi X_{t-1} + \xi D_t + \varepsilon_t \qquad (21)$$

Here D_t represents the dummy variable containing the dummies for second, third, fourth and fifth day within week and these dummies are generated to capture the long run behavior of anomalies. In this way we will be able to find that if the anomaly occurred on any day is for short run or it will be extended in long run.

The first normalized equation for VECM could be constructed as shown below:

$$\Delta Risk = \sum_{i=1}^{p+1} \beta_1 \Delta \mathrm{Return}_{t-i} + \sum_{i=1}^{p+1} \alpha_i \Delta Risk_{t-i} + \gamma 1 * EC1_{t-1} + \gamma 2 * \sum_{t=1}^{5} D + \varepsilon_{1t} \qquad (22)$$

This is our Error Correction model, where risk is the dependent variable. One of the benefits of VECM is that the model automatically converts the variables first difference hence making the series stationary and fit for time series estimations. β_i and α_i are coefficients and EC1 is error correction term and $\gamma 2$ is coefficient of dummy variables. D represents the dummies for each day. ε_{1t} is residual. $EC1_{t-1}$ is the trailed value of residuals and this is calculated by using the regression analysis run on the security yields.

5.4 SUMMARY

This chapter defines the methodology to empirically test the EMH. It explains the paradigms of the study with the sample design and data. The testable model with the support of the literature support reveals the scope of the analysis. The chapter also explains the importance of dichotomous variables and their significance in checking the DOW anomaly. It explains the significance of the ARCH & GARCH models, and the GARCH specification in the differential equation with dummy variable. One contribution of the current study is that it captures volatility using the ARCH family of models, incorporating dummy variables to capture the DOW effect. Moreover, we employed VECM models to examine the behaviour of the DOW effect in short and long term.

The chapter also explains the rationale for developing the portfolio and provides literature support regarding the characteristics for developing the portfolios. It explains the CAPM and panel data models, and finally, it explores the vector error correction models to demonstrate how this study will capture the dynamic relationship of risk and return. The next chapter deals with the data analysis, and tests the models we developed in this section to obtain the results.

CHAPTER 6

6. DATA ANALYSIS AND FINDINGS

This segment empirically tests the dynamics of trading irregularities, using the robust statistical techniques used in previous studies. As discussed in chapter one, there are five research questions this study seeks to answer. We start with the descriptive statistics to observe the distribution pattern of the data and help decide the model specification. Correlation analysis is used to see whether the variables of the model, that is, return of the various days, are uniform. After finding a pattern in the mean return across different days, the study uses the dummy variable technique to confirm the anomaly and locate the irregularity at the PSX.

After finding the anomalies, the study attempts to find the major sources of irregularities and the specific sources that apply to the Pakistan stock market. For this purpose, based on the literature review, we undertook portfolio formation using the panel data technique and developed three portfolios on the basis of beta (using fixed effect model), size of the firm (using the median approach) and trading volume.

Examining the anomaly from the return perspective is incomplete, unless we do this from the risk perspective. This study then examines the various dynamics of the stock market in terms of efficient markets, using the ARCH and GARCH models, incorporating the proxy indicators within the variation analysis. This enables us to observe the affiliation

among the variance and the yield. The study follows the standard ARCH/GARCH specification in the literature.

Finally, as the second objective of this research was to find the risk associated measures for investors in the PSE, this chapter explores the irregularities at the PSX in the short and long time, expending the VECM models. The purpose is to see whether the anomaly that appears in the short period also prevails in the long period.

To observe the characteristics of the dataset of companies listed on the 100 index, we initially ran the descriptive statistics and correlation analysis. We present the descriptive statistics for the PSX 100 index keeping days return as a grouping variable. The objective is the measurement of fundamental trend and processes of variability or spread across the mean return among the DOW.

6.1 DESCRIPTIVE STATISTICS

We used descriptive statistics to show how that dataset is distributed across the average return. Using descriptive statistics allows us to examine the distribution pattern based on measures; moreover, it allows us to see if the distribution of data is leptokurtic mesokurtic or platykurtic. These descriptive results include the distribution pattern of 100 index companies grouped by day for 2008-2017. The result of the descriptive analysis will help us choose the proposed model of the study and its methodology.

6.2 DESCRIPTIVE STATISTICS OF FINANCIAL VARIABLES

Table 6.1

Pakistan Stock Exchange 100 Index mean return from 2008 to 2017.

Day	N	Mean	Median	Minimum	Maximum	Std. Deviation	Skewness	Kurtosis
Fri	422	0.00159	0.001446	-0.04194	0.03924	0.011347	-0.4662	2.7012
Mon	402	-0.00162	-0.00018	-0.04077	0.04771	0.013073	-0.1809	1.9116
Thu	423	-0.00001	0.000000	-0.04221	0.04232	0.010997	-0.1494	3.0042
Tue	486	0.00085	0.000196	-0.04342	0.07425	0.012373	0.4869	5.6394
Wed	396	0.00026	0.000975	-0.04554	0.03425	0.012215	-0.6894	2.2122
Total	2129	0.00019	0.000301	-0.04554	0.07425	0.012054	-0.2025	3.0519

Note. Total numbers of observations are 2129 excluding the days where no trading takes place

The results represented in Table I have calculated using the formula explained in the subsequent sections. Since the data on stock return among different days are not distributed equally; hence, the data cannot be explained the distribution and the frequencies. To see more details about the data, skewness, and kurtosis have been calculated. All the returns are negatively skewed and he value of the coefficient of skewness considerably less than zero except Tuesday, in another way its shows that the distribution of data is skewed towards left and has a long tail. In order to calculate the skewness of the data standard formula has been used, which is given below, this formula captures the asymmetry distribution.

$$S = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{X_i - \overline{X}}{\hat{\sigma}}\right)^3 \qquad (23)$$

Where ‘X’ is the variable from the stock return of the day used in the reading, and ‘S’ represents for the skewness. The former figures used in the equation describes the standard methodology. The skewness of the PSX 100 index tells us that except Tuesday the entire returns are left-skewed; it measures that most of the numbers fall on the right hand of the average values.

Kurtosis is used to measure the thickness of distribution of the data and is usually denoted by bell shape distribution. He following formula is used to capture its dynamics.

$$K = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{X_i - \overline{X}}{\hat{\sigma}}\right)^4 \qquad (24)$$

The result shows that the value of ‘K’ is equal to or below 3 for all variables of stock returns. It tells us that the distribution of data is not normal and has a bell shape with higher top, it also shows that the data is intense round the average values and have denser tails. This shows that there is a probability of intense values.

The descriptive statistics show that the mean return on Friday is the highest among all the days. And mean return on Mon is adverse; it indicates the abnormal behaviors of the PSX 100 index on first and last day. Maximum and minimum average yields on Friday and Monday have an almost identical minimum value, and the index drops to -.04. However, on Friday, it turns positive, and on Monday, it keeps its negative gesture till the close of the day. The median of Monday can also be seen as a negative figure; it shows the midpoint of a frequency distribution. Having a negative median means that the probability of return has an equal opportunity of falling above or below it. Comparing the median of Monday with previous days within the week reveals that the probability of getting a positive return on Monday is very bleak as it is below -.000162 then it means more loss and even if it is above this value it will still be negative.

Looking at the standard deviation among Day-of-the-week it is visible that Wednesday and Tuesday returns are close to average returns of that day. Similarly, Friday and Thursday returns are clustered around the mean returns of the days. However, on Mondays, returns are not close to average, and the deviation is relatively high. This

deviation also explains the historical volatility on Monday returns. It shows that the investor will gauge the number of expected returns based on the previous returns on Monday.

6.3 CORRELATION ANALYSIS

Table 6.2 shows the variables used for the current research. We can see that the correlation between Fri and other DOW is not uniform. The link amid Friday and Mon, Thursday is positive but very week. It shows that the return of these three days tends to move together, but the movement in the same direction is not very strong. Friday and Tuesday are almost unrelated as the correction is only .001, which shows that the return of these two days does not move together. Surprisingly Wednesday is negatively correlated with Friday means return of Friday tends to follow the reverse of Wednesday return.

Table 6.2

Correlation analysis between Friday and others DOW

	Correlation Matrix				
	Fri	Mon	Thu	Tue	Wed
Fri	1.000	.087	.067	.001	-.021
Mon	.086	1.000	-.039	.081	-.019
Thu	.058	-.051	1.000	-.047	.016
Tue	.001	.076	-.041	1.000	.118
Wed	-.022	-.016	.017	.115	1.000

Low level of correlation here shows that the multicollinearity among the variables is either week or non-existed.

6.4 CONFIRMATION OF ANOMALY

It is evident from the descriptive analysis and the correlation analysis of PSX 100 index companies that there exists a pattern in the average return across different DOTW. However, one limitation of the descriptive analysis is, it does not tell us that the mean differences among days are statistically significant or not, moreover whether two or more means are significantly different from each other. For these reasons, we have used more robust statistical techniques to confirm whether the anomaly exists at PSX or not. We have used Error bar chats, analysis of variance, multiple comparisons, and dummy variable techniques to test the EMH.

6.4.1 Error bar charts

Using the error bar chart is one approach of looking at the distribution of data. Researchers often use the error bar charts to explain the data. Figure 3. shows the error bars of five working days at the PSX 100 index for a year.

Error bar is generally and alternatively a measure of distribution of data. In this study there are two purposes to employ error bar

1. Changing location of error bar shows the increasing or decreasing relationship between return of PSX 100 index among different days.

2. Size of error bar if increase indicates the variation in return on a particular day.

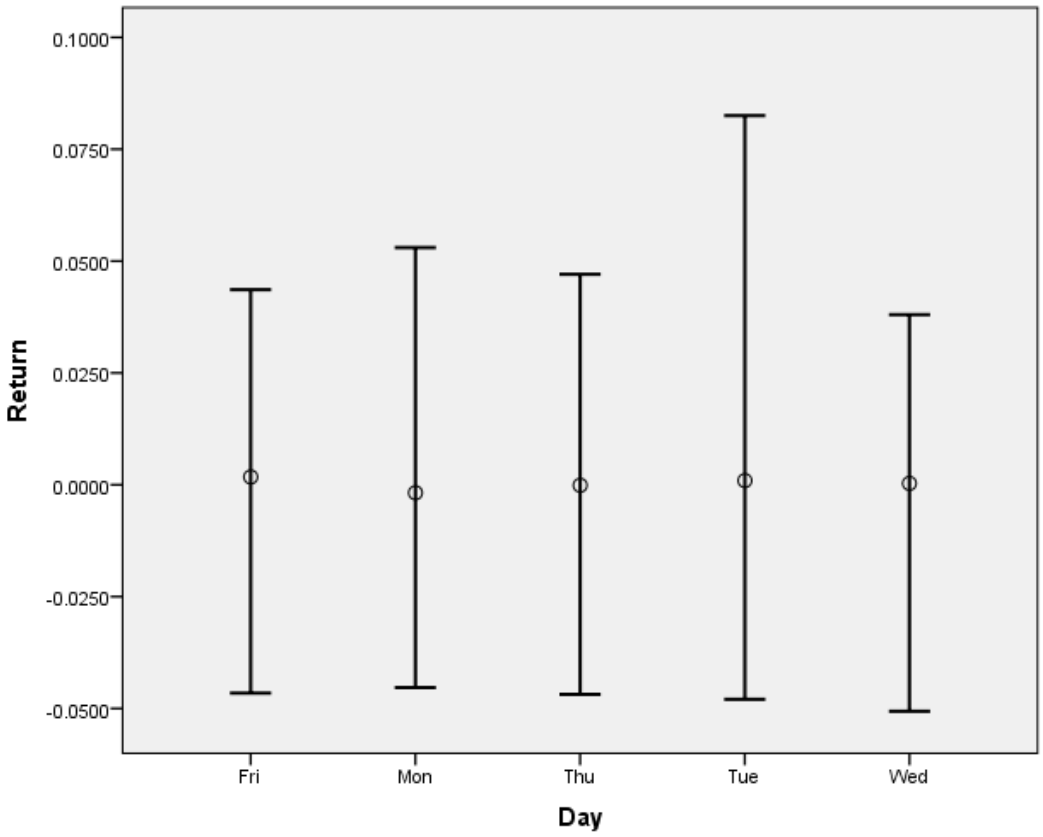

Figure 6.1. Mean difference between Day-of-the-week starting from Fri to Wed

We fix the criteria of 95% confidence interval means we are highly confident to observe this relationship that is up to 95%. 95% chances are that this relationship is a repeated sampling technique. It is visible from the bars that return on Friday is overall above 0 and return on Monday is below zero. Tuesday seems to be more volatile than other days of the week.

6.4.2 Descriptive table

Table 6.3

	N	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum

PSX 100 Index mean standard deviation.

The descriptive Table 6.3 gives essential information regarding the data, like average standard deviation and 95 % confidence interval for the conditional variable (PSX 100 index return) for each separate group (Mon, Tues, Wed, Thurs and Fri), as well as after the total of all the subgroups.

			Lower Bound	Upper Bound		
Mon	422	0.000842	-0.00328	4.23E-05	-0.04077	0.04767
Tue	402	0.000821	-0.00072	0.002431	-0.04321	0.07425
Wed	423	0.000788	-0.00127	0.001803	-0.04554	0.03452
Thu	486	0.000708	-0.00151	0.001295	-0.04221	0.04223
Fri	396	0.000739	0.00012	0.003034	-0.04194	0.03924
Total	2129	0.000348	-0.00049	0.000872	-0.04554	0.07425

6.4.3 ANOVA table

The ANOVA Table 6.4 shows that either there is a difference in the group averages and is it statistically significant in this instance, the groups are DOTW, and the mean represents the return of each day. We can observe that the significance level is 0.051 (p = .039) and therefore, it is a statistically meaningful variation in the mean yield of days. But this significance does not provide the complete details about the data and it could be the case that only Monday return is different with other days and only Friday is different. To solve this problem, we have used the multiple comparison table, which contains the result of the posthoc test.

Table 6.4

One-way ANOVA between Group means

	Sum of Squares	Df	Mean Square	F	Sig
Between Groups	.0019	4	.000	2.219	.039
Within Groups	.199	1099	.000		
Total	.217	2129			

Significance level is 0.051 (p = .039)

From the results so far from the descriptive table and ANOVA, it is clear that there is a verifiable variance among the return of various DOTW. To get the details on which days return is different, the table below could help. The Tukey posthoc test is commonly the chosen investigation for piloting posthoc tests on a one-way ANOVA. We can see from Table 6.5 that there is a major variance in the returns of Monday and Friday (p = 0.035). However, there are no substantial modifications amongst other DOTW.

6.4.4 Multiple comparison

Table 6.5

Tukey HSD Multiple Comparison

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Mon	Tue	-0.00247	0.001098	0.146	-0.00547	0.000529
	Wed	-0.00188	0.001091	0.377	-0.00486	0.001099
	Thu	-0.00152	0.001096	0.574	-0.00451	0.001477
	Fri	-0.0031*	0.001101	0.028	-0.00612	-0.000119
Tue	Mon	0.00247	0.001098	0.146	-0.00053	0.005469
	Wed	0.00058	0.001093	0.885	-0.00254	0.003576
	Thu	0.00095	0.001098	0.817	-0.00205	0.003954
	Fri	-0.00072	0.001104	0.869	-0.00374	0.002291
Wed	Mon	0.00188	0.001091	0.377	-0.00141	0.004863
	Tue	-0.00059	0.001093	0.885	-0.00358	0.002399
	Thu	0.00036	0.001091	0.897	-0.00262	0.003347
	Fri	-0.00131	0.001097	0.678	-0.00431	0.001684
Thu	Mon	0.00151	0.001096	0.574	-0.00148	0.004509
	Tue	-0.00095	0.001098	0.817	-0.00395	0.002046
	Wed	-0.00037	0.001091	0.897	-0.00335	0.002615
	Fri	-0.00168	0.001101	0.492	-0.00469	0.001433

Fri	Mon	0.00319*	0.001101	0.028	0.00015	0.006204
	Tue	0.00072	0.001104	0.869	-0.00229	0.003748
	Wed	0.00131	0.001097	0.678	-0.00168	0.004309
	Thu	0.00167	0.001101	0.492	-0.00133	0.004687

*. The mean difference is significant at the 0.05 level.

6.4.5 Dichotomous variables and portfolio returns.

Keeping in mind, the previous studies dummy variable technique has been employed using the (French, 1980) model. The purpose is to see if the mean/ average return on Tue, Wed, Thu and Fri are statistically diverse from Mon return. Regression analysis is used using the equation as under.

$$R_i = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + u_i \quad (13)$$

In this equation proposed by Asteriou and Hall (2015) R_i is the return of PSX 100 index. The intercept β_0 is the average yield for Mon, and represented coefficients β_1 to β_4 assess the standard Yields for each of the other days. Tue, Wed, Thu, and Fri takes the value of 1 if the return fall under that day, and 0 if it does not fall on the indicated day. Refusal of the insignificant postulation shows that average daily yields are diverse throughout the week and the DOW anomaly exists.

Table 6.6 represents the regression results for PSX return from 2008 to 2017. It is evident that the outcome of the whole phase for Mon is negative and it is statistically meaningful (p = .020) comparing other days with Monday it is noticeable that other days have measured greater mean return than Monday. These outcomes are identical with the previous studies and show that Mon's return is negative as compared to other days.

Table 6.6 *Summary of Dummy Regression Analysis (N = 2129)*

Variable	B	Std. Error	t-Statistic	Prob.

Intercept	-0.162	0.000774	-1.879309	0.0200*
Tues	0.256	0.001098	2.099414	0.0178*
Wed	0.188	0.00109	1.553750	0.07516
Thu	0.152	0.001094	1.246566	0.12221
Fri	0.319	0.001101	2.612785	0.0018**

Note. Monday represents the intercept in the dummy regression

Consistent with the methodology with Compton et al. (2013), we have used second regression equations. Equation 12 is run to test the null hypothesis i.e., within the week all days have the same average return.

$$R_t = \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + u_i \quad (12)$$

Here R_t is the yield of PSX 100 index for the sample phase selected. Coefficients β_1 . . . β_5 characterize average daily yield for each interchange DOW effect, the dummy variables D_1 . . . D_5 are 1, in case average yield falls on that instance, and zero if it falls any other day, and u_i is the error term. Refutation of the null hypothesis specifies that average daily yields are dissimilar during the week and the DOW calendar anomaly is present.

Table 6.7

Summary of Dummy Regression Analysis (N = 2129)

Variable	B	Std. Error	t-Statistic	Prob.
Mon	-0.161640	0.000774	-1.879309	0.0410*
Tues	0.094500	0.000779	1.092191	0.2452
Wed	0.026550	0.000768	0.311593	0.6822
Thu	-0.009990	0.000774	-0.116398	0.7891
Fri	0.157860	0.000782	1.816109	0.0398*

*p < .05. **p < .01

To escape estimation problem with the dummy variable, we have assigned a dummy to each DOTW, and omitted the intercept term. If there is a daily consequence on a certain day, that will be specified by a statistically greater *t* value of the dummy coefficient of that specific day. In this way we are regressing R_i effectively on an intercept, except that we take into account a unalike fintercept in each day. As a result, the dummy for each day will give us the mean daily return of each day.

The estimated β_i coefficients in equation 6.2 represents the average or mean, daily return on each day. Thus the average return on Monday is about -.1616 which is negative and statistically significant. On Tuesdays .0945, Wednesday.0265, Thu -.0099 and on Fri it is positive return .1578 and also statistically significant.

These results have answered the first research question that is, does the stock return remain the same across the week. We found that there is a difference among mean daily income among altered days of the week. ANOVA results show that there is a significant difference between the mean daily returns of days. Similarly, multiple comparisons demonstrate that Mon's return is considerably diverse than the Friday return. Finally, results of regression with dummy variables have confirmed that there is a difference amongst Mon and Fri return and Monday return for the test phase selected is negative and statistically significant and Friday return for the same period is positive and significant. In light of the above, we can reject the hypothesis that within the week, mean or average return remains constant for all the days.

6.5 PORTFOLIO FORMATION

It is evident from previous section i.e. dummy regression analysis that the anomaly exists between the various Days-of-the-week. To answer the question of what are the major sources of irregularities in general and what specific sources apply to Pakistan Stock market, we have built different portfolios and run the regression analysis. In this way we will check whether the Monday and Friday anomaly behaves differently on the portfolio level. In Pakistan context, most of the studies have been conducted of individual stock

rather than portfolio level, in this way this study will fill the gap by using portfolio level data. Three portfolios have been developed on the bases of beta (using fixed effect model), size of the firm (by using median approach) and trading volume. Theoretical support along with the methodology has been given.

6.5.1 The fixed effect model and beta

Panel data model have been used in the current study to calculate the beta of selected stocks and three portfolios have been developed on the bases of high, medium and low beta firms. Beta plays a significant role not only to capture the systemic risk but also considered important proxy in identifying the risky and less risky stocks. The panel data set for the calculation of beta is expressed by a trial that contain 95 cross sectional units (that is stocks listed on PSX) that are witnessed at *diverse t* time periods (from 2008-2017). The model in its simplified form is exposed below.

$$y_{it} = \beta X_{it} + u_{it} \quad (25)$$

Y representing the return of PSX and X represents the individual securities. In this model the variable Y and X have both *i* and *t* subscript for *i* = 1, 2,…..,N sections and *t* =1,2,…..,*T* time periods. It means *i* i.e. that companies will take a value of 1 to 95 and denotes the cross sectional data of 95 companies and *t* i.e. represents he time stretching from 2008 to 2017.

Using the fixed effect model, the disturbance term u_{it} has been divided into individual units (companies) precise result u_i and expression v_{it} is he value that could be denoted as disruption. This v_{it} record the impenetrable evidence about y_{it}, that is return of stock market. the final equation can be written in the following way.

$$u_{it} = u_i + v_{it} \quad (26)$$

Here might be a problem of heteroscedasticity and to avoid it cross sectional weights has been assigned for the assessment of generalized least square (GLS). Similarly,

to cater the period based heteroskedasticity periods weights were assigned. Table A1, A2 and A3 of Appendix A shows the detail of beta sorted stocks, panel data regression, and lists the Large, medium and small stocks respectively.

6.5.2 Market Capitalization and portfolio formation

The relation amongst market capitalization and the DOW has also been confirmed by various studies (e.g., Keim & Stambaugh, 1984). While confirming the size anomaly documented that 63 percent of the size effect occurs on Friday.

The DOW effect seems to be more profound among small cap firms, which have very few institutional investors. Brounen and Ben-Hamo (2009) in a study confirms that as in the absence of any plausible clarification of the DOW anomaly it can be assumed that size effects may be the possible explanation. In another landmark study Fama and French (1992) documented that size " is considered as the most important tool that elaborate strong description of the cross tabular of normal yield for period 1975-1995." They concluded that market capitalization is a valuable proxy for the cross section of stock return. They further argue that their findings have imperative implication for portfolio formation and for the investor size could be one of the dominant factors in deciding portfolio evaluation.

Various studies have used the portfolio technique to check the affiliation between the DOW anomaly and the firm size (Chung et al., 1999; Kim & Park, 1994; Rogalski, 1984). The portfolio was constructed according to firm size where firms are placed by their market value of equity and each portfolio consisted of equal numbers of securities. The market value was calculated by augmenting the last closing price of the previous year with the quantity of stocks of outstanding common stock. The compositions of the size portfolios were updated annually.

The common approach in the previous studies to construct the portfolio based on market capitalization is to divide all the stocks traded on the market over a specific period into equal number of portfolios based on their past one Month market capitalization. On the same note Kim and Chan (1999) in a study developed portfolios by dividing all of the

shares exchanged in U.S. markets during 1984–1988 into10 diverse portfolios on the basis of their preceding six-Month market capitalization.

However, this method where shares are graded from highest to lowest based on their average market capitalization, and then dividing them in the equal number of quintile portfolio has one drawback Derbali and Hallara (2016) that is average market capitalization for a stock gives us the measure of size of stock for the entire period. In this way we can miss the trend of individual stocks, for example a stock may be small in one Month based on its market capitalization and could be large cap in another Month.

Another way is to calculate the median market capitalization that is the midpoint of the range of market capitalization of stocks held in an index. With this approach half of the stocks in the portfolio will be larger than the median and the half will be smaller. In this way it is easy to calculate the small and large cap stocks, but medium cap stocks will be difficult to identify.

Keeping this limitation in mind, we have used panel data technique to develop the portfolio based on market capitalization. In this way we have increased the sample size and better estimation has been obtained. The formula we use is as under.

All the stocks are arranged in a panel for the time period under study. M-ean and median for the panel is calculated.

Daily mean of individual stocks is compared with the panel data mean

$$\text{If} \quad \mu_{it} < \mu_p = Small\_Cap\_stock \tag{27}$$

$$\mu_{it} > \mu_p = large\_Cap\_stock \tag{28}$$

Where μ_{it} is the mean of security i, for the period t, and μ_p is the mean of panel data. The final list of high, medium and small cap is given in Table A3 Annex A.

6.5.3 Volume and portfolio formation

The literature review revealed that volume of stock traded on the stock market may explain the DOW effect. Although it is difficult to isolate the effect of volume on stock return anomaly, however researchers believe that if not all volumes can explain at least the partial cause of the anomaly.

Lakonishok and Maberly (1990) in a study establish that Mon return was, on average, lower as compared to the other days around 10% and volume may proxy for individual verses institutional investor. Consistent with this study Tkac (1999) also found that the volume and stock market anomaly has some link. The study finds that institutional investor may refrain from investment in the start of the week hence causing the Monday anomaly.

One of the reasons this study builds portfolios on the bases of high, medium, and low volume stocks is because a study by Loughran and Schultz (2004) revealed that settlement procedure, bid, ask spread, and other fundamental variables has less to do with DOW anomaly and volume may contain evidence regarding the shareholder sentiments and buying patterns. We followed the same methodology of mean, median approach as explained in market capitalization, for constructing the portfolios based on high, medium and large volume stocks.

After the confirmation of anomaly in section 6.4 we have developed the portfolios, the study runs regression as per equation 12 on nine portfolios naming, high beta, mid beta, low beta, high volume, mid volume, low volume, and finally on large market cap, mid-market cap and small cap portfolios.

6.6 DICHOTOMOUS VARIABLE AND PORTFOLIO RETURN

After developing the portfolios mentioned in pervious section i.e. portfolio formation we run the dummy regression on the portfolios. This method will help us to isolate the major sources of anomaly at the PSX. It means that we can see that how the Monday and Friday effect respond to different portfolios developed on the basis of beta, volume and market capitalization stocks.

6.6.1 High beta portfolios and DOW effect anomaly

Table 6.8

Summary of Dummy Regression Analysis for High Beta Portfolios (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon	-0.24743	0.000851	-2.17977	0.00289*
Tues	-0.04283	0.000855	-0.37559	0.461145
Wed	0.43537	0.000845	0.02383	0.731025
Thu	-0.02115	0.000851	-0.18651	0.625027
Fri	0.12015	0.000886	1.04697	0.122225

*p < .05. **p < .01

Various studies have generally supported the CAPM in a sense that beta rated portfolios are important in explaining cross sectional differences in average security return during different Day-of-the-week. The first portfolio we developed in this study is based on high beta stocks where coefficient on beta representing an estimate of the market risk premium.

Equation 12 was run on the high beta portfolios. D_1 to D_5 in the equation which represents Monday to Friday respectively. Dummy variable regression on high beta portfolios shows interesting results. Table 6.8 represents the regression results for high beta portfolio stocks from 2008 to 2017. It is evident that the result of entire period for Monday is negative and it is statistically significant (p = .002) comparing other days with Monday it is noticeable that other days have measured greater mean ret-urn than Monday.

6.6.2 Mid beta portfolios and DOW effect anomaly

Table 6.9

Dummy Regression Analysis for Mid Beta Portfolios (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon	-0.12653	0.00063	-1.51786	0.0340*
Tues	-0.05220	0.00063	-0.62313	0.30465
Wed	-0.03540	0.00062	-0.42765	0.42645
Thu	-0.01598	0.00063	-0.19152	0.59888
Fri	0.10650	0.00063	1.26412	0.06915

*p < .05. **p < .01

The results of mid beta portfolio in Table 6.9 for dummy variable are more or less the same as high beta portfolio stocks. Here we can see that Monday return is statistically significant only. However, when we compare these result with high beta portfolios it is not robust either in the high beta or mid beta portfolios. It means that investor should refrain from investing in high or mid beta portfolios as the overall significant negative returns are confirmed.

Friday anomaly seems to fade away in case of high beta as well as mid beta stocks although the return on both portfolios on Friday are positive but statistically insignificant that is (p = .122 & p = .069)

6.6.3 Low beta portfolios and DOW effect anomaly

Table 6.10

Dummy *Regression Analysis for Low Beta Portfolios (N = 2129)*

Variable	β	Std. Error	t-Statistic	Prob.
Mond	-0.03570	0.00033	-0.81017	0.21023
Tues	0.03045	0.00033	0.06874	0.69525
Wedne	0.03180	0.00033	0.72755	0.24915
Thur	0.01583	0.00033	0.35879	0.47438
Frid	0.08280	0.00033	1.85711	0.0192*

*p < .05. **p < .01

Interesting findings have been found on low beta portfolios stocks. As per the CAPM the systematic risk of an investment is usually a linear function, moreover means higher beta stocks portfolio should yield higher return. However, in the above results it is obvious that DOW anomaly specially Monday consequence has not been captured by low bet portfolios.

Friday anomaly seems to be explained by the low beta stocks and the results are statistically significant (p = .0192)

6.6.4 High volume portfolios and Day-of-the-week effect anomaly

Table 6.10

Dummy Regression Analysis for High Volume Portfolios (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.22553	0.00081	-2.08103	0.00420**
Tue.	-0.03435	0.00082	-0.31579	0.50535
Wed.	0.01133	0.00081	0.10527	0.66630
Thu.	0.03068	0.00081	0.02829	0.72743
Fri.	0.13905	0.00082	1.26986	0.06803

*p < .05. **p < .01

Lakonishok and Maberly (1990) in their study found that trading volume of stock contains hidden information regarding the stocks. Generally, liquidity means the capacity to include large number of stocks at a low brokerage cost and without a huge effect on market prices. In a study by Brown et al. (2009) the author finds four dimensions of liquidity that is trading speed, trading cost, and trading volume and price impact. In this study the regression of dummy variable on the high volume stocks tries to find the link about trading volume and portfolio return in the context of DOW effect. One of the reason for developing the high, mid and low volume portfolios is, earlier studies recorded that trading volume substitute for factors like momentum, liquidity, and information.

Generally, for relatively less liquid stocks investor may seek an assets premium, which may result in a negative correlation involving stock return and trading volume (proxy for liquidity). On the contrary for liquid stocks portfolios investor may envisage information and momentum effects that could result in a positive connection between

trading volume and stock return. Chordia & Swaminathan (2000) studied turnover and concentrated on autocorrelations in the portfolios developed on size.

In current study we found some surprising results for both high volume and mid volume portfolios. Consistent with previous studies especially that in US, where market reflects lowest return on Monday (Keim & Stambaugh, 1984; Cross, 1973; Gibbons & Hess, 1981; French, 1980), we found that the Monday anomaly is also confirmed at PSX. However, the high volume stock and stock return positive relation as discussed in previous studies did not seem to fit the results. For high volume as well as mid volume stocks portfolios Monday return is negative and statistically significant that is (p = .0042 and p = .011 respectively) in table 6.11 and 6.12.

6.6.5 Mid volume portfolios and DOTW effect anomaly

Table 6.12

Dummy Regression Analysis for Mid Volume Portfolios (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.15570	0.00064	-1.81252	0.01185*
Tue.	-0.03173	0.00065	-0.36823	0.46763
Wed.	-0.01770	0.00064	-0.20780	0.58635
Thu.	-0.03315	0.00064	-0.38600	0.45518
Fri.	0.05408	0.00065	0.62313	0.30465

*p < .05. **p < .01

6.6.6 Low volume portfolios and DOTW effect

Table 6.13

Dummy Regression Analysis for Low Volume Portfolios (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.03188	0.00037	-0.64883	0.29040
Tu-es.	-0.02438	0.00037	-0.49388	0.38273
Wed.	0.00780	0.00037	0.16024	0.62310
Thu.	0.00960	0.00037	0.19499	0.59618
Fri.	0.11625	0.00037	2.34067	0.00135**

*p < .05. **p < .01

There are numerous reasons found in the literature regarding the causes of weekend effect. Few of the potential causes are settlement effect, measurement error, specialist related biases, and timing of earning announcement. However, all these descriptions are unable to describe the causes of week-end impact.

A study by Loughran and Schultz (2004) found that the propensity of security return to be depressing on first day and positive of last day has lot to do with the investor behavior rather than the settlement procedure and other fundamental variables. Mustafa and Nishat (2010) documented that weekend anomaly may be because of settlement period. The finding of the study were that as there is a change in settlement period, the DOW anomalies vanish. This does not work with the current study as the settlement procedure for all the portfolios were same yet the weekend anomaly is not statistically significant for all the high beta, high volume and high market cap stocks.

The result of the current study for the portfolios of low volume stock is contradicting with some of the previous studies, like Lakonishok and Maberly (1990) found

that low volume stocks trends to be negative on Friday. However, the dummy regression shows in table 6.13 that for low volume portfolios only Friday return is positive as well as significant that is (p = .0013)

6.6.7 Large market capitalization portfolios and Day-of-the-week effect

Table 6.14

Dummy Regression Analysis for Large Cap Stocks (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.17385	0.00068	-1.91442	0.00810**
Tues	-0.03705	0.00068	-0.40602	0.44130
Wed.	-0.01013	0.00068	-0.01126	0.74100
Thu.	-0.03773	0.00068	-0.41555	0.43470
Fri.	0.10658	0.00069	1.16107	0.09143

*p < .05. **p < .01

Literature review and the theoretical framework for this study highlighted that various studies have shown that DOW effect are systematically related to non-beta fundamental variables like large/small capitalization stocks (proxy for size) (Banz, 1981; Fama & French, 1992).

Brown et al. (2009) showed that stocks with large-market-capitalization have higher yields as compared to their counterparts. The study also show that it is important that portfolios are sorted on the trading volume as well as turnover. However, the result for the dummy regression on the large, mid and small capitalization portfolios does not seem to fit PSX return. The results in table 6.14 and 6.15 show that the return of large capitalization stocks are negative on Monday and are statistically significant (p = .0081 and p = .0113). Mid cap and small cap portfolios are not affecting the any other day return.

6.6.8 Mid-market capitalization portfolios and Day-of-the-week effect

Table 6.15

Dummy Regression Analysis for Mid Cap Stocks (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.13815	0.00057	-1.83273	0.01103**
Tues	-0.04043	0.00057	-0.53357	0.35775
Wed.	-0.00900	0.00056	-0.12046	0.65430
Thu.	0.00953	0.00057	0.12638	0.64965
Fri.	0.10223	0.00057	1.34142	0.05543

*p < .05. **p < .01

6.6.9 Low market capitalization portfolios and Day-of-the-week effect

Table 6.16

Dummy Regression Analysis for small Cap Stocks (N = 2129)

Variable	β	Std. Error	t-Statistic	Prob.
Mon.	-0.09615	0.00052	-1.38692	0.04853
Tues.	-0.01358	0.00052	-0.19551	0.59580
Wed.	0.01073	0.00052	0.15557	0.62678
Thu	0.00795	0.00052	0.11500	0.65865
Fri	0.09998	0.00053	1.42689	0.04508

*p < .05. **p < .01

6.6.10 Summary

The results for all dummy regression on all the portfolios are summarized in table 6.17. It is evident that all the high and mid portfolios irrespective of beta, volume or market capitalization has contributed significantly to Monday anomaly. Based on these results we can reject our second postulation that is average yield remains identical throughout the week across all different portfolios (No Anomaly). As compared to the published literature where high beta stocks have high return but the current study shows that the high beta stocks are the one which contributed most to the Monday anomaly with strongest significant results of (p = .0028). Monday anomaly is also confirmed with high volume stocks. Contrary to the literature where high volume stocks are more liquid with low transaction cost hence have positive relation with stocks, current study empirically shows that that is not the case especially for PSX.

Table 6.17

Portfolio returns with Dummy Variables

	Mon	Tues	Wed	Thu	Fri
High beta Portfolio	0.00289**	0.46245	0.731025	0.60277	0.12225
Mid beta Portfolio	0.03240*	0.30465	0.42645	0.59888	0.06915
Low beta Portfolio	0.21023	0.69525	0.24915	0.47438	0.0192*
High Volume Portfolio	0.00420**	0.50535	0.6663	0.72743	0.06803
Mid Volume Portfolio	0.01185*	0.46763	0.58635	0.45518	0.30465
Low Volume Portfolio	0.2904	0.38273	0.62315	0.59618	0.00135*
Large Cap portfolio	0.00810**	0.4413	0.74121	0.43479	0.09143
Mid Cap portfolio	0.01103**	0.35775	0.65437	0.64965	0.05543
Low Cap portfolio	0.04853	0.5958	0.62678	0.65865	0.04508

Note: *p < .05. **p < .01

Friday anomaly is however more easily linked with portfolios, we can see from the results that only two portfolios out of nine have significant impact on the Friday positive return that is low beta portfolios and low volume portfolios with a p vale of .0192 and .00135 respectively.

So far we have seen the DOW effect from the return point of view however it is important to note that presently there is a strong affiliation linking risk and return and it should be explored in the setting of DOW effect. Literature has shown that volatility of return from its mean value can be classified as risk (Poon & Granger, 2003). This led us to investigate the second objective of our research that is to explore what are the short span as well as long run link of risk? We have used ARCH and GARCH family of models to address this question.

6.7 VOLATILITY TEST OF DOW USING GARCH

When securities return moves in a random way we can call it Volatility. We can say that a security is more volatile if in a short span of time the price moves up and down quick significantly and in a quick succession. Risk represented by volatility is important factor because when creating portfolios and doing investments it is important to keep in mind the volatility characteristic. When we explain risk/volatility in statistics it means how the observed value deviate from the mean values (Poon & Granger, 2003). To calculate it we use the formula;

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2} \qquad (29)$$

where $\bar{x}$ represents the mean return of security in a time t. This scattering factor denotes the second instant demonstrative of the section and is only equivalent for the normal disseminations and it is not useful where the constraints are time changing and the

shapes of distribution also vary (Kovačić, 2007) we can say that the distribution of data is leptokurtic and the stock returns are not considered normal.

6.7.1 ARCH Effects

Research shows stock returns when hold the leptokurtic distributions in the mean values, then it is difficult to capture the properties of asset return that are changing and therefore using the standard deviation as a measurement of dispersion from the mean become invalid to capture the asset return. Here ARCH model come into play as one of the property of this model is it can capture the lag value of the return or the conditional variance and can comprehend the previous information (Poon & Granger, 2003). Therefore, the academicians' focal concern today is on the expectedness of the asset returns built in the historical information of the security prices which makes the EMH a little vague model in studying stock return predictability function.

In many studies (Fama, 1970; Lamoureux & Lastrapes, 1990; Ross, 1976) volatility in the return of stocks is attributed to firm specific factors like market to book value, high and low P/E ratios; economic factors like foreign reserve and GDP or anomalies. In such a situation finding what specific factors are causing theses volatilities in the return of stocks is imperative. Hence, this academic paper has studied, analyzed and forecasted the portfolios return volatilities through explicit to common approach in the ARCH models there the specific approach explains the regression of the current portfolio proceeds with the past portfolio returns.

In a study (Kurz, 1994) showed that the existence of volatility can be traced if the organizational changes or surprises exist in the adjustment of the security return are studies. He explains that these sudden shifts can explain the extra volatilities that are present in the returns. The author has developed an algorithm for the purpose to capture that unconditional variances in the mean return and sudden shifts. The algorithm calculates the sum of squares in the residuals of mean equation through iterative process and is called ICSS iterated cumulative sums of square. This academic study has used ARCH/GARCH approach to see if there are overlooked shocks and they are present in portfolio return's unconditional variance then it is pertinent to use the general approach of the ARCH family

of models. To be precise, this specific approach is the finest method in analyzing the portfolios of stock return's volatilities in ARMA models. Moreover, one contribution of the study is to incorporate dummy variables and used in variance equation to capture the DOW effect.

6.7.2 Graphical representation of ARCH effects

As the literatures shows (Asteriou & Hall, 2015; Gujarati, 2009) first steps in estimating ARCH models is to graphically present the series to identify possible effects of ARCH.

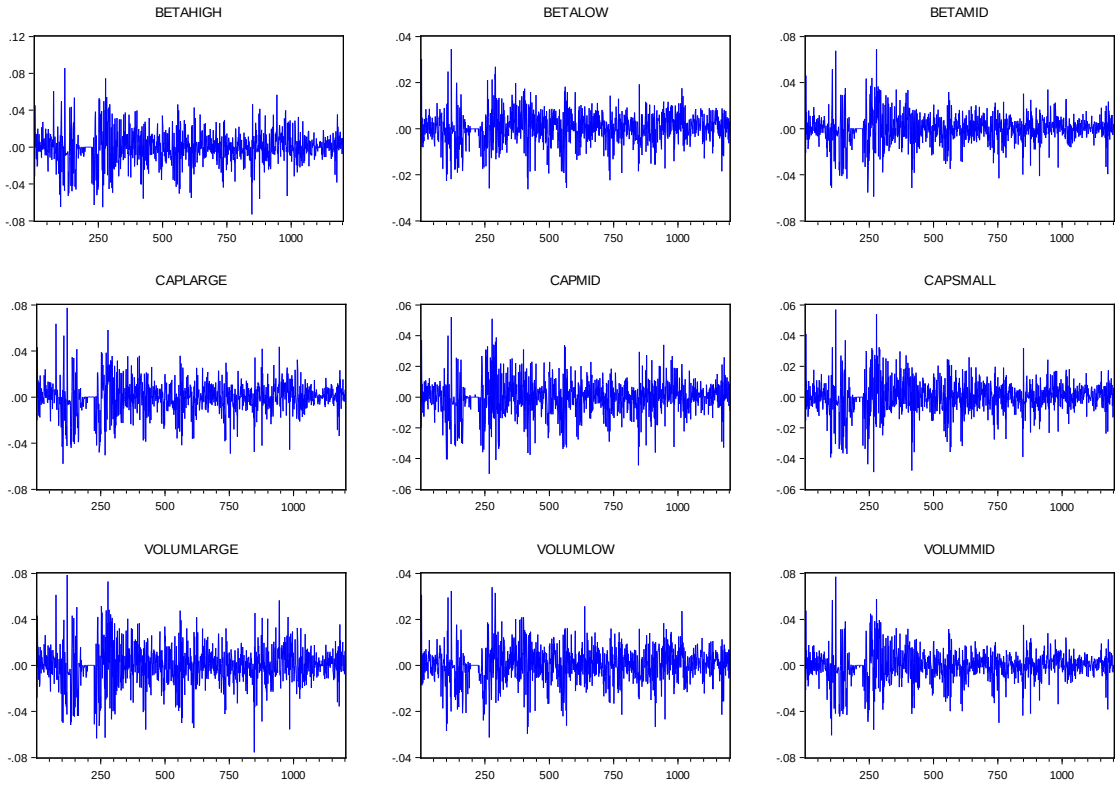

Figure 6.2 Residuals plot from mean equation for all portfolios

6.7.3 Checking stationary of series

It has been considered that market is deemed to be working under the proficient in a weak form if the return of the stocks follows a random pattern that is they are non-stationary. In an efficient market all the new freely obtainable material is absorbed in the security prices and a shock to the market persist lastingly. Unit root tests were used to survey the characteristics of time series specially the properties stock market equities. To date literature has shown many type of unit root test to check the properties of time series

like Dickey Fuller Test, Elliott–Rothenberg–Stock Test, and Phillips–Perron (PP). Different tests to check the unit root vary in their assumptions. However, we have used the Dickey fuller test to test the null hypothesis that there is a unit root in the return of stock market series. The reason we have used this test is because if the sequences is combined then its lagged value i.e. y_{t-1} will deliver no evidence to predict the transformation in in y_t.

Dickey and Fuller (1979) procedure is normally incorporates the data for checking its static in the regression. Moreover to see if he data is static. Dickey and Fuller (1979) purpose a test which contains added lag terms of dependent variables to check if the series under consideration has the serial correlation. ADF test the specification are as follows.

$$\Delta y_t = a_0 + \beta y_{t-1} + \sum_{t=1}^{p} \gamma i \, y_{t-1} + u_t \quad (30)$$

Where $y_t$the sequence to prove for unit-root and p is the value of lagged divergences. The findings are provided in Table 6.18.

Table 6.18

ADF Test (Unit root test)

Variables	ADF test	t-statistics	Unit Root = Yes/No
Beta-low	-20.678	-3.501	Yes
Beat-High	-30.436	-3.624	Yes
Beta-Mid	-30.547	-3.531	Yes
Cap-Large	-28.735	-3.418	Yes
Cap-Mid	-30.959	-3.762	Yes
Cap-Small	-32.516	-3.742	Yes
Volume –Mid	-28.747	-3.851	Yes
Volume –Low	-20.635	-3.737	Yes
Volume –Large	-32.052	-3.425	Yes

Note. Test critical values: 1% level

The above results show that the underlying portfolios return are not stationary and ARCH models may help incorporating standard deviation in mean equation.

6.7.4 ARCH LM Test

As Asteriou and Hall (2015) pointed out before employing he ARCH family of models it is imperative to check that ARCH effects are present in residuals of equation 12 the outcomes of all the portfolios are recapitulated in Table 6.19

Table 6.19

ARCH effects in portfolios

Portfolio	F-statistics	Obs*R-Squared	Probability
Beta-High	49.500	47.659	0.00000**
Beat-Mid	46.093	44.497	0.00000**
Beta-Low	48.759	46.972	0.00000**
Cap-Large	67.755	64.314	0.00000**
Cap-Mid	36.070	35.098	0.00000**
Cap-Small	44.906	43.391	0.00000**
Volume –Large	35.451	34.512	0.00000**
Volume –Mid	68.860	65.308	0.00000**
Volume –Small	43.488	42.069	0.00000**

*p < .05. **p < .01

The above result clearly shows that we discard the assumption of homoscedasticity, and can determine that ARCH effects are present.

6.7.5 Regression with Dummy variable using ARCH/GARCH

If ARCH is significant it shows that former day's portfolio proceeds information that is ARCH can impact today's portfolios return volatility. In case if GARCH is also

found substantial then it means that previous day's portfolio return volatility i.e. GARCH can control today's portfolios return.

Based on the result it can be said that unpredictability in stock return is essentially reliant on its peculiar shock such as ARCH and GARCH and is similarly manipulated by various DOTW. To specifically check the if this anomaly we run the following equation:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \sum_{i=1}^{n} \beta_n \sigma D_n + u_t \qquad (16)$$

The outcomes are shown in Table 6.20, 6.21 and 6.22.

Table 6.20

ARCH, GARCH Models with Dummy Variables (Beta Sorted portfolios)

	Coefficients	Z-Statistic	Probability
High beta portfolios			
ARCH(-1)	15.59250	9.558409	0.00000**
GARCH(-1)	84.25329	55.281334	0.00000**
Mon	-0.001023	-1.022870	0.324409
Tues	0.002045	1.798088	0.080489
Wed	0.000000	-0.246201	0.828205
Thu	-0.001023	-1.634605	0.112500
Fri	0.007159	5.774206	0.00000**
Mid beta portfolios			
ARCH(-1)	13.820114	8.154102	0.00000**
GARCH(-1)	85.959205	57.431956	0.00000**
Mon	0.001023	1.570745	0.13841
Tues	-0.001023	-0.735863	0.38954
Wed	-0.002045	-3.607343	0.00040**
Thu	0.000000	-0.812925	0.39548
Fri	0.002045	3.407093	0.00090**
Low beta portfolios			

ARCH	11.437159	7.095948	0.00000**
GARCH	85.886591	39.351252	0.00000**
Mon	0.000000	1.180688	0.253943
Tues	0.000000	-0.684061	0.515045
Wed	0.000000	-0.105494	0.938659
Thu	-0.001023	-2.197503	0.03170*
Fri	0.001023	1.914556	0.06120

*p < .05. **p < .01

The residuals from the mean equation $R_t = X_t^{'} + \varepsilon_t$ are used in making variation calculation. $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$. The σ_t^2 is the variance of residuals derived from equation $R_t = X_t^{'} + \varepsilon_t$ and they can be termed as present day difference or impulsiveness of portfolio return. $\beta\sigma_{t-1}^2$ is previous day residual variance or volatility of portfolio return and also known as GARCH term. It means that today's fluctuation in the return are dependent on the previous day return fluctuation. The term $\alpha\varepsilon_{t-1}^2$ is the ARCH term and it means that previous day squared residuals derived from $R_t = X_t^{'} + \varepsilon_t$.

As discussed earlier that one of the perseverance of this research to check the stock market dynamics in context of the Day-of-the-week effect at PSX, and the related question we sought to answer is how we locate irregularity at the PSX. This ARCH and GARCH specification will help to study that how the volatility in the portfolio are affected by the previous day volatility as well does the volatility of different days has different effect on the current day variance of return. Total 2129 value are selected from the period covering 2008-2017. Intercept term has been taken away from the regression equation to avoid dummy variable trap and to be consistent in interpreting results with and with our incorporating risk in mean regression equation. Another reason to exclude the intercept term is because in this way direct comparison between different Day-of-the-week is possible.

First thing we look at in the estimated results in the variance equation is which variables are significant and what are their interpretations. First we can discuss the ARCH term that is squared residuals from the mean equation and as they are represented as lag term it means that how much risk can be explained by the residuals from previous day. We can see that the ARCH term is significant what does it means, basically it means that this term is significant to explain the current day volatility or risk of portfolio rerun. We can see that our GARCH stint is also substantial, it denotes that the current day volatility of security yield can be influenced by the previous day residuals variance.

We used dummy variables in the discrepancy equation as the exogenous variable. Therefore, each dummy has an impact on the risk of the portfolio on a specific day, so for

example if the Monday results are significant it means that the volatility of the portfolio will be influenced by Monday volatility and it has seasonal effect. In case any other day is insignificant it will mean that this particular day's volatility has no impact on the risk of portfolio on that day.

According to Markowitz (1952) and Sharpe (1964) investors chose the stock as per their risk preferences, hence a chance taker stockholder may pick risky security for his portfolio and a risk hesitant shareholder may choose less risky stocks although both have used diversification in their portfolios. This risk can be explained by the concept of beta. It explains the riskiness of an distinctive stock as compared to the total market. The range of high beta stock mean that they are riskier asset and hence produce more return.

From our regression result in table 6.20 we can see that DOW has weak effect on the volatility of portfolios. Coefficients on Mon. and Thur. are negative means that volatility on these two days has negative impact on the overall high beta portfolio volatility but as the p values are insignificant that is less than .05 we cannot conclude that the Monday anomaly is because of the high volatility on Monday return. In fact all they DOW effect in high beta portfolio has insignificant p values (except Friday) and we can say for highly risky stocks volatility across the DOTW has no impact on the overall unpredictability of portfolio.

Friday results are significant for high beta portfolios, this is interesting finding as we can see that when we run the dummy regression on portfolios return without using the ARCH and GARCH in variance equation Friday return was insignificant that means that return on Friday has no impact on the overall portfolio return for high beta portfolios. However, table 6.20 shows that p value is significant it means that the volatility of high beta portfolios is influenced by the unpredictability of Friday revenue. Therefore, from the prospective of risk and return on the high beta portfolios we can say that return of Friday may be positive but there is no risk of volatility attached to it. Similarly, an inverse relation can be witness for Monday return and risk where Monday returns was significant in dummy regression but using variance equation using ARCH it is insignificant. These results lead us to work on the long term relationship of risk and return.

Mid beta portfolio of stocks means that investor is taking medium level of risk and in return can compromise on return. ARCH and GARCH effect are significant meaning that for mid beta portfolios the volatility of current day is not only affected by the previous day but also by the previous day residual variance. More or less same results have been reported for low beta stocks portfolios where in the return prospective Monday anomaly was confirmed but from the risk perspective the Friday volatility has significant impact on the volatility of mid beta portfolios.

Low beat stock portfolios mean a portfolio of all the stocks that have less risk when we compare these stock with that of PSX 100. It is found that because of the marginal contribution the general unpredictability of extremely differentiated portfolios is negative.

We can say that the investor in low beta stocks can expect a low return because as compared to market these stocks are less risky. In the actual trading, some investors are barred from using leverage and on the other hand for some investors' leverage is only limited to margin requirements. That is why they tend to give weights to risky stocks instead of using leverage, which makes these stocks more expensive. Because of this behavior risky stock have generally low risk adjusted return than low-beta stocks.

The results in Table 6.20 show the volatility of low beta stocks has no impact on the volatility of overall portfolio, moreover the dummy for all the days are statistically insignificant it means that there is no difference between the volatility among different days. In other words, the risk related to mid beta stock portfolios are homogenous across the week. Literature demonstrate that small beta stocks generally outclass high-ranking beta stocks. One reason could be that the low beta stocks are less uncertain and the volatility is insignificant across the week that makes them good investment.

Table 6.21

ARCH, GARCH Models with Dummy Variables (Volume Sorted portfolios)

	Coefficients	Z-Statistic	Probability
High volume portfolios			
ARCH(-1)	14.702727	8.233169	0.00000**
GARCH(-1)	83.070000	45.608605	0.00000**
Mon	0.002045	7.651872	0.00000**
Tues	-0.003068	-1.976359	0.045780*
Wed	-0.004091	-2.561247	0.00145**
Thu	-0.003068	-5.456588	0.00000**
Fri	0.006136	5.512418	0.00000**
Mid Volume portfolios			
ARCH(-1)	19.367386	10.703792	0.00000**
GARCH(-1)	82.794886	62.510124	0.00000**
Mon	0.000000	-0.605178	0.45125
Tues	0.001023	2.621547	0.01235**
Wed	-0.001023	-1.293903	0.214580
Thu	0.000000	0.636842	0.452150
Fri	0.002045	3.237617	0.001254**
Low Volume portfolios			
ARCH(-1)	14.634205	8.030199	0.00000**
GARCH(-1)	85.067386	47.022423	0.00000**
Mon	0.000000	1.650222	0.184521
Tues	-0.001023	-1.256175	0.32104
Wed	0.000000	-0.701806	0.38452
Thu	-0.001023	-2.527752	0.01295**
Fri	0.001023	1.313765	0.184570

*p < .05. **p < .01

Suominen (2001) documented that that the time series comprise of coexistent correlation between the price variability and the volume of the stocks traded and this auto correlation in the price volatility needs GARCH estimation. He has also documented the role of volume and the investor behavior. By using the GARCH model the author finds that traders in the stock market guess the accessibility of confidential information consuming historical period trading volume. He also finds that trading volume also contains useful information regarding the investor during the weekend and on week days.

Various studies highlighted in the literature review encourage us to study the relationship between trading volume and the DOW. One of the reasons to develop high volume stock portfolio to check the causes of DOW effect was that literature Karpoff (1987) documented that trading volume and security gain unpredictability are positively interrelated. Moreover, high volume stocks may predict future volatility. Suominen (2001) also emphasized that trading volume can have strong impact on investor behavior during the week.

In context of Pakistan a related analysis was performed by Nishat and Mustafa (2002) in which working of the relationship between trading volume and DOW anomaly. The study concludes that trading volume has a significant effect on Tuesday and Wednesday. Nishat and Mustafa (2002) confirms that low to mid volume stocks has lowest return on Monday and Tuesday is among the day with the highest trading volume. Most of the studies in the background of Pakistan have explored the DOW the scurity level however we have tried to build portfolios based on the high volume, mid volume and small volume to see is there any difference between the portfolio level and individual stock level.

GARCH specification has already been explored by various researches in relation to high volume stocks (Pagano et al., 2009). The reason to choose the GARCH specification in the daily security return are estimated to suggest that the correlation in the information that is arriving in the security return, i.e. the transaction volume. In simple words the unconfirmed variance of the portfolio return is said to be an the direct function to show the information flow of the market.

Following the Suominen (2001) we have used the GARCH methodology to model the portfolio return volatility. This will help us to analyze the changing behavior portfolio volatilities and to identify the impact of volatility for high beta stock portfolios. In case where our mean equation $R_t = \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + u_i$ fails to apprehend the rate at which information is coming and other dummy variables the variance equation using dummy will explain the impact of each day volatility on overall volume based portfolios.

The residuals from the mean equation $R_t = X_t^{'} + \varepsilon_t$ are used in making discrepancy estimation $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$. Here the mean equation represents the portfolio returns of high, mid and low volume stocks. The σ_t^2 is the inconsistency of residuals gained from estimation $R_t = X_t^{'} + \varepsilon_t$ and they can also be marked as present day adjustment or volatility of volume based portfolio return. $\beta\sigma_{t-1}^2$ is preceding period residual variation or unpredictability of volume based portfolio return and also known as GARCH term. It means that today's fluctuation in the return are dependent on the previous day's return fluctuation. The term $\alpha\varepsilon_{t-1}^2$ is the ARCH term and it means that previous days squared residuals derived from $R_t = X_t^{'} + \varepsilon_t$.

Table 6.21 shows the results for GARCH (1, 1) estimation with dummy variable in the variance equation for volume based stocks. Total number of observation for each portfolio are 2129 for the period covering the period of 2008 to 2017. Since it is pointless to represents the results of GARCH in mean equations we have only represented our results for the variance equation using the dummy variables. The results show a strong evidence that ARCH and GARCH effects are presents in the residuals of mean equation.

The results demonstrate that our ARCH and GARCH conditions are substantial for all three portfolios based on volume, it means irrespective of the portfolios that have high or low volume stocks the current day volatility or shock is affected by the previous day volatilities and also by the previous day residual variance.

It will be essential to relate these outcomes with the dummy variable equation results. Our results in the dummy equation for high volume and mid volume portfolios show that the Monday return was negative and significant. It means that the Monday anomaly prevail in high and mid volume portfolios. Looking from the risk perspective we can see that for high volume portfolios Monday has statistically significant result as well. It means that Monday volatility is significantly affecting the high volumes portfolio volatilities. In summary we can say that Monday return for high volume portfolios is negative and significant but also the risk on Monday is high and significant. However, we cannot conclude that Monday anomaly is because of volatility because we can see that for high volume portfolios dummies are significant for all DOW effect. It means the volatilities of current day is affected by each day in the same manner.

For mid volume portfolios Friday and Tuesday results are significant it means that current day volatility has been influenced by the volatility of Tuesdays as well as by Fri and for small volume stocks volatility of portfolio return will affect negatively the current day volatility.

One future consideration could be to check how these anomalies prevail in long term and we need to check this liaison concerning risk and revenue by studying the VECM model.

Table 6.22

ARCH, GARCH Models with Dummy Variables (Capitalization sorted portfolios)

	Coefficients	Z-Statistic	Probability
High Cap portfolios			
ARCH(-1)	19.741705	8.849076	0.00000**
GARCH(-1)	77.750795	39.202773	0.00000**
Mon	0.004091	4.419123	0.00000**
Tues	-0.006136	-3.757694	0.00010**
Wed	-0.005114	-4.397492	0.00000**
Thu	-0.005114	-4.472959	0.00000**
Fri	0.001023	1.397444	0.14584

Mid Cap portfolios			
ARCH(-1)	20.261250	9.574445	0.00000**
GARCH(-1)	81.125795	49.331148	0.00000**
Mon	0.000000	-1.094533	0.32145
Tues	0.001023	1.136588	0.19541
Wed	0.002045	2.696830	0.00790**
Thu	-0.001023	-1.517778	0.124157
Fri	0.002045	3.254451	0.00130**
Low Cap portfolios			
ARCH(-1)	12.586705	8.194960	0.00000**
GARCH(-1)	85.998068	52.306333	0.00000**
Mon	0.000000	0.135931	0.785412
Tues	-0.001023	-2.059200	0.03650*
Wed	0.000000	0.253023	0.457120
Thu	0.000000	-0.138774	0.754810
Fri	0.003068	5.595116	0.00000**

*p < .05. **p < .01

It is a well-known fact that market capitalization is appropriate measure for the firm size. According to the financial theory market capitalization could defined as the value that is the part of the stock in the future term. Although there is no standard definition of market capitalization, it is measured by taking stock price and multiplying it by total outstanding shares. The classification of stocks into different capitalization helps the investor to identify growth stocks and the risk associated with it. Generally high cap stocks have slower growth but at the same time enjoy the low risk.

A glance at the high cap companies on PSX 100 index can tell us that these are the largest traded companies and investor are keen to invest in them like Abbot, NESTLE, U-lever, Siemens, Fouji cement etc. The results of high cap portfolio show that there is a strong evidence that there are ARCH consequences in the security yield. It means that the

volatilities of high cap portfolios are affected by Day-of-the-week volatilities. We can see that for Monday and Friday are positive for high cap stocks and the p statistics are significant it means that the Monday and Friday return volatilities have positive impact on the overall portfolio volatility or risk. Tuesday to Thursday have negative coefficients but significant p values, it means that all DOW significantly affect the portfolio volatility. It is important to note here that the regression results with dummy variable in mean return equation also confirms the Monday anomaly as well as ARCH/GARCH specifications. It simply means that there is a strong correlation involving the variance and return of high cap stocks and we need to further explore this relationship in an error correction environment to see if this relationship prevails in long run.

Studies show that portfolio managers are becoming more and more inclined toward investing in mid cap stocks portfolios. One of the reasons is mid cap stocks globally outperform large cap stocks. However, one of the main contributions of this study is not only to seek how mid cap stocks perform at PSX but correlated the DOW effect at portfolio level. Few of the reason why we develop mid-level portfolio are because mid cap companies at PSX are the companies with prime of growth like, Attock refinery, National refinery, Meezan bank, Pak Suzuki, Pakistan refinery Fuji cement etc. These companies have seen acceleration in both cash flows and earning per share in the last few years. Secondly most of the mid cap companies at PSX are in existence since long and the majority of the small cap companies like MAI, THI, INDU etc. With more mature product having big market shares, recognizable market brand, exposure in the global community and subsisting profits.

The results for the mid cap stock shows no evidence that the Monday or Friday volatilities has an impact of the volatility of residuals. Monday anomaly was confirmed in mean equation but it disappears in ARCH/GARCH variance equation. It means that the return of mid cap portfolios is affected by DOW but risk in relations of volatility has no significant impact on the portfolio risk.

Extensive literature confirms that the return of small stocks is negative on first day and positive on last day. A study by Gibbons and Hess (1981) using the data of S&P from

the period 1962 to 1978 found that for small cap stocks Monday yield a negative return and Friday was positive. They confirm these anomalies on weighted and value-weighted market return indices. A similar finding was documented by Brounen and Ben-Hamo (2009) who found that DOTW effect was most profound for small-cap stocks as these firms have less institutional investor holding their shares. The rationale for this study to construct assorted portfolio on the notion that its can be divided into medium as well as small capitalization stock was to check the link amongst portfolios of stocks based on market capitalization and DOTW anomaly at PSX, and how the market will respond when we factored in the risk factor in portfolio return.

ARCH and GARCH specifications are significant for low cap portfolios it means that both positions are substantial to describe the current day volatility of portfolio return and previous day residual variance has also a role in the current day volatility. These results are consistent not only with the existing literature Cross (1973) and French (1980) who found average gain at beginning of week was significantly low as equated to other DOW effect of varying magnitude, but also with the studies on PSX (Nishat & Mustafa, 2009). Interesting interpretation can be made regarding these results that is Monday anomaly is not confirmed when we simply run dummy variable regression on small cap stocks, but when we factor in the variance in mean equation we can see the anomaly clearly arises. We can conclude from these results that investor from small cap stock should refrain from investing on Monday. We can partially accept our third hypothesis that is volatility of return is same across the week. From the result we can see that for Monday return we can accept of null hypothesis as volatility of different portfolios are same across the week however for the Friday anomaly we can scrap our null hypothesis and found that for all the portfolios developed there is significant difference in mean daily return.

6.7.6 Summary

The results for all dummy regression on all the portfolios are summarized in table 6.23. We can see Monday anomaly is confirmed for high volume and large cap portfolios. This result is quite different from the result of table 6.17 where we check the Monday anomaly using dummy variables in mean equation. Here using the same portfolios but

incorporating ARCH and GARCH effect in the variance equation the result is significantly different. Monday anomalies have vanished for high beta, mid beta, mid volume and mid cap portfolios.

As far as Friday is concerned dummy variable in variance equation using ARCH and GARCH effect shows that almost all the portfolios has statistically significant results and the volatilities have significant role to play means today fluctuation is influenced by yesterday fluctuations. These finding are totally different when we compare it with table 6.17 where on Friday only low beta and low volume portfolios have significant results.

Table 6.23

Portfolio return among Day-of-the-week effect (volatilities)

	Mon	Tues	Wed	Thu	Fri
High beta Portfolio	0.324409	0.080489	0.828205	0.1125	0.00000**
Mid beta Portfolio	0.13841	0.38954	0.00040**	0.39548	0.00090**
Low beta Portfolio	0.253943	0.515045	0.938659	0.03170*	0.0612
High Volume Portfolio	0.00000**	0.045780*	0.00145**	0.00000**	0.00000**
Mid Volume Portfolio	0.45125	0.01235**	0.21458	0.45215	0.001254**
Low Volume Portfolio	0.18452	0.32104	0.38452	0.01295**	0.18457
Large Cap portfolio	0.00000**	0.00010**	0.00000**	0.00000**	0.14584
Mid Cap portfolio	0.32145	0.19541	0.00790**	0.12416	0.00130**
Low Cap portfolio	0.785412	0.03650*	0.45712	0.75481	0.00000**

Note: *p < .05. **p < .01

So far we have covered dynamics of stock market using the means and variance approach. First we have seen that DOTW anomaly is existing when we run the dummy regression on different portfolios developed on the basis of CAPM, market-cap and volume. Secondly we use the ARCH and GARCH specification in the differential estimation having dummy variable. In both cases we have seen that DOTW effect is not consistent among various portfolios and for various days. For example, Monday anomaly was statistically significant for in mean equation with dummy variables however same anomaly vanished when we use volatility/risk in the variance equation.

Moreover, we found that Portfolios have small effect on the calendar anomalies especially on Friday. Our regression results with dummy variables in mean equation shows that Friday anomaly was only significant for low beta and low volume portfolios, rest of the

portfolios did not demonstrate significant effect. However, from the risk point of view and using ARCH/GARCH specification in variance equation most of the portfolios show that ARCH/GARCH effects have significant role to play in identifying the anomalies.

One of the findings of dummy regression in mean or variance equation is that for the high volume and large cap stock Monday anomaly was present. That means that the return of stocks that have high volume or large capitalization are not only negative on Monday but the fluctuation of these stock is also influenced by Friday volatility.

These finding help us to expend our investigation about the link among variance and yield of stocks especially in the framework of DOW anomaly. Moreover, to check whether this relationship is short run only of it has a long run relation. Put it in other words we can investigate that DOTW effect is short run only or it prevails in long run also. For this reason, we have used error correction specification to evaluate this affiliation.

6.8 LONG AND SHORT DURATION LINK BETWEEN PORTFOLIO RETURNS

As mentioned in the first chapter that is description of topic, one of our objective in this paper is to advise investor to mitigate risk with investing specially at Pakistan Stock Exchange. The question we aim to answer under this objective is to see that what are the short/long span connection of risk and return in context of dummy variables at Karachi Stock Exchange. To study this dynamic relation of risk and return in various times periods ranging from few days to few years we pick a dynamic model of Engle and Granger (1987) with the insight that even though the risk and return of portfolios are non-stationary they might be co integrated. In his way we were able to separate the short/long span bond amid the DOTW effect and the portfolios return. It turns out that the existence of anomaly and its disappearance process is error correction process of VECM representation.

The rationale of employing the VECM model was to unleash the long a well as short span connection between risk and return at PSX. We incorporated dummy variables for each day to show how individual day return changes in response to change in the risk. VECM provide the correction terms that show influence of deviation of the relationship between risk and return from long run equilibrium to short run parameters. The existence of

co-integration and stationery time series would be tested, before incorporating the VERCM model.

Employing the VECM model requires that the series under consideration must be non-stationary, Table 6.18 shows that the all the portfolios has a unit root that implies that the average and adjustment of risk and return are not persistent over the period of time. We can see that the variables are assimilated of same data order hence we may use Johanson co-integration test. We have used Johansen co-integration test as proposed by (Johansen, 1991, 1995) exercising the cluster object using an assessed VAR object.

We have checked that the variables under consideration that are risk and returns are integrated of same order hence we applied Johansen-Juselius maximum likelihood method of co-integration to obtain the number of co-integrated vectors. The model to find the co-integrations are as follows

$$\Delta X_t = \sum_{i=1}^{p} \Gamma_i \Delta X_{t-1} + \Pi X_{t-1} + \varepsilon_t \qquad (32)$$

Where X_t is the vector (Risk, return) respectively, Δ is the sign of change operator, ε_t is vector of residuals. The VECM estimation contain the information on the time of adjustments to change in X_t via the projected restrictions Γ_i and Π correspondingly. Here the illustration ΠX_{t-1} is the error correction method and the value Π could have been incorporated using couple of unique matrices α and β such that $\Pi = \alpha\beta$, where β symbolizes the vector of co-integrated parameters while α is the vector of error correction coefficients and it is used to capture velocity of transformation to the longer span.

Our null hypothesis in the analysis states that there is no co-integration between return and risk at portfolios level. However, the trace statistics are more than the critical values that means there exist a co-integration between our two variables i.e. return and risk. In other words, we can say that our variables have long run association with each other. If the variables are co-integrated, then the estimation of Vector Error correction could be an option. Outcomes of restricted Co integration Rank Test (Trace) for all portfolios are shown in table 6.24.

Table 6.24

Unrestricted Co integration Rank Test (Trace)

	Hypothesized No. of CE(s	Eigenvalue	Trace Statistic	0.05 Critical Value
High beta portfolios	None *	0.147140	10255.2	15.42
	At most 1 *	0.131231	3587.2	3.785
Mid beta portfolios	None *	0.147554	8547.3	15.452
	At most 1 *	0.079524	1982.4	3.658
Low beta portfolios	None *	0.132145	7625.2	15.745
	At most 1 *	0.078452	2954.8	3.754
High vol portfolios	None *	0.154102	9125.5	15.625
	At most 1 *	0.089652	3254.2	3.743
Mid vol portfolios	None *	0.130214	12150.6	15.745
	At most 1 *	0.137814	4562.6	3.652
Low vol portfolios	None *	0.1412586	8592.3	15.842
	At most 1 *	0.078654	2154.6	3.547
Large Cap Portfolios	None *	0.132415	8541.4	15.547
	At most 1 *	0.069501	2625.5	3.698
Mid Cap portfolios	None *	0.145871	7415.6	15.358
	At most 1 *	0.032568	2475.6	3.475
Low Cap portfolios	None *	0.184751	8921.5	15.658
	At most 1 *	0.078965	3012.6	3.745

Trace test indicates 2 co-integrating equations at the 0.05

* denotes rejection of the hypothesis at the 0.05 level

We can see from the co-integration test that it could be a case where one can compute the VECM model. The benefit of using the VECM is that it has co-integration build into its specifications. So in this case it limits the long span performance of dependent variable (risk) to congregate to their co-integration affiliation with return while allowing the short run adjustments dynamics. As the long run equilibrium is corrected progressively throughout a succession of fractional short span adjustment the co-integration expression is recognized as error correction term.

Our objective is to develop an Error Correction Model (ECM) under Vector Error Correction Model (VECM) environment to check whether risk has a positive impact on return. Moreover, to check if the risk varies across different Day-of-the-week we have incorporated dummy variable. The reasons to use dummy variable in order to measure the consequence of each day on the risk. So Monday dummy =1 when Monday has significant effect on the risk and 0 when it has no effect and all the dummies through Tuesday to Friday has been created in the same fashion.

Given that return and risk of portfolios are co-integrated a VECM vector error correction model (VECM) employed to shed light on the time dynamic of short/long span interactions. The detail model is discussed in the testable model section however the final model looks like:

$$\Delta Risk = \sum_{i=1}^{p+1} \beta_1 \Delta \mathrm{Re}turn_{t-i} + \sum_{i=1}^{p+1} \alpha_i \, \Delta Risk_{t-i} + \gamma 1 * EC1_{t-1} + \gamma 2 * \sum_{t=1}^{5} D + \varepsilon_{1t} \qquad (22)$$

The result of the equation 22 are given in Table 25.

Table 25

Vector Error Correction Models with Dummy Variables

	Coefficients	t-Statistics	Probability
High beta portfolios			
$\Delta Risk(-1)$	-6.79E-01	-1.33E+02	0.0000**
$\Delta \mathrm{Re}turn(-1)$	7.45E+09	2.62E+00	0.0107*
Mon	-2.74E+08	-2.14E+00	0.0258*
Tues	4.58E+07	3.56E-01	0.6954
Wed	5.51E+08	4.38E+00	0.0000**
Thu	-1.01E+08	-7.85E-01	0.3954
Fri	-1.95E+08	-1.51E+00	0.1352
Mid beta portfolios			
$\Delta Risk(-1)$	6.33E-06	1.47E+00	0.1325
$\Delta \mathrm{Re}turn(-1)$	2.88E+09	1.17E+00	0.1254
Mon	-2.26E+08	-1.79E+00	0.08651
Tues	-7.50E+07	-5.93E-01	0.4751
Wed	6.51E+08	5.27E+00	0.0000**
Thu	-1.44E+08	-1.14E+00	0.1854
Fri	-2.49E+08	-1.95E+00	0.0425*
Low beta portfolios			
$\Delta Risk(-1)$	-2.21E-01	-4.15E+01	0.0000**
$\Delta \mathrm{Re}turn(-1)$	8.38E+12	3.10E+00	0.0018**
Mon	1.38E+11	1.44E+00	0.1471
Tues	1.38E+10	1.44E-01	0.9854
Wed	-3.25E+10	-3.47E-01	0.6984
Thu	-1.24E+11	-1.30E+00	0.2145
Fri	-7.35E+09	-7.49E-02	0.8974

*p < .05. **p < .01

	Coefficients	t-Statistics	Probability
High Volume portfolios			
$\Delta Risk(-1)$	-2.49E-01	-4.45E+01	0.0000**
$\Delta \mathrm{Re}turn(-1)$	-3.21E+09	-2.20E-01	0.8457
Mon.	-7.66E+08	-1.82E+00	0.06985
Tues.	-5.61E+07	-1.32E-01	0.7458
Wed.	1.70E+09	3.09E+00	0.0001**
Thu.	-2.12E+08	-4.57E-01	0.5985
Fri.	-7.44E+08	-2.74E+00	0.0668
Mid Volume portfolios			
$\Delta Risk(-1)$	-6.86E-01	-1.34E+02	0.0000**
$\Delta \mathrm{Re}turn(-1)$	-1.25E-03	-2.15E+00	0.0289*
Mon.	-8.33E+07	-1.63E+00	0.1524
Tues.	-3.74E+07	-7.29E-01	0.3985
Wed.	2.53E+08	5.04E+00	0.0000**
Thu.	-3.80E+07	-7.42E-01	0.5478
Fri.	-8.58E+07	-1.66E+00	0.1125
Low Volume portfolios			
$\Delta Risk(-1)$	-3.14E-01	-5.97E+01	0.0000**
$\Delta \mathrm{Re}turn(-1)$	5.45E+12	2.66E+00	0.0087**
Mon.	9.09E+10	1.24E+00	0.1587
Tues.	3.64E+10	3.43E-02	0.4857
Wed.	-3.22E+10	-3.57E-01	0.5487
Thu.	-1.20E+11	-1.46E+00	0.1658
Fri.	2.31E+10	2.47E-01	0.6767

*p < .05. **p < .01

	Coefficients	t-Statistics	Probability
High Cap portfolios			
$\Delta Risk(-1)$	-1.70E-01	-3.46E+01	0.0000**
$\Delta \mathrm{Re}turn(-1)$	3.36E+12	2.54E+00	0.0158
Mon.	6.40E+10	1.12E+00	0.2365
Tues.	2.70E+30	4.58E-01	0.5865

Wed.	-1.69E+20	-3.95E-01	0.4875
Thu.	-7.17E+20	-2.35E+00	0.1258
Fri.	1.45E+10	2.64E-01	0.6987
Mid Cap portfolios			
$\Delta Risk(-1)$	-6.61E-04	-3.11E+00	0.0019**
$\Delta \mathrm{Re}turn(-1)$	-2.43E+09	-3.63E+00	0.0002**
Mon.	-4.62E+07	-1.41E+00	0.1475
Tues.	1.88E+07	5.72E-01	0.4782
Wed.	1.04E+08	3.26E+00	0.0013**
Thu.	-3.10E+07	-9.48E-01	0.2584
Fri.	-4.89E+07	-1.47E+00	0.1475
Small Cap portfolios			
$\Delta Risk(-1)$	-2.43E-01	-4.42E+01	0.0000**
$\Delta \mathrm{Re}turn(-1)$	-1.82E+10	-1.78E+00	0.0478
Mon.	-4.77E+08	2.49E-01	0.1584
Tues.	-9.95E+07	8.27E-01	0.4258
Wed.	1.18E+09	3.38E-03	0.0012**
Thu.	-3.74E+08	3.69E-01	0.2475
Fri.	-1.71E+08	5.11E-01	0.6985

*p < .05. **p < .01

First thing in the results show in table 25 is to look for the error term i.e. $\Delta Risk_{(-1)}$. As per the literature if the coefficients are negative and significant then it means there exist legitimacy of the extended relationship between all the factors taken. The above results show that except for mid beta portfolios all the portfolios have negative coefficients and are significant. In other words, we can say that all the variables have long term association.

Results of dummy variables are shown as a dummy for each day starting from first day to the last day. If the dummy of particular day is significant it means that there is a long span affiliation amongst the return of that day and risk in a long term. It simply means that he DOTW anomaly prevails in long run. Similarly, if the p values are in significant it means that the anomaly does not last for long run and it vanishes in short run.

We can accept our forth hypothesis that is anomalies (Beta, Size and Volume) prevail in the long run we found neither Monday nor Friday return is statistically significant for long term anomalies.

6.8.1 Summary

Applying the Vector Error Correction Model concludes our "data analysis and finding section". We started the analysis by applying the dummy variable on portfolios of return. We found that Monday anomaly exists for most of the portfolios and Friday anomaly was only present in low beta and low volume portfolios. The limitation of these finding was that the analysis was limited only to the return side.

To incorporate the risk effect on the portfolio return we have developed the ARCH and GARCH model. We have incorporated risk in the variance equation using the dummy variable. We found that risk has a different role to play in the portfolio return. Conversely to mean equation our dummy regression result in variance in the ARCH/GARCH environment shows that almost all the results on Friday are statistically significant. It means that on Friday volatility has an important role to play when checking the DOWT effect.

Finally, we have used the VECM estimation to see what the short span bond of risk and return is. We found that most of the anomalies that were present in the short time disappear in the long term.

CHAPTER 7

7. CONCLUSION AND RECOMMENDATION

7.1 INTRODUCTION

In this chapter finding of the research are discussed, considering the research question, problem identified in literature and overall objectives of the research. The study tries to find whether daily return anomalies are present in the Pakistan Stock Market, moreover identify the sources of these irregularities, and finally explore the short term and long term association between risk and return.

7.2 REVIEW OF RESEARCH OBJECTIVES

The concept of EMH has been around for decades. The concept assumes that there is unsystematic movement in the stock prices. Prices of stocks at a given point in time are purely random and it is difficult to identify any pattern. Further, the concept entails that stock prices include all the existing information and any price change, high or low, is purely random. Although this concept finds support in the literature, many researchers have rejected the concept of EMH and random walk. This is because it is based on hypothetical assumptions, such as the market being completely competitive and the participants are rational investors who are risk-averse. Although these assumptions are part of EMH, the actual behavior of the market and its participants are very different from theory.

One of the objective this research intended to investigate is to find the state of Pakistan Security Market.i.e., Market efficiency at PXE. specifically, to find whether the Pakistan Stock Market is an efficient market. Is the DOW effect, which is a global phenomenon, still prevailing at the PSX? If anomalies are still prevailing, does it relate to the mean return of the day or does risk have any role in deriving these anomalies. We also investigated the role of portfolio return in identifying the sources of anomalies.

We followed the standard dummy variable technique to identify the DOW effect. To check the role of volatility/risk we incorporated a dummy variable in the ARCH/GARCH environment. Portfolios were constructed to see the role of portfolio return and the DOW effect. Finally, we observed the short term and long term correlation among risk and return under the dynamic environment of Vector-Error-Correction-Model (VECM) to see if the deviations in price from the efficient market value prevail in the long run or fade away.

The research objectives were as follows:

1. To investigate trading irregularities in the given stock market dynamics in the PSX.
    a. Does the stock return remain the same across the week for individual and portfolio of stocks?
    b. How do we locate irregularities in the PSX?
    c. Does the volatility of return remain the same across the week for individual and portfolio of stocks (No Anomaly)?
    d. What are the major sources of irregularities that apply to the Pakistan Stock Market?
2. To find the risk associated measures for an investor in the PSX.
    a. What are the short-term as well as long-term behaviours of the anomaly?
    b. How can investors safeguard their interest in the short and long run?

7.3 SUMMARY OF FINDINGS

The first research objective was finding the trading irregularities at the PSX, checking if they still prevail, and locating them. We started the analysis by examining

simple descriptive statistics, and found a difference among the average daily return in weekdays. Returns on Mon and Tues seem to be negative, while they were positive for Wednesday to Friday. We also checked for a positive co-relation among days to see how the return of one day moves in relation to another. We found that Monday and Friday are correlated. We also used error bar charts to see if the mean return is significant. To test the significance between groups and within groups, we used the analysis of variance. We found that there is a considerable variance in the average return of days, at p=.039.

Following the methodology of various researchers (French, 1980; Ali & Mustafa, 2001; Tahir, 2011; Sultan, Madah, & Khalid, 2013) for checking the DOW effect, we used the dummy variable model with intercept to understand how the mean returns across the week starting from second day of the week (Tuesday) to last working day (Friday), are statistically dissimilar from returns on Mon, and without intercept, to test if all the DOW have equal daily mean return. Both regression results show that the anomaly exists at the PSX and we found that first day returns are negative and statistically significant, while last day mean returns are not only positive but are and statistically significant. These finding shows that this research has similar results as compared to previous research on the DOW effect in the PSX.

When investigating the irregularities in the given stock market dynamics, we checked the role of portfolio and the DOW effect, by taking this concept from various studies. Stmabuagh and Kiem (1984) investigated the DOW effect on various portfolios, while Lokanishok and Meabrly (1990) documented the weekday effect on various portfolios. We built portfolios based on historical studies, which find strong evidence that deviation in stock returns is easily traceable by using portfolios, developed on some fundamental characteristics. We followed the approach of Fama and French (1992) in developing the portfolios on the basis of beta. We used the panel data model to calculate the beta of selected stocks and developed three portfolios on the bases of high-, medium-, and low-beta firms. Chung et al. (1999) proposed developing a portfolio in the basis of size; we developed the sized portfolios proxy by market capitalisation. Finally, we developed mid-, high-, and low-volume stock portfolios following Lakonishok and Maberly (1990).

Our regression results on the various portfolios shows that the Monday anomaly still prevails at the portfolio level. We found significant evidence that the returns of various portfolios are negative and statistically significant on Mondays. Nonetheless, the Friday anomaly seems to disappear at the portfolio level, as only the return of low beta portfolios, and low volume portfolios on Friday are statistically significant.

These findings lead us to our second objective, which is to understand how the returns of various portfolios are related to risk. As discussed in the theoretical framework, various studies have proposed exercising the ARCH and GARCH models to analyse the behaviours of stock return volatilities (risk). We used these models to check the volatility of portfolio return in context of the DOW effect. Few researchers have suggested including some seasonal exogenous variable into the GARCH specification to explain the conditional variance of portfolio return. We allowed dummy variables as an exogenous variable in the ARCH/GARCH differential equation.

We found that the Friday anomaly was significant when dummy for each day is incorporated in the variance term, using ARCH/GARCH specifications. We found that in high volume and large cap portfolios, the DOW effect was existent in both the mean (return) equation and in the (volatility) risk equation. We also found that the DOW anomaly responded differently to risk and return. For example, for high- and mid-beta portfolio, we confirmed the Monday anomaly in the average (return) equation; however, it disappeared in the risk (unpredictability) equation, and Friday was significant. In mean (return) equation, we found no evidence of the DOW effect from Tuesday to Thursday; however, there is strong and significant evidence that that DOW effect is existent in the risk (Variance) equation.

We found that one reason for the Monday anomaly is high-volume stocks, as our results with the ARCH term in the variance equation shows that volatility in high-volume stock is causing Monday anomaly. Furthermore, running the regression with the means return of portfolios, the Monday anomaly continues to prevail for high-volume stocks. We can conclude that in the PSX, high-volume stocks cause the Monday anomaly.

We discovered that ε_t, that is, the ARCH term, is both positive and significant. It represents the variance from the last periods and it is captured as a lag of squared residuals from the average equation. On day 1, the information index is created and it remains significant for some time; however, the information about the event created on day 1 takes some time to reach investors.

Finally, after finding that the DOW anomaly prevail in retunes as well in risk equation, and it also varies across the week, we investigated the short-term and medium to long-term behavior of risk and return in the context of the DOW effect. We empirically tested that the risk and return for our portfolios are co-integrated and non-stationary. This can be interpreted as co-integrated systems, comprising risk and return. We witness profound evidence of log-term association among risk and return. However, as we used dummy as an exogenous variable in our error correction model, mostly, the DOW effect prevailed both in the extended period of the time as well as during the intermittent duration, as all anomalies, especially on Monday and Friday, which were present in the return or risk equation and were found insignificant in the long run. We also found that long run equilibrium does not exist for mid beta portfolios. In fact, investors in mid beta portfolios are neither high-risk takers nor extremely risk-averse. Therefore, the error correction term for such types of portfolios does not provide equilibrium in the long run.

This study has discussed investor protection keeping in mind the Pakistan stock market. Investors in Pakistan's stock markets are reluctant to invest on Monday, as stock returns, on average, are negative on Monday. This phenomenon has been highlighted in the literature (Iqbal et al., 2013). The current study has obtained some results that can help investors safeguard their interests in the stock market. First, although previous literature confirmed the Monday effect, it could not explain the anomaly. We found that as discussed in previous studies (Poon & Granger, 2005), volatility does not affect the Monday returns, as the Monday return does not prove to be different from other days for the remaining portfolios developed. This requires investigating the Monday anomaly further, through other approaches, such as behavioural finance.

Second, investors are also concerned about the reliability of the anomaly, that is, if the anomaly appears, is it short term or will it remain for a long time? This issue is very important for investors, as it has direct impact on the short-term position taken in the market as well as investing in stocks for the long term. We identified this issue using the VECM model and proposed that neither the Monday negative return nor Friday positive return is consistent. Most of the anomalies that appear were not long lasting and tend to diminish with the passage of time.

This finding has the following direct implications for investors:

1. It helps understand the stock market better and identify anomalies, which have a profound effect on trading strategies.
2. It is useful for traders and portfolio managers, as it will help them take short positions in the market and build portfolios for the longer time frame.
3. Participants in the stock market and policymakers may use the information about anomalies by examining the patterns in the PSX.
4. Provide evidence on anomalies in the Pakistan Stock Market. We found that only the-high beta stocks can significantly contribute to the Monday anomaly.

The major academic and practical contributions of this study are as follows:

7.1 ACADEMIC CONTRIBUTION

1. The academic contribution of this thesis is that it has further explored trading anomalies in the Pakistan Stock Market. Many on the PSX have highlighted trading anomalies and recommended finding explanations for this irregular behaviour. This thesis has taken a step further and explored the types of stocks causing these anomalies. This will help investors understand the market better.
2. This thesis has bridged the gap identified in previous studies such as Fama (1970) and Derbali and Hallara (2016). It has explored the long-run relationship of risk and return under the VECM environment and determined the speed of adjustments towards these equilibria.

3. This thesis has identified the anomalies through volatility clustering in the long run. Volatility clustering is also an indication of anomalies and justifies the practice of the ARCH and GARCH specification. Using the ARCH/GARCH specification, this thesis has not only located the anomaly, ε_t, but the component of the model employed reflects the information index of the market. The results show that conditional heteroskedasticity, that is, means volatility, is conditional upon the availability of market information.

7.2 PRACTICAL IMPLICATIONS

1. The study discusses investor safeguards by exploring some plausible explanations of the Monday anomaly. This will help investors develop their portfolios. The results of this thesis show that high beta stocks cause the Monday anomaly.
2. This thesis explains the role of information and its results show that the market takes some time to absorb any information. Hence, the ARCH and GARCH models best explain this phenomenon. This will help investors understand the market better.
3. The results will be helpful for portfolio managers, as most of the anomalies that appear in the short-run do not last long; hence, this thesis concludes that except for the stock return of high beta stocks, none of the portfolios has shown any irregularity in the long-run.
4. For individual investors, this thesis identifies the type of stocks with a skewed profits on first day of week and those that show a upbeat return. Almost all the stocks in the portfolios show a significant result.
5. For day traders, this thesis is helpful because it shows that the profits on first day of the week is negative but in short-run and on Friday, the return is positive but insignificant. However, for short-term investments, they can earn a good return on investments on Wednesday.

7.3 POSSIBLE FUTURE RESEARCH

This study has some limitations that future research can address. First, future research should broaden the scope by using econometric techniques that are more rigorous,

for example, this thesis limits its investigation of the risk and return volatility to the GARCH specification. However, future studies can use a more asymmetric GARCH estimation, such as the Threshold GARCH to show stock return volatility. Thus, future research should be able to capture the volatility clustering phenomena, when large/small volatility follows large/small volatility. Future studies can also use the EGARCH model, which can eliminate some restrictions of the GARCH, such as the sign of lagged residuals. Similarly, this thesis uses a standard dummy variable approach that future studies can replace with an extended dummy variable approach for better estimation.

Second, this thesis limits the analysis to the portfolio level, which should be enhanced on the firm-specific level, for example, future research should examine firms or sectors that have contributed the most to the DOW effect.

Stock market anomalies have been discussed thoroughly from the behavioural perspective; this should be the future area of research while considering the DOW effect.

Consistent with the methodologies, this thesis has used beta sorted portfolios using the constant version of the beta. Future research can instead use time-varying beta.

7.4 LIMITATIONS OF STUDY

One limitation of this thesis is that it does not discuss the information bias when addressing market efficiency. For example, it does not take into account cognitive biases such as investor overconfidence, information bias, and some other important biases, such as representative bias, and other predictable human errors.

The data analysed for this thesis was limited to only 10 years. Moreover, this thesis has investigated companies included in the 100 index only, because these 100 companies represent the overall stock market. However, future research should incorporate companies that are not part of the 100 index.

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9. APPENDIX A

TABLE A1

Panel Data regression for highest to lowest a vales.

N0	Variable	Coefficient	Std. Error	t-Statistic	Prob.
1	LOTPTAY_PSX	1.607962	0.115366	13.93796	0
2	LPCL--Y_PSX	1.521744	0.084395	18.03124	0
3	TRG--Y_PSX	1.385804	0.055630	24.91093	0
4	JSCL--Y_PSX	1.263365	0.055999	22.56046	0
5	ANL--Y_PSX	1.242755	0.056448	22.01608	0
6	NIB--Y_PSX	1.238434	0.055589	22.27849	0
7	PAKRI--Y_PSX	1.208406	0.063167	19.13033	0
8	DGKC--Y_PSX	1.144613	0.056146	20.38619	0
9	WTL--Y_PSX	1.121425	0.056998	19.67465	0
10	NML--Y_PSX	1.113512	0.056848	19.58738	0
11	PACE--Y_PSX	1.096219	0.055843	19.63048	0
12	MCB--Y_PSX	1.088673	0.056537	19.25610	0
13	AICL--Y_PSX	1.060136	0.057152	18.54942	0
14	NBP--Y_PSX	1.057648	0.055589	19.02618	0
15	ATRL--Y_PSX	1.036904	0.056556	18.33427	0
16	BAFL--Y_PSX	1.026197	0.055615	18.45178	0

N0	Variable	Coefficient	Std. Error	t-Statistic	Prob.
17	AKBL--Y_PSX	1.000668	0.055556	18.01199	0
18	FABL--Y_PSX	0.966166	0.056095	17.22381	0
19	NETSO--Y_PSX	0.961737	0.055933	17.19446	0
20	AHL--Y_PSX	0.956720	0.057403	16.66661	0
21	SNBL--Y_PSX	0.953128	0.056126	16.98192	0
22	LUCK--Y_PSX	0.945328	0.057156	16.53936	0
23	PGF--Y_PSX	0.938078	0.055929	16.77270	0
24	FCCL--Y_PSX	0.924698	0.055589	16.63445	0
25	POL--Y_PSX	0.914386	0.055850	16.37231	0
26	UBL--Y_PSX	0.913777	0.055776	16.38286	0
27	PTC--Y_PSX	0.906598	0.056013	16.18549	0
28	OGDC--Y_PSX	0.902151	0.055596	16.22705	0
29	HBL--Y_PSX	0.890607	0.056264	15.82915	0
30	PRL--Y_PSX	0.884434	0.057056	15.50107	0
31	PSO--Y_PSX	0.870340	0.056604	15.37584	0
32	EFUG--Y_PSX	0.862324	0.056730	15.20049	0
33	PSXC--Y_PSX	0.846311	0.055589	15.22452	0
34	MDTL--Y_PSX	0.843956	0.118218	7.13897	0
35	DAWH--Y_PSX	0.832436	0.057295	14.52902	0
36	FFBL--Y_PSX	0.828539	0.055925	14.81515	0
37	MAI--Y_PSX	0.823774	0.056885	14.48142	0
38	SCBPL--Y_PSX	0.819219	0.055683	14.71222	0
39	NRL--Y_PSX	0.814321	0.056851	14.32387	0
40	APL--Y_PSX	0.797064	0.057204	13.93381	0
41	ABL--Y_PSX	0.769854	0.056578	13.60706	0
42	PPL--Y_PSX	0.769697	0.056254	13.68242	0
43	FEUL--Y_PSX	0.766635	0.058278	13.15471	0
44	EPCL--Y_PSX	0.750889	0.056266	13.34526	0

N0	Variable	Coefficient	Std. Error	t-Statistic	Prob.
45	EPCL--Y_PSX	0.750889	0.056266	13.34526	0
46	PTEC--Y_PSX	0.749914	0.061989	12.09755	0
47	ICI--Y_PSX	0.721198	0.057319	12.58208	0
48	ACPL--Y_PSX	0.718560	0.056895	12.62962	0
49	PKGS--Y_PSX	0.709655	0.056693	12.51743	0
50	THAL--Y_PSX	0.704219	0.056997	12.35538	0
51	SNGP--Y_PSX	0.701033	0.055870	12.54754	0
52	PICT--Y_PSX	0.667844	0.056440	11.83276	0
53	MEBL--Y_PSX	0.649357	0.056945	11.40321	0
54	PSMC--Y_PSX	0.645278	0.057057	11.30946	0
55	IGIIL--Y_PSX	0.626322	0.057406	10.91042	0
56	PIAA--Y_PSX	0.621238	0.055594	11.17463	0
57	SHEL--Y_PSX	0.615364	0.057618	10.68010	0
58	FFC--Y_PSX	0.614869	0.055966	10.98642	0
59	INIL--Y_PSX	0.600869	0.055769	10.77431	0
60	HUBC--Y_PSX	0.591849	0.055929	10.58219	0
61	GLAXO--Y_PSX	0.591088	0.056257	10.50696	0
62	SSGC--Y_PSX	0.586725	0.057196	10.25817	0
63	ABOT--Y_PSX	0.572090	0.056813	10.06965	0
64	GHGL--Y_PSX	0.516377	0.056790	9.09270	0
65	PNSC--Y_PSX	0.512960	0.058304	8.79800	0
66	HMB--Y_PSX	0.507825	0.058761	8.64219	0
67	INDU--Y_PSX	0.497530	0.057918	8.59025	0
68	BAHL--Y_PSX	0.496658	0.056819	8.74112	0
69	PCAL--Y_PSX	0.486290	0.059507	8.17195	0
70	CPL--Y_PSX	0.454670	0.057698	7.88019	0
71	PAKT--Y_PSX	0.451738	0.058534	7.71759	0
72	AGIL--Y_PSX	0.439965	0.057608	7.63720	0

N0	Variable	Coefficient	Std. Error	t-Statistic	Prob.
73	KAPCO--Y_PSX	0.431141	0.055692	7.74158	0
74	MTL--Y_PSX	0.429904	0.055673	7.72199	0
75	SEPL--Y_PSX	0.421902	0.057752	7.30542	0
76	IBFL--Y_PSX	0.420378	0.061352	6.85194	0
77	BWCL--Y_PSX	0.398671	0.097304	4.09718	0
78	AGTL--Y_PSX	0.397761	0.059521	6.68266	0
79	NESTLE--Y_PSX	0.380900	0.065975	5.77340	0
80	BYCO--Y_PSX	0.362402	0.055316	6.55149	0
81	ATLH--Y_PSX	0.358320	0.062843	5.70187	0
82	PSEL--Y_PSX	0.354425	0.075601	4.68811	0
83	MUREB--Y_PSX	0.311481	0.062370	4.99406	0
84	BATA--Y_PSX	0.309985	0.071981	4.30652	0
85	KOHE--Y_PSX	0.288361	0.060561	4.76149	0
86	LAKST--Y_PSX	0.287593	0.068761	4.18248	0
87	SHFA--Y_PSX	0.242017	0.072964	3.31692	0
88	GRAYS--Y_PSX	0.233858	0.100525	2.32638	0
89	ULEVER--Y_PSX	0.212848	0.058552	3.63517	0
90	COLG--Y_PSX	0.180908	0.067761	2.66979	0
91	SIEM--Y_PSX	0.154799	0.066401	2.33128	0
92	RMPL--Y_PSX	0.139407	0.092925	1.50022	0
93	UPFL--Y_PSX	0.094823	0.119139	0.79591	0
94	EWIC--Y_PSX	0.003816	0.109391	0.03488	1
95	DREL--Y_PSX	-0.012719	0.094360	-0.13479	1

TABLE A2

Panel data regression for Pooled data Observations (98,070)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000432	9.12E-05	-4.736720	0.0000
ABOT--Y_PSX	0.572090	0.056813	10.06965	0.0000
AICL--Y_PSX	1.060136	0.057152	18.54942	0.0000
ABL--Y_PSX	0.769854	0.056578	13.60706	0.0000
AKBL--Y_PSX	1.000668	0.055556	18.01199	0.0000
ATLH--Y_PSX	0.358320	0.062843	5.701869	0.0000
APL--Y_PSX	0.797064	0.057204	13.93381	0.0000
ATRL--Y_PSX	1.036904	0.056556	18.33427	0.0000
BAHL--Y_PSX	0.496658	0.056819	8.741117	0.0000
BAFL--Y_PSX	1.026197	0.055615	18.45178	0.0000
BATA--Y_PSX	0.309985	0.071981	4.306515	0.0000
COLG--Y_PSX	0.180908	0.067761	2.669790	0.0076
DGKC--Y_PSX	1.144613	0.056146	20.38619	0.0000
EFUG--Y_PSX	0.862324	0.056730	15.20049	0.0000
FEUL--Y_PSX	0.766635	0.058278	13.15471	0.0000
FFBL--Y_PSX	0.828539	0.055925	14.81515	0.0000
FFC--Y_PSX	0.614869	0.055966	10.98642	0.0000
FABL--Y_PSX	0.966166	0.056095	17.22381	0.0000
GLAXO--Y_PSX	0.591088	0.056257	10.50696	0.0000
HMB--Y_PSX	0.507825	0.058761	8.642188	0.0000
IGIIL--Y_PSX	0.626322	0.057406	10.91042	0.0000

INDU--Y_PSX	0.497530	0.057918	8.590249	0.0000
JSCL--Y_PSX	1.263365	0.055999	22.56046	0.0000
KAPCO--Y_PSX	0.431141	0.055692	7.741581	0.0000
LUCK--Y_PSX	0.945328	0.057156	16.53936	0.0000
MCB--Y_PSX	1.088673	0.056537	19.25610	0.0000
MEBL--Y_PSX	0.649357	0.056945	11.40321	0.0000
MTL--Y_PSX	0.429904	0.055673	7.721987	0.0000
NBP--Y_PSX	1.057648	0.055589	19.02618	0.0000
NRL--Y_PSX	0.814321	0.056851	14.32387	0.0000
NESTLE--Y_PSX	0.380900	0.065975	5.773403	0.0000
NIB--Y_PSX	1.238434	0.055589	22.27849	0.0000
NML--Y_PSX	1.113512	0.056848	19.58738	0.0000
OGDC--Y_PSX	0.902151	0.055596	16.22705	0.0000
PKGS--Y_PSX	0.709655	0.056693	12.51743	0.0000
PSMC--Y_PSX	0.645278	0.057057	11.30946	0.0000
POL--Y_PSX	0.914386	0.055850	16.37231	0.0000
PPL--Y_PSX	0.769697	0.056254	13.68242	0.0000
PSEL--Y_PSX	0.354425	0.075601	4.688107	0.0000
PSO--Y_PSX	0.870340	0.056604	15.37584	0.0000
PAKT--Y_PSX	0.451738	0.058534	7.717585	0.0000
PGF--Y_PSX	0.938078	0.055929	16.77270	0.0000
RMPL--Y_PSX	0.139407	0.092925	1.500215	0.1336
SHEL--Y_PSX	0.615364	0.057618	10.68010	0.0000
SNBL--Y_PSX	0.953128	0.056126	16.98192	0.0000
SCBPL--Y_PSX	0.819219	0.055683	14.71222	0.0000
SNGP--Y_PSX	0.701033	0.055870	12.54754	0.0000
SSGC--Y_PSX	0.586725	0.057196	10.25817	0.0000
THAL--Y_PSX	0.704219	0.056997	12.35538	0.0000
UBL--Y_PSX	0.913777	0.055776	16.38286	0.0000
ULEVER--Y_PSX	0.212848	0.058552	3.635172	0.0003

SIEM--Y_PSX	0.154799	0.066401	2.331279	0.0197
PSXC--Y_PSX	0.846311	0.055589	15.22452	0.0000
BWCL--Y_PSX	0.398671	0.097304	4.097182	0.0000
AGTL--Y_PSX	0.397761	0.059521	6.682655	0.0000
GHGL--Y_PSX	0.516377	0.056790	9.092700	0.0000
PNSC--Y_PSX	0.512960	0.058304	8.798002	0.0000
INIL--Y_PSX	0.600869	0.055769	10.77431	0.0000
KOHE--Y_PSX	0.288361	0.060561	4.761494	0.0000
UPFL--Y_PSX	0.094823	0.119139	0.795908	0.4261
PRL--Y_PSX	0.884434	0.057056	15.50107	0.0000
ANL--Y_PSX	1.242755	0.056448	22.01608	0.0000
WTL--Y_PSX	1.121425	0.056998	19.67465	0.0000
FCCL--Y_PSX	0.924698	0.055589	16.63445	0.0000
MAI--Y_PSX	0.823774	0.056885	14.48142	0.0000
DAWH--Y_PSX	0.832436	0.057295	14.52902	0.0000
AHL--Y_PSX	0.956720	0.057403	16.66661	0.0000
EPCL--Y_PSX	0.750889	0.056266	13.34526	0.0000
LAKST--Y_PSX	0.287593	0.068761	4.182477	0.0000
HUBC--Y_PSX	0.591849	0.055929	10.58219	0.0000
PAKRI--Y_PSX	1.208406	0.063167	19.13033	0.0000
IBFL--Y_PSX	0.420378	0.061352	6.851940	0.0000
AGIL--Y_PSX	0.439965	0.057608	7.637200	0.0000
PIAA--Y_PSX	0.621238	0.055594	11.17463	0.0000
PICT--Y_PSX	0.667844	0.056440	11.83276	0.0000
EPCL--Y_PSX	0.750889	0.056266	13.34526	0.0000
MDTL--Y_PSX	0.843956	0.118218	7.138967	0.0000
EWIC--Y_PSX	0.003816	0.109391	0.034883	0.9722
ICI--Y_PSX	0.721198	0.057319	12.58208	0.0000
ACPL--Y_PSX	0.718560	0.056895	12.62962	0.0000
HBL--Y_PSX	0.890607	0.056264	15.82915	0.0000

DREL--Y_PSX	-0.012719	0.094360	-0.134792	0.8928
LPCL--Y_PSX	1.521744	0.084395	18.03124	0.0000
TRG--Y_PSX	1.385804	0.055630	24.91093	0.0000
SEPL--Y_PSX	0.421902	0.057752	7.305422	0.0000
PTEC--Y_PSX	0.749914	0.061989	12.09755	0.0000
LOTPTA--Y_PSX	1.607962	0.115366	13.93796	0.0000
BYCO--Y_PSX	0.362402	0.055316	6.551485	0.0000
CPL--Y_PSX	0.454670	0.057698	7.880185	0.0000
GRAYS--Y_PSX	0.233858	0.100525	2.326376	0.0200
MUREB--Y_PSX	0.311481	0.062370	4.994055	0.0000
NETSO--Y_PSX	0.961737	0.055933	17.19446	0.0000
PACE--Y_PSX	1.096219	0.055843	19.63048	0.0000
PCAL--Y_PSX	0.486290	0.059507	8.171946	0.0000
PTC--Y_PSX	0.906598	0.056013	16.18549	0.0000
SHFA--Y_PSX	0.242017	0.072964	3.316922	0.0009

Fixed Effects

(Cross)

ABOT--C	0.000237
AICL--C	0.000196
ABL--C	0.000272
AKBL--C	-0.000833
ATLH--C	0.000375
APL--C	0.000118
ATRL--C	0.000196
BAHL--C	-6.53E-05
BAFL--C	-0.000207
BATA--C	0.001282
COLG--C	0.001520
DGKC--C	0.000271
EFUG--C	-0.001014

FEUL--C	-0.000958
FFBL--C	0.000450
FFC--C	0.000551
FABL--C	-0.000887
GLAXO--C	-0.000396
HMB--C	-0.000382
IGIIL--C	-0.000974
INDU--C	0.000581
JSCL--C	-0.001323
KAPCO--C	0.000676
LUCK--C	0.000328
MCB--C	0.000152
MEBL--C	0.000226
MTL--C	0.001173
NBP--C	-0.000797
NRL--C	0.000116
NESTLE--C	0.002682
NIB--C	-0.000809
NML--C	0.000226
OGDC--C	0.000997
PKGS--C	-3.66E-05
PSMC--C	-0.000764
POL--C	0.000825
PPL--C	0.000429
PSEL--C	-0.000749
PSO--C	0.000335
PAKT--C	-0.000129
PGF--C	-9.74E-05
RMPL--C	0.000309
SHEL--C	-0.000415

SNBL--C	-0.000977
SCBPL--C	-0.000624
SNGP--C	-0.000462
SSGC--C	0.000124
THAL--C	-0.000373
UBL--C	0.000277
ULEVER--C	0.001900
SIEM--C	0.000248
PSXC--C	-8.34E-05
BWCL--C	0.000261
AGTL--C	0.000152
GHGL--C	0.000552
PNSC--C	-0.000255
INIL--C	-0.000891
KOHE--C	0.000304
UPFL--C	0.002146
PRL--C	-0.000882
ANL--C	-0.000822
WTL--C	-0.000677
FCCL--C	7.40E-05
MAI--C	-0.000696
DAWH--C	-0.001621
AHL--C	-0.001495
EPCL--C	-0.000162
LAKST--C	0.000770
HUBC--C	0.000862
PAKRI--C	-0.000723
IBFL--C	0.000192
AGIL--C	0.000740
PIAA--C	0.000116

PICT--C	0.001429
EPCL--C	-0.000162
MDTL--C	-0.000180
EWIC--C	0.001035
ICI--C	0.000121
ACPL--C	0.000266
HBL--C	7.37E-05
DREL--C	0.001894
LPCL--C	-0.000854
TRG--C	-0.000249
SEPL--C	-0.000148
PTEC--C	0.000362
LOTPTA--C	-0.001199
BYCO--C	0.000528
CPL--C	0.000961
GRAYS--C	0.001728
MUREB--C	0.000339
NETSO--C	-0.000831
PACE--C	-0.002042
PCAL--C	-0.000864
PTC--C	5.39E-05
SHFA--C	0.001435

TABLE A3

List of large, medium and small capitalization stocks

Name	Size	Name	Size	Name	Size
ABOT	Large Cap	MCB	Mid cap	EPCL	Small Cap
FFC	Large Cap	PKGS	Mid cap	MUREB	Small Cap
JSCL	Large Cap	PSEL	Mid cap	PCAL	Small Cap
PSXC	Large Cap	WTL	Mid cap	THAL	Small Cap
SCBPL	Large Cap	GLAXO	Mid cap	SEPL	Small Cap
NBP	Large Cap	MEBL	Mid cap	GRAYS	Small Cap
SIEM	Large Cap	BYCO	Mid cap	PTEC	Small Cap
AHL	Large Cap	MDTL	Mid cap	PTC	Small Cap
PAKRI	Large Cap	SNGP	Mid cap	KOHE	Small Cap
UBL	Large Cap	PSMC	Mid cap	TRG	Small Cap
NESTLE	Large Cap	NRL	Mid cap	LOTPTA	Small Cap
DAWH	Large Cap	ATRL	Mid cap	PIAA	Small Cap
AICL	Large Cap	BWCL	Mid cap	HUBC	Small Cap
PPL	Large Cap	PICT	Mid cap	AGIL	Small Cap
ULEVER	Large Cap	SNBL	Mid cap	SHFA	Small Cap
EFUG	Large Cap	LAKST	Mid cap	ICI	Small Cap
FEUL	Large Cap	COLG	Mid cap	SSGC	Small Cap
LUCK	Large Cap	PACE	Mid cap	AGTL	Small Cap
UPFL	Large Cap	NETSO	Mid cap	BAHL	Small Cap
BAFL	Large Cap	FCCL	Mid cap	MAI	Small Cap
ANL	Large Cap	IBFL	Mid cap	INDU	Small Cap
DGKC	Large Cap	INIL	Mid cap	APL	Small Cap
HMB	Large Cap	PRL	Mid cap	ATLH	Small Cap
NIB	Large Cap	KAPCO	Mid cap	MTL	Small Cap
PSO	Large Cap	LPCL	Mid cap	EWIC	Small Cap

Name	Size	Name	Size	Name	Size
GHGL	Large Cap	CPL	Mid cap	NML	Small Cap
AKBL	Large Cap	PNSC	Mid cap	DREL	Small Cap
SHEL	Large Cap	BATA	Mid cap	HBL	Small Cap
FABL	Large Cap	PGF	Mid cap	RMPL	Small Cap
ABL	Large Cap	ACPL	Mid cap	PAKT	Small Cap
IGIIL	Large Cap	POL	Small Cap	FFBL	Small Cap
		OGDC	Small Cap	POL	Small Cap
				OGDC	Small Cap

TABLE A4

List of companies selected

2008-9	2010-11	2012-13	2014-15	2016	2017
Abbott Laboratories	ABOT	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories	Abbott Laboratories
Adamjee Insurance	AICL	Adamjee Insurance	Adamjee Insurance	Adamjee Insurance	Adamjee Insurance
Allied Bank	ABL	Allied Bank	Allied Bank	Allied Bank	Allied Bank
Askari Bank	AKBL	Askari Bank	Askari Bank	Askari Bank	Askari Bank
Atlas Honda	ATLH	Atlas Honda	Atlas Honda	Atlas Honda	Atlas Honda
Attock Petroleum	APL	Attock Petroleum	Attock Petroleum	Attock Petroleum	Attock Petroleum
Attock Refinery	ATRL	Attock Refinery	Attock Refinery	Attock Refinery	Attock Refinery
Bank AL Habib	BAHL	Bank AL Habib	Bank AL Habib	Bank AL Habib	Bank AL Habib
Bank Alfalah	BAL	Bank Alfalah	Bank Alfalah	Bank Alfalah	Bank Alfalah
Bata Pak Ltd.	BATA	Bata Pak Ltd.	Bata Pak Ltd.	Bata Pak Ltd.	Bata Pak Ltd.
Colgate Palmolive	COLG	Colgate Palmolive	Colgate Palmolive	Colgate Palmolive	Colgate Palmolive

2008-9	2010-11	2012-13	2014-15	2016	2017
D G Khan Cement Co	DGKC	D G Khan Cement Co	D G Khan Cement Co	D G Khan Cement Co	D G Khan Cement Co
EFU General Insurance	EFUG	EFU General Insurance	EFU General Insurance	EFU General Insurance	EFU General Insurance
EFU Life Assurance	FEUL	EFU Life Assurance	EFU Life Assurance	EFU Life Assurance	EFU Life Assurance
Fauji Fertilizer Bin Qasim	FFBL	Fauji Fertilizer Bin Qasim	Fauji Fertilizer Bin Qasim	Fauji Fertilizer Bin Qasim	Fauji Fertilizer Bin Qasim
Fauji Fertilizer Co	FFC	Fauji Fertilizer Co	Fauji Fertilizer Co	Fauji Fertilizer Co	Fauji Fertilizer Co
Faysal Bank	FABL	Faysal Bank	Faysal Bank	Faysal Bank	Faysal Bank
Glaxo Smith Kline	GLAXO	GSK (Pak) Ltd.	GSK (Pak) Ltd.	GSK (Pak) Ltd.	GSK (Pak) Ltd.
Habib Met Bank	HMB	Habib Met Bank	Habib Met Bank	Habib Met Bank	Habib Met Bank
IGI Insurance Ltd.	IGIIL	IGI Insurance Ltd.	IGI Insurance Ltd.	IGI Insurance Ltd.	IGI Insurance Ltd.
Indus Motor Co	INDU	Indus Motor Co	Indus Motor Co	Indus Motor Co	Indus Motor Co
Jahangir Siddiqui	JSCL	JS & Co Ltd.;	JS & Co Ltd.;	JS & Co Ltd.;	JS & Co Ltd.;
Kot Addu Power	KAPCO	Kot Addu Power	Kot Addu Power	Kot Addu Power	Kot Addu Power

2008-9	2010-11	2012-13	2014-15	2016	2017
Lucky Cement Ltd.	LUCK	Lucky Cement Ltd.	Lucky Cement Ltd.	Lucky Cement Ltd.	Lucky Cement Ltd.
MCB Bank Ltd.	MCB	MCB Bank Ltd.	MCB Bank Ltd.	MCB Bank Ltd.	MCB Bank Ltd.
Meezan Bank Ltd.	MEBL	Meezan Bank Ltd.	Meezan Bank Ltd.	Meezan Bank Ltd.	Meezan Bank Ltd.
Millat Tractors	MTL	Millat Tractors	Millat Tractors	Millat Tractors	Millat Tractors
National Bank of Pak Ltd	NBP	National Bank of Pak Ltd	National Bank of Pak Ltd	National Bank of Pak Ltd	National Bank of Pak Ltd
National Refinery Ltd.	NRL	National Refinery Ltd.	National Refinery Ltd.	National Refinery Ltd.	National Refinery Ltd.
Nestle Pak Ltd.	NESTLE	Nestle Pak Ltd.	Nestle Pak Ltd.	Nestle Pak Ltd.	Nestle Pak Ltd.
NIB Bank Ltd.	NIB	NIB Bank Ltd.	NIB Bank Ltd.	NIB Bank Ltd.	NIB Bank Ltd.
Nishat Mills Ltd.	NML	Nishat Mills Ltd.	Nishat Mills Ltd.	Nishat Mills Ltd.	Nishat Mills Ltd.
Oil and Gas dev Com	OGDC	OGDCL	OGDCL	OGDCL	OGDCL
Packages Ltd.	PKGS	Packages Ltd.	Packages Ltd.	Packages Ltd.	Packages Ltd.
Pak Suzuki Motor Co. Ltd.	PSMC	Pak Suzuki Motor Co. Ltd.	Pak Suzuki Motor Co. Ltd.	Pak Suzuki Motor Co. Ltd.	Pak Suzuki Motor Co. Ltd.

2008-9	2010-11	2012-13	2014-15	2016	2017
Pak Oilfields Ltd.	POL	Pak Oilfields Ltd.	Pak Oilfields Ltd.	Pak Oilfields Ltd.	Pak Oilfields Ltd.
Pak Petroleum Ltd.	PPL	Pak Petroleum Ltd.	Pak Petroleum Ltd.	Pak Petroleum Ltd.	Pak Petroleum Ltd.
Pak Services	PSEL	Pak Services	Pak Services	Pak Services	Pak Services
Pak State Oil Co Ltd.	PSO	Pak State Oil Co Ltd.	Pak State Oil Co Ltd.	Pak State Oil Co Ltd.	Pak State Oil Co Ltd.
Pak Tobacco Co	PAKT	Pak Tobacco Co	Pak Tobacco Co	Pak Tobacco Co	Pak Tobacco Co
PICIC Growth	PGF	PICIC Growth	PICIC Growth	PICIC Growth	PICIC Growth
Rafhan Maize Products	RMPL	Rafhan Maize Products	Rafhan Maize Products	Rafhan Maize Products	Rafhan Maize Products
Shell Pak Ltd.	SHEL	Shell Pak Ltd.	Shell Pak Ltd.	Shell Pak Ltd.	Shell Pak Ltd.
Soneri Bank Ltd.	SNBL	Soneri Bank Ltd.	Soneri Bank Ltd.	Soneri Bank Ltd.	Soneri Bank Ltd.
Standard Chartered	SCB	SCB	SCB	SCB	SCB
Sui Northern Gas pipeline	SNGP	SNGPL	SNGPL	SNGPL	SNGPL
Sui Southern Gas	SSGC	SSGC	SSGC	SSGC	SSGC

2008-9	2010-11	2012-13	2014-15	2016	2017
Thal Ltd.	THAL	Thal Ltd.	Thal Ltd.	Thal Ltd.	Thal Ltd.
United Bank Ltd.	UBL	United Bank Ltd.	United Bank Ltd.	United Bank Ltd.	United Bank Ltd.
Unilever Pak	ULEVER	Unilever Pak	Unilever Pak	Unilever Pak	
Siemens	SIEM	Siemens	Siemens	Siemens	
Karachi electric supply company	KESC	KESC	KESC	KESC	
Bestway Cement	BWCL	Bestway Cement	Bestway Cement	Bestway Cement	
Al Ghazi Tractors	AGTL	Al Ghazi Tractors	Al Ghazi Tractors	Al Ghazi Tractors	
Ghani Glass	GHGL	Ghani Glass	Ghani Glass	Ghani Glass	
Pakistan National Shipping Corp	PNSC	PNSC	PNSC		
Int. Industries	INIL	Int. Industries	Int. Industries		
Kohinoor Energy Ltd.	KOHE	Kohinoor Energy Ltd.	Kohinoor Energy Ltd.		Kohinoor Energy Ltd.
Unilever Pak Foods Ltd.	UPFL	Unilever Pak Foods Ltd.	Unilever Pak Foods Ltd.		
Pak Refinery	PRL	Pak Refinery	Pak		

2008-9	2010-11	2012-13	2014-15	2016	2017
			Refinery		
Azgard Nine	ANL	Azgard Nine			Azgard Nine
WorldCall Telecom	WTL	WorldCall Telecom			
Fauji Cement Co	FCCL	Fauji Cement Co		Fauji Cement Co	Fauji Cement Co
New Jubilee Insurance Co	NJI	New Jubilee Insurance Co			
Mari Gas Co	MAI	Mari Gas Co			
Dawood Hercules Chemicals	DAWH	Dawood Hercules Chemicals			
Arif Habib Securities	AHL	Arif Habib Securities			
Engro Chemical Pak	EPCL	Engro Chemical Pak			
Lakson Tobacco Co	LAKST	Lakson Tobacco Co			
The Hub Power Co Ltd	HUBC	The Hub Power Co Ltd			
Pak Reinsurance Co	PAKRI			Pak Reinsurance Co	Pak Reinsurance Co
Ibrahim Fibre Ltd.	IBFL		Ibrahim Fibre Ltd.	Ibrahim Fibre Ltd.	
Agriautos Indust	AGIL				Agriautos Indust

2008-9	2010-11	2012-13	2014-15	2016	2017
Pak Int. Airline		PIAA	Pak Int. Airline	Pak Int. Airline	
Pak Int. Container Terminal		PICT		Pak Int. Container Terminal	Pak Int. Container Terminal
	Engro	EPCL	Engro Polymer	Engro Polymer	
	Media Times Ltd	MDTL	Media Times Ltd	Media Times Ltd	
	East West Insurance Co	EWIC	East West Insurance Co	East West Insurance Co	
	I C I Pak	ICI	I C I Pak	I C I Pak	I C I Pak
	Attock Cement Pak	ACPL	Attock Cement Pak	Attock Cement Pak	Attock Cement Pak
	Habib Bank Ltd.	HBL	Habib Bank Ltd.	Habib Bank Ltd.	Habib Bank Ltd.
	Dreamworld Ltd.	DREL	Dreamworld Ltd.	Dreamworld Ltd.	
	Lafarge Pak Cement	LPCL	Lafarge Pak Cement		Lafarge Pak Cement
	TRG Pak Ltd.	TRG	TRG Pak Ltd.	TRG Pak Ltd.	TRG Pak Ltd.
		Security Paper Ltd.	SEPL	Security	

2008-9	2010-11	2012-13	2014-15	2016	2017
				Paper Ltd.	
		Pak Telephone Cables Ltd.	PTEC	Pak Telephone Cables Ltd.	
		Lotte Pak PTA Ltd.	LOTPTA	Lotte Pak PTA Ltd.	
		Byco Petroleum Ltd.	BYCO	Byco Petroleum Ltd.	
		Clariant Pak Ltd.	CPL	Clariant Pak Ltd.	Clariant Pak Ltd.
		Grays Of Cambridge (Pak) Ltd.	GRAYS	Grays Of Cambridge (Pak) Ltd.	Grays Of Cambridge (Pak) Ltd.
		Murree Brewery Co Ltd.	MUREB	Murree Brewery Co Ltd.	Murree Brewery Co Ltd.
		NetSol Technologies Ltd.	NETSO	NetSol Technologies Ltd.	NetSol Technologies Ltd.
		Pace (Pak) Ltd.	PACE	Pace (Pak) Ltd.	Pace (Pak) Ltd.
		Pak Cables Ltd.	PCAL	Pak Cables Ltd.	Pak Cables Ltd.
		Pakistan Telecommunication Company limited	PTCL	PTCL	PTCL
		Shifa Int. Hospitals Ltd.	SHFA	Shifa Int. Hospitals	Shifa Int. Hospitals

2008-9	2010-11	2012-13	2014-15	2016	2017
				Ltd.	Ltd.