Assessing for the volatility of the Saudi, Dubai and Kuwait stock markets:

TIME SERIES ANALYSIS (2005-2016)

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Dedication

I dedicate this thesis to my dad and mum

Mr. Abdulaziz Bin Ateeq & Mrs Al Jawhara Bin Dayel

My wife Afnan

My Greatest boys Muhanad & Abdulaziz

My lovely sisters Salwa & Hissa

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DECLARATION

I hereby declare that no part of this thesis has been submitted for another award at this or another university.

List of Acronyms

ADSM	Abu Dhabi Securities Market
ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
AR	Autoregressive Model
AMF	Arab Monetary Fund
ARMA	Auto regression and moving average
ARIMA	Autoregressive Integrated Moving Average
BIC	Bayesian Information Criterion
CML	Capital Market Law
CMA	Capital Market Authority
DIFX	Dubai International Financial Exchange
EMH	Efficient market hypothesis
ESCA	Emirate Securities and Commodities Authority
FTSE	Financial Times Stock Exchange
FSC	Federal Supreme Council
AMH	Adapted Market Hypothesis
GCC	Gulf Cooperation Council
GICS	Global Industry Classification Standard
PP	Phillips-Perron
MPAE	Mean Absolute Percent Error
MSE	Mean Square Error
MAE	Mean Absolute Error
MAPE	Mean Absolute Percent Error
NCCY	The Company for Cooperative Insurance
IFS	International Financial Statistics
IMF	International Monetary Fund
MSE	Mean Square Error
MAE	Mean Absolute Error
MENA	Middle East and North African
MA	Moving Average Model
NCCY	The Company for Cooperative Insurance
OLS	Ordinary Least Squares
OPEC	Organization of the Petroleum Exporting Countries
PP	Phillips Perron
RMSE	Root Mean Square Error
RWH	random walk hypothesis
SSM	Saudi Stock Market
SABIC	Saudi Basic Industries Corp
SAMA	Saudi Arabian Monetary Agency
SIC	Schwarz Information Criterion
TASI	SAUDI Composite Index
UAE	United Arab Emirates
KSM	KUWAIT Stock Exchange
ACF	Autocorrelation Function
PAC	Partial Autocorrelation function
Q	Ljung- Box
WFE	Weak form efficiency

ABSTRACT

The Kuwait, UAE and Saudi stock markets, alongside five specific firms from the latter, provided the indicator data for analysing market volatility. Autoregressive integrated moving average (ARIMA), Bayesian and Akaike analysis, Ljung-Box Q test, Partial autocorrelation function (PAC) and autocorrelation were the unit root tests applied, alongside matrix error, in this quantitative research. The study aims were to: assess weak-natured efficiency; contrast stock markets' efficiency; explore market efficiency changes as time progresses. Statistics regarding matrices errors enabled variables influencing market efficiency to be established.

Agreement on market efficiency has not been reached by researchers, with one shortcoming of EMH being lack of acknowledgement that an explored time frame may be characterised by varying efficiency levels. Consequently, the EMH and financial conduct have been subject to historiography, yet the connection between EMH and the financial behaviour model has not been the focus of studies using historical data. Accordingly, this research shortcoming tackled through this study, with the company-linked variables influencing stock market efficiency being identified through a literature review. Further, this study prospects identified, with the ongoing development of market efficiency and acceptance of inefficiency and efficiency's simultaneous presence being the outcome. Finally, liberalisation, financial crises and reform in the Middle East and North Africa (MENA) region is a focus lacking in the extant research, with this study offering a further contribution in this regard.

The study reveals that, with five companies and all countries characterised by market inefficiencies, which also changed as time progressed. Foremost efficiency characterised DSM, with SSM second, based on contrasting the obtained data's random walk. The overall index had less efficiency than the specific firms. Concerning variables, SSM mark efficiency was not enhanced via crises or liberalisation, although it was by reform. Further, the research explains the results' implications.

Key words: stock market, share prices, efficiency market, varying-efficiency, Saudi, GCC

Chapter 1.Introduction

1.1.Background of research

In 1984, the Saudi government opened the Saudi capital market, which became one of the fastest growing share markets in the world. In recent times, the Saudi stock market (SSM) has integrated into globalized financial system. The peculiarity in the Saudi Arabia situation is the oil that it has as its major financial assets. However, the volatility of financial assets is one of the most critical issues of concern in finance and economics literature. The volatility of stock markets as defined by Kim et al. (2018) Volatility in financial markets, such as the stock market, indicates to the degree to which stock prices fluctuate and measures the degree of uncertainty or risk. The notion underlying market efficiency is that competition will ensure that the price reflects fast and accurate information, is independent of previous price changes and follow a random walk (Fama, 1970). If the price fully reflects that information provided, a market is said to be efficient (Fama, 1970); As a result, the efficient market hypothesis (EMH) is not only an indicator of the securities market's health and growth, but also a key factor that affects asset pricing and security performance evaluation. The efficiency test of the SSM directly reflects stock market conditions, and influences investors' strategies and confidence levels when participating in the SSM.

However, there is no market that can be permanently efficient, so it is important to test the market across different time periods and samples. Examining efficiency at different stages of development is important, since stock markets are very sensitive and subject to variances from a number of factors. In a market that is efficient and able to adapt, opportunities for making profits arise from historical data, but investors learn from past price history that profit opportunities gradually decrease over time (Lim and Brooks, 2011) . Therefore, the efficiency test of GCC share markets directly reflects stock market conditions, influence investors strategies and confidence level in participating in GCC stock markets.

The relationship between the historical share price and the future share price has long been founded both by theoretical discussions and empirical studies. In fact, EMH is central in financial theory and is widely accepted by academic financial economists; for example, see (Fama, 1970). It is the basis of many theories in finance for example, the Capital Asset Pricing

Model (CAPM). In addition, "there is no other proposition in economics, which has more solid empirical evidence supporting it than the Efficient Market Hypothesis" (Jensen, 1978).

"The Efficient market hypothesis is in essence an extension of the zero profit competitive Equilibrium condition from the certainty world of classical price theory to the dynamic behaviour of prices in speculative markets under conditions of uncertainty"(Jensen, 1978).

Thus, the efficient market theory ensures the extent to which the price of securities incorporates all public information and private information, as result that investors cannot beat the market, because the market contains all the information. In fact, the EMH has played a major role in the past half century as fundamental assumption of various modern asset-pricing models. In recent times, due to severe financial market crashes, controversies have been rising with regards to the validity of the EMH.

However, efficient market hypothesis, has been faced with criticism specifically since 1980. The belief that stock prices could be anticipated to some extent became widespread among financial economists and statisticians. Highlighting that prediction of stock prices had underpinnings of psychology and behaviour, a new generation of economists started advocating that previous patterns of stock prices and specific "fundamental" valuation measures could be used to anticipate future stock prices (Lo and MacKinlay, 2002; Burton G. Malkiel, 2003). Table 1.1 below show the historical track of the random walk theory:

Table 1. 1: The evolution of efficient market hypothesis over time:

Year	Subject	Features	reference
1850-1900	Random studies	Physicists / stock market/ medicine/ philosophy	(Regnault, 1863)
1900-1949	Theoretical/conceptual foundations of the EMH	Mathematics /economic/ finance	(Bachelier, 1900; Pearson, 1905)
1950-1970	Solid empirical evidence and absolute sense of the random walk	Golden age/brownian motion/ random walk/ martingale	(Kendall and Hill, 1953; Fama, 1965c; Fama, 1965b; Fama, 1965a; Samuelson, 1965a; Malkiel and Fama, 1970)
1970-1989	Weak, sim strong and strong form/ event study critics	(events , IPO study 1969/ pay dividends)	(Lo and MacKinlay, 1988)
1990-2000	Critics of the EMH	Anomalies/ noise trader	(Campbell et al., 1997b)
2000-2010	The relative weak form efficiency and AMH	Time varying of the efficient market	(Lim and Brooks, 2006; Cajueiro and Tabak, 2004a; Lo, 2004a; Malkiel et al., 2005)
2010-2015	Factors influencing the efficient market hypothesis	Financial crises/ technology	(Lim, Robert, 2011; Jarrow and Larsson, 2012)

Source: compiled by the author

According to Lim and Brooks (2011), the underlying factors that affect market efficiency are some of these factors which will be considered in this research below:

I. ***"Non-overlapping Sub-samples with Fixed Parameter: Addressing the Effect of Major Events on Weak-form Market Efficiency.***

1. *The Opening of Domestic Stock Market to Foreign Investors.*
2. *The Adoption of an Electronic Trading System.*
3. *The Implementation of a Price Limits System.*
4. *The Occurrence of a Financial Crisis.*
5. *The Changes in Regulatory Framework.*
6. *Technological Advances.*

II. ***Full Sample Analysis with Time-varying Parameter: Tracking the Changing Degree of Weak-form Market Efficiency over Time.***

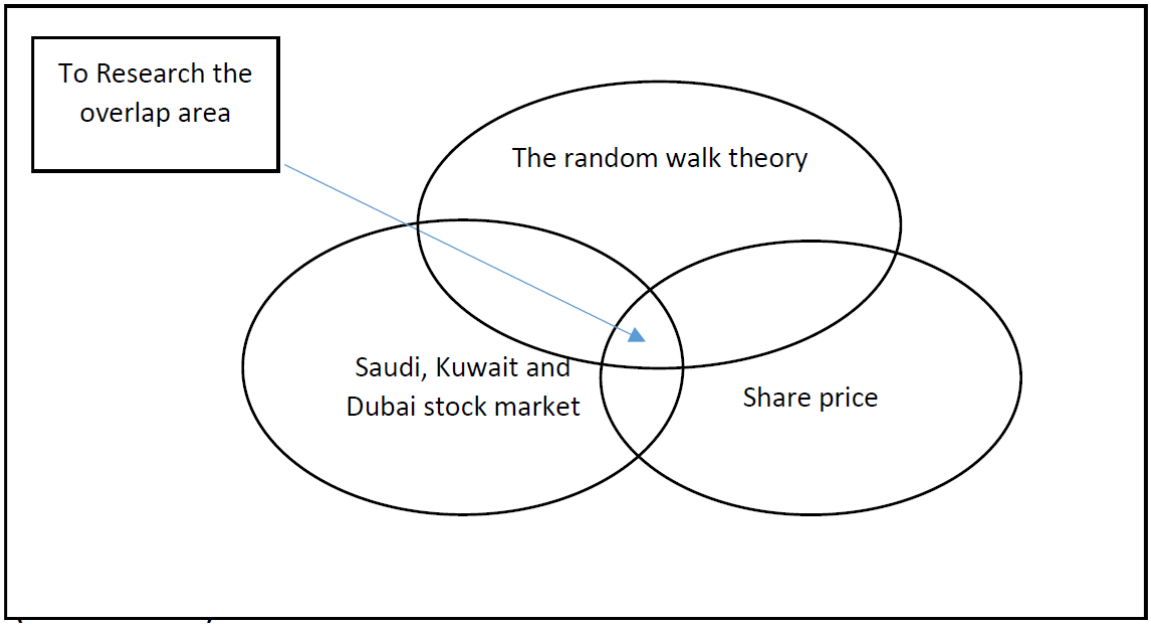
III. ***Rolling Estimation Windows with Fixed Parameter in Each Window: Measuring the Persistence of Deviations from a Random Walk over Time.***

1. *Assessing the Relative Weak-form Efficiency of Stock Markets.*
2. *Identifying the Events that Coincide with Periods of Weak-form Market Inefficiency.*
3. *Determining the Impact of Postulated Factors on the Degree of Weak-form Market Efficiency.*

4. *Exploring the Cross-country Determinants of Weak-form Market Efficiency."* (Lim and Brooks, 2011).

As result, the following research has the purpose of studying how historical share price and past information affects stock prices in SSM, and evaluates the behaviour of stock prices in the Saudi Stock Market by testing efficient market hypotheses in the Saudi Stock Market. This is represented in figure 1.1 below:

Figure 1. 1: Research framework



Source: author's construct

1.2.Justification of research

In the early 2000s, the Saudi stock market transformed from a traditional stock market to an electronic market, and became the fastest-growing stock market in Arab countries and across the Middle East. Thus, from a general economic point of view, Saudi Arabia region is considered as one of the most promising centres for economic growth. The Saudi Government, represented by the Capital Market Authority (CMA), sought to ensure its stock market was integrated and remains part of world financial system, the dependence of many world economies on oil prices has been significantly influenced by the Saudi oil sector. Especially as the price of oil has been an increasingly important force in influencing the world financial balance, see (chapter 3). Research into understanding the Saudi stock market will

not only assist with wealth management, but will also have an indirect impact on the health of the world financial markets.

However, the bulk of previous theoretical and empirical studies of EMH are based on the proposition that share prices follow a random walk behaviour, which implies that share prices cannot be predicted. This framework is known as the Random Walk Hypothesis (RWH). For example, in GCC Market, only a few empirical studies have investigated the Saudi stock market. (Butler and Malaikah, 1992; Khababa, 1998; Elango and Hussein, 2008; Onour, 2009; Al Ashikh, 2012a and Alharbi, 2009). These research findings generally conclude that the Saudi stock market is inefficient, even though the Saudi Government has invested great effort into the stock market development and increased the level of transparency and disclosure. Therefore, these previous empirical studies reveal a lack of quantitative evidence and all the studies used the short period of share price, which affected the weak form test. Moreover, no account was taken of the economic reforms introduced by the Saudi Arabian Government throughout the history of the stock market in the country. In addition, the standard methodology employed by the majority of earlier studies concerned with market efficiency involved assessment of weak-form efficiency over a particular span of time. This methodology is problematic because it adopts an all-or-nothing stance in assessing market efficiency over an entire timespan, disregarding the concept of relative efficiency that allows comparison of the efficiency of two markets. Campbell et al, (1997) explained that it is because it relies on the premise of a lack of fluctuation in market efficiency over a certain timespan, which is improbable since market efficiency oscillates according to a range of factors (Lim and Brooks, 2011). Meanwhile, one study maintained that perfect market efficiency was unattainable because in the absence of market inefficiency and opportunities to generate profit, traders would lack motivation to purchase expensive information(Grossman and Stiglitz, 1980). Lastly, the researcher has discovered a dearth of knowledge in the relative sense of the efficient market in order to find out the impact of deferent economic events. Thus, this gap in research knowledge will be filled by this research study by focusing on the time period from 2005 to 2016.

The table (table 1.2) below presents the regulations and consequent improvements in the Saudi, Dubai and Kuwait stock market. The Saudi and Kuwait and Dubai financial market website was used to collect the information.

Table 1. 2: The improvement of Saudi, Kuwait and Dubai stock markets 2005-2010

Year	Saudi stock market	Dubai Financial Market	Kuwait Stock Exchange
2000		• Open the stock market. • Regulation on Market Licensing. • Regulation on Disclosure and Transparency.	Has allowed the foreign investors to own shares in existing companies.
2001	Online Trading System launched.		
2002		Regulation on the Listing of Foreign Companies.	
2003	The issuance of the Capital Market Law.		• Online trading started in November 2003. • Futures were introduced in 2003.
2005		• Regulation on the Listing of Islamic Bonds. • Regulation on the Listing of Debt Securities.	Options have been traded on KSE since March 2005.
2007	Formation of Saudi Stock Exchange (TADAWUL)	• Regulation on Online Trading (Trading via the Internet) • Regulations on corporate governance.	
2008	• Applying sector index • Open up the market to foreign investors through swap agreements.	Launching of the SCA's portal, which includes four websites – one each for SCA, ESM, Emiratization program (SHARE) and Awareness, in addition to Report Services.	
2009	• World federation of exchange membership. • Launch of E-Trading for sukuks and bonds	The criteria of corporate governance and institutional discipline standards.	The "X-stream" trading system and the "SMARTS" surveillance system.
2010	• The launch of the new identity Availability of remote voting for shareholders. • The Launch of ETFs • Electronic voting		

Source: Author's elaboration based on Saudi stock market https://www.tadawul.com.sa/wps/portal/tadawul/home/ ; on Kuwait stock market https://www.boursakuwait.com.kw/; on Dubai stock market https://www.dfm.ae/.

In summary, this research will not test the absolute sense of the efficient market and the relative weak form efficiency only, it will go further to assess the impact of the regulations and events over the level of volatility and assessing the volatility by using the degree of the efficiency in the GCC stock market. Therefore, it will provide insight into the Saudi stock Market (SSM), Dubai stock market (DSM) and Kuwait stock market (KSM) and show development and advancement in the Saudi stock market compared pre and post of 2010 and other countries with other studies. Moreover, this study will contribute to the limited literature on developing capital markets in general, and the Saudi and Dubai and Kuwait capital market in particular adding further insight into the dynamics of this market. As a result,

this study would be important especially since the result that will be obtained from this study will help to designing future policies for enhancing and sustaining economic growth in GCC. In addition, it will be a foundation for academics and economics in Saudi as well as for the entire participant in the stock market (Researcher, Investors, company and the authority) of KSA, DSM, and KSM. The information obtained from this research would be helpful in providing guidance on the management of risk, portfolio, and treasury and asset allocation in the context of Saudi Arabia and Kuwait and Dubai.

1.3.The motivation of the study

One issue faced by the researcher in addressing this study was the lack of statistical evidence in market inefficiency and testing. It was commented by Fama (1970) that an efficient market was one in which security prices "fully reflect" all available information at a given point in time (p.388). The Efficiency Market Hypothesis (EMH) is an essential understanding of modern portfolio theories, which include mean Variance Optimisation Model (MVO); Capital Asset Pricing Model (CAPM), proposed by (Treynor, 1961; Sharpe, 1964; Mossin, 1966)Option Pricing Theory (Black and Scholes, 1973). The assumption and prerequisite of the EMH are changes in stock pricing, upon which the three models were constructed. It would be inappropriate to apply any of the models in pricing stocks or measuring stock performance should the Saudi stock market be inefficient. Moreover, Asset pricing is one of the most important part in finance and economic because it will not impact on individual investors or the evolutions of the company but also highly linked to the economic growth (Sharifzadeh, 2010).

A number of researchers, including (Malaikah, 1992; Khababa, 1998; Elango and Hussein, 2008; Onour, 2009; Al Ashikh, 2012) empirically proved the existence of market inefficiency in the Saudi share market. They used the absolute sense of market efficiency that faced a lot of criticism (see chapter two). Moreover, they commented that since stock movements are not random, and equity returns are predictable, more statistical evidence was required in order to verify the hypotheses that the Saudi stock market was inefficient. As result, this research will extend the investigation by using the relative sense of the efficiency market to discover factor that could be contributed to increase the weak form in Saudi stock. Thus, this study adds to the growing literature on the EMH and link to the levels of share return predictability to market conditions.

1.4.Research Questions and Objectives:

A considerable number of studies provided conflicting results on the Absolute sense of efficient market around the world, which led modern empirical economists to highlight the vital role of factors as "the engine of efficient market". There seem to be an enormous dearth in studies in the area of investigating the causality between factors and the engine of the efficient market in the GGC. While most study's test the weak form in the absolute sense, which faced the bulk of critical reviews. The aim of this research is to examine and assessing the volatility of the GGC Stock Market over the different (factors and event) and the efficient market in GCC by testing the relative weak form efficiency and this may help in designing future policies for accelerating Efficient market. The specific objectives of this research are to:

- Test the weak form of the efficiency in Saudi, Dubai, Kuwait stock market.
- Determine the degree of the weak form efficiency (WFE) on the stock market in SSM, DSM and KSM over the period from 01/Jan/2005 to 31/Dec/2016.
- Determine the impact of postulated factors (reforms, global financial crisis 2008, GCC Stock market crisis 2006 and financial liberalisation) on the degree of the weak form efficiency (WFE).
- Build the ranking for the efficiency between the countries, also between companies, which were chosen from the Saudi Stock Market.

The following research questions as below:

1. Do SSM, DSM and KSM follow random walk between 01/Jan/2005 and 31/Dec/2016?
2. Does the degree of variance in stock prices affect the efficiency of the Saudi stock market?
3. How does (reforms, global financial crisis 2008, GCC Stock market crisis 2006 and financial liberalization) affect the weak form market efficiency (post and pre 2010)?
4. Are there suitable comparisons between the Saudi stock market efficiency with Kuwait and Dubai stock market?

1.5.Structure of the Research

This thesis is organised into nine chapters including an introduction, literature review, overview of GCC (Cooperation Council Countries) market, methodology and methods, variables and analysis of secondary data, first empirical chapter, interpretation of ARIMA

model applied, discussion of relative efficient market, and conclusion. Here researcher presents a brief outline of each chapter.

Chapter 1 elucidates the introduction of the thesis. It comprises the general background of the study and a brief outline of the underlying theory (efficient market hypothesis) used in the research. It also presents the aims, objectives and motivations of the research, and plan of the thesis.

The remaining chapters of this study are organized as follows. Chapter 2, which is divided into five sections, presents a review of the relevant literature (the theoretical framework and empirical literature review). Firstly, it starts with introduction, presenting a brief overview of the literature. The second sections provides an overview of the EMH highlighting the definition, the main features and theoretical considerations of stock market development. The third section, comprising EMH and random walk theory, critical review of the EMH and the random walk theories. The third section, discusses the non-random walk of the share price by providing the historical, theoretical and empirical syntheses. The fourth Section includes the studies discussing the Shift in the relative efficient market and the elevation of the EMH. This is followed by underlying factors that lead a market to become efficient including Regulatory Framework, Foreign Investors in Domestic Stock Markets, Financial Crisis Events, Technological Advances and Algorithm Trading.

Chapter 3 Introduces an outline of the background as a descriptive study of the of economic development and stock market of GCC, the Saudi Arabia ,Kuwait And Unite Arab Emirate economic and markets. This chapter is divided into five main sections. Accordingly, the first portion demonstrates a brief overview of the Gulf Cooperation Council countries (GCC). The second part highlights Economic and development plans in Saudi Arabia, including the five-year national development plans, up to 2015, and the Saudi vision 2030. In addition, the historical development of the Saudi stock market from its initiation phase in 1935 up to 2016 is reviewed, including its development and further information related to their context. The third part is related to overview of UAE economies and equity markets including Dubai and Abu Dhabi stock markets. The fourth portion gives overview of the Kuwait economy and stock market. The last portion presents descriptive analysis in the form of tables and figures utilised to demonstrate the developments and trends in various variables related to Saudi stock market. It also includes the statistical analysis utilised in highlighting the stock market behaviour to study the behaviour of the market. Additionally, it is concerned with

indicators of Saudi economic growth, consisting the General index, Sector and a number of listed companies, the number of shares traded, and value of shares traded.

Chapter 4 Outlines the methodology and methods used in this research that involves the underlying philosophical assumptions, hypothesis and objective and statistical definition of the EMH followed by brief reviews of the theoretical background and the concepts of the method. Unit Root Tests, an autoregressive (AR), Integrated (I), Moving Average (MA), Autocorrelation Function (AC), Partial Autocorrelation function (PAC), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), the Auto regression and moving average ARMA model and Autoregressive Integrated Moving Average ARIMA are the main methods used in this study. Other techniques involved in analysis are Error Metrics that Mean Absolute Error (MAE), Mean Square Error (MSE), Root Mean Square Error and Mean Absolute Percent Error (MAPE).

Chapter 5 is divided into two sections; the first section highlights the variables, data being used for the study, daily movements in Saudi stock market (SSM), Kuwait stock market (KSM) and Dubai stock market (DSM) and individual companies by means of tables, graphs and figures. The second section analyses the secondary data in order to obtain an understanding of various aspects of Saudi, Kuwait and Dubai stock market development. Accordingly, it outlines the descriptive statistics and normality of the log of market returns and the distribution of the return series.

Chapter 6 Is the first empirical chapter of this thesis. A number of empirical analysis methods have been used to scrutinise the characteristics of the data. Firstly, to test the existence of unit root, Augmented Dickey fuller test (ADF) and Phillips-Perron were used. Secondly, those results are further examined by using Ljung-Box Q-Statistics Function, AC Or Sample, and Autocorrelation PAC Or Partial Autocorrelation. To figure out the optimum lags for the ARIMA, AIC Or Akaike's Information Criterion and, BIC or Bayesian Information Criterion and the best choice of parameters followed by diagnostic checking are applied. However, this empirical study closely follows the steps introduced in Chapter 4. One contribution of this chapter to the study of finance and economics is providing evidence of serial correlation from using PAC and AC and ljung-box Q statistical. Therefore, the presence of inefficiency in GCC, which is proved in previous studies, confirmed.

Chapter 7 Involves interpreting the different models of ARIMA chosen in section six to report the empirical results and Performance. In addition, graphs are illustrated in this chapter.

Moreover, the researcher analysed the underlying factors chosen form literature review in order to find whether that factors lead a market to become efficient or not. Factors are reforms and the global financial crisis, and financial liberalisation.

Chapter 8 Discusses and examines the relative efficient market, pre and post reform. In addition, underlying factors leading a market to become more efficient including pre-post financial crisis and during the financial crisis, pre-post financial liberalisation are interpreted and reported. Furthermore, to comprehend different facets of Saudi, Dubai and Kuwait stock market development, the all-market index and share price are examined in the this chapter.

Chapter 9 Concludes the study which include a summary of the main findings of the study, the contributions of the study and recommendations is provided in this chapter.

Chapter 2.Literature review

2.1.Introduction:

The present chapter focuses on the weak-form efficiency version. Primarily, the term efficiency is used to describe a market in which relevant information is impounded into the price of financial market (Dimson and Mussavian, 2000). The main contribution of this chapter is to provide historical review of the efficient market hypothesis. Researcher classifies the weak-form EMH literature based on the previous research framework adopted, namely EMH, the weak-form, The non-random walk of the efficient market, The relative random walk form, Adaptive market efficiency (AMH), The evolving of random walk and Factors and events that effect the level of the efficiency.

This chapter is divided into four sections. The second section 2.2 discusses the history of EMH proposed by fama (1970) providing the theoretical literature of the Efficient Market Hypotheses (EMH) that will include the concept and the importance of the efficient market hypothesis. The third section 2.3 includes the empirical and Theoretical literature of random walk of stock market through outlining the proponents of the EMH that tests return predictability from past price changes. However, the fourth section 2.4 discusses the non-random walk of the stock market by providing historical, theoretical, and empirical syntheses in understanding the rationality of investors, share prices, and stock market efficiency behaviour in the theoretical lenses of underpinnings of psychology and science behaviour. For example, behavioral finance paradigm and the previous study of advocates of behavioral finance.

The fifth section 2.5 will outline evolving weak-form stock market efficiency, which is consistent with the prediction of Adapted Market Hypothesis AMH and estimate time-varying market. Evaluating the time-varying return predictability in order to find out the impact of certain factors on market efficiency is investigated in the present chapter to establish the nature of the correlation between measures of return predictability and fluctuating market conditions, which including Regulatory Framework, Foreign Investors in Domestic Stock Markets, Financial Crisis Events.

2.2. Overview of the Efficient Market Hypotheses (EMH)

In the Nineteenth Century, stock prices were described as fairly priced (Regnault, 1863). According to Rayleigh (1880) there was also an awareness of the random walk idea, together with the concept of both a Brownian motion and random walk (Venn, 1866). Gibson (1889) made the point that shares became publicly known and available within an open market, and the value that they acquired was based upon a combination of the best intelligence and personal judgements (Gibson, 1889; Sewell, 2011). Despite these early attempts, efficient market hypotheses, as we have come to know it, was only suggested formally in the 1960s, with modern literature relating to market efficiency commencing with an article by Samuelson in 1995 (Lo and MacKinlay, 1999).

Market efficiency is a concept that dates back to Louis Bachelier, a French mathematician, and his Ph.D. thesis submitted to the Sorbon University in 1900 that was entitled "Theory of Speculation"(Bachelier, 1900). In his opening paragraph, Bachelier recognises that

"past, present and even discounted future events are reflected in market price, but often show no apparent relation to price changes" **(Bachelier, 1900)**.

In addition, Bachelier's dissertation introduced a range of pertinent ideas about commodity prices, commenting about the randomness of price fluctuation, leading to speculators earning large profits over the longer term, whilst describing this as a "fair game". These ideas were followed by Pearson (1905) who first introduced the term "Random Walk" when he commented about "The Problem of the Random Walk" relating to an optimal search strategy to find a drunken man walking in a field with only a range of vague directions. His conclusion was that the man would most likely finish at or close to the start position (Dimson and Mussavian, 1998).

This unusual analogy was then applied to a series of successive changes that are serially independent within economics and finance. The random walk model states that later changes in asset price changes reveal a random departure from prices quoted earlier. The random walk hypothesis is usually linked to the market efficiency concept, since asset prices follow the behaviour of the random walk. The discussion about market efficiency is based upon information that is already reflected in the stock price, suggesting that movements in price do not follow specific trends or patterns. The unpredictability of price changes suggests that investors cannot outpace the market to gain greater profit. The random walk approach stems

from the 1930s when Cowles (1933) published an article reflecting the failures in forecasting during the US stock market crash of 1929. The work of over forty agencies that claimed forecast stock prices was examined, which showed that their average performance over time was no better than a game of chance. Cowles came to the conclusion that stock market forecasters were a little better than fortune tellers. Bachelier's work was mostly forgotten until other economists, such as Samuelson, considered it further (Bernstein, 1993); later translated and published it in English in 1964 by (Cootner, 1964).

In fact, during the period 1900 to 1950, financial analysis was dominated by fundamental analysis and technical analysis, which possibly formed the basis of early conflict between different efficient market hypotheses. Fundamental Analysis and Technical Analysis against Efficient Market Hypothesis (EMH) present different challenges. The concerns of fundamental analysts are linked to the forces underlying the overall economy, particularly the financial markets. Fundamentalists will examine interest rates, economic growth, dividend pay-outs, income statements, balance sheets etc. Within technical analysis, whose practitioners are often called chartists, there is a dependency upon charts, analysis of price and volume statistics in order to interpret market behaviour, as well as attempting to predict and identify patterns of movement. Fundamentalists consider the market to be 90% logical and 10% psychological (Malkiel, 2003). Conversely, it is believed by Chartists that the market is 90% psychological and 10% logical (Burton G. Malkiel, 2003).

The efficient markets hypotheses (EMH) began to be considered seriously in the 1950s, when computers made it possible to study the behaviour of a series of lengthy price changes over time (Dimson and Mussavian, 1998). Friedman commented that EMH might be used successfully where trading strategies are correlated due to arbitrage (Friedman, 1953). Should prices be predictable and profits could be made based upon predictability, in an efficiently operating market, arbitrage would eliminate these profits. The absence of predictability of security prices in this context is implied by EMH (Groenewold et al., 2003). The random walk model became acceptable and consistent with efficient market hypothesis providing an enhanced understanding of the formation within competitive markets. (Samuelson, 1965a) Samuelson (1965) commented that

"within competitive markets there is a buyer for every seller. If one could be sure that a price will rise, it would have already risen."

Samuelson commented upon the requirement for price changes over time to be published, $X_{t-1} – X_{t,}$ demonstrating a random walk without bias (Samuelson, 1965b).

The term 'Market Efficiency' emphasises the importance of information in price setting. Fama (1970) commented that there would be no transaction charges when trading securities, information will be available, and all participants will agree with current price implications and future prices distributions of each security in order for the market to work efficiently. He also stated that these conditions only exist in the real-world markets, but that an absence of these conditions does not mean the markets are inefficient, but highlights likely inefficiency sources. Attempts to make profits through the exploitation of information that is currently available is pointless. Since the market price already reflects available information, it is important that share prices be fairly priced. Fama (1965a) refers to the random walk theory, commenting about the important challenges it will present to enthusiasts of both techniques of technical and fundamental analysis. Samuelson also comments making anticipated profits by extrapolating earlier changes in the price of futures are unlikely.

Market efficiency is defined in a variety of ways see (Rubinstein, 1975; Jensen, 1978; Beaver, 1981; Black, 1986; Malkiel, 1992; Dacorogna et al., 2001; Rubinstein, 2001; Malkiel, 2003; Timmermann and Granger, 2004; Milionis, 2007). Fama's market efficiency definition became established from his seminal paper, commenting that:

"A market in which prices always fully reflect available information is called efficient"

(Fama, 1970, p. 383).

Fama (1970) also had the clarity to understand that his definition was too general for empirical testing. In order to improve this, he examined informational market efficiency to provide a comprehensive review of the market efficiency. Theory moved on to empirical evidence that covered most of his earlier theoretical and empirical work. Thus, Fama (1970) provides a comprehensive guide to information sets that are available to market participants, as well as classifying EMH into several forms such as weak, semi-strong and strong. Weak form EMH claims that prices of stock reflect information of past prices; semi-strong claims that stock prices take into account information that is available publically; the strong form maintains that market prices reflect information available to all. Later, Fama (1991, p1577) developed his weak form definition from a rejection of the forecasting power of earlier returns to a return predictability test. The revised definition rejects the power of prediction within earlier returns, as well as the forecasting potential of variables such as interest rates

and dividends. Current research focuses upon the relative weak-form version, claiming that the forecasting power of previous stock prices relatively reflects market price information history to determine the degree of the prediction, thus validating stronger degrees of market efficiency.

Considerable empirical studies have been dedicated to testing the behaviour of share prices. The definition of market efficiency was developed by Rubinstein (1975); Latham (1985) by stating that the market would be regarded as efficient if the information caused no portfolio changes following an informational event. Jensen (1978) commented that EMH had solid empirical evidence supporting it:

"A market is efficient with respect to information set ϑ_t if it is impossible to make economic profits by trading on the basis of information set ϑ_t" ***(Jensen, p.96)***

In addition, Malkiel (1992) provides a closely related definition of market efficiency:

"A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set, Ω, if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set, Ω, implies that it is impossible to make economic profits by trading on the basis of Ω."

According to Jensen's definition and the conclusion of paper of the Timmermann and Granger. (Timmermann and Granger, 2004) Concluded that the classic EMH does not discuss how the information variables in Ω are used to produce actual forecasts. Thus, Timmermann and Granger (2004 p.25, 26) extended Jensen's definition by specifying how the information variables in θt are used to generate forecasts as follows:

"A market is efficient with respect to the information set, Ω, search technologies, St, and forecasting models, Mt, if it is impossible to make economic profits by trading on the basis of signals produced from a forecasting model in Mt defined over predictor variables in the information set Ω and selected using a search technology in St." **(Timmermann and Granger, 2004, p. 25, 26).**

As a result of these definitions, the notion underlying market efficiency is that competition will ensure that the price reflects fast and accurate information and that the prices of stock established in an efficient market can be relied upon. Intelligent participants will provide competition in an efficient market that will force securities to take into account information and events that have already occurred. If the price fully reflects that information provided, a

market is said to be efficient (Malkiel and Fama, 1970); if the information is made fully available to all participants, the market price would be unaffected (Malkiel, 1992).

The search for the perfect market should be through certain characteristics that must be met in the capital market before market may be referred to as efficient. As Atilgan et al. (2015) explained, when a completely efficient market is in place, equivalent risk-adjusted returns will be produced through assets, while estimation of stock returns will be impossible. Mak and Ip (2017) related how the genuine value of securities will be presented by the effective cost in the form of the paid cost of the securities, regardless of investors' inclinations and perspectives, under EMH. Contrastingly, as Mensi et al. (2017), Ali et al. (2018) and Peón et al. (2019) identified, new data's effect is typically overestimated or underestimated by price indicators within an inefficient market, which Tiwari et al. (2019) has noted means resource distribution is subsequently impacted upon. Accordingly, Weller (2018) related how a limited complete degree of informativeness may be indicated in a price, despite unanticipated new being completely reflected in the price. Indeed, Goldstein and Yang (2017) suggested that the kind of data managers seek to learn from will be derived from financial markets when data that is of a high standard informs prices, given the informational nature of prices.

According to EMH, news is responsible for affecting stock market prices rather than present and past prices. According to Qian and Rasheed (2007) due to the unpredictability of news, stock market prices will follow a random walk pattern providing not more than an accuracy of 50%. This view has considerable implications on portfolio management stock market analysis. Abnormal profits are non-existent in the case of an efficient market (Rejeb and Boughrara, 2013). Nguyen and Fontaine (2006) make the case that investors are easily able to determine the risk and the return of their investments in an efficient market, since no assets are overvalued and/or undervalued. Prices accurately reflect the perspectives of the listed company in an efficient market, leading to capital investment being efficiently allocated to the most profitable investments that are beneficial for the development of the market, as well as the promotion of economic growth(Rejeb and Boughrara, 2013).

Whether or not markets are rational is a question asked in recent years. The market is represented by market investors based upon three levels (Shleifer, 2000; Ackert and Deaves, 2010). Ghazani and Ebrahimi (2019) related how investors' rational perspectives and the EMH's basic assumptions are the pervasive concern of behavioural finance academics. Furthermore, the USA's anticipated returns have been found to be cross-sectionally

connected to company features in certain empirical finance investigations. Nevertheless, Fang et al. (2014) found that investigators often make errors relating to hindsight bias, data collection and sample selection bias which result in scepticism over EMH. The belief that unseen risk variables are mitigated by stronger returns is held by certain academics.

The case for the EMH is based upon assumptions. Firstly, it is assumed that investors are rational and therefore securities are rationally valued. Secondly, some investors are not rational, which means that their trading will be irrational and nullify each other without affecting prices. Thirdly, investors are similarly irrational and meet rational arbitrageurs who negate their influence upon stock prices (Shleifer, 2000). EMH does not exist due to the rationality of investors, due to the irrationality of investors, markets are regarded as efficient (Shleifer, 2000). Freedman (1953) suggests that although irrational investors lose money, they cannot lose money endlessly; eventually they become poorer and will be removed from the market. Historical evidence against market rationality was considered by Rubinstein, concluding that that markets are rational (Rubinstein, 2001). Criticisms of EMH were also examined by Malkiel (2003), concluding that there is greater efficiency and less predictability within stock markets than concluded by some researchers.

The empirical evidence amassed in relation to the efficient market hypothesis (EMH) in the past five decades has been chronologically reviewed in (Yen and Lee, 2008). During the 1960s, EMH was highly popular but began to be severely criticised in the field of behavioural science during the 1990s. As observed by one study, a major problem is that proponents of EMH and of behavioural science have failed to reach common grounds (Malkiel, 2005).

The various survey studies that have been conducted tend to focus on a particular topic, such as research on long-term return irregularities of information underreaction and overreaction (Barberis et al., 1998), research reporting predictable stock return patterns of statistical significance (Malkiel, 2003; Schwert, 2003), and research proposing substitution of market efficiency with an evolutionary alternative (Lo, 2004). The co-existence of EMH and behavioural finance is promoted by the novel concept of adaptive market hypothesis (AMH), which maintains that market efficiency changes constantly over markets and over time, rather than being governed by an all-or-none condition. One study explored the evidence regarding how profitable technical trading rules were in different speculative markets Park and Irwin (2007) by reviewing 66 stock market studies published during the period 1960-2004. From the perspective of EMH, however, this is not a cost-effective approach. According to the

theory, abnormal returns should not be yielded on a consistent basis by trading based on technical rules when the stock market has at least weak-form efficiency, as historical information is already included in stock prices. Particular fields have had summaries of their extant literature brought up to date through contemporaneous reviews. Moreover, Particular fields have had summaries of their extant literature brought up to date through contemporaneous reviews. Thus, various EMH assessments that have been undertaken have been given a broad overview by Peón et al. (2019), and emerging market studies have been focused on by (Atilgan et al., 2015). Hence, regarding the efficiency of stock markets, no definitive conclusion can be drawn from the available literature. Among others, see (Metghalchi et al., 2012; Boboc and Dinică, 2013; Nor and Wickremasinghe, 2014; Sobreiro et al., 2016; Urquhart and McGroarty, 2016; Mensi et al., 2017 and Shahzad et al., 2017).

In particular, a number of recent papers provide further justifications for this current research. First, There is a paucity research of time-varying market inefficiency (Lo, 2004a). Second, Ito and Sugiyama, (2009) use a state space model to estimate autoregressive coefficients over time reporting that the stock market in the US demonstrates efficiency levels that vary over the period 1955 to 2006. Third, a comprehensive survey is provided by Charles and Darné (2009b) on variance ratio (VR) tests, in which they comment on structural change effects upon VR tests that can be addressed through the use of rolling sub-samples. Fourth, Lim and brooks (2011) reviewed the weak-form market efficiency literature by providing a systematic review. They concluded that Weak-form efficiency within the stock market is investigated in a number of studies on the basis that market efficiency levels are unchanged during the estimation period. In addition, Weak-form market efficiency has received greater attention, with studies including the rolling estimation window, the time-varying parameter model, and non-overlapping sub-period analysis techniques. The hypothesis of adaptive markets can provide documented evidence of developing stock return predictability.

EMH has been at the base of modern asset pricing theories since its introduction. Despite this, the validity of the EMH is still being considered by some academics(Malkiel, 2003; Hersh, 2005), with the exact interpretation of market efficiency at the centre of the debate. Enthusiasts of EMH use the term to describe the lack of arbitrage trading opportunities (Fama, 1991; Malkiel, 2003), whilst the proponents of behavioural finance refer to rational pricing to define market efficiency (Shefrin, 2005, p. 111). However, Jarrow and Larsson (2012)

"revisit the meaning of market efficiency to rectify various misconceptions in the literature and to develop new theorems related to market efficiency. As such, one can then better understand the implications of an efficient market for empirical testing, profitable trading strategies, and the properties of asset price processes" (*Jarrow and Larsson 2012).*

2.3.The Random Walk and the Weak Form Efficacy (WFE)

As mentioned above, researchers used computers for the first time in the mid-20th Century to study lengthy price series behaviour, which led to empirical research on stock price modelling. However, there is the assumption by economists that economic time series could be modelled and scrutinised by extracting long-term movement and trends for movements in the short-term and random fluctuations (Kendall and Hill, 1953). Market efficiency literatures commenced with Samuelson (1965), which is often thought to be the first formal economic discussion aiming for an efficient market that provided a market efficiency definition in less restricted terms Martingale, instead of the random walk suggested by (Fama, 1965b; Samuelson, 1965a).

Prices in the stock market were analysed by Fama (1965) who concluded that they follow a 'random walk' (RWH). He considered the stock price behaviour literature and the serial dependence and distribution of stock market returns and concludes that

"It seems safe to say that this paper has presented strong and voluminous evidence in favour of the random walk hypothesis". (Fama, 1965)

Fama (1965) provided a prices definition of the random walk model and its main characteristics in finance as below:

"The future path of the price level of a security is no more predictable than the path of a series of cumulated random numbers. In statistical terms, the theory says that successive price changes are independent, identically distributed random variables. Most simply this implies that the series of price changes has no memory, that is, the past cannot be used to predict the future in any meaningful way". (Fama, 1965, p. 34).

Moreover, two hypotheses form the basis of the 'random walks' theory in stock prices, which include the independence of successive price changes in individual securities and some probability distribution is responsible for price changes. Price changes have to be independent in order for the RWH theory to be valid. RWH conforms to some probability

distribution, but specificity is unimportant as long as the distribution is theoretical and characterises price change processes (Fama, 1965a, p 41).

Fama (1970) the weak form, semi-strong and strong-form EMH, provide more detailed coverage of the weak form. Studies prior to 1970 mostly deploy tests of serial correlation and technical trading rules that strongly support the weak form of market efficiency. Twenty years later, a further review of literature relating to market efficiency was conducted by (Fama, 1991). Instead of only focusing upon on earlier returns, weak-form EMH is extended to test return predictability through the deployment of variables that include earnings–price ratio, book-to-market ratio, dividend–price ratio and interest rate measures. Black (1971) commented that the previous history of stock price movements and stock trading volume fail to provide information that allows investors to do better consistently than buy-and-hold strategy. Random Walk Theory (RWT) suggests that, especially in the short term, a stock price follows a random path that historical price information cannot determine.

The literature can be split into two groups within the weak-form category. The first strand, which is the focus in this study, tests security return predictability based upon previous changes in price. Previous studies deployed a variety of statistical tests in this category to detect random walk deviations within a financial time series; these included unit root, long memory, low-dimensional chaos, linear serial correlations, and nonlinear serial dependence. Trading strategies and profitability based on previous returns were examined in the second group. Park and Irwin (2007) reviewed profitability and technical trading rules in a variety of markets published between 1960 and 2004. More recently, as noted by Bagheri et al. (2014), in order to make accurate decision in capital market, there are two ways which are fundamental and technical. The technical trading uses its decisions based on the previous share prices, under the assumption that previous behaviours have an effect on the future share price. Technical trading rules is common to use indicators and chart pattern. For example, see (Bagheri et al., 2014; Hu et al., 2015 and Patel et al., 2015)

One measure of the independence of changes in prices and returns is statistically testing for the efficient market hypothesis. If significant independence is discovered, it could be considered as evidence of weak market efficiency. This is a traditional test form approach whereby historical asset prices are the only information required. It was first suggested by Bachelier (1900) that stock markets return follow a random walk, which can be modelled by standard probability calculus. Twenty-two stocks and commodity prices in the UK were

analysed by Kendall (1953), who observed that when a series of prices is regularly examined, random changes are large enough to overcome any systematic effect that may be present. Samuelson (1965) and Mandelbrot (1966) also supported Kendall's (1953) interpretation. Thirty stocks of the Dow Jones Industrial Average were tested by Fama (1965) using serial correlation and daily price data from 1957 to 1962, concluding that that the DJIA was efficient. Random numbers were used to generate a time series that could not be identified from a record of US stock prices was demonstrated by Roberts (1959) asked for attention to be given to previously ignored empirical results produced by financial analysts. US stock price data were analysed by Osborne (1959) who demonstrated his results to physicists at the Naval Research Laboratory in the United States. It was revealed by Osborne that the prices of common stocks contain properties that are similar to the movement of molecules. Statistical mechanics methodologies were applied to the stock market, together with an analysis of stock price fluctuations from a physicists' point of view. The New York Stock Exchange was examined by Granger and Morgenstern (1963), using spectral analysis, who concluded that no significant serial correlation could be discovered. Weak-form efficiency was also found in emerging markets, duly reported by Panas (1990) for Greece, Hong (1978) for Singapore, and for Malaysia (Barnes, 1986).

Previous studies suggest that even weak-form EMH may not hold in stock returns despite having found favour in early empirical studies, which suggests that asset prices may be predictable. A variance ratio test approach, comparing variance estimators from different frequency data samples, was proposed by Lo and MacKinlay (1988), who suggested deploying this test to weekly stock market returns in the US. These researchers rejected the period sampled between 1962 to 1985, and rejected the random walk. The variance ratio test on monthly data through mean reversion was deployed by Poterba and Summers (1988) using the US stock prices. Serial correlation in stock returns that proved to be positive over a period of less than a year was discovered by the researchers, and negative serial correlation in the longer horizon returns. Fama and French (1988) came to similar conclusions regarding patterns of autocorrelation. Recent study, the use of historical market data to estimate price changes is rejected by weak-natured efficiency; as such changes are considered arbitrary. As Patil and Rastogi (2019) explained, assessing this arbitrariness is undertaken to determine the market's weak-natured efficiency. Rizvi and Arshad (2018) related how determining whether short selling, trading magnitude, historical prices and other historical market data is in

accordance with the market data can be undertaken through weak-form efficiency assessments.

There is no consensus on the validity of the weak efficiency hypothesis in developing markets, because emerging countries are known for weak volumes of trading, disclosure of low quality of information and inadequate accounting regulations, which over time may lead to weak price dependency and reputation as weak markets (Rejeb and Boughrara, 2013). In one example, the runs test was deployed to test random walk efficiency in the Hong Kong share market, from which Wong and Kwong (1984) came to the conclusion that the market was inefficient. Urrutia (1995) deployed the variance ratio test to examine market efficiency in Chile, Argentina, Mexico and Brazil, rejecting the random walk hypothesis in these markets. However, the weak efficiency hypothesis conclude that emerging market returns are not auto-correlated in a number of studies (Han Kim and Singal, 2000; Füss, 2005), whilst others stress that weak form efficiency is invalid (Dockery and Vergari, 1997; Emerson et al., 1997; Zalewska-Mitura and Hall, 1999; Rockinger and Urga, 2001 and Lo, 2005).

Empirical findings on Market efficiency on MENA are in favour of market inefficiency, with slight cases of weak-form efficient markets. Early studies on efficiency in the Kuwaiti Stock market was conducted by Gandhi et al. (1980) he proposed that KSM is inefficient. Similar deductions were also reached by Bulter and Malikah (1992) who used serial correlation and run tests to investigate the efficiency of Saudi and Kuwaiti stock markets. They found that significant serial correlation in both markets which can be considered evidence of market not following a random walk. Ebid reported on the inefficiency of the UAE share market (Ebid, 1990). More recent studies have produced similar results and confirm that stock markets in the Gulf Region do not follow the random walk hypothesis; for example, Elango and Hussein (2008) analysed the Saudi Kuwait, UAE, Bahrain, Oman, Qatar, (GCC Countries) using runs test. The found that the GCC markets during the study period Between 2001 and 2006 do not follow a random walk. Thus, weak-form efficiency was rejected for all GCC markets. Other study Onour (2009) tested individual and on sectoral price indices, as well as on the aggregate price index of Saudi stock exchange Market. He concluded that the results of the tests rejected the hypothesis of the random walk at all levels of stock price indices. Ibrahim al-Arabiya in his PhD thesis examine the efficient market in the six states of the (GCC): Saudi Arabia, United Arab Emirates (UAE) Kuwait, Bahrain, Oman and Qatar. He found that clear evidence of nonlinearity in the GCC markets which will consider that strongly rejected GCC

stock markets do not follow the random walk (Alharbi, 2009). Al Ashikh (2012) used a set of highly regarded parametric and nonparametric linear serial dependence tests, and concluded that the efficient market is inexistent in Saudi stock market. In addition, More recent study by (Jamaani and Roca, 2015) tested the efficiency of the GCC capital markets, they found that GCC stock market do not follow a random walk. Moreover, (Syed and Bajwa, 2018) who tested the Saudi stock market found that SSM does not bear semi-strong form of EMH. In additions, Study proved that both the Dubai financial indices and the Abu Dhabi index are predictability short run and long run (Kapar et al, 2019).

However, few empirical findings are in support of market efficiency in some GCC capital markets. For example, study by Dahel and Labbas (1999) who tested efficiency in markets in Saudi Arabia, Kuwait, Bahrain, and Oman stock market, suggested that these markets follow a random walk. In addition, Abraham et al. (2002) using runs and variance test to ascertain the efficiency in three Saudi, Kuwait, and Bahrain stock markets, their result prove evidence of weak-form market efficiency in Saudi Arabia and Bahrain, but not Kuwait. Lastly, (Neaime, 2015) using panel and time series unit root tests to investigate the weak form efficiency in ten MENA countries' concluded that MENA region are not mean reverting which is consistent with EMH. In fact, the main results of the previous research are that the GCC markets considered are inefficient in the weak form.

This literature review should not be regarded as comprehensive, and especially for markets that are well established such as in the US. However, it does indicate unpredictability within the weak-form. EMH has undergone a range of thorough empirical tests across national stock markets over a number of years, with empirical evidence inconclusive across both national stock markets, as well as within a particular market. The discussion relating to the U.S. stock market is effectively summarised by Malkiel (2003b); Lo and MacKinlay (1999); Singal (2004). Fama et al. (1969) undertook an event confirming the efficiency of the stock market, and was the first to consider the problem of 'joint hypothesis'. Samuelson (1973b) revised his earlier work (1965) to include stocks that are dividend paying, whilst Ball's (1978) survey revealed excess returns consistently following public announcements of firms' earnings.

There is considerable amount of literature related to cross-sectional return predictors. Post-Earnings-Announcement-Drift (PEAD), which relates to how high earnings stocks outperform low earning stocks studied by (Ball and Brown, 1968). (Jegadeesh, (1990); Lehmann (1990) examined short-term stock reversals. The size and effect upon value were examined by (Fama

and French, 1992), with negative returns when linked to the size of the company and positively when related to the ratio of book-to-market. The momentum effect was examined by (Jegadeesh and Titman, 1993) when buying previous winners and selling earlier losers, which may lead to returns that are questionable. The aberration of accruals, whereby lower, abnormal returns are yielded by stocks with non-cash components of earnings, was investigated in (Sloan, 1996), while a different study focused on high idiosyncratic volatility stocks yielding lower returns compared with low idiosyncratic volatility stocks by (Ang et al., 2006). Research has also been conducted stocks with higher asset growth that yielded lower returns compared to lower asset growth stocks (Cooper et al, 2008), whilst Pontiff and Woodgate (2008) and Fama and French (2006) document the impact of new equity issuances and profitability.

2.4.The non-randomness and critical Review

Most studies in the early 1980s, unlike earlier analysis, were undertaken with superior econometric methodologies and provide evidence against the efficient market, with the random walk view thus emerging.

The earlier work of Grossman (1976) was developed by Grossman and Stiglitz (1980) to further analyse EMH and the view that investors must be motivated by incentives before they are willing to invest in resources for collecting and analysing information to trade. A stock market demonstrating perfect efficiency would cause trading demotivation and ultimately market collapse by eliminating incentives for acquisition of information as the current stock price would already incorporate that information. Hence, since it would deprive investors of the motivation to acquire information, perfect market efficiency is impossible. This study rejected the strong form of formulated market efficiency suggested by Fama (1970), because it failed to provide investors with some incentive for information gathering. However, regarding the eventual collapse, Ball (2009) criticised those who blamed the EMH for crashes in financial markets. A number of crashes in the market occurred before the existence of EMH, such as the 1637 Dutch Tulip crisis, Bubbles, the 1720 south sea company, as well as the 1929 market collapse. According to Ball, a theory is just an abstraction, if people do not use it wisely, the theory should not be blamed for the damage that may occur.

It is not possible for stock price variation to be explained by ulterior modifications in dividends because the latter are excessively large, since expectations models underestimate the

fluctuation of long-term interest rates (Shiller, 1981). Amendments to tax laws, price index or data issues cannot be held accountable for the failure of the efficient market model. Another study maintained that stock markets fluctuated to an extreme degree and could not be considered efficient (LeRoy and Porter, 1981). Shiller's variance-bound methodology was inspected in (Marsh and Merton, 1986), arguing that the hypothesis of stock market rationality could not be assessed through that methodology, whilst also drawing attention to the implication of EMH dismissal. On the other hand, fluctuation determinants that challenged EMH were emphasised in (Shiller, 1989), while Shiller (2000) disputed EMH, arguing that the movement of corporate dividends or earnings did not provide a historical explanation for markets.

Developing research examined EMH from different points of view. Malkiel (2003) considered the issue from the perspective of the Socioeconomic Theory of Finance (STF), followed by (Prechter and Parker, 2007), behavioural economics (Smith, 2003) and behavioural finance (Nofsinger, 2005). A number of behavioural finance advocates have begun to reject the idea of rational investors and the notion of EMH, with the random walk under attack from the school of behavioural finance. For example, Tuyon and Ahmad (2016) described how the investigated investors' conduct is considered to have the foremost impact on trading, as behavioural finance dynamics suggest.

The debate between EMH proponents and its critics continues, particularly in the field of behavioural finance. According to behavioural finance and investor sentiment theorists, the behaviour of investors is formed by either optimism or pessimism about future market values (Bollen et al., 2011). Bondt and Thaler (1985) studied monthly stock market returns, revealing that stock prices overreact; they reject the validity of the EMH and claim the discovery of weak forms of market inefficiencies, commenting that Prices fluctuate from their base values according to whether investors are optimist or pessimist. Excessive reaction to previous events is consistent with the behavioural decision theory proposed by (Kahneman and Tversky, 1979) , whereby there is over confidence of investors in forecasting future stock prices or future corporate earnings. Findings such as these support investment techniques of buying unpopular stocks, as well as avoiding stocks that have been popular over time.

Behavioural finance economists also question the validity of 'Modern Portfolio Theory" MPT (Barberis et al., 1998). These researchers demonstrated the irrationality of investors, overreaction to earning announcements, and under reaction to good or bad news (p307).

This, they claim, is contrary to the MPT assumption that investors are rational, and pursue maximum returns at given risk and minimum risk at given returns. According to this view, the sophisticated investors should be able to easily gain excess returns by judging and taking advantage of investors under and over reactions.

Haugen emphasises that overreaction that causes price movement in the short term, may lead to reversals in the long-term (Haugen, 1995). Statistical market efficiency tests are ineffective when discriminating against inefficiency (Summers, 1986). People interpret the same information in different ways, and participants in the market demonstrate biases, such as over reaction, over confidence, information bias, representative bias, and other in information processing and reasoning (Friesen and Weller, 2006). One study maintained that short-term serial correlations were not zero based and the hypothesis regarding the behaviour of stock prices as true random walks was invalidated by regular movement in the same direction (Lo and MacKinlay, 1999). Meanwhile, to identify the signal patterns of stock prices employed by technical analysts, Lo et al. (2000) employed non-parametric statistical methods like the 'head and shoulders' formation and 'double bottoms'.

Psychologists and economists in the field of behavioural finance consider that a correlation exists between short-run momentum and psychological feedback mechanisms. An increase in stock price causes people to flock to the market in what is known as the bandwagon effect (Malkiel, 2003). The rise in stock prices that occurred in the US in the 1990s was attributed by Shiller (2000) to psychological contamination that turned into unsound behavioural ebullience, which further elucidated patterns of short-term momentum and investors' proclivity for underreaction to fresh information. Furthermore, stock prices display positive serial correlation during the limited timespan over which essential news is comprehended.

Stock market returns, when analysed by researchers, often present unusual events of patterns due to influences of seasons, time of day, day of the week, week of the month and month of the year. Small capitalisation stocks are particularly evident in return premiums (Keim, 1983). The effect defined as 'Incredible January' highlights the high returns during January (Haugen and Lakonishok, 1988,). In addition, Marrett and Worthington, (2011) found higher returns in April instead of January. However, Caporale and Plastun, (2017) provide evidences about the absence of the January effect in the Ukrainian stock market. The evolution of the January effect was test by Perez (2018) who studying the performance of 106

indexes. He concluded that while this effect can still be appreciated in some markets it would appear that it is decreasing globally over time.

Other research studies identify specific days of the week, such as higher returns on Mondays (French, 1980). In a comparative study between the USA and other countries, the findings report differences that are significant (Hawawini and Keim, 1995). End of month return patterns are reported by Lakonishok and Smidt (1988), and during holiday periods reported by (Ariel, 1990). However, attempts to exploit these dependable or non-random effects would involve transactions costs that would be higher than the relative benefits that would be small, so that excessive returns that are risk adjusted for investors cannot be gained, as arbitrage opportunities are not offered with these patterns (Malkiel, 2003). Lastly, Rossi and Gunardi (2018), conclude that there is some doubt on the significance of studied Calendar Anomalies. When news is released by media sources based on market status reports, this also contributes to the dynamics of stock markets, and creates an impact (Robertson et al., 2006; Wisniewski and Lambe, 2013). Therefore, prices of stocks could be predicted, as they do not follow a random walk (Kavussanos and Dockery, 2001; Qian and Rasheed, 2007), so that basic assumptions of EMH are challenged. Other research studies have attempted to predict commercial and economic indicator changes by extracting data from social media, such as Facebook, Twitter and blogs, which are considered to be very early indicators compared with news media that is considered to be unpredictable. Several researchers have analysed the influence of social media on stock markets, and findings indicate that the sale of published books can be predicted by social media comments (Gruhl et al., 2005). In addition, the sale of DVD films can be predicted by assessing comments and attitudes collected from blogs (Mishne and De Rijke, 2006). However, “noise traders” is a concept that describes patterns of trading on social media that is not based on specific information, so that when there are many sellers and buyers in the market and transactions are cheap and simple, such as liquid markets, “noise trading” is considered to be very important (Black, 1986).

However, EMH continues to be supported in research studies due to market efficiency tests that indicate the maintenance of long-term returns despite the critically important issues raised above. (Fama, 1998b) It is important for investors to avoid return anomalies that could be predicted, such as technique changes, methodology changes, post-events and pre-events that occur over time, as well as under-reaction and over-reaction, as these are based on chance, but anomalies affecting long-term returns tend to have less influence (p.25). Some

changes in how these are measured often lead to removing these anomalies. Findings suggest that when using various statistical methods and various risk adjustment approaches, anomalies are often removed for normal return expectations, compared with specific models (Fama, 1998 p.25,26). This study also reports that distinguishing economic significance from statistical significance is important, because a random walk in stock markets is not mathematically exact, so that despite long-term return anomalies, market efficiency survives (Fame, 1998). Therefore, perceptions of stock markets are likely to be less predictable and more efficient, because opportunities due to price change patterns or short-term distortion of prices are likely to be short-lived (Malkiel, 2003). These findings show that there is still no general agreement on this issue or attempts of compromise of existing beliefs from different researchers (Malkiel et al., 2005).

Over the past fifty years, the Efficient Market Hypothesis (EMH) has been both supported and challenged by the findings of various research studies, and the concept of financial economics that should be "fair game", developed by Samuelson (1965), has remained a controversial issue, and views of researchers have changed over time. One example of changing views of academic researchers is Fama (1970), who strongly supported the concept of EMH, but later reported views of EMH that changed due to anomalies (Fama, 1991). There still appears to be no general consensus, as EMH is reported to be almost true by Malkiel (2003), but EMH is challenged by (Shiller, 2005), and it is possible that there could never be general agreement on this issue. Nowadays, the debate around the EMH has become too extensive to be summed up briefly. The EMH and behavioural finance camps continue to clash and the end of this conflict is nowhere in sight.

The empirical evidence regarding stock markets in both developing and developed countries remains indecisive. For example, in the US share market, the titles of three books provide an accurate overview of the dispute. The concept of random walk support in USA by Malkiel (2003b) 'A random walk down Wall Street', But challenge by Lo and MacKinlay (1999) who describe a non-random walk in "A non-random walk down Wall Street", and Singal (2004) who defines the concept of 'Beyond the random walk'.

Moreover, within a specific stock market, such as the USA, there appears little agreement for EMH, and of course, across the developing market stock markets there is inconclusive empirical evidence presented in previous studies about this concept. Evidence to support

EMH is difficult to analyse, because findings of various studies appear to conflict. Fakhry (2016) also suggested that complete inefficiency or efficiency does not characterise markets. Therefore, using a classical hypothesis to give validity to EMH appears to produce results that are inaccurate or half-truths, so that research studies should attempt accurate measurement of relative market inefficiency (Campbell et al., 1997). An Assessment of markets must be conducted in each development phase because perfect and constant market efficiency is unattainable. Ultimately, Tuyon and Ahmad (2016) determined that EMH's veracity is undermined by inefficiency and flaws being found in the market, whereas scant empirical evidence supports the more original AHM.

2.5.The Relative Weak Form Efficiency

In line with EMH, behavioural bias means that a completely inefficient or efficient market should not be anticipated. Likewise, efficiency within markets may be influenced by certain events and behavioural bias' presence within a market, as Khuntia and Pattanayak (2018) evidenced. According to Campbell et al. (1997), producing a relative market inefficiency measurement is of more value to researchers than attempting to validate the random walk with previous hypotheses. Previous studies have used time series data to analyse relative market efficiency across a time period, as most studies in recent years have only compared market efficiency relative performance. One empirical study has overcome the difficulty of establishing the relationship between price movements and information in stock markets by measuring market inefficiency through a gradual time varying structure (Lo, 2004b). It is also reported that it is impossible to ensure that all information available fully reflects stock prices at all times, and this is also confirmed by researchers who consistently support the concept of EMH (Malkiel and Fama, 1970). Furthermore, various markets' predictability over a longer period of study was found to alter in different investigations. Thus, return estimation and non-estimation eras for stock returns were identified in the OMXS30 stock index when investigated by Svensson and Soteriou (2017), showing estimation of stock returns to alter over time.

Therefore, to measure the speed of price subjective information that would be reflected in stock prices would require objective information, which is not currently available in financial markets. Absolute market efficiency is measured by tests of statistics that have a focus on the notion of everything or nothing, as empirical implementation of traditional efficiency studies,

which is often criticised for its weakness, because this does not reveal a negative or positive market, does not reveal the level of inefficiency or efficiency, and for the sample period, these tests only infer a market is weak-form efficient or is not. However, relative efficiency is suggested when market measurements are compared, such as between dealer and auction markets, between spot and futures markets, and between stock exchanges in different countries (Campbell et al., 1997). This study challenges previous traditional efficiency studies that adopt an everything or nothing measurement, and suggests that relative efficiency is of more importance.

Comparisons between this concept and the traditional measurement reported in market efficiency studies shows that on the basis of relative proportion of fuel or energy that creates work that is useful, physical systems provide an efficiency rating (Campbell et al., 1997a). It would be unfair to define all stock markets at various stages of development to be inefficient, and it is unrealistic to have a goal of perfect efficiency, so the benchmark of perfect efficiency is unrealistic and not practically viable (Campbell et al., 1997). To a certain extent, all markets are efficient, and some are more efficient, but financial markets are not inefficient overall or efficient overall (Cutler et al., 1990a, Shleifer, 2000).

The degree of market efficiency is affected by the types of traders and characteristics of financial instruments differ, but the performance of investors with insufficient knowledge will be weaker than those with greater knowledge. For example, Noda (2016) identifying that the degree of market rivalry, actors' flexibility, market circumstances and market actors all liable to change. Thus, as time progresses, the changeability of market efficiency will be apparent.

Overall, foreign exchange markets and government bond markets are defined as very efficient, because professional traders are involved in these operations, but markets dealing with stocks with lower capitalisation are defined as less efficient. In addition, compared with the previous trend of studies focusing on absolute market efficiency, there has been a recent increase in studies that have adopted a focus on relative market efficiency (Lim and Brooks, 2010).

Studies of relative efficiency report factors linked to panel regression or cross-sectional regression to explore greater efficiency, as well as comparing companies and countries to reveal levels of information efficiency. In addition, over the sample time period, test statistics of the relative approach often reject the random walk hypothesis. Therefore, over a sample time period, comparative analysis is more meaningful when comparisons are made of the

stock market deviation frequency from a random walk. Significant test statistics from a percentage of subsamples infers relative efficiency, so that stock price deviations are more frequent with a higher percentage, which demonstrates that information efficiency is lower.

Changes in information technology, demographic behaviour of market participants, financial crises, market regulations and macro institutions all contribute to the evolution of market efficiency at a macro level. Findings suggest that new stock markets cannot be efficient, because price discovery mechanisms are not known by traders, but also there is no clear agreement between researchers that financial markets that are well developed are also efficient. It is also argued that new stock markets become more efficient over time as they operate and develop further (Cornelius, 1994). According to Lo (2004), evolutionary principles need to be applied to an enhanced version of EMH, which over time should encompass the changing levels of market efficiency. This discussion focuses on market efficiency from an evolutionary alternative concept, where biological perspectives are adopted to provide valuable insights of stock markets (Lo, 2004; Lo, 2005).

Previous studies on EMH during a time period estimation make assumptions about fixed levels of market efficiency, but this has been challenged by Lo (2004, 2005) who suggests that stock markets do not exist in a state of equilibrium continuously, and that it is wrong to assume this. Therefore, evolutionary principles need to be applied to EMH, so that a new version would make allowances for market efficiency to continuously vary across markets and over time. Lo (2004, 2005) developed an adaptive market hypothesis (AMH) based on factors of changing demography of stock market investors and institutional changes in stock markets, which drive market dynamics. Rather than perceiving investors' rationality as unquestionable, AMH recognises that stock market investors could present many different responses, so that compared with previous hypotheses, AMH is less restrictive theoretically.

EMH's empirical discrepancies are able to be better comprehended through the application of AMH, rather than the former being transplanted by the latter. In this regard, Patil and Rastogi (2019) suggested that the AMH's explanatory power is more relevant to comprehending changes in efficiency over time. Ultimately, as Verheyden et al. (2015) and Tuyon and Ahmad (2016) established, AMH's international application included research states has been small, leaving limited empirical evidence for its theoretical relevance to market efficiency analysis. With no exception to GCC.

Findings from various research fields, such as psychology, behavioural finance and neoclassical economics could validate the AMH approach, and it also enables various modelling approaches, such as agent-based modelling or direct modelling of economic agents that offer new research tools due to the development of new technology (Soufian et al., 2014). Market inefficiency and EMH operate within AMH in a manner that is logically consistent (Urquhart and Hudson, 2013), and over time, recognises that market efficiency can evolve (Self and Mathur, 2006). These findings suggest that stock prices behave for a period of time that meet expectations of efficient market definitions, and then anomalies for this behaviour are found systematically by analysts that also meet expectations of efficient market definitions, although whether stock market prices are based on underlying market structures is still not known. Therefore, when stock market efficiency deviates this could relate to factors, such as existence of market imperfections, noise trading, psychological bias, limits to arbitrage or characteristics of the market microstructure.

However, In addition, we know that, there is no market that can be permanently efficient, therefore, assessment of markets must be conducted in each development phase because perfect and constant market efficiency is unattainable since stock markets are very sensitive and subject to variances from a number of factors. Historical data can provide opportunities for profit generation in markets demonstrating efficiency and adaptability. However, the price history teaches investors that there is a steady reduction in profit-making opportunities over time (Lim and Brooks, 2011). Moreover, According to Schwert (2003) publication of anomalies prompts practitioners to introduce tactics insinuated by the papers, resulting in the minimisation or disappearance of the anomalies. To put it differently, market efficiency is improved by research results. More particular, within the literature relating to temporary market inefficiencies, (Groenewold, 2004, Timmermann and Granger, 2004, Park and Irwin, 2007) make the point that the Efficient Market Hypothesis (EMH) provides a useful input for regulators of the market. Moreover, Al-Shboul and Alsharari (2018) found changing efficiency to be characterising ADSE and DFM in the UAE, with weak-natured efficiency being shifted towards from the largely inefficient character of each market. Moreover, Bououiyour et al. (2018), Martineau (2019) and Tiwari et al. (2019) also established that market efficacy changed as time progressed.

This produced a number of studies designed to examine further the impact of a number of factors upon efficiency within a specific market. Antoniou et al. (1997) argued that, to

accurately reflect modifications in market regulations, efficiency must be investigated in various developmental phases, since market efficiency may be affected by a regulatory framework. Daily data from the Istanbul Stock Exchange (ISE) Composite Index was employed by the authors to examine efficiency over each year during the period 1988-1993, finding that, from 1991 onwards, the efficiency of the ISE grew thanks to the amendments made to the regulatory framework towards the end of 1989. The conclusion thus derived was that market efficiency was promoted by a regulatory framework by stimulating market participation, implementing institutional trading constraints and providing investors with precise and dependable information. Moreover, The Chinese model suggests that changes in regulations governing the direct involvement of banks in the stock market would have a significant impact upon the efficiency of the market, on the basis that Chinese banks traditionally played a dominant role in their country's financial system (Groenewold et al., 2003; Groenewold, 2004), In order to address this issue, these authors examined the efficiency of the market over different time periods focused on stock market efficiency when banks are directly involved, as the country's financial system had been dominated by national banks at various periods to reveal whether this had been effective for market efficiency. This empirical study analysed market efficiency when different regulations controlled the banks' influence over different time periods. The findings reveal that from 1996 to 1999, the banks were excluded from the stock market, and market efficiency reduced, but from 2000 to 2001, the banks were readmitted to the stock market, and market efficiency improved. The implication of these papers is that market efficiency is not an all or none condition; it is a characteristic that varies continuously across markets and over time (Lim, 2009). Convergence to an equilibrium, although central to the EMH, neither guarantees nor is likely to occur at any point in time; markets must move towards perfect efficiency or some ideal state of equilibrium (Lo, 2005).

A rolling estimation window or time-varying parameter model are often used to track market efficiency evolution over a time period with empirical evidence reported in several literature studies, which include the use of the Kalman filter technique to estimate time-varying autocorrelation coefficients (Emerson et al., 1997) to reveal if stock markets that are newly established are improving their efficiency.

A time-varying parameter model or rolling estimation window serves as the basis for monitoring the development of market efficiency in numerous studies. Introduced by Emerson et al (1997) the time-varying parameter model relies on the Kalman filter method to

approximate time-varying autocorrelation coefficients. Studies adopting this model tend to focus on whether the efficiency of newly founded stock markets increases. The rolling estimation window is used by studies in conjunction with available weak-form EMH tests. For instance, the rolling Hurst exponent (Cajueiro and Tabak, 2004a), the rolling-bicorrelation test (Lim, 2007; J. H. Kim and Shamsuddin, 2008; Todea and Zoicas-Ienciu, 2008). The rolling window basically shows how consistent the movements in share price away from a random walk level during the time. Empirically, the effect of certain factors (e.g. financial crisis) on the level of market efficiency was investigated by several studies to determine the relative efficiency of the stock markets that they samples (Cajueiro and Tabak 2004a; Lim 2007; Lim et al. 2008b). In addition, the implementation of price limits system by (Lim and Brooks, 2010). All the mentioned papers indicated clear evidence of evolving weak-form market efficiency.

2.6. Factors & Events affecting the weak form efficiency

Findings form previous studies indicate that for a stock market to become efficient, underlying factors need to be better understood, research on emerging financial markets since the 1980s have often focused on the impact of financial liberalisation, although there have been separate approaches to the impact of liberalisation on financial crises and the impact of financial liberalisation on information efficiency. Moreover, Urquhart and McGroarty (2016) and Obalade and Muzindutsi's (2018) research shows that a number of developed markets' return estimation has been focused on of late in relation to the instructive nature of dominant economic and market circumstances. Alterations in regulations, instability, inflation and market circumstances all affect efficiency, with estimation ability falling as time progresses, according to (Zhou and Lee, 2013). However, to improve understanding of financial liberalisation on information efficiency, an in-depth analysis is needed of the interaction of factors of financial crises, information efficiency and financial liberalisation (Rejeb and Boughrara, 2013). Various regulatory agencies based in emerging countries report that liberalisation contributes to improving performance of financial markets, as well as reducing risks. Therefore, assessments of emerging markets to determine their information efficiency is important, and over a longer term period, it could also reduce volatility in these markets (Nguyen and Fontaine, 2006).

In summary, this section discusses issues raised from the review of literature on this subject by using sub-samples that do not overlap to focus on suggested factors that could influence stock market efficiency. Predetermined events are the basis for the evaluation of previous empirical studies, but findings are inconclusive regarding comparative studies of countries for pre- and post-changes of a random walk, so that the statistical tests adopted reject or do not reject the null hypothesis. However, this discussion highlights that characteristics of market efficiency are not static based on the framework and supported by several previous studies. The following section discusses how efficient markets could be influenced by predetermined events or factors.

2.6.1.Regulatory Framework:

Stock market regulation often uses the data provided by EMH, as this is useful in measuring market efficiency, but various research studies have attempted to improve the accuracy of these measurements by focusing on specific markets to identify various factors that could influence market efficiency and to what degree. One study reports that market regulations need to reflect any changes in efficiency at various stages of development, because market efficiency could also be influenced by the regulatory framework (Antoniou et al., 1997). This study reports on an analysis of the Istanbul Stock Exchange (ISE) from 1988 to 1993 that extracted data from its composite index, and the findings show that by 1991, the regulatory structure became efficient. This study suggests that a regulatory framework ensures investors have access to information that is reliable and of good quality, any institutional restrictions on trading are removed, and that participation in the stock market is encouraged, which produces an efficient stock market.

A study of banks in China over different time periods focused on stock market efficiency when banks are directly involved, as the country's financial system had been dominated by national banks at various periods to reveal whether this had been effective for market efficiency (Groenewold et al., 2004; Groenewold et al., 2003). This empirical study analysed market efficiency when different regulations controlled the banks' influence over different time periods. The findings reveal that from 1996 to 1999, the banks were excluded from the stock market, and market efficiency reduced, but from 2000 to 2001, the banks were readmitted to the stock market, and market efficiency improved.

Another study analysed the Shenzhen Stock Market that focused on reforms of the stock market, and reports that within one day of trading and after a regulatory change involving price changes that were then limited, this stock market became more efficient, and with a 0.5 Hurst exponent (Wang et al., 2009). However, after October 2007, market efficiency was reduced for around one year due to strong fluctuations and a falling index, which was explained by a herding behaviour of investors that created this pressure on the stock market, and market efficiency was clearly reduced (Horta et al., 2014).

2.6.2.Foreign Investors in Domestic Stock Markets

Stock markets in emerging countries gradually became more liberal in their operations from the 1980s, and played more significant roles in other stock markets across the world. These stock markets needed more foreign investors, to learn from their experiences, to improve levels of efficiency, improve information transparency, increase levels of liquidity and diversify portfolio risks. Dash and Maitra (2019) suggested that developing markets' cycles of bust and boom may be mitigated by the injection of money from developed markets, as actors in these markets engage in particular trading conduct influenced by sentiment. However, the liberalisation of stock markets in emerging markets is not reflected in general agreement by the literature on global finance, despite better integration. Analysis of these findings of empirical studies suggests that in emerging stock markets the relationship between information efficiency and financial liberalisation remains unclear, as empirical results diverge significantly. Findings also indicate that ineffective accounting regulations, weak trading volumes and poor quality of information disclosure are factors that generally characterise stock markets in emerging countries (Rejeb and Boughrara, 2013).

Market efficiency is defined as weak, when prices are shown to demonstrate a weak dependency over time periods, but some researchers claim that this liberalisation of stock markets in emerging countries has led to better efficiency due to the involvement of foreign investors by studying periods before and after liberalisation. Studies suggest that stocks become more efficiently priced when based on better availability of information, as a result of domestic and international investors being able to be involved due to liberalisation of stock markets (Groenewold and Ariff, 1998). Therefore, policy initiatives need to aim to improve market efficiency, but following the financial crisis of 1997, there has been significant

concerns raised about existing liberalisation measures, and whether these should be reversed, so that capital flows could be controlled better (Kim and Singal, 2000a, 2000b).

There is insufficient agreement from previous empirical studies of stock markets of emerging countries. One study of the stock market in Greece reports that its efficiency improved in the 1990s when the country's financial market was liberalised (Cajueiro et al., 2009). Some studies support these findings, and report that when stock markets in emerging countries are opened to foreign investors there is an improvement in market efficiency overall (Kim and Singal, 2000a; Kim and Singal, 2000b; Füss, 2005). However, the hypothesis that stock markets in emerging countries become more efficient with better information for investors following financial liberalisation is only weakly supported in other studies(Basu et al., 2000; Laopodis, 2003; Laopodis, 2004; Rejeb and Boughrara, 2013; Koulakiotis et al., 2016; Sukpitak and Hengpunya, 2016). Other studies report that sample study markets are often shown to be inefficient or weak before they are open to liberalisation (Groenewold and Ariff, 1998; Kawakatsu and Morey, 1999a, 1999b). Another study reports that after liberalisation, the Amman Stock Exchange remained inefficient, so that levels of efficiency might not be affected by market liberalisation (Omet and Maghyereh, 2002).

2.6.3.Financial Crisis Events

In times of financial crisis or market crash, this chaotic financial transactions environment often produces panic in investors, which contributes to being unable to efficiently price stocks, which is a factor that influences market efficiency. Although this is an important factor that influences market efficiency, insufficient studies have analysed market efficiency during periods of financial crisis. In one study of stock markets in developing countries in Asia, eight stock exchanges were evaluated for evidence of the influence of the 1997 financial crisis. This study covered the period prior to this financial crisis from 1990 to 1997, and following the financial crisis from 1998 to 2004 with variance ratio tests. Six of the stock exchange markets, Thailand, Singapore, Philippines, Malaysia, Indonesia and Hong Kong were defined as inefficient before the crisis and remained inefficient following the crisis, so their level of efficiency was not affected by the 1997 financial crisis. In contrast, Korea had been efficient before this crisis and remained at the same level of efficiency following this event, and Taiwan was shown to improve its level of efficiency following the financial crisis, which concluded a weak-form efficiency for these markets (Hoque et al., 2007).

In a comparative study of inefficient stock markets and efficient stock markets in Asian countries that could have been influenced by the 1997 financial crisis, two samples were studies where the first covered 1990 to 1996, and the second covered 1998 to 2005 with a novel multiple variance test, which separated the influence of the crisis. The findings suggest that this financial crisis produced insignificant changes to efficiency of stock markets in these countries overall, so that Taiwan, Korea, Japan and Hong Kong defined as efficient and Philippines, Malaysia and Indonesia defined as inefficient had no significant changes. However, following the 1997 financial crisis, Thailand and Singapore became more efficient (Kim and Shamsuddin, 2008). Other studies used different time periods to analyse the impact of the 1997 financial crisis, such as 1991 to 1996 defined as pre-crisis, 1997 to 1998 defined as crisis, 1998 to 2000 defined as linked to the US dollar, and 2001 to 2005 defined as post-crisis (Cheong et al., 2007). The order of levels of inefficiency were shown to be highest in the period of the financial crisis, and then in descending order of inefficiency was the pre-crisis period, then the post-crisis period and the lowest level of inefficiency during the period when linked to the US dollar by using rolling Hurst exponents developed by (Cajueiro and Tabak, 2004a, 2004b; Shahzad et al., 2017). More recent**,** Liao et al. (2019) found that financial crises do affect the degree of market efficiency, based on the 2018 financial crisis reactions among 16 principal European stock markets and their degree of efficiency. Thus, Nikkinen et al. (2019) suggested that the ability to establish which markets can offer diversification advantages while crises are occurring is crucial, allowing the comprehension of market connections during rough periods, as stressed by the past twenty years' series of financial crises.

Previous studies conducted on the potential of financial liberalisation triggering a financial crisis in recent years have mostly focused on 2011 the Greek debt crisis, 2007 to 2009 the sub-prime crisis, 2001 the Turkish crisis, 1997 to 1998 the Russian and East Asia crises, 1994 to 1995 the Tequila crisis and 1992 to 1993 the European Monetary System crisis (Ranciere et al., 2006; Giannetti, 2007; Cunado et al., 2006; Aka, 2006). In a study of 53 countries from 1980 to 1995, financial liberalisation and banking crises were shown to be empirically linked, and reports that liberalised countries tend to have banking crises instead of countries that are not financially liberalised, and that when the institutional environment is strong, the banking sector is weak due to the influence of financial liberalisation (Demirgüç-Kunt and Detragiache, 1998).

There is agreement from some researchers that effective external and internal controls and enhanced prudent regulations introduced after liberalisation tend to make banking crises less likely (Noy, 2004; Currie, 2006; Menkhoff and Suwanaporn, 2007). Over a period from 1977 to 1997, 56 countries were analysed in a study as a sample with a multi-variate probit model, and the authors suggest that following financial liberalisation, there is a high likelihood of a financial crisis within five years(Mehrez and Kaufmann, 2000), and that in countries where there is widespread corruption, the likelihood of a financial crisis is greater. These researchers suggest a time-frame pattern for measures of financial liberalisation (Mehrez and Kaufmann, 2000), and a later research study supports these findings based on further evidence from a sample of developing and developed countries (Schmukler and Kaminsky, 2003). This second study confirms that when stock markets adjust to newly introduced financial reforms after financial liberalisation, any initial short-term effects that are negative quickly disappear.

These findings suggest that information efficiency of stock markets is influenced by several factors, and not just liberalisation measures, and for stock markets in emerging countries, financial liberalisation does not appear to be directly responsible for levels of inefficiency. However, the processes of liberalisation could influence other factors, which play a more important role in contributing to financial crisis. Over recent years, there have been many financial crises in the economies of developing countries, and researchers in this field of study have focused on the effects of efficiency of stock markets in developing countries and the effects of financial crisis and whether these are linked, but insufficient studies have focused on the financial crisis impact on stock market information efficiency (Rejeb and Boughrara, 2013), which validates the importance of this current study.

Economic consequences of financial crises are serious, when financial institutions face increased risks when operating globally, and employment and economic growth are negatively influenced, and crises are a phenomena that occur often (Horta, 2013). Financial crisis is often directly influenced by an effect defined as financial contagion, and links across different markets in an individual country or group of countries are increased significantly (Forbes and Rigobon, 2002). One example of this financial contagion is the 1997 Asian financial crisis, as many countries were affected, so that efficiency of these stock markets requires careful examination. The World Bank and the OECD recommended that international practices and standards for non-financial and financial disclosure should be adopted by investors, regulators and policy makers in these countries, after the 1997 crisis (OECD, 2003).

2.6.4.Technological Advances and Algorithm Trading

In recent years, computerised trading systems have replaced mostly human involvement on trading floors in stock exchanges across the world, which is recognised as a significant reform of market trading, and in a study of stock exchanges in 120 countries information about electronic trading was analysed (Jain, 2005). These findings report that over the previous 25 years, 101 stock exchanges in these countries had introduced transparent and fully automated systems of electronic trading. The introduction of computerised trading systems has also initiated more research studies of whether this affects the efficiency of stock exchanges. Findings from a study of Singapore Stock Exchange show that after changing to an electronic system of trading, autocorrelations of returns reduced (Naidu and Rozeff, 1994) (Naidu and Rozeff, 1994), and another study reports that prices are more efficient when more investors use new technology for trading (Kondor, 2009; Oehmke, 2009; Chaboud et al., 2014). In addition, arbitrage is avoided, when quotes reflect new information quickly, and prices reflect information efficiency when traders who use algorithms are better informed and provide liquidity (Hoffman, 2014). Further, Weller (2017) suggested that undermining of financial markets and lower price knowledge were linked to algorithmic trading, while Boehmer et al. (2018) noted greater associated volatility.

The formation of prices in stock markets is positively affected by the advantage of speed of algorithmic traders compared to human traders, as they can respond to public information more rapidly (Biais et al., 2011; Martinez and Rosu, 2011). In addition, Dugast and Foucault (2018) proposed that market actors' developed data may be transplanted by cutting-edge information technologies' associated reduced expenditure during collation of data, as well as stronger data dissemination. So that stock prices are informationally efficient when many algorithmic traders operate. These findings are challenged by other studies that have analysed the introduction of new technology into stock exchanges, such as the Toronto Stock Exchange, as no material effect could be identified from the introduction of its computer-assisted trading system on its weak-form efficiency, with the use of rescaled range analysis (Freund et al., 1997). Another study reports that levels of market efficiency in the New York Stock Exchange showed no significant changes following the introduction of different forms of technological automation, which also applied rescaled range analysis (Freund and Pagano, 2000).

In a study conducted using the Dow Jones Industrial Average between 1896 and 1998, market efficiency evolution in the USA stock market was analysed, but recognising that during the past 50 years, information technology had been introduced and that investors had more accurate and up-to-date information to determine their investments, the market moved towards efficiency and levels of autocorrelation were reduced during this more recent period (Gu and Finnerty, 2002). This hypothesis was tested by using runs, serial correlation and VR tests for each of these years to compute first-order autocorrelation between daily returns. These findings report that from 1941 to the 1970s there were high levels of autocorrelation and the market was not weak-form efficient for most years in this period. Within this overall sample time period, the first 35 years reflect a very low level of autocorrelation with moderate fluctuation, and from 1896 to the 1970s there was greater autocorrelation, which is not consistent with the hypothesis of this study, so that for this 103 time period, the first three quarters there was no dominant effect of technological advances on levels of market efficiency.

These findings suggest that improvements in investors' experience informed by enhanced information technology since the 1970s was due to a sharp decline in autocorrelation, and that since that time many stock markets have evolved and gained efficiency. However, this hypothesis was adopted in another study that focused on the NASDAQ Composite Index between the years 1971 and 2001 to investigate how levels of autocorrelation of daily returns had evolved by using the VR test, but this study reports that from 1991 to 2001 the stock market only demonstrates weak-form efficiency (Gu, 2004).

Findings from previous studies that compared traditional human systems of trading with electronic exchanges show that information efficiency of prices produce mixed theoretical predictions. Some studies report that front running of customers' orders, insider trading and other abusive practices are reduced and information asymmetry experienced by some investors is reduced, because of better transparency, more publically available information, and lower trading costs with computerised trading that enhances liquidity(Pagano and Röell, 1996; Jain, 2005; Stoll, 2006). In addition, investors can compete with brokers that have exchange seats, barriers to market-making activity are reduced, stock prices are kept closer to equilibrium values by arbitrageurs, because of improved liquidity from higher volumes and lower trading costs. Będowska-Sójka's (2018) new research evidenced that spreads are beneficially influenced by greater liquidity, itself stemming from high-tech updates to trading

infrastructure. Moreover, algorithmic trading's extent and the presence of various trading locations' rivalry may influence liquidity (Gresse, 2017). However, algorithmic trading can have various implications, with data collation being significantly and detrimentally impacted upon, whereas price efficiency is improved through algorithmic trading (Weller, 2018). Overall, stock price changes, the standard of order implementation and the trading conduct of particular stock holders may be influenced by algorithmic processes.

In contrast, other studies suggest that repeated face-to-face interactions enhance the reputations of brokers through lowering bid-ask spread and information asymmetry being mitigated with floor trading, and that compared with floor exchanges, spreads are wider with electronic exchanges (Benveniste et al., 1992; Venkataraman, 2001; Theissen, 2002). In addition, information asymmetry increases and informed traders continue to trade in the anonymous electronic stock market after trading traditionally ends, but evidence indicates that there is a rich exchange of information between humans on trading floors (Pirrong, 1996). Other findings argue that stock prices are driven from their basic values due to excessive uninformed trading, as a result of high turnover and low costs of trading (Shleifer and Summers, 1990). In addition, with or without a trading floor operating, information processing efficiency remains the same, and this current study focuses on whether new technology and the closure of human trading floors influence information efficiency of prices from an empirical perspective.

Chapter 3.overveiw of Saudi, Dubai and Kuwait economices and financal systems and stock markets

3.1.Introduction:

The capital markets of Saudi, Dubai and Kuwait were established after a long period of established stock markets in developed countries. Therefore, the details of the economy and the markets of these countries need to be discussed. Based on these details, this chapter has been divided into five main sections. In the first section, the details of the economy of the GCC countries have been provided. This is followed by the Review of Economic and development plans of the kingdom of Saudi Arabia (KSA), including the History of Saudi stock market (TASI), in the second section. In the third section, a brief introduction of the economy of Oman and equity markets, that discusses Muscat and Shalala stock market as well, is presented. After this, the fourth section discusses the economy of Kuwait and its stock market. All these sections will consider the history of the KSA, UAE and Kuwait to analyse the economic and financial developments and patterns of these countries. Many regulations and laws have also been involved in these developments which will be discussed. The organization of this study is further presented below.

In the fifth section, by using tables and figures, the descriptive analysis presents the developments and trends of several factors that are related to the Saudi stock market. These factors are: The General index, sector and number of listed companies, the number of shares traded and value of shares traded. The stock market behaviour is studied through the statistical analysis to reveal significant changes in the stock market indicators for the time-period under study. Due to the limitations of this research, this section will discuss only the Saudi stock market. The reasons behind the choice of Saudi Arabia are its second highest GDP growth and recent legislations which are not present in the case of other countries. Furthermore, in the developing countries, Saudi Arabia is among the largest economies and the wealthiest nations.

3.2. Overview of the Gulf Cooperation Council (GCC) countries:

The gulf stock markets have special and mutual economic factors that affect their efficiency. This makes them an interesting area of research as the regional emerging markets. These common factors include economy, geography, demographics, society and religion. The GCC is a relatively new union of countries as opposed to the developed countries' associations. Focus on the corporate environment and the financial markets, is even a newer concept. Therefore, the history of the GCC market is limited. For instance, the Kuwait Stock Market (KSM), the oldest market in the GCC, was established in 1961. Oil and gas was discovered in the early 20th century which changed the scenario for all the Gulf countries. Prior to this period, the livelihood of the people depended on the pearl diving, restricted agriculture or sheep herding; the people reached out to the neighbouring countries for job opportunities. The GCC was considered poor or less-developed. In addition, the expertise and the technologies of the developed countries were also brought in by the traditional activities, which raised the competition bar for the developed countries who wanted to have a strong market share in the Gulf. This led to the Gulf quickly becoming a modern market to experience new economic developments.

The main treasure of the GCC is oil and this commodity holds significant share in the total capital stock. This makes the GCC a main energy supplier and exporter of oil. The GCC reportedly has the regional reserves which are 71% of the oil of the world (OPEC, annual statistical, 2018). The Gulf States have experienced relatively easy access to the international markets due to the investments made by the sovereign wealth funds in the international markets as well as the significant economic reforms, like financial liberalization. This can be supported by The World Investment Report (UNCTAD, 2010) which states that in 2009, the Western Asian countries experienced world inward foreign investment of more than 6% as opposed to less than 1% in 1999. According to the World Investment Report published by UNCTAD (2017), Saudi Arabia is the third largest FDI recipient in the Western Asia, the first being Turkey and the second being the United Arab Emirates. Nevertheless, these countries still cannot compete with the foreign investments and foreign pulled capital of the Latin American and East Asian regions. Furthermore, there are few types of capital inflows, like portfolio investment, which are not permitted in the Middle East and North Africa (MENA) region. The example can be the restricted ownership for a type of share in Kuwait and Saudi

Arabia up to 20%, or up to 49% in the UAE. In addition, the Total (QFI. Approved QFI clients and swap) ownership by market value is around 1% (Tadawul) in the Saudi stock market. The markets such as financial markets, especially the stock markets, are highly affected by the oil prices due to oil's importance as the main energy source for the modern countries. The oil prices often become a major determinant of changes in the overall stock market prices. There is a lot of available literature on the oil price shocks which reveals the substantial oil price impacts on the developed as well as developing economies Hamilton, (1983); El-Sharif et al. (2005; A). The oil prices are volatile and often change in a fast and unforeseeable way which is why the value of oil cannot be determined beforehand. This leads to a fluctuating and unsteady economic development at the local and regional levels (Bhattacharyya, 2011). Additionally, as the GCC is highly dependent on oil, the oil value may vary or the oil reserves may get exhausted which may pose a grave threat to the economic stability of the Gulf countries. Therefore, the policy makers of the GCC are devising remedial plans to diversify the growth factors of the economy and minimize the dependence on oil and gas. The GCC governments have proposed a feasible plan that entails the growth of the GCC stock markets along with the improvement in the GCC equity markets' efficiency to increase the market sentiment and investment(AlKhazali, 2011).If the market liquidity, efficiency and competitiveness of the regional stock markets are increased, it would support the long run growth plans of the GCC stock markets (Al-Khazali et al., 2006; Jamaani and Roca, 2015). In addition, it would lead to a decrease in the cost of capital, maximization of the market returns and improvement of the global capital flows (Boughanmi, 2008). This indicates that if the GCC markets are inefficient, the GCC markets would not be able to attract the international investments. Furthermore, the GCC governments are taking steps to increase the cross-border investments by minimizing the restrictions, enacting the regulations and bringing the administrative changes to improve the transparency of the market (Al Janabi et al., 2010).

The market capitalizations in the stock markets in all the GCC countries - Oman, Kuwait, Saudi Bahrain, the United Arab Emirates (Abu Dhabi and Dubai) and Qatar - are worth mentioning. These countries experienced an upward trend: $117.0 in 2000 increasing by ten percent to become $1,135.5 in 2005. Further, the value traded rose 60 times from $23 million in 2000 to $1.373 billion in 2005. In 2005, among the Gulf countries, Saudi Arabia had almost half of the total market capitalization and 80% of the value traded, giving it a leadership status(CMA, report 2008).

According to the latest figures, the GCC stock markets had the total market capitalization of $916 billion in 2015 which indicates an increase of around 7 times from the figure of $137 billion in 2002 (AMF, report 2016). The stock market of Saudi Arabia is considered the largest market in the GCC countries as it accounts for 46% of the total stock market capitalization. The smallest stock market is that of Bahrain. In addition, Kuwait has, the maximum number of 216 listed companies in the region. Saudi Arabia comes next with 172 listed companies and then comes Oman with 131 listed companies.

Table 3. 1: The GCC stock Markets in 2015

	Saudi	**Kuwait**	**UAE**	**Bahrain**	**Oman**	**Qatar**
Listed companies in 2015	172	216	127	46	131	42
Market capitalization (USD Millions)	420.656	87.767	195.776	19.093	40.984	151.892
Year of passing a Capital Market Law	2003	2010	2000	2002		2012
GDP (USD Millions)	**646.002**	**114.041**	**370.296**	**31.126**	**69.831**	**164.641**
GDP growth for 2014	6.8%	5.1%	3.9%	3.9%	5.0%	6.6%
Market cap/GDP	0.65	0.77	0.53	0.61	0.59	0.92

Source : from the Arab Monetary Fund (2016) and the World Bank.

The GCC countries have devised several policies to improve their stock markets. The focus of these policy reforms has been on protecting the investors, pulling investments, improving the functionality of the financial system and seeking new ways of financing and investing (Naceur et al., 2008). In addition, making the stock markets strong has been a main goal of these policies as well. In Saudi Arabia, the number of listed companies rose from 86 in 2006 to almost 170 in 2015. Along with this, in 2008, the cross-border investors were permitted to invest in the Saudi stock market. These facts indicate the effects of the policy reforms that have been implemented by Saudi Arabia.

3.3. Economic and development plans of the kingdom of Saudi Arabia

3.3.1. Overview of the Kingdom of Saudi Arabia:

The fifth largest state in Asia is Saudi Arabia according to the (Soldatkin and Astrasheuskaya 2011). It occupies the land area of 2,149,690 km2 (830,000 mi2) making it the second largest state in the Arab world. Moreover, it has the second largest coastline along the Red Sea and the Arabian Gulf. Its prime source of income in the early 20th century was the pilgrims to its holy cities. After the growth in production of oil, its first national budget was passed. Presently, the largest regional oil reserves lie in the Saudi Arabia (IBP, 2016). To develop economically and socially, Saudi Arabia has accordingly implemented different strategies and policies. This is done to reduce its dependency on oil import and export and so various measures are taken to increase the efficiency and diversity as well as reduce the production of waste. For example, since 1970, Saudi government has implemented development plans which say

"diversifying sources of national income and reducing dependence on oil through increasing the share of other productive sectors in gross domestic product"

(Ministry of Economy and Planning, 2014, p. 23).

The prime reason to implement those plans is to increase income through diversifying the economy (Al-Razeen 1997, Soufi, 1985). In this regards, they have been looking forward to practice free market tenets which will make the position of the private sectors strong among the main drivers of the economic activities. The following policies and incentives have been developed to achieve this:

- Various development funds raised to provide interest-free loans.
- The removal of the customs duty on the raw materials and machinery for manufacturing.
- The government will provide a beneficial rate on the priority, guaranteed purchase.
- To initiate industrial and agricultural project land is either given for free or for a very little amount.

Presently, the private sector will flourish more by the Saudi Arabia vision 2030 which is now functional. Moreover, to bring about economic diversification, develop health, education, construction of infrastructure, recreation and tourism, reduce oil dependency and to attain

an economy that is integrated and stable the Saudi Vision 2030 was launched on 25th April 2016.

There are three fundamentals of this strategic vision: an ambitious nation, a vibrant society and a thriving economy. The strategic plan consists of many different aims and objectives that will be attained towards the end of 2030 like the transforming program. To develop the institutional capacity and capabilities required to achieve Saudi Arabia's Vision 2030, Vision 2030 was developed in collaboration with the National Transformation Program 2020.

The national stock market is under consideration as to promote privatization programme and to supply finance for the development of the economy, the stock market plays a significant role. For example, these plans include market-opening reforms. Financial Times Stock Exchange (FTSE) has collaborated with Saudi market authorities to minimize the barriers to foreign investment to facilitate foreign investors with easy access to their capital markets and also to enhance corporate governance and transparency. To make it successful, Saudi Arabia met the nine-point FTSE rule-based criteria and developed an independent external advisory process as a Secondary Emerging market which is to be made a part of an international equity-market benchmark. Hence, to review the developments of the Saudi stock market, the following section was denoted with the role to contextualize the basic research.

3.3.2.Saudi Stock Exchange (Tadawul):

In the Kingdom of Saudi Arabia, the registered securities are bought or sold by the authorized brokers in the Saudi Stock Exchange named Tadawul and this has been in place since 1945. The companies that first went public were Arab Automobile Company in 1932 and Arab Cement Company in 1954, among which the first one is now closed. Towards the end of 1975, 14 joint-stock companies were developed. In the early 1980s, this number increased to 42 in the SSM. However, no precise regulations were there in the Saudi stock market as it was informal (Al-Suhaibani and Kryzanowski, 2000).

The Royal Decree made a Ministerial Committee so as to come up with the key capital market rules and regulations. The following are the three major parts of the committee:

- Minister of Finance and Economy (presently called the Ministry of Finance, "MF").
- Minister of Commerce (presently called the Ministry of Commerce and Industry, "MCI").

- Governor of the Saudi Arabian Monetary Agency SAMA.

The MF was responsible for developing the general policies and setting the goals of the stock market. Moreover, the MCI was responsible to set the rules associated with governing the capitalization, incorporation, conversion of companies and internal management. For instance, transforming closed form to public form.

The capital market in Saudi Arabia is regularly controlled by the SAMA, a legislative authority to impose the operational and general rules. Its responsibilities include regulating Shares Control Administration, building and operating the ESIS (Electronic Securities Information System) which came into being in 1989 which gave a new platform to operate sales and purchases through it. However, the fifth plan was developed between 1990 and 1995 to industrialize Saudi Arabia through the domestic savings. To do so, investors in the stock market were facilitated by the government through incentives.

Owing to offerings in 1996, the highest capitalization was under the Saudi stock market amidst the GCC the public markets. In 1997, secondary market obligations were imposed by the Ministerial Committee by issuing disclosure rules to enhance the objectives further. For example, unfair influence of some parties on share prices was posed due to their access to information regarding specific events.

Thus, important events (reality of their companies' situation) were exposed by the companies that could affect the share prices. Although, the performance of the Saudi's stock market was not appealing, its capitalization position was quite well compared to the GCC countries. To enhance and expand Saudi stock market, Tadawul or upgraded version of the ESIS operated in 2001. The responsibility of this new system was trading, matching orders by price, clearing securities and also prioritizing orders depending upon their prices. Moreover, through different channels like website, diverse information was provided.

To ensure fair-trading and organized market, monitoring, supervision and surveillance were among the duties of this system. Other duties include improving transparency, generating a proper investment environment, disclosure of standards, preventing and protecting dealers and investors from illegal activities. In 2003, under the Capital Market Law (CML), the CMA or Capital Market Authority was established. Thus, a safer market with lower risks was ensured through the principal framework of the listed regulations. Moreover, it provided access to all information as a significant part of protecting investors associated with increasing the efficiency of the trading processes.

The CMA prepared and issued the important regulations continuously, for instance, giving better protection to the rights of the stakeholders and the shareholders, in 2006 issuing the CGR or Corporate Governance Regulations and setting the rules and standards for management of the mentioned companies to ensure that they are complying with the practices. To efficiently implement the governance practices, various regulations were passed by the CMA in 2006. (Tadawul Annual Report, 2008). A resolution was issued by the CMA in 2008 permitting authorized persons to draw Swap Agreements with non-resident foreign investors, either individuals or financial institutions (Tadawul Annual Report, 2008). There are two main goals of the CMA behind this, first one is to dig deeper into the capital market as well as promote its efficiency. The second one is to motivate foreign investors to invest in the Saudi capital market which will then reinforce reduced barriers in the market for foreign direct investments. Consequently, the swap agreements rose by 26% in 2009 and the volume totaled SR 24.8 billion in 2010. In 2010, the percentage of investments made by financial institutions dropped slightly to 99.89% of total swap agreements, as compared to 99.97% in 2009 (CMA, Report, 2010).

To support the quality of the IT services, the IT Governance section was developed to overview the services made available and to submit periodic reports on the IT Division's performance. Moreover, 2013 came with four accomplishments; first, modification of the Exchange's trading platform i.e. upgrade of the current trading system (SAXESS) to (X-Stream INET) at the start of 2014, Agreement with NASDAQ OMX was made. Quick performance of deals and high capacity along with a wide range of products are the features of this new system which is in compliance with the development plans of Saudi Stock Exchange. Secondly; preparation and disclosure of financial results and news from the mentioned companies on the Tadawul website, Tadawul launched an interactive multi-usage system (IFSAH). The mentioned companies collaborated with it to develop this system to optimize market effectiveness and efficiency. Thirdly; for iPad and iPhone, a new version of its own iOS was launched by the Tadawul. Through this, the users can display information and indices from the Stock Market, along with the market news and company's announcements (Tadawul, Reprot, 2013).

The incorporated Securities Depository Centre Company ('Depository Centre') as a closed joint stock company was under complete ownership of Tadawul as announced by the Saudi Stock Market (Tadawul) in 2015. Ownership registration, deposit, transfer, settlement, and

clearance; registering investment portfolios in the deposit and settlement system; and registry of ownership limitations for deposited securities are the key roles of the Depository Centre. Additionally, market had no barriers for the international investors; it required only financial institutions with minimum assets of $5 billion and more than 5 years' experience of investment to be eligible for registration with the Saudi Capital Market Authority being an international investor.

Nevertheless, Saudi Arabia's addition in the FTSE benchmark marks the biggest of such an event in the developing equity markets in 2001 (FTSE Russel, research, 2018). It let the country enjoy the prominent emerging market status and is also a major development for both the investors; active and passive. Among the Middle East and the Africa index, Saudi Arabia has 17% of the FTSE which stands second to South Africa only in market size, considering the constituents of the index. After realizing the importance of capital markets for economic development, empowering of the stock market in the GCC countries became the focus of the reform agenda. For example, from 2004 to 2012 the number of the mentioned companies rose from 73 to 158 companies in 2012, showcasing an increase of 107%. Further, in 2015 the companies numbered to 170. To further facilitate the foreign investors, a new system was made for the stock market in 2008.

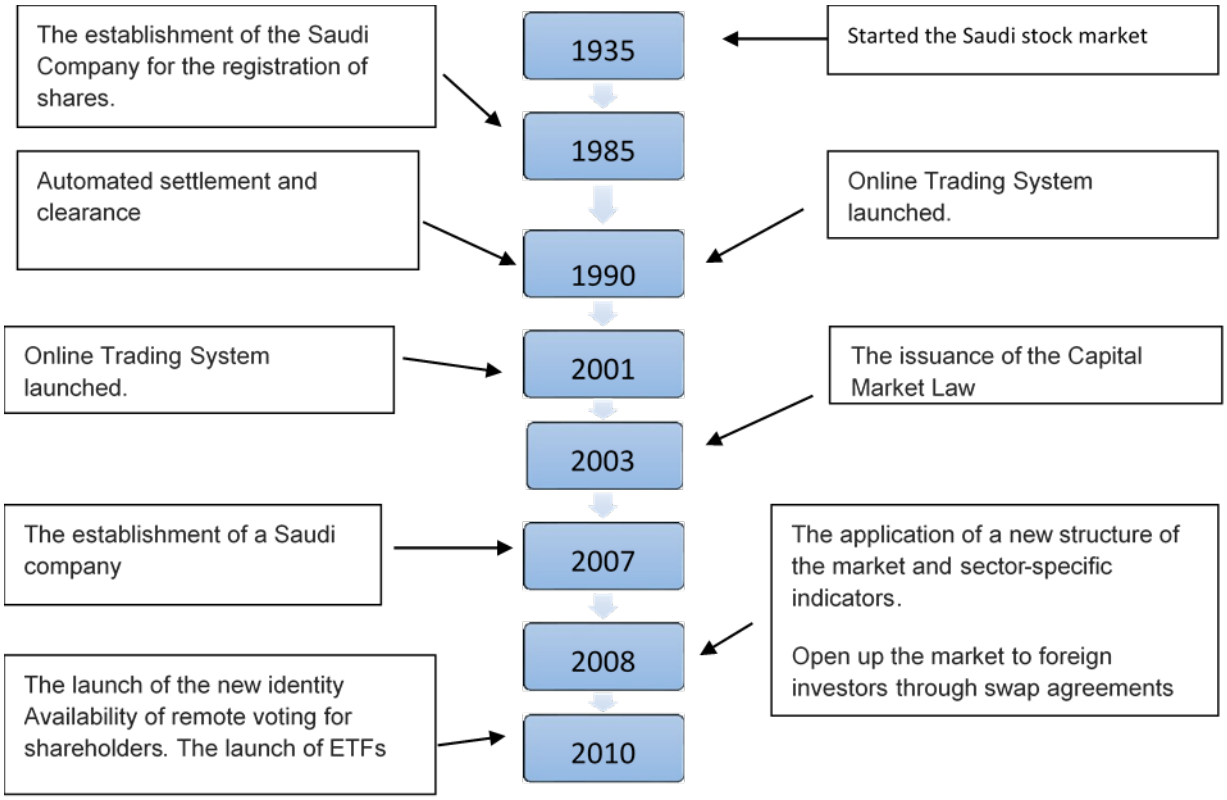
The review of the history and formation of Saudi stock market, the Saudi stock market (Tadawul All Share Index (TASI)) has apparently improved since its formation in the aspects of trade volume, regulations, the number of companies, structures and participants. Thus, the British Standards Institute which is an independent non-profit international organization among the parties responsible to authorize the ISO certification globally; cleared Tadawul in its auditing process. Furthermore, the annual awards held by the London-based Capital Finance International magazine ranked The Saudi Stock Exchange as the 'Best Stock Exchange MENA 2013'.

In the Middle East and the North Africa (MENA), TASI stands to be the largest market. In regards to the market value or name it other way, "Market Capitalization or Market Cap" has approximately US$452 billion in value according to The Wall Street Journal (2015); The Financial Times (2014), explains that it stands amongst the most active Arab market in terms of the daily traded volumes and rates. Moreover, in the Middle East and North Africa (MENA) region, the SSM is recognized as the biggest and most liquid stock exchange. Its position is very advanced amongst the emerging markets. It acquired 38% of the region's total equity

trading value (in US dollar terms) and 14% of shares traded in 2016 as per the presently available trading data compiled by the World Federation of Exchanges (FTSE Russel, research, 2018). Thus, it is ranked second in trading activity to Bursa Istanbul. In the previous years, the average trading volume for the FTSE Saudi Arabia All Cap Index totalled to the US$600 million. Nevertheless, the FTSE Emerging Index of the country figures to 2.7% according to the FTSE Saudi Arabia Inclusion Index Series, makes it stand amongst the 10 biggest growing stock markets. This weight could almost become twice the figure i.e. 4.6%* through the planned initial public offering of national oil giant Saudi Aramco and will raise the EM index's Middle East exposure, greatly (FTSE Russell. Data as of February 28, 2018). Robust economic fundamentals, a growing regulatory environment for the capital market, a well-developed financial system, a strong banking system acquiring the latest technology and the depth and breadth of the market are the foundations for the strength of the SSM (The Capital Market Authority- semi-annual statistical bulletin, 2014).

The goal of the Tadawul is to attain its strategic objectives associated with building infrastructures of the following procedures through these changes to carry out transactions corresponding to the international standards. Improvement in the efficiency of deposit and registration services that are offered by the Depositary Centre corresponding to the Vision 2030 are also under consideration. This could be accomplished via developing a more resourceful environment that assures excellence within all sectors linked to the capital market (Tadawul, Report, 2016). The enhancement of Saudi stock market is shown in the figure 3.1.

Figure 3. 1 The improvement of Saudi stock market.



Source: Saudi Stock Market (Tadawul, report 2012).

3.4. Economy and stock market of The United Arab Emirates (UAE)

3.4.1. Overview of the United Arab Emirates (UAE):

The United Arab Emirates is a Middle Eastern federation comprising seven Emirates and is located in the South-East of the Arabian Peninsula. More specifically, the Emirates amalgamated in December 1971 and are now governed by the Federal Supreme Council (FSC) of rulers (glufbase). Abu Dhabi and Dubai are the most prosperous and substantial emirates and dwarf the remaining members, who are Ajman, Fujairah, Ras Al-Khaimah, Sharjah, and Umm Al-Quwain. Characterised by openness and wealth, the UAE has an impressive per capita income and a substantial trade surplus. The emirate of Abu Dhabi is the main oil exporter and its city, also called Abu Dhabi, is the federal capital and thus the hub of government-related concerns. Acting as the entry point for trade in the Gulf and the Middle East, the influential emirate of Dubai takes the commercial lead. Only Abu Dhabi and Dubai produce oil, yet overall oil and gas comprise almost a quarter of Gross Domestic Product for the entire UAE. Furthermore, since this source also accounts for 45% of export earnings and 40% of government revenue it is hardly surprising that the UAE stock market is highly responsive to oil price variations (gulfbase).

The discovery of oil brought with it substantial overseas investment, dramatic changes for UAE residents, and key transferals of expertise and technology as developed nations vied to establish a foothold in the oil-rich federation. Consequently, today's economic conditions in the UAE can be considered to be based upon the economic progress that occurred in the period immediately following confederation. As mentioned above, the outward-facing and economically buoyant character of the UAE has witnessed enormous growth in the last twenty years, wherein GDP has risen from AED 254.2 billion, equivalent to US $ 69.2 billion, in 2001 to AED 1,391 billion, or US $ 371 billion, in 2016 (Central bank of UAE, The Annual Report, 2017), As Table 3.2 demonstrates, the discovery of oil was closely followed by an increase in real GDP from AED 1,132 billion, or US $ 301.86 billion, in 2011 to 1,391 Billion, or US $ 371 billion, five years later. This was despite a fall in international oil prices during the period from 2014 to 2016. The wealth of the UAE may well have been founded upon oil and gas, but today non-oil revenues account for a larger proportion of GDP (see table 3.2). Thus,

whilst it once depended solely on these original sources, it has now undergone a process of diversification into sectors such as tourism, banking and finance, and manufacturing.

Table 3. 2: GDP oil/GDP Non-oil

	2011	2012	2013	2014	2015	2016
Real GPD In billion	1,132	1,190	1,259	1,300	1,350	1,391
GPD NON OIL -REAL	765	808	865	905	933	959
GPD OIL- REAL	367	382	394	395	417	433

Source: Central Bank of U.A.E, the Annual Report, (2017).

This diversification explains the hardiness of the UAE economy in the face of unfavourable global variations in oil prices. It is the fortuitous investment of oil revenues in infrastructure which encouraged the flourishing of other sectors of the economy, and thus why the economic success of the UAE can be attributed principally to oil. Furthermore, the UAE operates under a unified financial structure whereby all government agencies and private businesses conform to a single federal model. Whilst this ensures consistency from local state level to federal level, it nevertheless means businesses are still at liberty to manage themselves in a commercially gainful manner(Al-Zarouni, 2009).

3.4.2. Overview UAE stock market

Despite being the newest of the Gulf Cooperation Council (GCC) stock markets, the UAE stock market is one of the fastest growing reputation wise and in terms of factors such as market size, trade volume and participation. Thus, the UAE stock market is regionally second in size only to the Saudi Arabia stock market. Yet, UAE stock market prices have experienced considerable instability due to the combination of excessive speculative activity and enormous inputs of capital. The transferal of price and instability across the UAE's two major local markets is a fascinating outcome of the distinctive characteristics of the UAE stock market. This is exemplified by the unparalleled growth of the stock market over the past twenty years and the exponential increase in listed companies. For example, when the UAE stock market was launched in 2000, there were only fifty-two listed companies, accounting for a total market capitalisation of $22 billion. However, by the end of 2007 this had risen to one hundred and forty listed companies and market capitalization of $250.9 billion. Nevertheless, in line with the global financial crisis and the implosion of stock prices, market captilisation fell dramatically to $131.9 billion in late 2009.

Stock trading within the UEA in fact dates back to the early 1970s when an unofficial stock exchange emerged in which stocks were exchanges through non-specialist, unlicensed traders. Founded in 1959, the Dubai Beverages Company was the first public joint stock company, with a capitalization of a mere AED 2 million dirhams, or $533,333 US. It was followed five years later by the Dubai National Bank in 1962, then by the Oman Limited Bank in 1967, the Abu Dhabi National Bank in 1968 and ultimately by the National Cement Company also in 1968(Al Mohana and Maatouq, 2015). In recent years the UAE stock market has actually comprised three separate stock markets. Abu Dhabi hosts the ADSM and Dubai is home to the two remaining stock markets. Specifically, the latter two are the DSM, formerly known as the Dubai Financial Market (DFM), and NASDAQ Dubai, previously operating as the Dubai International Financial Exchange (DIFX). In 2000, under Federal Law No. 4/2000, January 2000, the UAE federal government launched the ESCA (Emirates Securities and Commodities Authority), an umbrella organization designed to supervise all securities markets activities and apply uniform structure and policies therein. The ESCA controls the Abu Dhabi Securities Exchange and the Dubai Financial Market with the objective of eliminating the potential for dispute through both the separation of supervisory responsibility and the organisation of commodities and securities trading along the lines of regulatory structure and policy equivalence.

Supervision of markets, brokers, investors, parties with securities and other parties involved in market activities lie in the hands of the Securities and Commodities Authority who thereby act as the overall regulatory body. This organization furthermore scrutinses and standardises all commodities and securities markets within the UAE to guarantee the observance of globally acknowledged securities markets requirements. Within the UAE the ESCA is supervised by the Ministry of the Economy. The DSM and the ADSM were actively launched in 2000 under ESCA regulation and constitute two functionally identical but geographical distinct markets with different stock listings. Both the DSM and ADSM have independent legal personalities and are public institutions. In January 2003 the ban on non-nationals purchasing stocks in UAE markets was lifted, permitting foreigners to invest in most listed stocks. The following year legislation was passed compelling all UAE shareholding companies to list their shares in either the ADS or the DSM. That same year the federal government moved to create the Dubai International Financial Centre (DIFC) as a financial centre permitting open access to financial transactions for all UAE residents, including non-nationals. Unrestricted access to

facilities without hindrance from any ESCA regulations were part of a larger UAE strategy aimed at promoting financial services within the UAE and augmenting the influx of overseas investment. The benefits to foreigner investors included the use of platforms for investments yielding returns based on the performance of local UAE businesses. Since the DSM and ADSM meet all these requirements (RAO, 2008), the years following 2004 have witnessed major increases in capital and listings along with a wider growth in the securities market. Permitting the open use of its facilities, free from ESCA control, had huge implications for the promotion of financial services within the UAE and promoted the influx of overseas capital, as was the original intention behind the establishment of financial markets. The benefits for foreign investors included the presence of investment platforms and the possibility of returns based upon the performance of local UAE businesses. Since both the DSM and the ADSM fulfil these requirements (RAO, 2008), the years since 2004 have witnessed considerable augmentation in capital volume, listings numbers and progress in the securities market.

In the wake of resolutions agreed upon at the general meetings of several public shareholding companies in 2005, there have been status amendments permitting non-residents to own share capital. The main objective here was to augment shareholder base and increase liquidity through elevated demand, trading and supply based on share numbers. This has resulted in rate of foreign ownership in companies ranging from 20% to as much as 50%.

Market development has benefited considerably from federal assistance in the shape of tax exemptions the profits, capital gains and dividends of listed companies. Moreover, there have been other avenues of support, not least the absence of restrictions on foreign exchange or the repatriation of capital, and the provision of operational and business continuity facilities which serve to add extra enticements and guarantees for overseas investors.

Previously operating as the Dubai Financial Market (DFM) the Dubai Stock Market (DSM) is a public institution based in Dubai City, the largest city and consequently the financial heart of the country. The DSM was launched in March 2000 as a securities trading market but has since expanded to become a stock exchange. It is an autonomous corporate entity and functions as a secondary market trading in both public shareholding company-issued securities and bonds issued by local and federal government, by public institutions, and by foreign and domestic financial institutions. The addition of sixteen new companies to the DFM in 2006 saw the total number of companies listed on the market rise to forty-six. According to the Annual Report, Central Bank of UAE (2006, p. 43) this represented an increase of 53.3%

compared to the previous year. The majority of these new companies were domestic concerns, although a handful originated from other Gulf States and thus had dual names. By the end of 2006 the market capitalization of listed companies totaled AED 311.32 billion, a fall of 24.1% in comparison to the previous year which closed with listed companies accounting for some AED 413.0 billion. Similarly, the market's general index for 2006 only reached 4127, against 7426 at the end of 2005 (The Annual Report, Central Bank of UAE, 2006 page 43). The sixty companies listed on the DSM in 2016 represented 48% of the total listed companies on the UAE stock market. In terms of trading practices, the DSM has a Pre-Open Session between 9.30am and 10.00am, during which the opening prices for all shares are set but no actual trading occurs. Subsequently, the Continuous Trading Session takes place between 10.00am and 2.00pm, at the end of which the closing price for each security is decided upon.

Previously known as the Dubai International Financial Exchange (DIFX), NASDAQ Dubai was launched on 26 September 2005 as an international stock exchange with global accessibility. Issuers are based in numerous countries, including the United Kingdom, Australia, Bahrain, India, Kuwait, Saudi Arabia and South Africa (www.nasdaqdubai.com). NASDAQ Dubai is regulated by the Dubai Financial Services Authority. The consolidation of the DFM with NASDAQ Dubai in 2010 both created a powerful regional force in capital markets and brought considerable benefits to investors. The latter are now afforded an enhanced selection of assets and improved access to NASDAQ Dubai listed securities through the use of a single investor number (NIN). Thus, uninterrupted trading across two exchanges becomes possible, whilst both exchanges remain under separate regulatory control. Specifically, the DFM is monitored by SCA and NASDAQ Dubai by the Dubai Financial Services Authority (DFSA).

In conclusion, the proclivity of the United Arab Emirates to support free economic activity had directly created high levels of overseas investment on a global scale. The key financial areas of Abu Dhabi and Dubai possess independent financial markets which govern fiscal activities within their own dominions. There exist three stock exchanges within the UAE. The capital city of Abu Dhabi is home to one, whilst the financial centre of Dubai hosts the remaining two. Bearing in mind the restricted size and population of the UAE, the existence within it of three stock exchanges could arguably constrict liquidity, order flows from global investors, and new listing requests from domestic businesses. The situation is exacerbated by the presence of duplicate regulatory authorities. Namely, the ADSM and the DSM are governed by the Emirate

Securities and Commodities Authority (ESCA) and NASDAQ-Dubai is regulated by the Dubai Financial Services Authority.

Both Abu Dhabi and Dubai share identical aspirations. To that end, each wishes to become the financial heart of the Arab Gulf. Yet each state is pursuing a different strategy as a means to achieving this aim. Despite considerable endeavours by stock markets in both these states, market capitalization and trading value remain depressed. Hence, the proposition that the DSM and the ADSM merge to benefit from M & A synergies, a suggestion which requires a significant feasibility assessment. The merger of any financial markets requires the elimination of barriers to fiscal inflow in order to create free capital flow, whilst acknowledging that the risks and return must be shared by all parties to the merger.

3.5.Overview of Kuwait

3.5.1.Introduction

The historical background, organization, development phase and significant events of the KSM will be presented in this section as well as the following section. The oil in Kuwait was discovered after the Second World War and till that time, exchanges of any sort that involved securities did not take place. This oil discovery and the independence in 1961 were the two factors that led to the growth of economic development in Kuwait. In 1946, the export of the crude oil occurred for the first time. From then on, oil holds the greatest share in the exports of Kuwait and this has put an end to the traditional activities. In the traditional period, the exchange of land and real estate used to generate maximum income for the economy.

According to (Al-Yaqout, 2006), the oil discovery, revenue generation through oil and the increased awareness of the government about the associated advantages of the corporate structure are the variables that influenced the growth of the corporation concept in Kuwait. Similarly, the independence in 1961 also led to a better economic health of the country. When Kuwait became independent, a compensation scheme for the real estate property of the citizens was introduced to make Kuwait a modern country. The citizens were to make use of the scheme money for the setting up of new commercial firms. In addition, the oil export generated income were to be invested in further development of these growing firms (Al-Zumai, 2007).

In this section and in some parts of the following sections, the history, organization and development phase of the Kuwait stock market have been presented. Nevertheless, the previous research has well investigated the parallel growth of the financial markets and the associated regulation, in Kuwait (Al-Bannay, 2002; Alanezi, 2006; Alfaraih, 2009; Al-Saidi, 2010; Al Shuraian, 2014; Alshammari, 2014).

3.5.2.Kuwait stock market overview

There are five markets in the Kuwait Stock Market (KSM) or the official Kuwait Stock Exchange (KSE). These are: the official market, the parallel market, the fractional market, the options market and the futures market. In the 1950s, the stock trading started in Kuwait but, it was only in 1977 that an official stock market was formed, a market that is still evolving (Al-Yaqout, 2006). The period of 1950s is called a 'transition' period due to the associated social and political modifications occurring for the government to face in a rising economic situation. In 1952, the National Bank of Kuwait (NBK) was created to become the first private Corporation or joint stock company in Kuwait (Al-Sultan, 1989, Bley and Chen, 2006). This was followed by the National Cinema Company in 1954 and the Kuwait Oil Tankers Company in 1957 (Yacoub Sarkhouh, 1993-1994). After these companies were formed, Kuwait introduced its company law, Law No. 15 of 1960. The government then focused its attention on the creation of the stock exchange after around 10 years of the company law. In the Gulf countries, the Kuwait stock market is the oldest stock market. In 1961, the Regulation of Financial Transactions Law laid the foundation for the functioning of the market. In 1983 and 1984, significant changes were brought in the law along with the minor changes in different years. Furthermore, the Commercial Companies Law No. 15 (1960) regulated the companies' issuance of shares and the share subscribers (Amid Salam,2002). In addition, the law provided the details for trading operations, requirements for financial reporting and requirements of at least two external auditors for the listed companies (in effect from 1994). The standards of IFRS for the financial reporting were imposed in 1990. The growth of the companies in Kuwait, in the 1960s and 70s, rose the number of the incorporated companies to 18 (Abu Mustafa, N., 2007). However, till this period, the securities trading was not covered by any law.

The trading system and the regulations of the Kuwait's stock market have faced various modifications in the last forty years(Almujamed et al., 2013). The first collapse that occurred between 1976 and 1977, along with the al-Manish crisis of 1982, were the reasons behind the

modifications of the regulations (see Al-Yaqout, 2006; Al Shuraian, 2014). To regulate the functioning of the stock exchange, different laws were enacted by the government. The official establishment of The Kuwait Stock Market (KSM) can be dated back to March 1983 and the trading started in a new permanent building in September 1984 (KSE, 2010a). The Kuwait Clearing Company (KCC) was formed, in 1987, mainly due to the Al-Manakh crisis, by The Market Committee MC (Al-Qenae et al., 2002; Annual Economic Report of the KSE, 1987). The KCC was to serve the central clearing, settlement and depository functions for the Kuwaiti securities market. In addition, the KCC was to deal with the obligations and rights arising from the market transactions and inform the listed firms about changes of ownership. The profits' distribution and the few IPO subscriptions' management are additional functions of the KCC (Al Mohasiboon Magazine, 2009b). The situations, like the Al-Manakh crisis, can be avoided by managing the security trading through a qualified body, such as the KCC. In 1998, KSM put a requirement on all the listed companies that every quarter of the year, they are to provide the details of the accounting information of their operations (Al-Yaqout, 2006). The electronic trading system was introduced by the KSM in 2000. This was followed by X-stream in 2012, a system of NASDAQ OMX KSE, Report,2015). Over 1998–2011, the listed companies in Kuwait almost doubled in number due to the privatization programme of the government.

In 2000, Law No. 20 was passed which allowed the non-Kuwaiti, foreign investors, to invest and buy equity shares (even in large quantities) in KSM listed companies (Almujamed,et al.,2013). The equity markets would be benefited with these foreign investments as the foreign investors would bring their funds and expertise in the KSM leading to its increased efficiency and better functioning.

In 2008, the global financial recession occurred which suspended the trading activities. The recession affected numerous countries, including Kuwait, in terms of financial challenges (Al-Mutawaa, 2009). To encounter this situation, the government regulators and the financial institutions of Kuwait collaborated for the overall economic benefits. For instance, to improve the banking sector, The Central Bank of Kuwait (CBK) decreased the interest rates on loans and ordered the banks to raise their capital (Al- Mutawaa, 2009). The encountering attempts proved to be unsatisfactory for the KSM investors. One example could be the group that filed a lawsuit against the KSM and demanded their lost money (Al-Atrabi and Al-Sayed, 2008). Due to the prevalent circumstances, all trading on the KSM was suspended by the Administrative Court in Kuwait for two working days on November 13, 2008 (Al-Shal Report,2008). This had

never happened before in the history of the KSM, not even in the critical scenario of the Al-Manakh crisis. According to the financial analysts, this suspension of trading was a bad idea which was not thought through. They considered the regulators of Kuwait as ineffective for dealing with the severity of the recession situation. The analysts further stated that the issue of losses was being experienced by almost all the countries and hence Kuwait is no exception which is why the market forces should not be interrupted, even in the case of market forces generating extreme clearing prices (Al-Shal, Report, 2008).

The functions performed by the US Securities Exchange Commission (SEC) and the Australian Securities and Investments Commission were to be performed in Kuwait by the regulatory body called Capital Market Authority (Gilmore and McManus). The CMA would deal with the operations and the proper functioning of the market to improve market transparency, investor confidence and investor protection. There are new regulations by the CMA for the quoted firm and the foreign companies who want to become listed companies on the KSM (KSM, Report, 2015). The listed companies are required to reveal and publish the news that may influence the investors in terms of share prices. The news could relate to, for instance, any uncommon or unexpected activity that may impact share prices or transaction volumes. In addition, the listed companies are to provide the details of any sort of important information of the past. The examples of this could be predictions, rumors and any related impacts that occurred due to this information (Kuwait bourse,2015). Through the CMA, the securities regulatory framework may develop strong roots and improve the functioning of the KSM so that the KSM can rise to the mark of the international standards. Kuwait, being the last among the GCC nations, created a Capital Market Authority (Gilmore and McManus), only after the Capital Market Law was passed by the Parliament of Kuwait in February 2010 (Eiman, 2010). On 13th March, 2011, the law was announced to establish a sole, autonomous, accountable authority to improve the capital market functioning in Kuwait. The authority, called the CMA, is to be supervised by a Board of Commissioners who have the required controls. The transparency, trust and confidence in the financial system of Kuwait are expected to rise due to the creation of the CMA. In addition, in April 2014, Boursa Kuwait, a private organization, was created to supervise the Kuwait stock market as well as successfully complete a transition of operations. The main focuses of this organization were: transparency, efficiency and accessibility.

In 1984, when the KSM started its operations, it only had 30 listed companies. Now, the number has reached over 200. There are fourteen sectors whose companies' shares are floating in the KSM. These are: Oil & Gas, Basic Materials, Industrials Sector, Consumer Goods, Health Care, Consumer Services, Telecommunication, Banking, Insurance, Real Estate, Financial Services, Investment Instruments, Technology, and Paralle (Kuwait bourse, report, 2014) (KSE, 2014b). The KSM opens at and Pre-Market from 8:50 am to 9:00 am. After that, the Trading session starts at 9:00 am and ends at 12:30 pm. These timings are from Sunday to Thursday.

3.6.AN ANALYSIS OF CAPITAL MARKET REGULATION IN SAUDI ARABIA

3.6.1.Introduction

This section focuses on a detailed analysis regarding the growth and trends in different variables linked to the stock market, such as the General index, Sector and listed companies, number and values of traded shares. This is presented in the form of tables and figures. There have been advancements in the market trends as the trends have increased, hence, the SSM behaviour has been focused in this section through statistical analysis to present the significant modifications during the period in the stock market indicators under consideration.

3.6.2.General Index

In order to keep a track of all the listed companies in exchange, a Tadawul All-Share Index (TASI) was formed in 1985 with a base value of 1,000. This is SSM's composite index. The method of calculating Index is by Current day's total free float market capitalization ÷ previous day's total free float market capitalization x index value from the previous day.

The activity of SSM general index market key indicator during the years 1985 to 2014 are presented in Table 3.3 and Figure 3.2. Since the commencement of market activities in 1985, there has been consistent fluctuations and instability in SSM's performance. For instance, by the end of 1992, it rose to 1,888 points from the base rate of 1,000 points and then declined to 1,282 points in 1994 when the world faced huge economic recession. Since its formation in 1986, the index experienced its lowest level at 646.03 points. There was an increase seen in the index price from 1,367.6 points to 2,028.53 points between 1995 and 1999(Alghamedi,

2012). However, 1998 witnessed a decrease to 1,413.13, a fall of 27.8% as compared to 1997. Regardless of the index instability in the years 1985 to 2000, the growth rates kept increasing. The year 2003 began a new era of stock market growth as an increase was experienced in the Saudi market with the involvement of several new investors and reaching their highest level in February 2006. By the end of 2003, TASI closed at 4,437.6 as compared to a 2518.1 close at the end of 2002. There was an immense increase seen in the index, which managed to close at 8,206 after an increase of 84%. The Saudi stock market closed above 16,000, increasing by 103.7% by the end of 2005. There was a continuous increase in the share prices since 2002, which reached its peak at 20,634 being the historical highs 20,000 points by February 2006. The credit of this rapid enhancement in the general index of capital market goes to the formation of Tadawul trading system in 2001, which had a positive effect as a new trading (Alshogeathri, 2011). In addition to this, the Saudi Arabian Monetary Agency Annual report also stated that capital market's expansion was due to domestic economy, high confidence in the market, high company earnings, lower rate of return on deposits and numerous new market investors.

However, after the peak the index started to experience a drop and within few months fell below 8,000 points. This resulted in the breakdown of the Saudi Stock Market in which the price index lost more than 13,000 points by falling 65% from its peak. This incident was first ever in the history of Saudi stock market. By August 2008, the TASI was 8,700 points and it continued to fall in September 2008 by reaching 7,400 and at the end of the year Tadawul All Share Index (TASI) closed at 4,802.99 points compared to 11,038.66 points in 2007 by a total loss of 6,235.67 points (56.49%). Though a trend reversal was seen by the in index during 2006 and 2008 but it still could not regain its historical peak.

The SSM was also significantly affected by the major collapse in general index in 2006 and 2008. Despite increase in oil rates, money supply and technological utilization, year 2006 is known for enhancement in the domestic economy. The 2008 decline in market is linked to the high state of doubt and confusion due to global economic recession and drop in international oil price. Moreover, from year 2003 to 2007, foreign investors could not take part in the Saudi exchange. After 2010, the Saudi Market finally started to regain its position but it still could not reach the level it had before 2006 crash. That also explains the behaviour of some investors during and after crash (Al-Twaijry, 2011).

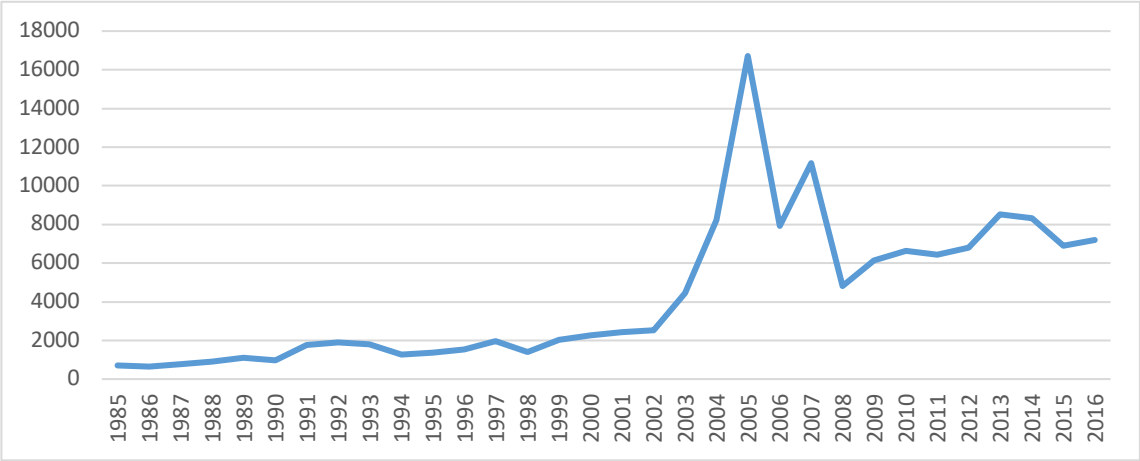
After 2010 as the market started to recover, major developments and growth in trend were seen till 2016. The highest peak reached by the index in year 2013 was 8535 point and in 2011 the lowest drop was observed at 6417.73 point. However, with rising oil prices, geopolitical tensions in the area and an increased fear of extended slowdown in China market. Moreover, a minor development was noticed by the developed nations in their economies with the quantitative easing program (Eurozone). By the end of year, the increase in Fed rate also forced the investors to maintain and manage their strategy for different markets or other secure investment opportunities. However, the above factors negatively influenced the performance of GCC market.

Table 3. 4: Trends in the General Index

Year	General Index (1985=1000)	Year	General Index (1985=1000)
1985	690.88	**2001**	2430.11
1986	646.03	**2002**	2518.08
1987	780.64	**2003**	4437.58
1988	892	**2004**	8206.23
1989	1086.83	**2005**	16712.64
1990	979.8	**2006**	7933.29
1991	1765.24	**2007**	11175.96
1992	1888.65	**2008**	4802.99
1993	1793.3	**2009**	6121.76
1994	1282.9	**2010**	6620.75
1995	1367.6	**2011**	6417.73
1996	1531	**2012**	6801.22
1997	1957.8	**2013**	8535.6
1998	1413.13	**2014**	8333.3
1999	2028.53	**2015**	6911.76
2000	2258.29	**2016**	7210.43

Source: the Annual Reports of the Saudi Capital Market Tadawul,(2005,2007,2013,2015,2017);and Saudi Arabian Monetary Agency Capital Market and https://www.argaam.com/.

Figure 3. 2: Trends in SSM (TASI) General Index (1985=1000) (1985-2016)



Source: Author's estimation based on The Annual Report of the Saudi Capital Market (Tadawul,2007,2013,2015,2017) ; and Saudi Arabian Monetary Agency Capital Market— 46th Annual Report and ARGAAM.

3.6.3.Sector and listed companies in the Saudi Stock Market

The consistent developments witnessed in Saudi Arabia's economic sector have resulted in significant emergence of public and private industries all over the country. The various groups of companies listed in Tadawul also need to be modified according to the developments occurring in the economic area of the Kingdom. According to the list published by the CMA regarding the number of security offers, listing rules and more programs leading to privatisation of a large number of family companies and closed companies added them to the listed companies of stock market. Table 3.4 shows the growth of development sector over the years. There were initially limited number of companies listed in the Saudi Stock Market but over a period of time with the extent of Saudi stock sectors expanding, there has been an increase in the number of listed companies from 75 in 2000 to more than 170 companies in 2016 (see Figure 3.3). This number is expected to keep increasing in the future as well.

The older version of Tadawul's sector classification had several weaknesses as it was not formed according to the international classification standards. For instance, due to older classification curbs the sectors were unable to properly represent the businesses of companies planning to become public. Moreover, the companies were not frequently monitored to identify the modifications in their specific classification caused by any change in the companies' business profiles. The older version of Tadawul's sector classification remained active till 2008.

In 2008, with the introduction of Capital Market Law seven new sectors were added in the present eight sectors of the stock market. Until 13th of November 2016, the fifteen sectors in which the listed companies were divided were: Banks & Financial Services, Petrochemical Industries, Cement, Retail, Energy & Utilities, Agriculture & Food Industries, Telecommunication & Information Technology, Insurance, Multi-Investment, Industrial Investment, Building & Construction, Real Estate Development, Transport, Media and Publishing, and Hotel & Tourism. In 2016, a new sector named RETA was included in Tadawul‘s listed equities that were previously divided into 16 sectors on 13/11/2016.

Recently, another new industrial classification system began on 8th January 2017, which was implemented by Tadawul. This totalled the Tadawul’s market structure into 20 sectors (Industry Groups), which represented Level 2 under GICS hierarchical classification system. These 20 sectors (Industry Groups under GICS at Level 2) represented the distribution of existing listed companies that are presented below:

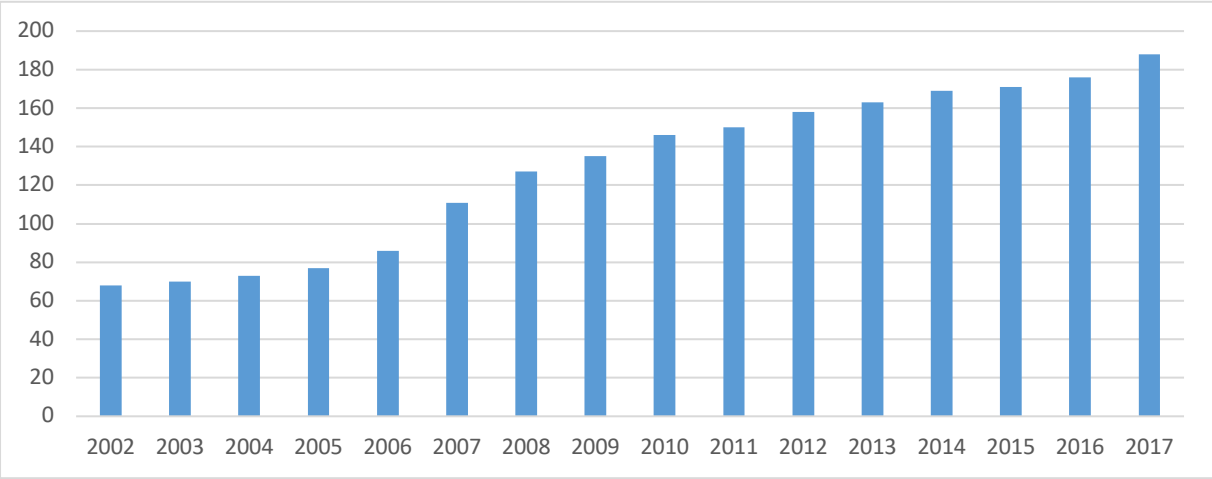
Energy Materials , Capital Goods , Commercial & Professional Svc , Transportation , Consumer Durables & Apparel , Consumer Services , Media , Retailing , Food & Staples Retailing , Food & Beverages , Health Care Equipment & Svc , Pharma, Biotech & Life Science , Banks , Diversified Financials, Insurance , Telecommunication Services , Utilities, REITs , Real Estate Mgmt & Dev't. Through new classification system of Tadawul, the limitations are countered by combining the company’s business activities with the sources of revenues to its sector classification. The stock market sectors were reclassified according to the Global Industry Classification Standard (GICS), which is commonly used by majority of market investors belonging to all key groups: asset managers, brokers (institutional and retail), consultants, researchers and stock exchanges. GICS was a joint venture by the internationally leading companies Standard and Poor’s (S&P) and Morgan Stanley Capital International (MSCI) that provided independent international financial data, indices and benchmark-related products and services. This aids in improving transparency and providing authentic data related to sector performance. Moreover, Tadawul can be compared with other international equity markets. The local and foreign investors will be motivated to make better evaluation of the Saudi Stock Market through this new internationally recognised classification standard. Moreover, it would allow important comparisons between stocks and sectors across global equity markets.

Table 3. 5: The development of the Saudi stock market sectors

the Market before 5/4/2008	**the Market After 5/4/2008**	**AFTER 11-03-2016**	**After 8/1/ 2017**
1. Banking 2. Industry 3. Cement 4. Services 5. Electricity 6. Telecommunication 7. TeleCommunication & Information 8. Technology Sector 9. Insurance 10. Agriculture	1. Banks & Financial Services 2. Petrochemical Industries 3. Cement 4. Retail 5. Energy & Utilities 6. Agriculture & Food Indust. 7. Telecom. & Information Tech. 8. Insurance 9. Multi-Investment 10. Industrial Investment 11. Building & Construction 12. Real Estate Development 13. Transport 14. Media & Publishing 15. Hotel & Tourism	1. Banks & Financial Services 2. Petrochemical Industries 3. Cement 4. Retail 5. Energy & Utilities 6. Agriculture & Food Indust. 7. Telecom. & Information Tech. 8. Insurance 9. Multi-Investment 10. Industrial Investment 11. Building & Construction 12. Real Estate Development 13. Transport 14. Media & Publishing 15. Hotel & Tourism 16. REITs	1. Energy 2. Materials 3. Capital Goods 4. Commercial & Professional Svc 5. Transportation 6. Consumer Durables & Apparel 7. Consumer Services 8. Media 9. Retailing 10. Food & Staples Retailing 11. Food & Beverages 12. Health Care Equipment & Svc 13. Pharma, Biotech & Life Science 14. Banks 15. Diversified Financials 16. Insurance 17. Telecommunication Services 18. Utilities 19. REITs 20. Real Estate Mgmt & Dev't

Source: Tadawul, Capital Market Authority & Saudi Arabian Monetary Agency Capital Market.

Figure 3. 3: Saudi stock market listed companies (2002–2017)



Source: Author's estimation based on The Annual Report of the Saudi Capital Market (Tadawul,2007,2013,2015,2017) ; and Saudi Arabian Monetary Agency Capital Market— 46th Annual Report and ARGAM.

3.6.4.Number of Shares Traded

The total number of traded shares is presented in Table 3.5 and Figure 3.4 which shows the trends and developments in the number of traded shares in Tadawul from 1985 to 2016.

The number of shares traded greatly increased from 4 to 152 million between the years 1985 and 1994 and steeply dropped in 1995 to 117 million, with a decrease of 23 percent. In 1999, it gradually rose to 528 million shares. Table 3.5 and Figure 3.4 shows the total number of shares that were traded during year 2000, which made up to 555 million with a rise of 5.1 percent compared to last year.

The period being scrutinized in this study of Saudi Stock market, 12,281 million shares were seen to be traded in 2005 with a rise to 67,729 million traded shares in 2016. A consistent increase of traded shares was seen between the years 2003 and 2005, when the shares reached 12281 million. A rapid increase in shares was observed in 2006, when they reached 68515 million as compared to only 12281 shares noted in 2005. The decrease of shares from trend in 2006 was observed to be caused by the division of trading shares in 2005, which resulted in the production of a large number of shares. The increase continued in the year 2007 to 57,829 million, which further increased in the following year by 3.2% to 59,682 million. However, by the end of 2009, the traded shares dropped by 5% to 56,685 million and continued to fall in 2010 by reaching 33,255 million shares traded.

Trade markets started to grow rapidly after the year 2010 and a significant increase in traded shares was seen in 2012 at 84949 million and 70971 million in 2014. Especially in the year 2011, the total number of shares traded was seen to reach 51,326 million as compared to last year which witnessed 33.33 billion shares traded. Thus a rise of 45.61 percent was observed in 2011. The shares traded further increased in the year 2012 by reaching 82.54 billion as compared to 51.32 billion shares traded in 2010, which saw an increase by 71.03 percent. The total number of shares traded in 2014 peaked to 70.97 billion as compared to 53.53 billion shares traded in the previous year, thus rising by 32.28 percent.

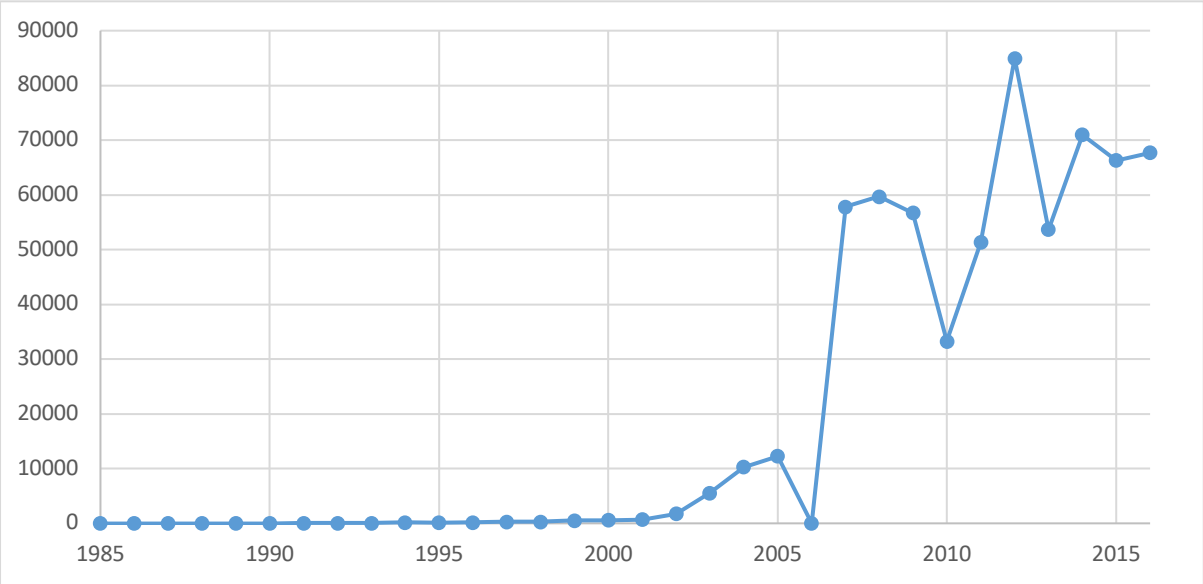
Table 3. 6: Number of Shares Traded (Million) (1985-2016)

End of Period	Number of shares Traded (Million)	End of Period	Number of shares Traded (Million)
1985	4	**2001**	692
1986	5	**2002**	1736
1987	12	**2003**	5566
1988	15	**2004**	10298
1989	15	**2005**	12281
1990	17	**2006**	68515*
1991	31	**2007**	57829
1992	35	**2008**	59682
1993	60	**2009**	56685
1994	152	**2010**	33255
1995	117	**2011**	51326
1996	138	**2012**	84949
1997	312	**2013**	53678
1998	293	**2014**	70971
1999	528	**2015**	66275
2000	555	**2016**	67729

Source: the Annual Reports of the Saudi Capital Market Tadawul,(2005,2007,2013,2015,2017);and Saudi Arabian Monetary Agency Capital Market and ARGAAM https://www.argaam.com/.

Note: (*) As from 2006, a share was split into five shares and the shares of the companies listed become SR 10 per share instead of SR 50 in April 2006.

Figure 3. 4: Number of shares Traded (Million)



Source: Author's estimation based on The Annual Report of the Saudi Capital Market (Tadawul,2007,2013,2015,2017) ; and Saudi Arabian Monetary Agency Capital Market— 46th Annual Report and ARGAAM.

3.6.5.Value of Shares Traded

The total number of shares traded is shown in Table 3-6, while the trends and developments in traded shares value in the Tadawul form 1985 to 2016 are presented in Figure 3-5. A steady increase in the value of shares traded from SR 760 million in 1985 to SR 24871 million in 1994 are shown in Table 3.6 and Figure 3.5. However, year 1995 witnessed a rapid drop to SR 23,227 million, with a decline of 6.6 percent, before it instantly rose again by 144% from SR 25397 million in 1996 to SR 62060 million in the following year. 1999 also experienced an increase in the value of shares traded by SR 56578 million, with a rise of 9.3% as compared to SR 51510 million of 1998.

The rise and fall of traded shares experienced within years 2000 and 2010 show that the total value of shares traded in 2003 were SR 5,965 billion as compared to the previous year, which showed Rs 134 billion, thus presenting a rise of 346%. In 2002, the total value of shares traded was SR 133,787 billion, with a rise of 60% from SR 836 billion observed in 2001. Year 2006 also witnessed an increase in total value of shares traded by SR 5.26 trillion and a rise of 27.14% from SR 4.14 trillion in the previous year. After 2006, a rapid drop of shares traded was seen as the shares fell by 51.4% in 2007 to SR 2,557.71 billion (US$ 682.06 billion) and by 23.3% in 2008 to SR 1962.95 billion (US$ 523.45 billion). Further

decline was seen in 2009 by 35.6% to SR 1,264,012 million, and finally a drop by 39.94 percent was observed in 2010 by reaching SR 759,184 million as the value of shares traded.

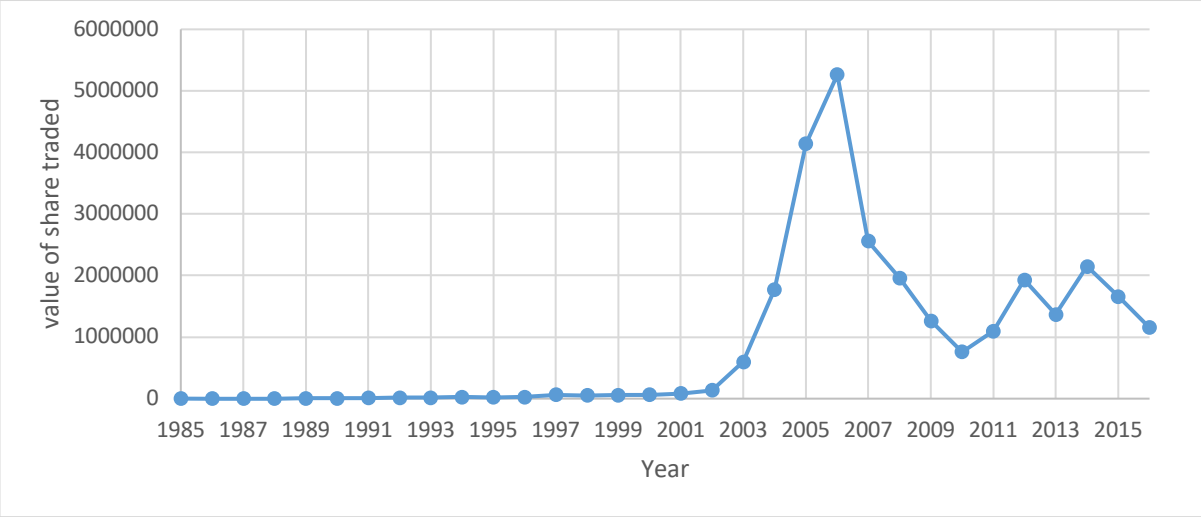
There was a general rise in the value of shares traded from 2010-2016, which began in 2011. For instance, the total value of Shares Traded in 2011 reached SR 1,098.84 billion (US$ 293.02 billion) as compared to SR 759.18 billion (US$ 202.45 billion) for the year 2010, thus rising by 44 .74% and a further increase to 1,929,318 in the following year. Moreover, in 2014 the total value of shares traded reached SAR 2,146.51 billion (US$ 572.41 billion) as compared to SAR 1,369.67 billion (US$ 365.25 billion) in 2013, which rose by 56.72%. It further increased and reached a peak in 2014 by SAR 2,146.51 billion but the values of shares trade started to decrease in 2015 by reaching 1,660,622 and 1,156,987 in 2016. This was stated to be caused by the decline in internal oil prices.

Table 3. 7: Value of Shares Traded in million (1985-2016)

Year	value of Shares Traded	Year	value of Shares Traded
1985	760	2001	83,601
1986	831	2002	133,787
1987	1686	2003	596,510
1988	2037	2004	1,773,859
1989	3364	2005	4,138,695
1990	4403	2006	5,261,851
1991	8527	2007	2,557,712
1992	13699	2008	1,962,945
1993	17360	2009	1,264,011
1994	24871	2010	759,184
1995	23,226	2011	1,098,836
1996	25,397	2012	1,929,318
1997	62,060	2013	1,369,665
1998	51,509	2014	2,146,511
1999	56,578	2015	1,660,622
2000	65,292	2016	1,156,987

Source: the Annual Reports of the Saudi Capital Market Tadawul,(2005,2007,2013,2015,2017);and Saudi Arabian Monetary Agency Capital Market and ARGAM https://www.argaam.com/.

Figure 3. 5: Value of Shares Traded:



Source: Author's estimation based on The Annual Report of the Saudi Capital Market (Tadawul,2005, 2007,2013,2015,2017) ; and Saudi Arabian Monetary Agency Capital Market— 46th Annual Report and ARGAM.

3.6.6.Market Value of Shares

The total number of shares traded is presented in Table 3.7, while Figure 3.6 which shows the trends and developments in the market value of shares traded in Tadawul form 1985 to 2016. According to Table 3.7 and Figure 3.6, the change in values of shares traded between 1985 to 1999 show that the shares gradually increased in 1985 from SR 67 billion to SR 229 billion in 1999, with a rise of approximately 241%. However, in 1986 the shares decreased by 6% as compared to 1985 by falling to SR 63 billion. Moreover, in 1990 another downfall was seen by to SR 97 billion, which rapidly increased to SR 206 billion in 1992, thus rising 13.8% as compared to previous year.

The market values of shares traded between years 2000 and 2009 are presented in the Table 3.7 and Figure 3.6. The market value increased to SR 2438 billion ($650 billion) by the end of 2005 and reached SR 924 billion ($246 billion). In 2008 it increased from SR 255 billion in 2000, and showed a rise of 856.1%. Especially in 2002 the total value of shares traded was SR 133.8 billion, with a rise of 60% from the SR 83.6 billion in the previous year. There was further increase experienced in 2003, when the total market value shares rapidly rose to SR 590 billion. A rapid increase to SR 1,149 billion and SR 2438 billion was seen in 2004 and 2005 respectively, with a rise of 48.7% and 112.2%. By the end of 2008, the collapsing of market caused a drop in the total market capitalization, which reached SR 924.53 billion (US$ 246.54 billion) and a loss by 52.50% to the previous year. 2009 witnessed a rise of 22.7% and reached

SR 1196 Billion. Table 3.7 and figure 3.6 show market values between 2010 and 2016, in which the value increased in 2014 to1,812 billion from SR 1,325.39 billion in 2010.

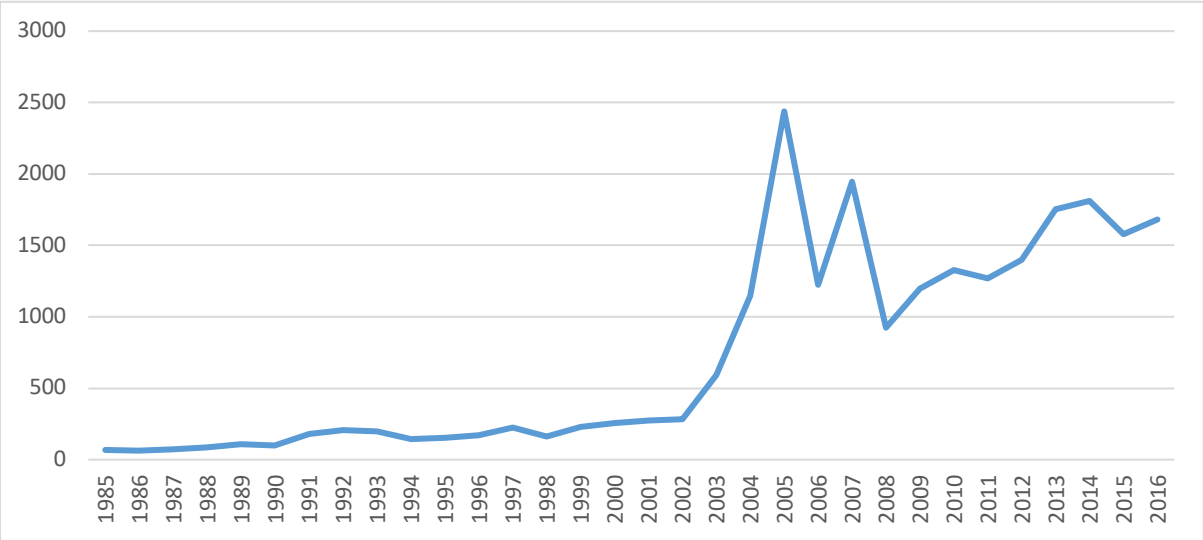
Moreover, by the end of 2010, the market capitalization of the IPOs companies had reached SR 13.41 billion which showed 1.01% of the total market capitalization. Hence, the total Market Capitalization reached a peak of SAR 1,812.89 billion (US$ 483.44 billion) in 2014. The total Market Capitalization in 2015 was seen at SAR 1,579.06 billion (US$ 421.10 billion), which fell by 12.90%. Finally, by end of 2016, the total Market Capitalization was SAR 1,681.95 billion (US$ 448.52 billion), thus rising by 6.52% as compared to 2015.

Table 3. 8: Value Shares (Billion SAR)

End of Period	Market Value of Shares	End of Period	Market Value of Shares
1985	67	2001	275
1986	63	2002	281
1987	73	2003	590
1988	86	2004	1149
1989	107	2005	2438
1990	97	2006	1226
1991	181	2007	1946
1992	206	2008	924
1993	198	2009	1196
1994	145	2010	1325
1995	153	2011	1,270
1996	172	2012	1,400
1997	223	2013	1,752
1998	160	2014	1,812
1999	229	2015	1,579
2000	255	2016	1,681

Source: the Annual Reports of the Saudi Capital Market Tadawul,(2005,2007,2013,2015,2017);and Saudi Arabian Monetary Agency Capital Market and ARGAM https://www.argaam.com/.

Figure 3. 6: Market Value Shares (Billion SAR)



Source: Author's estimation based on The Annual Report of the Saudi Capital Market (Tadawul,2005, 2007,2013,2015,2017) ; and Saudi Arabian Monetary Agency Capital Market— 46th Annual Report and ARGAAM.

Chapter 4.Methodology of the Research

4.1.Introduction:

This chapter outlines the methodology and methods applied in this thesis and, more specifically, various epistemological and ontological assumptions that are commonly raised by researchers when researching the social sciences. An overview of different methodologies used by social researchers, finance and economics is also discussed in this chapter. Philosophical assumptions that form the basis of this research, such as epistemology, ontology, human nature and methodology, are discussed within Section 3.2. Societal considerations are also discussed, which includes the sociology of regulation and radical change. There is a discussion of alternative research paradigms, together with the reasons why a particular paradigm has been selected. Section 3.3 outlines the research assumptions of this study, together with justifications supported by finance and economic research references.

The research methods deployed in this research are outlined in Section 3.4. The researcher has selected a quantitative approach, because it helps to address the research questions of the study, which develops from the functionalist paradigm upon which this research is based, supported by statistical methodologies. Evaluating forecast accuracy and auto-regressive integrated moving average (ARIMA) methods are deployed in this research, which are used to investigate the level of market efficiency among the GCC emerging stock markets.

4.2.Philosophical Assumptions that Underpin Social Science Research

A number of philosophical assumptions affect social science research, which are based upon the researcher's perception of the world. A subjective-objective framework was suggested by Burrell and Morgan (1979), which includes four categories of philosophical assumptions relating to the nature of social sciences: human nature, methodology, epistemology and ontology. These writers comment that assumptions within social science research is dependent upon these four factors, and specifically that German idealism and sociological positivism define the framework's objective and subjective aspects. Saunders et al. (2007) comment that the objectivist approach assumes that entities are external to those involved in the research, yet exist in the real world. Bryman (2004) offers a similar stance, claiming that

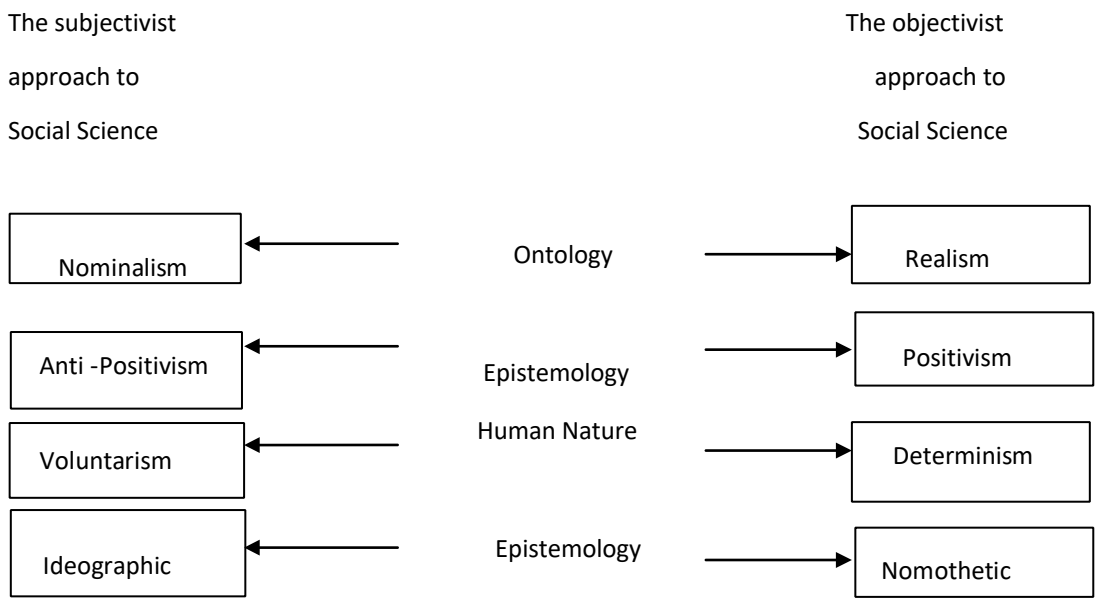
the objectivist makes the assumption that the social world is separate from human beings, and has an independent existence. Contrary to this approach is the view of the subjectivist who views entities as social constructs, with an existence that relies upon the actions and perceptions of human beings (Bryman, 2016).

In Figure 4.1, the two extremes of the subjective-objective framework are described(Burrell and Morgan, 1979). Ontology is the first assumption described in the framework, which deals with the nature of both being and reality (Saunders et al., 2015).Reality is external to the individual or, alternatively, a product of internal individual consciousness, which may be 'objective' with an existence that is independent of human awareness of interaction; alternatively, it may be an individual construct within the mind (Burrell and Morgan, 1979). Both realism and nominalism are part of the ontological debate, with the debate surrounding reality suggesting that the social world that comprises concepts, labels and names exists in perceptions, yet a 'real' structure to the world does not exist (Burrell and Morgan, 1979).

The objectivist approach which assumes that entities are external to those involved in the research, and yet exist in the real world was supported by Bryman (2004), he added to this stance by claiming that the objectivist makes the assumption that the social world is separate from human beings, and has an independent existence. Contrary to this approach is the view of the subjectivist who views entities as social constructs, with an existence that relies upon the actions and perceptions of human beings (Bryman, 2008).

Figure 4. 1: Assumptions made about the Nature of Social Science Research

The Subjective - Objective Dimension



Source: Burrell and Morgan (1979)

This approach to 'reality' proposes that the social world exists in a state that is independent of human perception, and comprises structures that are real and concrete (Burrell and Morgan, 1979).

Epistemology is the second assumption within the subjective-objective model, which refers to how one might understand the world and communicate knowledge to others (Burrell and Morgan, 1979). An explanation of epistemology is questioning whether knowledge is something that can be claimed that is labelled as positivism on the subjective-objective dimension. Alternatively, is it based upon personal experience, which is regarded as anti-positivism (Burrell and Morgan, 1979).

Quantitative research is often linked to positivism, since it is based upon hard facts. Saunders et al. (2007) suggest that this approach has been adopted by social scientists in their study of human nature, because it involves methods of research and models. An epistemology that is positivist attempts to predict, as well as to explain what is going on by looking for causal relationships and regularities in the social world (Burrell and Morgan, 1979). In contrast, an epistemology that is anti-positivist makes the assumption that the social world can only be

understood from the standpoint of an individual who is involved directly in the activities studied. Knowledge about the social world is viewed by anti-positivists as subjective and not objective (Burrell and Morgan, 1979).

The researcher's view relating to human nature in social services is the third assumption of the subjective-objective framework, which is linked to epistemological assumptions, but may be seen as separate from a conceptual point of view. The relationship between the environment and human beings is explained in this assumption by Burrell and Morgan (1979), who refer to 'determinism' and 'voluntarism' as two extreme perspectives of human nature. 'Determinism' considers human beings as being under environmental control, whereas 'voluntarism' assumes that the environment can be influenced by human beings.

The continuum as it relates to methodology is the fourth assumption of the subjective-objective discussion, which is about how human nature epistemology and ontology have a direct influence upon the determination of the methodology to be deployed. Methodology may be categorised as 'nomothetic' or 'ideographic' alongside the subjective-objective dimension. A methodology that is ideal could be considered for use when humans have free will and when reality is based upon experiences that are subjective (Ryan et al., 2002). According to Burrell and Morgan (1979), an approach that is 'ideographic' is based upon first-hand knowledge of the subject being investigated; nomothetic research methods should be used if the reality has not been constructed socially and the researcher has a deterministic view of human nature, which focuses upon quantitative data analysis techniques. It is commented by Godfrey et al. (2000) that quantitative methods applied in social science research draws conclusions by focusing upon the testing of hypotheses.

The researcher uses the positivist approach in this thesis, preferring not to mix this approach with other paradigms. The typology raised by Burrell and Morgan (1979) encouraged the researcher to consider his own world view and to satisfy himself that valid assumptions underpin this thesis. In addition, the attention of the researcher was focussed upon the questions being asked, together with the appropriateness of the methodology and methods used. The next section shows how the current research fits into the functionalist paradigm suggested by (Burrell and Morgan, 1979).

4.3. Research considerations that underpin the Current Thesis

The researcher considers that markets, including stock markets, are socially constructed by those that form the market. People have rules to guide behaviour in the market, which sometimes get broken or circumvented either intentionally by those wishing to influence matters to their own advantage, or through inefficiencies in the market. The EMH basic premise is that prices in the stock market reflect all available information, and that the market is in pure form and is efficient. These markets are not real as such, because they are socially constructed. However, these markets are real in their consequences and people can make or lose money. So the researcher could argue in a Durkheim (2013) way that these markets form their own reality 'sui generis' and all participants in the market believe in that reality. If that is so, it may be all that is needed to know to study the nature of their being – existence. Any study of these markets will then generate knowledge that is useful to buyers and sellers in the market (i.e. the participants). The study will confirm how these markets behave, such as EMH. Thus, we can make an argument in a different way if you were a realist, a critical realist, or a positivist.

In positivist research, the key ideas are that the social world exists through objective methods and that social phenomena can be studied, measured and understood like physical objects using scientific methods. A single eternal reality exists, which is independent from human feelings, ideas and perceptions, and the end product can be law-like generalisations similar to those produced by natural and physical scientists (Remenyi et al., 1998).

According to Saunders et al., (2011), the positivist philosophy follows the deductive approach where law-like generalisations are made based on the results and the hypotheses. Using the deductive approach gives the researcher opportunities for a broad consideration of positivism and realism. In this study, the mean methods of share price statistical analysis is used to describe share price patterns, and make statistical inferences about the causes of the patterns.

The positivist view of stock markets stems from the motivation by researchers to advance market efficiency theory by creating law-like principles and subsequently, efficient market theory (Malkiel and Fama, 1970). Positivist research presents EMH models in the manner of scientific laws, as these models are regarded as having universal validity and are intended to be used as a choice by stock market authorities and practitioners (Fama, 1991).

Economics is a natural science that uses positivist claims in its research. According to (Friedman, 1962), economic methodology refers to basic foundations that are used to develop theories by testing hypotheses that return significant outcomes; for example, in his argument for the use of the term 'positive', he vouches for monetarist authorities to have a solid ratio of capital to grow the supply of money in the economy. This is out of the belief that money is neutral past short-run economic situations. Therefore, Friedman encourages the use of more empirical evidence emanating from mathematics by providing a distinction between hypotheses and theories.

Hempel argues that scientific argument can only be determined indirectly. As a result, there is a need to derive an observable consequence. The philosopher behind 'The Philosophy of Natural Science' argues that we need to test observable consequences of a scientific hypothesis, as this provides second-hand proof to either support or reject a postulate (Hempel, 1966) This study tests the hypothesis of the weak form efficiency in five companies of the Saudi Stock Market, and will then support or reject the postulate. The researcher suggests that more than one methodology should be used in the determination of the weak form efficiency of the SSM. There are various methodologies used in previous studies, which discovered various types of deviations from a random walk by using a wide array of statistical tests.

According to Feyerabend, (1975), science is an anarchic enterprise and not monic, and divides his analysis into a critique abstract followed by various historical case studies. The former is a 'reductio ad absurdum' and therefore, argues that a single methodology can be used to achieve scientific progress (Feyerabend, 1975). According to his argument, there are four features that are critical to methodological monism, which are: the principle of falsification, increased demand for empirical content, the consistency condition and the strictness of hypotheses that are considered ad hoc.

In conclusion, this is an empirical research, and the philosophy adopted is positivism, ergo the deductive approach is most suitable method to use. The hypotheses in this research are derived from existing theories in market efficiency and how previous information and economic event affects current and future stock market prices (Fama, 1991). These hypotheses are tested, and confirmed either fully or partially or rejected based on the results that emerge from the data gathered and their analysis. However, research and understanding the Saudi Stock Market assists with wealth management. According to Fama (1970), the

theory is built on the random walk model that states that the current price of a security based on available information is independent of previous price changes and follows random movement. Thus, no investors can make guaranteed returns in the stock market. As result, the EMH is not only an indicator of the securities market's healthy growth, but also a key factor affecting asset pricing and security performance evaluation. The efficiency test of the Saudi Stock Market directly reflects stock market conditions, influences investors' strategies and confidence level in participating in the Saudi Stock Market.

This thesis uses quantitative research methods that are based on data relating to share prices. It is assumed that the results may be generalised for similar markets. Bryman (2008) comments that it is usual for research that is quantitative-based to emphasise quantification in the collection and analysis of data. It is a strategy that is both deductive and objectivist, and includes a natural science model of the research process, which is influenced by positivism. The researcher believes given the objective of this thesis, the change in share prices within the emerging GCC emerging stock market represents an important reality rather than human perceptions of socially constructed events.

An efficient market is important, since it is directly related to share price changes. In order to understand modern portfolio theories, the market efficiency hypothesis (EMH) provides an essential understanding of the Variance Optimisation Model (MVO) and the Capital Asset Pricing Model (CAPM). EMH assumes changes in stock pricing from which three models were constructed. Should the stock market be inefficient, it would be inappropriate to apply any pricing stock model or to measure the performance of stock. EMH represents changes to the wealth of individuals, as well as the possibility of having significant consequences to a region's economies. The liberalisation of countries' economies, as well as the encouragement of foreign investors to own shares means that any changes in stock market prices may have a global impact, which is not restricted to national investors.

This thesis adopts a realist ontology, assuming a positivist view of what constitutes knowledge. It aims to predict share prices by investigating the causal relationships between equity returns by using real historical data. Burrell and Morgan (1979) comment that positivist epistemologies attempt to predict and explain social world events by examining causal relationships and regularities between constituent elements. The researcher regards share prices to constitute market participants' knowledge and worthy of study. The methodical choices for this thesis became clear after reviewing epistemological and ontological

assumptions, with the current research adopting a methodology that is nomothetic, and drawing upon work in the natural sciences, since it uses quantitative techniques for analysis and assumes that the findings can be generalised, which is the case based on results from the natural sciences.

4.4. Statistical Definition of the Efficient Market Hypothesis and the Random Walk

In 1970, Fama presented a general notation that went some way in explaining how investors generate stock price expectations, which Cuthbertson et al. (1996) describes this as:

$$\mathbf{E}(\mathbf{P_{J,t+1}}|\mathbf{\Phi_t}) = \{\mathbf{1} + \mathbf{E}(\mathbf{r_{j,t+1}}|\mathbf{\Phi_t})\}\mathbf{P_{j,t}} \quad \textbf{(4.4.1)}$$

Where:

E: is the expected value operator.

$P_{j,t+1}$: is the price of security j at time t+1.

$r_{j,t+1}$: is the return on security j during period t+1.

Φ_t: is the set of information available to investors at time

Therefore,

$E(P_{J,t+1}|\Phi_t)$: based upon available information at the beginning of period Φt, this is the end-of-period price on stock j that is expected.

$\{1 + E(r_{j,t+1}|\Phi_t)\}$: This has the same amount of risk as stock j, and over the forthcoming time period of stocks this represents the expected return.

Other than by chance, abnormal profits cannot be made by stock market traders, according to the EMH, based on available information set Φ_t. When share prices are undervalued or overvalued this means:

$$\mathbf{x_{jt+1}} = \mathbf{P_{J,t+1}} - \mathbf{E}(\mathbf{P_{J,t+1}}|\mathbf{\Phi_t}) \quad \textbf{(4.4.2)}$$

Where:

χ_{jt+1} Based on the information available Φ_t, the difference between the price anticipated by investors and the actual price for security j at the end of the period is determined by x_{jt+1}:

Therefore, when an efficient market is suggested:

$$\mathbf{E}(\mathbf{x_{J,t+1}}|\mathbf{\Phi_t}) = \mathbf{0} \quad \textbf{(4.4.3)}$$

Therefore, the stock price reflects the information set Φ_t, and according to the EMH, the returns for a particular stock based on rational expectations are presented as:

$$\mathbf{p_{t+1} = Ep_{t+1} + \varepsilon_{t+1}} \quad (4.4.4)$$

Where, the forecast error at time t+1 is ε_{t+1} and the stock price at time t+1 is p_{t+1} . Therefore, on average P_{t+1}- Ep_{t+1} should be zero and should have no correlation with any information Φ_t.There is zero expected value for forecast error for bad news or good news when the random variable is defined as $E\left(x_{J,t+1}|\Phi_t\right) = 0$

The forecast error value is zero:

$$\mathbf{Et_{\varepsilon_{t+1=}} E_t(p_{t+1} - E_t p_{t+1}) = E_t p_{t+1} - E_t p_{t+1} = 0} \quad \mathbf{(4.4.5)}$$

There is evidence of market efficiency if stock market returns indicate random walk, white noise, martingale and fair game properties (Samuelson, 1965a). Returns will not produce any arbitrage opportunities and stock market speculators will fail to gain abnormal profits in such circumstances. Stock market participants, according to the theory of fair game, will correct the stock price during an arbitrage opportunity, resulting in price levels being maintained at the fair price. This property can be modelled as a random walk:

$$\mathbf{P_t = P_{t-1} + e_t} \quad \mathbf{(4.4.6)}$$

There is an assumption in the Random Walk Model that stock market information previously available is equal. For instance, **'P_t'** is close of price on one day, as well as close of price – Pt-1. A price that is zero forms an alternative assumption that the price of stock is likely to fall or rise. In efficient stock markets, the Martingale Hypothesis is usually applied, whereby tomorrow's price is predicted as the next value that is based on previous and present values. The price quoted 'today' is used to predict the best price for 'tomorrow'. The formula for the Random Walk Model is:

$$\mathbf{P_t = \propto + P_{t-1} + e_t} \quad \mathbf{(4.4.7)}$$

Due to the presence of a constant or an intercept, allowance is made for non-zero average changes in variables, as intercept is used for random walk with drift, but in the random walk model intercept is not used.

4.5. Research Methods

4.5.1.Introduction:

Various concepts and techniques that are useful for understanding the problem, selection of appropriate techniques and models, as well as their analysis are discussed in this section. Forecasting, modelling techniques and a brief description of forecasting models used for optimisation of error metrics are also included. Research methods were selected to address the research questions after determining the appropriate research paradigm from those proposed by Burrell and Morgan (1979). The econometric and statistical methods deployed to investigate the weak form of the EMH in GCC stock markets is also discussed.

This section also discusses the research methods used when examining EMH among the three GCC emerging stock markets of KSM, DSM and (SABIC, STC,NCCY, Al-Rajhi Bank and Electricity Company), together with the level of successful prediction. The Box Jenkins Method, which is based on residual analysis and Akaike information criterion were the main statistical methods determined for analysis purposes. Data analysis was performed using the STATA statistical package. Forecasting efficiency was based on unit root tests, ARIMA analysis and following error measures MAE (Mean Absolute Error), RMSE (Root Mean Square Error) and MSE (Mean Square Error).

4.5.2.Unit root test:

Non-stationary tendencies exhibited by time series variables are reported to be significant weaknesses in various studies (Khan et al., 1995). According to Granger and Newbold (1974), serious regression can be created if the Durbin-Watson statistic is exceeded by the adjusted coefficient of determination (R2), as one observation may influence another through a time lag (t-1, t-2, t-3, t-4…….t-k), because time series variables are nonstationary. Specifically, residuals correlated over time are indicated by a low Durbin-Watson statistic, but true relationship between variables is not necessarily indicated by high T2 in serious regression. When non-stationary time series data is used, autocorrelated residuals are exposed, so that non-stationary problems are revealed with a very low D-W statistic and a high adjusted R squared.

Granger and Newbold (1974) suggest first difference of data could be used to limit this problem, and this has been widely adopted by other researchers, so that a theory for changes

where model building includes both levels and changes is equivalent to a good theory that holds for levels, but not specific regarding time series properties for residuals. Therefore, time series variables should have a constant variance and constant mean to be observed as stationary before the ARIMA test is applied.

Other findings report that stationary data and non-stationary data present significant differences, such as there are permanent shocks to non-stationary time series, but only temporary shocks to stationary time series. Also, variance is time-dependent and there is no long-run mean for non-stationary data, but there is time invariant finite variance and a long-run mean for stationary series (Enders, 1995). As lag length increases, the small number of clear spikes produced diminishes in the correlogram of a stationary time series, so that autocorrelations remain around zero at various lags (Gujarati, 2003). This contrasts with non-stationary time series, as lag length increases, the initial very high values decrease slowly towards zero in the autocorrelation coefficient (Gujarati, 2003; Enders, 1995). In this current research study, plots and correlograms were first subjected to visual inspection of the variables of level and first difference to investigate the stationarity and pattern of the variables. This approach is supported in previous findings, which highlight the importance of determining the integrating properties when correlograms indicate variables with short time length (Hall, 1986).

The presence of a unit root should be tested by identifying whether there is a non-stationary time-series variable by using correlograms and time series plots (Harris, 1995; Enders, 1995), and the following model tests the unit root (Enders, 1995; Gujarati and Porter, 2003):

$$\mathbf{P_t = \rho P_{t-1} + \varepsilon_t \qquad -1 \leq \rho \leq 1} \qquad \mathbf{(4.5.2.1)}$$

Where the following conditions satisfy an independent white-noise process with a return time series $\{r\}_t$:

1. $E(r_t) = 0$
2. $E(r_t^2) = \sigma^2 < \infty$
3. $E(r_{t,} r_{t-j}) = 0 \forall j \neq 0$

Therefore, future realisations cannot be predicted, as no time pattern is shown, because there is a finite mean variance for a white noise process, and current realisations have no value. No correlation that is statistically different from zero, PACF or partial autocorrelations, ACF or mostly flat autocorrelation functions characterise a white noise process, because absence of autocorrelation is implied by independence. Financial econometrics inform

efficient market hypothesis assumptions, when the white noise process class can be ascribed to returns.

If ρ = 1, time series P_t is non-stationary, so that if regress P_t on P_{t-1} the estimated ρ is statistically equal to 1 (Gujarati, 2003). Alternatively, this is expressed by subtracting Yt-1 from both sides:

$$\mathbf{P_t - P_{t-1} = \rho P_{t-1} - P_{t-1} + \varepsilon_t = (\rho - 1)\, P_{t-1} + \varepsilon_t} \qquad \mathbf{(4.5.2.2)}$$

Therefore:

$$\mathbf{\Delta\, P_t = \gamma P_{t-1} + \varepsilon_t} \qquad \mathbf{(4.5.2.3)}$$

The first difference operator is represented when γ = (ρ – 1) and Δ (Gujarati, 2003). Testing the hypothesis takes the actual price to observe changes in price first difference by:

H0: ρ = 0 against H1: ρ < 0.

The test then regresses the ΔYt on Yt-1 to observe if estimated coefficient γ in the regression is equal to zero. If γ = 0, this means that ρ =1 and in this case the time series variable is non-stationary. If γ is negative (ρ must be less than one) the time series is stationary.

The existence of a unit root is also tested in three equations proposed by (Dickey and Fuller, (1979) :

ΔP_t is a random walk:

$$\mathbf{\Delta P_{it} = \gamma P_{it-1} + \varepsilon_{it} \quad e \sim IID\ (0, S^2);\ \ (No\ intercept\ and\ trend)} \qquad \mathbf{(4.5.2.4)}$$

ΔP_t is a random walk with drift only:

$$\mathbf{\Delta P_{it} = \alpha 0 + \gamma P_{it-1} + \varepsilon_{it} \qquad e \sim IID\ (0, S^2)\ \ (Intercept)} \qquad \mathbf{(4.5.2.5)}$$

ΔP_t is a random walk with drift and trend:

$$\mathbf{\Delta P_{it} = \alpha_1 + \gamma P_{it-1} + \alpha_2 T + \varepsilon_{it} \qquad e \sim IID\ (0, S^2);\ (Intercept\ and\ trend)} \qquad \mathbf{(4.5.2.6)}$$

Where,

- P is the share price.
- (α) = constant (Drift).
- (β) = (γ -1)
- t current time

- (ε) white noise error term.
- Δ is the first difference.
- t-1= time at t -1.
- T= Trend variable
- (β)= slope coefficient.

According to Gujarati (2003), random walk with time trend and intercept represents the third equation, random walk with intercept represents the second equation and random walk represents the first equation shown above. Random errors are not correlated, and normally shown with zero mean and variance σ2 { εt ~ ii(0,σ2) for t = 1, 2, ….}. The time series is stationary when γ < 0 and a unit root exists when γ = 0 as the null hypothesis.

Autocorrelation is eliminated when the dependent variable includes extra lagged terms that extends the unit root test process, because errors would not be white noise, as reported by Asteriou and Hall (2007) from a proposal by Dickey and Fuller, so that unit root exists when tested by the following equations:

$$\Delta P_t = \gamma P_{t-1} + \sum_{i=1}^{p} \beta i \Delta Y_{t-1} + \varepsilon_t \qquad (4.5.2.7)$$

$$\Delta P_t = \alpha 0 + \gamma P_{t-1} + \sum_{i=1}^{p} \beta i \Delta Y_{t-1} + \varepsilon t \qquad (4.5.2.8)$$

$$\Delta P_t = \alpha 0 + \gamma P_{t-1} + \alpha_2 T + \sum_{i=1}^{p} \beta i \Delta Y_{t-1} + \varepsilon t \qquad (4.5.2.9)$$

Deterministic elements of α2 and α0 are represented in this Dickey Fuller test. The lagged dependent variable coefficient is based on the value of t-statistics in the ADF test, where Akaike Information Criteria (AIC) AND Schwarz or Bayesian (BIC) is the basis for choosing the optimal leg length and the proposals of Schwert (1989) determine the maximum lag length. The critical value is compared with the calculated t value as a calculation to accept or reject the null hypothesis, and in macroeconomic variables is it often the case that variables are not stationary, but by taking the first difference (ΔPt = Pt - Pt-1) these can be made stationary.

According to Gujarati (2003), the conclusion of tests could be wrong if random walk with intercept is estimated as a basis for the test, if the true model is a random walk, so that the way that tests are conducted will influence results due to the sensitivity of DF types of tests. Therefore, this study attempts to overcome this limitation by checking the appropriateness

of each form and including an intercept and trend with the model for estimation suggested by(Dolado et al., 1990). Specifically, the model is re-estimated and insignificant terms are excluded when trend or intercept are statistically insignificant.

Whether test results can be shown to be robust, has a higher likelihood of confidence when using two or more forms of testing (Al-Khazali et al., 2006), and semi-parametric correction of time-dependent heteroscedasticity and serial correlation presents a different unit root test (Phillips and Perron, 1988). Chen et al. (2002) argue that nuisance serial correlations could be treated by applying P-P and ADF unit root tests and calculating the difference; however, models with a trend term and constant are least restrictive in the process suggested by Gilmore and McManus (2002).

Enders (1995) reports that error terms are heterogeneously distributed and weakly dependent in the generalisation of the DF procedures used in the PP test or Phillips Perron test, which applies the following equations:

$$\mathbf{P_t = \alpha^*_0 + \alpha^*_1 P_{t-1} + \mu t} \qquad \mathbf{(4.5.2.10)}$$

$$\mathbf{P_t = \alpha^*_0 + \alpha^*_0 P_{t-1} + \alpha^*2\,(t - T/2) + \mu t} \qquad \mathbf{(4.5.2.11)}$$

Where there is no requirement that the error term is serially uncorrelated, but the error term µt is such that Eµt =0, and T is the number of observations. The error process is shown to be less restrictive when ADF t-statistics are modified by Phillips-Perron t-statistics are taken into account (Enders, 1995; Asteriou and Hall, 2007). Doldado et al. (1990) suggest including trend and constant when the PP test is performed, and the PP test can also have critical values applied(MacKinnon, 1991).

The non-rejection of a unit root is shown to be a bias of the PP and ADF test statistics, when the data has structural breaks, so that within each period after and before the break, the series is stationary, and evidence of non-stationarity identifies a structural break. Therefore, this research study evaluates time series properties with a structural break included in the unit root test suggested by (Saikkonen and Lütkepohl, 2002), which is also supported by another study that when structural change is suspected to have occurred, special care must be applied when performing unit root tests (Enders, 1995).

4.5.3. An Autoregressive (AR)

General economic variables are characterised by high persistence that drives the AR model, but this is at a lesser extent for financial time series, so one term represents the AR process AR (1), is

$$\mathbf{r_t} = \boldsymbol{\delta} + \emptyset \mathbf{r_{t-1}} + \boldsymbol{\varepsilon_t} \qquad \textbf{(4.5.3.1)}$$

Where

r_t follows AR(1) or first-order autoregressive

- r_t the share price at time t
- r_{t-1} the share price at time t-1
- δ is the mean of r

ε_t is white noise or the uncorrelated random error term with zero mean and constant variance σ^2

ε_t is and i.i.id process, Ø is the AR coefficient, and δ is the constant. The value of Ø identifies alternative processes. When

1- Ø = 1 the process in (4.5.3.1) is a random walk;
2- Ø > 1 the process in (4.5.3.1) non-stationary;
3- Ø < 1 the process in (4.5.3.1) stationary.

An AR $_{(p)}$ Process is a generalization of the AR(1) PROCESS TO $_P$ lags, so that r_t follows an AR (1), stochastic process or first-order autoregressive process if the above equation is true:

Thus,

$$\boldsymbol{r_t} = \boldsymbol{\delta} + \emptyset \boldsymbol{r_{t-1}} + \emptyset \boldsymbol{r_{t-2}} + .. + \emptyset_P \boldsymbol{r_{t-P}} + \boldsymbol{\varepsilon_t} \qquad \boldsymbol{\varepsilon_t} \sim (0, \sigma^2) \qquad \textbf{(4.5.3.2)}$$

Where ε_t follows a Gaussian distribution as a white-noise process with a mean of 0 and a constant variance σ^2,Ø is the AR coefficient, and δ is the constant (accounting for the long-run mean).

4.5.4.Moving Average (MA) Model (Residuals)

This model does not only apply shocks that occur at previous times and at time t, but also at random variable time t, and the order of the process is defined by a number of significant lags. The assumption of MA is that when an economy experiences negative shocks, financial institutions normally have expectations that this negativity influences current market

movements and those in the near future. Therefore, a variable and residuals from a previous period are applied by MA models to explain any likely relationship of these residuals, one term describes the MA process, MA(1), and is defined as

$$\boldsymbol{r_t = \mu + \theta\varepsilon_{t-1} + \varepsilon_t} \qquad \mathbf{E}\ (\boldsymbol{\varepsilon_t}) = \mathbf{0},\ (\boldsymbol{\varepsilon_t}) = \boldsymbol{\sigma^2} \qquad \textbf{(4.5.3.3)}$$

Where $\boldsymbol{\varepsilon_t}$ is a white noise process with constant variance σ^2 and mean 0, t is the time, θ is the coefficient for the lagged error term in time t-q, μ is the constant and $\theta\varepsilon_{t-1}$ is the moving average of previous error terms.

The (MA) Process can be generalised to an MA (q) process including q lags:

$$\boldsymbol{r_t = \mu + \theta_1\varepsilon_{t-1} + \theta_2\varepsilon_{t-2} + \ldots + \theta_q\varepsilon_{t-q} + \varepsilon_t} \qquad \textbf{(4.5.3.4)}$$

Where $\boldsymbol{\varepsilon_t}$ is the white noise process with a constant variance of σ^2, and a mean of 0.

4.5.5.The ARIMA Model

Time series can be forecasted with the general class model known as ARIMA (p, d, q), which includes moving average components and autoregressive components, where moving average components are represented by q, differencing factor is represented by d, and autoregressive components are represented by p within differencing transformation, so that to adopt the appropriate model, the values of q, d and p need to be determined.

ARIMA does not construct a single equation model or a simultaneous equation model, but applies a unique approach of analysing an economic time series with a focus on probabilistic elements or stochastic elements that is used to produce clear data. Unlike regression models, the Box Jenkins method explains stochastic error terms and Pt-1 by use of past or lagged values, and Gujarati (2009) describes ARIMA as an atheoritic model. Autoregressive models apply k to forecast the current value based on number of periods in the past, and p is a function of past values, such as Pt-1, Pt-2, ..., Pt-k, so that the current value of the time series, Pt is the basis of this concept. This explains that current values of a time series compared with previous values of the series creates a linear regression as the basis of AR models. Therefore, when a time series of prior values of shocks or white noise is compared with current values, the linear regression is defined as a MA model, and integrated order is defined as I.

When processes need to be represented that are non-stationary or stationary, Box Jenkins models are often used, as stationary ARMA, MA or AR cannot directly be applied if a time series is not stationary. The use of differencing technique is used to make non-stationary time series stationary, so that after differencing d times, an ARMA(p, q) model becomes an

ARIMA(p, d, q) model, so that d times apply differencing technique. Therefore, the ARIMA model meets the demands of a unit-root non-stationary process, where I stands for integrated order formed from the ARMA model, and when the time series is not stationary, so that autocorrelation structure in the data helps to describe stationary time series in the ARIMA model. This means that fitting an ARMA model of first-difference data that is on returns (Pt –Pt-1) is the same as fitting an ARIMA model on the log-prices Pt. When differenced series, Rt = Pt – Pt-1 is applied in an ARIMA(p,1,q) representation, this follows a time series Pt and follows the stationary and invertible ARMA(p,q) model.

It is normally expected that the forecasts of traders would be similar to market forecasts, but there should be no process for traders to beat the market on a systematic basis. Section 4.5.2 explains how a sample is formed from normal distribution from first differences in a random walk series, so that Pt - Pt-1 =ϵ, with ~ (0,σ) 1. With no constant term, this describes the ARIMA (0,1,0) model, but when 0 is used as a non-zero constant term, there is an indication that previous data has no information that could be used to predict future expected values. In contrast, illiquid assets tend to reflect slower price adjustment to new releases, so some assets could reflect some level of autocorrelation, and Chan (1993) suggests that compared with single stocks, autocorrelation properties provide more characterisation of stock indexes. This study examines the factors of current errors, past errors and past changes in prices influence change in price series by applying Box-Jenkins ARIMA models.

These findings provide validation for this study to investigate comparisons between actual observed values of share price and expected value of share price from a random process, investigate serial dependence in share price movements and test the randomness of the series with the ARIMA model. A previous study explains that observed time series is generated by the stochastic process of the ARIMA model (McCleary et al., 1980).

According to (Ismail et al., 2009), there are many advantages for researchers in using the ARIMA time series model, because the adjacent error terms are usually correlated in time series data, so that this is more often selected to investigate time series data than ordinary least square regression methods. There is an estimated bias for standard errors of ordinary least square parameters because covariance of error terms does not equal 0, so conclusions could be unfounded, and t statistics could be significantly overstated (McCleary et al., 1980)There are statistic controls of serial dependence within the ARIMA model. ARIMA has another advantage, because it can form a stationary time series from a homogeneous non-

stationary time series by applying an accurate degree of differencing, so that it can describe various non-stationary time series (Ismail et al., 2009). ARIMA also takes account of seasonality, systematic trend and random error, also known as noise, as these factors often obscure any intervention, and present another advantage for its adoption (McCleary et al., 1980).

Table 4. 1 Meaning of ARIMA model lag

In ARIMA (p,0.0) means purely AR(p)	p= the number of autoregressive terms
ARIMA(0,d,0) supports the (RWM)	d= to be different before it become stationary.
In ARIMA (0,0.q) means purely MA(q)	q= The number of MA terms.

Source: Interrupted Time Series Analysis (McCleary et al., 1980)

4.6.ARMA and the Box-Jenkins (BJ) Methodology

ARMA(p,q) is an ARMA model that combines p autoregressive terms and q moving average terms, but all properties of financial time series cannot be captured by an MA process or an AR process, and both have characteristics of r, and known as ARMA, and the process of ARMA(1,1) is expressed as:

$$\boldsymbol{r_t = \delta + \emptyset r_{t-1} + \varepsilon_t + \mu + \theta \varepsilon_{t-1} + \varepsilon_t} \qquad \textbf{(4.6.1)}$$

where $\boldsymbol{\varepsilon_t}$ is a white noise process with a constant variance σ^2 and mean 0 and shares properties from AR and MA processes. With

$|\emptyset| < 1$ being the stationarity condition.

$|\theta| < 1$ being the inevitability condition.

A generic ARMA (p,q) model id is identified by p and q, in the order of the AR and MA components, respectively:

$$\boldsymbol{r_t = \delta + \sum_{i=1}^{p} \emptyset_i r_{t-i} + \sum_{i=1}^{q} \theta_j \varepsilon_{t-j} + \varepsilon_t} \qquad \textbf{(4.6.2)}$$

There are four steps involved in the ARIMA model that are explained below:

1. Model and identify very low values of q and p for stationary time series, and determine values of q, d and p with the principle of parsimony with a correlogram and partial correlogram.
2. Estimate the ϕ and θ parameters with a maximum likelihood estimator from a least squares approximation.

3. Check diagnostics to achieve an accurate model by repeating the complete process, so that revisions and checks can define the adequacy of the proposed model.
4. Produce forecasts (Gujarati, 2009).

4.6.1.Find Order of (p, q): Identify Model

Stationary variables are used as factors to determine the order of the ARMA model, and this is then identified by PACF or partial autocorrelation function and ACF or autocorrelation function that play important roles in this process. Analysis uses the statistical methods of (BIC) or Baysin information criterion, (AIC) or Akaike information criterion and residual analysis as a basis for selecting the model.

4.6.2.ACF or autocorrelation function, PACF or partial autocorrelation function

The researcher use ACF and PACF to identify the ARMA model. Thus, The covariance between past values and current values is related to the distance between the two time realisations, k in a weak stationary process (Boffelli and Urga, 2016).

$$\boldsymbol{\rho_k} = \frac{\mathbf{Cov(r_t, r_{t-k})}}{\sqrt{\mathbf{Var(r_t)}}\sqrt{\mathbf{Var(r_{t-k})}}} = \frac{\mathbf{Cov(r_t, r_{t-k})}}{\sqrt{\mathbf{Var(r_t)}}} = \frac{\mathbf{Cov(r_t, r_{t-k})}}{\mathbf{Var(r_t)}} \qquad \textbf{(4.6.2.1)}$$

Where,

ρ_k Autocorrelation coefficient of time series.

r_t the return at time t.

r_{t-k} the return after k lags.

$Cov(r_t, r_{t-k})$ the covariance between the two return.

$Var(r_t), Var(r_{t-k})$ the variance on return over time period (t, t-k).

The estimation of (1.3) at generic log k is given by

$$\widehat{\boldsymbol{\rho_k}} = \frac{\sum_{t=k+1}^{T}(r_t-\bar{r})(r_{t-k}-\bar{r})}{\sum_{t=1}^{T}(r_t-\bar{r})^2} \qquad \textbf{(4.6.2.2)}$$

In contrast, the following gives the partial autocorrelation for the process $\{r\}_t$

$$\boldsymbol{\pi_k} = \frac{\mathbf{E(r_t r_{t-1} | r_{t-1}, \ldots, r_{t-k+1})}}{\mathbf{var(r_t)}} \qquad \textbf{(4.6.2.3)}$$

ACF and PACF differ irrespective of observations that occur between (t-k) and t, in that PACF measures existing linkage between a generic lag(t-k) and time t. Therefore, there is a pretence of being blinded about what happens between t and (t-k), because the value of covariance between (t-k) and time t given $r_{t-1}, \ldots, r_{t-k+1}$, the expected value of the numerator is 1.5,

which means that for the time structure of the time series, there is additional contributions for each lagged value, and this additional information is provided by the PACF. This shows that the linear relationship between process at time t and (t-k) is measured by partial autocorrelation, so that within an ARMA model, PACF and ACF decal exponentially. To summarise, sample PACF graphs and sample ACF graphs can be used to initially identify an ARMA model, which is explained in Table 4.2.

Table 4. 2Criteria of Identifying the Model Based on the ACF and PACF

Process	Autocorrelation function	Partial autocorrelation function
AR(p)	Autocorrelation die out	Partial autocorrelation cut off after the first **p** lags
MA(q)	Autocorrelation cut off after the first **q** lags	Partial autocorrelation die out
ARMA(p,q)	Autocorrelation die out after first **q-p** lags	Partial autocorrelation die out After first **p-q** lags

Source: Introduction to Time Series using Stata (Becketti, 2015)

4.6.3.Akaike and Baysin information criteria

The researcher used BIC criteria and AIC criteria as a more detailed model selection criteria to discover the best order of (p,q), as well as using PACF and ACF to identify an ARMA model. The information of (Akaike, 1973) is bias corrected in the AIC criterion version and is defined by

$$\textbf{AIC} = -2\frac{In\ L}{T} + \frac{2}{T}K \qquad \textbf{(4.6.3.1)}$$

$$\textbf{BIC} = -2\frac{In\ L}{T} + \frac{In(T)}{T}K \qquad \textbf{(4.6.3.2)}$$

Where in the estimated model of log likelihood between the two models, the length of the times series is T and the number of parameters is k, and simultaneous characterisation of fewer parameters and higher log likelihood determines the one that should be selected, so that the one with the lowest information criteria is always the best model (Boffelli and Urga, 2016).

4.6.4.ARIMA Model: Estimation

When a suggested model is selected, parameters should be estimated.

4.6.5.ARMA Model: Testing

The model requires a significant test, so that when all sample information has been sampled and tracked by the established model, white noise is the residual error, but if the model does not track out all the information, and some is left in the sample, then the fitted model is insufficiently efficient. To overcome these limitations, the researcher tested for white noise by adopting the Portmanteau (Quirchmayer et al.) test, where a white noise process determines distribution of residuals, and a null hypothesis results, and formula is shown as:

$$\boldsymbol{Q^*(m) = T(T+2)\sum_{k=1}^{m}\frac{\hat{\rho}_k^2}{T-k}} \qquad \textbf{(4.6.5.1)}$$

Which is distributed as x_m^2 under

- H_0= ρ_1=.... =ρ_m= 0
- H_1= $\rho_k \neq 0$

Where T is the length of the time series, k is the number of parameters and m is the number of coefficients estimated in the model, based on chi-squared distribution with m-q degree of freedom, because Q*(m) is asymptotically distributed as x_{m-q}^2.

4.6.6.ARMA Model: Prediction

The intention is to obtain prevision at time t+k, that is, r_t +k, where k >= 1 is the forecast horizon, so this step is at time t and known as forecast origin.

Given an ARMA (1,1) we have

$$\boldsymbol{r_t = \delta + \emptyset r_{t-1} + \varepsilon_t + \mu + \theta\varepsilon_{t-1} + \varepsilon_t} \qquad \textbf{(4.6.6.1)}$$

Only one step forecasting is considered.

$$\boldsymbol{E(r_{t+1}|I) = \delta + \emptyset r_t + \theta\varepsilon_t} \qquad \textbf{(4.6.6.2)}$$

At the forecast horizon k=1, the information set is I.

At time horizon k, the forecast is generalised as

$$\boldsymbol{E(r_{t+1}|I) = \delta(1+\emptyset) + \emptyset^k r_t + \emptyset^{k-1}\theta\varepsilon_t} \qquad \textbf{(4.6.4.2.3)}$$

Under the stationarity condition $|\emptyset|$<1 and for k→ ∞, the forecast has a tendency towards the unconditional mean of the series δ/1-∅.

4.7. Error Metrics applied:

4.7.1. Overview:

Various models and methods of forecasting may result in varied forecasted values and each methodology requires different means of assessment. (G. C. Wang and Jain, 2003) Wang, et al, (2003), recognizes some of these forecasting models which are practiced customarily: Logistic Regression: Linear Regression, Auto regression and Auto regression Moving Average (Nassirtoussi et al.). The groundwork of this thesis is based on Auto Regression Integrated Moving Average (ARIMA) model. However, the error metrics help us determine the precariousness of a forecast model or method. Due to this, it is noteworthy that the efficacy of any prediction system relies heavily on choosing proper metrics. Likewise, the traits of the object of concern along with the characteristics of performance metrics should be apprehended before selecting a suitable model for the application of metrics to particular circumstances. Moreover, Complex metrics are not the first priority of any practitioner, since these procedures can complicate a forecast. For example, financial forecasting is complicated and decisions depend upon motivation and explanations. Thus a good error metric would be easy to decrypt.

The caliber of a prediction method can be assumed by applying numerous metrics. Hyndman and Koehler (2006) noted that absolute errors or squared errors are more popular for scale-dependent calculations. These include Mean Square Error (MSE), Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Median Absolute Error (MAE). However, The purpose of this thesis is to deduce metrics in accordance to prediction method to tackle the time series. This can be achieved by understanding the stock market with regards to measurements. Hence, when considering the stock market, the relative efficient market is concerned with two things: firstly, to govern the difference between the forecasted values and actual values, secondly, to check the strength of the linear relationship between dependent and independent values.

Resolution of a suitable metric which abides by the above prerequisites of the stock market is possible if the primary aspects of good metric are realized. The equations which present the difference between the actual and predicted value are called as Error metrics. The value of outcome from comparing the forecasted values to the actual values is the deciding factor a model's performance. If the outcome is minimal, this would mean that the forecast model

is dependable for the given circumstances and is an efficient instrument for predicting future movements. Thus, Mean Absolute Error (MAE), Mean Square Error (MSE), Root Mean Square Error (RMSE) and Mean Absolute Percent Error (MAPE) are used to evaluate the performance of these prediction models. These are efficient means of prognosis for movement and the assessment of share price and indices. Formula of these evaluation measures are shown in below:

Mean Absolute Error (MAE):

$$\text{MAE} = \frac{1}{N}\sum_{I=1}^{N}\frac{|P_t - \hat{P}_t|}{P_t} \quad (4.7.1)$$

Mean Square Error (MSE):

$$\text{MSE} = \frac{1}{N}\sum_{I=1}^{N}(P_t - \hat{P}_t)^2 \quad (4.7.2)$$

Root Mean Square Error (RMSE):

$$\text{RMSE} = \sqrt{\frac{1}{N}\sum_{I=1}^{N}(P_t - \hat{P}_t)^2} \quad (4.7.3)$$

Mean Absolute Percent Error (MAPE):

$$\text{MAPE} = \frac{100}{N}\sum_{I=1}^{N}\frac{|P_I - \hat{P}_I|}{P_I} \quad (4.7.4)$$

Where N is the number of forecasting periods, Pt is the actual stock price at period t, and $\hat{Pt}$ is the forecasting stock price at period t.

4.7.2.Performance Evaluation Metric:

This research involves the evaluation of performance of the prediction model, this would be achieved by studying three indices from GCC market involving five individual companies from Saudi stock market. There are four common errors involved in achieving this, which are the Mean Absolute Error (MSE), Mean Square Error (MSE), Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). Varied time series and various samples are applied

across varied error metric methods, and the results are compared so as to assume their accuracy.

"Each of these measures have their relative advantages and disadvantages. The MAE has no scale by which they can be relatively measured. The MAPE is somewhat scale dependent that when forecasting very low values or integers such as a none or two- the size of the measure is easily inflated to 100% or more. Therefore, when using the MAPE, it is important to accompany it with the MAE to provide a sense of balance"(Yaffee, 2010) in addition to the issue with RMSE, when large positive errors are divided over larger negative errors, the result may be approaching 0; MAE is used in place of RMSE in such a case. RMSE may be used when large errors are not valuable. RMSE imparts high weightage to large errors through the squaring process. It responds drastically to the infrequent large errors when squared (Decision 411, 2010). All the differences are weighed equally in MAE. On the other hand, RMSE will always be larger than or equal to MAE. Therefore, for a given set of forecasts, the two can be utilized together to derive the variation in the errors. The RMSE and MSE are more sensitive to outliers than MAE. However, they have been common, because of their theoretical relevance in econometrics modelling. (Jon Scott Armstrong, 2001).

MSE results in squared errors and the resultant will always be a squared value, thus RMSE is preferred over it. RMSE provides a more accurate forecast as square rooting the resultant reverses the effect of squaring the errors and the result is not exaggerated. On the other hand, (Willmott and Matsuura, 2005) gave preference to MAE over RMSE terming it a better metric for the purpose of Average Error and argued that RMSE could result in a deceptive result. However, model evaluation studies frequently utilize both methods. The arguments put forth by Willmott and Matsuura (2005) and Willmott et al., (2009) cannot be disagreed with, but RMSE cannot be ignored completely. Even though the researchers in the above mentioned study employed MAE over RMSE to provide a representation of their model evaluation statistics, MAE presents an underrated resultant effect making it least favourable in the various aspects like decision making. For that purpose, (J Scott Armstrong and Collopy, 1992) Scott and Armstrong and Collopy (1979) proposed using Mean Absolute Percentage Error (MAPE) which is capable of giving a close percentile representation for decision making. It is dependable and outliers are prevented in applying this error.

MAPE was employed as a primary measure in the M-competition (Makridakis et al., 1982). Hanke (1995) and (Bowerman et al., 2004) are some of the numerous literatures that support

the use of MAPE. Percentage Errors are used in differentiating between a varied set of forecast performance data. It is one of the most widely practiced evaluations metric for forecasting due to its scale independent nature (Klimberg et al., 2010). On the downside, MAPE has been criticized for not being the best means for decision making; however, they provide an accurate magnitude of the movement. Makridakis has been a noted critic of the use of Percentage Errors. Makridakis et al., (1998), along with Wheelwright and Hyndman (1998), avoided using MAPE in particular situations. It was observed that MAPE tends to apply a heavier penalty on positive errors than on negative errors. This lead to the use of "symmetric" measures(Makridakis, 1993). Ord and Fildes (2013) recommended the use of MAPE in exclusive circumstances when the values are bigger than zero. This is the most prominent drawback of applying this error. Furthermore, Makridakis in 1998 noted that Percentage Errors are capable of drawing a meaningful zero. This draws a hindrance in evaluating percentage errors when time series includes zero (Fildes et al., 1998). This applies to situations with time series values which are negligible or approaching zero. In such a case, assuming the percentage error serves no purpose.

4.8.Conclusion:

The proposed ARIMA model as shown in this section was to test various time series and different sub-sample in order to forecast the share price and the index. Moreover, five different error metrics are considered for the evaluation of forecasting models. Four indices, MAE (mean absolute error), MSE (mean square error), MAPE (mean absolute percent error), and RMSE (root mean square error), were used as measures of forecasting accuracy. The forecasting ability of the models is found at different steps i.e. pre-event and post-of-samples. It is also found for multiple horizons. Moreover, the forecasting value was compared to the actual value data, and the error is calculated in order to find the difference with different series and times. Therefore, the error rates are measures of the deviation between the actual stock prices and predicted stock prices from the experiments. Error metrics are the mathematical equations used in this study as measures of forecasting accuracy. The smallest value is not supportive the weak form efficiency. A higher degree of weak-form market efficiency is indicated by more frequent price deviations from higher value.

Chapter 5.Variables and data under study

5.1.Variables Data and Sources

The focus of this research is on secondary data and daily time series in order to provide an empirical analysis through a quantitative skills approach. The unit of analysis is the historical stock price, with quantitative analysis used to test and compare the multiple time series. Historical stock prices over the past twelve years from 1/Jan/2005 to 31/Dec/2016 were downloaded to an Excel sheet and transferred to STATA software. Three emerging economies and five individual companies are included in the sample, which includes three GCC stocks markets based in Saudi Arabia (SSM), Dubai (DSM) and Kuwait (KSM) and a sample of five companies have been selected from the Saudi Stock Exchange: SABIC, STC, NCCY, Al Rajhi Bank and Electricity Company.

The availability of data determined the choice of markets, together with their relatively large market size, and anticipated economic and financial linkages between these markets. However, Since the market is too uneven and large, not all sectors or companies listed in the SSM, KSM, DSM could be used. In order to give an equal size time-series for each company and sector, a sample is drawn from the population, with the results generalized for the entire population. All relevant data for the Saudi stock market was obtained from the Saudi Stock Market Authority and the Tadawul Company. Data for the Kuwaiti stock market was available for download from its main website. Data for The Dubai Stock Market was downloaded from the ARGAM website. The sample size for the constituents are showing in table 5.1.

Table 5. 1: Sample under study

	Stock market	Country	Index	Period from	Period to
1	Saudi	Saudi	TASI	01.01.2005	31.12.2016
2	Dubai	UAE	DFM	01.01.2005	31.12.2016
3	Kuwaiti	Kuwait	KWSE	01.01.2005	31.12.2016
5	SABIC	Saudi	SABIC	01.01.2005	31.12.2016
6	STC	Saudi	STC	01.01.2005	31.12.2016
7	Electricity company	Saudi	Electricity	01.01.2005	31.12.2016
8	AL Rajhi Bank	Saudi	Al Rajhi Bank	01.01.2005	31.12.2016
9	The Company for Cooperative Insurance (Tawuniya)	Saudi	NCCY	13.01.2005	31.12.2016

5.2. Descriptive Variable

To investigate the fluctuations in the SSM, KSM and DSM; for individual companies and fluctuations in GCC stock markets for stock market returns, the time interval was represented by the independent variable. The general index and the stock price change was represented by the dependent variable, and the dummy independent variable represented all other variables.

The dependent variable is represented by t for change in time, and to resolve the issues of heteroscedasticity, variables were changed into a form of logarithm, after which stock market prices were calculated for first differences within natural logarithms. The following formula explains the calculation when local currency denominations are reflected in stock price indices that inform the nominal log returns:

$$\mathbf{R_{it} = Ln \frac{P_{it}}{P_{it-1}}} \qquad \textbf{(5.2.1)}$$

Where the natural logarithm is represented by Ln, the index price level for the previous day is represented by Pit-1 and the index price level in day t is represented by Pit index i in day t return is represented by $\mathbf{r_{it}}$. Continuously compounded rates are produced by converting data by using log transformation instead of using discrete compounding.

The independent variable uses one previous time interval period change (lag 1- ∞), and the researcher analysed the previous twelve years of time cycles in GCC stock market movements to discover the potential of a long term memory that could be persistent, and evaluated regression statistics and correlation statistics to reveal any relationship between the independent variable and the dependent variable with multiple time series.

The dummy independent variable represented all other variables that including first, Reforms that took place from 01-01-2005 to 31-12-2010. Second, Financial Crisis, which includes the internal crisis that took place in 2006 and the international financial crisis that occurred in 2008. Thirdly, financial Liberalization or Effects of foreign investors on domestic stock markets that occurred in 2008 for Saudi stock market.

5.3. Hypothesis and objective:

The aim of this research is to contribute to the debate in relation to the market efficiency of one of the emerging markets, namely (Saudi, Dubai and Kuwaiti) and the individual companies

of Saudi stock market (SABIC, STC, NCCY, Bank al Rajhi and Electricity Company). The Objective of the study is:

1. To test the absolute weak-form efficiency of stock market
2. To assess the Relative Weak-form Efficiency of Stock Markets
3. To discover the influence of the Effect of Major Events on Weak-form Market Efficiency:

A. Reforms of Saudi stock market.

B. The Occurrence of GCC Stock market Crisis.

C. The Occurrence of Global Financial Crisis.

D. The financial Liberalization.

Therefore, this research explore the stock movements randomness from 2005-2016 and assessed the degree of market efficiency by determining the fractional dimension of stock price changes from January 2005 to 2016 by testing the pre- and post-stock market- reforms periods, Financial crisis and financial liberalization in the below the six hypotheses.

Hypothesis 1: Test the absolute sense of weak form efficiency:

- $H1_0$: SSM stock market returns follow a random walk.
- $H1_1$: SSM stock market returns do not follow a random walk.

Hypothesis 2: Test the relative of the weak form efficiency:

- $H2_0$: There is no difference between GCC market on level of the market efficiency
- $H2_1$: There is difference between GCC markets on level of the market efficiency.

Hypothesis 3: Testing the impact of reform of Saudi stock market

- $H3_0$: The reforms have significant effect on the degree of the market efficiency.
- $H3_1$: The reforms have no significant effect on the degree of the market efficiency.

Hypothesis 4: Testing the impact of Financial Crisis 2008

- $H4_0$: The financial crisis in 2008 has significant effect on the degree of the market efficiency.
- $H4_1$: The financial crisis in 2008 has no significant effect on the degree of the market efficiency.

Hypothesis 5: Testing the local of Financial Crisis 2006

- $H5_0$: The financial local crisis in 2006 has significant effect on the degree of the market efficiency.
- $H5_1$: The financial local crisis in 2006 has no significant effect on the degree of the market efficiency.

Hypothesis 6: Testing the financial liberalization 2008

- $H6_0$: FDI has significant effect on the degree of efficiency in Saudi stock market.
- $H6_1$: FDI has no significant effect on the degree of efficiency in Saudi stock market.

The hypothesis will test whether they are accepted or rejected. In addition, the researcher spilt the observations into three categories: estimation window, event time and post event window. The table 5.2 below displays a summary of the group under study.

Table 5. 2: Illustrate the groups under study.

Hypothesis	Group	Dependent Variable	Independent Variable (Time period)	Objective
Hypothesis 1	Group 1	General index and stock price change (return)	Jan. 2005 – Dec. 2016	Absolut weak form efficiency
Hypothesis 2:	Group 2	General index and stock price change (return)	Jan. 2005 – Dec. 2016	Relative efficiency
Hypothesis 3:	Group 3 Group 4	General index and stock price change (return)	Pre (Jan.2005 to Dec.2010), Post (Jan.2011 to Dec.2016).	Reforms periods
Hypothesis 4:	Group 5 Group 6 Group 7	General index and stock price change (return)	Pre(Jan. 2005 – Dec. 2005) During (Jan. 2006– Dec. 2006) Post (Jan. 2007 – Dec. 2007)	Financial crisis local
Hypothesis 5:	Group 8 Group 9 Group 10	General index and stock price change (return)	Pre(Jan. 2005 – Dec. 2006) During (Jan. 2007 – Dec. 2008) Post (Jan. 2008 – Dec. 2010)	Financial crisis international
Hypothesis 6:	Group 11 Group 12	General index and stock price change (return)	Pre (Jan. 2005 – Dec. 2007) Post (Jan. 2009 – Dec. 2011)	financial liberalization

Source: Author

Table (5.2) shows groups under study In terms of testing the research hypotheses, the table contains summary of 12 time series that were tested in this study and six hypotheses were designed corresponding to the research question. The first hypothesis to test if there are differences return between the Saudi general indexes and for the all-share price index for

DSM, KSM and the individual companies. This study perform tests for the full period for the absolute sense of weak form efficiency, in order to explore if the time series follow a random walk during the 12 year time period from January 2005 to December 2016. This test applied the same test of hypothesis on KSM and DSM. In addition, applied to the five individual companies that have been selected from the Saudi Stock Exchange: SABIC, STC, NCCY, Al Rajhi Bank and Electricity Company.

The first hypotheses, this study perform tests for the full period from 2005 to 2016 for the absolute sense of weak form efficiency, in order to explore if the time series follow a random walk

The second hypotheses is the same test as hypothesis one above except that it relates to assessing the Relative Weak-form Efficiency of Stock Markets from Jan 2005 to December 2016.

The third hypotheses is a similar test as the second, but the researcher spilt the observations into two categories for the reforms (estimation window, post event window); In order to determine the degree of improvement of the efficiency on stock market. It should mentioned that, the researcher spilt the time series into two equal number of categories for the reforms period, to explore if the reform period coincide with a significant change in the level of the market efficiency. Thus, The pre-reforms period (Jan.2005 to Dec.2010), and the post reform period (Jan.2011 to Dec.2016). In order to explore whether during the 6 years of reforms, the Saudi stock market had positive effect on information's efficiency and became more efficient. The research goes further to then determine the degree of improvement of the efficiency on stock market.

The fourth and the fifth hypotheses are similar tests to the third, but the researcher spilt the observations into three categories for the global financial crisis and GCC stock market crisis. Three categories for financial crisis 2008 and local crisis 2006: (estimation window, event time, post event window). Therefore, The time series for the Global Financial Crisis into three categories that pre crisis (Jan.2005- Dec.2006), during crisis (Jan.2006 to Dec.2007) and post crisis (Jan.2007 to Dec.2008). However, the GCC stock market crisis are pre-crisis (Jan.2005-Dec.2006), during-crisis (Jan 2007 to Dec.2008) and post-crisis (Jan2009 to Dec.2010). From psychology perspective investors are generally swamped by panic in the chaotic financial environment this will lead to adversely affect their ability to price stocks then to the level of efficiency. In addition, financial crisis do arise in historical data but if investors learn from past

price history. This financial crisis will gradually erode through time. Therefore, this study explore the issue of whether the crises on SSM, KSM, DSM and the companies that were chosen from the Saudi stock market has significant effect on the degree of efficiency.

Sixth hypotheses, for financial liberalization the first categories from (Jan.2005 to Dec.2008), and the second categories from (Jan.2009 to Dec.2011). The aim is to explore the issue of whether the opening of Saudi stock market and the individual companies to foreign investors has a positive effect on the state of information efficiency before and after the official year of liberalization in 2008 for Saudi stock market and the sample chosen form Saudi stock market. It should be mentioned that the general index change (for countries) and the stock price change (for the individual companies) was represented by the dependent variable, and the independent variable is the interval time, and the dummy variable is the Reforms period that occurred from 2005-2011, financial crisis 2008, local crisis 2006 and financial liberalization 2008. This research tested the stock movement randomness from 2005 to 2016 and various sub-samples.

5.4.Justification for Selecting the Countries and the Companies

The Saudi Stock Market was chosen, because it is the largest stock market in Arab countries and the Middle East, and Kuwait because it is the oldest market regulated in the GCC. Dubai links the West and East, and is also considered an important financial center. Therefore, the comparison of the efficiency of the Saudi Stock Market with these other markets should find differences and factors that could affect the efficiency of the market. Moreover, The index of Dubai and Kuwait was compared with the Saudi Stock Market, because of the importance of such markets, especially when considering the economic conditions in Middle East countries. Generally speaking, the GCC has recorded high economic growth rates, low rates of poverty and unemployment, and higher levels of productivity. In addition, and especially in the last ten years, the GCC had a good level of technological progress, quality in education, and public accountability. Saudi Arabia, Kuwait and Dubai have similar economic resources, demographic and society, so that these markets have the similar conditions and circumstances in their countries. Thus, the differences in efficiency between these stock markets could reveal the factors that affect their efficiency.

The reason for the focus on Saudi companies is it that would offer an effective out-of-sample test of market efficiency. There are five main reasons for choosing this option, which are

outlined here. Firstly, Saudi is in the forefront of the Arabian and Middle Eastern stock markets, so it should be a good representative of market activity during the relevant period. Secondly, there are large differences in terms of types of investor between the Saudi stock market and those of America and Europe, which makes for interesting research. The third reason concerns the number of investors in the Saudi market, 4.67 million, many of whom are individual domestic investors new to stock market trading. This contrasts sharply with similar investors within established American and European markets.

The fourth reason for my decision to study the Saudi stock market is its comparably recent development, which has brought greater integration with outside markets. In addition, investment anomalies may more easily arise in such a youthful market. Finally, following the worldwide economic crises of 2007 and 2008, and the reform of stocks between 2005 and 2011, the Saudi market experienced a higher level of liquidity and market share, as well as an increase in the number of participating stock market businesses.

Five Saudi stock market companies across several industry sectors were chosen to provide a broad-based sample of the market as a whole, thereby enabling a valid estimation of market efficiency. Samuelson's (1998) argument that the efficient markets hypothesis is more effective when individual shares are used, rather than the aggregate stock market index, forms the basis for the choice of samples used here.

The Saudi Stock Market are SABIC, STC, Tawuniya and Electricity Company and were chosen as representatives of the Saudi Stock Market from different sectors. In in particular, Bank and financial services were included since emerging markets are usually dominated by banks. Thus, there is much significance of banks index for this study, although this comprises of various banks having different structures, such as conventional banks and Islamic banks. This is a significant sector since stock markets and banks are correlated. The researcher selected Al Rajhi bank as a big company and the small and new company included the NCCY. Through this, the efficiency between small and large company of the Saudi Arabian Stock Market could be compared.

5.5.Sampling frame and Descriptive data

In this section, the researcher ran time plot for the 8 time series, the 12 year Daily reports were collected from the first group (SSM, DSM and KSM) for the period of 1 January 2005 to 31 December 2016, excluding periods of holidays, which gave 2935, 3062, and 2953

observations daily for each country respectively. The second group sample from (SABIC, STC, NCCY, Al Rajhi Bank, Electricity Company) ran from 1 January 2005 to 31 December 2016, excluding holidays, which provided 3059, 3059, 3045, 3059, 3059 daily observations respectively. Only the trading on the TAWUNIYA closing price (NCCY) was started in 13/1/2005, allowing for 14 observations to be missing; therefore, total returns will not be in alignment with other companies. The size of the sample is large enough to allow for small sample deficiencies. Through the graphs, the researcher gained insight on trend outliers and periodicities. The researcher examined the mean, standard deviations, variance, skewness, and kurtosis then conducted normality test called the Bera-jarque and probability on the data in selected time periods. The graph below illustrates daily movements in the SSM, DSM and KSM and for the individual companies (SABIC, STC, NCCY, Al Rajhi Bank, Electricity Company).

Figure 5. 1: The movements plot in the SSM price index

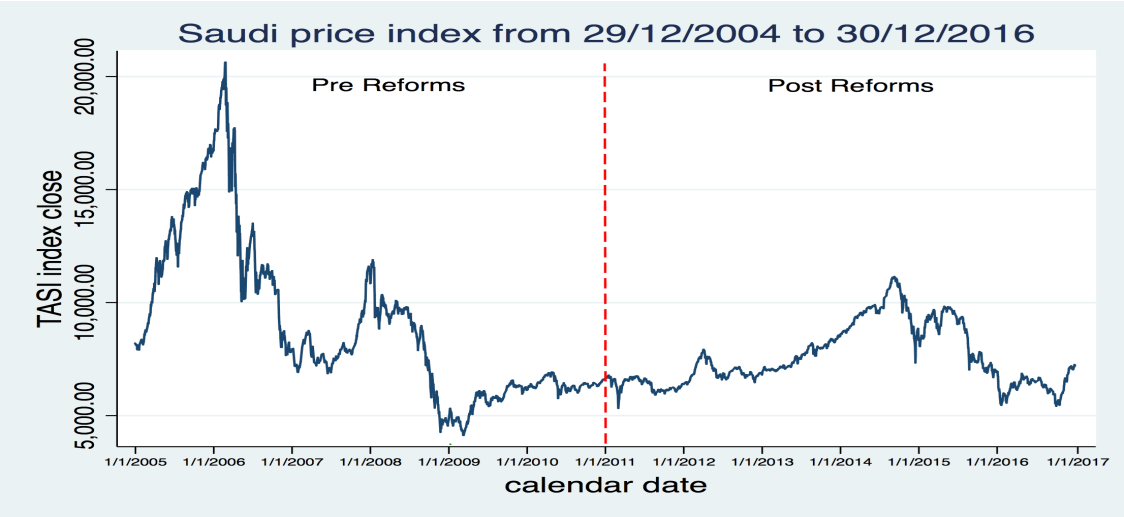
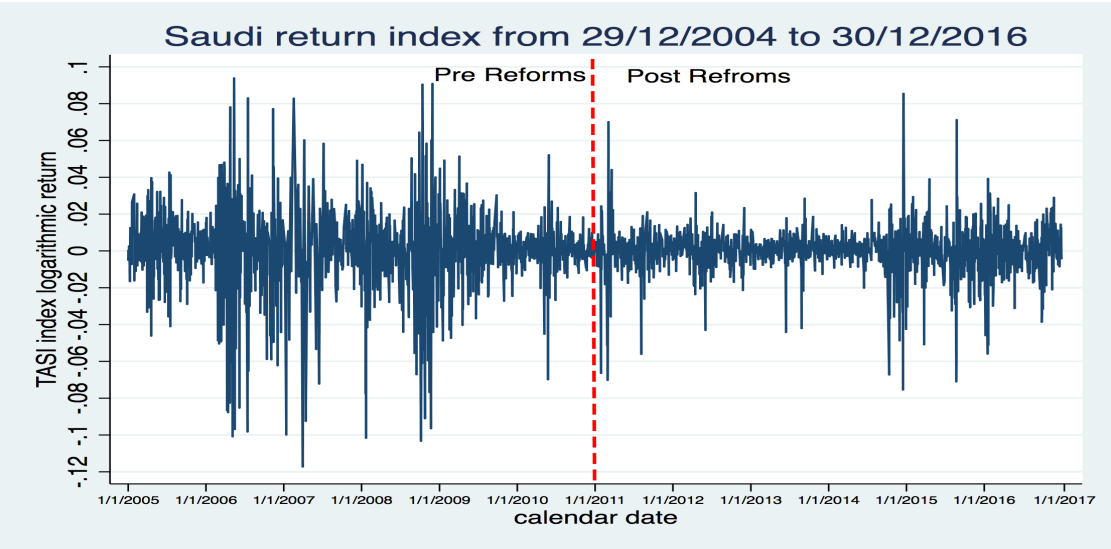


Figure 5. 2: The movements in SSM returns.



The plot (5-1) and (5-2) are time series plot of the daily closing price and daily return respectively of Saudi stock market. It is present the whole 12 year from 01-jan-2005 to 31-dec-2016. The comparison and contracting of price changes between the first 6 years and the last 6 years reflect the effects of the stock market regulation and reform implemented in 2005-2011. The sub-sample from 2011 to 2016 shows less volatility in (price and return) which indicates an improvement when compared with time before 2011 and good response to the reforms that took place between 2005-2010. However, the sub-sample period from 2005 to 2011 shows a price index with negative trends and high level to volatility, which is dissimilar to the sample for 2011 to 2016 that illustrates a positive trend and less volatility as an implication of the reforms.

Figure 5. 3: The movements in the DSM price index

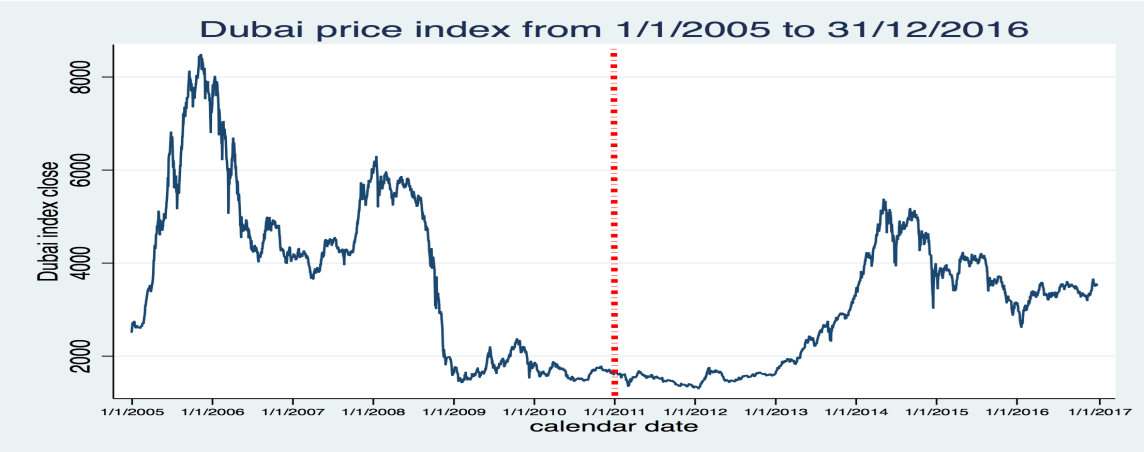
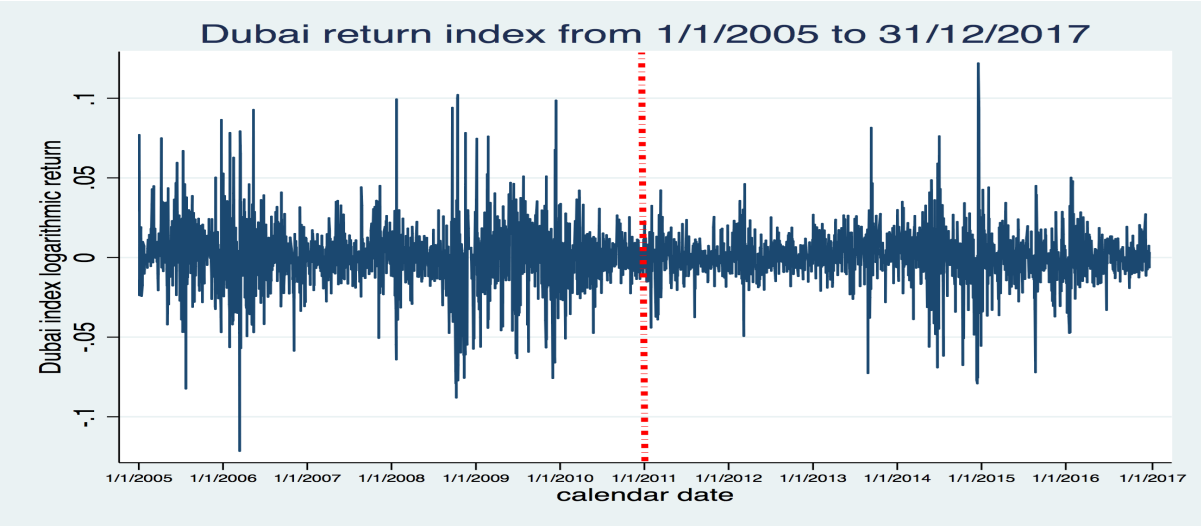


Figure 5. 4: The movements in DSM index returns



The plot (5-3) and (5.4) are time series plot of the daily closing prices and daily returns respectively of Dubai stock market. It is present the whole 12 year from 01-jan-2005 to 31-dec-2016. The figure show that there is less volatility after 01-01-2011, but still high volatility comparing with Saudi stock market. Which indicate the Saudi stock market recovery faster after the two financial crisis. Moreover, Saudi stock market is much bigger than Dubai stock market in terms of liquidity, number, and value of share trade. Those lead the SSM be faster to recovery form the financial crisis. In 2006, the market close to the highest point in its history at more than 8000 point. However, the lowest point was in 2009 which took place during the financial crisis. Since then, the market suffered a decline until the mid of the 2012, the market started to pick up and recovery slowly, which means the Dubai stock market was struggling from the three crises, which occurred in 2006, 2008 and 2011.

Figure 5. 5: The movement's Kuwaiti index close:

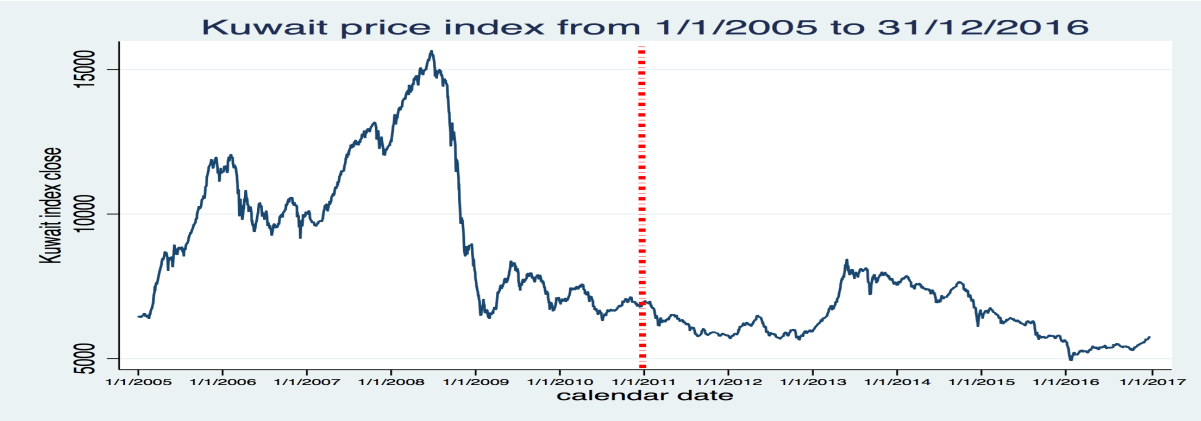
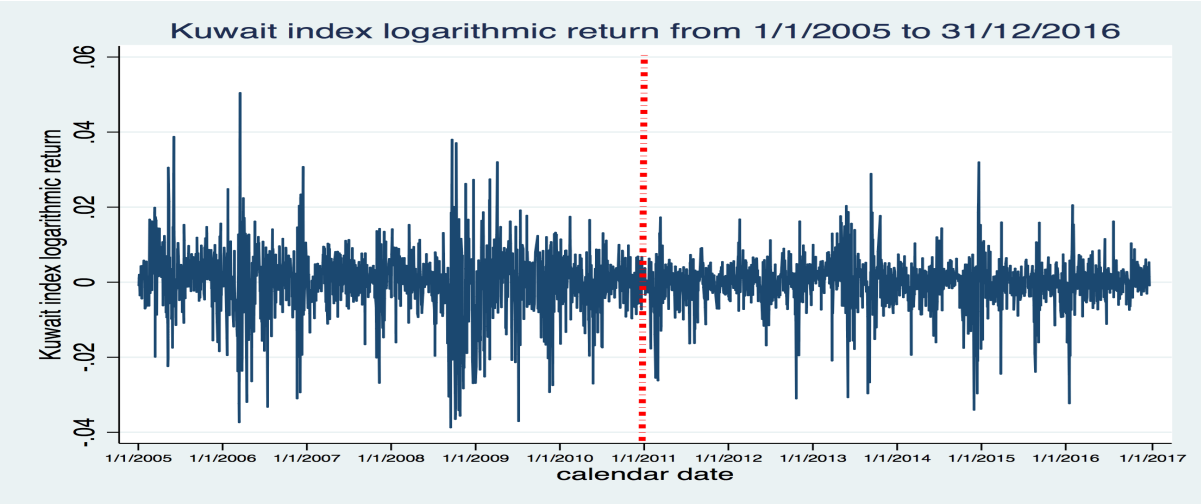


Figure 5. 6: The movement's Kuwaiti index returns:



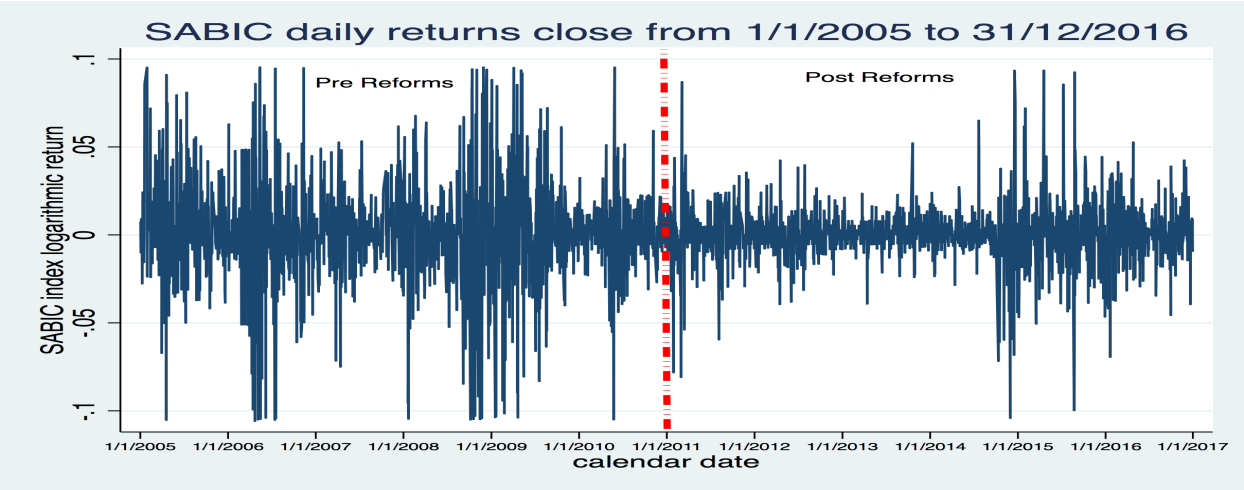
The plot (5.5) and (5.6) are time series plot of the daily closing prices and daily returns respectively of the Kuwait stock market. It represents the whole 12 year from 01-jan-2005 to 31-dec-2016. The figures shows that there is improvement and less volatility after 01-01-2011. In addition, KSM had less volatility when compared with the Saudi and Dubai stock markets. In addition, KSM reached its first peak in its historical 2006 that was over 12000 points and the second historical peak more than 15000 points at the end of 2008 in a short time period. After the second peak, the price fell to less than 7000 points, and remained in the range between 8000-5000 points until the end of 2016. It should be mentioned that during the global financial crisis, Kuwait government suspended the trading in 2008 in order to protect the market form financial crisis. However, market participants were not sufficiently impressed by such efforts and a lawsuit against the KSM was filed by one group attempting to recoup their losses (Al-Atrabi and Al-Sayed, 2008).

Comparative analysis was carried out between the general index by using the SSM, DSM, KSM graphs that form table (5.1, 5.2, SSM), (5.3, 5.4, DSM), (5.5, 5.6, KSM), the graphs show the daily price at close of trading and are not stationary, which is unlike the series of daily returns that follow a stationary process with a mean close of zero. The assumption of a variance that is constant does not follow for all series, with calm periods showing periods of volatility. This is one of the key characteristics referred to in asset return volatility, known as volatility clustering. In the sample, the financial crisis represents a small period within the entire sample, yet has a strong effect upon the variability of the stock market. The diagram shown in all Figures show an increase in variability between 2007 and 2009.

The researcher notes that, there is high level of contagion between GCC. For example, During the period 2005 to 2010 and 2015 to 2017, the index return graph shows that the SSM, DSM, KSM returns were more volatile than usual; with a similar pattern for both the Kuwait and Dubai stock markets, with the time series revealing clear spikes during the Local financial crisis of 2006 and financial crisis period of 2007 -2009. The series show volatility clustering with significant changes followed by large changes, and with small changes grouped together. In addition, for all markets under study, the smallest returns are far apart when compared with the highest returns. For example the Saudi stock market with the highest return was in 2006 at more than 20000 points, however, the lowest return was in 2009 and less than 5000 points that was corresponding to the global financial crisis. In addition, the graphs also show that the price index rapidly increased during 2005. For instance, in January 2005, the Saudi Stock Market was about 8000 points, yet by the end of the year, it was around 20000 point, which was its peak. It was similar behaviour for the Dubai Stock Market and the Kuwait Stock Market, which more than doubled in less than one year.

Figure 5. 7: The movements in the SABIC price close

Figure 5. 8: The movements in SABIC returns



The plot (5.7) and (5.8) are time series plot of the daily closing price and daily return respectively of SABIC stock market. It is represents the whole 12 year from 01-jan-2005 to 31-dec-2016. Two sub-sample periods of 6 years horizon cover the time periods of jan-2005 to Dec-2010 and from jan2011 to Dec 2016 respectively. It should mentioned that SABIC company's one of the largest companies not only in Saudi but also in GCC and the worldwide. The beginning of the first year the price went up straight and reached the peak in 2006 at SR 250. After the peak, the price dropped quickly and dramatically to about SR120, The lowest point in the first half was in 2009 that was coincided with financial crisis. However, after 2009 the share price started to rise up all way until the ending of 2014 and reached to the peak on the second half at about SR 150. Then, the price had high level of fluctuation that corresponded with drop of oil price.

Figure 5. 9: The movements in Saudi telecom closing price

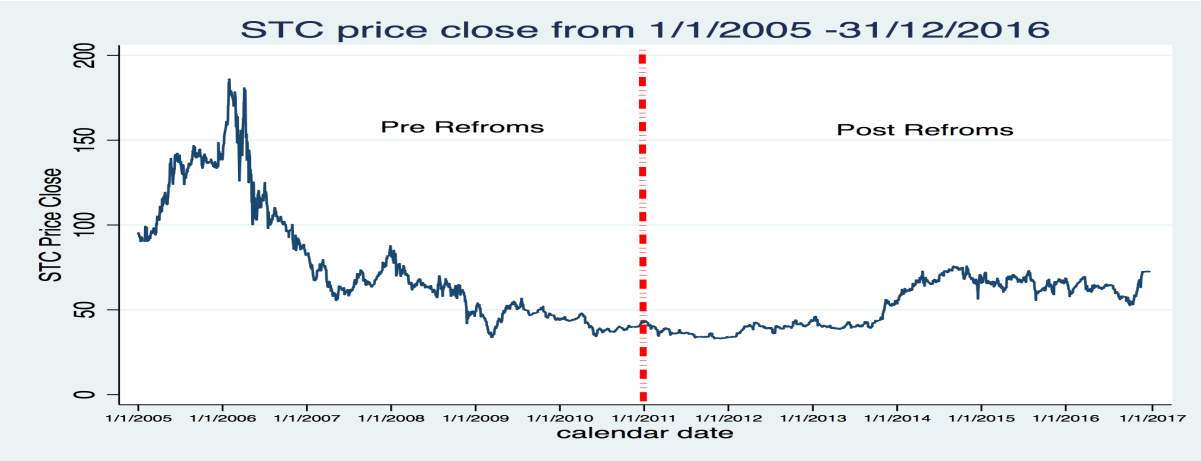


Figure 5. 10: The movements in Saudi telecom closing price

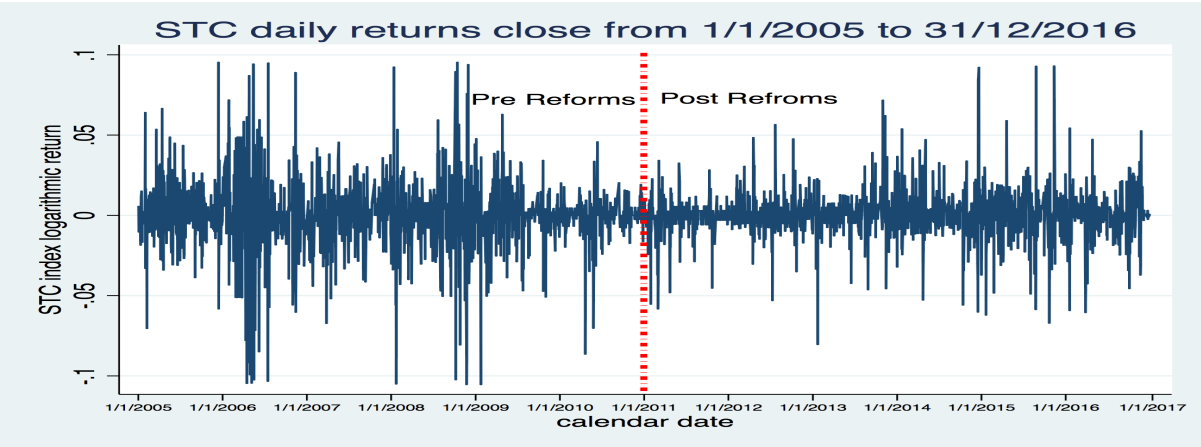


Figure (5.9) shows the time series plot of Saudi telecom company STC that been chosen from Saudi stock market for 12 Year from 2005 to 2016. In 2005, the price climbed and reached a historical peak at about SR 200 in 2006. After the peak, the share price plummeted to less than SR 50 in 2009, which is the lowest point during the period of this study. However, after the lowest price the share price remained in the range 40 to 75. Thus, the reforms had positive impact on the STC.

Figure 5. 11: The movement TAWUNIYA closing price (NCCY)

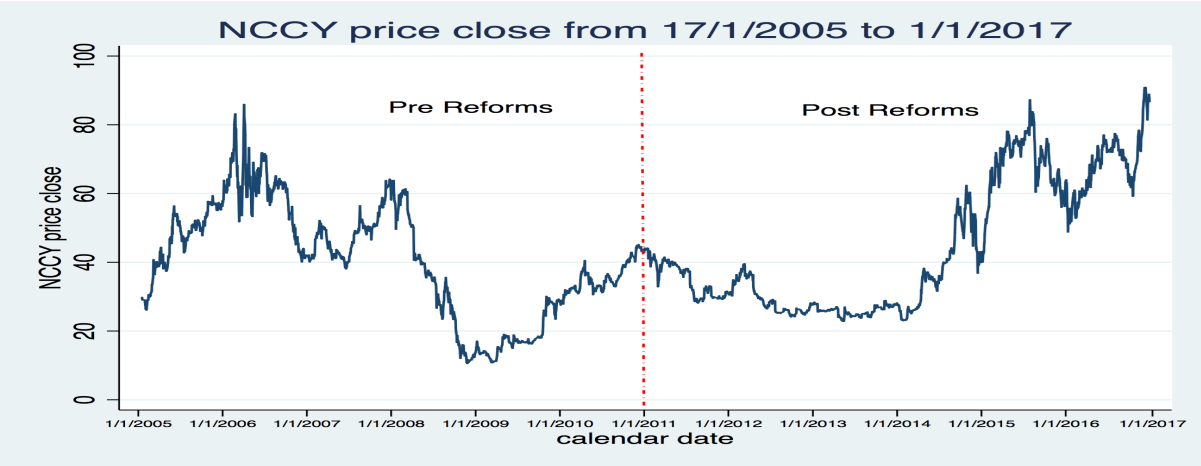
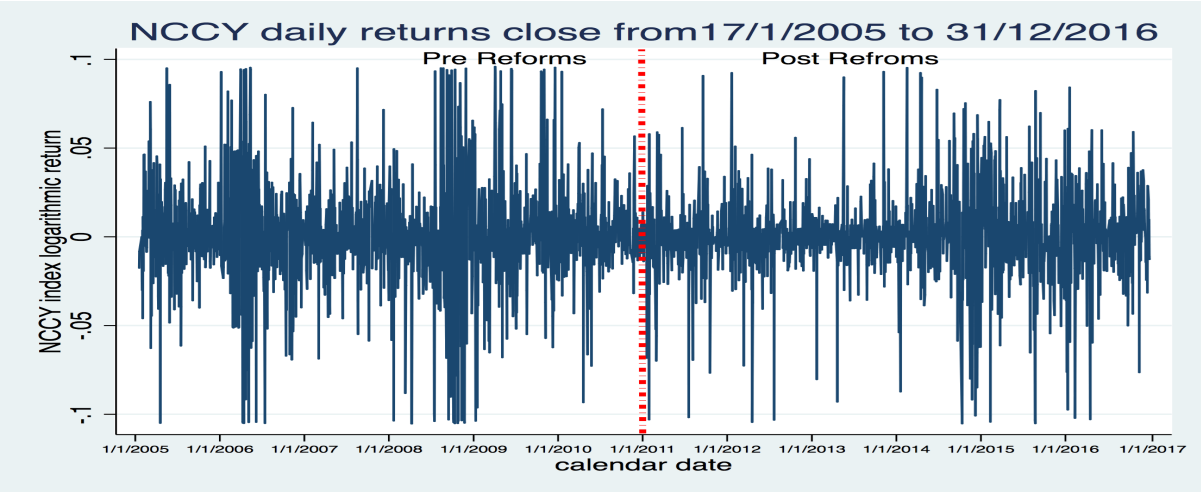


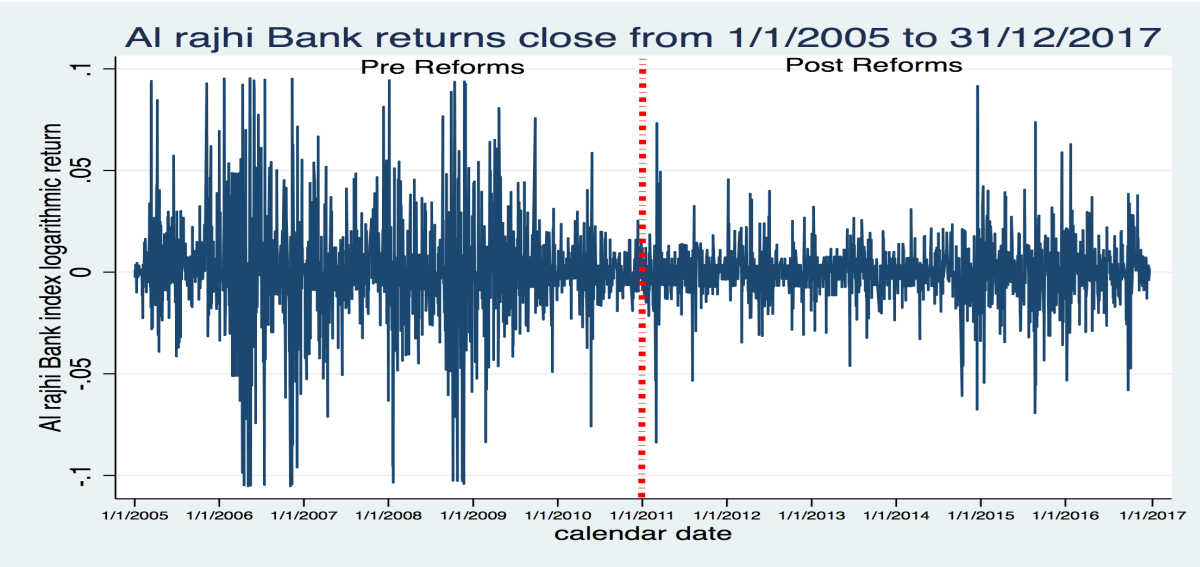
Figure 5. 12: the movement TAWUNIYA (NCCY) returns



The plot (5.11) and (5.12) are time series plot of the daily closing price and daily return respectively of Tawuniya (NCCY) share price. It is represents the whole 12 year from 01-jan-2005 to 31-dec-2016. The movements of Tawuniya (NCCY) shows high levels of volatility when compared to other companies during whole the period. the since its first trading on the Saudi Stock Market was on 13 January 2005 and therefore at an early stage of development. According to Emerson et al., (1997); Zalewska and Hall, (1999), it is unnecessary to consider whether transitional stock markets are efficient or not. Since it takes time for the price discovery process to become known, it is doubtful that stock markets that are newly established will be created as efficient models. Efficiency levels of new markets or companies will improve as participants in the market become more familiar and experienced with market systems over time.

Figure 5. 13: The movements in Al Rajhi bank price close

Figure 5. 14: The movements in Al Rajhi bank price close



The plot (5.13) and (5.14) are time series plot of the daily closing price and daily return respectively of Al Rajhi bank share price. It represents the whole 12 year from 01-jan-2005 to 31-dec-2016. In 2005, the price increased and reached its historical peak at about more than SR 200 in 2006. After the peak, the share price plummeted to less than SR 50 in 2009, which is the lowest point during the period of this study. However, after the lowest price the share price remained in the range 40 to 75. By comparing between the first half and the second half, the first half witnessed more fluctuations than the second half which reflected the reforms that occurred between 2005 to 2010. Al rajhai Bank saw more price movement compared with other companies because it was flat most of the time and low in volatility. In addition, it has a good response to the reforms that occurred place between 2005-2010.

Figure 5. 15: The movements in Electricity company price close

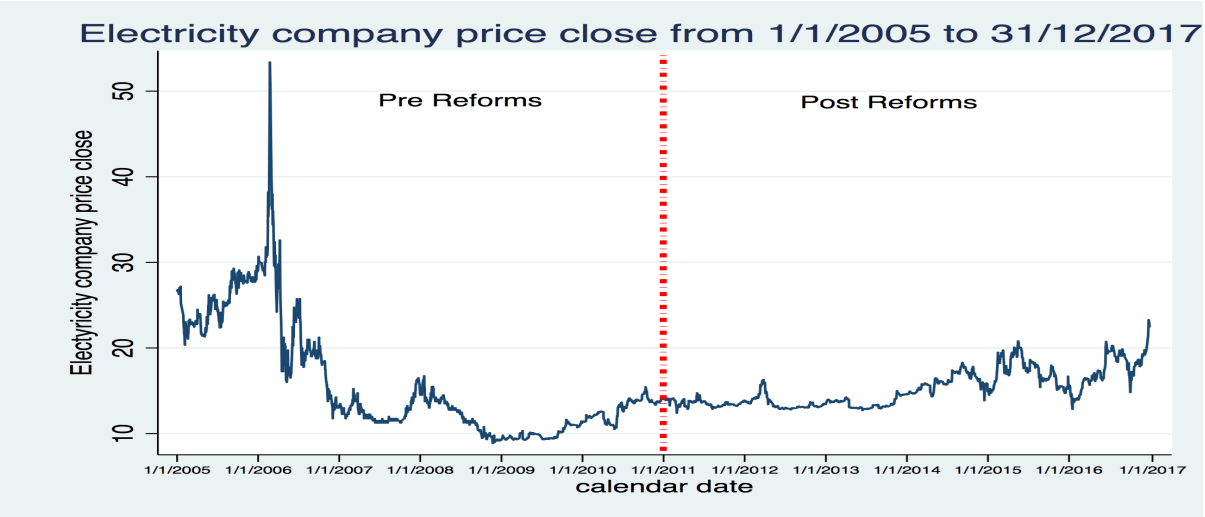
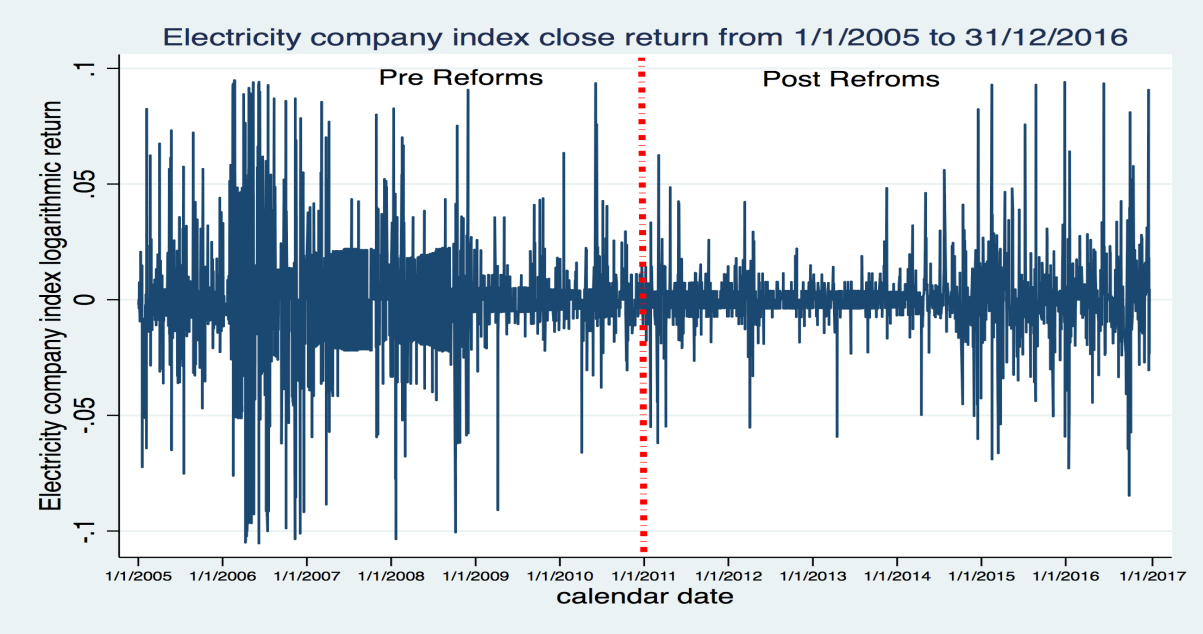


Figure 5. 16: The movements in Electricity company returns:



The figure (5.15) shows the movement of share price of Electricity Company. It is represents the whole 12 year from 01-jan-2005 to 31-dec-2016. The outliers of high and low returns in the first sub-sample (pre-reforms 2005-2010) are more frequent compared to the second sub-sample (post reforms) that happened between 2011 to 2016.

Overall, there is a high degree of similarity in daily price and return movement between all the individual companies. For example, The SABIC, STC, NCCY, Al Rajhi Bank and Electricity Company graphs show that during the period 2005 to 2010, as well as 2015 to 2016, above normal volatility took place. In addition, all shares price had the peak in 2006 and the lowest price for the individual companies was in 2008, which corresponds to the period of the

financial crisis 2008. Moreover, the frequency in the first half was much higher than the second half, which indicates that the higher degree of volatility existed before 2010. In addition, all the share price went up in 2005 to reach the historical peak. However, it was flat in the second half and only back to the fluctuation from 2014 to 2016. That indicated a high synchronization in the share price. Therefore, the stock exchanges operated under the same government and police. Finally, the reforms have the same effect on the most the individual companies and only the NCCY.

5.6. Descriptive statistics and normality

The tables below show the descriptive statistics of the log of market returns and the distribution of the return series. Before ARIMA was used for testing, important features of the series return were highlighted by performing a preliminary analysis. The results show for each constituent the return series with a summary of the preliminary statistics, from all the sample local currencies for the twelve-year period, the daily nominal return series was calculated from descriptive statistics. In addition, this shows the main periods from 2005 to 2016, the sub-sample for 2005-2011 and 2011-2016, three countries and five individual companies.

Also shown below are Mean, Std. Dev., Variance, Skewness, Kurtosis and Bera-Jarque. Mean estimate is based on the daily returns and reports from the descriptive statistics. Negative or positive returns generated by assets determine the mean, and asset volatility. Risk and uncertainty are measured by Variance. Therefore, there is greater risk for decision-based returns when certainty is lost, likely realised values become less certain and there is a wide dispersal of returns distribution that occurs when variance becomes larger. Volatility is another term for loss of certainty. In addition, skewness was calculated. A positive skewness coefficient is shown by a right skewed distribution, a zero-skewness coefficient is shown by symmetric distributions, and a negative skewness coefficient is shown by a left skewed distribution. There is greater risk for investors when large negative returns are generated by assets indicated by a negative skewness. In contrast, there is lower risk for investors when large positive returns are generated by assets indicated by a positive skewness. Moreover, Extreme values for a given variance and Mean are produced from the distribution of heavy tail distributions, so this heaviness is measured by the kurtosis coefficient. Therefore, this research shows that all kurtosis coefficients were greater than the standard normal

distribution of 3, so this defines all series as leptokurtic. When the kurtosis coefficient is 3, there is a normal distribution within financial econometrics of benchmarked distribution. Moreover, to test normal levels of series distribution, the Bera-Jarque test statistic was applied, where 1% significance for all constituents is strongly significant, but at 1% significance level, normality is rejected.

Table 5. 3: Statistical summary of SSM, DSM and KSM

Statistics	Saudi stock market			Dubai stock market			Kuwait stock market		
reform	original series	Pre-reform	Post-reform	original series	Pre-reform	Post-reform	original series	Pre-reform	Post-reform
observations	2935	1445	1488	3062	1559	1503	2953	1471	1482
mean	-0.000044	-.00014	.000053	.0001108	-.00027	.0005141	-.000038	.0000515	-.00012
Std. Dev.	0.017	.0213	.0117	.018	.0211	.0152	.0075	.0089	.0059
Variance	0.00029	.00045	.00013	.0003429	.00044	.0002333	.0000577	.000080	.000034
Skewness	.97	-.87	-.82	.015	.05	-.013	-.60	-.511	-.84
Kurtosis	11.48	8.49	13.05	8.420357	6.95	10.41	7.75	6.31	8.81
Bera-Jarque	808.8	319.94	403.27	364.89	148.42	228.41	474.84	177.32	327.91

Source: Calculations of researcher

Table 5-3 summarises the descriptive statistics daily general index return for SSM, DSM and KSM. The results are presented in three periods based on official reforms dates. whole period from 2005- 2016, pre-reform 2005-2010 and post-reforms periods from 2011-2016 respectively.

For whole period that from 2005-2016, the daily Mean returns for the three countries are almost the same; only Dubai stock market have appositive return at .0001108. For the first half from 2005-2011, the descriptive statistics displays that the mean daily return are (-.00014) for Saudi stock market and (-.00027) for DSM, which indicated to negative return and high level of the risk and volatility. In addition, SSM has negative skewness of (-.8762074) and a positive kurtosis of 8.49 indicating a leptokurtic distribution. daily mean returns for the two periods (pre -post Reform) show increase during the post-Reforms period when compared with post-reform for all market only KSM, there is just a slight decline during the post-reforms period from .0000515 to (-.00012).

The standard deviation which is the unconditional variance in returns, Dubai stock market had the highest risk and volatility at .0185 then Saudi stock market at 0.017 and followed by Kuwait at .0075. Overall, Standard deviation shows a decline in the post-reforms period for all markets when compared with the post reform period. For example, SSM appears low

during the post-Reforms period at .0117 when compared with .0213 during the pre-reforms period.

The kurtosis and the Bera-Jarque tests show that there is non-normal distribution of stock market returns from this financial time series and conforms to the general expectation, because higher departure from normality is shown when there is a higher frequency at which data are sampled. For example, the kurtosis is quite above three in the all markets, obviously indicating a leptokurtic distribution. However, the skewness is negative in both SSM and KSM, but not in DSM. In all-time series, their values of skewness differ from zero. In addition, The Jarque-Bera is well above the critical value with two degrees of freedom at 1%,5%,10% level of significance which is a rejection of the null hypothesis of normal distribution. Therefore, The Jarque-Bera has a high value indicating the rejection of the null hypothesis of a normal distribution for all markets and all different period.

As result, skewness, kurtosis and Jarque-Bera statistics do not follow a normal distribution. Therefore, this supports the view that there is non-normal distribution within equity market returns, and each sub-sample and the main sample, there was mostly a negative skew for the daily return, which indicates that the level of extreme negative returns has a tendency to be more than those of extreme positive returns.

Table 5. 4: Descriptive statistics of SABIC, STC, NCCY.

Statistics	SABIC			STC			NCCY		
reform	Original Series	Pre-reform	Post-reform	Original Series	Pre-reform	Post-reform	Original Series	Pre-reform	Post-reform
observations	3059	1562	1497	3059	1562	1497	3045	1548	1497
mean	.0000114	.000109	-.000090	-.000087	-.000515	.0003559	.0003511	.0002356	.0004705
Std. Dev.	.0240	.0295362	.016472	.0186791	.022021	.0143844	.0272602	.0301689	.0238925
Variance	.000578	.0008724	.0002713	.0003489	.000485	.0002069	.0007431	.0009102	.0005709
Skewness	-.2953	-.3098406	-.054229	-.2668	-.357923	.2712579	-.1635	-.063477	-.3533
Kurtosis	7.653	5.618112	10.46099	10.19559	8.405774	10.89269	6.679453	5.90868	7.505827
Bera-Jarque	366.	228.77	124.85	479.73	221.62	254.27	278.31	103.57	196.72

Source: Calculations of researcher

Table 5. 5: Descriptive statistics of Al Rajah Bank and Electricity Company

Statistics	AL RAJHI BANK			ELECTRICITY COMPANY		
reform	Original series	Pre-reform	Post-reform	Original Series	Pre-reform	Post-reform
observations	3059	1562	1497	3059	1562	1497
mean	.0000425	.0002076	-.0001298	-.0000555	-.0004122	.0003166
Std. Dev.	.0208252	.0259614	.013534	.021754	.0267321	.0148802
Variance	.0004337	.000674	.0001832	.0004732	.0007146	.0002214
Skewness	-.1125466	-.1228592	-.0357856	.0084393	-.0560104	.55997
Kurtosis	9.415441	6.973051	9.450149	9.272922	6.733194	13.32826
Bera-Jarque	417.8	152.40	207.25	405.0	141.51	346.20

Source: Calculations of researcher

Table 5.4 and 5.5 summarises the descriptive statistics daily general index return for SABIC, STC, NCCY, Al Rajah Bank and Electricity Company. The results are presented in three periods based on official reforms dates. That is: whole period from 2005- 2016, pre-reform 2005-2010 and post-reforms periods from 2011-2016 respectively.

During the whole period from 2005-2016, One of longest established company in this market is Al Rajhi Bank that is shown to be .0004732 and reflects the smallest variance. However, the NCCY Company was launched in the SSM in 2005, which could explain why it is shown to be (.0007431) between 2005 and 2016 and reflects the highest variance. Moreover, variance shows an increase in the post-reforms period for NCCY when compared with the post reform period from (.0301689) to (.0238925). These findings indicate that markets improve over time to become efficient.

The daily indicators on the table are quite improved when compared between the two periods (Pre-post). Therefore, the reforms have the same effect on most of the individual companies. For example, the daily mean returns for most of the companies have increased, with just a slight decline during the post-reform period for SABIC and Al Alrajhi Bank. In addition, the standard deviation declined for all companies during the post-reforms period when compared with pre-reform period. For example, Electricity Company decreases from (.0267321) to (.0148802) in the post-refrom period, which indicates lower volatility in the post-reform. Moreover, the skewness is negative in pre-reforms periods for all companies, depicted by left skewed distribution. When large negative returns are generated by assets it is indicated by a negative skewness. Overall, in the three periods, asymmetry is shown, and their values of skewness differ from zero. Moreover, kurtosis is quite above three in the three periods clearly indicating a leptokurtic distribution. The Jarque-Bera is well above the critical value with two degrees of freedom at 1%, 5%, 10% level of significance which is a rejection of the null hypothesis of normal distribution. As result, this supports the view that there is non-normal distribution with stock market return.

Conclusion, the result for the general index and the individual companies are summarized as bellow:

1. Non-normal distributions for all datasets that is confirmed by skewness, kurtosis and Jarque-Bera statistics all indicate a non-normality distribution.
2. Reform that occurred from 2005-2011 had positive effect on all general markets and the individual companies and improved the market efficiency because there was higher degree of normality distribution than pre-reform. In addition, the skewness of most of the general index and most of the companies has shifted to have a positive skewness coefficient in post-period, which indicate lower risk for investors when large positive returns are generated by asset indicated by a positive skewness. Also the stander deviation and the variance are lower in post-reform when compared with pre-reforms period.

Chapter 6.Empirical results: an examination of Saudi, Dubai and Kuwaiti stock market return from perspectives of the (RWH) and behavioural finance.

6.1.Introduction

This chapter outlines the identification and evaluation of the ARIMA model with a detailed empirical study that attempts to select the best choice in the order of p and q in the model by comparing differences between BIC or Bayesian Information Criterion and AIC or Akaike Information Criterion. It involves explaining how the significance of lag, BIC and AIC form the basis for selecting the ideal model from various ARMA models using market historical data.

In particular, this chapter starts with the analysis of empirical results with unit root tests. This is then followed by describing the use of the Augmented Dickey Fuller Test (ADF) and The Phillips-Perron, as this confirms whether the variable adopts a random walk pattern or the variable has a unit root (Dickey and Fuller, 1979). The next stage is the examination of Ljung-box Q-statistics function, PAC or Partial Autocorrelation, and AC or Sample Autocorrelation between varies time series within section 6.3. BIC and AIC are also used in section 6.4, to select the initial model, and the model is then assessed for autocorrelation structures of residuals with diagnostic checking and parameter estimations. Section 6.5 reveal whether residuals follow a white noise process, the confidence intervals of the values are shown by cumulative periodograms and Bartlett's periodogram when drawing the AC and PAC.

6.2.Unit Root Tests

To investigate the existence of stochastic non-stationary in the time series and ensure that all variables are stationary, which means that they have a constant mean and variance. Therefore, in order to determine the order of integration of the variables, two unit root tests are applied. These are the Augmented Dickey-Fuller (ADF), the Phillip-Peron. The time series are (SSM, DSM and KSM), and the (SABIC, STC, NCCY, Al Rajhi Bank and Electricity company). However, a differencing technique was needed to transform this into a stationary series, because the time series has trending movement and was not stationary in all plots and statistical tests in figure 3.1 taken from chapter 5, so the differenced series was applied to the model. The differenced times series is denoted as follow:

$$R_t = P_t - P_{t-q} \quad (6.2.1.1)$$

Therefore, the time series Pt represents the general share index value or share price for today, Pt-q is the previous day of the general index value or the previous share price. When the times series in not stationary or has a unit root the ADF and PP unit root tests give a null hypothesis, but if the series is stationary the hypothesis is the opposite. The ADF and PP test should be significant and show stationary series at the first difference or take the second difference. Thus, the hypothesis for the test is depicted below:

- H0: Variables are not stationary or got unit root
- H1: Variables are stationary.

The Augmented Dickey-Fuller (ADF) test results are shown in table 6.1, and the Phillips-Perron. Tests are shown in table 6.2 for the gathered data.

Table 6. 1: First Difference and logarithmic level of ADF, ADF drift and ADF With trend and drift test

	ADF			ADF drift			ADF With trend and drift		
Statistics	**Test Statistic**	**Significant level**	**Critical Value**	**Test Statistic**	**Significant level**	**Critical Value**	**Test Statistic**	**Significant level**	**Critical Value**
SSM	-29.348***	1%	-3.430	-29.348***	1%	-2.328	-29.344***	1%	-3.960
	-lag 2	5%	-2.860	Lag2	5%	-1.645	Lag2	5%	-3.410
	-	10%	-2.570	-	10%	-1.282	-	10%	-3.120
DSM	-4.555***	1%	-3.553	-4.555***	1%	-2.378	-4.560***	1%	-4.108
	Lag4	5%	-2.915	Lag4	5%	-1.669	Lag4	5%	-3.481
		10%	-2.592		10%	-1.295		10%	-3.169
KSM	-11.304***	1%	-3.430	11.304***	1%	-2.333	-11.355***	1%	-3.960
	Lag3	5%	-2.860	Lag3	5%	-1.648	Lag3	5%	-3.410
	-	10%	-2.570	-	10%	-1.283	-	10%	-3.120
SABIC	-55.701***	1%	-3.430	-55.701***	1%	-2.328	-20.253***	1%	-3.960
	Lag0	5%	-2.860	Lag0	5%	-1.645	Lag2	5%	-3.410
	-	10%	-2.570	-	10%	-1.282	-	10%	-3.120
STC	-40.069	1%	-3.430	-40.069***	1%	-2.328	32.784***	1%	-3.960
	Lag1	5%	-2.860	Lag3	5%	-1.645	Lag2	5%	-3.410
	-	10%	-2.570	-	10%	-1.282		10%	-3.120
NCCY	29.898***	1%	-3.430	-37.955***	1%	-2.328	-26.847***	1%	-3.960
	Lag2	5%	-2.860	Lag1	5%	-1.645	Lag3	5%	-3.410
	-	10%	-2.570	-	10%	-1.282		10%	-3.120
Al-Rajhi bank	-30.570***	1%	-3.430	-30.570***	1%	-2.328	-26.666***	1%	-3.960
	Lag2	5%	-2.860	Lag2	5%	-1.645	Lag3	5%	-3.410
	-	10%	-2.570	-	10%	-1.282		10%	-3.120
Electricity company	-26.246***	1%	-3.430	-26.246***	1%	-2.328	26.286***	1%	-3.960
	Lag3	5%	-2.860	Lag3	5%	-1.645	Lag3	5%	-3.410
	-	10%	-2.570	-	10%	-1.282		10%	-3.120

Note: Numbers in parentheses corresponding to ADF test statistics are the optimal lags, chosen based on Akaike Information Criterion (AIC).

*, **, *** denote the rejection of the null hypothesis of a unit root at 10%, 5% and 1% respectively

Source: Author's calculation

The table (6-1) show the result of the ADF test for the log levels and first difference for the time series SSM, DSM and KSM as general index, and SABIC, NCCY, STC, Alrajhi Bank and Electricity Company as individual companies.

The results for Saudi Dubai and Kuwait stock market indicate that all the series are of integrated order one I (1). That is all the series are stationary at first difference due to the test statistic being larger than the critical value at the 1% level of significance. For example, Saudi stock market with a Statistic of (-29.348) is greater than the Critical Value of (-3.430) at significant 1% level.

The results for the individual companies (SABIC, NCCY, STC, Alrajhi Bank and Electricity Company as individual companies) reveal that the null hypothesis can be rejected for the unit root and accepted for the alternative hypotheses at a significance level of 1% for all the variables, because at 1%, 5% and 10% levels, t-statistics values are more negative than ADF critical values. For example, SABIC approximate critical value is (-3.430) and the test statistic is (-55.701) so the researcher would reject the null hypothesis and accept the alternative hypothesis.

Table 6. 2: First Difference at logarithmic level of test PP, PP drift and PP With trend and drift

	PP			PP with Drift			PP with drift and trend		
Statistics	Test Statistic	Significant level	Critical Value	Test Statistic	Significant level	Critical Value	Test Statistic	Significant level	Critical Value
	PP			PP drift			PP With trend		
SSM	-29.348***	1%	-3.430	-29.348***	1%	-2.328	-29.344***	1%	-3.960
	-lag 2	5%	-2.860	Lag2	5%	-1.645	Lag2	5%	-3.410
	-	10%	-2.570	-	10%	-1.282	-	10%	-3.120
DSM	-4.555***	1%	-3.553	-4.555***	1%	-2.378	-4.560***	1%	-4.108
	Lag4	5%	-2.915	Lag4	5%	-1.669	Lag4	5%	-3.481
		10%	-2.592		10%	-1.295		10%	-3.169
KSM	-11.304***	1%	-3.430	11.304***	1%	-2.333	-11.355***	1%	-3.960
	Lag3	5%	-2.860	Lag3	5%	-1.648	Lag3	5%	-3.410
	-	10%	-2.570	-	10%	-1.283	-	10%	-3.120
SABIC	-55.701***	1%	-3.430	-55.701***	1%	-2.328	-20.253***	1%	-3.960
	Lag0	5%	-2.860	Lag0	5%	-1.645	Lag2	5%	-3.410
	-	10%	-2.570	-	10%	-1.282	-	10%	-3.120
STC	-40.069	1%	-3.430	-40.069***	1%	-2.328	32.784***	1%	-3.960
	Lag1	5%	-2.860	Lag1	5%	-1.645	Lag2	5%	-3.410
		10%	-2.570		10%	-1.282		10%	-3.120
NCCY	29.898***	1%	-3.430	-37.955***	1%	-2.328	-26.847***	1%	-3.960
	Lag2	5%	-2.860	Lag1	5%	-1.645	Lag3	5%	-3.410
		10%	-2.570		10%	-1.282		10%	-3.120
Al-Rajhi bank	-30.570***	1%	-3.430	-30.570***	1%	-2.328	-26.666***	1%	-3.960
	Lag2	5%	-2.860	Lag2	5%	-1.645	Lag3	5%	-3.410
		10%	-2.570		10%	-1.282		10%	-3.120
Electricity company	-26.246***	1%	-3.430	-26.246***	1%	-2.328	26.286***	1%	-3.960
	Lag3	5%	-2.860	Lag3	5%	-1.645	Lag3	5%	-3.410
		10%	-2.570		10%	-1.282		10%	-3.120

Note: Numbers in parentheses corresponding to PP test statistics are the optimal lags, chosen based on Akaike Information Criterion (AIC).

*, ** and *** *, imply 10%, 5% and 1% levels of significance respectively.

Source: Author's own calculations

The table (6-2) present the result of the PP test for the log levels and first difference for the time series (SSM, DSM and KSM), and (SABIC, NCCY, STC, Alrajhi Bank and Electricity Company).

The PP unit root test for all selected capital markets and individual companies, and the result are reported in table 6-2. It is clear that, the null hypothesis of unit root (non-stationary) is rejected, as the value of test statistic is more negative than the critical value in each country and individual company's case. Thus, the result indicate that the capital markets and the stock price in select companies and developing markets do not follow random walk hence, market are not weak-form efficient.

The results for SSM, DSM and KSM, and SABIC, NCCY, STC, Alrajhi Bank and Electricity Company as individual companies indicated to be stationary after taking the first difference at log level. The result goes into the negative direction, the basic logic is to reject the null hypothesis if the test statistic is sufficiently extreme. For example, Al-Rajhi bank at (significant level 10%, critical value -2.570) is larger and more positive than (5% significant level and critical value at -2.860) and 1% critical value more extreme than 5% and is lower at (-3.430). However, the actual test statistic is (-30.570), this is an extreme than the conventional 1% value and even the 5% and 10% value because it is more negative than -3.430 (and even -2.860 and -2.570. Therefore, the researcher does reject the null hypothesis of unit root at 1% significance levels.

The results confirmed that all the time series for the period 2005-2016 are of integrated order one I (1). That is all the series are non-stationary after taking into account that the first difference of time series are stationary. Therefore, the first difference time series passes the Phillips-Perron PP test and Augmented Dickey-Fuller ADF test with 99% confidence, has an approximate constant variance and a constant mean.

6.3. Analysis of index and individual companies: Ljung-box Q-statistics function, AC or Sample Autocorrelation, and PAC or Partial Autocorrelation

First differences are used to determine the derived series that are, according to PP and ADF tests all stationary, and are shown in table 6.1 and 6.2. Moreover, Figures 6.1 to 6.8 shown below present the derived series in terms of Sample Autocorrelation functions and Partial Autocorrelation. This analysis is intended to characterise the (KSM, DSM and SSM) index and (SABIC, STC, NCCY, Al Rajhi and Electricity Company) individual companies on the underlying

ARIMA model to produce better clarity of the proper number of terms, and to investigate the random walk hypothesis or weak form of EMH.

When minor serial correlations are exhibited by the data, the ARIMA model can be successfully used, and sample autocorrelation functions and graphs are used to analyse serial correlation. For (KSM, DSM and SSM) index and (SABIC, STC, NCCY, Al Al Rajhi and Electricity Company) individual companies the daily returns of lags from 0 to 40 are shown in a plot in figure (6.1-6.8) with sample autocorrelation and Partial Autocorrelation, and to check for serial correlation in the return data, this can be checked by the PAC and AC. At each lag, the value of autocorrelation coefficient is compared at a 95% confidence level to confirm that the autocorrelation coefficient is different from zero by: $\pm 1{,}96 \times 1\sqrt{T}$ where T is the number of observations. This means that if a given lag of autocorrelation coefficient values falls outside this band, the null hypothesis is rejected, as it is significant that the coefficient value is zero. When the sample size T is small, there can be a large bias on the order of 1/T, but for most applications of finance, T is sufficiently large and does not weaken the findings of this study. However, the hypothesis for the AC and PAC and Q is bellows:

- H_0: There is no serial correlation thus, the market is random walk.
- H_1: There is serial correlation thus, the market is not follow random walk

Table 6. 3: SSM, DSM and KSM: AC, PAC and Ljung-Box Q Statistics:

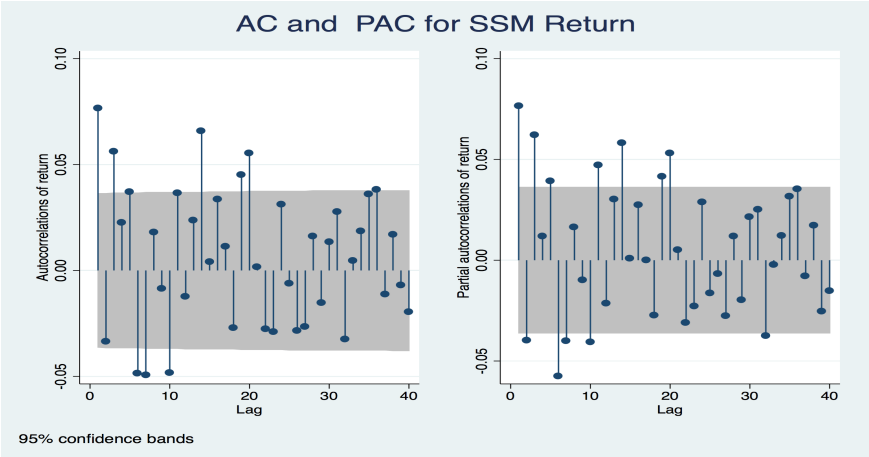
Statistics	Saudi stock market			Dubai stock market			Kuwait stock market		
Lags	AC	PAC	Q	AC	PAC	Q	AC	PAC	Q
1	0.0765	0.0765	17.182*	0.0472	0.0472	6.8159*	0.2398	0.2398	169.93*
2	-0.0337	-0.0397	20.51*	0.0305	0.0282	9.6669*	0.0696	0.0129	184.27*
3	0.056	0.0622	29.742*	0.0156	0.0128	10.412	0.0673	0.0506	197.65*
4	0.0226	0.0119	31.25*	0.0373	0.0352	14.675*	0.0751	0.05	214.33*
5	0.0369	0.0392	35.261*	0.041	0.037	19.824*	0.0851	0.0564	235.77*
6	-0.0487	-0.0576	42.236*	0.0012	-0.0046	19.828*	0.0814	0.0462	255.38*
7	-0.0493	-0.0402	49.389*	0.0267	0.0238	22.01*	0.0327	-0.0054	258.56*
8	0.018	0.0163	50.343*	0.0205	0.0161	23.303*	0.0201	0.002	259.76*
9	-0.0085	-0.01	50.558*	0.0454	0.0399	29.635*	0.0583	0.0439	269.83*
10	-0.0483	-0.0405	57.442*	0.0115	0.0048	30.039*	0.0572	0.0249	279.52*

*, ** and *** denote significance at 1%, 5% and 10% level, respectively.

Ljung-Box Q-Statistics (Q)

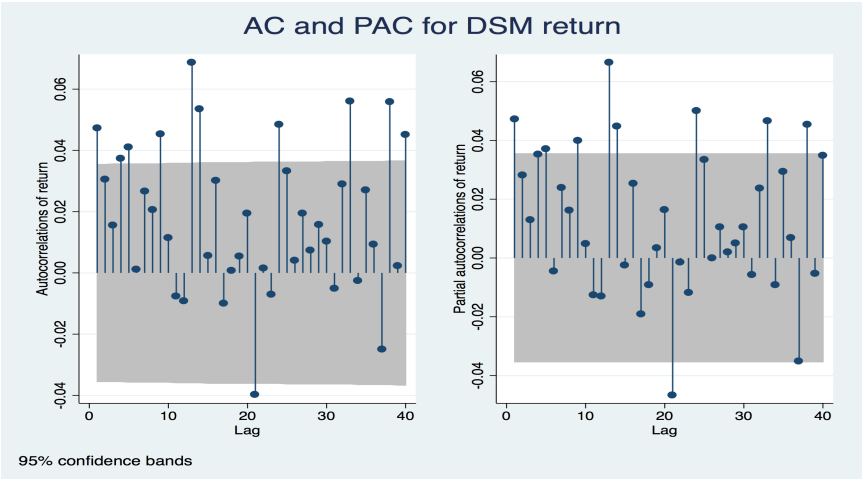
Source: Author's own calculations

Figure 6. 1 : ACF and PACF FOR SSM daily return



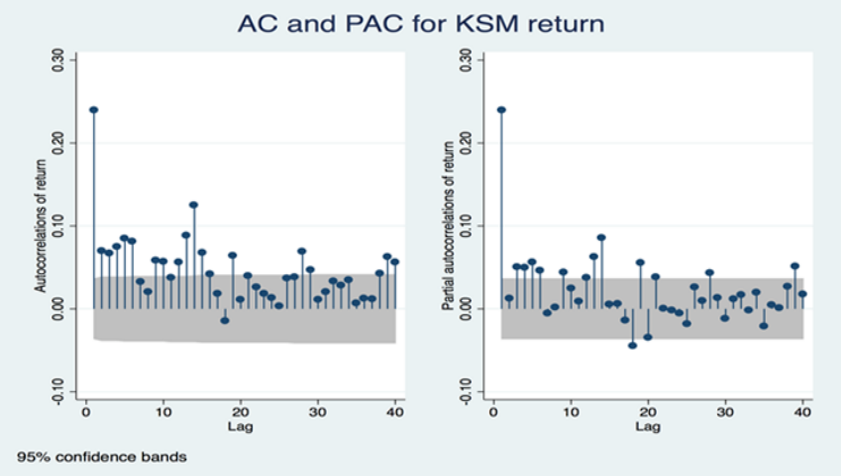
Source: Author's own calculations

Figure 6. 2: ACF and PACF FOR DSM daily return



Source: Author's own calculations

Figure 6. 3: ACF and PACF FOR KSM daily return



Source: Author's own calculations

Table 6. 4: AC, PAC and Ljung-Box Q-Statistics in Daily for the individual Saudi companies Returns:

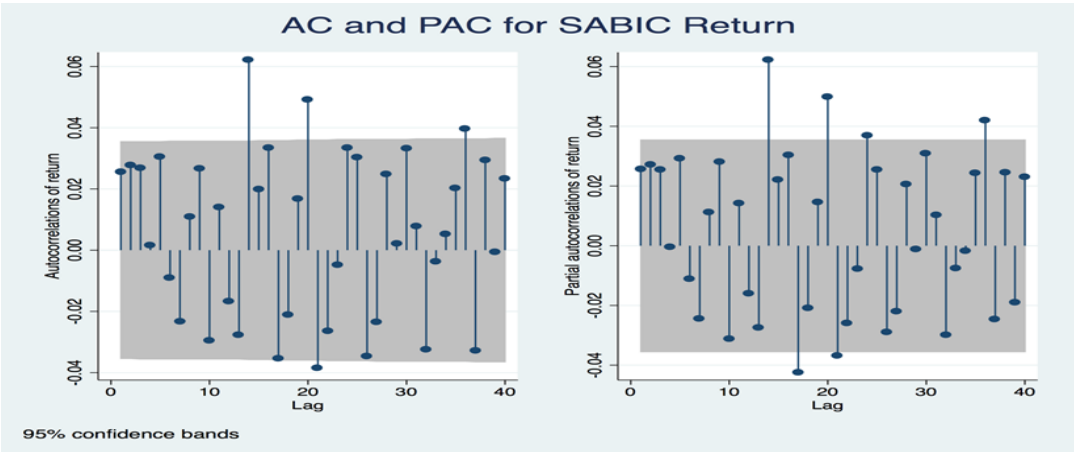
Statistics	SABIC			STC			NCCY			AL RAJHI BANK			ELECTRICITY COMPANY		
Lags	AC	PAC	Q	AC	PAC	Q	AC	PAC	Q	AC	PAC	Q	AC	PAC	Q
1	0.0256	0.0256	2.0071	0.0634	0.0634	12.32*	0.0768	0.0768	17.959*	0.1258	0.1258	48.472*	-0.0317	-0.0317	3.0797
2	0.0277	0.0271	4.364	-0.0535	-0.0578	21.088*	-0.0071	-0.0131	18.113*	-0.0281	-0.0446	50.889*	-0.0103	-0.0113	3.4056
3	0.0268	0.0254	6.5573	-0.0176	-0.0104	22.034*	0.0425	0.0443	23.612*	0.0175	0.0273	51.826*	0.0076	0.0070	3.5841
4	0.0016	-0.0005	6.5648	0.0141	0.013	22.647*	-0.0142	-0.0212	24.223*	0.0099	0.0028	52.126*	0.0583	0.0587	13.986*
5	0.0305	0.0291	9.4201	0.0078	0.0045	22.835*	-0.0127	-0.009	24.714*	0.0398	0.0405	56.978*	0.0287	0.0328	16.506*
6	-0.009	-0.0112	9.6666	-0.0019	-0.0014	22.846*	0.0101	0.0096	25.026*	0.0042	-0.0064	57.032*	-0.0464	-0.0438	23.118*
7	-0.0233	-0.0245	11.338	-0.044	-0.0431	28.786*	-0.0349	-0.0356	28.753*	-0.0344	-0.0319	60.664*	-0.0509	-0.055	31.066*
8	0.011	0.0112	11.709	-0.0147	-0.0093	29.452*	0.0114	0.0181	29.146*	0.0246	0.0322	62.528*	0.0346	0.0267	34.741*
9	0.0267	0.028	13.892	0.0222	0.019	30.963*	-0.0134	-0.0181	29.692*	0.0022	-0.0084	62.542*	0.0035	0.0021	34.779*
10	-0.0295	-0.0312	16.563	-0.0329	-0.0386	34.295*	-0.0123	-0.0061	30.152*	-0.045	-0.043	68.764*	-0.0335	-0.0278	38.224*

*, ** and *** denote significance at 1%, 5% and 10% level, respectively.

Ljung-Box Q-Statistics (Q)

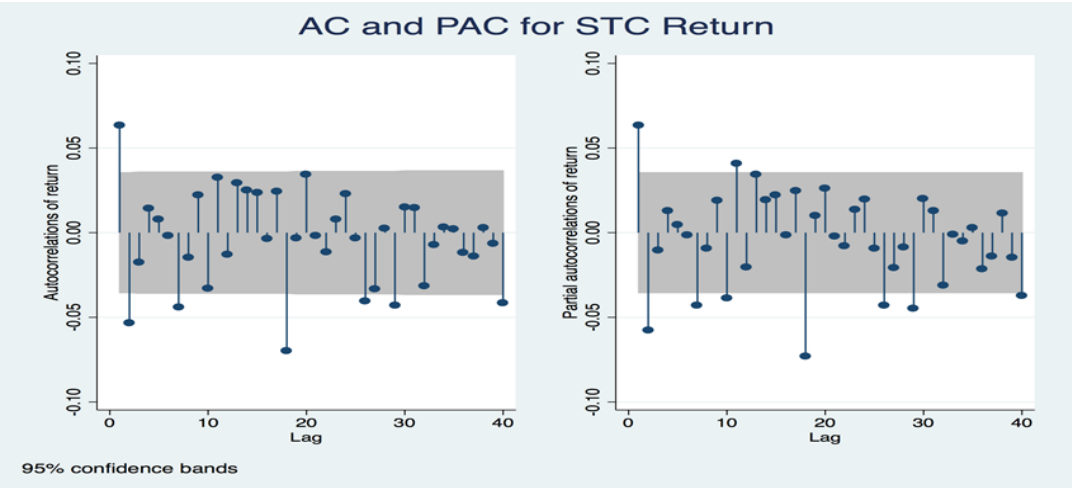
Source: Author's own calculations

Figure 6. 4: AC and PAC FOR SABIC daily return



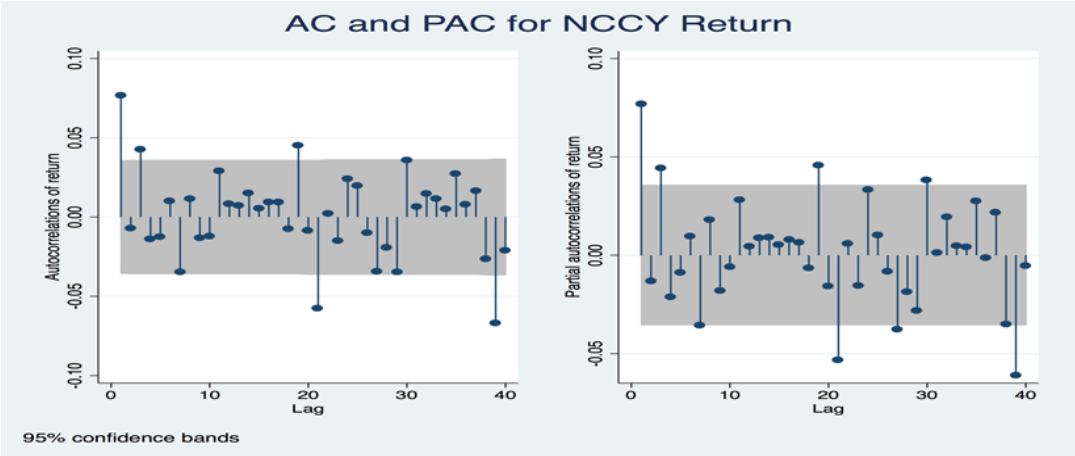
Source: Author's own calculations

Figure 6. 5: AC and PAC FOR STC daily return



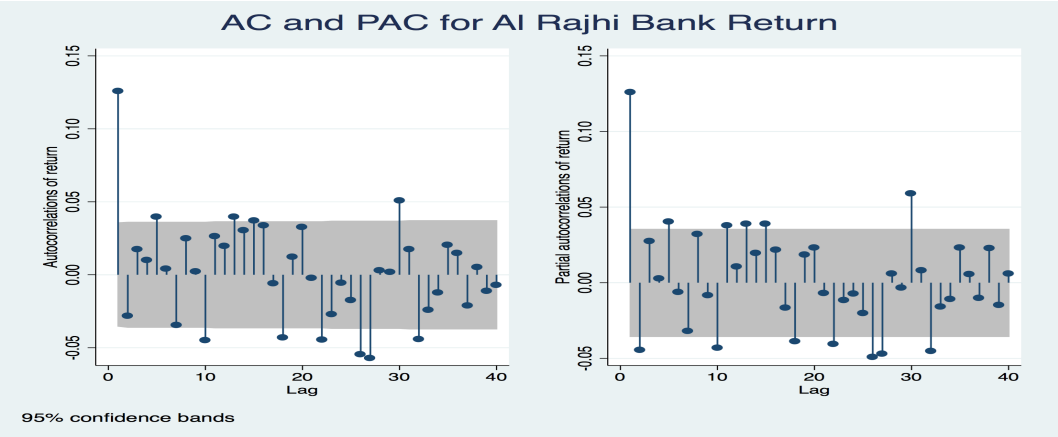
Source: Author's own calculations

Figure 6. 6 AC and PAC FOR NCCY daily return



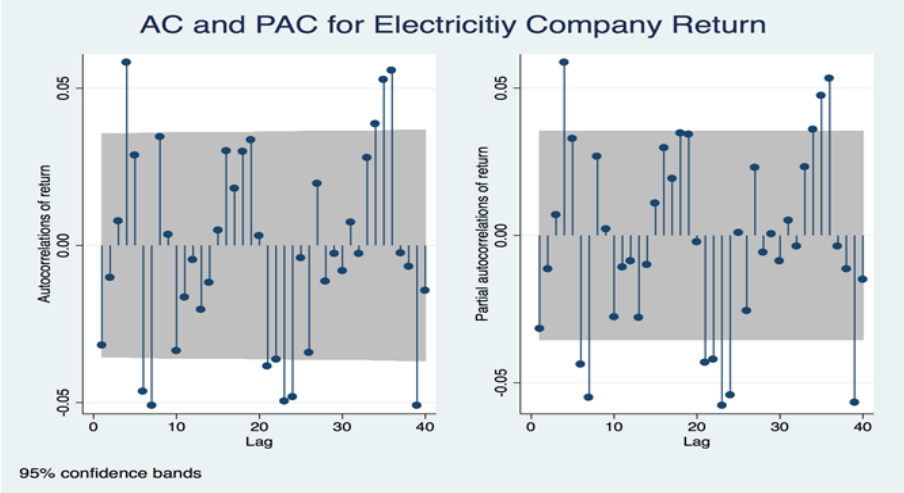
Source: Author's own calculations

Figure 6. 7: AC and PAC for Al Rajhi Bank daily return



Source: Author's own calculations

Figure 6. 8: AC and PAC for Al Electricity Company daily return



Source: Author's own calculations

Table 6.3 and 6.4 shows the sample constituents of each return series for the first tenth lags sample of AC, PAC and Ljung-Box Q-Statistics. Moreover, to check for serial correlation in the data we use and AC and PAC function and the graph are presented for analysis. The plot in (figure 6.1 to 6.8) shows the AC and PAC function for the daily returns of lags 0 to 40 for the SSM DSM KSM and the individual company that (NCCY, STC and SABIC, NCCY, STC, Al Rajhi Bank and Electric Company).

According to AC, PAC results of first ordered correlations provide positive strong evidence. For example, Kuwait (AC 0.23 and PAC 0.23 at significant 1% level). However, Except Electricity Company where it is negative (AC -0.0317 and PAC -0.0317 with 99% confidence) and SABIC where no evidence at significant 1%,5% and 10% level and partly of Dubai stock market. Thus, the null hypothesis of no first ordered serial dependence is rejected. As result, Strong evidence against the Random Walk Hypothesis exists, as positive autocorrelation in stock index returns and the individual company have been noticed see (table 6.3 and 6.4). In addition, label Q in the output above identifies the Portmanteau test statistic that support the null hypothesis is rejected, as autocorrelations are equal to 0 and the first tenth lags rejected the null hypothesis at one percent significant level for the entire sample series. Therefore, Box Q statistics indicates evidence of possible dependence in the first and higher moments of the return distributions except for (SABIC where it is not significant at level 1%, 5% and 10% and partly of DSM and Electricity Company). For example, Dubai is not only

significant at lag three (10.412 at significant 1%, 5% and 10% level). SABIC has the biggest share price in the Saudi Stock Market, and has 70% government ownership, and is 20% higher in value than the electricity company, and this company's liquidity is high compared to other companies in the Saudi Stock Market, and makes it efficient.

Figure from (6.1-6.8) report the estimated Autocorrelation and Partial Correlation denoted by filled circles connected by a straight line to the zero axis. The grey shadowed area identifies the α confidence level.

Generally, there is insufficient clarity from a visual inspection of the sample autocorrelation function plot if there is serially correlated data, for example at lag 1 and 2 there is serial correlation for SSM that is significant, and lag 1, 5 and 9, and DSM has minor significant and serial correlation. In the 6.3 Figure daily returns for KSM there are high positive correlations that only slowly declines with increasing lags. This indicates a lot of positive autocorrelation. Thus, there is a high persistence of autocorrelation, which provides valid empirical evidence that past price series could be applied to predict the future, and against the weak form efficiency of this market.

As a result, these findings provide clear evidence of serial correlation from using PAC and AC, and Ljung-Box Q statistical findings also support this, so that the researcher is confident that for KSM, DSM and SSM null hypothesis of no serial correlation is rejected, a figure of the AC and PAC display different plausible models, therefore confirming the presence of inefficiencies and findings from the review of literature on emerging markets to support the findings of this current study, for example, see (Al Ashikh, 2012; Bley, 2011; lee et al, 2010). Therefore, the level of production in KSM, DSM and SSM can be revealed by using the ARIMA model.

Other considerations should also be mentioned here that the AC or autocorrelations and PAC or partial autocorrelations decay towards zero, not sharply but slowly, and the evolution of the studied variable might be described better by an ARMA model. A better fit could be a MA model or moving average model if PAC falls slowly and AC falls sharply. In contrast, an AR model or autoregressive model would be better if PAC falls sharply and AC falls slowly. Therefore, various MA and AR models are tested to provide greater certainty, and to identify the model that best serves the intended goal. The AR model is analysed first. Thus, In terms of KSM, DSM and SSM, and the individual companies SABIC, STC, NCCY, Al Rajhi and Electricity Company the correct number of terms that characterise an ARIMA model are not clearly

provided by either PAC or AC. According to Brooks (2002) when identifying components of MA and AR in the economic series, identification processes are often criticised when using PAC and AC, as they mostly cannot identify single patterns from real data, so that these are difficult to interpret. However, removing subjectivity when attempting to interpret PAC and AC with the alternative technique of information criteria approach is possible, and this study modelled each series with BIC and AIC criteria as auxiliary instruments. Therefore, a parsimonious model was formed by choosing the model with the lowest value of BIC and AIC and by assuming two lags for each component, and this was then tested for serial correlation. When serial autocorrelation was shown to be present in any series, these were re-modelled by including more components until residuals disappeared in the serial correlation. The researcher identified the beginning and the middle of the figure where significant peaks are identified, so that for DSM, ARMA (1,1) and for SSM, ARMA (1,3) could be a good beginning. However, the role is explained in the methodology chapter (Table 6 Criteria of Identifying the Model Based on the ACF and PACF)

6.4. Bayesian information criterion (BIC) and Akaike's Information Criterion (AIC)

This study recognises that to model each series, BIC and AIC criteria should be used as auxiliary instruments, so to identify an effective model it is important that identify the number of **p** parameters or autoregressive parameters and the number of **q** parameters or moving parameters. There are two factors that form the basis of information criteria, where introducing extra parameters to the model invokes a penalty for loss of degrees of freedom, and the RSS term or residual sum of squares function. Therefore, when a model has an extra lag added or new variable added, the information criteria is affected by increasing the value of the penalty and decreasing the RSS. This means that the aim is to discover how many parameters could minimise the information criterion value, but these could vary, linked to the penalty term severity, so there are various different criteria. This study applies BIC or Schwarz Bayesian Information (1978) Criterion and AIC or Akaike Information Criterion (1974), as these are often used in research studies.

According to (Brooks, 2002), in comparing both criteria, AIC imposes a less severe penalty than the BIC criterion. The AIC is generally more efficient, but not consistent, and the BIC is not efficient but strongly consistent. This means that on average a larger model is produced by the AIC, and the correct model order is delivered asymptotically by the BIC. This contrasts with a greater average variation in a given population for some model orders from various

samples for the BIC rather than the AIC. This indicates that when there are too many parameters in selected models, the AIC is used, but as a sample size grows the BIC criteria remains consistent, and often the preferred choice of model. According to Kennedy (2004), the example of the Monte Carlo studies represents an example of the good performance of the BIC as demonstrating the best criterion. Mills and Prasad (1992) also recommend the BIC criterion based on findings of robustness when dealing with collinearity and non-normal errors and other complications, from investigating various model selection criteria.

Therefore, to construct an optimum ARIMA model for the stock markets in this study, BIC or Bayesian Information Criterion and AIC or Akaike's Information Criterion were used as a basis of fitting various ARMA models to historical data. This resulted in selecting models where all coefficients at 5% level were significant, and with the least AIC and BIC, and these results are shown in (table 6.5 and 6.6).

Table 6. 5: BIC and AIC used to Specify and Select ARIMA Model for index group

Statistics	**Saudi stock market**		**Dubai stock market**		**Kuwait stock market**	
Model	**AIC**	**BIC**	**AIC**	**BIC**	**AIC**	**BIC**
ARMA01	-15550.5	-15532.54	-15740.38	-155722.3	20600.09	-20582.12
ARMA02	-15553.82	-15529.89	-15740.86	-15716.75	-20605	-20581.04
ARMA03	-15562.25	-15532.33	-15739.18	-15709.05	-20607.42	-20577.47
ARMA10	-15548.94	-15530.99	-15740.75	-15734.72	-20610.37	-20592.4
ARMA20	-15551.57	-15527.63	-15741.21	-15717.1	-20608.86	-20584.9
ARMA30	-15560.95	-15531.03	-15739.71	-15709.58	-20614.42	-20584.47
ARMA11	-15568	-15526.11	**-15758.83**	**-15734.72**	-20609.28	-20585.32
ARMA22	-15560.73	-15524.82	-15756.59	-15720.43	-20650.5	-20620.55
ARMA23	**-15561.92**	**-15537.98**	-15754.8	-15712.61	-20649.77	-20607.84
ARMA34	-15563.9	-15516.02	-15752.91	-15704.7	**-20657.5**	**-20597.59**

Source: Author's own calculations

Table 6.5 shows the BIC and AIC for aggregated indices for SSM, DSM and KSM within the time series from 2005 to 2016. When various ARMA models were applied, the choice of best AIC and BIC for SSM produced a values of (-15561.92 and -15537.98) respectively for the ARMA (2, 3) ; and The choice of best for KSM is ARMA (3, 4) at AIC (-20657.5) and BIC (-20597.59), and the best for DSM is ARMA(1,1) at AIC (-15758.83) and BIC (-15734.72).

Table 6. 6: ARIMA model Specification/Selection for Saudi companies:

Statistics	SABIC		STC		NCCY		AL RAJHI BANK		Electricity Company	
Model	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
ARMA01	-14123.65	-14105.57	-15679.56	-15661.48	-13310.33	-13292.26	-15053.3	-15035.22	-14736.53	-14718.46
ARMA02	-14123.8	-14099.69	-15685.39	-15661.28	-13308.95	-13284.86	-15054.71	-15030.6	-14734.79	-14710.69
ARMA03	-14123.76	-14093.63	-15684.49	-15654.36	-13312.71	-13282.6	-15053.8	-15023.67	-14733.28	-14703.15
ARMA04	-14121.77	-14085.61	-15682.98	-15646.83	-13310.93	-13274.8	-15051.82	-15015.67	-14741.89	-14705.73
ARMA10	-14123.75	-14105.68	-15678.05	-15659.97	-13309.82	-13291.76	-15049.14	-15031.06	-14736.47	-14718.39
ARMA11	**-14125.52**	**-14106.41**	-15681.9	-15657.8	-13310.72	-13286.64	-15055.61	-15031.51	-14734.66	-14710.55
ARMA12	-14123.91	-14093.78	-15684.09	-15653.96	-13309	-13278.9	-15053.88	-15023.75	-14732.82	-14702.69
ARMA13	-14122.13	-14085.97	-15682.97	-15646.81	-13310.82	-13274.7	-15053.16	-15017	-14734.86	-14698.7
ARMA14	-14120.89	-14078.7	-15680.99	-15638.81	-13309.45	-13267.3	-15051.25	-15009.07	-14740.5	-14698.32
ARMA20	-14124	-14099.9	-15686.27	-15662.17	-13308.34	-13284.26	-15053.23	-15029.13	-14734.86	-14710.76
ARMA21	-14123.9	-14093.77	-15684.49	-15654.36	-13309.07	-13278.96	-15053.89	-15023.76	-14732.87	-14702.75
ARMA23	-14121.09	-14078.91	-15686.11	-15643.92	**-13311.1**	**-13298.96**	-15051.39	-15009.21	-14746.05	-14703.87
ARMA24	-14119.22	-14071.02	-15679.03	-15630.82	-13323.22	-13275.05	-15056.21	-15008	-14752.43	-14704.22
ARMA30	-14123.97	-14093.84	-15684.6	-15654.47	-13312.32	-13282.21	-15053.51	-15023.38	-14733.01	-14702.88
ARMA31	-14122.66	-14086.51	-15682.95	-15646.79	-13311.12	-13274.99	-15052.38	-15016.22	-14733.9	-14697.74
ARMA32	-14121.15	-14078.97	-15682.84	-15640.66	-13321.1	-13278.96	-15051.39	-15009.2	-14746.17	-14703.99
ARMA33	-14136.11	-14087.91	-15685.42	-15637.21	-13319.11	-13270.94	**-15061.09**	**-15040.88**	-14743.82	-14695.61
ARMA34	-14117.9	-14063.67	-15688.28	-15634.04	-13317.33	-13263.14	-15070.08	-15015.84	-14752.06	-14697.83
ARMA40	-14121.97	-14085.82	-15683.12	-15646.96	-13311.68	-13275.55	-15051.53	-15015.38	-14741.56	-14705.4
ARMA41	-14120.76	-14078.58	-15681.15	-15638.96	-13309.98	-13267.83	-15050.77	-15008.59	-14740.72	-14698.54
ARMA42	-14119.94	-14071.73	**-15685.43**	**-15667.22**	-13319.1	-13270.93	-15050.32	-15002.11	-14751.69	-14703.48
ARMA44	-14117.98	-14063.75	-15687.85	-15633.62	-13317.37	-13263.18	-15070.16	-15015.93	**-14750.47**	**-14696.24**

Source: Author's own calculations

Table 6.6 shows the NCCY, STC and SABIC, NCCY, STC, Al Rajhi Bank and Electric Company individual companies with BIC and AIC for the times series from 2005 to 2016. This indicates that for non-nested alternatives, AIC is useful for selecting models, as there is a preference for smaller values in AIC. This table also shows that only statistically significant parameters are used for making choices, and selecting the lowest value of the AIC results in selecting the best length of lag distribution. The optimum AIC was achieved after fitting various ARMA models, which confirmed the results for SABIC is ARMA(1,1), for STC is ARMA(4,2), for NCCY is ARMA(2,3), for Al Rajhi Bank is ARMA (3,3), for Electricity Company is (4,3).

In conclusion, Table 6.7 Shows the suitable ARIMA model for the data collected based on the lowest value AIC and BIC, which consider the initial order of (p, q). Thus, the next step is to test the correlation of residual to confirm this result of AIC and BIC by Parameters Estimation and Diagnostic Checking.

Table 6. 7: Initial Model Selected Using the AIC and BIC Criteria

Statistics	ARIMA	AIC	BIC
SSM	(2,0,3)	-15561.92	-15537.98
DSM	(1,0,1)	-15758.83	-15734.72
KSM	(3,0,4)	-20657.5	-20597.59
SABIC	(1,0,1)	-14125.52	-14106.41
STC	(4,0,2)	-15685.43	-15667.22
NCCY	(2,0,4)	-13311.1	-13298.96
AL RAJHI BANK	(3,0,3)	-15061.09	-15040.88
Electricity Company	(4,0,4)	-14750.47	-14696.24

Source: Author's own calculations

6.5. Estimation of Parameters and diagnostic checking:

This first requires the discovery of the initial order of p and q, by analysing autocorrelation structures of residuals that should identify if the model is specified correctly. When a white noise process is followed by residuals, the model is correctly specified, but the model would be under-parameterised if residuals show some time patterns. Therefore, a white-noise process distribution of residuals would be the null hypothesis. Therefore, the researcher tests selected models for adequacy by drawing a Bartlett's periodogram, AC by using a constant variance and constant mean to evaluate the null hypothesis of uncorrelated random variables from a white noise process, and whether the residuals are white noise. The hypothesis for this test is shown below:

- H_0: residuals are follow a white noise process.
- H_1: residuals are follow a white noise process.

The table 6.8 shows Cumulative Periodogram White-Noise test In order to examine the adequacy of the fitted model. Thus, table 6.8 suggests that the models are correctly specified for the three markets and for the five individual companies. The Bartlett's periodogram-based test shows white noise for SSM to be (B=0.78, P= 0.56), for DSM (B=0.74, P= 0.64), and for KSM (B=0.54, P = 0.93), and the Saudi companies for SABIC is (B=0.77, P= 0.60), for STC is (B=0.62, P= 0.84), for NCCY is (B=0.44, P= 0.99), for Al Rajhi Companies is (B=0.57, P= 0.89), and for Electricity Company is (B=0.56, P= 0.91). because The test statistic has a p-values greater than 1%, 5% and 10%. Which means that the process is not significantly different from white noise.

Table 6. 8: Cumulative periodogram white-noise test

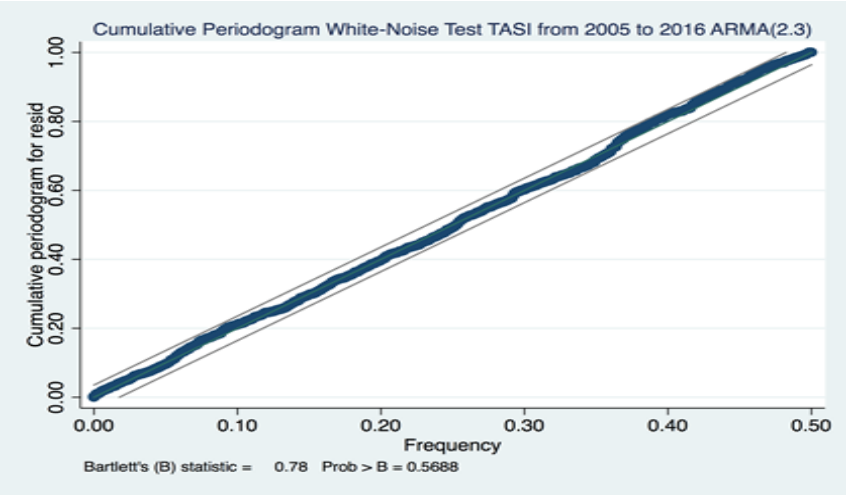
Log - returns	SSM 23	DSM 11	KSM 34	SABIC 11	STC 42	NCCY 23	AL RAJHI BANK 33	Electricity Company 43
Bartletts B statisict	.78	.74	.54	.77	.62	.44	.57	.56
Prob>p	.5688	.6402	.9340	.6010	.8418	.9906	.8922	.9147

*, ** and *** denote significance at 1%, 5% and 10% level, respectively.

Source: Author's own calculations

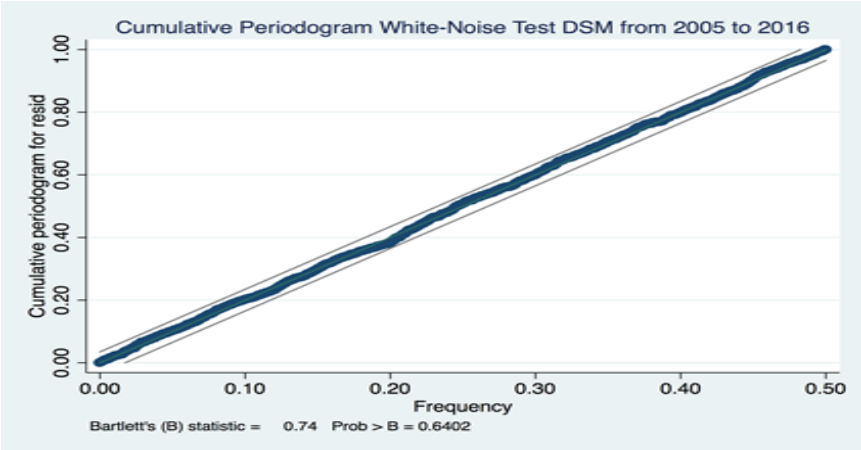
Moreover, we can see in the graphs below form 6.9 to 6.16 that the values are within the confidence intervals and never appear outside the confidence bands for all markets and the individual companies. Therefore, researcher conclude that there is no serial correlation in the model's residuals and the null hypothesis is accepted and the process is not different from white noise. As result, all Models satisfies the stability and correctly specified.

Figure 6.9: Portmanteau Test for SSM



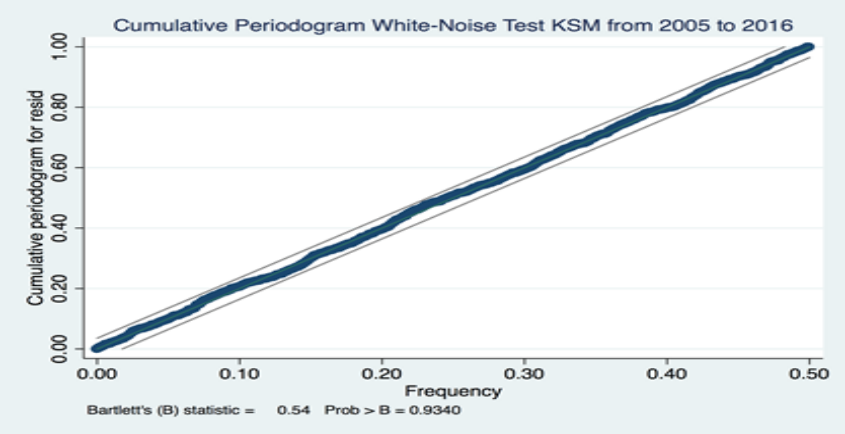
Source: Author's own calculations

Figure 6. 10: Portmanteau Test for DSM



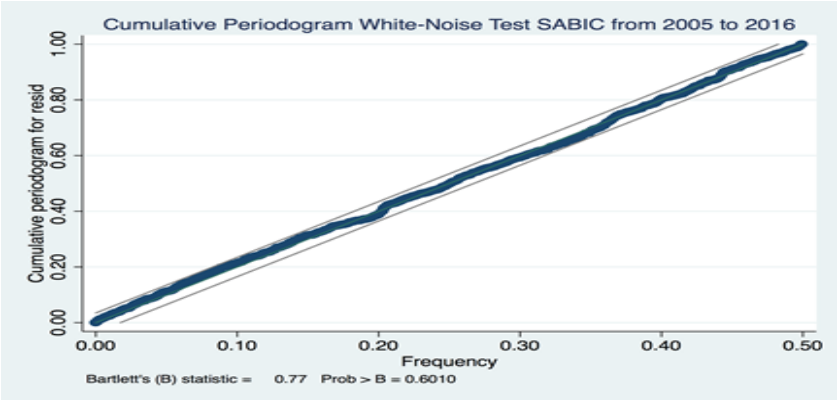
Source: Author's own calculations

Figure 6. 11: Portmanteau Test for KSM



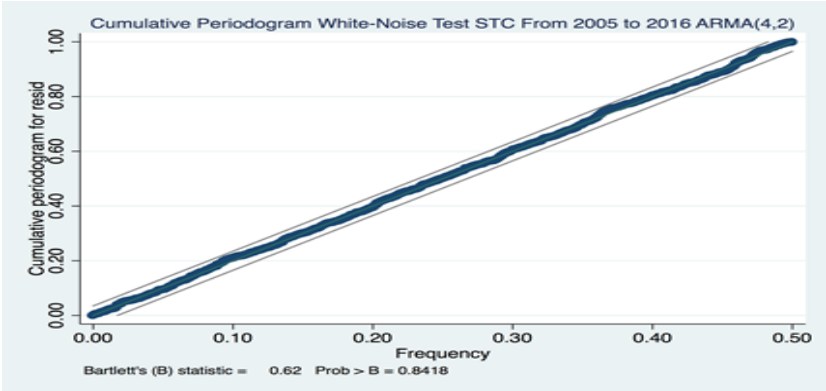
Source: Author's own calculations

Figure 6. 12: Portmanteau Test for SABIC



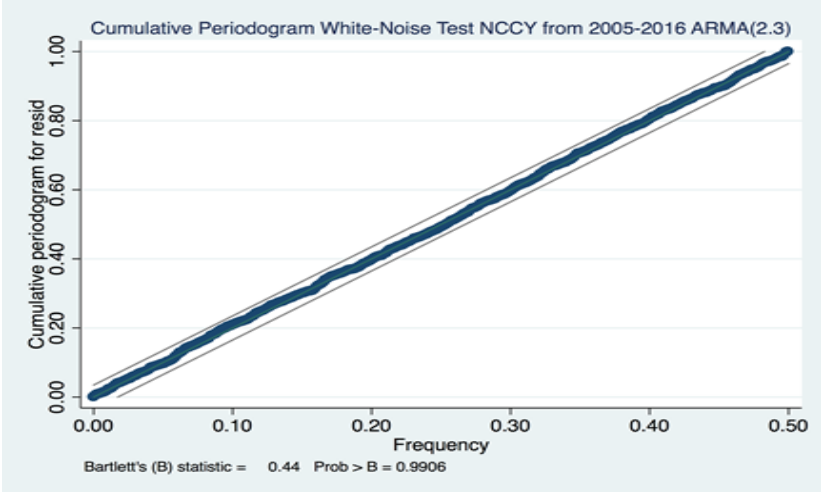
Source: Author's own calculations

Figure 6. 13: Portmanteau Test for STC



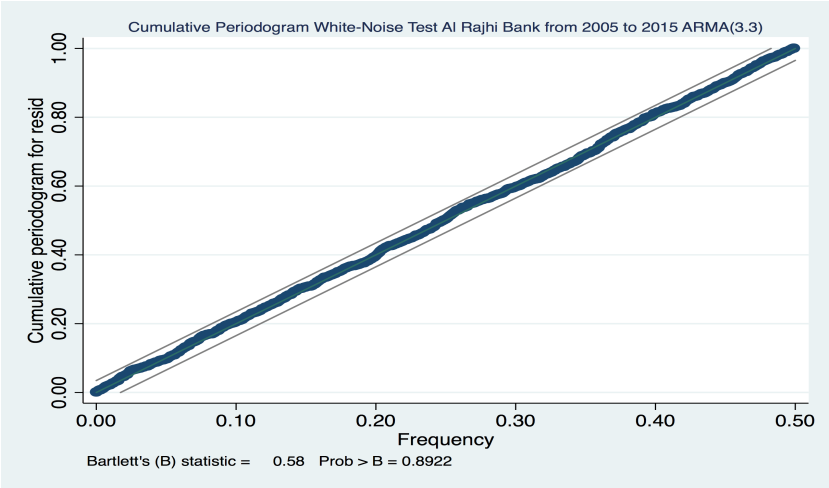
Source: Author's own calculations

Figure 6. 14Portmanteau Test for NCCY



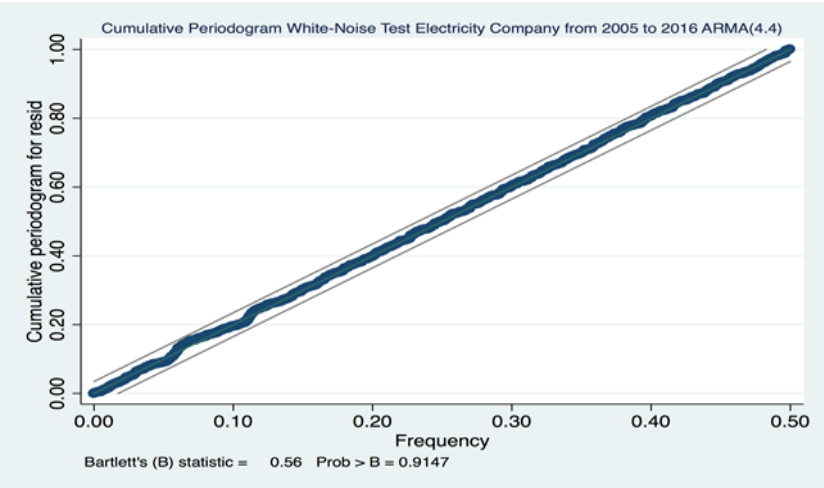
Source: Author's own calculations

Figure 6. 15: Portmanteau Test for Al Rajhi



Source: Author's own calculations

Figure 6. 16: Portmanteau Test for Electricity Company



Source: Author's own calculations

Chapter 7.Forecasting accuracy and discussion:

7.1.Introduction:

According to the EMH, returns should not be predictable because all the available information is already discounted to the market price. However, some shares can show some degree of autocorrelation. In particular, the most illiquid ones as a consequence of as slower price adjustment to news release. Moreover, some evidence show that stock indexes are more characterised by autocorrelation property than singles stock are for example see (chan,1993). Nonetheless, this research aims to investigate whether the GCC stock markets have turned out to be less predicting or otherwise, which is taken as a rising weak-form effectiveness of the market.

This chapter will be subdivided into four sections: the first section will carefully examine the performance in detail with various ARIMA models that were chosen in chapter six, so as provide comparison between models and with those from previous studies. In the second and third sections, graphs are demonstrated, so that the performance of the volatility in the nominated sample could be evaluated. In addition, it will also examine the impact of qualitative macro factors on the GCC markets. Therefore, the likely results of the state space ARIMA are illustrated by the under-mentioned graphs. Consequently, we can determine the existence of autocorrelation and the impact of macro factors in the chosen sample, and the volatility behaviour can be evaluated by considering the graphs. Conclusions will be drawn at the end of the chapter (fourth section).

Figures 7.1 to 7.8 would graphically exhibit the internal forecasts of the volatility of (SSM, DSM and KSM) and (SABIC, STC, SABIC, Alrajhi bank, NCCY and the Electricity Company). The models used to predict the share price series and that of particular Stock market index from 2005 to 2016 are illustrated, and the realized volatility would be outlined by the figures. Furthermore, the production models for ARIMA would be drawn by using the red lines. With regard to each figure, the conditional variance is determined by the vertical axis, while the duration of the time for the internal forecast is calculated by the horizontal axis. Moreover, the real index is represented through blue lines and the red lines are used to outline production models for ARIMA.

7.2.ARIMA Model

To determine if the SSM, DSM, KSM return works as per a random walk model, an autoregressive integrated moving average model (ARIMA) was applied. For assessing the random walk model, the model ARIMA (0, 1, 0) had to be fit according to share price and general index as it incorporates the integration process. Moreover, future share returns in particular will not be based on the share returns' previous lag values or previous error terms if the coefficient differs considerably from zero. The crucial auto-regression coefficients are indicated in terms of their mean value (AR) as well as the moving average (MA) of the past and current error terms that differ from zero, thus suggesting the series' dependency. Both of these statements do not comply with the random walk model's assumption. On the other hand, auto-regression coefficient that equals one suggests that only the current disturbance term influence the returns changes between different periods. That is, the return series is independent of the return series' previous information or previous forecasted errors. This is in tandem with the random walk assumption. In addition, the null hypothesis in the weak form is efficient. Table 7.1 presents the test result of the random walk model (0, 1, 0) for the gathered data.

Table 7. 1: ARIMA Model (0, 1, 0)

Statistics Log - returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
Coefficient	-.0000424	.00011	-.0000389	.00001	-.0000874	0.0003511	0.0000425	-.000055
Standard Error	.000332	0.00033	.00014	0.00043	0.000339	0.0004951	.0003768	0.0003933
T-statistics	-0.13	0.33	-.27	0.03	-0.26	0.71	.11	-0.14
P-value	.898	.741	.787	0.979	0.796	0.478	.910	0.888

*, ** and *** denote significance at 1%, 5% and 10% level, respectively.

Source: Author's own calculations

The table (7.1) presents the ARIMA test result for the model of (0, 1, 0) for the time series (SSM, DSM and KSM) as general index, and (SABIC, NCCY, STC, Alrajhi Bank and Electricity Company) as individual companies.

The results of ARIMA (0,1,0) are presented as evidence that all models are not well fitted for two reasons. Firstly, the parameters are all insignificant from zero for all samples. For

example, the index series for Saudi stock market the coefficient are (-.0000424, .000332) with a t-ratio (-0.13) and probability of .898, Indicating that they reject the null hypothesis. Secondly, all the coefficients are smaller than one and close to zero, which means that the changes in the return are not due to the historical stock price. For example, for SABIC share price coefficient is (.00001), the ε is (0.00043) and P-value is 0.979. Moreover, to build up a predictive model, first researcher calculate the ARIMA model, which is the best-fitted model during the historical period, including SSM (2,0,3), DSM (1,0,1),KSM (3,0,4), SABIC (1,0,1), STC (4,0,2), NCCY(2,0,4), AL RAJHI BANK (3,0,3) and Electricity Company (4,0,4). Table 7.2 shows the results.

Table 7. 2: Daily Share Price of Companies and SSM, DSM, KSM Index: ARIMA Model

Statistics	SSM	DSM	KSM	SABIC	STC	NCCY	Al Rajhi Bank	Electricity Company
Log -returns	23	11	34	11	42	23	33	44
AR1	.6266872	.9828098	-.5235378	.7301655	-.059206	-1.30222	1.229008	.3937772
SE	.0249994	.0072745	.0157715	.1268446	.0163466	.0194409	.0676398	.1017056
T-statistics	25.07	135.10	-33.20	5.76	-3.62	-66.98	18.17	3.87
P-value	0.000	0.000	0.000	0.000	.000	.000	.000	0.000
AR2	-.907866	-	.4780306	-	-1.020302	-.9594547	-.7100898	-1.136414
SE	.0250102	-	.0150002	-	.01859	.0194151	.0968375	.1066895
T-statistics	-36.30	-	31.87	-	-54.88	-49.42	-7.33	-10.65
P-value	0.000	-	0.000	-	0.000	0.000	0.000	.000
AR3	-	-	.9460813	-	.0458474	-	-.1699598	.3859019
SE	-	-	.0154925	-	.0108103	-	.0673616	.0980909
T-statistics	-	-	61.07	-	4.24	-	-2.52	3.39
P-value	-	-	0.000	-	0.000	-	.012	0.000
AR4	-	-	-	-	.0495581	-	-	-.4276052
SE	-	-	-	-	.0125294	-	-	.096902
T-statistics	-	-	-	-	-3.96	-	-	-4.33
P-value	-	-	-	-	0.000	-	-	0.000
MA1	-.546808	-.9652503	.7457514	-.7004815	.1258915	1.384532	-1.103049	-.4295245
SE	.0267917	.0096243	.019953	.1328172	.0128121	.0226631	.0671169	.099188
T-statistics	-20.41	-100.29	.37.38	-5.27	9.83	61.09	-16.43	-4.33
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	.000
MA2	.8326189	-	.3291567	-	.9757897	1.055628	.5144542	1.150905
SE	.1104613	-	.0211185	-	.01327	.0261098	.0967076	.1027889
T-statistics	29.60	-	-15.59	-	73.53	40.43	5.32	11.20
P-value	0.000	-	0.000	-	0.000	0.000	0.000	0.000
MA3	.1104613	-	-.9936215	-	-	.0850651	.3215199	-.4199861
SE	.0112731	-	.0205703	-	-	.0122286	.0669135	.0931536
T-statistics	9080	-	-48.30	-	-	6.96	4.81	-4.51
P-value	0.000	-	0.000	-	-	0.000	0.000	0.000
MA4	-	-	.1602501	-	-	-	-	.4962727
SE	-	-	.0141834	-	-	-	-	.0902162
T-statistics	-	-	-11.30	-	-	-	-	5.50
P-value			0.000	-	-	-	-	0.00
Sigma	.0170562	.0184341	0.0073049	.0240147	.0185729	.0270889	.0205473	.0216218

Source: Author's own calculations

After finding the initial order of (p, q), the researcher estimates parameters of the ARIMA models by using the conditional least squares estimation. Thus, by using STATA Table 7.2 show the different parameters of autoregressive (p) and moving average (q) among the several ARIMA models experimented upon, which shows all significance from zero for the time period from Jan-2005 to Dec-2016 which represents the whole sample period.

All of the coefficients are auto- high correlated and significant. In term of significance of estimated coefficients, the MA lags and AR lags coefficients have a 1% level of significance. Therefore, highly significant and shows the best fitted model. Only AL Rajhi Bank raises one issue with estimated standard deviation of the white-noise disturbance E or (Sigma) is .0205473, AR coefficient is -.1699598 and significant at .05 level of significance with lags 3.

The model that is more appropriate is probably for Kuwait stock market followed by Saudi stock market, then Dubai is significant at the 99% level of significance. Note that Dubai stock market ARIMA (1, 0, 1) found that the coefficients are close to one which means that partly the return do not depend on past information of the return series or past forecasted errors, which is properly consistent with the random walk assumption. Null hypothesis that the market is efficient in weak form. Dubai stock market has positive impact of AR1 coefficient at (.982); and negative impact MA1 (–.965); significant at the 1 per cent level of significance. Comparing with Saudi stock market ARIMA (2, 0, 3) is high auto-correlated at AR1 coefficient (.626); AR2 (–.907); and MA1 (–.546); MA2 (.832); MA3 (.11); significant at the 1 per cent level of significance. Thus, this result is consistent with auto-correlation and partial correlation in chapter 3.

However, if the auto-regression coefficient is equal to one, then all ARIMA for the complete time series is calculated for examination. This was addressed by diagnostic checking, which showed in the return series that there was no significant residual autocorrelation. This suggests that the random walk model or current disturbance terms are not responsible for changes in the return series, so that past price series can predict future trends, and again all evidence is against the weak form efficiency of markets studied. The result suggests that the stock index and individual company was statistically significantly impacted by the by previous price.

It should be mentioned that, Table 7.2 shows indications of complex dependencies, because some AR coefficients have high lags, such as for SSM this is significant at Ø_1, but residuals

still pass the white noise test and confirm that the model is proper and tracks information sufficiently. Thus, The equation given below shows best model which is forecasted,

- **The model for Saudi stock market: ARMA(2,3)**

Researcher found a reasonable fit model for Saudi stock market and the values of θ, α1, and β1, Hence, our model would take the following form:

$$\boldsymbol{r_t = \delta + .626 + (-.907) + \varepsilon_t + \mu + (-.5468) + .8326 + .1104 + \varepsilon_t}$$

The resulting out-of-sample forecast of the SAUDI All-Share Index for twelve years, ranging from January 2005 to December 2016, the forecast and actual return general index of the series are graphed in Figure7.1 below.

- **The model for DUBAI STOCK MARKET: ARMA(1,1)**

To forecast of the Dubai daily return series, starting from January 2005 to December 2016, the estimated model for forecasting which can be written as-

$$\boldsymbol{r_t = \delta + .9828 + \varepsilon_t + \mu + (-.9652) + \varepsilon_t}$$

The forecast and actual general index of the series are graphed in Figure 7.2 below.

- **The model for KUWAIT STOCK MARKET: ARMA(3,4)**

The final model to forecast Kuwait stock market daily Index series can be written as-

$$\boldsymbol{r_t = \delta + (-.5235) + .4780 + .9460 + \varepsilon_t + \mu + .7457 + .3291 + .9936 + .1602 + \varepsilon_t}$$

The forecast and actual general index of the series are graphed in Figure 7.3 below.

- **The model for SABIC Company: ARMA(1,1)**

The researcher found a reasonable fit model for SABIC and the values of θ, α1, and β1, Hence, the model would take the following form:

$$\boldsymbol{r_t = \delta + .7301 + \varepsilon_t + \mu + (-.7004) + \varepsilon_t}$$

The forecast and actual general index of the series are graphed in Figure 7.4 below.

- **The model for STC Company: ARMA(4,2)**

The best of formal choice of STC share price is depicted below

$$\boldsymbol{r_t = \delta + (-.0592) + (-1,020) + .0458 + .0495 + \varepsilon_t + \mu + ..1258 + .9757 + \varepsilon_t}$$

The forecast and actual general index of the series are graphed in Figure 7.5 below.

- **The model for NCCY Company: ARMA(4,2)**

In forecasting form, the best model selected can be expressed for NCCY share price as follows:

$$\boldsymbol{r_t = \delta + 1.302 + .9594 + \varepsilon_t + \mu + 1.384 + 1.055 + ..0850 + \varepsilon_t}$$

The forecast and actual general index of the series are graphed in Figure 7.6 below.

- **The model for AL RAJHI BANK : ARMA(3,3)**

$$\boldsymbol{r_t = \delta + 1.229 + (-.7100) + (-.1699) + \varepsilon_t + \mu + (-1.103) + .5144 + .321 + \varepsilon_t}$$

The resulting out-of-sample forecast of the al Rajhi share price for twelve years, ranging from January 2005 to December 2016, the forecast and actual return general index of the series are graphed in Figure 7.7 below.

- **The model for AL Electricity Company: ARMA(4,4)**

Lastly, the best model selected can be expressed for Electricity Company share price as follows:

$$\boldsymbol{r_t = \delta + .3937 + (-1,136) + .3859 + .4276 + \varepsilon_t + \mu + (-.4295) + 1.150 +}$$
$$\boldsymbol{+(-.4199 + .4962 + \varepsilon_t}$$

As per the criteria suggested in Chapter 6, the present study used ARIMA models. According to the evidence, past returns information depends significantly on all samples. This does not only comply with the market's weak-form efficiency but also proves that the markets' and individual companies' future returns can be speculated by the past return series. Hence, the weak form inefficiency evidence indicates that the substantial amount of stock prices in individual companies as well as select capital markets is either overvalued or undervalued. Further, the ARIMA model affirms that, throughout the sampling period, the previous results are all consistent. These results are also comparable to the results of (Ariyo et al., 2014) in which the Zenith bank stock price and Nokia stock index were assessed using ARIMA model. According to the results, the ARIMA model has significant ability to predict in the short-term and is equivalent to the current methods used to predict stock price. Furthermore, (Yousif and Elfaki, 2017) examined the Qatar stock market's general closing index for 2007–2016 and discovered that for the daily general index, ARIMA (2, 2) is the most appropriate linear model. The univariate ARIMA forecasting model was assessed by (Al-Shiab, 2006) by applying the Amman Stock Exchange (ASE) general daily index during 4/1/2004 and 10/08/2004. They found that in its weak form, ASE closely followed the Efficient Market Hypothesis (EMH). The autoregressive integrated moving average (ARIMA) model was used by (Pai and Lin, 2005) who determined that the ARIMA model is unable to easily identify nonlinear patterns. Moreover, in GCC countries, Nourredine Khaba (1998), found proof of non-randomness stock price behaviour and of market inefficiency, and (not weak-form efficient), on the Saudi stock market. A study by Asiri (2008) attempted to measure the stock price behaviour of the Bahrain Stock Exchange (BSE) for which autoregressive integrated moving average (ARIMA) was used

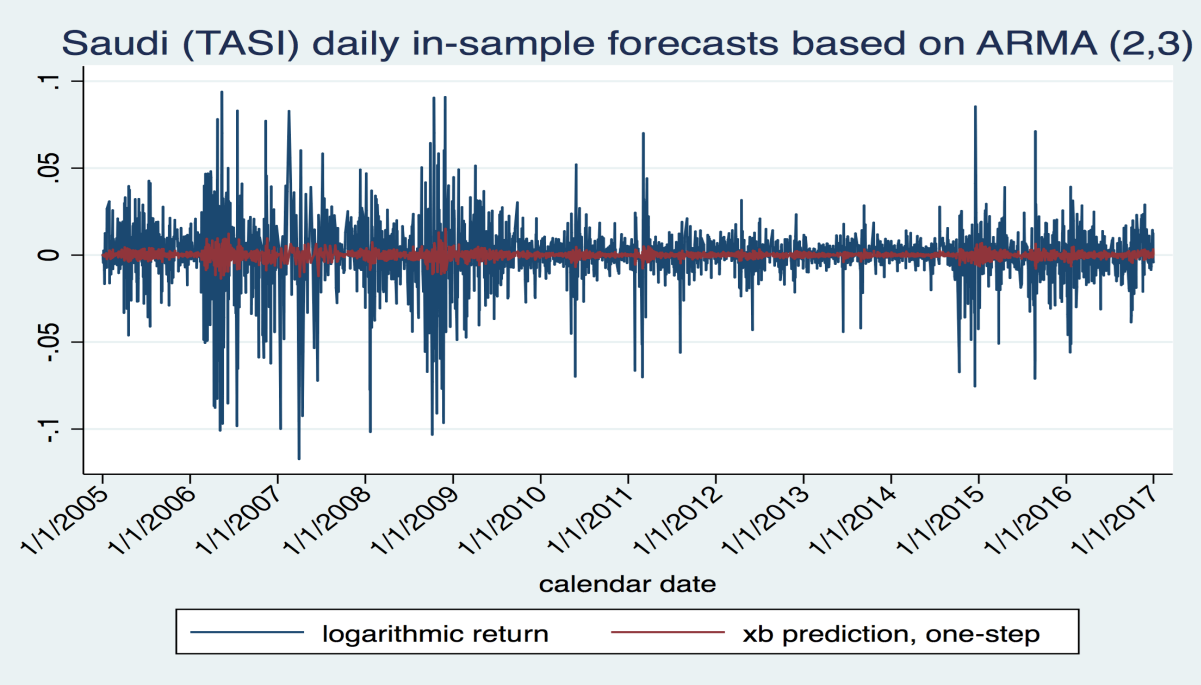
for measuring the weak-form efficiency and they found that BSE's efficiency in the weak form was supported by the ARIMA (AR1) tests.

It is important to note that there are various factors resulting in the inefficiency of stock markets. A study by (Ito et al., 2012) that focused on the US stock market noted that when the investors have to deal with extraordinary circumstances such as financial crises or severe recessions, they become irrational. Further, though investors are generally rational, during that time, their stochastic discount factor tends to change. For gaining a comprehensive understanding of the factors responsible for the inefficiency of markets, ARIMA model must be further assessed for evaluating the extent of the deviation between the fitted value and the actual value. In the next section, figures 7.1–7.8 illustrates the actual stock price as well as the predicted values that indicate the selected ARIMA model's performance by clarifying the predicted price as compared to the actual stock price.

7.3.The forecasting for the index for the emerging stock markets:

7.3.1.Saudi Index Stock Market

Figure 7. 1: SSM return in sample forecasts based on ARMA



The predicted values, which are apparently conforming to the ARIMA (23) model are revealed by the figure 7.1. Hence, the forecasts for the SSM Index returns were produced through this model as depicted in the above mentioned chart. Moreover, the forecasts from the ARMA23 model are also found to be better and dependable. According to the graph, the selected ARIMA model yields satisfactory performance in the beginning and drops gradually with the passage of time. This is a perfect indication of an upsurge of Saudi stock market over time, as the unstable period was much higher than after 2011. In addition, 2005-2011 was believed to be the unsteady period. However, because of declining oil price from 2014-2015, an improvement was again shown by the predicted values between 2015 and 2017.

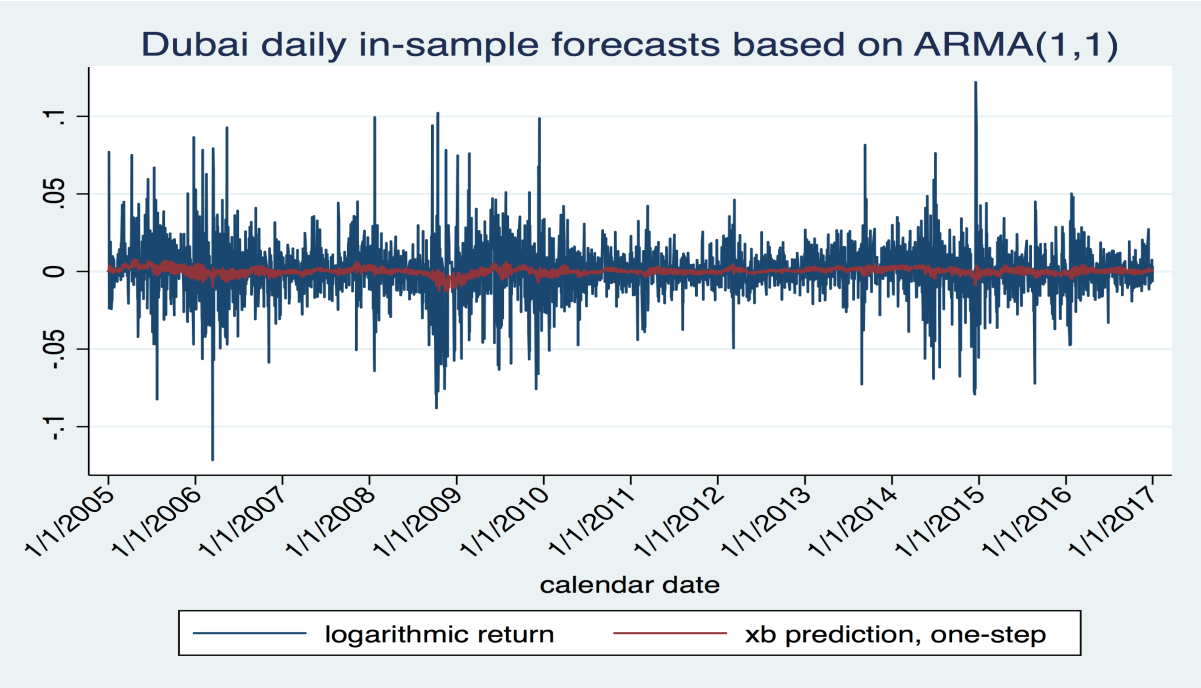
Specifically, due to improved oil supply in the US and reductions in global demand, the price of oil became half from June 2014 to March 2015. Actual decline in the oil prices has direct impacts on trade. Moreover, the indirect effects can be realised through investments, growth and adjustments in inflation.

These findings are thought-provoking, because the perception that the complex models give ideal performances in unstable periods like the 2008/2009 season can simply be overlooked.

We learnt from the behavioural finance approach that the markets run their business operations in a different ways during different time periods. For instance, different behaviours might have been reported in the financial crisis, when the crisis was getting worse than when it was being alleviated.

7.3.2.DUBAI Index Stock Market

Figure 7. 2: DSM return in sample forecasts based on ARMA

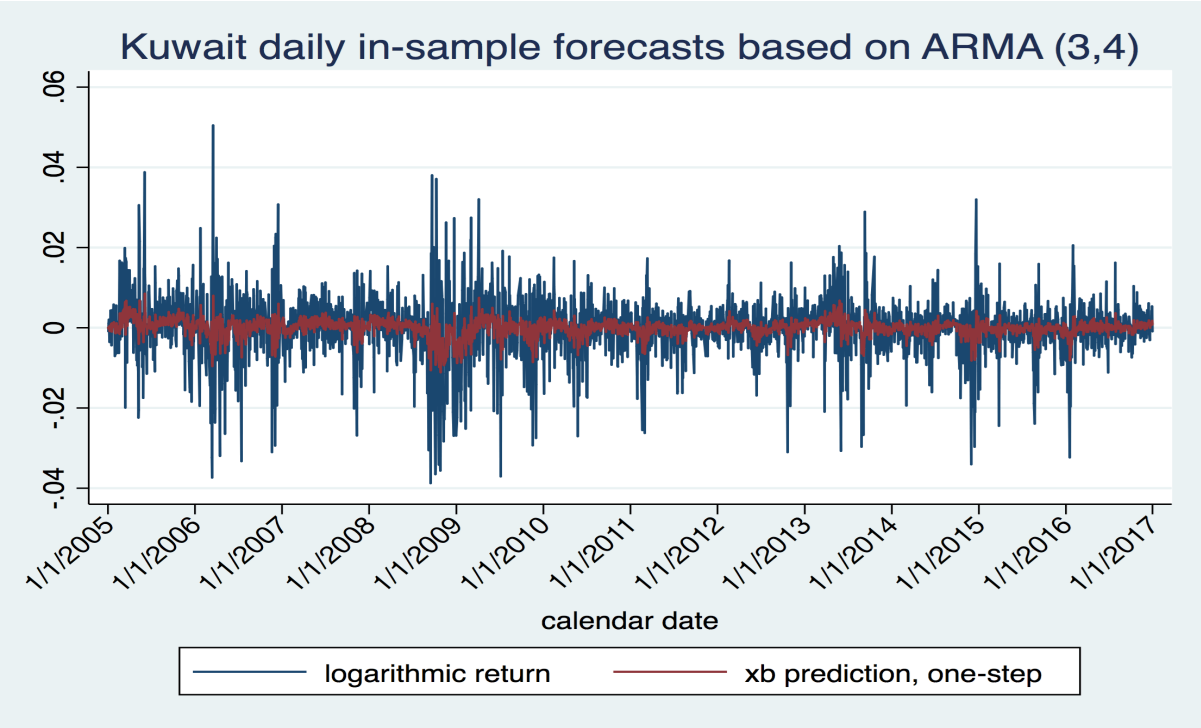


Concerning the Dubai stock market between 2005 and 2016, the forecast on the basis of the ARMA(1, 1) is shown by the chart 7.2. From the ARMA (1, 1) model, the forecasting and real logarithmic return and the Dubai index return are compared with the above indicated chart. In this situation, the perfect model for Dubai stock index after several adjustments of the autoregressive (p) was none other than the ARIMA (1,1). Other than this, the moving average(q) parameters were also adjusted in STATA software. The degree of accuracy was demonstrated through the blue line, which indicates the actual stock return, while the return merely was predicted by the red line in Figure 7.2. The graph reveals unacceptable performance of the ARIMA model, because wide margins between the predicted values and the actual values were observed. Consequently, the ARIMA model fails to oppose the realised volatility in a successful manner. Therefore, DSM is found extremely efficient as compared to

the other GCC stock market. With the help of the AC and PAC in the chapter 6, the earlier findings of this research study have corroborated this result.

7.3.3.Kuwaiti Index Stock Market

Figure 7. 3: KSM return in sample forecasts based on ARMA

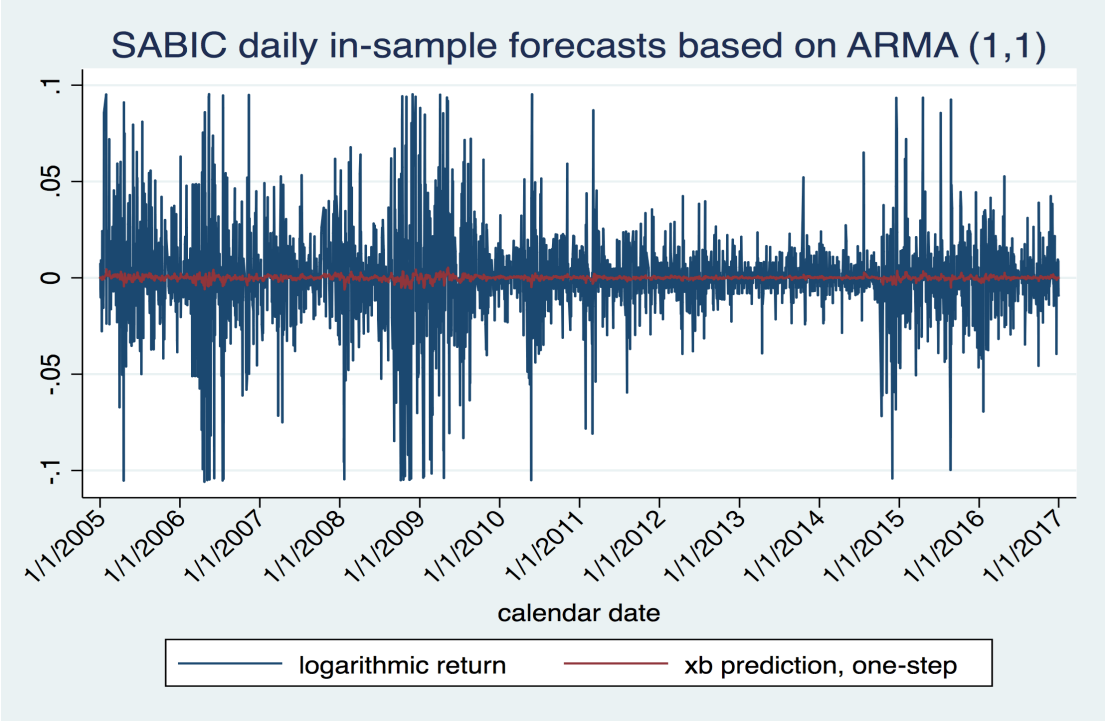


For Kuwait stock index, ARIMA (3, 4) is used by the figure 7.3.to demonstrate the accurate relationship, the predicted price is tested against the actual stock price. As the realised volatility can be successfully traced through this model, it was hence exclusively selected to be the most effective and most efficient. We have carefully analysed the figure 7.3 and we have found that there is a similarity between the actual value and the fitted value and the peak volatile period is indicative of the deviations. This reveals that a very low level of the efficiency is observed in the KSM while it was compared with the Dubai stock market and the Saudi stock market, where high level efficiency was observed. Nevertheless, the performance of ARIMA remained fairly better than other periods during the spike periods. This result can be interpreted by the weakness of regulation in Kuwait stock market. For example, as stated by (Bouresli, 2009); International Monetary Fund 2004; Kuwait Chamber of Commerce and Industry, (2006 the KSM and the Market Committee essentially are one establishment that have different responsibilities and functions. Therefore, they both had a conflict of interest

as well as power division that led to contradictory regulations, weak surveillance, and inconsistent enforcement. As stated by International Monetary Fund (IMF) (2004), the Kuwaiti regulatory framework in terms of the securities market was weak as their commercial law and regulations underwent several amendments for improving its regulatory environment (Alfaraih, 2009). It was in 2011 that the Capital Market Authority Gilmore and McManus (2002) was established in Kuwait, as compared to Dubai establishing it in 2000 and the Saudi Stock Market in 2003. The CMA is a regulatory body akin to the Australian Securities and Investments Commission and the US Securities Exchange Commission (SEC).

7.3.4.SABIC Share Price

Figure 7. 4: SABIC return in sample forecasts based on ARMA

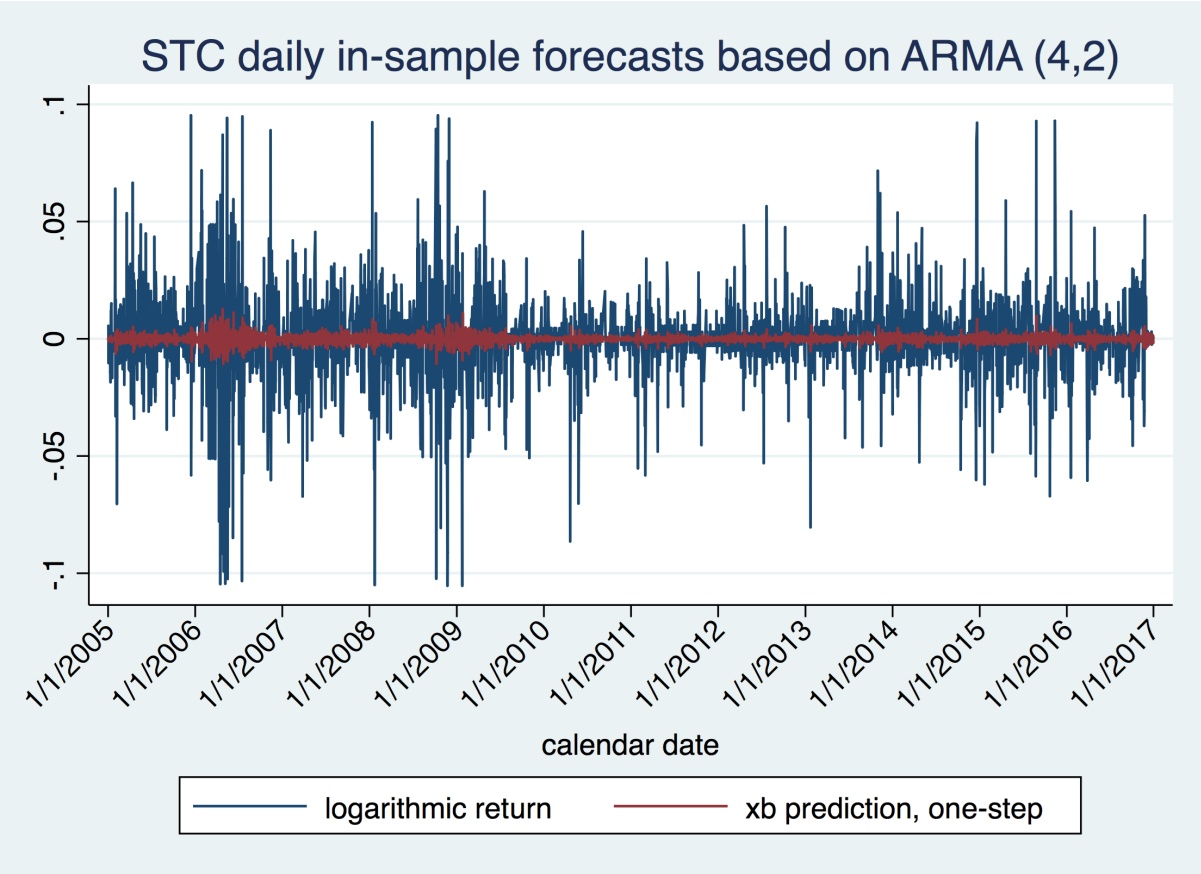


The ARMA (1,1) model is depicted in figure 7.4. The basic aim was to generate predictions for the SABIC share price returns. It has been found that the ARMA11 model yielded poor forecasts, since frequent deviations were observed with the passage of time by this model in this regard. Furthermore, describing the events, which can trace the volatility of the individual companies of Saudi stock market, is a challenging task upon seeing the forecast line. Therefore, the efficient market hypothesis and of this research are similar. Moreover, this is also consistent with the assumption of prices to adhere to a martingales process. By taking

the AC and PAC in (chapter 6) into account, the previous findings of this research have validated this result.

7.3.5.STC Share Price

Figure 7. 5: STC return in sample forecasts based on ARMA



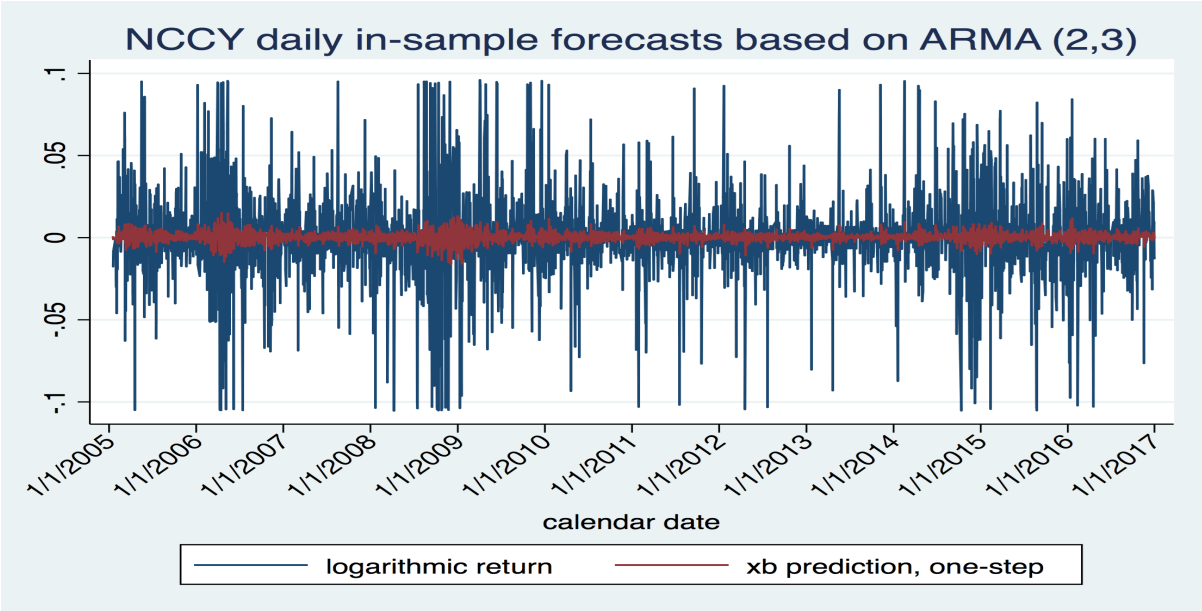
As far as the STC stock market between 2005 and 2016 is concerned, the forecast on the basis of the ARMA (4.2) is shown by the chart 7.5. The chart above compares the STC share price return with the ARMA based forecasting and real logarithmic return model. In this situation, the optimum model for STC share price after several adjustments of the autoregressive (p) was none other than the ARMA (4.2). Moreover, in this regard, we also have used the moving average(q) parameters in STATA software. The return was predicted through the red line in figure 7.5 and the actual stock return was illustrated through blue line to show the level of accuracy.

According to the figure 7.5, the STC Share return remained stable during the period until the overvaluation in 2006 where a financial crunch in Saudi stock market was seen. The graph

indicates that the selected ARIMA model has an acceptable performance in the beginning and declines with the passage of time. We can discover that the level of efficiency is generally improved especially after 2011 and this evident improvement is the consequence of the reforms brought in Saudi stock market.

7.3.6.NCCY Share Return

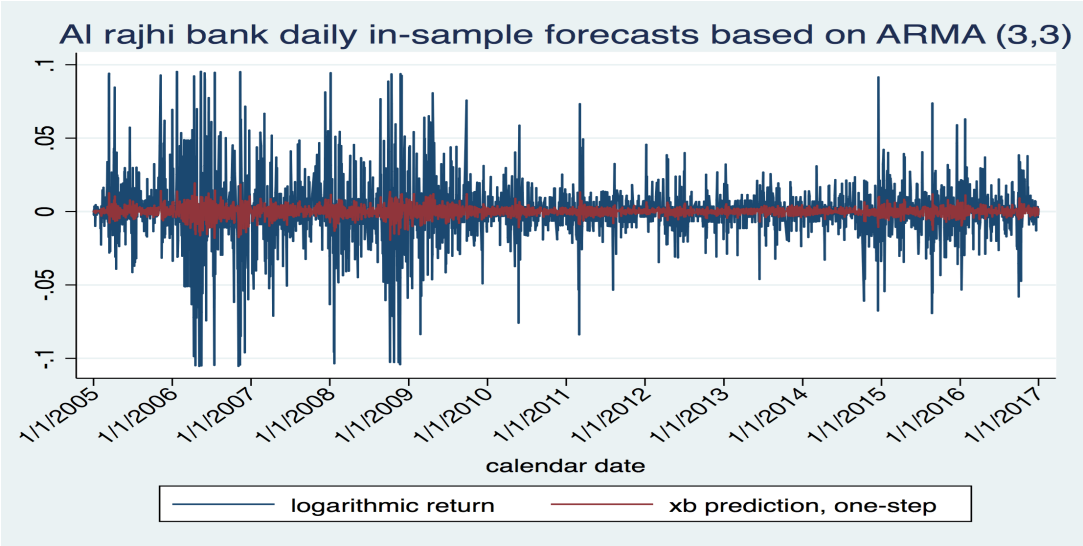
Figure 7. 6: NCCY return in sample forecasts based on ARMA



According to the figure 7.6, performance of the ARIMA (2, 3) is better than those of the STC and the SABIC because the most volatile periods are captured by the models upon their happenings. The chart is clearly indicating that the NCCY with the passage of time has same level of predictability even after reforms (2011), which is contrary to other share prices. Therefore, this representation of the low level of the efficiency or more predictions could be realised by this share as compared to other share prices. This is truly consistent with extant literature. The year, 2005 witnessed the first trading of NCCY Company and it cannot be that professional and well-organised. It can be said that we cannot assume the share price is efficient as it needs time to improve the level of the efficiency.

7.3.7.Al Rajhi Bank Share Price

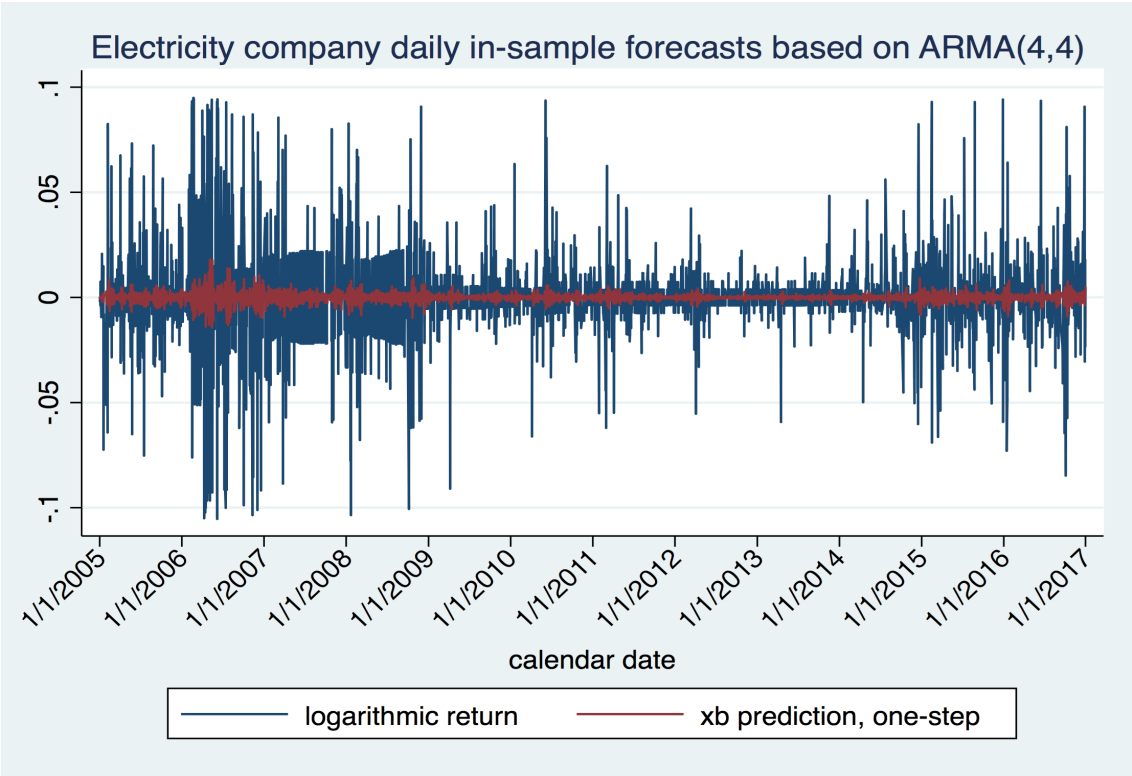
Figure 7. 7: Al Rajhi Bank return in sample forecasts based on ARMA



From January 2005 to December 2016, the results for Al Rajhi Bank's share price are illustrated by the figure 7.7 through the ARMA (3.3). Similar interpretations for Al RAJHI Bank return can also be observed with the help of ARIMA (3.3). Ultimately, settlement of the financial crisis led to the stability in Al Rajhi share price, and the issue was triggered by over-reaction of the investors at the moment of the events' announcement. Actually, the financial crunch is depicted by the huge volatility and spikes. Moreover, we can substantiate that there was an increase in the stock prices during the financial crisis between 2007 and 2009, which attained a high level of the instability than their normal level and their adjustment progressively attained the average level. Nonetheless, the level of return had a worst prediction after 2011, which was almost consistent with a straight line throughout the time frame. This particular phenomenon and the efficient market were almost similar. Consequently, the findings revealed that the level of the efficiency has again improved in most of the Saudi stock companies with the passage of time.

7.3.8.Electricity Company Share Price

Figure 7. 8: daily in sample forecasts based on ARMA



As far as the Electricity Company share price daily series and the histogram of returns are concerned, the plots/designs/outlines are given by the figure 7.8. As slight decrease was exhibited during mid-2006 by the return series and a drop in the series was also noticed during 2008 to 2009, which corresponding with the financial crisis. As per the plot, negative returns are variable and had a significant effect as compared to positive returns. Nonetheless, huge improvements after 2011 have been seen, which are evident and self-speaking. The reforms in the Saudi stock market have considerably reduced the level of volatility. Thus, the diagram 7.8 clearly reveals that most of the spike periods especially from (2011 to 2016) cannot be traced through the ARIMA.

7.4.Conclusion:

This Chapter analysed the general closing index for the GCC stock market from January 2005 to December 2016. Table 6.9 shows the different parameters of autoregressive (p) and moving average (q) among the several ARIMA models experimented upon, which show all significant from zero. ARIMA were applied and it was concluded that SSM ARMA(2,3), DSM ARMA(1,1) KSM ARMA(3,4), SABIC Company: ARMA(1,1), STC ARMA(4,2), NCCY ARMA(4,2), AL RAJHI BANK ARMA(3,3) and AL Electricity Company ARMA (4,4) were the most suitable time series model for the daily general index.

Based on time series plots, share prices for GCC capital market showed continuous increase and it was found that different levels of efficiency are shown by the ARIMA models between different markets at various times. For instance, most Saudi companies and the stock markets had their efficiency enhancement, only NCCY did not show clear improvement in the level of the efficiency. In the first years from 2005-2011, there was a weak level of the efficiency and high level of the volatility and they rather negatively responded to the fluctuating crisis. For example, there was a drop in the time series because of the world's financial crisis in 2008-2009. As the stock market is highly fluctuating especially pre-2010, it is more appropriate to study the general closing index by analysing data on a daily basis. This is comparable with the mature markets. Nevertheless, obvious improvement was observed in the efficiency level in the last 5 years that is from 2011-2015. This is due to the fact that GCC's stock market is a rapidly growing market because of the tremendous economic growth in the country. As more and more companies are joining the stock market, the number of investors increases as well. However, there is a variation in the current amendments in the long-range dependence across the market and companies indices. For instance, a downward trend towards incompetence is exhibited by some of them as the Saudi stock market from 2014 to 2016 is a clear indication of this phenomenon. Specifically, due to improved oil supply in the US and reductions in global demand, the price of oil became half from June 2014 to March 2015. Actual, decline in the oil prices has the direct impacts on trade. Moreover, the indirect effects can be realised through investments, growth and adjustments in inflation. However, the regulatory reforms yield apparent and significant improvements specially after 2011.

The rest of the companies illustrated similar patterns of evolving efficiency. However, especially before 2011, high level of correlation was observed among markets in GCC. For

instance, the Kuwaiti stock market and the Dubai stock market were affected by the internal financial crisis 2005-2006 in Saudi stock market. Moreover, between 2007 and 2009, the result was the same for the external financial crisis. As a result, there was a high level of contagion and volatility clustering between GCC Stock market thus, the future prediction can be done by modelling volatilities, for example by ARCH and GARCH models.

Chapter 8.Relative measures in forecast evaluation and comparing outcome:

8.1.Introduction:

The review of literature of this subject shows that there is general consensus to test for weak-form efficient markets, but some studies suggest that better understanding of underlying factors is more important, as these could lead to greater efficiency in markets. Thus, instead of seeking absolute efficient markets, relative inefficiently provides a balanced perspective of efficiency rankings of stock markets studied. This chapter examines levels of efficiency for the period from 2005 to 2016 in the market price index of SSM, DSM and KSM stock markets; and the individual companies of Saudi stock market SABIC, STC, NCCY, Al Rajhi Bank and Electricity Company to identify any variations in their efficiency levels. Then, non-overlapping sub-samples are used to examine effects of postulated factors influencing efficiency of markets. In particular, this chapter presents this investigation based on relative weak form efficiency from (01-01-2005 to 31-12-2016); and events that are predetermined that are:

- Reforms that are pre from **(01-01-2005 to 31-12-2010)** and post- from **(01-01-2011 to 31-12-2016);**
- Internal crisis period of pre from **(01-01-2005 to 31-12-2005)**, post- from **(01-01-2007 to 31-12-2007)** and during **(01-01-2006 to 31-12-2006);**
- Financial crisis period of pre- from **(01-01-2005 to 31-12-2006)**, during from **(01-01-2007 to 31-12-2008)** and post from **(01-01-2009 to 31-12-2010)**;
- Saudi Stock Market 2008, liberalisation (Swap Agreement) period of pre from **(01-01-2005 to 31-12-2007)**, post from **(01-01-2008 to 31-12-2010)**.

This case study approach compares error metrics and forecasting methods to highlight any differences. Forecasting models and actual stocks are analysed to investigate any linear correlation by using the Box Jenkin's Method which is used to provide analysis of the results, and one-step-ahead forecasting is evaluated by model design with prediction results produced by ARIMA models. Forecasting out-of-estimation samples from a previous period often result in cumulative errors, but these problems can be overcome by adopting one-step-ahead forecasting. Subsequently, MAPE, RMSE, MSE and MAE error matrices to discover relationships.

These investigations into predicted stock prices and actual stock prices enable the computation of error rates. This study analyses measures of forecasting accuracy by

calculating the error rate with MAD or mean absolute error, MSE or mean squared error, RMSE or root mean squared error and MAPE or mean average percentage error. A high level of prediction is indicated when the smallest value is not supportive of weak-form efficiency. Percentage of rolling time windows is indicated by percentage of significant forecasting accuracy statistics. A higher degree of weak-form market efficiency is indicated by more frequent price deviations from higher percentages. The relevant periods and the events are listed in next section, and at the end of this chapter, conclusions are presented.

8.2. Stock Markets: Relative Weak-form Efficiency Assessment:

H_0: Between individual companies and GCC countries, there is no significant differences between efficient markets.

H_1: Between individual companies and GCC countries, there is significant differences between efficient markets.

Table 8. 1: 2005 – 2016: Forecasting Accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.01025	0.01205	0.0052	0.0168	0.0111	0.0151	0.01242	0.01204
MSE	0.00029	0.00033	0.0001	0.0007	0.0005	0.0003	0.00041	0.00044
RMSE	0.01697	0.01827	0.0074	0.02660	0.0239	0.0183	0.02029	0.02098
MAPE	0.85	0.90	0.77	0.90	0.87	0.86	0.88	0.75

Source: Author's own calculations

Table 8.1 compares one-sample performance from 2005 to 2016 by using the summary of MAD, MSE, RMSE and MAPE to compare models' degree of production, so that for the markets and individual companies studied, the degree of predictions is compared by applying relative market efficiency.

These results show that DSM Market has the highest level of the efficiency at (0.01205 for MAD, 0.00033 for MSE, 0.01827 for RMSE and 0.90961 for MAPE) when compared with KSM and SSM. However, When individual companies were compared to show the level of efficiency, results are higher for SABIC at (0.0168 for MAD, 0.0007 for MSE, 0.02660 for RMSE, and 0.9035 for MAPE). SABIC is based in Riyadh and is a publicly traded company since 1976. SABIC is the largest and most profitable non-oil companies in the Middle East region, and in terms of total market capitalization, the company accounts for around 18% and also one of

the world's 10 largest petrochemical manufactures (Tadawul, 2017). NCCY has only been publicly traded since March 2005, but is the most predictable company studied, but this could be explained by insufficient time to develop efficiency. Thus, ranking the index and the individual companies are shown to be meaningful in table 8.2 and 8.3 presenting MSE test for determining the degree of production.

Table 8. 2: From 2005-2016: Ranking using MSE, ARIMA MODEL

Statistics Log -returns	MSE
DSM	0.00033
SSM	0.00029
KSM	0.0001

Source: Author's own calculations

Table 8. 3: Individual Companies: Ranking

Statistics Log -returns	MSE
SABIC	0.0007
STC	0.0005
Electricity Company	0.00044
Al Rajhi Bank	0.0004
NCCY	.0003

Source: Author's own calculations

The table 8.2 and 8.3 show the efficiency ranking result for the individual companies and stock market indices for countries included in this study. Thus, Kuwait has the least efficient stock market with MSE of 0.0001 and Dubai has the most efficient stock market with MSE of 0.0003. In addition, these results suggest that the aggregate index of different countries is less efficient than individual companies when these are compared. According to Samuelson (1998), efficient market hypothesis works less well for an aggregate stock market index than it does for individual shares. In the same context, Findings from an empirical study by Lim and Brooks (2006) suggest that generally, developed markets are more efficient than those in

emerging countries, but that the level of weak-form market efficiency between different countries varies widely.

Various studies identify market microstructures and irrational behaviours that are different within European stock markets (Sensoy and Tabak, 2015), and the subprime crises that resulted in financial shocks have a significant influence on time path evolution of market efficiency (Sensoy, 2013). Another study suggests that institutional characteristics, capitalization and market turnover of stock markets are factors that influence the changing degree of weak-form efficiency at various stages (Jefferis and Smith 2005). According to (Yiheyis and Cleeve, 2016), the evolution of financial markets depends on foreign exchange availability, monetary policy and domestic economic activity. In a study of the Malaysian Stock Market, it is suggested that short bursts of nonlinear behaviour are often associated with significant political and economic events (Lim et al., 2006). Zalewska-Mitura and Hall (1999) argue that time is needed for price discovery processes to be revealed, and that when stock exchanges are newly established they are not born efficient, so there is no need to investigate if transition economies' stock markets are efficient. This argument is supported by (Campbell et al., 1998; K.-P. Lim and Brooks, 2006), who report that time is needed to know price discovery processes, as newly established markets cannot be measured for efficiency accurately. Therefore, stock markets become more efficient within a finite amount of time as market microstructures develop and markets operate.

These findings are supported by (Mensi et al., 2018), who test the efficiency market for five GCC stock market indexes and comparing them to what obtains globally. Their results indicate that The GCC stock market is less efficient than what obtains globally. In addition, the Kuwaiti stock market is the least inefficient in the short-term compared with the remaining markets. Other studies by Rejichi et al.(2014) applied the Hurst exponent to test these six stock markets' indices that Jordan, Turkey, Kuwait, Saudi Arabia and the UAE from the MENA region daily closing prices and 26 sector indices from 2000 to 2007. The study reports that the degree of efficiency improved generally by the end of the testing period, but all indices showed varied degrees of efficiency through this time period; however, SSM, DSM and KSM and the other indices studies showed no weak-form efficiency. Moreover, a study of GCC stock markets from 2005 to 2013 examined weak-form efficiency, and suggests that these had experienced periods of not only improved efficiency, but also demonstrated different degrees of time-varying efficiency. That study also ranked the efficiency of stock markets in this region with

the most efficient stock market as the UAE, and then Bahrain and Saudi Arabia, but Oman was adjudged the least efficient market (Charfeddine and Khediri, 2016).

In conclusion, table 8.1 indicates that DSM have the highest degree of efficiency, when compared to Saudi and Dubai stock markets. However, the results between SSM and DSM are very close to each other, but KSM has the lowest efficiency level. In terms of the individual companies that has been chosen form SSM the result indicated that SABIC is, the most efficient company studied and NCCY is the least efficient in Saudi companies listed on the share market. Lastly, it is clear that the individual companies have high level of the efficiency compared to the all-stock market index.

8.3. Pre/Post Reforms:

H_0: For the degree of the efficient market, there is significant change effect of reform for SSM, KSM and DSM; and individual companies.

H_1: For the degree of the efficient market, there is no significant change effect of reform for SSM, KSM and DSM ; and individual companies.

This study has attempted to reveal whether the five individual companies of the SABIC, STC, NCCY, Al Rajhi Bank and Electricity Company and the stock exchanges of SSM, DSM and KSM have applied organizational improvements over the twelve years from (2005-2016) to become more efficient following the economic and regulatory events experienced between 2005 and 2011 known as the sub-period. This involved the use of the ARIMA model approach to test for relative weak-form efficiency, as well as forecasting accuracy.

It should mention that, the belief that efficiency level specifically influences macro-level reforms (factors) such as investor protection, transparency and stock market regulations, underpins the market efficiency indicators adopted in this research. Accordingly, the influence on stock market effectiveness of the correlation between efficiency and such reforms can be investigated. Consequently, market efficiency data will be significantly uncovered by assessing return share price trends. Greater share price return efficacy and lower volatility is expected to be linked to an increasingly efficient market, once an adequate market infrastructure is in place and legislative changes have been implemented. In this

regard, analysing the way in which emerging stock markets are affected by stock market reforms will be most open and direct.

However, it should be mention that, market reforms' genuine impacts may be poorly understood if taken from the time at which they entered into effect, regardless of whether the return share price is directly altered by reforms. Given that, Strong sensitivity of stock markets is also apparent, with an incremental procedure of reform often being seen or economic changes typically occur following reformation of a stock market. Overall then, market reforms' genuine impact will not be completely grasped if only taking reform implementation dates as the starting point. Accordingly, additional variables should be analysed in subsequent research.

It should be mention that, with stock returns potentially influenced by reforms; this has been controlled for in the research. One aspect of this is the assumption that as the reforms were introduced, other factors remained unchanged, allowing the impact of financial market reforms on stock prices to be explored using the theory. A second aspect is that the January 2005-December 2010 period that saw the foremost reforms is the sole timeframe being analysed, meaning that market reforms have a lower chance of affecting the economic factors outside of this timeframe. The third aspect is that the findings will be influenced by variables un-associated to market reforms, with data complexities being compounded as a consequence. However, the principal market studied is Saudi Arabia's stock market, while Kuwait and Dubai's stock markets that are characterised by similar economic variables provide the contrasting case, to diminish the chance of the findings being influenced by external variables.

It should be mentioned that, Within SSM or Saudi Stock Market, the CMA or Capital Market Authority was created in 2003, which attempts to increase public participation in financial markets, and promote greater transparency, fairness and efficiency with a regulatory and legal framework to open up the Saudi capital market. This contributed to improved regulatory supervision, and financial product choice and sophistication with greater depth and variety, and in 2007 restrictions on share ownership for GCC nationals were relaxed by the CMA (CMA, Annual Report 2007, 2008). In 20/10/2007, the Saudi Stock Exchange (Tadawul) launched a new electronic trading platform provided by OMX (NewGen), complete Equality between the Citizen of GCC States - Owning & Trading Shares and The Saudi Stock Exchange Tadawul Company was formed in March 2007 by the Council of Ministers, and the Tadawul is a joint

stock company and operates (Tadawul, Report 2007). Moreover, The CMA later announced that in 2008, foreigners or non-GCC nationals would be allowed to purchase shares listed on the Tadawul using Saudi intermediaries that were authorized with swap agreements (Tadawul, Annual Report 2008).

Regarding to DSM, established in March 2000, by 2007 it accounted for 49% of total market capitalisation and contributed 40% to the GDP following a rapid expansion (SCA, repot 2007). In addition, foreign direct investments have been encouraged through a privatisation programme by the UAE Government, and priority government projects have encouraged greenfield IPOs, such as for tourism, air transport, electricity and water supply and other public services and infrastructures for restructuring purposes described in the Strategic and Practical Information Business and Investment Guide produced by the United Arab Emirates Government(IBP, 2016). During the period from 2005 to 2007, 32 bilateral investment agreements were produced, which helped the stock market to become more efficient. Local crisis financial events during 2006 and the global financial crisis during 2008 affected the sub-period of SSM, DSM and KSM between 2005 and 2011. The objective of reforms in the capital market have been to present further protection for investors, encourage private investments, introduce new approaches of finance and investment, and improve the financial system's efficiency as a tool of intermediation in the economy (Naceur et al., 2008).

This section investigates how the GCC stock market crisis in 2006 and the 2008 global financial crisis influenced these stock markets and individual companies, and to highlight how reforms have influenced the levels of efficient markets. Thus, the time series from 1 January 2005 until 31 December 2016 is divided into two periods by the researcher to be able to compare reforms pre- and post-financial crises, to discover the impact of reform and degree of evolving market by adopting degree of prediction.

Table 8. 4: 2005-2011 (Pre-Reforms): forecasting accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.0076	0.0110	0.0040	0.0108	0.0086	0.0150	0.0090	0.0079
MSE	0.0001	0.0003	0.00001	0.0003	0.0002	0.0006	0.0002	0.0002
RMSE	0.0119	0.0160	0.0059	0.0164	0.0140	0.0238	0.0131	0.0127
MAPE	1.0271	1.0200	1.1062	0.9441	0.8994	0.8729	0.8776	0.8313

Source: Author's own calculations

Table 8. 5: 2011-2016 (Post- Reforms): forecasting accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.0133	0.0150	0.0062	0.0208	0.0148	0.0207	0.0171	0.0170
MSE	0.0004	0.0005	0.0001	0.0009	0.0005	0.0009	0.0007	0.0007
RMSE	0.0211	0.0214	0.0088	0.0300	0.0224	0.0304	0.0259	0.0269
MAPE	0.9221	0.9644	0.9891	0.9794	0.9623	0.9625	0.9999	0.7700

Source: Author's own calculations

Table 8.4 shows the period from 2005 until the 2011 for pre-reforms. This period included two financial crisis events, Liberalization and change of software used by the stock market. The second period from 2011 until 2016 for post-reforms is shown in table 8.5 that highlights comparisons to show impact of change. However, the measure of error (MAD, MSE, RMSE and MAPE) is used to show the degree of production in table 8.4 and 8.5. The sample adopted in this study includes the SSM, DSM and KSM indices, and SABIC, STC, NCCY, Al Rajhi Bank, and Electricity Company as individual companies.

It is observed from these tables that over time in all return series, the degree of prediction changes substantially, and show values forecasting accuracy methods, and specifically significant change and improvement between different periods, so that for this study of a sample of all-market index and individual companies, the degree of efficiency has improved overall. This is shown in SSM in pre-reforms increasing MAD with 0.0076, MSE with 0.0001, RMSE with 0.0119 and MAPE with 1.02 to post-reforms for MAD with 0.0133, MSE with 0.0004, RMSE with 0.0211 and MAPE with 0.9221. This degree of efficiency is also improved for all individual companies and for DSM and KSM indices. Therefore, the null hypothesis is confirmed that reform has significantly improved the degree of efficient markets overall, but

when comparing Saudi share Market and the Dubai share Market with the share Stock Market, KSM shows less improvement.

Therefore, over the previous twelve years (2005-2016), the results for SSM, DSM and KSM markets indicate greater efficiency and increased levels of efficiency based on the reforms undertaken. Therefore, the markets and individual company have an evolving tendency towards efficiency. However, following 2011, price changes are not distributed randomly, and are not independent and do not fully reflect available information. These findings suggest that some returns could lead to abnormal profit making and arbitrage opportunities as they could be predictable, and have implications for regulatory authorities and investors, and contrary to RWH and EMH. The result suggest that internal market development reforms seeking to increase market capitalization, liquidity, automation of trading systems and the transparency have an impact on market microstructures by increasing efficiency and decreasing the volatility.

This finding confirms that of (Lagoarde-Segot, 2009), who assessed how financial reforms affect emerging equity markets' time-varying microstructures during 1996 –2007. As per their findings, the political and economic climates influence the stock market microstructures and are considerably linked to each other as well as rely on particular institutional reforms. Moreover, (Arjoon, 2016) examined the impact of financial reforms and microstructures in an emerging equity market setting on time-varying informational efficiency. Their study determined that, in the long term, informational efficiency is significantly affected by microstructure variables such as total shareholders, volatility, liquidity, and automation. In addition, the time-varying model approach utilised by Ito et al. (2014, 2016) determined that the market efficiency changes as per the international stock markets with time. A study by (Budd, 2012) used the Variance Ratio Test and the Runs Test for evaluating the Saudi Stock Market's weak form during April 2007– May 2011 and found that in the weak form, the Saudi stock market was inefficient. This study also noted that its infrastructure technology underwent considerable improvement and began providing evidence of weak form in other sectors.

Another study reports long-range memory exhibited by all MENA stock returns, and greater efficiency shown in certain markets, so that the stage of inefficiency could be explained by anti-self-dealing index, market capitalisation and trading costs (Rejichi and Aloui, 2012). More close study reveal that a generalised Hurst exponent analysis was adopted by (Sensoy, 2013)

to investigate MENA stock markets' time-varying efficiency from 2007 until 2012 by using a rolling window technique for daily data. This study concludes that there were different degrees of long-range dependence over time that varied exhibited by all MENA stock markets. Lastly, Gu et al., (2013) whom investigated the Shanghai stock market by tested correlations between multifractality and efficiency. They found out that negative correlated before the equity division reforms in the efficiency in the Shanghai capital market.

In conclusion, as well as counteracting short comings of large individual trading and improving liquidity and transparency by spreading institutional trading and enhancing investment cultures, there remain demands to accelerate efforts to deepen and expand these markets. Therefore, it is important to obtain a better understanding of the relationship between market efficiency and market characteristics by analysing likely explanations that underlie these findings, and to help present recommendations for regulatory authorities. The researcher suggests that these two problems could be overcome by applying the Evolving Efficiency Test. This study attempts to highlight the sample of GCC stock markets and five individual companies to reveal weak-form efficiency dynamics, and to investigate if relevant financial crises, financial liberalization and reforms have influenced their efficiency, and the degree of this influence. It is proposed that these findings could support the work of regulatory policy makers to detect deviation from market efficiency causes, and how to overcome economic distortions.

8.4. Financial Crisis

H_0: Between efficient markets in GCC countries and individual companies, there is no significant impact of financial crises.

H1: Between efficient markets in GCC countries and individual companies, there is significant impact of financial crises.

This study compares the efficiency of SSM, DSM and KSM indices and SABIC, STC, NCCY, Al Rajhi Bank and the Electricity Company, which is important as two significant crises occurred during the time line series: 2006 local stock market crisis, and 2008 global financial crisis.

One of the most serious economic recessions in history began in the USA in 2006 from a significant financial crisis, when American banks offered too many mortgages to support mortgage-backed securities, which became known as the subprime mortgage crisis. In 2006,

house prices fell in the USA, and many home owners with these subprime mortgages defaulted their payments. Many of these subprime mortgages or derivatives were owned by corporations, pension funds and mutual funds, which exposed these to financial risks. These factors then contributed to the financial crisis of 2007, and the recession that resulted is described as the worst since the Great Depression. However, this financial crisis was not contained within the USA, and many foreign countries were then exposed to financial crisis, especially in the Middle East and in European countries, contributing to a global economic crisis. In comparison with the USA and other developed stock markets, GCC equity markets suffered more serious consequences. At the beginning of 2008, the Dubai (UAE) and Saudi Arabia indices lost over 40% in value, and in 2009, Dubai requested restructuring of its debts, and caused significant financial disturbance in capital markets due to delayed repayment of Nakheel Sukuk, an Islamic financial instrument, which caused the Dubai debt crisis at this time. Weak financial controls in many European countries developed this financial crisis further, and contributed to the European debt crisis, which affected Cyprus, Spain, Italy, Ireland, Portugal and Greece. These six European countries were shown to present the most serious financial problems, but defaulted in repayments from these countries led to significant financial consequences in other countries across the world. This section attempts to explain how Global financial crisis, and GCC stock market crisis affected the efficiency of SSM, DSM and KSM stock markets within the GCC.

To enable greater clarity on these effects of global financial crisis on the efficiency of GCC markets, the researcher identified the overall time series is six years from 1 January 2005 until 31 December 2010, three sub-periods are used for comparisons which are related to pre-financial crisis period(2005-2006), a phase of financial crisis period(2007-2008) and a post-financial crisis(2009-2010), so that the time series is divided into three parts.

Lastly, 2007 heralded the start of the financial crisis in the USA, which spread to the GCC in 2008. This research deals with the period between 2007 and 2009, thereby covering the entire above mentioned crisis periods. The financial crisis caused great market disruption, with investors well aware of the American situation in 2007. Especially when we know that the financial contagion between the markets. This makes the period an interesting one for research, hence my decision to evaluate the condition of the Saudi Arabian stock market during the 2007 and 2009 period.

8.4.1.Global Financial crisis 2007-2009

Table 8. 6: Pre-financial Crisis Jan-2005 to 1 Dec-2006: Forecasting Accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.01542	0.01556	0.00632	0.02191	0.01699	0.02071	0.01951	0.02360
MSE	0.00053	0.00049	0.00008	0.00096	0.00066	0.00091	0.00090	0.00125
RMSE	0.02293	0.02213	0.00915	0.03102	0.02577	0.03022	0.02999	0.03538
MAPE	0.94025	0.89661	0.90401	0.99747	0.95155	0.91458	1.13513	0.88454

Source: Author's own calculations

Table 8. 7: Phase-financial crisis jan-2007- Dec-2009: Forecasting Accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.01196	0.01208	0.00553	0.02232	0.01521	0.02187	0.01797	0.01765
MSE	0.00049	0.00039	0.00007	0.00104	0.00051	0.00108	0.00069	0.00060
RMSE	0.02222	0.01982	0.00841	0.03222	0.02263	0.03293	0.02634	0.02459
MAPE	0.63992	0.85485	0.93528	0.99919	0.90101	0.93757	0.91724	0.67546

Source: Author's own calculations

Table 8. 8: Post -financial Crisis Jan-2009 to Dec-2010: Forecasting Accuracy

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.00793	0.01318	0.00564	0.01706	0.00942	0.01663	0.01212	0.00770
MSE	0.00017	0.00036	0.00006	0.00064	0.00023	0.00064	0.00032	0.00017
RMSE	0.01294	0.01901	0.00789	0.02538	0.01509	0.02527	0.01788	0.01290
MAPE	0.84782	0.87454	0.95842	0.90369	0.86218	0.91221	0.87729	0.73542

Source: Author's own calculations

Table 8.6, 8.7 and 8.8 uses the measure of error of MAD, MSE, RMSE and MAPE for SSM, DSM and KSM and the five individual companies to show the degree of prediction and the impact of financial crises with pre-crises, phase crises and post-crises sub-samples and making comparisons.

In terms of the all-market index, results show clearly that the global financial crisis affected the stock market. Such as for SSM that decreased gradually after pre-crises levels of MAD,

MSE, RMSE and MAPE of (0.01542, 0.00053, 0.02293 and 0.94025), phase of crises period of (0.01196, 0.00049, 0.02222 and 0.63992), and post-crises period of (0.00793, 0.00017, 0.01294 and 0.84782). Moreover, during Pre-financial Crisis from Jan-2005 to Dec-2006 comparison of index countries, SSM is the most efficient market with (MSE, .00053), But not during the post -financial Crisis from Jan-2009 to Dec-2010, as DSM is the most efficient market with (MSE 0.00036) when compared with Saudi and Kuwait stock market.

For the individual companies studied, the result show that the financial crises affected the individual companies. The highest level of efficiency was in in pre-financial era which then started to decrease gradually until the post-financial crisis period. However, only SABIC and NCCY had the highest level of efficiency which was during the financial crisis. For example, SABIC was increasing after pre-crises levels of MAD, MSE, RMSE and MAPE of (0.02191, 0.00096, 0.03102, 0.99747), and during phase of crises period of (0.022, 0.0010, 0.032, 0.99); but during the post -financial Crisis Jan-2009 to Dec-2010 the level of efficiency and aggressiveness dropped to (0.017, 0.00064, 0.025, 0.903). Moreover, during the financial crisis the highest level of efficiency was Electric company follow by SABIC, NCCY, Al Rajhi Bank and STC.

This result shows the deteriorating efficiency of GCC markets from jan-2005 to Dec-2010. In particular, the levels of efficiency of equity markets for the SSM, DSM and KSM indices and SABIC, STC, NCCY, Al Rajhi Bank and the Electricity Company that took a sudden turn for the worse in the short term after the Global Financial Crisis. In terms of SABIC and NCCY, it showed a significant increase in efficiency levels due to high volatility in that period. This indicates that overall, market inefficiency is not related to high volatility, so that the results gives an indication, but not a conclusive answer. Future research pathways should examine this relationship with a rigorous analysis to provide greater insights, as these current indications from results could be confirmed. These results also show clearly that levels of efficiency is different from time to time. Thus, time-varying efficiency should be studied also rather than only study the absolute side. Lastly, under the environment of financial crisis affecting the worldwide markets, policy makers dedicated time to enhancing the efficiency degree of stock markets to weaken the effects of crisis (Y. Wang et al., 2009).

In terms of efficiency, results show a direct relationship between recovery speed of a market and market maturity for SSM, DSM and KSM. One finding is that during the pre-crises period and the phase of crises period the most efficient stock market was SSM, but this was not

reflected in the post-crises period. Correlations and convergence to efficiency is observed in DSM and SSM markets, so clear conclusions cannot be made. During the post-crises period, the Dubai Stock Market quickly recovered to efficiency levels, but SSM and KSM continued to face problems in the post-crises period. These findings suggest that financial crises do not have similar qualitative effects on stock market efficiency, as adverse effects are seen only in Dubai during crises, but in SSM and KSM, up to a certain degree.

Regarding recovery, these emerging markets have seen less recovery or did not even happen especially for the developed markets, possibly due to the fast recovery during the post-crisis period. According to (Sensoy and Tabak, 2016) who argue that though the majority of emerging stock markets were able to recover regarding the improved market efficiency, this recovery was gradual and did not occur in developed markets. This study also determined that, to an extent, the GCC stock price movements demonstrate vital mean-reverting patterns through and during-crisis as well as post-crisis phases. On the other hand, the stock price increments through the pre-crisis phase are more similar to the random walk paradigm. Thus, during financial instability, the market agents' herding behaviour can result in abnormal price movements which can also lead to considerable market inefficiency. This finding states that if a buy-and-hold strategy must be applied, then investment in these countries is approved.

This finding confirms that of (Mensi et al., 2017) who assessed 10 sector indices data of the DJIM stock index and proved that market efficiency changes with time, with reduced efficiency after global financial crisis. A study by (Anagnostidis et al. (2016) evaluated the effect of the 2008 financial crisis on 12 Eurozone stock markets' weak form efficiency and found that it had a negative effect on the majority of the markets and this led to considerable mean-reverting patterns in the movements of stock prices. They also noted that delineating the factors that may result in market efficiency or inefficiency is not the categorical solution and that there is need for further empirical study. A study by (Sensoy and Tabak, 2015) stated that the 2008 global financial crisis negatively impacted almost all EU stock markets as well as determined that share prices of developed and emerging European markets include crucial mean-reverting and long memory patterns. Further, using the MF-DFA method to report deviations for multiple EU stock markets from the random walk hypothesis suggested that there was a considerable effect of the financial crisis on the majority of the stock market index returns' memory properties and that the Subprime crisis included markets losing efficiency.

(Horta et al., 2014). Smith, (2012), Cajueiro and Tabak, (2004a) where similar results are concluded. Lastly, there seem to be few theories for testing the impact of the financial crisis on the efficient market in MENA Region.

In conclusion, the 2008 global financial crisis is included within the time interval of this study, and table 8.6, 8.7 and 8.8 shows time-varying factors influencing stock market efficiency reacting to this crisis. The All-share index and industries shows a downward trend except for SABIC and NCCY in which there was a rise during the crisis, and then during the post crisis period began to witness a decrease. However, this efficiency is affected adversely and then recovers within a short time interval, such as Dubai, efficiency is affected adversely and then slowly recovers, such as up to 2 years for the Saudi Stock Market, and efficiency is affected adversely, but no recovery is observed for the Kuwait Stock Market.

8.4.2. GCC stock market Crisis (2006)

The Matrices errors test results are shown in table 8.9 for the pre-crises period, table 8.10 for the phase of local crises and table 8.11 for the post-crises ranging from 1 January 2005 until 31 December 2007 with a larger period of 700 data points for the whole sample. It is proposed by the researcher that the GCC stock market collapse would significantly affect market efficiency, as market collapse would strongly influence the behaviour of investors. The researcher analysed the three sub-periods to investigate market efficiency, as these periods had different regulations to specifically understand if the local crisis of 26 February 2006 enhanced the degree of prediction in this series. The time series was divided into pre-crisis from 1 January 2005 until 31 December 2005, phase of financial crisis from 1 January 2006 until 31 December 2006, and post crisis from 1 January 2007 to 31 December 2007.

Table 8. 9: 2005-2006: Forecasting Accuracy Pre local crisis

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.00965	0.001897	0.0052	0.01791	0.01173	0.0150	0.011417	0.013168
MSE	0.00018	0.00043	0.0001	0.00064	0.00029	0.00051	0.000325	0.000412
RMSE	0.01341	0.01452	0.0074	0.0253	0.0171	0.02268	0.018046	0.020297
MAPE	0.92684	0.2089	0.8712	0.9858	0.9627	0.9075	1.16633	0.90907

Source: Author's own calculations

Table 8. 10: 2006-2007: Forecasting Accuracy During crisis

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.02145	0.01601	0.00767	0.02639	0.02300	0.02747	0.02871	-0.00277
MSE	0.08405	0.03478	0.02059	0.06571	0.08158	0.07826	0.12012	0.03574
RMSE	0.28991	0.18651	0.14350	0.25635	0.28563	0.27975	0.34659	0.14781
MAPE	1.3133	1.13	1.82	1.01	0.939	1.08	1.14	0.38447

Source: Author's own calculations

Table 8. 11Table 8.11 2007-2008: Forecasting Accuracy Post-crisis

Statistics Log -returns	**SSM**	**DSM**	**KSM**	**SABIC**	**STC**	**NCCY**	**AL RAJHI BANK**	**ELECTRICITY COMPANY**
MAD	0.02240	0.01588	0.0075	0.026396	0.02288	0.0270544	0.028606	0.0353
MSE	0.00094	0.0357	0.0212	0.0657	0.0818	0.08044	0.120	0.14838
RMSE	0.03071	0.188974	0.1455	0.25643	0.2860	0.283	0.34693	0.38520
MAPE	0.95	0.90	0.93	1.01	0.93	0.92	1.100	0.856

Source: Author's own calculations

The mean square error of the residuals for the three indices countries and individual companies for the prediction period of 1st January 2005 to 31st December 2007 are shown in Table 8.9, 8.10 and 8.11. The simulated prospective counter parts perform less successfully than the retrospective models and both the retrospective and simulated prospective ARIMA model are outperformed by the Random Forest simulated prospective model. The analysis is pursued further in this section through the examination of the efficiency for the pre-crisis,

crisis and post-crisis sub-periods. It is easier to define the remaining two sub-periods, because the crisis period has been identified at an earlier stage. In order to ensure a fair comparison and that there are a broadly equal number of observations in each sub period, the pre-crisis and post-crisis corresponds from 1 January 2005 to 31 December 2005 and from 1 January 2007 to 31 December 2007. During the crisis from 01-01-2006 to 31-12-2006, it should be mentioned that the volatility for GCC stock returns series surged dramatically. The question is whether or not the reported inefficiency in these GCC stock markets is related to market volatility and arises naturally. In theory, there is no clear relationship between volatility and market efficiency, yet policy objectives are always to reduce volatility and enhance market efficiency.

Table 8.9, 8.10 and 8.11 shows that the degree of the efficiency has been increased when the pre-crisis and post-crisis periods are compared; for instance, MSE was in the pre-crisis 0.00018 and increased to 0.00094. It is difficult to come to a conclusion during the period of the financial crisis. However, because there was high level of volatility. The mean of the raw indices of the actual line reveal a sharp decline, which coincides with a rising of the forecasting line or vice versa, which complements the findings of (Horta, et al 2014 and Cajueiro et al. 2009), contradicted results were published by (Kristoufek, 2012).

One explanation for these findings may be that the crisis period encouraged major institutional investors to leave the stock markets and to sell their assets, which reduced the investor base and liquidity, as well as reduce the efficiency of the market (Cajueiro et al., 2009). Within the GCC markets, convergence and correlations to efficiency may be observed; for instance, the 2006 crisis began in the Saudi stock market before moving to other GCC markets. The literature also provides a number of interpretations of these events; for instance, there are several papers showing the existence of contagion during the European sovereign debt crisis (Constâncio, 2012; Mink & Haan, 2013; Arghyrou & Kontonikas, 2012) with the GIIPS's group of 23 demonstrating stronger contagion due to their weaker macroeconomic position.

All markets tend to show signs of inefficiency during the entire sample period, exhibiting a long memory effect. When comparing the global financial crisis and local crises, data suggests that local financial crises had a greater effect upon stock markets than the global financial crisis. Investors gained confidence following the 2006 crisis and returned to the stock markets.

Additional liquidity was provided to the markets, resulting in an increased efficiency, which may be due to the stock market fall during the 2008 crisis being smaller than during the 2006 crisis in order to increase the level of efficiency. It may be concluded that the 2006 internal crisis caused a more intense impact upon the sampled GCC stock markets than the 2007-2009 financial crisis.

8.5.Liberalisation (the Swap Agreement) effects within the Saudi Stock Market

Hypothesis 1: There is no significant impact of the Swap agreement between efficient markets in GCC countries and individual companies.

Hypothesis 2: There is a significant impact of the Swap agreement between efficient markets in GCC countries and individual companies.

That free flow of goods benefits both economies without serious risks is a generally accepted viewpoint, yet the free flow of capital is seen differently. A number of economists and policy makers are generally skeptical about the benefits of free flow of capital, viewing the flow of uncontrolled capital as both destabilising and risky. Others believe that the free flow of capital leads to more efficient resource allocation, leading to greater economic growth. A number of researchers have explored the issues of whether the opening of emerging markets during the financial liberalisation in developing countries to foreign investors has had any positive effect. This has been carried out by examining the state of informational efficiency before and after the official date of liberalisation. Following the 1997 Asian financial crisis, this investigation became even more relevant, because policy discussions considered the possible reversal of previous measures of liberalisation by imposing capital controls. Researchers examined the experience of emerging economies during the time that foreign investment in stock markets were allowed in order to ascertain the degree of prediction associated with capital flows.

In this study, the researcher investigates the impact of capital flows upon the efficiency of the Saudi stock market by examining changes in stock market efficiency at the time of market openings to determine whether or not stock returns have become more random. Therefore, in this section a comparison of the degree of randomness with other Dubai and Kuwait stock market and the individual companies is made.

Table 8. 12: 2005-2008: Forecasting Accuracy Pre-liberalisation

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.01567	0.01349	0.00561	0.02038	0.01563	0.01902	0.01808	0.02170
MSE	0.00056	0.00038	0.00007	0.00084	0.00055	0.00077	0.00076	0.00104
RMSE	0.02358	0.01955	0.00818	0.02892	0.02341	0.02771	0.02748	0.03232
MAPE	0.93526	0.90168	0.91574	0.99468	0.93016	0.92901	1.07340	0.80630

Source: Author's own calculations

Table 8. 13: 2008-2011: Forecasting Accuracy Post-liberalisation

Statistics Log -returns	SSM	DSM	KSM	SABIC	STC	NCCY	AL RAJHI BANK	ELECTRICITY COMPANY
MAD	0.01165	0.01533	0.00605	0.02061	0.01225	0.02060	0.01512	0.01113
MSE	0.00036	0.00050	0.00008	0.00094	0.00040	0.00100	0.00053	0.00032
RMSE	0.01910	0.02233	0.00881	0.03063	0.01997	0.03166	0.02310	0.01800
MAPE	0.93032	0.94931	0.94943	0.93925	0.88170	0.91262	0.88567	0.73121

Source: Author's own calculations

Table 8.12 and 8.13 report the MAD, MSE, RMSE and MAPE test form ARIMA model. The first sub sample is for the sub-periods of the pre-Swap agreement between 01-01-2005 to 31-12-2007. The second sub-sample is the post-swap agreement between 01-01-2008-31-12-2010. The state of informational efficiency before and after the official date of liberalisation is examined.

Table 8.12 shows that the returns in the all countries index and the individual companies were predictable either in the MSE or RMSE tests or both during the pre-swap agreement stage between 2005-2008. There are changes in the degree of efficiency before and after the swap agreement. The results show Saudi to be the most efficient stock market in this sample period when ranking the GCC markets in terms of weak-form stock market efficiency; DSM, and KSM are ranked 2 and 3 respectively. Table 8.13 illustrates changes in the predictability of returns post market openings, which reveals a statistically significant reduction in the predictability of returns for SSM, DSM and KSM and most of the companies within the Saudi stock market

(STC, NCCY, Al Rajhi Bank and Electricity Company) show an increase in predictability, demonstrating the negative impact of the Swap agreement. For instance, SSM on post-liberalisation has a lower MAD, MSE, RMSE and MAPE (0.01165, 0.00036, 0.01910, and 0.93032, respectively) than during the pre-liberalisation period which is MAD, MSE, RMSE and MAPE (0.01567, 0.00056, 0.02358, and 0.93526, respectively); SABIC is the only one showing an effect that is positive. The opening of SSM to foreign investors has not had any positive effect on the efficient market, which is confirmed for individual companies, such as STC, NCCY, Al-Rajhi bank and Electricity Company; only SABIC demonstrates a positive effect. This result confirms the alternative hypothesis that there is no significant impact of liberalisation.

Stock market information efficiency literature suggests that removing capital controls should result in increased liquidity from foreign participation, and especially in markets characterised by thin trading and low liquidity. Disclosure and the quality of information should be improved by foreign participation which, in turn, should lead to an increase in market efficiency. The results in Table 8.12 and Table 8.13 contradicts this view, showing the opposite effect for Saudi, which can be interpreted as showing the Saudi stock market to be relatively more efficient during the period of less integration into global markets. There are several possible reasons for this, suggesting that foreigners buy and sell less than in the developed market. There is also evidence of optimality in foreign shareholding that suggests that the efficiency benefits disappear after a certain threshold level is exceeded by foreign ownership (Lim et al., 2016). Foreign investors within Saudi stock market account for about one per cent of the total market. Partial lifting of restrictions on foreign investment in the Saudi stock market, could be another reason, since foreign investment trade is only allowed through the Swap agreement in that time. There are also possible fears that a sudden reversal of foreign capital flow into the country, followed by irrational stock sell-offs could amplify fluctuations in stock price, and particularly since the Saudi stock at that time had just recovered from the internal crisis of 2006.

A number of academics comment that that the liberalisation of financial market does not necessarily lead to a more efficient stock market (J. Wang, 2013; Graham et al., 2015; Al-Khouri and Abdallah, 2012)

The question whether a liberalisation policy alters the volatility structure of the Qatar exchange market was examined by (Al-Khouri and Abdallah, 2012) Al-Khouri and Abdallah (2012), who found no significant change in the volatility of market returns. A negative link

between foreign ownership and the future volatility of Indonesian stocks was commented upon by (J. Wang, 2013). Such reports suggest some evidence of an inverse relationship between the integration of global stock markets and stock market efficiency. This contradicts evidence reported by (Han Kim and Singal, 2000; Ataullah et al., 2004; Chordia et al., 2008; Cajueiro et al., 2009; Bae et al., 2012; Hooy and Lim, 2013; Ahmed, 2016; Vo, 2017). De Roca, Luna and Tan (2017). However, this strand of studies explains that positive impacts of market liberalization are only visible under a developed financial system and improved institutions.

Smimou and Karabegovic, (2010) examined the impact of economic freedom upon stock market returns in the MENA region, using data for eleven countries from 2000 to 2007. Their results show a statistically positive impact on the market returns of the sample within MENA countries following changes in the overall level of economic freedom. These findings suggest that other factors affect the level of return predictability, including political events, external shock and macroeconomic effects. Foreign investors are likely to gain from the predictability of returns if markets are predictable and foreign investors are sophisticated. Market inefficiencies will be taken advantage of by foreign investors, leading to a reduction in market inefficiencies, with prices reacting more rapidly as new information become available. A more efficient allocation of capital should reflect less predictability in stock prices. Another explanation for the observed. More frequent trading may also decrease predictability, leading to a reduction in the non-synchronicity bias; this is discounted by (Kim and Singal, 2000)

The conclusion is that the opening of SSM to foreign investors has not had any positive effect upon the efficient market, which applies to most of the individual companies within the Saudi stock market, therefore confirming the alternative hypothesis that there is no significant impact of liberalisation. This finding also suggests a low level of return predictability related to other potentials, such as political events, external shocks and macroeconomic effects.

Chapter 9.Conclusion

9.1.Summary of the research

In this chapter the researcher would provide a summary explanation of how the ARIMA model method was used to test the stock market movement form Jan-2005 to Dec-2016, and various sub-sample periods which have been tested, in order to discover the impact of underlying factors using the three GCC market and five individual companies. The tests performed are time plots, descriptive statistic, and normality test. The tables and figures present the result of all the test conducted, and review will be summarised in the section as bellow:

Firstly, a time series plots was ran on the daily closing price and returns of Saudi and Dubai and Kuwait stock markets beside the individual companies that is SABIC, STC, NCCY, AL RAJHAI, Electricity company. The graph brings a quick visualisation of index price trend, outliers, and periodicities over the 12-year study time period and the sub-sample period pre- and post the reform; and pre-, during- and post global financial crisis 2008 and GCC crisis 2006. Lastly, pre and post financial liberalisation of Saudi stock market. Therefore, The Saudi, Dubai and Kuwait stock markets reached the lowest and highest price points within a three year time period between Jan-2006 and the beginning of 2009 for all markets. The basic trends are similar for all the three stock markets and the individual companies, as the daily prices were at a high fluctuated level before 2010, and dropped during 2006 and 2008. It went flat after 2010 in the first half of the period and remained the same trend afterwards. Therefore, the trends are a clear indication that the market movements are highly synced, which is indicative of the financial contagion. Hence, there was high level of correlation observed among markets in GCC.

Secondly, the descriptive statistic section on return presents the statistical properties of the mean, standard deviation, variance, skewness, and kurtosis of the studied time series and coefficients. In this sense, the skewness and kurtosis are one way of measuring normal distribution. As the existence of departure from zero skewness and departure, form three kurtosis, even though some of the mean are close to zero, the Pre-reform has a higher degree of normality than post-reforms series. Hence, the results show that the all-time series coefficients are not normally distributed. Lastly, high levels of volatility before 2010 were

found. This is consistent with increased synchronisation of opinions. Increased synchronisation is accompanied by a period of greater intensity of herding.

Thirdly, the empirical results (shown in Chapter six, seven and eight) reveal the market capitalisation weighted price index of the three countries and five individual companies during the period 2005–2016. The results indicate that the entire eight hypotheses were rejected in 99% significance level for all series except for Al Rajhi bank with 95% significance. Thus, all stock markets and the individual companies are inefficient, and stock movement do not follow a random walk during the period from Jan-2005-to Dec-2016. These results are in line with previous findings in the literature.

Fourthly, the researcher examined the relative weak form of GCC stock that form Jan-2005 to Dec-2016. In addition, the results showed that the Dubai stock market has the highest level of efficiency, followed by Saudi stock market then Kuwait stock market. However, regarding the companies that been chosen from Saudi stock market, SABIC has the highest level of efficiency followed by STC, Electricity Company, Al Rajhi bank and NCCY respectively.

Fifthly, the researcher tested the impact of GCC stock regulation reform that took place in Jan-2005 and Dec-2010. The results show that different levels of efficiency are shown by the ARIMA models and MAE, MSE, RMSE and MAPE error matrices between different markets at different times through comparison of various sub-samples. For instance, in the first six years from Jan-2005 to Dec-2011, there was a weak level of the efficiency and high level of the volatility and they rather negatively responded to the fluctuating crisis. This is comparable with the mature markets. Nevertheless, obvious improvement was observed in the efficiency level in the last 5 years that is from 2011-2015 and only NCCY did not show clear improvement in the level of the efficiency, suggesting that market microstructure variables may shed some light on efficiency results. In addition, the impact of global financial crisis on the GCC stock market that took place in Jan-2007 to Dec-2008 and the results show that there was no significant improvement found in the level of market efficiency through the comparison of before, during and after financial crisis-era. Moreover, the researcher tested the impact of GCC crisis on the GCC stock market that took place in Jan-2006 to Dec-2006 and the results show that there was no significant improvement found in the level of market efficiency through the comparison of before, during and after financial crisis-era. Lastly, the researcher tested the impact of financial liberalisation on the GCC stock market that took place in Jan-

2008 and the results show that there was no significant improvement found in the level of market efficiency through the comparison of pre- and post-financial liberalisation.

In conclusion, these empirical results show that the degree of the market efficiency is, in fact, time varying; and there are times when international markets are partly efficient and inefficient. After considering three countries and five individual companies, the researcher found firstly, that GCC stock markets are inefficient from 2005-2016. Secondly, the individual companies become more efficient when compared with the stock market. In addition, further investigation should reveal the mechanism of how the degree of market efficiency fluctuates from time to time – especially why the degree of market efficiency exhibits inefficient markets during extraordinary times – by utilising larger samples of data and by various statistical tests. The results provide strong evidence that the level of market efficiency varies over time and decreases after market collapse. Generally, the GCC markets indices and the companies that were chosen from Saudi stock market have been more efficient after 2010 than it was previously.

9.2.Contributions of the Study

This research uses the sub-sample approach, rather than the EMH test originally proposed, as it better indicates any gradual changes in the linear behaviour of returns over a specified time-period. Moreover, it allows the detection of linear serial dependencies and gives a clearer picture of patterns that have developed over that period, which permits an evaluation of stock market efficiency. This enables the detection of factors that may have affected market efficiency.

this research uses the ARIMA model to investigate time varying market efficiency and market volatility, which is obtained by using a sub-sample. The study reveal that the Saudi and Kuwait and Dubai stock market do not follow the random. The Fact that no evidence was found with regards to the efficiency of markets in stock market, does not suggest inefficiency of markets as it is possible that these markets are partially efficient. In additions, it shows an improvement in efficiency within the Saudi, Dubai and Kuwaiti stock markets over time. It also reveals a marked link between the lag in Saudi market efficiency and other factors. For example had a positive influence in when we compare between the pre/post reforms. However, global financial crises had negative effect; and no affect found for with financial liberalisation.

The key 'novel' contributions of this study relate to contribute in the debate of the efficient market by analysing stock market development in SSM, KSM and DSM by testing the weak form; assessing the relative efficiency; capturing the evolving dynamics over time; and discover variables concerning to stock market evolution. More specifically, the number of contributions of this study achieved will be discussed follows.

First contribution, the area of effects of stock market Reforms, financial crisis, financial liberalisation markets is under researched, therefore it provides an opportunity to extend the existing discourse.

Second contribution, this study highlights questions surrounding the widespread notion that links market efficiency with the various stages of market evolution. The aim here is to develop a model that can be interrogated as to any effects of reform within a wider context.

Third contribution, is that the study applies several sub-samples in an alternative time series of empirical tests that add to the EMH literature. Moreover, it employs a new data set and an increased observation period of 2005 to 2016.

Forth contribution: as expressed earlier, the research gap was uncovered by analysing a range of previous studies that examined the relationship between the impacts of share price and variety of economic factors.

Fifth contribution, much time series research on Gulf nations' stock market efficiency is based firmly on the weak form of the EMH. In contrast to that and other research, this study takes a novel approach to analysing stock market development in SSM, KSM and DSM by testing the weak form, assessing the relative weak, and four variables concerning stock market evolution.

Sixth contribution, these findings are significant for policymakers' and investors' asset allocation. This is because, market inefficiency suggests that there may be behavioural biases as well as market imperfections and thus policymakers can develop new reforms for improving these markets' efficiency.

9.3. Limitations of the research:

All empirical research demands the acknowledgement of limitations, which may arise from a number of sources, such as those imposed by information or resources not available when the related research was performed. While this study is wide-ranging and is based on a representative sample, limitations affecting the results are always an important consideration. One obvious limitation arises from the twelve-year sample duration. Clearly, the statistical integrity of the study would be improved if data gathered over a longer time-period was included. It would also indicate any important changes that take place over longer periods, thereby lessening the possibility that the findings may relate to specific market conditions of the time, or that observational data is too limited. The data used here was for the period 2005 to 2016 – the only period for which relevant information was obtainable when gathered.

A second limitation arose from the lack of information contained within the market databases; this only indicated stock prices on an 'open, high / low and close' basis. A more in-depth analysis would be possible if information on, for example, transaction charges and dividends were to be included.

A Third Limitation, the study employs the 'stock market all-index' as the single variable when examining stock market fluctuations in the DSM and KSMs. The complexity of the stock market and associated behaviours should also be taken into account, as should the fact that a number of other important variables affecting stock markets were not considered in this study. The employment of such additional variables would add to the integrity of the findings by showing their direct or indirect effects overall.

A fourth limitation relates to the ways in which the findings might impact on company policies, which could provide investors with a basis for determining their behaviour regarding changes in share prices. Nevertheless, investigating the causal links between market efficiency and the evolution of stock markets within the GCC may yield useful information when future policy is designed. One should remember, however, that the differing economic characteristics of the oil-producing countries makes any generalisation difficult, with the finding of this study having greater relevance to GCC members.

A fifth limitation relates to the researcher's identifying of certain relevant factors within existing research literature that permits comparison of a forecasting price with an actual price

across several time periods. However, some factors in this study is unable to explain much for all the sample. Such as direct financial liberalisation and financial crisis. Thus, more study with different methods need to by apply. However, in spite of the limitations outlined above, the findings of this thesis constitute a valuable addition to existing stock market research literature.

9.4. Future research:

Despite the important insights into the field of stock market research gained during this study, future research could overcome some or all of its limitations. However, as with any empirical study within any body of knowledge, this study offers a range of suggestions for future study in the same or similar areas as follow:

The fact that no evidence was found with regards to the efficiency of markets in stock market, does not suggest inefficiency of markets as it is possible that these markets are partially efficient. It is important to apply further research to better understand why markets become inefficient by focusing on the underlying factors for assessing the main time series and compare the pre as well as post-sample time series to determine the effect of these factors. Hence, in evaluating the efficient market, it should be taken into consideration that these tests records the detected patterns' evolution with time and to gauge whether and to what extent these patterns are repeated as well as examine the stock markets' relative efficiency in comparison with other stock markets.

Future studies should also focus on determining why the stock market efficiency in some countries is better. Though there may be various factors for these results, a more comprehensive study that analyses multiple factors such as market macrostructure and microstructure is important. The author believes that there is an opportunity to extend this research to factors such as market macrostructure and microstructure.

Further, future studies can use other methods for assessing other countries' crises in order to determine the impact of these crises on share price as well as how relevant this exponent is for evaluating contagion. In addition, there is need for careful interpretation of these markets' local inefficiency as extreme financial events can have significant impact and reduce the efficiency of the stock markets.

Moreover, one useful line of future research could involve investigating factors contributing to market inefficiency during particular time periods. Not all of the behavioural hypotheses

research currently under development, such as that to do with behavioural finance, has been considered here. More work on testing theories would be valuable, as would possible changes to, for example, Socioeconomic Theory of Finance, behavioural economics.

To conclude, this research provides encouragement for further testing of market efficiency using alternative models to be undertaken. For example, Jarrow and Larsson (2012) display that “an efficient market is completely characterized by the absence of both arbitrage opportunities and dominated securities". In addition, they provided theorems for the examining of market efficiency. Moreover, the rolling-sample approach permits a gradual alteration over time to the non-linear behaviour of returns. Therefore, the percentage of H windows provides a useful indicator when the efficiency of stock markets and the conjunction of particular events is compared. This research supports the idea of a Development Indicators project, which would hopefully result in the creation of a composite indicator for efficiency stock market comparison.

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