The Effect of Royal Decrees and Economic Announcements on the Saudi Stock Market: A High-Frequency Data Analysis

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Abstract

Significant economic, social and cultural progress has taken place in Saudi Arabia since Saudi Vision 2030 was initiated in 2016. This progress has been accelerated by a number of royal decrees that aim to reform the structure of the government and support social, political and economic development. This thesis investigates the effects of Saudi royal decrees and economic announcements on stock market returns based on the assumptions of the efficient market hypothesis. This specialised empirical study considers four industrial sectors in the Saudi stock market: banking, energy, materials and telecommunications. The effects of royal decrees on the Saudi financial market have not been studied in the literature.

High-frequency stock market data provide a clearer and more accurate view of the market's behaviour than low-frequency data. The primary objective is to determine how market return volatility responds to royal decrees and Saudi and US economic announcements. Realised volatility of the TASI at 5-minute intervals is used for the period 2014–2019 were obtained for the selected sectors. A multiple linear regression model was employed to examine the selected variables affecting Saudi stock market volatility.

The estimation results confirmed that Saudi stock market responds positively to royal decrees, Saudi economic announcements and the Standard & Poor's (S&P) 500 Index movements. In addition, a significant relationship was identified between the volatility of Saudi stock returns and Saudi economic announcements. However, there is no significant relationship between Saudi stock market returns and US economic announcements. These results have important implications for domestic and foreign investors in the Saudi stock market. This study fills a knowledge gap regarding the importance of Saudi royal decrees to the Saudi stock market. The findings of this study will provide policymakers, market participants, market regulators and academic researchers with important insights into the behaviour of the stock market.

Keywords: Announcement effect; Behavioural finance; Financial markets; Government decisions; High-frequency data; Informed trading; Macroeconomic announcements; Realised volatility; Royal decrees; Stock market; Tadawul; TASI

Declaration of Authenticity

I, Abdulaziz Aldahoum, declare that the PhD thesis entitled 'The Effect of Royal Decrees and Economic Announcements on the Saudi Stock Market: A High-Frequency Data Analysis' is no more than 80,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research and Victoria University's Higher Degree by Research Policy and Procedures.

Signature Date: January 26, 2021

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List of Abbreviations

AAR	Average Abnormal Returns
ACF	Autocorrelation Function
ADF	Augmented Dickey–Fuller
ANN	Artificial Neural Network
APT	Arbitrage Pricing Theory
ARCH	Autoregressive Conditional Heteroskedasticity
BOP	Balance of Payments
CAAR	Cumulative Average Abnormal Returns
CAPM	Capital Asset Pricing Model
CEDA	Council of Economic and Development Affairs
CMA	Capital Market Authority
CPI	Consumer Price Index
ECM	Error Correction Mechanism
EMH	Efficient Market Hypothesis
ETFs	Exchange-Traded Funds
FII	Foreign Institutional Investor
FTSE	Financial Times Stock Exchange
G20	Group of 20 of the World's Largest Economies
GARCH	Generalised Autoregressive Conditional Heteroskedasticity
GCC	Gulf Cooperation Council

GDP	Gross Domestic Product
GICS	Global Industry Classification Standard
GST	Goods and Services Tax
IPO	Initial Public Offering
KSA	Kingdom of Saudi Arabia
LM	Lagrange Multiplier test
MLR	Multiple Linear Regression Model
MNPI	Material Non-Public Information
MPT	Modern Portfolio Theory
MSCI	Morgan Stanley Capital International
NTP	National Transformation Program
OLS	Ordinary Least Squares
OPEC	Organization of the Petroleum Exporting Countries
PIF	Public Investment Fund
PPI	Purchasing Power Index
RRV	Rolling Realised Volatility
RV	Realised Volatility
S&P	Standard & Poor's
SAMA	Saudi Central Bank
Saudi Aramco	Saudi Arabian American Oil Company
SMEs	Small- and Medium-Sized Enterprises

SV	Stochastic Volatility
Tadawul	Saudi Stock Exchange
TASI	Tadawul All Share Index
TBNI	Tadawul Banks Index
TENI	Tadawul Energy Index
TMTI	Tadawul Materials Index
TTSI	Tadawul Telecommunication Services Index
UK	United Kingdom
US	United States
VAR	Vector Autoregression Model
VAT	Value-Added Tax
WTO	World Trade Organization

Chapter 1: Introduction

1.1 Background

A country's financial system comprises a number of elements, of which the capital market is one of the most significant. A stock exchange provides a platform for companies to raise capital by issuing and selling shares to the public. In addition, a stock exchange provides benefits such as holistic support to participating companies. It benefits investors by providing a platform to exchange stocks that are issued by listed companies, which helps create liquidity in the market (Aggarwal, Inclan, & Leal, 1999). Share prices may vary to a significant degree based on a number of factors, which can lead to a positive source of return for investors, as well as sizeable losses. Before investing on the stock exchange, investors should understand how the stock market works, as well as the role of certain variables in determining the stock market (Bekaerta & Harvey, 1997). This study uses high-frequency finance data to analyse four sectors to measure the effects of royal decrees and economic announcements on stock return volatility at the aggregate stock market level.

Our understanding of stock return volatility plays an important role in determining investment decisions. Stock market volatility is considered one of the most significant elements associated with the decision-making processes of investors and stakeholders (Chandra, 2008). It is significantly influenced by factors such as fear and greed rather than economic and financial events only (Lo, Repin, & Steenbarger, 2005). Further, stock market volatility may result from artificial price hikes or reductions rather than actual financial or economic fundamental factors. For instance, the global financial crisis of 2008 was largely caused by the speculative housing bubble created in the United States (US) (Welch, 2012).

Finance literature often provides divergent results regarding the effect of stock market liberalisation on emerging market volatility. Market liberalisation is associated with decisions that involve reducing government control and opening the market for private organisations and entities (Henry, 2000). The level of computation increases during the stock market liberalisation process. An increase in the level of competition leads to an increase in market information, which leads to an increase in the number of factors

influencing the stock market. This suggests that market liberalisation leads to emerging markets experiencing more stock market volatility as a result of certain domestic policies and greater inflows of foreign capital into these economies (Bekaert & Harvey, 2002). These policies not only contribute to market volatility but also improve the current market mechanism by improving the efficiency of the market. Liberalisation policies affect emerging markets in terms of macroeconomic factors as well as decisions made in developed economies, as capital from these countries is invested in emerging markets (Ederington & Lee, 1993).

Over the past few years, the Saudi Capital Market Authority (CMA) has initiated several steps to liberalise the market by improving corporate governance standards to make the market attractive to investors, as well as giving foreign investors access to the Tadawul in the first half of 2015. Figure 1.1 illustrates the historical performance of the Saudi Arabian stock market from 1999 to 2018. As shown, after the Saudi stock market crash in 2006 and the global financial crisis in 2007–2008, the market experienced more significant volatility. Thus, the Council of Ministers, headed by the king, issued a number of royal orders to alleviate the effects of the crisis and prevent damage to the economy by issuing new corporate governance guidance, conducting a stock split for the whole market (5:1) to reduce par value and market value, and establishing Tadawul as the official source of Saudi market information. According to Saudi Vision 2030, market liberalisation is one of the most significant elements of the reform program.

Figure 1.1: Saudi Stock Market Index (TASI)

The historical performance of the Saudi stock market suggests that there is a close association between stock market volatility and market liberalisation. During the phase of market liberalisation, investors take an optimistic approach and are inclined to make decisions related to short-term investments because volatility and fluctuations in the short term provide an opportunity to enhance capital earnings from share trading. Investors who are risk-averse prefer to avoid making investments during periods of volatility and will instead wait for the market to stabilise.

Some studies have found a relationship between the stock market's sensitivity to developments in macroeconomic factors and the predictive strength of a particular factor. For example, Rigobon and Sack (2004) found that stock market indexes react significantly to movements in monetary policy. Thus, macroeconomic factors also play an important role in determining the direction of stock market returns. Essentially, macroeconomic announcements provide an understanding of the direction of future movements in government policies as well as a base for investors to determine their specific investment strategies, and these factors ultimately contribute to volatility in the market. The application of computer technology in the 1980s and upgraded mechanisms of trading have significantly changed the pace of adapting to changes in the market. As a result, reflections on macroeconomic announcements can be observed more rapidly regarding stock prices (Sangsubhan & Basri, 2012). A considerable amount of research has been conducted into financial markets, and the focus on volatility and the availability of high-frequency data have enabled researchers to examine particular matters in greater detail and provide more accurate results. High-frequency trading volume data for the stock market are used to determine the effects of macroeconomic announcements on the price of different assets listed on the stock market (Cajueiro & Tabak, 2004). Aggarwal et al. (1999) conducted a study for developed and emerging markets and found that the reason for higher volatility in emerging markets compared with developed markets is country-specific political, social and economic events, whereas the role of global factors is insignificant.

This study takes into account the effect of royal decrees and macroeconomic announcements on the Saudi stock market. Saudi Arabia is considered the most important country in the Arab world in terms of market capitalisation and accounts for about 40% of the countries in the Gulf Cooperation Council (GCC) and approximately one-third of

the Arab countries (Jouini, 2013). The first Saudi public limited company, the Arabic Automotive Stock Company, was listed in the 1930s, but by 1975, the number of listed companies had only reached 14. These companies contributed to the economic growth of the country to a greater degree than the average company (Kung, Carverhill, & McLeod, 2010). This led to rapid economic growth and mergers with foreign banks in the 1970s and encouraged the establishment of a large number of newly established companies and banks. A considerable body of research has examined different aspects of the capital market. After electronic technology was introduced to the Saudi stock market, research results became more accurate. Kalyanaraman (2014) suggested that the stock market return behaviour of Saudi Arabia is categorised as leptokurtosis, skewness and volatility clustering. Kalyanaraman applied a GARCH model to establish whether there is return volatility and to determine the nature of the relationship with selected variables. According to Bollerslev (1986) and Engle (1993), the standard GARCH (1,1) offers a suitable system to model high-frequency time-series data. An extensive body of research has explored the effects of macroeconomic announcements on the return volatility of the Saudi stock market (Kim & Shamsuddin, 2008).

1.2 Aims and Context of Study

The aim of this study is to investigate the effects of royal decrees and macroeconomic announcements on equity return volatility. This is an extension of the study by Haryadi (2016), who examined the influence of macroeconomic announcements on the Indonesian stock market. An extensive review of the empirical literature has been undertaken to make the study as comprehensive as possible. The Saudi stock market (Tadawul All Share Index [TASI]) has gained momentum as an alternative mode of financing, and Saudi Arabia has witnessed a surge in the number of small- and medium-sized enterprises (SMEs) and private sector entities, particularly since 2001 (Aljazira Capital Report, 2010). A number of empirical studies of emerging stock markets have recognised the role of macroeconomic variables as one of the most significant factors. According to Ratanapakorn and Sharma (2007), who studied US stocks, the correlation between stock prices and interest rates (long term) is negative and the correlation between stock prices and the money supply, industrial production, inflation, the exchange rate and interest rates (short term) is positive. Conversely, Haryadi, Hallahan and Tanha (2014) found no evidence that US macroeconomic announcements are significantly related to the equity

return volatility of the Indonesian stock market. Interestingly, the Saudi riyal currency has been at a fixed exchange rate to the US dollar since June 1986 (Al-Hamidy & Banafe, 2013). Moreover, the interest rate of the Central Bank of Saudi Arabia reflects the interest rate applied by the US Federal Reserve. For example, the Saudi Central Bank (SAMA) raised the interest rate in September 2018 following a rate hike by the US Federal Reserve. However, Hammoudeh and Li (2008) found that the Saudi stock market is more sensitive to major global events and is also affected by the US equity and global oil markets. Therefore, this study examines whether the Saudi stock market is affected by the US economy as a result of the Saudi riyal being pegged to the dollar. As outlined below, there are four motivations for conducting the current study related to information efficiency and assessing the effect of royal decrees and macroeconomic announcements on the TASI using the volatility of returns.

First, because the government of Saudi Arabia seeks to maximise citizens' welfare through the Saudi Vision 2030. Recently Saudi Arabia has been going through a cultural and economic reform, where the Saudi government has released a number of royal orders and decrees for the economic growth, development and cultural promotion worldwide of the Kingdom. For example, reducing dependence on oil revenues, allowing foreign investors to invest in the Saudi stock market. These announcements have enhanced deepening liquidity in the Saudi stock market, fortifying the role of the debt market and paving the way for the derivatives market. The implementation of this vision is expected to bring both new opportunities and challenges for Saudi citizens and non-Saudi nationals. In the current study, it is pected to have a positive relationship between stock prices and the announcement of a royal decree. So this study concerns the contribution of royal decrees to the economic and financial sectors.

Second, a number of studies have investigated the volatility of the Saudi stock market and found that Tadawul is quite volatile (Abdalla & Suliman, 2012; Alsubaie & Najand, 2009; Hammoudeh & Li, 2008; Malik & Hammoudeh, 2007). In the last several years, the Saudi stock market has experienced its highest closing prices for the TASI at levels last observed in August 2015, which is the second-highest peak after the tremendous growth witnessed in 2006. Macroeconomic announcements are one of the most influential factors behind such remarkable growth (Admati & Pfleiderer, 1988). The current study is

conducted to clarify the effect of royal decrees and macroeconomic announcements on the volatility of the Saudi stock market.

Third, a number of studies have examined information flows related to the stock market, including the role of national media and social media in creating perceptions of the condition of the stock market. There have been mixed conclusions about the informational efficiency of the Saudi stock market using the random walk model. Studies have indicated that the Saudi stock market is mostly weak-form efficient (Abraham, Seyyed, & Alsakran, 2002; Al-Razeen, 1997; Asiri & Alzeera, 2013; Khababa, 1998). These results suggest that small markets tend to have lower efficiency in terms of information. The current study and analysis have been used realised variance, which is more accurate, to provide additional evidence regarding the information efficiency of the TASI.

Fourth, studies have investigated the fact that investors start trading on available information or in the event of the arrival of such information, and thus the trading volume increases, which can be correlated with an increase in volatility (Admati & Pfleiderer, 1988; Foster & Viswanathan, 1994; Karpoff, 1987). Given the availability of the high-frequency data needed to test such a finding for the Saudi stock market, this study examines the intraday patterns of volatility and the relationship between volatility and royal decrees and macroeconomic announcements.

In conclusion, this study aims to determine the effect on, and relationship between, royal decrees, macroeconomic announcements and return volatility on the Saudi stock market using evidence from high-frequency data. It also examines the TASI and compares the indexes of four industries—banks, energy, materials and telecommunications—to obtain valuable insights into the informational efficiency of the stock market and provide industry-specific analysis to assist investors to make informed decisions. These sectors were selected because they are the most influential on the TASI (materials companies comprise 28.14% of the index and banks 40.16%). Also, the energy index as one of the sectors related to oil prices on the TASI and because the Kingdom is one of the largest oil-producing countries. Further, the telecommunications sector is considered one of the most active among the TASI market indicators.

1.3 Research Questions

This research primarily focuses on determining the effect of various announcements on the stock market. The study is guided by five main research questions:

- To what extent can royal decrees contribute to movements in the TASI?
- What is the effect of Saudi economic announcements on the intraday return volatility of the Saudi stock market?
- How do United States economic announcements affect the volatility of the Saudi stock market?
- What is the effect of royal decrees and economic announcements on the volatility of sectors returns?
- How do selected market sectors interact during economics announcements and royal decrees?

1.4 Contribution to Knowledge and Statement of Significance

1.4.1 Contribution to Knowledge

The Saudi Arabian Government adopts the monarchy system, whereby all economic and political orders are issued upon the approval of the king of Saudi Arabia. This study focuses on the Kingdom of Saudi Arabia because no past studies have investigated the effect of royal decrees on stock markets. In addition to royal decrees, this study examines the effect of macroeconomic announcements. Following Haryadi (2016), the current study advances the analysis by incorporating realised variance and applying it to the Saudi stock market, and by comparing four sector indices. Thus, the current study contributes to the empirical literature in four ways.

First, the study focuses on the TASI's efficiency and provides insights into the level of market efficiency. Although numerous studies have examined the TASI's efficiency, this research has focused on volatility, royal decrees and macroeconomic announcements to determine the level of market efficiency.

Second, given the growing interest in models based on high-frequency financial data, this study has provided imperative evidence to detect the behaviour of the Saudi stock market using high-frequency instead of low-frequency data. The study used 5-minute intervals

to analyse the information to provide a clearer and more accurate view of market conditions. High-frequency data are commonly used in developed markets (Andersen & Bollerslev, 1998; Ederington & Lee, 1993; Smales, 2013). To the best of this researcher's knowledge, no published studies have considered the Saudi stock market's behaviour using high-frequency data. Therefore, the empirical analysis in the current study has been dealt with the TASI's behaviour using intraday data—for example, the relationships between trading volume, announcements and returns volatility. In addition, this study reveals how trading activity reflects public information in Tadawul, which contributes to the empirical literature relating to emerging markets.

Third, Saudi Arabia is one of the few countries in the world that has an absolute monarchy system of government[1]. All royal decrees are issued and signed by the king of Saudi Arabia. Pastor and Veronesi (2012) observed that government policy increases volatilities and correlations among equity markets. To extent the literature, this study is the first to examine the effect of royal decrees on the Saudi stock market.

Fourth, an important practical contribution of this study follows the approaches adopted by Gropp and Kadareja (2012) and Smales (2013). This study uses the rolling volatility windows method to investigate the effect of royal decrees and macroeconomic announcements on volatility and the stock market index, and to compare four industry

[1] These are the approximate categories which present monarchies fall into:

Commonwealth realms: Antigua and Barbuda; the Commonwealth of Australia; the Commonwealth of the Bahamas; Barbados; Belize; Canada; Grenada; Jamaica; New Zealand; the Independent State of Papua New Guinea; the Federation of Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Solomon Islands; Tuvalu; and the United Kingdom of Great Britain and Northern Ireland.

Other European constitutional monarchies: The Principality of Andorra; the Kingdom of Belgium; the Kingdom of Denmark; the Grand Duchy of Luxembourg; the Kingdom of the Netherlands; the Kingdom of Norway; the Kingdom of Spain; and the Kingdom of Sweden.

Muslim monarchies: The Kingdom of Saudi Arabia; the Kingdom of Bahrain; the Nation of Brunei, the Abode of Peace; Malaysia; the Hashemite Kingdom of Jordan; the State of Kuwait; the Kingdom of Morocco; the Sultanate of Oman; the State of Qatar and the United Arab Emirates.

East and Southeast Asian constitutional monarchies: The Kingdom of Bhutan; the Kingdom of Cambodia; Japan; and the Kingdom of Thailand.

Countries where monarchs still maintain absolute power are: the Kingdom of Saudi Arabia; the Kingdom of Bahrain; Oman; Qatar; the United Arab Emirates; the Kingdom of Eswatini; the Nation of Brunei; Vatican City State.

indexes (banks, energy, materials and telecommunications). Hence, this study contributes more efficient information by using a rolling volatility method for an emerging market.

1.4.2 Statement of Significance

This study has been contributed to existing knowledge regarding the behaviour of the stock market and the effects of royal decrees and macroeconomic announcements on the Saudi stock market. The most practical contribution of the study is that it provides an overview of the relationship between stock market return volatility and announcements. No previous empirical studies have provided systematic guidance for interested investors. This study and analysis have been provided guidance for them to help make a decision. In addition, the study has been provided information for policymakers and market regulators by examining the efficiency of the stock market and studying the announcements that may influence the volatility of the Saudi stock market. Further, this study has been improved the accuracy of the estimated model of market volatility by taking into consideration announcements, and it has been contributed to the empirical literature by providing an alternative measure for the TASI volatility of return. Moreover, developers create trading software that caters for a wide range of investors to help anticipate future movements in the index and stock prices. This study contributes to computerised programming and lead to the consideration of these factors, which may help developers to build scalable formulas for commercial trading systems. Therefore, the outcomes of the study will be of interest to market participants, market regulators, academic researchers and trading platform developers.

1.5 Structure of the Thesis

This thesis consists of six chapters, which are briefly outlined below.

Chapter 1 provides the background of the study, outlines the research objectives, presents the research questions and discusses the significance of the study.

Chapter 2 provides an overview of Saudi Arabia and its history, geography and economy. It also provides an overview of the relevant bodies, Saudi Vision 2030 and Saudi Arabia's position as a country in the Group of Twenty (G20) and the Organization of the Petroleum Exporting Countries (OPEC).

Chapter 3 reviews the literature that is relevant to the aims of the study and focuses on the theoretical framework of the study related to the capital market, including the economics of asymmetric information and the effect of government policies on the stock market.

Chapter 4 discusses the research philosophy and approach, including the quantitative methodology, and provides the conceptual framework and data used for the study. It also presents a detailed description of the research design and techniques used.

Chapter 5 presents the data analysis based on the realised volatility model, using descriptive statistics, followed by the unit root test and then the applied multiple regression analysis model. The results of the study are then discussed and linked with previous studies.

Chapter 6 presents an overall summary of the study, a conclusion and recommendations for future studies.

1.6 Summary

The introduction to this chapter provided a brief overview of the study endeavour, which aims to determine the effect of royal decrees and macroeconomic announcements on the Saudi stock market using high-frequency data analysis. It began by explaining the background to the study and how the idea of the study originated. Next, the importance of the study for the body of literature was explained, and the research aims and research context were outlined. Establishing a specific and high-quality research objective has a clear effect on the quality and reliability of a research study. The research questions, contribution to knowledge and statement of the significance of the study were then outlined.

Chapter 2: Context of Study: Saudi Arabia

2.1 Introduction

Saudi Arabia, officially known as the Kingdom of Saudi Arabia, is a West Asian nation that occupies most of the Arabian Peninsula. The country is considered the most developing nation in the world and in the Middle East. Saudi Arabia is continuing to follow proper diversifications and business reforms, and it has implemented different reforms within the country's social process, the structure of politics and different industries. In relation to business reforms, Saudi Arabia is considered a valuable member of the World Trade Organization (WTO). Since 2009, Saudi Arabia has been a member of the G20 of the world's 20 major economies that bring together the most important industrialized and developing economies to discuss international economic and financial stability.

In 2016, Saudi Arabia introduced its 'Vision 2030' to create a high-class economic environment for 'sustainable economic growth' that is sufficient to meet the aspirations of Saudi Arabian citizens. Considering Vision 2030, the financial sector can be viewed as a purely diversified and sufficient financial service constructed by three major pillars (Vibrant Society, Thriving Economy, and Ambitious Nation). One of the main goals of thriving economy pillar is establishing an advanced and secure capital market in the country. This chapter will present background information about Saudi Arabia and its process of evolution. It will also outline aspects of the research concerning the main economic structure of Saudi Arabia.

2.2 A Brief Historical Background of Saudi Arabia

Saudi Arabia is one of the largest countries in the Middle East, occupying the majority of the Arabian Peninsula towards the west of Asia. Geographically, the country is bound by the Arabian Gulf, Qatar and the United Arab Emirates to the east, and Yemen and Oman to the south. To the west is the Red Sea and Gulf of Al-Aqaba, and Jordan, Iraq and Kuwait lie to the north of the country. Saudi Arabia occupies approximately 2,200,000 square kilometres of land and has a population of around 21 million Saudi citizens and 13 million non-Saudi citizens (General Authority for Statistics, 2018). The geography of the Kingdom is primarily dominated by the Arabian Desert, as well as many mountain

ranges and highlands. Although there are no permanent rivers in the country, it has a few lakes and several wadis (dry channels). Fertile areas are found in the alluvial deposits located in the wadis, basins and oases. The central plateau, which rises sharply from the Red Sea and descends to the Nejd and towards the Arab Gulf, is the main topographical feature of the land. The typical climatic conditions of Saudi Arabia are extremely hot summers and warm winters with exceedingly dry air. The official language of the Kingdom is Arabic, and to assist deaf people, Saudi sign language was developed as the official language of the deaf community.

Saudi Arabia is a monarchy, but the king is required to comply with the Sharia law and the Quran. The Sunnah and Quran are the country's constitution; no political parties or national elections are permitted. In 1902, King Abdulaziz Al Saud recaptured Riyadh, the Al Saud dynasty's former capital. He went on to subdue the rest of Nejd, Al-Hasa, Jebel Shammar, Asir and Hejaz (the locations of the Muslim holy cities of Mecca and Medina) between 1913 and 1926. The resultant polity was named the Kingdom of Nejd and Hejaz from 1927 until it was further consolidated with Al-Hasa into the Kingdom of Saudi Arabia in 1932 under Islamic law. The country developed at a faster pace following the formation of the modern state on 23 September 1932 by the first monarch and founder of Saudi Arabia, the 'third Saudi state' King Abdulaziz bin Abdulrahman Al Saud (Ibn Saud). It is estimated that the population of the country in 2019 was 34.14, increased at an annual rate of 1.68% from 2018 (General Authority for Statistics, 2018). The current king and prime minister is Salman bin Abdulaziz Al Saud, while Mohammad bin Salman is the crown prince.

In 1938, following the discovery of oil reserves, Saudi Arabia became one of the first countries to export oil. This became the foundation for the country's strong economic and material infrastructure and led to significant developments that heavily influenced educational and socioeconomic factors in the country. Oil wealth has enabled the country to develop and achieve objectives in the fields of education, technology and science. There has also been a notable change in the outlook and perception of the population due to the modernisation that has resulted from the increase in wealth.

In 2019, the World Bank database was ranked the Kingdom of Saudi Arabia as the largest economy in the Middle East and the eighteenth largest in the world (Silver, 2020). The economy is primarily governed by the petroleum sector because the country has the

world's second largest proven oil reserves. Saudi Arabia is also the largest exporter of petroleum in the world and has the fifth largest natural gas reserves. For this reason, the country is considered an energy superpower (Danish & Smith, 2012). Saudi Arabia's economy is primarily petroleum-based. Almost 63% of its budget revenue and 67% of exports are derived from the oil industry alone, and 45% of gross domestic product (GDP) is attributable to the oil industry, while the private sector contributes only 40%. The country has oil reserves totalling 260 billion barrels, which is nearly one-fifth of the world's total reserves (Cassell & Blake, 2012).

One of the biggest challenges for the Kingdom is halting or reversing the decline in per capita income. Another major challenge relates to preparing the youth for future employment and providing them with sufficient job opportunities. Other prominent and related challenges include the need to diversify the economy, stimulate the private sector, construct sufficient houses and reduce levels of corruption and inequality in the country.

2.3 Government and Legislature

Along with Saudi Arabia's single political framework and status as an Islamic country and autonomous power, the legal structure of Saudi Arabia has influenced its inhabitants inversely compared with other emerging and established countries. This section provides a detailed explanation of basic system of government and the manner in which law making has been developed and endorsed in Saudi Arabia.

2.3.1 Constitution

The constitution of Saudi Arabia is in accordance with the Sharia Islamic law or teachings of Islam, from which the country's laws and traditions derive. This is not well recognised or understood in some non-Muslim countries. Moreover, the Sharia law contains instructions regarding how Muslim society must be arranged and ruled. It also offers the means for resolving disagreements between people and between citizens and their governors on day-to-day matters.

The Sharia law is obtained from four essential sources that are based on the Quran. The Holy Quran includes the commands of Allah and sets the main general standards for Muslims to guide their ambitions (Al-Farsy, 1990). The second source is the Sunnah, which reflects the tradition and exclamations of the Prophet Muhammad (peace be upon

him) and elaborate matters that are stated in the Quran. The third source is consensus (Ijma), which records the agreement and unity of religious scholars in their clarifications of the revealed books. This source is of interest in this study because it discusses vicarious regulations for Muslim society. The fourth source is analogical reasoning (Qiyas), which settles the truth concerning facts in a case or some of the arguments that have been done by analogy.

The constitution of Saudi Arabia consists of 40 amendments for the welfare of the country according to the Sharia law. No constitution is passed that does not fall under the four sources of the law. These amendments include laws regarding education, marital life, citizenship, employment rights, equity, non-discrimination and inheritance. All of these amendments were implemented in line with the Sharia law.

According to Article 9 of the Basic Law, families are an important part of society, and every family in Saudi Arabia should live their lives and perform activities while making the religion of Islam their utmost priority.

The Sharia law is fundamental to Saudi Arabia and directs every aspect of an inhabitant's life, financial and political affairs, family and social relationships, humanity, rights and responsibilities of residents, and religious practices. The below subsections describe the formal framework of governance obtained from principles of the Sharia law.

2.3.2 Government

The government of Saudi Arabia is based on the monarch system. The concept of the royal family started in 1953 and is still observed today. The government is given in inheritance to the prince by the king. This is done to save the monarch status of the family and maintain the royal blood. The king of Saudi Arabia ensures that the government is being run according to the Sharia law and the four essential sources that are based on the Quran (Yamin & Mattar, 2016).

The King, as Prime Minister, is advised by the Consultative Council (Majlis Al-Shura) which has been developed in the era of 1992. As well as in the era of 1993 in August, it has been directing for the effectiveness, in this regard King Abdullah reconstructed the Majlis Al-Shura. Essentially made of 60 protruding members of Saudi political, communal and religious life and the counsel has been extended by 150 members in 2005.

In 2013, he issued two royal orders to amend the Majlis Al-Shura system, allowing the inclusion of women at a rate of no less than 20%, as the council structure included 30 women. The Majlis Al-Shura recommends the King and the Meeting of Rectors on a daily basis on substances regarding to government programs and some of their policies. The Majlis Al-Shura's has essentially been functioned for the assessment, clarification and transformation of legal system of kingdom, through laws, agreements and some of their worldwide contracts. In 2003 the reduction sanctions the council to recruit laws, moreover, it has now reply to the argument which has been made with king as the last arbitrator.

The Council of Ministers was selected by the king in 1953 to advise on the construction of all-purpose policy and direct the events of the developing bureaucracy. The council is composed of the king as the prime minister, the deputy prime minister and 35 ministers. The king and the Council of Ministers represent the executive branch and are responsible for implementing all legislation (Al-Zaharani, 2013) and making everyday decisions to ensure that the Kingdom can achieve growth and prosperity (Alsuwaida, 2010). The king, apart from having all legislative powers, is the head of the executive authority and has all power over it. All of the state authorities report to the king (Camp, Roobol, & Hooper, 1992). Legislation is enacted by resolution of the Council of Ministers, ratified by the Consultative Council and royal decree, and must be compatible with the Islamic law. Further, the Council of Ministers and Shura Council cooperate fully in the legislative authority, and there is no separation between them. It also has the authority to approve international treaties, agreements, regulations and concessions.

The Kingdom is divided into 13 emirates (provinces) along with domestic matters which has been directed. Every action is controlled by the governor of the province, who is hired by the king. The governor is assisted by the vice-governor and the provisional council, which is based on the head of the provincial government and their departments, as well as 10 participants of dominant entities within the society who are selected for a 4-year term. Moreover, in 1993, King Fahad Late enacted laws for some provisional systems to assist with the management of the provinces.

Article 44 of the Saudi Basic Law of Governance states that the authorities of the state shall consist of the Executive Authority, the Regulatory Authority and the Judicial Authority. These authorities cooperate to perform their functions according to this system

and other regulations, and the king is the reference of these authorities (Saudi Arabia's Basic Law of Governance, 1992).

2.3.2.1 Royal Orders

The majority of laws passed in Saudi Arabia are passed by royal order. Monarchy is an important factor in the government of Saudi Arabia, and many decisions are made with the assistance of the royal family in the form of royal orders. In March 1992, King Fahad passed three laws by royal order: Basic System of Governance, Consultative Council Law and Regional Law (Cassell & Blake, 2012).

2.3.2.2 Royal Decrees

A royal decree is an order given by the king or queen. The king in Saudi Arabia holds legislative, executive and judicial powers and issues royal decrees that form the basis of the country's legislation (Al-Turki, 2011). The law is formed and executed through these royal decrees. The legislative process includes drafting and implementing international treaties, agreements, regulations and concessions, which are then passed and amended by royal decree after deliberation by the Council of Ministers. In accordance with Article 23 of the Law of the Council of Ministers in 1993, all royal decrees are published in the official gazette and come into force from the date of their publication, unless stipulated otherwise. Therefore, this study reviews the extent to which these royal decrees affect the Saudi stock market.

2.3.3 Judicial Authority

In 1970, a Ministry of Justice was created by King Faisal to assume the administration of the country's courts. The legal executive was established in 1975, in view of the Sharia courts, that led to the establishment of the Supreme Judicial Council to administer all Shari'ah courts. In 2007, King Abdullah issued a new judiciary law that replaced the 1975 judiciary law. The Basic Law provide that the Saudi judicial system is divided into two systems, the Shari'ah courts and the Board of Grievances (administrative courts). The Shari'ah courts consist of three levels that function under the supervision of the Saudi Supreme Judicial Council: the Courts of First Instance, the Courts of Appeal, and the Supreme Court (Al-Hamoudi, 2014). In the judiciary system, with the decision of the minister of justice that is recommended by the Supreme Court judicial, the chief judge of

the appellate court is appointed. In addition, accepting the Sharia law as in the form of main principles of the state's law, which has been taken as in the meaning of actions of every single entity and the government must have to rule under such kind of constitutions exclusively, and no other would have the influence to oppose it.

2.4 The Saudi Economy

2.4.1 Economic History of Saudi Arabia

Saudi Arabia has steadily modernised over time, and different generations have contributed to the country's progress and development. For decades, Saudi Arabia has been investing in the lives of citizens and enhancing the markets. The wealth generated from natural resources is used to fund social, economic and infrastructure development projects. Vast resources have been dedicated to enhancing the wellbeing of citizens (Mitchell & Alfuraih, 2018). The economy has grown strongly in recent years as a result of growth in private sector activities, high oil prices and output, increased government spending, and investments in domestic reform initiatives. Overall, the economic outlook has been favourable, which has helped Saudi Arabia remain competitive. In the past, the economy mainly relied on oil revenues for growth and development; however, the increased reliance on oil revenues made the economy vulnerable. Policymakers found it difficult to manage the country's heavy dependence on oil revenues, and they also faced challenges in helping the economy diversify to manage its overall revenues (Al-Darwish et al., 2016).

Today, Saudi Arabia is an influential country in the Gulf region. It holds a strategic position as the largest economy in the Arab world and the only Arab country in the G20. The government exercises control over the primary economic activities, which are mainly based on oil production and trade. Since 2016, the government and authorities have highlighted the need to diversify the economy. The United Nations set the Sustainability Goals in 2015, which formed the basis of the economic reform plan in Saudi Arabia known as Vision 2030. This plan focuses on both short-term and long-term goals and objectives, and it aims to diversify the economy and create jobs for the growing population (Rahman & Qattan, 2020). Consequently, regulations and policies have been streamlined to encourage growth and development, and the education system is playing a vital role in closing the skills gap and training students to contribute to the job market

and economic growth. Political and governmental developments are vital for building an ambitious nation, and it is important to consider the expectations of new generations while planning development so that the right decisions can be made and the right actions undertaken (Grand & Wolff, 2020).

Saudi Arabia has managed to build and maintain strong and positive relationships with many countries, and this has contributed to the overall stability of the economy. New generations have introduced new opportunities and challenges for the economy, which need to be understood. Taking the global trends and challenges into account, Vision 2030 was unveiled as an ambitious program of development. It emphasised investments and geographical connections, as well as becoming a more tolerant country and focusing on modernisation and development. Commitment to Vision 2030 and the initiation of projects and activities are expected to help Saudi Arabia strengthen its economy and position in the global market (Al-Darwish et al., 2016). Today, Saudi Arabia is a well-developed and strong country from an economic standpoint. Since 1970, the country's GDP has grown at a steady rate. During the 1970s, GDP was US$5.30 billion, but by 2019 this had grown to US$792.97 billion. During the 1930s, Saudi Arabia was a subsistence economy, and in 1951 the first offshore fields were discovered in the Middle East by the Arabian American Oil Company. In the 1980s, the price of oil peaked and demand increased, which helped the country achieve significant economic growth and prosperity.

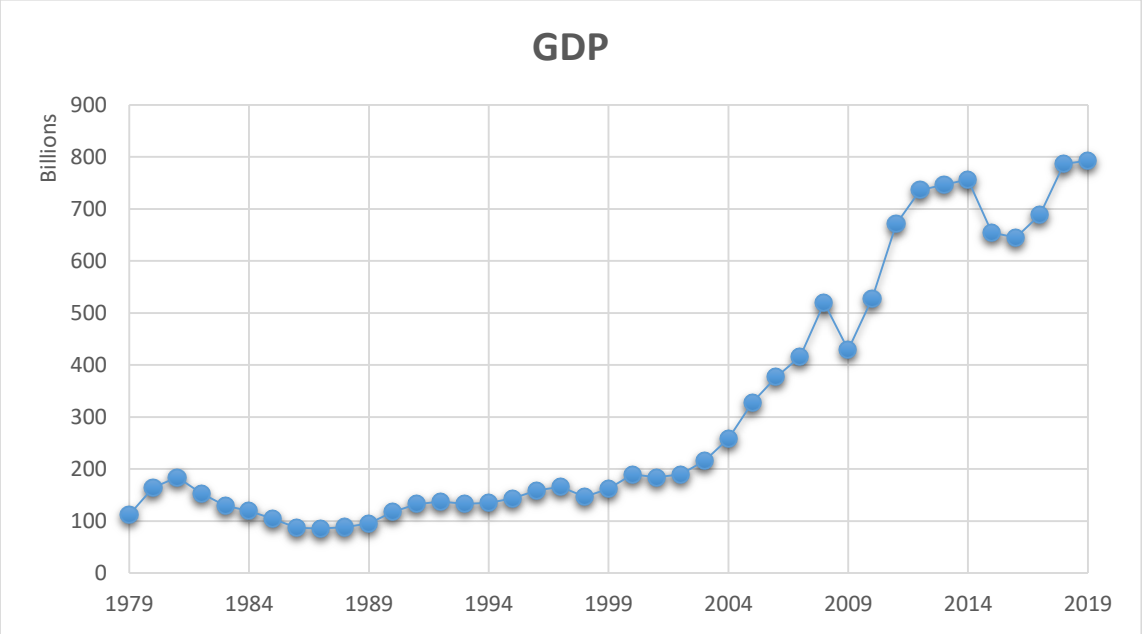

Figure 2.1: GDP of Saudi Arabia 1979–2019 (World Bank, 2020)

2.4.2 Indicators of Saudi Economic Growth

There are various parameters by which Saudi Arabia's economic growth can be expressed and interpreted. In 2000, the GDP per capita was US$9,171 and the GDP growth rate was 5.6%. However, by 2012, GDP per capita had increased to US$25,243, which was higher than the GDP per capita in 2011, and GDP growth was 5.4%, which was also considerably higher than that of previous years. By 2018, GDP per capita had decreased to US$23,338 and the GDP growth rate was 2.43%, and in 2019, GDP per capita was US$23,139 and the GDP growth rate fell to 0.33%. It was observed that this might be the result of OPEC production cuts and Saudi Arabia's over-compliance with the quota by about 5%. In addition, the GDP per capita growth declined to −1.33 in 2019 as a result of GDP growing at a rate lower than the growth of the population. The population increased from 33.7 million people in 2018 to 34.2 million in 2019 (an increase of 1.68%). Table 2.1 reviews the economic growth of Saudi Arabia from 2012 to 2019. On the basis of these indicators, it can be said that the country has achieved a stable growth rate and has performed very well in economic terms.

Table 2.1: Macroeconomic Indicators and Population Rate of Saudi Arabia, 2012–2019

Indicator	2012	2013	2014	2015	2016	2017	2018	2019
GDP per capita (current US$)	25,243	24,844	24,463	20,627	19,879	20,803	23,338	23,139
GDP growth (annual %)	5.41	2.69	3.65	4.10	1.67	−0.74	2.43	0.33
GDP per capita growth (annual %)	2.20	–0.36	0.75	1.47	–0.60	−2.71	0.60	−1.33
Inflation, GDP deflator (annual %)	4.01	–1.21	–2.26	–16.90	–3.04	7.56	11.50	0.48
Official exchange rate	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Exports of goods and services (% of GDP)	54.27	51.91	46.87	33.32	31.14	34.85	39.90	36.03
Stocks traded, total value (% of GDP)	69.45	48.53	75.01	66.78	47.50	31.71	29.18	27.84
Total population (Million)	29.16	30.05	30.92	31.72	32.44	33.1	33.7	34.14
Population (% of growth rate)	3.1	3.0	2.8	2.6	2.3	2.0	1.8	1.68

Source: World Bank (2020).

2.4.3 Saudi Arabia Balance of Payments

Saudi Arabia's economy is considered one of the leading economies in the world. After the 1970s boom, Saudi Arabia was able to export oil at substantial prices, which led to it

becoming one of the fastest-growing emerging economies in the world. According to recent reports, Saudi Arabia's balance of payments (BOP) was US$46.949 billion in December 2019. BOP is a bookkeeping record of a country's connection with the rest of the world in regard to all money-related exchanges.

The most well-known use of BOP measurements identifies with stock fares as its synthesis and changing examples after some time uncovers creation blend and changing the relative preferred position of the economy. This is despite the fact that Saudi Arabia is the world's largest producer and exporter of oil and has one-quarter of the world's known oil reserves. Consequently, it is evident that Saudi Arabia is the dominatingly oil situated. However, through Vision 2030, the Saudi government has started focusing on raising the indicators of the non-oil sector to GDP.

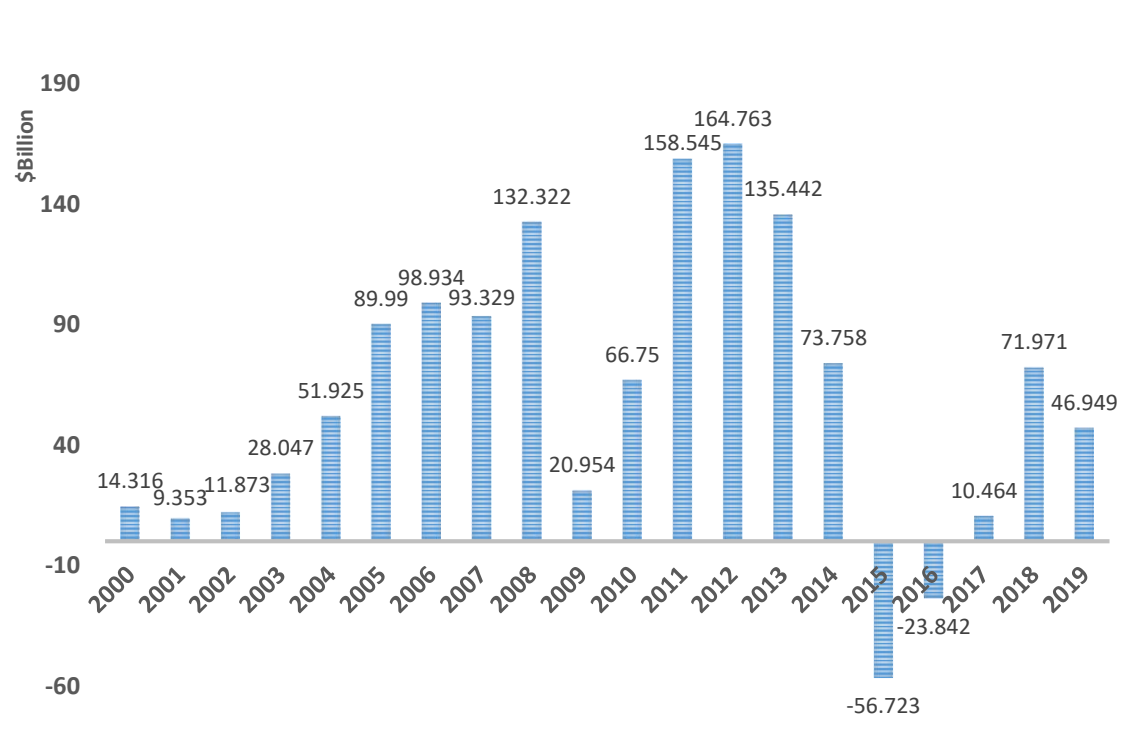

Figure 2.2: Saudi Arabia's BOP

Figure 2.2 shows BOP data for the period 2000–2019. According to the 48 observations between 1971 and 2019, these data have updated at an average of US$5.048 billion. The highest value in history (US$164.763 billion) was recorded in 2012, while the lowest value (US$−56.723 billion) was observed in 2015 (Yang, Poon, Liu, & Bagchi-Sen, 2015). Further, the current account balance increased between 2016 and 2019. Given that BOP data were recorded annually between December 1976 and 2019, the current account balance data were also observed annually (Yang et al., 2015). This balance positively increased in 2018 to US$71.971 billion.

2.4.4 Saudi Arabia Structure of Trade

2.4.4.1 Exports from Saudi Arabia

Saudi Arabia's economy has experienced many changes in a relatively short period. It has advanced from an essential farming society to a territorial and worldwide financial force with a cutting-edge foundation. Oil products are a vital part of the economy, as Saudi Arabia is the world's biggest producer and exporter of oil. In recent years, the Kingdom of Saudi Arabia has progressively enhanced its economy; today, it exports an assortment of mechanical merchandise to the rest of the world (Shash & Qarra, 2018).

The Saudi economy is the twentieth major exporter and thirty-second major importer in the world. Exports are now considered representative in all economic sectors in the Saudi economy. In addition to exports of petroleum, crude oil and products related to crude oil, Saudi Arabia exports plastics, petrochemicals, construction materials, electrical appliances and metal goods to around 90 countries. Foreign trade represents 67% of the country's GDP. Petroleum products accounted for 76.4% of total exports in 2017 and 78.3% in 2018. Saudi Arabia's main export partners are Belgium, India, Singapore, the United Arab Emirates and the US (Ntui, 2012).

Saudi Arabia's business sector is developing quickly, mainly as a result of generous incentives provided by the government to the commercial sector. These incentives include interest-free long-term loans and support facilities and services. In addition, chambers of industry and commerce in the main cities promote different ventures. To promote international trade, expand non-oil areas and attract foreign investors, the legislature declared its intention to establish four 'financial urban communities' in various locales (Nasir, Rehman, & Ali, 2017).

2.4.4.2 Imports to Saudi Arabia

The Kingdom of Saudi Arabia is a well-known economy globally. In addition to being a major oil exporter, the country is ranked as the twentieth major importer in the world economy. Saudi Arabia's interdependence with the rest of the world is considered one of the major characteristics of the country's economy, and it has significantly increased as a result of the increase in oil revenue (Mann & Sephton, 2015). Imports as a percentage of GDP increased from 19% in 1990 to 30% in 2019, which demonstrates the development of the Saudi economy during this period.

Saudi Arabia's major import partners are the US, China, Germany, India and the United Arab Emirates. The Kingdom of Saudi Arabia mainly imports cars, food products (barley, wheat, rice), gold, delivery trucks and broadcasting equipment. Vehicles (including heavy-duty trucks, sedans, cars and buses) are considered the major product imported by Saudi Arabia (Mahmood, Alkhateeb, & Ahmad, 2017), with 440,922 vehicles imported in 2018. The second major category of imports is pharmaceutical products. In 2018, more than US$5.53 billion was spent by Saudi Arabia on pharmaceutical products. Saudi Arabia imports 59% of its pharmaceuticals from the Gulf region. Given the recent growth in the medical industry in Saudi Arabia, it is expected that the country will import approximately US$8.9 billion of pharmaceutical products in 2023. Vision 2030 has led to tremendous growth in all fields—mainly in the life sciences sector; however, the country is only able to fulfil 30% of its pharmaceutical demand locally. As a result of the rapid increase in the population, Saudi Arabia imports the majority of its medicines from other countries (Joharji & Starr, 2011).

2.5 Regulators of the Financial Market

2.5.1 The Ministry of Finance

This ministry is responsible for controlling state expenditure in Saudi Arabia. It is currently controlled by His Excellency Mohammed Al-Jadaan, Minister of Finance. The ministry performs functions related to financial and economic policy, revenue management, and budget and financial affairs. In the context of financial and economic policy, the Ministry of Finance develops financial plans, evaluates a range of financial policies and conducts financial research to select an appropriate financial plan. In addition, the revenue department is focused on the development of financial, tax and

customs systems along with appropriate supervision for handling different revenue-related issues. Further, the Ministry of Finance is responsible for the state budget in relation to fiscal policies, and for coordinating with various government authorities. The financial affairs section implements the state budget and is responsible for financial reporting regarding a wide range of state operations and financial projects along with public spending. This department also manages international financial affairs to help the country establish bilateral relations and multilateral partnerships with international partners to preserve long-term trade relationships and ensure economic growth.

2.5.2 The Ministry of Economy and Planning

This ministry was initially formed in 1953 before being disestablished in 1954. It was re-established in 2003 and is now one of the premier governmental bodies in the country. Its primary function is to develop and implement 5-year plans to reflect the country's long-term financial targets. It consists of several agencies, including the Central Department of Statistics and the National Computer Centre.

2.5.3 The Ministry of Commerce

This ministry is a cabinet-level government ministry and is responsible for regulating trade, commercial policy and promoting economic growth. The ministry also develops and implements policies and mechanisms to control and monitor the commercial sector, and it enhances methods and procedures for the public interest, anti-fraud and consumer protection. It was initially established by royal decree in 1954 to regulate internal and external commerce, but in 2016, because of a restructure and reorganisation, the Ministry of Commerce and Industry was formed. In 2020, the name of the ministry was changed to the Ministry of Commerce.

2.5.4 The Ministry of Investment

Created on 25 February 2020 to replace the General Investment Authority, which was established on 10 April 2000, this ministry provides licences for foreign investment. Its main aims are to regulate, measure and formalise the process of economic liberalisation, and to provide services and facilities to investors to improve the investment climate and promote economic development in Saudi Arabia. It awards investment licences through online channels and reports back to the president of the Supreme Economic Council.

2.5.5 Saudi Central Bank

SAMA is the central bank of the Kingdom of Saudi Arabia and was incorporated in 1952 to control monetary and financial affairs. The department performs several functions in accordance with various laws and regulations. SAMA's primary objective is to deal with a wide range of banking affairs, and it is also responsible for minting and printing the national currency. In addition, SAMA develops policies that are intended to stabilise the value of the Saudi currency (Al-Bassam, Ntim, Opong, & Downs, 2018), which is essential when importing and exporting goods around the world. Further, SAMA is responsible for managing the Kingdom's foreign exchange reserves, as per the imports and exports of the country. It is responsible for controlling monetary policy, and it offers assurances for the stability of prices and the exchange rate. The institution also promotes the growth of the financial system and its efficiency. It acts as a regulatory authority for supervising commercial banks as well as exchange dealers within financial markets. Similarly, SAMA controls cooperative insurance organisations and self-employment professions involved in different financial services. The organisation also sets regulations to assist finance companies and credit information companies to enhance the effectiveness and efficiency of the financial system. King Salman bin Abdulaziz approved a law to change the name of SAMA to the Saudi Central Bank, with direct reporting to the King. The Saudi Central Bank continues to enjoy financial and administrative independence. This approach is in line with international best practices for central banks. The law also stipulates that the Saudi Central Bank shall replace SAMA in all its rights and obligations.

2.5.6 General Authority for Statistics

This government agency is responsible for statistical work such as conducting national surveys. It is governed by a board of directors that is headed by the Ministry of Economy and Planning, and it consists of 15 government entities as well as private agencies and firms. The agency is responsible for developing statistical work methodologies, conducting surveys, conducting statistical research and analysing data and information.

2.5.7 Capital Market Authority

The CMA was incorporated as a government organisation for the facilitation of full financial, legal and administrative independence. The CMA's functions are mainly

focused on regulating and developing the Saudi Arabian Capital Market by creating a wide range of rules and regulations to implement the various provisions of Capital Market Law (Albassam, 2015). The core objectives of the CMA are to establish an appropriate investment environment, boost confidence and disclose different standards within all listed companies to protect investors and dealers against illegal actions in the market. The CMA also plays an important role in regulating and developing the capital market using appropriate standards and tools for all entities involved in securities trade operations. It plays a critical role in protecting investors and the public from unfair and unethical practices such as fraud, deceit and cheating during transactions in financial markets. In addition, the CMA tries to maintain fairness and transparency in securities transactions and reduce risk factors. It is responsible for developing, regulating and monitoring the issuance of securities as well as under-trading transactions. The department also regulates and monitors the full disclosure of information when dealing with securities.

2.5.8 Saudi Stock Exchange (Tadawul)

The financial market mainly consists of participants who want to exchange funds for the purpose of generating a return. Some people have knowledge about how to use funds, while others have funds but no technical knowledge. Financial markets mediate between the participants to exchange funds and satisfy each other's needs. A dynamic and healthy financial market is important for the betterment of a country's economy. Generally, there are two types of financial markets: one where long-term funds are exchanged and one where short-term funds are traded.

Tadawul is Saudi Arabia's stock exchange and the region's largest stock exchange, and it can be easily accessed by companies. In addition, Tadawul has a sole regulator for a market that was incorporated in 2007 as the Saudi Stock Exchange (Tadawul) Company. More than 190 companies are listed on Tadawul, and they command more than 40% of the total GCC market capitalisation (Al-Bassam et al., 2018). Tadawul also provides access to financial services for the energy industry and other sectors.

Over the years, the Saudi stock market has achieved significant growth at a healthy rate, and today it is one of the top 20 countries due to its strong economic background (Al-Somali, Gholami, & Clegg, 2011). The Morgan Stanley Capital International (MSCI) index is a prominent index that describes the overall performance of a country and

provides an indication of its standing in the international arena. In June 2017, Saudi Arabia was awarded the emerging market in MSCI, which demonstrated the country's efforts to modernise its stock market and thereby attract significantly more investment. Further, Tadawul offers a wide range of equities, Islamic bonds, exchange-traded funds (ETFs) and mutual funds. TASI is an important stock market index that tracks the performance of all firms listed on the Saudi Stock Exchange. Appendix 1 outlines Saudi Stock Market developments and events for the period 1985–2019.

Public limited companies started operating in Saudi Arabia in the 1930s. The first of these was the Arabian Automobiles Company, and the number of listed companies stood at 14 by 1975. There was then significant growth in listed companies. Currently, there are approximately 190 companies listed on Tadawul. Table 2.2 shows the performance of the Saudi market index since 2010.

Table 2.2: Performance of the Saudi Market Index Since 2010 (by Closing Price of the Last Day of the Year)

Year	TASI	Change (point)	Change (%)
2010	6,621	499	8%
2011	6,418	−203	−3%
2012	6,801	383	6%
2013	8,536	1735	26%
2014	8,333	−203	−2%
2015	6,912	−1421	−17%
2016	7,210	298	4%
2017	7,226	16	0.20%
2018	7,827	601	8%
2019	8,389	562	7%

2.5.9 Public Investment Fund

Saudi Arabia's Public Investment Fund (PIF) was established in 1971. This fund is charged with controlling public spending relating to Vision 2030. The PIF program (2018–2020) is one of 12 Vision 2030 realisation programs. The program mainly focuses on managing local and international investments that play a vital role in the diversification

of various resources for the country's development and growth. It plays a central role in efforts to achieve economic diversity by creating distinct business strategies within sectors (Albassam, 2015). Therefore, government authorities have focused on growing the PIF in the form of a sovereign wealth fund. In addition, government agencies are trying to build strong economic partnerships to strengthen the effect and role of Saudi Arabia in regional and global economic development. The PIF considers specific projects for managing investments through equity capital, debt or guarantees, as well as public funds. In addition, the PIF provides medium- and long-term loans for managing large-scale government and private sector industrial projects (Abid & Akhtar, 2016). The PIF invests in the fields of aerospace, energy, telecommunications, green business technologies and security.

2.6 The Direction of Saudi Vision 2030

Vision 2030 is focused on building the best possible future for the country. It is based on three important pillars that represent the country's unique characteristics and are regarded as competitive advantages (Mitchell & Alfuraih, 2018) that will help the country assume a leading role as the centre of the Arab and Islamic worlds. In addition, Vision 2030 places a significant emphasis on using the investments in the nation to create a highly diverse and sustainable economy. Saudi Arabia is using its strategic location to develop the country's role in promoting international trade by connecting three continents (Asia, Africa and Europe). Therefore, Vision 2030 is based on three pillars themes: a vibrant society, a thriving economy and an ambitious nation.

Vibrant Society: A vibrant society is considered the most critical element of Vision 2030 because it plays a critical role in laying the foundation for the country's economic prosperity. According to this theme, citizens should live according to the Islamic principle of moderation, and they should feel proud of their national identity along with their ancient cultural roots. Vision 2030 pays special attention to social lifestyles so that citizens can enjoy a good life within a beautiful environment while also being protected by their families and supported by a highly effective social and healthcare system.

Thriving Economy: The second theme focuses on a thriving economy that provides opportunities for all citizens by providing an education system that is aligned with current market needs and industry requirements. This theme pays particular attention to creating

new economic opportunities for all entrepreneurs, including small enterprises and large corporations. In this context, agencies will create new investment tools to unlock growth in the nation's economic sectors, diversify the economy and create new job opportunities (Nurunnabi, 2017). In addition, Vision 2030 is structured to grow the economy and improve the quality of services by encouraging the private sector to manage certain government services and improve the business environment. To improve economic efficiency, government agencies are attracting highly skilled workers and investment from around the world by leveraging the country's unique strategic location at the centre of three continents.

Ambitious Nation: The third theme is associated with an ambitious nation. The country is highly motivated to attain all of its economic objectives by applying efficiency and responsibility at all levels of economic development. Therefore, the third theme is associated with an active, accountable, enabling, transparent and high-performing government (Neil & Sprusansky, 2017). Therefore, Vision 2030 pays special attention to preparing the right environment for local citizens, private sector organisations and non-profit organisations by being responsible for managing various challenges and accessing new opportunities.

Each theme highlights a selection of directions and goals and reflects the nation's ambition for the attainment of different objectives. Vision 2030 is playing a unique role in managing future decisions along with all future projects that are aligned with the objectives of economic development.

Vision 2030 is helping to increase diversity in the economy. The decrease in oil prices in 2014 was an alarming situation in Saudi Arabia because it showed that the economy is highly vulnerable to fluctuations in world oil prices. Therefore, it became crucial to diversify the capabilities of the economy. Vision 2030 aims to develop a stable economy that provides opportunities for all citizens. Overall, Vision 2030 aims to create a vibrant, thriving and ambitious nation. It relies on three pillars (Vibrant Society, Thriving Economy, and Ambitious Nation) that are giving the country a competitive edge by creating a strong status. Moreover, investments are being used to create a sustainable and diverse economy. Third, Vision 2030 emphasises using the country's strategic location as a driver of international trade that connects Europe, Asia and Africa (Grand & Wolff, 2020).

In recent years, a shift from the focus on the oil sector has shown that there are many untapped opportunities in the economy that require attention. Saudi Arabia has a rich blend of natural resources, and people and society make the nation exceptional. Faith in Islam has helped promote national unity, which is one of the core values of the nation. As an Islamic nation, the teachings of Islam provide guidance, and the principles of Islam have become a driving force for Vision 2030 (2020). Saudi Arabia holds a prominent and significant position in the world because it invites Muslims from around the world for Umrah and Hajj. In the past few decades, the number of visitors and pilgrims visiting the country has tripled. Saudi Arabia considers it a noble responsibility to provide good hospitality and services, and it aims to increase the country's capacity to welcome and service around 30 million visitors every year (Rostan & Rostan, 2020).

Vision 2030 also aims to promote culture and entertainment, which helps enhance the overall quality of life. The plan is to increase the variety and number of entertainment and cultural activities by opening dedicated venues. People must focus on living a healthy and balanced lifestyle; therefore, Saudi Arabia intends to provide people with opportunities to regularly engage in sports and athletic activities. The development of cities using smart ideas and smart plans is another important goal of Vision 2030 (2020). Saudi Arabia aims to create the safest cities in the world with the lowest crime rates. The steady development of infrastructure in the past few years has contributed to the economic development of the country. Moreover, societies are being empowered to modernise and enhance the social welfare system. Vision 2030 also aims to enhance the healthcare system so that every individual in Saudi Arabia has equal access to healthcare services (Rahman & Qattan, 2020).

2.7 National Transformation Program

The National Transformation Program (NTP) was developed to achieve governmental operational excellence and enhance living standards. It aims to enhance economic enablers and encourage the implementation of different infrastructure projects. The NTP also engages different stakeholders to co-create solutions to identified problems and challenges. Different programs can be initiated based on these goals. Further, the objectives of NTP are to ease access to health services and enhance the overall quality and efficiency of healthcare services while promoting the prevention of and treatments for different types of health risks. In addition, the NTP emphasises improving the quality

of services offered to people in cities, where living conditions can be improved by reducing pollution, promoting traffic safety and emphasising the development of the urban landscape. The program also aims to ensure development and food security while promoting sustainable access to water resources and ensuring environmental protection (Vision 2030, 2020).

The global decline in oil prices in 2014 led to increasing challenges for Saudi Arabia's economy. King Salman bin Abdulaziz Al Saud and his son responded to the challenge by proposing Vision 2030, which was declared in 2016 and aimed to improve the economy by reducing the country's dependence on oil. Vision 2030 emphasised robust growth in the private sector (NTP, 2016). To achieve Saudi Arabia's Vision 2030, the NTP was developed. The NTP focuses on identifying and investigating challenges faced by government bodies when making decisions related to economic and development areas. It is crucial to implement initiatives to achieve the goals of Vision 2030 (Mitchell & Alfuraih, 2018). Therefore, the NTP was initiated to develop action plans for the government and assist in making strategic decisions to achieve these goals. It also provides the foundation for achieving and meeting the requirements. In 2016, the first goal was identified, which was to improve the healthcare and education sectors in Saudi Arabia. Further, the NTP has enhanced the level of coordination and collective actions undertaken by the government and stakeholders to identify and achieve common goals (NTP, 2019).

In the context of the NTP, a number of enablers have been identified that aim to enhance the level of professionalism while maintaining the workflow in Saudi Arabia. These enablers include specialised support, institutionalisation and transparency. The operating model of the NTP is based on planning initiatives, coordinating efforts and managing the production of high-quality and achievable outcomes. It involves identifying challenges, taking initiatives, developing detailed plans, promoting transparency and continually improving auditing. The NTP was launched across 24 government bodies and includes a governance model that is designed to maintain strategies to achieve Saudi Arabia's Vision 2030. Overall, it promotes coordinated efforts and the integration of global best practices to manage the implementation (Moshashai, Leber, & Savage, 2020).

2.8 The Group of Twenty

The G20 comprises the world's 20 largest advanced and emerging economies that collectively represent approximately two-thirds of the world's population as well as 85% of global GDP and more than 75% of global trade. The G20 members include Argentina, Australia, Brazil, China, Canada, France, Germany, India, Indonesia, Italy, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom (UK), the US and the European Union (Goldthau, 2017).

In the context of the G20, Saudi Arabia has maintained a privileged position in both economic and geopolitical terms. Saudi Arabia's rising status on the world stage is the result of the increased importance of the Kingdom's international political and economic role. The G20 represents a significant proportion of world trade and world heritage. In 2019, the annual gathering of the leaders of the world's 19 top industrialised and emerging economies, along with the European Union, was held in Japan (Abid & Akhtar, 2016). In 2020, Saudi Arabia hosted the fifteenth meeting of the G20, which indicates the country's growing importance in the world. Saudi Arabia is the only Arab nation in the G20 and the only member of OPEC in the G20. Thus, Saudi Arabia is a vital member of two leading groups in the world, which indicates its increased role in the global economy and the country's power in dictating the oil price along with the international oil trade.

In addition, Saudi Arabia is closely connected with the global economy through energy markets, and it is considered an honour for the entire Arab community and Muslim world to have a great kingdom that wields such power (Al-Janadi, Abdul Rahman, & Alazzani, 2016). Nowadays, Saudi Arabia has shifted its economic focus to reflect Vision 2030 and the related local and foreign investments, as well as the banking and financial systems.

The importance of Saudi Arabia in the G20 has significantly increased because the country is recognised as the only significant oil producer with considerable spare output capacity. It is through the oil market that Saudi Arabia is able to influence energy prices as well as the global economy (Thomas, 2017). Further, the Kingdom has considerable financial and economic wealth along with political power; consequently, global economic security is influenced by its cooperation. As such, Saudi Arabia has assumed a position of influence among the members of the G20. In the context of current global trends, Saudi

Arabia is also focusing on distinct environmental issues to achieve more sustainable development goals.

2.9 The Organization of the Petroleum Exporting Countries

OPEC was founded in Baghdad, Iraq, following the signing of an agreement in September 1960 by five founding countries (Saudi Arabia, Iran, Iraq, Kuwait and Venezuela). Other countries that subsequently joined OPEC included Algeria, Angola, Congo, Ecuador, Gabon, Equatorial Guinea, Indonesia, Libya, Nigeria, Qatar and the United Arab Emirates. The primary objective of OPEC is to coordinate and unify petroleum policies among the various member countries to secure fair and stable prices for petroleum producers. By targeting stable prices, OPEC can deliver an efficient, economical and standardised supply of petroleum to customer nations. In this process, the group has also tried to achieve a fair return on capital that has been invested by the industry. In the context of oil production, Saudi Arabia boasts approximately 18% of the world's proven oil reserves and ranks among the largest exporters of petroleum. According to Moody's Investors Service, Saudi Aramco posted a net profit of $111.1 billion in 2018 and was the world's most profitable firm (see Figure 2.3). Saudi Aramco plays a central role in Saudi Arabia as a state-owned oil company and is the most profitable oil company in the world. In addition to petroleum, the Kingdom's natural resources include natural gas, gold, iron ore and copper. Saudi Arabia's share of oil production is well beyond the spare production capacity that is addressed as the world's most important commodity; therefore, Saudi Arabia wields remarkable economic power. In 2020, Saudi Arabia cut oil production to help manage the oil price and stem the losses of OPEC countries.

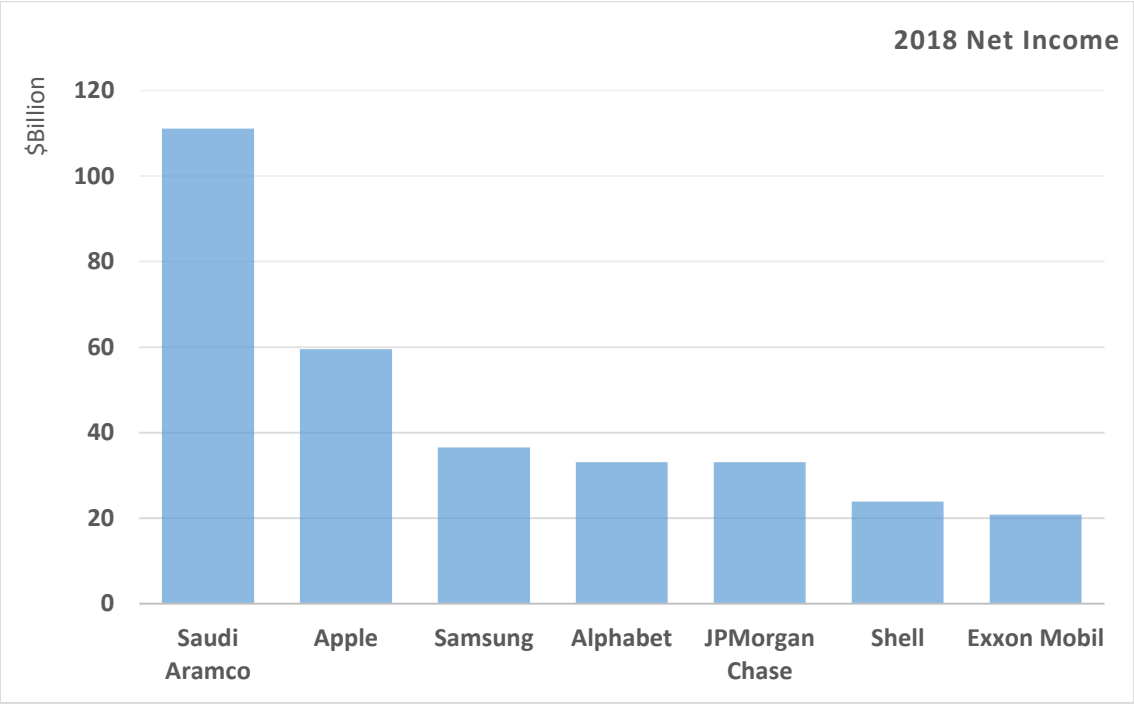

Figure 2.3: Saudi Aramco's Profit (Bloomberg, 2019, 'The Financial Performance of the World's Largest Companies in 2018 According to Moody's Investors Service')

2.10 Summary

The Kingdom of Saudi Arabia is emerging as a great country with highly developed legal and administrative systems. The economy is dominated by oil-based business activities; indeed, oil is by far the most crucial commodity in Saudi Arabia, contributing 70% of total exports. This chapter has shown that Saudi Arabia has 18% of the world's total proven oil reserves, from which it derives enormous wealth and economic power. This has given the country influence over the world economy and has significantly enhanced the country's position on the global stage. It is the only country that is a member of both the G20 and OPEC, and both groups have substantial power to control world trade and the economy.

Vision 2030 is useful for government agencies to attract investment and promote the country's economic development. It considers different aspects of economic growth such as employment, investment, financial services, improved lifestyles and industrial development. Saudi Arabia manages financial and investment markets through the Ministry of Finance, CMA and PIF. All economic decisions are backed by royal decrees and subject to close scrutiny by the ruling high command of the country.

This chapter provided the background of Saudi Arabia to link the country with the subject of the study. The next chapter will review previous studies related to the topic of this study, including macroeconomic announcements, capital market theories, efficiency of financial markets and models of volatility.

Chapter 3: Literature Review

3.1 Introduction

In the valuation of financial assets such as stock, the macroeconomic situation is directly relevant; thus, macroeconomic announcements and related news are highly anticipated by market participants so they can make informed decisions (Onour, 2009). Given the importance of macroeconomic announcements and their association with the stock market, several empirical studies have been conducted in relation to this topic. Capital market theories and financial market volatility have been studied by Ashikh (2012), Gan, Nartea and Wu (2018), Haron and Ayojimi (2018), Ma, Li, Liu and Zhang (2018) and Syed and Bajwa (2018). Further, the reaction of the stock market to macroeconomic announcements has been studied by Bomfim (2003), Donders, Kouwenberg and Vorst (2000), Lei, Wang and Yan (2017) and Lyócsa, Molnár and Plíhal (2019), with the results showing that volatility in stock prices increases on the days of announcements. These studies will be discussed in detail in this chapter.

The market efficiency of the Saudi stock market was empirically analysed by Al-Razeen (1997), Alkhaldi (2015), Ashikh (2012), Asiri and Alzeera (2013), Butler and Malaikah (1992) and Elango and Hussein (2008), among others. These studies found that the Saudi stock market is mostly weak-form efficient because random walk behaviour among stock prices was observed. Moreover, Pigorsch, Pigorsch and Popov (2012) stated that high-frequency data provide more information and accuracy in forecasting financial market volatility and allow a better understanding of reactions to prices and market behaviour than low-frequency data. This chapter will discuss this finding in greater detail. A case study of stock market volatility in Saudi Arabia and the US is also discussed to provide a clear understanding of the reasons why the Saudi stock market is more volatile.

In addition to macroeconomic announcements, royal decrees announced by the Saudi royal family are associated with the stock market. For instance, the royal decree regarding the ownership status of the country's national oil company (Aramco) caused the stock market to soar by 5.5% after the initial announcement (Kane, 2017). Such announcements and royal decrees influence the stock market and are difficult to anticipate beforehand. As a result, the study of royal decrees and their association with the stock market has

attracted the attention of several researchers. The current chapter presents a critical review of the empirical literature concerning the effect of royal decrees and macroeconomic announcements on the Saudi stock market. The chapter begins with a discussion of the economics of asymmetric information, followed by capital market theories, empirical literature on Saudi stock market efficiency, volatility of the stock market, high- and low-frequency data volatility, and macroeconomic announcements and the stock market.

3.2 The Theory of Asymmetric Information

One problem that can cause markets to fail is asymmetric or incomplete information. Frieden and Hawkins (2010), Hillier (1997), Stiglitz and Weiss (1992) and Hoppe and Schmitz (2015) examined how asymmetric information affects markets and how markets can function better by correcting information asymmetries. Another hidden information problem is adverse selection. If the hidden information problem results in adverse selection, then the only products available on the market will be of low quality. Other examples of adverse selection problems include insurance markets in which only people who engage in risky behaviour buy insurance, and labour markets in which the only workers available for hire are those who lack the skills needed for the available jobs. In extreme cases of adverse selection, the market will cease to function altogether. For example, if insurers do not want to sell insurance to high-risk customers, or if high-risk customers are unwilling to pay the high premiums that insurance companies charge these customers, then no insurance policies will be sold and the market will cease to exist. Similarly, if firms do not want to hire workers who lack the requisite job skills for the position, or if low-skilled workers are unwilling to accept the low wages being offered by a firm and the firm has to undertake the cost of training them, then no workers will be hired.

One solution to the adverse selection problem is to create a way of signalling that a product is of high quality. For example, the owner of a high-quality stock could purchase an option to signal that the stock is of high quality as long as the cost of the option is such that only owners of high-quality stock will choose to purchase the option. The use of a signal is effective for solving the hidden information problem. This type of equilibrium, whereby owners of high-quality stocks purchase the signal but owners of low-quality stocks do not, is called a separating equilibrium. It should be noted that the signal does not make the stock a high-quality stock; it is simply an indicator of the stock's quality

that was present before the owner made the purchase. Thus, the signal provides what is known as a sheepskin effect. Signalling does not solve the hidden information problem if the cost of the signal is such that the owners of both high-quality and low-quality stocks buy the option. In that case, buyers will still be unable to distinguish the quality, and the hidden information problem will remain unsolved. Therefore, it might be said that there is a pooling equilibrium.

The second type of information problem that buyers and sellers encounter in markets is the hidden action problem. This problem is illustrated by the principal–agent problem. In this market there are two participants: the principal, who is usually the stockholder, and the agent, who is the person working for the stockholder. The principal's goal is to incentivise the agent to invest their efforts into the company to maximise the principal's profits. The problem is that the principal cannot observe the agent's effort; they can only observe the result of the effort because the vicissitudes of the market are sometimes high, even if the agent only makes a limited effort. The principal–agent problem is an example of a moral hazard, which results from the fact that the principal cannot observe the agent's behaviour and the agent engages in behaviour that is damaging to the principal. An example of a moral hazard is employees of financial companies making investment decisions that are extremely damaging to the stockholders of the firm. One solution to the moral hazard problem is for the principal to design a reward system that incentivises the agent to do what the principal wants them to do. If the principal is successful at designing a system that aligns the agent's incentives with the principal's desires, it can be said that the reward system is incentive-compatible. Designing an incentive-compatible reward system is sometimes easier said than done. In cases when it is not possible to design an incentive-compatible system, monitoring can be considered. An example of a monitoring scheme that can counter moral hazards is the mutual monitoring systems that are used by most microfinance organisations.

Information asymmetry is one of the most common issues discussed in empirical studies alongside stock market volatility and efficiency. Asymmetric information has been studied by Breeden and Viswanathan (2015), Lawson (2009) and Miller and Rock (1985). They have been stated that information asymmetry creates an imbalance in the stock market because one party receives information beforehand and exploits the market condition, while the other group receives the same information at a later time. Some

researchers do not consider information asymmetry a major problem in the stock market because the issue can, at times, be mitigated by 'propitious selection'. As a result, buyers and sellers can make 'favourable selections' instead of 'adverse selections'.

However, some researchers consider the smaller presence of the asymmetric information problem beneficial because it can create a 'welfare-enhancing effect of private information' (Hoppe & Schmitz, 2015, p18). Information asymmetry was critiqued by Miller and Rock (1985), who argued that it affects central planning because the price-setting behaviour of the seller is in accordance with adverse selection theory. Therefore, some researchers consider information asymmetry a 'market failure' because markets fail to inform buyers and sellers perfectly about any transaction, with the presumption that Pareto-efficient public policy should be enacted to mitigate such a malfunction (Miller & Rock, 1985).

A classic example of information asymmetry was provided by Professor George Arthur Akerlof in the 'Market for Lemons' paper. Akerlof argued that the quality of goods can decline under conditions of information asymmetry between sellers and buyers. For example, imperfectly informed buyers are unaware of the quality of a used high-quality car and other good cars, even though they pay a price for a car that is fixed between a good one and a lemon (Frieden & Hawkins, 2010). The veracity of the asymmetric information and lemons problem was questioned in subsequent studies, including those of Breeden and Viswanathan (2015) and Hoppe and Schmitz (2015). Hoppe and Schmitz (2015) stated that the empirical literature is divided on whether a lemons market actually exists in the stock market, and the implications of such a problem in public policy have not been adequately addressed.

3.3 Capital Market Theories

The capital market is the financial market where financial instruments such as equity-backed securities and long-term debt instruments are traded (bought and sold). Capital markets are crucial because they facilitate the transfer of capital from individuals who do not have an immediate use (savers) to people who need the capital for investment purposes (investors) (Christensen, Hail, & Leuz, 2016). Capital market studies have investigated a number of theories over time. In this section, the study will consider capital markets in regard to capital market efficiency.

3.3.1 Efficient Market Hypothesis

In 1970, Eugene Fama established the efficient market hypothesis (EMH), or theory and has become an important proposition in finance. This theory states that all past information (either public or private) is already reflected in current stock market prices or returns (Fama, 1970). Based on this theory, all known information relating to investment securities are incorporated into the price of the securities trading in the market, ensuring that investors cannot generate benefits over others (Fama, 1970).

Eugene Fama, Ph. D., wrote his dissertation on the efficiency of financial markets and random walk behavior of stock prices in 1963, which marked the start of the Efficient Markets Theory's theoretical evolution. Fama notes the following in his work:

"An 'efficient' market is defined as a market where there is a large number of rational profit-maximizers actively competing, with each trying to predict future market values of individual securities, and where important current information is almost freely available to all participants. In an efficient market, competition among the many intelligent participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that has already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point of time the actual price of a security will be a good estimate of its intrinsic value" (Fama, 1995, p.76).

Theoretically, producing risk-adjusted excess returns using fundamental or technical analysis is not possible, and it is only inside information that can help investors make abnormal risk-adjusted returns (Basu, 1977; Fama, 1970). The EMH states that shares are traded at fair prices, which makes it impossible for general investors to achieve abnormal returns on their investments. Based on this theory, investors do not have to act logically; instead, they can act randomly and the market will remain 'right' irrespective of the individual actions taken by the investors. 'Efficient' in such a case indicates normal. In the event that a large number of investors seem to run in a certain direction in accordance with the information received at the market, others can follow them without making any rational decisions. The EMH exists in three forms: weak, semi-strong and strong, as described in the subsections below.

Despite the widespread application of the EMH in the capital market, its effectiveness has been criticised. Its main limitation is associated with long-run competitive theories, which focus exclusively on equilibrium results and ignore the entrepreneurial activities behind the outcomes. The EMH holds that investing in the stock market is totally different from business investment. However, stock markets do not operate on their own, suggesting that the same factors affecting business investments also affect security or capital markets. Many critics hold that the framework in which the theory is based is flawed (Munir & Kok, 2016).

The theory also holds that investors are rational, suggesting rationality of investments. Rationality occurs when investors can accurately calculate the net present values associated with expected cash flows. This assumption does not support the fact that investors have herd mentality, the possibility of investment portfolio churning, overreaction and underreaction to new information, and asymmetrical judging. The argument that investors cannot make returns above market averages is also not true, given that anomalies have been observed in past security prices—good examples are mean reversion and the January effect (Branger, Hülsbusch, & Middelhoff, 2018).

3.3.1.1 Weak Form of the Efficient Market Hypothesis

If the market price covers all information related to past changes in securities prices, but does not reflect new information that is not yet publicly available, as well as past information regarding price, volume and returns, and is independent of future prices, that market is called weak-form efficient (Malkiel, 2003, 2011). It is argued that there is a limited benefit of using fundamental or technical analysis to realise returns above market averages on investments when a capital market is weak-form efficient (Malkiel, 2011).

Fundamental analysis can only enable investors to generate returns that are above market averages in the short term. The fact that fundamental analysis, when dealing with past or historical information, cannot generate long-term advantages, excludes the importance of technical analysis. Technical analysis, also known as chart analysis, studies past stock prices and any other relevant background information and suggests that such information cannot be used to predict future prices of stocks at the market. It is assumed that future prices follow random walk theory, hence investors cannot rely on historical information alone (Tahir & Anni, 2017).

3.3.1.2 Semi-strong Form of the Efficient Market Hypothesis

The semi-strong efficiency form holds that all current information regarding a stock adjusts to a stock's price immediately when the information is released publicly, and it is less rigorous (Sewell, 2011). Sewell (2011) stated that security prices always factor in publicly available information, and changes in security prices to a new equilibrium level reflect the information that is available to the public. Sewell (2011) considered semi-strong form efficiency the most realistic of all EMHs, but this form of efficiency is unable to explain the context for material non-public information (MNPI). This means that technical and fundamental analysis will not help investors generate superior returns, but MNPI can help investors earn above-average returns on their investments (Sewell, 2011). However, the key challenge is to identify the relevant or most appropriate information. The information arriving at the market does not have an indicator to suggest that it is the most relevant for stock prices. New information may arrive and still fail to be useful to investors, especially when they cannot establish a strong link between the existing information and the new information.

3.3.1.3 Strong Form of the Efficient Market Hypothesis

This market efficiency holds that security prices should reflect all relevant information that is either publicly or internally available and highly rigorous (Borges, 2010). Borges (2010) argued that when a market is in this form of efficiency, it is impossible for an investor to generate an unexpected return from their investments because all information adjusts immediately when available. Borges (2010) also stated that this market efficiency form is not easily achieved in the real world. This EMH is considered the most compelling and satisfying to investors, but it may facilitate insider dealings, which harm the operation of the stock market.

3.3.2 Modern Portfolio Theory

Markowitz's Modern portfolio theory (MPT) is one of the most popular approaches to asset allocation that discusses ways for risk-averse investors to construct portfolios and how expected returns can be optimised based on the provided risk levels at the market (Markowitz, 1952). MPT provides a method to choose an optimal allocation of wealth in view of knowledge of few statistical properties of the return variables. This theory argues that, when determining investment portfolios, investors should use the efficient frontier,

which offers a higher expected return for a given level of risk while holding that risk forms part of the higher reward. The higher the risk, the higher the reward. This theory also argues that investors should consider not only an investment's risk and return characteristics, but also how the investment might affect the portfolio's return and risk (Markowitz, 1952; Omisore et al., 2011).

A rational investor chooses higher value over lower value to maximise expected returns based on a given level of market risk. MPT supports the idea that the risk and return profiles of a portfolio are better than a similar profile of an individual investment. Again, it supports that with adequate information, investors have the capability to establish a diversified portfolio that consists of various assets or investments and that will be able to offer maximum returns at low risks. Diversification is highly valued in this theory. The process in which investors select the assets or investment securities that will maximise their returns at the lowest risks possible is known as diversification. Investors can either choose investment assets within the asset classes under consideration or consider a mix of different bonds and stocks based on the available information. The theory is based on the concept of efficient frontier, and participants in the capital market are required to make decisions in respect to it (Hou, Li, & Zhou, 2017).

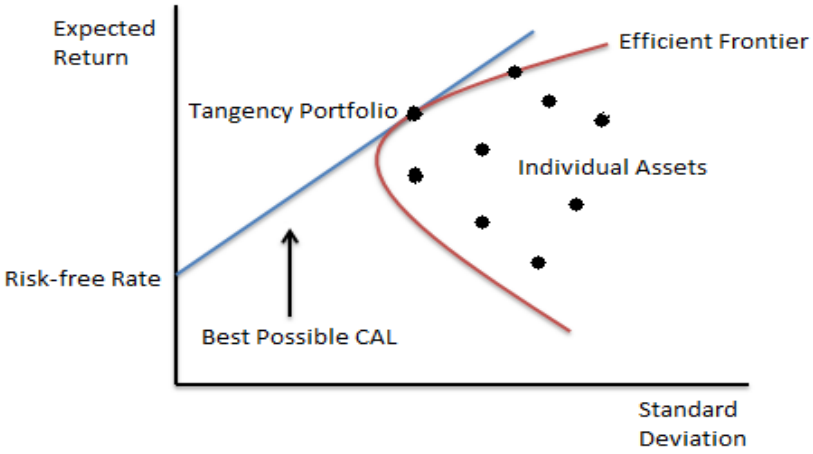

Figure 3.1: Modern Portfolio Theory (Omisore et al., 2011)

As shown in Figure 3.1, risk-averse and rational investors select their investment portfolio by taking individual assets that are within the efficient frontier, as they guarantee high returns at low risk.

3.3.3 Capital Asset Pricing Model

The modern financial theory that co-created the capital asset pricing model (CAPM) is based on the premise that markets are characterised by buyers and sellers who possess the maximum degree of understanding and thus compete efficiently (Al-Afeef, 2017). Further, it assumes that rational market participants intend to earn premiums in rewards for undertaking a higher degree of risk and will conduct market behaviour in the same way with identical expectations. In regard to these assumptions, the CAPM was introduced to Markowitz's (1959) frameworks to allow the building up of a testable forecast that reviews the nexus between risk and associated returns. That is, the CAPM discusses the relationship between the expected return and the known systematic risks. The CAPM is used to generate anticipated returns from an asset given the cost of capital and the risk of that particular asset (Barberis, Greenwood, Jin, & Shleifer, 2015). The model is widely used in the capital market to price risky assets—especially securities and stocks. It is also used to generate expected returns on assets in cases where the risk levels associated with the assets have been provided. The CAPM uses the following formula:

$$ER_i = R_f + \beta_i\,(ER_m - R_f) \tag{3.1}$$

where ER_i is the expected return of an investment i, R_f is the risk-free rate, β_i is the beta of an investment, ER_m is the expected return from the market and $(ER_m - R_f)$ is the market risk premium.

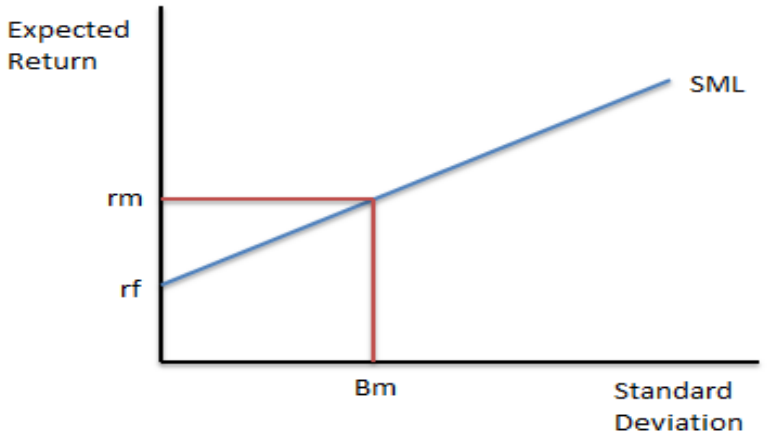

Figure 3.2: The CAPM (Ross, Westerfield, & Jordan, 2008)

To facilitate effective investment decisions, investors can couple the CAPM theory with the MPT, thus making good use of the efficient frontier, as indicated in Figure 3.3.

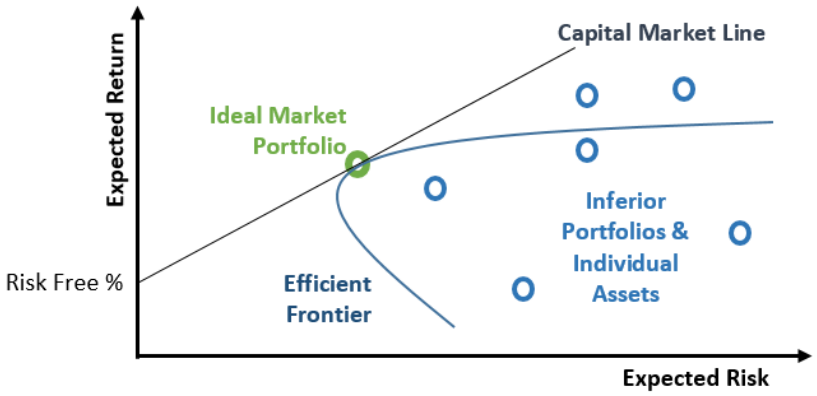

Figure 3.3: The CAPM and the Efficient Frontier

As shown in Figure 3.3, higher expected returns (y-axis) have a higher expected risk (x-axis). In accordance with MPT, from the point of the risk-free rate, the portfolio expected returns will increase with an increase in the level of the expected risk. The best portfolio can be selected by considering the assets falling within the capital market line.

CAPM is based on assumptions that seem to be logical in regard to capital market operations. Investors avoid investment risks and use diversification as a means of minimising risks. They are interested in maximising the utility of their wealth, and not the returns. Utility is the differences that occur between the individual's preferences. The market is assumed to be perfect, with the free flow of required information and an absence of taxes and transaction costs. The availability of the assets is said to be fixed, but can be divided and have obtained market, hence the possibility of diversification, selling and buying of the assets.

3.3.4 Arbitrage Pricing Theory

Arbitrage pricing theory (APT) attempts to minimise the inefficiencies of the CAPM framework. It is commonly used by investment decision-makers to evaluate the association between uncertainties and predicted returns by employing several factors instead of relying on a single market index. APT states that returns from an asset can be predicted using the linear association between the available macroeconomic variables at the market with the ability to incorporate the systematic risk and the expected returns on

the asset (Ross, 2013). Different from the CAPM, APT assumes that the market often misprices securities (Ross, 2013). According to this theory, arbitrageurs take advantage of any deviations from the fair market value of a security's price. Temporarily mispriced assets can be identified by determining the linear relationship in the security prices in the market using multifactor models.

The formula used by investors in the capital market is:

$$E(R) = E(R)z + E(i) – E(R)z \text{ X } \beta\eta \quad (3.2)$$

where E(R) is the expected return of the asset, Rz is the risk-free rate of return, βη is the sensitivity of the asset prices to economic changes in the market and E(i) is risk premium. The theory was developed by Stephen Ross in 1976 as an alternative to the CAPM. It is based on the fact that securities prices in the market are sometimes mispriced, and the market adjusts the prices to obtain fair values, unlike the CAPM, which holds that the capital markets are perfectly efficient (French, 2017).

3.4 Volatility of Returns

The volatility of equity prices is an important concept in finance and a well-known phenomenon to all investors, stakeholders and scholars, as evidenced in stock market crashes. The major cause of unpredictability in the equity market is an inquiry that remains unsettled in the sphere of finance. It is difficult to find a solution to this issue because different variables are involved; to date, there is no consensus regarding which variable affects the stock market the most. Given the importance of the topic, the analysis begins with a review of the empirical literature to define return volatility.

3.4.1 Definition and Measurement of Volatility

Mean analysis is one of the most popular and best ways to gain insights into quantitative data. However, when the data deviate considerably from the mean in any direction, this is referred to as volatility. Abid, Hammad and Rizwana (2006) noted that the volatility of a stock is an indication of incomplete information in the stock market. Low informational transparency in the market results in high volatility, which causes the share price to move up and down rapidly. This makes investment in the stock market very risky, and to bear a higher risk, investors demand higher returns. Companies whose share prices are highly

volatile usually grow their profits rapidly or pay high dividends to investors. Rubin and Smith (2009) conducted an empirical analysis of the joint relationship between dividend policy, institutional ownership and stock return volatility and showed that dividend policy is highly correlated with volatility. Volatility is present not only in stock prices but also in some economic indicators according to economic conditions. Because volatility is present in many areas of finance and economics, it has many definitions. This study uses a definition that fits with the variables and objectives of the study. The standard definition of volatility is the square root of the variance of return calculated from the index within a certain period (Bodie, Kane, & Marcus, 2008). If the price or return of the stock has a higher standard deviation or variance, it is considered a highly volatile share.

Various macroeconomic variables play important roles in determining asset prices and justifying multiple asset pricing concepts. For this reason, different stakeholders in the equity market have conducted studies to empirically establish a link between macroeconomic variables and volatility in stock market prices. Gatheral, Jaisson and Rosenbaum (2018) investigated whether macroeconomic variables are indirectly related to local risk sources and found evidence supporting their hypothesis. They also investigated the extent of commonality in exposure in the returns experienced in different stock markets and found marginal evidence of commonality in the global stock market. Bollerslev, Engle and Nelson (1994) examined the association between macroeconomic facets and equity market returns in the short run. They analysed the effects of interest rates, monetary supply, inflation and market activities and found that macroeconomic variables had a significant effect on equity market indices. Bingham and Kiesel (2013) studied the short-run active modification and long-run symmetry link between four macroeconomic facets: the exchange rate, interest rate, rising prices and the industrial production of a relevant market. The results were similar to those documented by French and Roll (1986). Equity market unpredictability can be assessed using macroeconomic elements such as rising prices, supply and market activities. Baillie (1996) conducted a similar study and reasoned that instability in a stock market is a consequence of the trade itself. As such, the higher the degree of trade volume, the greater the price changes. Francq and Zakoian (2019) also argued that irregular volatility in the equity market is a result of a reaction between price and volume.

French and Roll (1986) investigated the concept of unpredictability in the equity market and its effects. They found that instability is more prevalent during the trading time of day. The authors also claimed that volatility in the equity market is largely driven by the quantity of trading volume, followed by the arrival of new information or any kind of evidence that is directly related to the monetary values of stocks in the securities industry. Equity market volatility is a result of factors such as the inflation rate, commercial turnover, bond prices, credit policy, financial leverage, and social and political facets, among other macroeconomic aspects. Mala and Reddy (2007) studied the effect of interest rates in the Fijian equity market from 2001 to 2005. They used an autoregressive conditional heteroskedasticity (ARCH) framework and the generalised ARCH (GARCH) framework to test the presence of equity market unpredictability. The findings showed that fluctuations in interest rates have a huge effect on equity market volatility. However, their research only considered one macroeconomic variable to establish their conclusion and reveal the causes of equity market price unpredictability. Several researchers have studied the connection between different macroeconomic factors and equity market indexes. Thus, the current study will measure the effects of royal decrees and macroeconomic announcements on the volatility of the Saudi stock market.

3.5 Importance of Volatility

Andersen, Bollerslev and Das (2001) and Andersen, Bollerslev, Diebold and Labys (2003) noted that the quantification of the volatility of a stock helps to determine the risk associated with that particular stock and provides a basis to create a better portfolio and more effective risk management. Volatility is an important benchmark for investors when deciding which assets should be reallocated and which market is riskier than another (Schwert, 1989). The reflection of the determination of the volatility can be observed in the selection of assets for the purpose of investment (Schwert, 1989). Volatility can sometimes be deferred from market to market, indicating a difference in risk level and profitability depending on the market. Generally, emerging markets have a higher return volatility than developed markets (Aggarwal et al., 1999; Bekaert & Harvey, 1995). This indicates that information regarding volatility is of greater importance in the case of emerging markets than developed ones.

3.6 Types of Volatility Estimation

Various analyses have been conducted using different volatility models. This section explains the various types of volatility estimations that are used to analyse the volatility of returns in the stock market.

3.6.1 Autoregressive Conditional Heteroskedasticity

Engle (1982) established a model that can be used to evaluate the time-changing volatility in the equity market. According to Engle's ARCH framework, the best way to appraise an alteration prediction is to average it with the existing squared or what he referred to as 'surprise', which is the squared difference of the percentage of return from its average. Whereas predictable period sequence and econometric concepts work in the hypothesis of continual variation, the ARCH model provides room for the conditional discrepancy to differ over time as a result of past mistakes, leaving the unrestricted variance constant. In the pragmatic exercise of the ARCH framework, a comparatively long lag in the conditional discrepancy comparison is usually needed, and to avert such challenges with undesirable modification constraints, a constant lag framework is commonly employed. This exemplar has been extensively used in fiscal time-series examination, and especially in analysing the risk of having an asset/stock, analysing the value of a possibility, predicting time-changing intermissions and making a more effective estimator in the presence of heteroskedasticity.

Bollerslev (1986) attempted to surmount the restrictions presented by ARCH by introducing GARCH, which generalised the ARCH framework to take into account a broader memory and elastic lag framework. As discussed earlier, in the pragmatic use of the ARCH framework, a comparatively long lag in the provisional variance equation is expected, and to ward off issues with negative variance constraints, a fixed lag structure is usually used. In the ARCH process, the conditional variance is measured as a linear function of the previous model variance, while the GARCH framework allows the lagged provisional variances to pass in the same framework. Engle, Lilien and Robins (1987) established the ARCH-M concept as an annex of the ARCH framework to provide room for conditional variances to act as determinants of the mean. In a stock configuration, the ARCH framework exhibits the conditional alteration as a rectilinear function of the previous squared inventions in the new framework, which assumes that alternating the

conditional variance directly impinges on the projected return on a group. They found a positive effect when employing this new model in three different datasets of stock (Chatfield, 2016). Thus, the authors concluded that the risk premium is not time-invariant; instead, it changes methodically in an agent's discernment of underlying ambiguity.

ARCH and GARCH models have become important tools in the analysis of time-series data, particularly in financial applications. Nelson (1991) also protracted the ARCH model to designate the behaviour of stock return volatility. Nelson's study was important because it gave ARCH in a novel track, defying the rigidness of the GARCH description. Significantly, it recommended a framework exponential ARCH to assess the assumption that the adjustment of the return was inversely affected by constructive and negative revenues. The same analyses established that the report was relevant and the surplus revenues were negatively linked to the equity market modification. Schönbucher (2003) argued to amend the main boundaries of the GARCH-M framework that was founded upon the fact that the GARCH framework imposes an asymmetric reaction of volatility to both optimistic and undesirable shocks. Nelson (1991) and Schönbucher (2003) concluded that a constructive and substantial link exists between the restrictive mean and conditional instability of stock outcomes. In contrast, Föllmer and Schied (2011) revealed that the principles of the GARCH-M concept are miss-specified, and they substituted stipulations to provide an understanding of the two outcomes.

When the GARCH-M framework is altered to enable a constructive and undesirable unexpected return to have a diverse effect on provisional variance, an undesirable link is found between the restrictive average and the provisional variance of the surplus turnover on equities. Further, an optimistic and undesirable unanticipated return is revealed. Engle and Ng (1993) quantified the effects of bad and good updates on stock market instability and found that an irregularity in equity market unpredictability to good news equated to bad news. Explicitly, market instability is presumed to be linked to the advent of updates. A prompt drop in value is linked to bad news in the market, while an abrupt upsurge in price results from good news. Engle and Ng (1993) revealed that bad news creates additional instability compared with good news with an equivalent status. This irregular feature of the market is referred to as the 'leverage effect'. Beckers (1981) and Duffie (2010) explained the same instability irregularity with the influence effect, although their conceptual framework did not detail this irregularity. Engle and Ng (1993) produced a

novel analytic examination of the model, which incorporated the irregularity between the kind of news and market instability. They also advised investigators to use such boosted concepts when reviewing instability. Chatfield (2016) analysed the time-varying outline of equity return unpredictability and market asymmetry using the GARCH model. He later examined the prompt variation and likelihood of coincidence of these abrupt shifts with key political and fiscal occurrences that originated from domestic and foreign markets. Chatfield (2016) also analysed market sequences for changes in the market, interval and unpredictability of the bull and bear stages over the locus of time. He found that liberalisation of the equity market and the admission of foreign institutional investors (FIIs) does not have any unswerving effects on equity return precariousness. There is no operational variation in equity price instability around any liberalisation occurrence or around the dates of disruptions for unpredictability in FII auctions in the Indian market. The outward connection is largely pinched between equity price unpredictability and the prompt removal or heavy acquisitions by FIIs. For example, an unstable FII venture in the equity market does not appear to be accurate in the case of India. In every phase as explained by their organisational break scrutiny between 1991 and 1993 was the most unstable.

3.6.2 Stochastic Volatility

Hull and White (1987) wrote that the volatility σ_t of the underlying is modelled as a determinant role σ (·) of some supplementary process Y and is usually modelled as a diffusion:

$$dX_t = \frac{1}{2}\sigma^2(Y_t)dt + \sigma(Y_t)dW_t^Q$$

$$dYt = \alpha(Y_t)dt + \beta(Y_t)dB_t^Q, \qquad \text{(stochastic volatility)} \qquad (3.3)$$

$$\mathrm{d}(W^Q,\ B^Q)t = \rho dt,$$

In this case, $|\rho| < 1$. In the equation, B^Q is a Brownian motion that is correlated with W^Q. One usually adopts the correlation ρ to determine the empirical function to prove that when volatility rises, the price of the stock decreases in what is known as the leverage effect. One factor of the stochastic volatility situation, such as the one described, is that derivatives documented on *S* cannot be hedged in a perfect way through trading continuously (Brooks, 2019). However, a derivative represented on S could be simulated

impeccably through the nonstop exchange of stock. Therefore, the market can be completed by the nonstop trading of assuming options.

Assuming that volatility influencing *Y* dynamics and a volatility function $\sigma(\cdot)$ is the mean-regressive or ergodic definition with the existence of a dispersal Π that the ergonomic proposition has:

$$\lim_{t\to\infty} \frac{1}{t}\int_0^t g(Y_s)ds = \int g(y)\Pi(d_y) \tag{3.4}$$

The above equation denotes a single-factor stochastic volatility model. It is always possible to induce another supplementary procedure Z and framework the volatility σ_t as a function σ of both Y and Z. In cases where S, Y and Z are driven by three different Brownian motions, then continuously trading a bond, the causal S and the two options on S are projected to perfectly hedge more options on S. Multifaceted stochastic volatility frameworks have the ability to fit option prices better than single-faceted types. By continuing to trade a bond, it creates a situation where the fundamental S and two choices on S are supposed to be present for further options on S. Multifactor stochastic volatility models can fit more option costs better than their single-factor counterparts. Every additional model gives rise to mathematical challenges. In contrast, the SV model's upwards trajectory makes the market inadequate. Accumulating jumps also to a volatile situation can improve strongly implied volatility. The emphasis is on persistence-time replicas. It is worth noting that discrete time concepts in equity yields are studied on a large scale in the econometrics field. A large collection of discrete time models is ARCH, which was later generalised with the name GARCH. By the available model and parameters, computing one-time straightforward applying Monte Carlo approaches or a mathematical explanation of the cost. In other aspects, calculation is part of the iterative process to calculate the model to the pragmatic volatility surface; therefore, it is important to introduce a technique to subtract the option price or model-induced instabilities. As a result, numerous diverse and efficient approximation methods are forged.

3.6.3 Implied Volatility

Options or derivatives are one of the most frequently used assets. The term 'implied volatility' mainly refers to the estimation of the volatility of such assets. It is a forecast of volatility that is derived from the underlying assets' market price (Gençay, Dacorogna,

Muller, Pictet, & Olsen, 2001, p. 43). When the valuation of any derivative is calculated, volatility is assumed to be constant through its lifetime, but implied volatility can change rapidly when there is a prospect of a financial crisis (Black & Scholes, 1972). Wang, Yourougou and Wang (2012) established that the application of implied volatility may differ depending on the liquidity feature of the underlying asset.

The recent global financial crisis was attributed to housing mortgage repackaging and going on sale at collateralised debt obligations also exotic derivative items to financial institutions, individuals and pension funds. Leaders around the world are replacing on the problems that are arising because of the derivatives, absence of accounting standards and homogeneous laws (Föllmer & Schied, 2011). Too much freedom used by market players to innovate and the absence of comprehensive data for exchange.

Globally, leaders are working on the need to introduce more transparency and accountability in the functioning of derivatives markets. The most common assumption that has been challenged is the normalcy of stock returns not putting in mind heteroskedasticity. As a result of the challenges arising from obtaining a closed form of a parametric solution, many non-parametric approaches have been tested, including an artificial neural network (ANN) model, which is a good substitute (Andersen, Bollerslev, Diebold, & Labys, 2003). The available valuation options have elicited many reactions from academics and investors, leading to numerous developments in valuation models. Black–Scholes is the most common model to date and is based on the assumption that is progressively accumulated rate of return of stocks guided by a normal distribution. In this model, the hypothetical value of the possible price is guided by the actual market price (Dahl, 2004). The number of stock changes used in the Black–Scholes study is a framework discrepancy of the significant stock returns.

Huang and Startz (2018) stated that the difference between the hypothetical and actual price was not large enough to be fiscally significant because the business cost of trading in options reduced the expected income. Huang and Startz (2018) stated that the derivatives market increased by 300 times between 2001 and 2003 and is projected to continue growing. These changes resulted from government policies, budgets, the bullion market, inflation and the political environment. Huang and Startz (2018) focused on the procedures of the derivatives market in India, which attracts the attention of scholars, universities, corporate and research firms to conduct more research that is relevant. Taylor

(2008) highlighted Standard & Poor's (S&P) CNX NIFTY analysed the period from January 2003 to December 2008. Taylor (2008) investigated whether implied instability is a better prognosticator of volatile future equity revenues than past instability. The aim was to check whether there is any relation between historical unpredictability and implied instability and to determine whether the Black–Scholes framework miss-specified the existence of an instability beam in the case of S&P CNX Nifty possibilities.

3.6.4 Realised Volatility

Realised volatility involves a non-parametric, ex post estimation of stock market variations and measures the level of uncertainties that have already occurred. Volatility is calculated using the historical price of an asset. The commonly realised volatility quantity involves the totality of finely appraised squared outcome realisations over a static period intermission. In a practical market, the approximation attains reliability for the causal quadratic outcome disparity when the yields are appraised at a gradually higher frequency. Schönbucher (2003) stated that a major complication of this trait is that, conflicting with the raw outcome, the actual realisation of return volatility is directly visible. A widespread method used to handle the essential dormancy of turnover unpredictability is to extrapolate volatility via robust parametric patterns appealing, for example, the ARCH or a stochastic volatility (SV) framework projected with facts at day-to-day or a lower rate of recurrence. Andersen, Bollerslev, Diebold and Labys (2003) argued that another methodology is to use the option pricing framework to reverse the observed results values into the market-based predictions of oblique unpredictability over a static period in the future. These methodologies are model-dependent and integrate a hypothetically time-changing unpredictability risk premium into the ration; therefore, they generally do not provide impartial predictions of the volatility of the basic assets (Andersen, Bollerslev, Diebold, & Labys, 2003). Since instability is obstinate in such procedures that offer information, but unpredictability is also obviously mean riveting, which means that such unit root type predictions of impending instability are not ideal, and in fact provisionally prejudiced given the records of the previous outcomes.

The concept of realised volatility efficiently reverses the above situation. In regard to the continuous nature of pragmatic price or estimate data and inattentive deal costs, the realised return variation can be measured devoid of any error along with the attained turnover. Further, the realised disparity concept is associated with the increasing

projected variability of outcomes over the assumed horizon for an extensive assortment of fundamental arbitrage-free diffusive data.

3.7 Previous Literature Concerning Saudi Stock Market Efficiency

The number of market participants, the regulatory and institutional environment of the market, and the capitalised value of securities play major roles in determining the informational and operational efficiency of these markets (Al-Razeen, 1997). It is widely argued that if the historical barriers to both intra-market and inter-market capital flows are dismantled, the differences between the regulatory and institutional environments of a market assume an increasing role in determining the allocation and information efficiency of individual capital markets (Al-Razeen, 1997). Stock market efficiency has several important implications for both investors and regulators. It is important that stock markets effectively perform the 'sensitive processor' role so that investors cannot exploit the market using insider information. When this role is not appropriately performed by a stock market, investors question the 'hold-the-market' strategy and try to adopt a 'beat-the-market' strategy to select winners (Ashikh, 2012). Therefore, stock market efficiency helps to identify major improvement opportunities for stock markets.

When discussing the structure of the Saudi stock market, Butler and Malaikah (1992) argued that this market was largely unregulated prior to 1984. The market lacked a formal structure, but this changed after the Kuwaiti stock market crashed in 1982. The Saudi government then pursued various initiatives to bring the market under a regulatory framework and make the market more structured and efficient. The regulatory authority of the Saudi stock market followed the example of the German stock market, which allowed banks to have a brokerage monopoly (Butler & Malaikah, 1992). However, the development of the Saudi stock market involved some technical issues that made the market more volatile rather than more efficient (Butler & Malaikah, 1992). After applying misaligned policies and strategies, the regulatory authority of the Saudi stock market made the necessary adjustments to make the market more efficient and technically advanced.

Butler and Malaikah (1992) measured the efficiency of the Saudi stock market and found that all Saudi stocks in the sample exhibited random walk behaviour. Compared with other studies of the Saudi stock market, Butler and Malaikah (1992) reported an

autocorrelation coefficient of −0.471, which is the largest in magnitude. Compared with other thinly traded markets, the Saudi stock market showed greater serial dependence. In relation to inter- and intra-day price volatility, the Saudi stock market exhibited much higher volatility compared with other stock markets in the empirical literature (Butler & Malaikah, 1992). Further, investors in the Saudi stock market faced bid–ask spreads of over 10% of the share price, which was high compared with the Kuwaiti stock market. However, there was little evidence of a statistically significant autocorrelation regarding weekly returns and higher-order lags in the Saudi stock market according to Butler and Malaikah (1992), despite having an extremely large negative lag-one autocorrelation.

Al-Razeen (1997) tested the weak-form efficiency of the Saudi stock market and argued that it is common to have inefficiency in stock markets that are thinly developed and in which the number of stocks traded is very small. Al-Razeen (1997) studied stock prices between 1992 and 1995 and stated that the test of the semi-strong form of market efficiency is extremely rare in the stock markets of developing countries because there is an absence of data in an accessible form. The autocorrelation test result indicated that the coefficient of 60% of stocks was significantly different from zero at the first lag. In addition, Al-Razeen (1997) reported negative autocorrelation among 12 of the samples, which is also argued to be common in stock markets that are thinly developed and have wider fluctuations in returns. The autocorrelation test confirmed that there was significant autocorrelation among stock prices, which indicates the inefficiency of the Saudi stock market.

However, the filter rule test indicated that half of the stocks in the sample were more profitable than a buy-and-hold strategy. This finding is indicative of the inefficiency of the Saudi stock market. Al-Razeen (1997) argued that this weak-form market inefficiency is lower than other large stock markets, and this argument was backed by Elango and Hussein (2008). During the period of study, Al-Razeen (1997) found the Saudi stock market to be informationally inefficient and reported several reasons for this inefficiency. First, Al-Razeen (1997) argued that the Saudi stock market is still developing, which means that it lacks sufficient technical organisation to distribute information regarding stock prices. The second reason is that the trading volume in the Saudi stock market is very low and much more unstable compared with other developing stock markets (Al-Razeen, 1997). As a result of technical inefficiency, the Saudi stock market might take a

considerable amount of time to adjust information to the market. Therefore, investors would not be able to use historical prices to predict changes in stock prices to gain abnormal returns (Al-Razeen, 1997).

Al-Razeen (1997) made several recommendations to improve the market efficiency of the Saudi stock market, including liberalising financial institutions, the whole sector and the stock market. This is only possible if the government makes watchful macroeconomic policies. Al-Razeen (1997) also suggested that the trading volume of the Saudi stock market should be increased so that investors can obtain larger data to analyse while making their investment decisions. Further, the Saudi government should accelerate the pace of privatising government-owned companies and make it easier for companies to go public, which would increase the supply of shares on the stock market. It is also important that the Saudi government implements initiatives to increase investors' confidence in the market. Al-Razeen (1997) also suggested that regulations regarding share trading should be developed and improved in a way that facilitates easier share trading. Most importantly, Al-Razeen (1997) stated that three factors must be taken into account if a stock market is to develop efficiently: strong regulation, disclosure of information and economic stability.

Empirical analysis conducted by Elango and Hussein (2008) primarily discussed the market efficiency of the Saudi stock market and compared it with other stock markets in the GCC region. Larger variations in the stock prices of the Saudi stock market were reported in this study. The findings suggested that the variation in prices in the Saudi stock market was much greater than that of other GCC stock markets. In addition, the serial dependence of the Saudi stock market was the highest among all GCC stock markets. This finding might imply that the Saudi stock market is not weak-form efficient compared with other GCC stock markets (Elango & Hussein, 2008).

Onour (2009) argued that inefficient stock markets take considerably longer to adjust information in the market. That is, inefficient stock markets have a tendency to systematically overstate or understate the effects of such information on the prices of securities, thereby enabling some investors that receive that information prior to the market to make abnormal returns. However, Onour (2009) argued that abnormal security performance resulting from information adjustments to the market, or prior to an announcement, does not necessarily indicate market inefficiency. A market should be

considered inefficient if some investors can use public information to predict the price movements of a security more accurately before information is made available to the market (the anticipation effect).

Ashikh (2012) argued that the test of weak-form efficiency is common in developing stock markets, but it is rare to find efficient stock markets in developing economies. Ashikh (2012) used data for the daily closing price of TASI, the Banks and Finance Services Index and three companies to investigate Samuelson's dictum[2]. Linear serial dependence tests performed by Ashikh (2012) showed the existence of linear dependence in Saudi stock market returns, which indicates the weak-form inefficiency of the Saudi stock market. Empirical tests including ordinary least squares (OLS) and the GARCH model were performed by Ashikh (2012) and confirmed the existence of the day-of-the-week effect in Saudi stock market returns.

Asiri and Alzeera (2013) also studied the weak-form market efficiency of the Saudi stock market. They considered all sectoral indices and the share index for the daily closing price over the period 2006–2012. This confirmed that the Saudi stock market is weak-form market efficient for individual sectors and all share prices (Asiri & Alzeera, 2013). Asiri and Alzeera (2013) argued that this finding implies that investors are unable to make abnormal returns using the historical price information of individual stocks. However, the findings presented by Asiri and Alzeera (2013) contradict the findings of empirical investigations by Butler and Malaikah (1992) and Onour (2009). These contradictory findings might be the reason for changes in market behaviour, and for the application of different methodologies, at the time the articles were published.

The weak-form market efficiency of regional GCC stock markets was studied by Jamaani and Roca (2015), who argued that efficiency in developing stock markets is important because it provides stock markets with a theoretical and predictive model for the effective functioning of equity markets. Jamaani and Roca (2015) used the daily prices index for the period 2003–2013 to determine the market efficiency of the GCC stock markets as a single stock market or as a regional stock market. They reported that not all GCC stock markets were weak-form efficient because all stock markets exhibited characteristics that would motivate investors to exploit historical stock prices to predict future price

[2] Samuelson (1998) offered the dictum that the stock market is 'micro efficient' but 'macro inefficient'. That is, the EMH works much better for individual stocks than it does for the aggregate stock market.

movements. However, when Jamaani and Roca (2015) tested weak-form market efficiency from a collective perspective, they observed long-term cointegration among GCC stock market prices. This means that movements in stock prices can be predicted by investors based on historical price movements. The findings reported by Jamaani and Roca (2015) imply that investors in GCC stock markets might be able to identify mispriced stocks through careful observations of historical price changes in an individual stock market. Fund investors who want to diversify their investment portfolio might also exploit this market inefficiency.

Alkhaldi (2015) studied the Saudi capital market with a focus on measuring stock market efficiency after the 2006 crash, which was a defining moment in the Kingdom's political and economic environment. One of the main reasons behind the inefficiency of the Saudi stock market was the economic growth during the 1980s and 1990s, which was beyond the government's control at the time. As a result of the damage caused by the stock market crash in 2006, the government seized the initiative, but it was insufficient to stabilise the market. However, blame for the crash could also be attributed to the media and investors. In the years since the crash, the Saudi capital market has made significant progress in terms of transparency and fairness, but its efficiency has remained questionable. Most studies prior to that of Alkhaldi (2015) regarding Saudi stock market efficiency have concluded that the Saudi stock market is inefficient. Several reasons for this market inefficiency have been suggested in the empirical literature, including a lack of transparency, high transaction costs, inadequate infrastructure and a lack of information. The findings reported by Alkhaldi (2015) emphasised that the Saudi stock market's infrastructural insufficiency is one of the reasons for the market's inefficiency.

Syed and Bajwa (2018) studied earnings announcements, stock price reaction and market efficiency in Saudi Arabia, and found that the Saudi Stock Market does not bear the semi-strong form of EMH. The findings presented by Syed and Bajwa (2018) have some limitations. First, instead of using analysts' forecasts for the expected earnings, they used the earnings from the previous year as a proxy. Second, Syed and Bajwa (2018) did not consider the trade volume in the event window when taking measurements. The findings presented by Syed and Bajwa (2018) also have some social implications. For instance, investors closely monitor the announcements made by firms regarding their earnings and their respective share price movements around the announcement date. Given that the

Saudi government recently announced that it will open up to foreign investors on the Saudi stock market, local and small investors might not be able to enjoy the benefits they previously obtained by using historical price data to predict future prices. Rather, when large foreign investors gain entry, the behaviour of the market might change significantly, and this might adversely affect small investors in the market. For this reason, Syed and Bajwa (2018) argued that this is the right time to study the market efficiency of the Saudi stock market before foreign investors enter the market.

3.8 Volatility of the Stock Market and Announcements

The relationship between the volatility of the stock market and announcements is of great importance to scholars and researchers because participants in the capital market closely monitor different types of announcements so they can adjust their portfolio accordingly (Bomfim, 2003). The appraisal of a stock's value is associated with the company's financial information because investors take into account this information when making decisions regarding their investments and when assessing the future prospects of a firm. Different types of announcements that are relevant to stock values (e.g. earnings announcements, central bank announcements, options announcements and dividend announcements) play a significant role and arguably influence the price of a stock.

In practice, capital market participants create speculations and expectations regarding a stock's price prior to the release of announcements, which is why the capital market shows unexpected reactions in stock prices (Donders et al., 2000). The market tends to fluctuate to a greater extent when there are anomalies between the actual announcements and the expectations of investors. In this regard, when announcement expectations match the actual announcement, a surge in the share prices is generally observed. In contrast, if announcement expectations do not match that of the actual announcement, a drop in the share price is typically observed (Donders et al., 2000). This is what the EMH refers to when it states that an efficient stock market should be able to process information at such a pace that investors should not be able to generate abnormal returns based on inside information. Therefore, it is important for stock markets to develop infrastructures and technical structures in a way that can make correct adjustments in stock prices based on relevant announcements. Correct adjustments in the stock price would mean that the price of a stock neither underreacts nor overreacts when announcements are made public. Thus,

it is necessary for announcements (bad or good news) to be reflected correctly in the share price of a company when information is publicly available (Haron & Ayojimi, 2018).

Ederington and Lee (1993) discussed the ways in which markets process information and the association between volatility and news releases. They also investigated scheduled macroeconomic announcements and their effect on foreign exchange futures markets and interest rates. Ederington and Lee (1993) stated that macroeconomic announcements affect day-of-the-week volatility and time-of-day volatility patterns in the stock market. They also found that volatility in stock prices remains substantially higher than normal for 15 minutes, even though announcement adjustments to stock prices occur within the first minute. In some cases, volatility has been observed to be elevated for several hours.

However, Ederington and Lee (1993) argued that day-of-the-week and observed intraday volatility in stock prices mainly takes place because of the timing of major macroeconomic announcements. Volatility in the stock price has been found to be flat across the trading week when the announcement effect is removed from the analytical model. This finding points to the argument that macroeconomic announcements contribute to the volatility of stock prices. Ederington and Lee (1993) also suggested that the stock prices of public companies for the period 1988–1991 were affected by information related to the consumer price index (CPI), employment, purchasing power index (PPI) and durable goods orders. Moreover, Ederington and Lee (1993) reported that most macroeconomic announcements are adjusted in the prices of stocks within the first minutes of trading, although the same is not true for stock price volatility because elevated stock price volatility is observed for at least 15 minutes. Ederington and Lee (1993) argued that the elevation in volatility might be due to the fact that traders do not have details of the announcement, or the implications of the announcement for market prices had not been determined.

Bomfim (2003) examined the effects of pre-announcements and news on stock prices and their association with volatility in the context of monetary policy disclosure. Abnormally low conditional volatility was observed in stock markets on days when monetary policy decisions were announced. This quiet behaviour of the stock market in relation to monetary policy disclosure was found to be the result of the monetary policy disclosure practice of the Federal Reserve in early 1994. Bomfim (2003) also stated that macroeconomic announcements tend to stimulate volatility in stock prices in the short

run, but higher-than-expected stock values have been found to have a larger effect on stock price volatility. In an examination of the effects of pre-announcements and news on stock prices and their association with volatility in the context of monetary policy disclosure, Bomfim (2003) took into account both monetary and financial economists' perspectives regarding stock market volatility and news announcements. Bomfim (2003) argued that neither monetarist economists nor financial economists provided conclusive evidence regarding the effect of news announcements on stock market volatility.

Donders et al. (2000) empirically analysed the relationship between options, earnings announcements and stock market volatility in addition to trading volume, liquidity and open interest. Their findings revealed that on the day of the announcement, the volatility of stock prices became elevated, but this volatility subsequently decreased. In contrast, on the day of the announcement, an increase in interest rates was reported (Donders et al., 2000). In the case of options instruments, Donders et al. (2000) argued that the quoted spread of options securities tends to be more volatile on announcement days, and the trading volume of such instruments increases substantially.

One limitation of the study conducted by Donders et al. (2000) was that they studied only the effect of the scheduled announcement on stock market volatility, liquidity and trading volume. Ederington and Lee (1993) argued that companies often make different types of announcements regarding their business operations, and this contributes to stock market volatility. Thus, unexpected announcements made by companies or any other relevant body should be taken into account when studying stock market volatility. However, Donders et al. (2000) argued that the stock market is less informative regarding volatility caused by options and earnings announcements compared with the options market for several reasons: the leverage effect on a stock is lower than that of an option, and there are no short-selling restrictions on the stock market, which allows investors to make unexpected returns based on the information they obtain. Conversely, because of the presence of short-selling restrictions, the options market provides better insights into the effects of options and earnings announcements on the volatility of stock prices.

Lei et al. (2017) studied the response of the stock market to earnings announcements and the volatility of stock prices. They reported that implied volatility in stock prices increases when the announcement date nears. This volatility implies that informed investors in the stock market are the driving force behind stock market volatility. Implied volatility prior

to the announcement day also increases in the options trading market. However, Lei et al. (2017) further argued that the effect of announcements on stock and options trading is more pronounced when the pre-earnings option trading volume is higher. Nevertheless, the findings reported by Lei et al. (2017) support the notion that informed trading by traders in both the option and stock markets contributes to the volatility of the respective markets immediately before the announcement day, and this volatility tends to become elevated when the announcement date is closer.

The main purpose of the study conducted by Haron and Ayojimi (2018) was to examine the effect of pre- and post-GST (goods and services tax) announcements on the stock market index of Malaysia using intraday trading data to determine market volatility after the announcements. The study used both intraday data and daily closing data of different frequencies, which helped the authors observe the subsided period of volatility in addition to the extent of stock market volatility (Haron & Ayojimi, 2018). Intraday and daily closing data for the period 2009–2016 were used, and the GARCH model was used to make empirical estimations. Haron and Ayojimi (2018) found persistent volatility in the stock market index after the GST announcement, and higher volatility in the stock market index was recorded after the GST announcement compared with that of the pre-GST announcement. This finding implies that the implementation of tax policy creates unwillingness and volatility in the stock indexes. The findings presented by Haron and Ayojimi (2018) are consistent with the market expectation that the GST announcement increases the cost of living and the general price level of goods and services. This can be observed in the stock market's volatility after the GST announcement.

Lyócsa et al. (2019) examined the association between stock market volatility and monetary policy announcements in Canada, the Europe, France, Germany, Italy, Japan, the UK and the US. They found that stock market volatility increases alongside quantitative easing announcements. Further, on the days of policy meetings or discussions, the stock market exhibited a higher-than-average level of volatility in stock prices, and this volatility increased when a decision regarding interest rates was announced. Finally, Lyócsa et al. (2019) reported stabilised volatility in the stock market as a result of monetary policy announcements in the respective economies. The authors investigated monetary policy announcements and their association with stock market volatility and found that monetary policy announcements have a statistically significant

effect on stock market volatility. In addition, Lyócsa et al. (2019) reported that the volatility effect resulting from monetary policy announcements declines within the first 5 days of an announcement. Further, quantitative easing announcements have no effect on stock market volatility (Lyócsa et al., 2019).

Syed and Bajwa (2018) studied stock price reactions in relation to earnings announcements and the market efficiency of the Saudi stock market. They computed average abnormal returns (AAR) and cumulative average abnormal returns (CAAR) around earnings announcement days on the Saudi capital market to observe its information efficiency after earnings announcements. The effect of the earnings announcements was measured using quarterly earnings disclosures made by the listed companies. Using an event study approach, Syed and Bajwa (2018) found significant abnormal returns during announcement days, which does not support either form of the market efficiency hypothesis. Volatility in the stock price around the announcement day implies that the Saudi stock market considers earnings announcements useful.

Syed and Bajwa (2018) also suggested that the Saudi stock market exhibits more volatility in response to bad news than good news around the announcement day. This finding is in accordance with several previous empirical studies, including those by Jamaani and Roca (2015) and Lyócsa et al. (2019). Syed and Bajwa (2018) reported a strong post-announcement drift for CAAR when negative earnings announcements were made. This finding suggests that investors in the Saudi stock market delay their responses to a greater extent for bad news events compared with good news events, which are associated with the underreaction of stock prices in relation to earnings announcements, contributing to post-announcement drift. In conclusion, Syed and Bajwa (2018) argued that the Saudi stock market is not consistent with the semi-strong form of the EMH because significant abnormal returns have been observed around announcement days, which also suggests that earnings announcements stimulate stock market volatility in the Saudi stock market.

3.9 High-frequency and Low-frequency Data Volatility

Technology has revolutionised the way in which we interact with almost every aspect of our human lives. People have become accustomed to having information available at their fingertips. The development of computer-generated information regarding the stock market has made it possible to access high-frequency data, which has been used in

research to help understand the psychology and structure of the stock market (Smales, 2013). French and Roll (1986), Harris (1986) and Wood, McInish and Ord (1985) used high-frequency data to obtain important insights using a larger sample size in a comparatively narrow timeframe. The outcome of the analysis enables researchers to capture the short-term behaviour of the underlying assets and detect seasonal issues when dealing with long-term time-series data (Biais, Glosten, & Spatt, 2005). Apart from these benefits, high-frequency data can provide insights into the behaviour of financial markets and help isolate the effects in a more efficient way (Gençay et al., 2001).

Volatility modelling and forecasting estimation play a significant role in determining the price and allocation of assets in addition to risk measurement. The most popular methods of financial market volatility estimation and forecasting in recent decades have been the ARCH and GARCH models (Alizadeh, Brandt, & Diebold, 2002). To better explain the stylised facts of financial market volatility, Chi, Dong and Liu (2014), Gan et al. (2018), Ma et al. (2018) and Pigorsch et al. (2012) proposed corresponding extensions based on the GARCH model. Because the GARCH model and its corresponding extensions predict financial market volatility based on low-frequency data, this model fails to incorporate all of the available intraday information in the estimation process (Miwa, Kiuchi, Yamamoto, & Morikawa, 2012).

Alizadeh et al. (2002), Fan, Li and Yu (2012), Miwa et al. (2012) and Pigorsch et al. (2012) proposed using realised volatility (RV) in the estimation of financial market volatility. However, Fan et al. (2012), Gan et al. (2018) and Ma et al. (2018) argued that the realised volatility measurement is biased. The empirical findings reported by Pigorsch et al. (2012) suggested that the precision of financial market volatility using realised range-based volatility was five times greater than that of RV. This is because RRV forms extremes from the entire pricing process and reveals more information than RV. Given that high-frequency data contain more information than low-frequency data, they help to estimate financial market volatility more precisely and generate better insights for investors when making decisions (Pigorsch et al., 2012). Financial market volatility estimations based on high-frequency data have been conducted in several empirical studies (Alizadeh et al., 2002; Chi et al., 2014; Fan et al., 2012; Gan et al., 2018; Miwa et al., 2012), where it was argued that high-frequency volatility models are superior to conventional low-frequency volatility models. The findings regarding the superiority of

high-frequency data for estimating financial market volatility imply that low-frequency data are not as rich as high-frequency data for forecasting volatility.

A study conducted by Ma et al. (2018) compared the effectiveness of volatility estimation models based on high- and low-frequency data. The findings suggested that high-frequency data predict financial market volatility five times more accurately than low-frequency data. This implies that high-frequency data are five times more efficient in generating conclusive remarks. Further, intraday information is well processed in high-frequency volatility estimation models compared with low-frequency models. Pigorsch et al. (2012) stated that high-frequency data are consistent in estimating variations in asset prices over time compared with low-frequency data. Empirical estimations by Pigorsch et al. (2012) showed that volatility estimations using high-frequency data achieve high forecast accuracy. However, Pigorsch et al. (2012) suggested that the combination of low- and high-frequency data in volatility estimations outperforms individual low- or high-frequency volatility estimation models. In another study, Gan et al. (2018) suggested that low-frequency data provide reliable estimates of market volatility, but Pigorsch et al. (2012) and Ma et al. (2018) contended that high-frequency data provide the most accurate and reliable measures of financial market volatility.

3.10 Effect of Government Policies on the Stock Market

Stock markets are controlled by a variety of variables. Government decisions that refer to economic news, political news and the general state of a government's policy often affect stock traders' investment options. Fundamental news releases affect stock prices. The market movers—namely, the big hedge funds and banks—usually base their analysis, and therefore influence stock prices, through these announcements. The regulator responsible for the conduct of financial markets, with the central objective of achieving efficiency and fairness coupled with systematic development in the monetary sector, is faced with underlying constraints relating to the sensitivity of such markets to outside information. Formerly, the functioning of stock markets was poorly regulated and less transparent, which allowed government bodies to intervene with the help of diverse fiscal and monetary policy instruments. Often, the bodies themselves were manipulated into taking action by commercial influences. However, as the market has globalised, government intervention has been provided relatively a stricter room into the market while being heavily dependent on the national legal and economic framework (Wang, 2010).

According to Ofori-Abebrese, Amporfu and Sakyi (2016), investors directly or indirectly react to institutions and policies; thus, governments that heavily depend on equity markets to fund their expenditure may witness a greater influence on monetary and fiscal tightening. This is particularly true when the market capitalisation of the equity market is very low. The functioning of equity markets is substantially influenced by unanticipated changes in trade policies, exchange rate regimes, fiscal and monetary policies that can affect cash flows and profits of domestic firms, and fluctuations in national policies.

Reactions in the stock market refer to changes in a stock price as a result of a change in a factor affecting the stock. Given the importance of government decisions to investors and businesses, a study conducted in the US market with reference to the 2008 global financial crisis provides an understanding of how the policies adopted by a government affect reactions in the stock market (Somani, 2020). The study takes the approach that the intermediary factor in stock market reactions to policies adopted by governments is individuals' expectations (Somani, 2020). A study of the interaction between fiscal policies and the stock market established a relation between government spending and stock value in the private sector and internationally (Razin, 2020). Both studies show the effect of decisions made by governments on stock market factors, with changes in prices and the value of stock resulting from government policies. However, one study (Somani, 2020) focused on the national level and considered the interaction between expectations of relevant individuals and the potential effect of the policies. The other study used an international approach in an effort to explain the effect of fiscal policies like government spending on the domestic market and the effect on both private and public sectors internationally (Razin, 2020). The results of both studies are similar, with each establishing the effect of the policies on the stock market and how these effect can be used by governments to control the economy using stock market factors.

Guo, Jiao and Xu (2019) stated that government policies and decisions have a significant effect on the stock market. This is because the political stability of a country influences the activity of every economic sector, including companies that have their stocks trading in the market. Government policies are influential in shaping the appropriate conditions that will facilitate good business activities, including labour laws, regulations, subsidies and taxes towards trade. According to Gábor-Tóth and Georgarakos (2019), when there is a favourable opportunity for conducting business, stocks returns usually have good

returns, and when there are unfavourable government policies, stock returns are usually low. Usually, unexpected changes result in huge reactions. This especially occurs when presidents and influential leaders release unexpected news concerning governmental policies that affect the stock market. Ilyas, Soomro, Anwar, Shahzad and Yaqub (2020) suggested that changes concerning government policies that would promote stock prices should be implemented by the government's decision-makers, while those that can cause abrupt changes in the economy should not be implemented in quick progression.

Moreover, Foresti and Napolitano (2016) highlighted that stock indexes mirror the changes witnessed within macroeconomic fundamentals and policy negotiations. Emphasising the latter, literature has examined the link between monetary policy and stock markets. At the same time, researchers have attempted to analyse the association between fiscal policy paradigms and stock figures. Concerning the tools used in both of the policies mentioned above, Afonso and Sousa (2011) identified that state expenditure shocks have a negative effect on stock values. In contrast, state revenue shocks have a relatively insignificant yet positive effect. Collecting data from some of the most developed economies in the world, the VAR analysis reflects that fiscal shocks are known to contribute less when it comes to asset markets in both Germany and the US. At the same time, they largely impose upwards pressure on the variability of stock values in the UK. In contrast, state revenues have been known to contribute to rising fluctuations in the stock markets of Italy.

In regard to economic policy uncertainty mainly fuelled by government instability and constant interventions, Arouri, Estay, Rault and Roubaud (2016) added that such uncertainties result in a larger effect over returns acquired via equity markets when the financial environment is extremely volatile. Similarly, Maqbool, Hameed and Habib (2018) explained that unstable governments are known to allocate expenditures and resources inefficiently to produce revenues that satisfy personal desires. Such unstable environments not only hinder the growth of several macroeconomic sectors, but also weaken financial market algorithms because of rising inefficiencies. Empirical evidence presented by Sajjad, Jan, Saddat and ur Rehman (2012) supported this view, advocating that macroeconomic events such as government policy decisions and stock returns form a considerable relationship. While these findings are concentrated solely within US jurisdictions, Wu, Liu and Hsueh (2016) studied the underlying association between

policy uncertainties and stock markets in nine major economies (Canada, China, France, Germany, India, Italy, Spain, the United Kingdom and the United States). The results suggest that policy risk and changes affect all stock markets differently, but the UK seemed to be the most sensitive. In a dissimilar strand of research, Asongu (2012) highlighted the significance of well-established government policies along with effective governance to speed the process of raising equity market values. The author concluded that better market capitalisation figures are achieved as a direct result of an increased turnover rate and a surge in the number of firms listed when the policies are implemented along with the dynamics of government effectiveness.

Presidents and leaders can influence investors' stock decisions. For instance, Donald Trump typically tweets to share his thoughts and opinions on trade issues such as China-related issues. According to Guo et al. (2019), when the tweets are positive, there is an associated increase in the returns for manufacturing industries in the Chinese stock market. This is profitable for companies in China that are involved in international trade because it helps them build strong business relationships with the US and increase the stock market returns. Hence, Trump's tweets can significantly influence the stock market. When they are positive, there is a resulting sentimental effect that encourages investors and the companies involved in trade (Azar & Lo, 2016). This subsequently raises the stock market returns and provides benefits to stakeholders and investors.

According to Khatua (2016), Twitter discussions by prominent leaders adequately reflect socioeconomic concerns related to Brexit issues and the stock market. Reactions to the issue of Brexit in Britain have had many effects on the stock market, and government policies and EU policies relating to Britain exiting the EU have led to reactions in other markets. For example, when the then Prime Minister, David Cameron, tweeted about the issue of Brexit, the British pound fell significantly, which affected stock market returns. Companies in Britain were in perplexity, and the sentimental or fundamental state of these investors was punctured so that conducting business and investing in Britain became unfavourable. According to Ilyas et al. (2020), Twitter feeds on Brexit are considered potentially useful tools for predicting stock reactions. This fundamental analysis facilitates investors and companies to plan their economic activities and gains in the stock market. Subsequently, this affects stock prices and therefore proves the hypothesis that

government policies and Twitter responses from influential leaders result in significant stock market reactions.

3.11 Royal Decrees and the Saudi Stock Market

Stock markets are always sensitive and influenced by government or organisation decisions, either negatively or positively. Therefore, the main role of the relevant organisation is the disclosure and transparency of decisions, because the stock market reflects the country's economy. A royal decree is an official document that expresses the king's agreement with a subject that has already been presented to the Saudi Council of Ministers and the Saudi Shura Council. The influence of Saudi royal decrees on the stock market has not been empirically studied or reported in detail, although there have been some discussions on this topic. Vaughan (2018) stated that Saudi royal announcements regarding monetary policy and any other decrees signed by the king of Saudi Arabia might affect trading behaviour on the stock market because royal decrees regarding macroeconomic factors influence the affected industries either favourably or unfavourably. For example, the royal decree regarding the listing of Saudi Aramco (Saudi Arabia's largest oil company) on the stock market attracted considerable hype, which helped the stock market index increase substantially following the announcement. Although the decree will come into effect in the latter part of 2020, any news regarding Aramco's public listing influences stock market behaviour (Kane, 2017). Thus, it can be said that royal decrees relating to the stock market might influence trading behaviour.

Saudi Arabia is experiencing the largest and most extensive structural reform in its history. Since the government of Saudi Arabia announced the Saudi Vision 2030 economic reform plan and NTP 2020 in 2016, many royal decrees have been issued in relation to the economic and financial sector that reflect the continuing process of reform and structural modernisation of the domestic economy. In this respect, the Saudi stock market has responded to a series of royal decrees, including the decision to diversify sources of national income, build industrial cities and provide support to SMEs and domestic tourism. These decrees will contribute to the Saudi economy and its growth, thereby helping to restore confidence in both the economy and the stock market. There is a paucity of empirical studies that have investigated the contribution of royal decrees to the stock market. Therefore, this study will help fill this gap in the literature and contribute to the existing body of knowledge by focusing on royal decrees that relate to the economic

and financial sector. In addition, it will examine investors' expectations and how they act on their expectations when royal decrees are announced.

3.12 Macroeconomic Announcements and the Stock Market

Previous empirical studies regarding macroeconomic announcements and their relationship with the stock market show that macroeconomic announcements are associated with the stock market and can positively or negatively affect the market (Lyócsa et al., 2019). Scheduled announcements regarding macroeconomic factors continue to receive substantial interest in terms of both academic literature and the financial press. This is primarily due to their importance in terms of evaluating the efficiency of equity markets and predicting future market responses (Belgacem, 2013). These studies are typically intended to highlight which of the economic indicators are directly or indirectly associated with the paradigms of financial markets, and which ones investors must consider the most when making investing or divesting decisions.

Aray (2010) confirmed that stock returns and values behave as reactions to macroeconomic news because they are a direct reflection of the pulse of the economy. Thus, market participants, apart from investors, must closely observe bulletins that refer to macroeconomic data. Briefly, the stock price is referred to as the current discounted market value calculated by rationally forecasting upcoming dividends. Since news related to the macroeconomic spheres may influence expected dividends, the rate of interest or the net effect of macroeconomic headlines on stock values can thus be calculated in advance. The seminal work published by McQueen and Roley (1993) began to test this hypothesis in regard to empirical data. This enabled other scholars to expand their research towards this domain, and it concurrently assisted policymakers in regulating the state of the economy in an attempt to control the conduct of financial markets. According to these studies, prevailing information and exceptional nation-wide events tend to be responsible for fluctuations witnessed in financial markets. Specific news items (e.g. financial performance forecasts of major corporations, dividend releases and announcements, information related to general public sectors, alterations made in economic policies, political or government instability, natural catastrophes and terrorists attacks) are known to affect the conditions that facilitate the behaviour of capital markets.

Given that macroeconomic news announcements are scheduled to be released on predetermined dates and are generally not assembled exogenously, their aggregate effect on stock values and returns could be deliberate rather than unlooked-for given market turbulences and the state of the economy as a whole. An empirical investigation by Ederington and Lee (1993) suggested that stock prices are affected by some, but not all, information relating to the CPI, employment, PPI and durable goods orders. Conversely, abnormally low conditional volatility is observed in stock markets on days when monetary policy decisions are announced (Bomfim, 2003). Haron and Ayojimi (2018) suggested that tax rate announcements are significantly associated with the stock market because share prices are reported to be volatile after such announcements.

Lyócsa et al. (2019) found that stock market volatility increases alongside quantitative easing announcements, although the effect of such announcements on volatility is insignificant, which might be due to a smaller number of observations. The authors also stated that on the days of policy meetings or discussions, the stock market exhibits higher-than-average volatility in stock prices, and this volatility increases when a decision regarding interest rates is announced. Finally, Lyócsa et al. (2019) reported stabilised volatility in the stock market as a result of monetary policy announcements in the respective economies. Moreover, they suggested that monetary policy announcements have a statistically significant effect on stock market volatility.

3.12.1 Gross Domestic Product

The effect of GDP on the stock market has not been widely reported in empirical studies, but Abalala (2013) argued that when an economy's GDP increases, it is an indication that businesses are doing well within that economy. As a result, investors in the stock market feel confident about their investments in companies that have shown steady growth over time. The association between GDP and the stock market is an age-old debate among scholars, but it is generally believed that GDP has a close relationship with the stock market of an economy (Abalala, 2013). Rangel (2011) argued that GDP is one of the many macroeconomic indicators of an economy's health, but other macroeconomic factors might also affect the stock market. This argument implies that it is not always useful to gauge a stock market's position based on the GDP of an economy because it is impossible to develop a stable economy (Rangel, 2011).

The empirical evidence of Funashima, Iizuka and Ohtsuka (2020) showed identical findings and suggested that quarterly GDP estimates are one of the most significant components of real-time information and thus receive substantial interest from several micro and macro agents. This confirms that announcements made in advance are perceived to have a beneficial effect in terms of communicating information regarding current macroeconomic conditions. However, it also highlights that revisions made to early announcements can harm a country's economic stability. Hence, both initial announcements and revisions to GDP estimates can affect financial markets because they are highly responsive to public data.

Concentrating findings in US stock markets, Birz and Lott (2011) evaluated a large range of real sector economic announcements that might affect stock gains and returns. They found that traders' interpretation and overall understanding of statistical press releases is one of the most studied determinants of stock values because it directly influences their expectations concerning upcoming economic circumstances. Using newspaper coverage and announcements as proxies, the results identified that the correlation between news regarding unemployment and GDP is significantly positive concerning returns from equity markets. Birz and Lott (2011) explained that a positive GDP growth rate that is higher than the one expected previously would result in investors looking forward to a positive economic state of affairs, which ultimately increases the demand for stocks and other prospective investment opportunities, as well as the market price for securities.

3.12.2 Unemployment Rate

The unemployment rate is an important macroeconomic indicator that is believed to have a strong association with an economy's capital market (Singh, Mehta, & Varsha, 2011). Singh et al. (2011) argued that when an economy has a higher unemployment rate, this implies that the general income of people will be inadequate to make investments in the capital market. When income is limited, people exhibit less demand and interest in investing their money in the stock market. As a result, the demand for stocks might be affected which, in turn, might affect the price of stocks. Further, Birz and Lott Jr (2011) stated that high unemployment creates a ripple effect within the economy, which may lead to a decline in the value of money and stocks. The empirical investigation of Birz and Lott Jr (2011) suggested that the unemployment rate is not always announced on a

scheduled basis, but a decline in the stock index has been observed during periods of higher unemployment.

Gonzalo and Taamouti (2017) argued that the unemployment rate is specifically selected to reflect the real economy because of its accuracy as well as its ability to measure the economy's growth rate. The Federal Reserve also identified it as one of the most important macroeconomic indicators when it comes to evaluating the overall health of the nation when changes in monetary policy frameworks. The results of the study highlighted that any rise observed in the unemployment rate is followed by a rise in the price of securities traded in the stock market. The justification behind this is that surging unemployment rates typically result in the Federal Reserve decreasing the interest rate, which in turn raises the value of stocks. However, the empirical study of Boyd, Hu and Jagannathan (2005) asserted that news announcements made by the Bureau of Labor Statistics regarding unemployment levels and their effect on equity market reactions depend on whether the economy is experiencing a contraction or expansion. Generally, equity markets react favourably to announcements of rising unemployment during times of economic expansion but respond unfavourably during contractions. This results from information about the decline in interest rates during the expansion phase and information about future corporate earnings during the contraction phase. Birz and Lott Jr (2011) confirmed the direct link between unemployment news announcements and stock returns, suggesting that the stock market is highly integrated with the functioning of the real sectors. However, Rangel (2011) argued that although the effect is evident in the stock market, news concerning unemployment rates or growth tends to have a short-lived effect on the conditional volatility of returns.

3.12.3 Inflation

As per the fundamentals of financial theory, the inflation rate is typically brought into existence by the CPI and reflects the general rise in the price level of goods and services over time. An upwards movement forces consumers to spend more to purchase a similar level of satisfaction and is known to be linked to volatility in the stock market as well as risk (Geetha, Mohidin, Chandran, & Chong, 2011). Perhaps the most important macroeconomic variable that has a strong and direct association with the capital market is inflation (Harju & Hussain, 2011). Several empirical investigations have been carried out to examine the effect of inflation on stock market returns and its association with the

stock market (Altavilla, Giannone, & Lenza, 2014; Harju & Hussain, 2011; Hussain, 2011; Singh et al., 2011). Most of these studies have provided inconclusive findings regarding the effect of inflation on stock market returns and the way it affects the stock market. However, Harju and Hussain (2011) and Singh et al. (2011) reported that high rates of inflation negatively affect returns on stocks, whereas stable inflation attracts more investment into the capital market. Harju and Hussain (2011) stated that the effect of inflation on the stock market is dependent on several factors, including the government's monetary policy, time period, geography and investors' ability to hedge. In general, Harju and Hussain (2011) and Singh et al. (2011) concluded that inflation significantly affects stock market behaviour.

The news of unforeseen hikes in general price levels and stock returns is viewed from two distinct perspectives. Initially proposed by the conceptual dimensions of Estep and Hanson (1980), the association can be neutral, as the firms have the ability to transfer the inflation costs in the products or services they sell. This flow-theory hypothesis, which was further confirmed in a study by Jareño and Navarro (2010), asserts that corporations with an increased flow are relatively safe from unexpected changes in the inflation rate. Therefore, there is an insignificant effect on their respective stock prices. However, the alternative point of view, as put forward by the rational expectations equilibrium framework, suggests that stock values respond excessively to bad news when the economy is stable and under-respond when the news is favourable and the economy is relatively unhealthy. The rationale behind this phenomenon is that when news announcements concerning economic variables move in opposition to market tendencies, upwards pressure is imposed on investor uncertainty, thereby contributing to increased risk and volatility in equity markets.

Conversely, Li, Narayan and Zheng (2010) found that an inconclusive relationship between stock gains and inflation fluctuations is determined by whether the economy is experiencing low or high inflationary periods. The comprehensive literature presented by Díaz and Jareño (2013) employed the hypothesis mentioned above in an attempt to elaborate on the influence of inflation news announcements on stock values. They asserted that different responses generated by unforeseen inflation are mainly determined by the state of the economy and the direction of the releases. In particular, bad news or surging CPI figures give rise to a more positive disruption than good news in relatively

more sectors of the economy. At the same time, the reaction exercised by market participants is also larger when the news is unfavourable compared with when the news is favourable. Sathyanarayana and Gargesa (2018) pointed out that while indefinite terms inflation is referred to as the incongruity in aggregate supply and demand, its relationship with equity markets is significantly inverse because it exerts upwards pressure on listed corporations to adjust their profit margins.

3.12.4 Interest Rate

Similar to inflation, the interest rate affects stock markets because monetary policy decisions and other policy decisions are made based on the consideration of this important macroeconomic variable (Hussain, 2011). However, empirical studies such as those by Altavilla et al. (2014) and Hussain (2011) reported that changes in interest rates create a ripple effect in the economy, which increases or decreases demand for stocks among general investors. The studies explained that there are multiple channels through which monetary policy announcements, functioning as a framework for interest rates, affect stock prices. The first channel is through corporations' cash flows, as the risk-adjusted discount rate may substantially influence their finance charges. These news announcements also disseminate useful information that reflects economic activity over short and longer horizons and thereby serves as a signal. Monetary policy adjustments—that is, changes in the interest rate or money supply, and thereby its announcements—can cause equity prices to fluctuate through portfolio adjustments undertaken by investors in several markets.

Consequently, the prices of stocks also increase and decrease as a result of changes in the interest rate. Norfeldt (2014) added that monetary policy news encourages investors to react, regardless of whether it is deflationary or expansionary. However, the magnitude of the response in the equity markets is determined by the type of policy in the process. The findings of Altavilla et al. (2014) suggested that interest rate expectations also affect the stock market because when investors' expectations for interest rates match the actual rate, the stock market shows greater volatility. From these studies, it can be understood that interest rate announcements affect the stock market. Rahman and Mohsin's (2011) empirical study confirmed that unpredicted and predicted interest rates have a significant effect on stock returns. However, this is influenced by time duration, as statistics have shown that the relationship is more concrete between predicted rates of interest and

security returns in the short run, but stronger between unforeseen interest rate announcements and stock returns in the longer run.

Ahmad, Gul and Saeed (2010) asserted that anticipation circling alterations in interest rates are taken into deep consideration by market participants. This is because rising deposit rates encourage investors to minimise their stock investments and divert funds into savings accounts, which provide a certain level of interest with no risk. Hojat (2015) highlighted that press releases concerning monetary variables have two major components: the anticipated and the unanticipated or unlooked-for component. Any alterations made in the interest rate with reference to future contracts as a measure for the federal funds futures serves as an effective indicator of the unlooked-for element. This makes it necessary for market participants to recognise the unanticipated elements in monetary policy announcements, because uncertainty could influence and thus cause changes in prices of stocks traded via equity markets. That is, what equity markets have already expected does not necessarily affect stock values. Concerning empirical evidence, research by Khuntia and Hiremath (2019) examined the relationship between monetary policy announcements and returns acquired from stock markets by gathering statistics from Indian financial markets. The results showed that Indian equity markets are highly sensitive to unanticipated and unscheduled monetary policy announcements, while similar markets were habitual to the anticipated elements of scheduled news releases. In line with the rational expectation hypothesis, the evidence also suggests that the effect of a policy alteration direction and policy announcement—regardless of whether the type of news is good or bad—is observed on certain industrial stock returns. The study further advocates that the announcements of the repo rate—that is, the interest rate the central bank charges while lending money to commercial banks—generates a relatively significant response among specific sectoral returns.

3.12.5 Balance of Trade

The effect of the balance of trade or its relationship with the stock market has not been discussed in detail in previous empirical studies. Among the few studies that have considered this issue, Antonakakis, Gupta and Tiwari (2018) argued that a sustained trade deficit might have negative effects on the behaviour of the stock market. A sustained trade deficit means that an economy imports more than it exports for a sustained period, which results in an increased level of debt. Consequently, investors in the stock market notice

that spending on domestically produced goods is declining over time, and this is bound to affect domestic companies and the prices of companies stocks (Antonakakis et al., 2018). Further, a sustained trade deficit means that investors have less confidence in investing in domestic companies' stocks. Thus, the balance of trade might also affect the stock market. With reference to past studies that have examined the nexus between news announcements concerning the balance of trade statistics and prices of securities, the early work of Aggarwal and Schirm (1992) captured insights from the period 1985–1957. The study clarified that, unlike other data that are available on the auction market (e.g. interest rates, equity prices and exchange rates), existing figures of variables like balance of trade are relatively undefinable by economic agents. While such information might only be available monthly and remain subject to constant revisions, the announcements indicate the performance of the domestic currency in forex markets as well as the economy from a global perspective. Because trade balances and current account figures influence the position of net international assets, in line with the rational expectation theory, alterations in such figures can be perceived to affect the prices of several assets, including stocks.

3.12.6 Money Supply

The money supply is a crucial variable for the stabilisation of the economy because it can be used for immediate transactions. It serves as the middle ground between the exchange of economic transactions; in fact, it is a store for its value. The money supply is the total amount of money present in an economy at a given time. Fluctuations in the money supply and stock market returns are inversely related. An increase in the money supply often leads to excess money chasing after limited goods and services within an economy, and this includes stocks (Agrawal, Srivastav, & Srivastava, 2010). However, Ratanapakorn and Sharma (2007) studied the correlation between US stock prices and the macroeconomic variables over the period 1975–1999 and found that the relation between stock prices and the money supply is positive.

Announcements made by the Federal Reserve System, which is responsible for the implementation of several policy instruments to regulate the monetary framework and liquidity supply of the US, are known to influence economic forecasts and thus security prices globally and not just within the US economy (Argitis, 2013). Hojat (2015) added that fluctuations in monetary policy—both quantitatively, via changes in rates or money supply, and qualitatively, via news announcements—can result in diagnoses concerning

the economic path over the longer term. This is because the interpretation of future economic activities can influence both idiosyncratic and systematic risk for investors, thereby automatically diverting their investment options and decisions. Further, a proven mutual casualty that exists in the literature concerning monetary supply paradigms and the stock markets is too substantial to neglect (Chen, 2007).

3.12.7 Foreign Exchange Reserves

The effect of foreign exchange reserves on the stock market has been studied by Akbar, Khan and Khan (2012), Ray (2012) and Scholtus, Van Dijk and Frijns (2014), among others. Scholtus et al. (2014) reported that foreign exchange reserves significantly positively affect the stock market because stock market capitalisation has been observed to have a significantly positive association with foreign exchange reserves. Ray (2012) highlighted the unidirectional association between stock market capitalisation and foreign exchange reserves, which implies that economies with higher foreign exchange reserves might have better outcomes for investors in their stock market. The positive effect of foreign exchange reserves on the stock market was also reported by Akbar et al. (2012) and Scholtus et al. (2014).

Foreign exchange news is defined as an unscheduled announcement concerning the macroenvironment that is irregularly disseminated to the market by responsible agencies to inform stakeholders about economic affairs. The announcement is known to produce two aftershocks: one positive and one negative. Positive news is directly correlated with favourable stock prices and dividends, while negative news is associated with increased volatility. A large number of studies have studied a similar nexus and treated information releases as mere static factors that are disseminated into the market systematically or on scheduled durations to produce an equilibrium distribution of stock prices and return, thereby regulating volatile behaviour (Aliyu, 2012; Inyiama & Nwoha, 2014; Olweny & Omondi, 2011). However, Omokehinde, Abata and Migiro (2017) argued that announcements are rarely released into the market linearly; therefore, they are known to generate asymmetric instabilities, which progressively contribute to market distortions. Gathering evidence from Nigerian stock markets, the paper argued that negative news has a destabilising influence on fluctuations of stock gains relative to when positive news is released. It also asserted that any price turbulence in global forex markets is anticipated

to have undesirable consequences for foreign exchange reserves, supplemented into stock returns.

3.13 Saudi Stock Market and the United States Stock Market

Several studies have examined the relationship between the US and Saudi stock markets; thus, the current study presents some of the findings of those studies to develop a clearer path to analyse the behaviour of Tadawul. Finta, Frijns and Tourani-Rad (2019) investigated the intraday and contemporaneous spill-over effects between stock and oil markets in Saudi Arabia and the US. Continuous high-frequency data for oil futures splits were used in the study, and the findings suggested that the Saudi stock market is affected by the volatility of the US stock market. In contrast, a smaller effect on the Saudi stock market was reported as a result of the volatility of oil during the overlapping hours with the US stock market (Finta et al., 2019). Further, significant volatility spill-overs from oil were observed on the Saudi stock market. The findings of this study imply that any volatility in the US stock market directly affects the Saudi stock market. In addition, Finta et al. (2019) reported that when oil is traded in the US and Saudi markets simultaneously, volatility in the price of oil has a higher effect on the Saudi stock market. The implications of the findings for this study might be that investors in the Saudi stock market can generate abnormal returns on their investments by observing trading behaviour in the US stock market. As such, Finta et al. (2019) made it clear that volatility in the Saudi stock market is significantly associated with volatility in the US stock market.

3.14 The Development of the Saudi Stock Market Based on Empirical Evidence

The Saudi government should accelerate the pace of privatising government-owned companies and make it easier for companies to go public. This would significantly increase the supply of shares on the stock market. It is also important that the Saudi government takes the initiative to increase investors' confidence in the market. Alkhaldi (2015) suggested that regulations regarding share trading should be developed and improved in a way that facilitates easier trading of shares. Most importantly, Alkhaldi (2015) stated that three factors must be taken into account if a stock market is to develop efficiently: strong regulation, disclosure of information and economic stability.

Al-Razeen (1997) argued that an inefficient stock market takes a considerably longer time to adjust information in the market. That is, inefficient stock markets have a tendency to systematically overstate or understate the effects of such information on the prices of securities, thereby allowing some investors to access that information prior to the market to make abnormal investment returns. However, Ashikh (2012) argued that it is not necessarily the case that an abnormal security performance resulting from an information adjustment to the market or prior to an announcement indicates market inefficiency; rather, a market should be considered inefficient if some investors can use public information to predict the price movements of a security more accurately before the information is made available to the market (the anticipation effect).

Asiri and Alzeera (2013) studied the Saudi capital market with a focus on measuring stock market efficiency after the 2006 crash, which was a defining moment in the political and economic spheres. One of the main reasons for the inefficiency of the Saudi stock market was the economic growth witnessed during the 1980s and 1990s, which was beyond the government's control at that time. As a result of the harm caused by the stock market crash, the government pursued various initiatives, but these were insufficient to preserve the market. Prior to the study by Onour (2009), most studies regarding Saudi stock market efficiency concluded that the Saudi stock market is inefficient. They offered several reasons for the market's inefficiency, including a lack of transparency, high transaction costs, inadequate infrastructure and a lack of information. The findings reported by Finta et al. (2019) highlighted that the Saudi stock market's infrastructural insufficiency is one of the factors that contributed to market inefficiency.

3.15 Summary

Given the importance of macroeconomic announcements and their association with the stock market, several empirical investigations have been carried out regarding this topic, including those of Ashikh (2012), Gan et al. (2018), Haron and Ayojimi (2018), Ma et al. (2018) and Syed and Bajwa (2018). Information asymmetry is a common issue discussed in empirical studies alongside stock market volatility and efficiency. Some researchers have considered the presence of the 'asymmetric information' problem beneficial because it can create a welfare-enhancing effect of private information (Hoppe & Schmitz, 2015). However, information asymmetry was critiqued by Miller and Rock (1985), who argued that it affects central planning because the price-setting behaviour of the seller is in

accordance with adverse selection theory. As previously stated, there has been more recent research into whether macroeconomic announcements affect stock returns in emerging markets. There have been few studies conducted in the sense of Saudi Arabia, despite being one of the largest markets in the Gulf region. This thesis aims to fill the void in the literature.

Al-Razeen (1997) and Butler and Malaikah (1992) reported negative autocorrelation among stock prices, which is also argued to be common in stock markets that are thinly developed with wider fluctuations in returns. Empirical studies have argued that the Saudi stock market is still developing, which means that the market lacks sufficient technical organisation to distribute information regarding stock prices (Jamaani & Roca, 2015). Trading volume on the Saudi stock market is very limited and much less stable than other developing stock markets. As a result, it can be argued that, because of technical inefficiency, the Saudi stock market would take a considerable amount of time to adjust information to the market (Jamaani & Roca, 2015). In fact, emerging markets have often been regarded as inefficient in the literature of market efficiency due to their limited scale, thin trade, and lack of regulations. The contrasting results of weak-form market efficiency in Saudi and Arab markets, on the other hand, are not surprising, given that the developed and emerging markets showed the same contrasting results.

Empirical studies have also suggested expanding the Saudi stock market so that investors can analyse larger datasets when making their investment decisions (Elango & Hussein, 2008). Further, the Saudi government could accelerate the pace of privatising government-owned companies and make it easier for companies to list sharescan that can lead to increase the supply of shares on the stock market. The Saudi government could also pursue initiatives to increase investors' confidence in the market. Empirical studies have suggested that regulations regarding share trading should be developed and improved in a way that facilitates easier trading of shares. Most importantly, empirical findings have suggested that three factors must be taken into account if a stock market is to be developed efficiently: strong regulation, disclosure of information and economic stability (Ederington & Lee, 1993). Apart from finding that the Saudi stock market was neither developed nor informational efficient, their view was that the market needed to build on the experiences of developed financial markets.

Different types of announcements that are relevant to the value of stocks (e.g. earnings announcements, central bank announcements, options announcements and dividend announcements) play a significant role in, and arguably influence, the price of stocks. Empirical studies have suggested that macroeconomic and earnings announcements made by relevant authorities affect stock markets (Finta et al., 2019). Ederington and Lee (1993) stated that macroeconomic announcements affect day-of-the-week volatility and time-of-day volatility patterns in the stock market. They also suggested that the stock prices of public companies for the period 1988–1991 were affected by information relating to the CPI, employment, PPI and durable goods orders (Ederington & Lee, 1993). Literature to date has predominantly focused on daily or weekly data and thus ignores the spillover effects that occur within the same day. These intraday spillover effects, however, are expected to be strong and important.

Abnormally low conditional volatility has been observed in stock markets on days when monetary policy decisions are announced (Bomfim, 2003). Donders et al. (2000) stated that on the day of the announcement, the volatility of stock prices becomes elevated, but this volatility subsequently declines. They also argued that the quoted spread of options securities tends to be more volatile on announcement days, and the trading volume of such instruments increases substantially. Lei et al. (2017) suggested that stock price volatility increases when the announcement date nears. Haron and Ayojimi (2018) found evidence of persistent volatility in the stock market index post-GST announcements. Lyócsa et al. (2019) found that stock market volatility increases alongside quantitative easing announcements, although the effect of such announcements on volatility is insignificant, possibly because of the relatively small number of observations. Further, quantitative easing announcements do not affect stock market volatility (Lyócsa et al., 2019). Syed and Bajwa (2018) found significant abnormal returns on announcement days, which does not support either form of the efficiency market hypothesis.

Stock market efficiency has several important implications for investors and regulators. It is important that stock markets effectively perform the ‘sensitive processor’ role so that investors cannot exploit the market using inside information. When this role is not appropriately performed by the stock market, investors question the ‘hold-the-market’ strategy and try to adopt a ‘beat-the-market’ strategy to select winners (Ashikh, 2012).

Therefore, stock market efficiency helps to identify major improvement opportunities for stock markets.

Negative autocorrelation has been observed among Saudi stocks, and this is believed to be common in stock markets that are thinly developed with wider fluctuations in returns (Elango & Hussein, 2008). Gan et al. (2018) argued that this weak-form market inefficiency is less prevalent than in other large stock markets. However, the trading volume on the Saudi stock market is very low and much more unstable compared with other developing stock markets. As a result, it could be argued that because of technical inefficiency, the Saudi stock market would take a considerable amount of time to adjust information to the market. Therefore, the liberalisation of financial institutions and the stock market would likely yield benefits in the long term. However, this would only be possible if the government pursued watchful macroeconomic policies.

This study makes several contributions to the existing literature. It is the first to examine volatility transmission between the royal decrees and Saudi stock markets taking into consideration the high-frequency data. Therefore, the current study differs from the existing literature by including the royal decree effect on Saudi's financial market volatility that's missing out in terms of attention in previous studies.

Regarding the effectiveness of measuring stock market volatility, high-frequency data have demonstrated greater consistency and superiority over low-frequency data (Butler & Malaikah, 1992). Gan et al. (2018) suggested that low-frequency data provide reliable estimates of market volatility, but Ma et al. (2018) and Pigorsch et al. (2012) contended that high-frequency data provide the most accurate and reliable measures of financial market volatility. However, there is a dearth of empirical studies on the impact of events information on the developing countries, especially the Saudi stock market using high-frequency data, most of the studies that have been done are using low-frequency data. Also, the influence of royal decrees on the stock market has not been empirically studied or reported in detail, although there are some discussions of this topic, but it is missing in the literature in general and on royal countries in particular. Therefore, this study aims to fill the knowledge gaps by examining the effect of Saudi royal decrees on Saudi stock market. It is generally perceived that Saudi royal decrees tend to influence stock market behaviour. In addition, announcements of different macroeconomic variables, such as GDP, the unemployment rate, inflation, interest rates, the balance of trade and foreign

exchange reserves, are believed to influence how the stock market behaves. Finta et al. (2019) suggested that any volatility in the US stock market directly affects the Saudi stock market. In that spirit, this study aimed to fill this gap by examining the effects of economic announcements and royal decrees on the Saudi stock market by using high-frequency data.

Chapter 4: Data and Methodology

4.1 Introduction

The previous chapter reviewed the literature related to the theory of asymmetric information, capital market theories and the factors affecting stock market volatility. The broad aim of this chapter is to provide the rationale for the methodology used to achieve the objectives of the research and describe the methodologies used in this research. Based on the findings from previous studies, a theoretical model will be developed to investigate the effect of royal decrees and economic announcements within the context of the Saudi stock market.

This chapter explains how the study will achieve its stated goals and what types of data and methods will be used to analyse the data and provide insights into how the research questions will be answered to achieve the objectives of the research. This chapter is organised into seven sections, which are organised as follows. Section 4.2 presents and discusses the research philosophy. Section 4.3 outlines the research method, while Section 4.4 discusses the conceptual framework. Section 4.5 discusses data sources, collection and details of the sample. Section 4.6 presents the empirical model specification, and Section 4.7 presents the overall conclusions.

4.2 Research Philosophy

Mkansi and Acheampong (2012) defined the research philosophy as the beliefs and assumptions that influence the way in which research is undertaken. A research philosophy describes an idea of how data on a phenomenon are gathered, analysed and used (Kleinberg-Levin, 1988). Epistemology is a justified belief that is based on truth rather than opinion. This suggests that science is about understanding and processing data using and believing in what is known. In the Western tradition, the positivist and interpretivist approaches are the two main research philosophies. The positivist approach is considered scientific, whereas interpretivism is an anti-positivist approach (Galliers, 1991). Both of these philosophies affect various aspects of this doxology–epistemology movement.

4.2.1 Positivism

The positivist approach emphasises strictly scientific and empirical methods that are intended to be purely based on unbiased facts and data preserved from all human biases and interpretations (Kleinberg-Levin, 1988). The positivist approach comprises data collection, evaluation and analysis; therefore, the approach emphasises the quantitative research approach in comparison with the qualitative research approach (Creswell, 2009). Alavi and Carlson (1992) submitted that all empirical studies are positivist in approach (pejoratively, empiricist), and that the physical and natural sciences also have their roots in positivism.

4.2.2 Interpretivism

Interpretivism considers human activities as part of society and focuses on the reasons behind peoples' actions and behaviours (Charmaz, 2006). In the interpretivism philosophy, the study of phenomena in their natural settings is key. Interpretivism acknowledges that scientists cannot avoid affecting the phenomena they study (Rubin & Babbie, 2011); hence, researcher interference in the object of study is the norm.

4.2.3 Rationale for the Choice of Approach

No single research methodology is intrinsically better than another. Authors such as Kaplan and Duchon (1988) and Tsoukas and Knudsen (2003) have called for a blend of the positivist and interpretivist philosophies to improve research quality. Graham (1994) opined that a researcher should adopt the methodology best suited to the research problem and objectives. For the purpose of this research, the positivist philosophy is adopted, which usually involves collecting data in numerical form so that statistical calculations can be made and conclusions can be drawn that allow the researcher to obtain the facts.

4.3 Research Method

The process of gathering information and data for the purposes of making effective decisions is referred to as the research method (Saunders, Lewis, & Thornhill, 2012). Quantitative, qualitative and mixed methods are the three most popular and widely followed research methods proposed by Creswell (2009) and Saunders et al. (2012).

The qualitative approach answers questions such as ‘Why?’ and ‘How?’ One of the main tools used in qualitative research methods is interviews (Bryman, 2008), which require fewer participants. The researcher uses a notepad during the interviews to gather all potentially useful data in a systematic manner. Meanwhile, to test the hypotheses, quantitative methods help determine the basis of proving or disapproving the theory data depending on the outcomes of the test (Creswell, Hanson, Clark Plano, & Morales, 2007). This approach uses descriptive statistical analysis to provide more meaning to the available data. A common method for conducting research in the quantitative approach is the use of surveys to collect information from respondents.

The mixed methods approach is referred to as a system that combines quantitative and qualitative methods (Marcus et al., 2011). When combining different approaches effectively, the results become more valid. In this study, a quantitative method was adopted because the research question requires admissible evidence.

This study uses the quantitative method to estimate the effects of royal decrees and economic announcements at the market level, as measured by the TASI, and at the industry level, as measured by four industry indices: the Tadawul Banks Index (TBNI), Tadawul Energy Index (TENI), Tadawul Materials Index (TMTI) and Tadawul Telecommunication Service Index (TTSI). Therefore, the researcher measures and values this study from reliability and validity perspectives to obtain credible results and findings using quantitative methods.

4.4 Conceptual Framework

The literature review in the previous chapter examined various theoretical concepts to help develop a clear understanding of the factors affecting stock market volatility. The main objective of this thesis is to investigate the effect of royal decrees and economic announcements within the context of the Saudi stock market. Thus, the current study introduces important insights to consider the behaviour of the stock market. Figure 4.1 presents a simplified version of the conceptual framework for the study, which is followed by a detailed discussion of the elements of the framework.

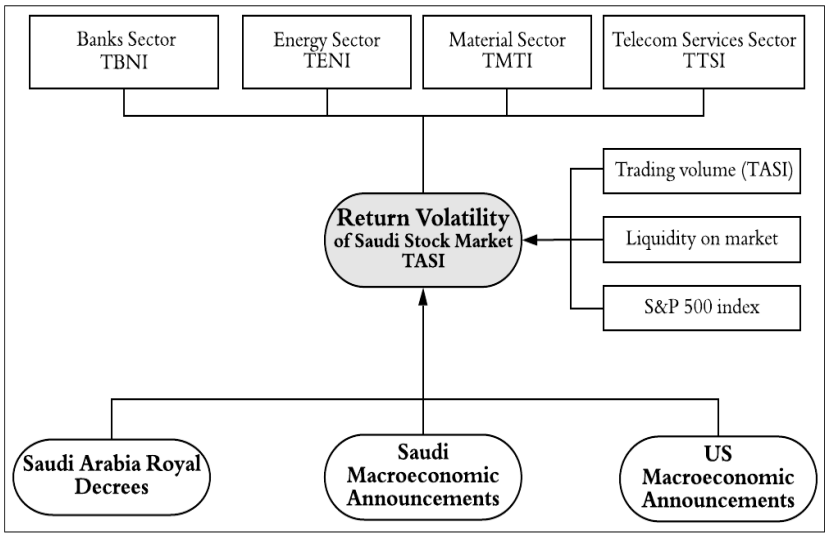

Figure 4.1: The Conceptual Framework for the Current Study

Figure 4.1 depicts the main objective of the study, which is to establish the nature of the relationship between return volatility, royal decrees, and Saudi and US macroeconomic announcements as a proxy for public information on return volatility using high-frequency data from the Saudi Stock Exchange during the period 2014–2019. The specific relationship between royal decrees and the stock market will be tested, and the extent to which macroeconomic announcements issued by Saudi Arabia and the US affect equity returns will be determined. In addition, the study includes three independent variables to capture previously documented determinants of return volatility. The study also analyses four industries besides the aggregate TASI to measure the effects of royal decrees and Saudi and US macroeconomic announcements on the volatility of four stock sector indexes (banks, energy, materials and telecommunications) and compare the industries to provide a better guide for investors and more depth to the study. Therefore, this conceptual framework will provide a deeper understanding of the Saudi stock market by examining public information that may play a significant role in investors' behaviours and decisions, which may in turn affect the price returns volatility in the market.

4.5 Data and Sample

The purpose of this study is to establish the relationship between return volatility, royal decrees and macroeconomic announcements in the Saudi stock market. The details of the data and sample are provided below.

4.5.1 The Saudi Stock Market (TASI)

For the purpose of this study, the required high-frequency data for the TASI were collected from Tadawul. The timeframe for the analysis covers the period of April 2014 to June 2019. Given that Tadawul is the official body to collect Saudi market data, the researcher was informed that high-frequency data has been available since 2014. In addition to the wider TASI, the study takes into consideration four separate sectors in the analysis (banks, energy, materials and telecommunications) for the purposes of comparison. The study divides the analysis into two parts. The first part, from April 2014 to June 2019, analyses the Saudi Stock Exchange, TASI. The second concerns the volatility of the selected sectors from January 2017 to June 2019 as a result of the change in sector classifications used by Tadawul. The previous sector classifications were limited because they were not based on global classification standards. Therefore, the study examines sector indices selected under Tadawul according to the new classifications shown in Table 4.1.

Table 4.1: Sectors Selected to Study

Stock Symbol	Sector Name
TBNI	Tadawul Banks Index
TENI	Tadawul Energy Index
TTSI	Tadawul Telecommunication Services Index
TMTI	Tadawul Materials Index

Note: A new sector classification on Tadawul started in January 2017 based on global standards.

The recently adopted sector classification system for Tadawul is derived from the Global Industry Classification Standard (GICS). The purpose of the GICS is to harmonise classification standards around the world to facilitate comparisons between countries by market participants such as brokers, analysts, asset managers and stock exchanges. The GICS was devised by the MSCI working in conjunction with S&P.

It was deemed appropriate to apply the GICS when reclassifying the industry sectors for Tadawul. This will facilitate comparisons between the various equity markets around the world. Crucially, adopting the new classification standard should encourage more foreign investors to include Saudi data in their analysis, thereby increasing the number of international comparisons that include Saudi stocks.

Prior to this reclassification, Tadawul comprised 16 industry sectors, but this has now been increased to 20 sectors, equivalent to Level 2 in the GICS hierarchical classification system. Table 4.2 lists the 20 sectors on Tadawul according to the GICS system.

Table 4.2: List of Tadawul Sector Industries According to the GICS

1	Energy	11	Food & Beverages
2	Materials	12	Health Care Equipment & Svc
3	Capital Goods	13	Pharma, Biotech & Life Science
4	Commercial & Professional Svc	14	Banks
5	Transportation	15	Diversified Financials
6	Consumer Durables & Apparel	16	Insurance
7	Consumer Services	17	Telecommunication Services
8	Media	18	Utilities
9	Retailing	19	REITs
10	Food & Staples Retailing	20	Real Estate Management & Development

4.5.2 Royal Decrees in Saudi Arabia

Royal decrees or orders in Saudi Arabia can only be issued by the king. Thus, it can be argued that the king applies executive, judicial and legislative powers along with royal injunctions to lay the foundation of the nation's legislation. All country announcements and directive principles are published earlier in 'official gazettes' and evaluated according to the date of publication. With King Salman as the country's leader, Saudi Arabia experienced good and efficient times when most countries were experiencing financial, political, economic and social crises. Since King Salman's ascension, the country has achieved a good standard of development in all aspects, including education, economy, transportation, social, healthcare, electricity, agriculture and industry. These major developments have moved Saudi Arabia in the list of most advanced countries. In recent years, different projects have been undertaken to improve citizens' lives. According to the National Competitiveness Centre, Saudi Arabia has made the most progress among the most competitive countries. In a report published by the Institute for Management Development (IMD, 2019), Saudi Arabia moved up 13 places from the previous year to rank 26 out of 63 countries. Hence, royal decrees and orders are always concerned with the future of Saudi Arabia and aim to the mainprovision of stability and assurance and enhanced pillar of development and progression.

On 25 April 2016, King Salman Bin Abdulaziz Al Saud approved Saudi Vision 2030 at a Council of Ministers meeting. In the meeting, the Council of Economic and Development Affairs (CEDA) was assigned to make the process and the major system needed to implement the objectives of the Vision 2030 and analyse its progress. Other legislative members and parts of the government were assigned to implement major processes to achieve the country's Vision. King Salman stated that Vision 2030 aims 'for our Country to be a pioneering and successful global model of excellence on all fronts'. All citizens were asked to work together to achieve the goals of Vision 2030.

The CEDA has established different entities and enablers. The enablers are efficient in supporting entire programs, and the entities are capable of analysing the process, evaluating major performances, indicating shortcomings and introducing better programs for the future. The enablers have been included by the enablers in this process, such as the National Centre for Performance Measurement, the Non-Oil Development Unit and the Spending Rationalization Office. Almost 24 legislation bodies have introduced the NTP in terms of development and economic sectors.

The country has gained different 'Qualitative Achievements' in different regions. All of the achievements are from the Almighty's particular guidance and the determination of King Salman and the Crown Prince Muhammad Ibn Salman to maintain the country's stability and citizens' wellbeing. According to King Salman, 'man is the first goal of development'. During King Salman's dynasty, the Kingdom has experienced many orders and decrees where King Salman has designated the major features in his explanations during his power, introduced by the abiding will—that is, progressive determination—to tackle major corruption and the safety of the country's integrity. This a proper method is a crucial pillar of different foundations, including social, economic and political 'Vision of Saudi Arabia 2030', which established new reforms, decreased the risk of corruption and confirmed the country's position in the list of the top 20 powerful countries in terms of the economy. Many royal directives aim to improve the country's economy in the future, including the introduction of packages aim to promote investment. Different processes have been undertaken in terms of allocating huge amounts rather than former figures for a different number of sectors, such as education, housing and health. Initial steps have been taken as a result of royal decrees and orders in the past years—regionally, internationally and locally—to mitigate terrorism and measure the responsible enablers

for this process in the country. In addition, the '41 member Islamic Military coalition' was established. Through King Salman's directive principles, the country introduced the 'Saudi Aid Platform' in 2018, which is a 'high-tech national podium' established by the King Salman Humanitarian Aid and Relief Centre (KSRelief) that aims to record and analyse the charitable and humanitarian contributions made by the top 10 nations globally, such as providing soft loans to developing nations. In addition, women have an opportunity to play a crucial role in building the nation, as they are now allowed to drive in the country.

Thus, the government aims to increase investment in the country, boost the standards of legislation and establish projects in the construction, entertainment, culture and tourism sectors. This is expected to provide better opportunities for the development of private investments, and this process will make more opportunities of jobs to improve the regulation and develop a framework to create valuable bonds between the private and public sectors. As mentioned above, royal instruction and announcement evaluates a better theoretical contribution to the assessment. Royal decrees and major orders in Saudi Arabia can be obtained from the Saudi Press Agency. Thus, the researcher gathered the data relating to royal decrees and orders for the period covered in this study. It should be noted that royal decrees were published outside trading hours; thus, the market could underreact to royal decrees, which would affect the next day's opening price.

Appendix 1 shows the most prominent historical royal decrees and orders during the study period of 2014–2019.

4.5.3 Data for Scheduled Macroeconomic Announcements

This study also uses various Saudi and US macroeconomic announcements, which will play an important role in realising the stated objectives of the thesis. The Saudi economic indicators data are reported on a weekly, monthly, quarterly and yearly through SAMA's website. Table 4.3 shows SAMA's schedule of the advance release calendar for economic bulletins:

Table 4.3: Schedule Dates for the Advance Release Calendar

Issue Date													
Report	Periodicity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Economic and Statistical Bulletins	Monthly	28	27	29	28	31	28	28	27	28	28	29	28
Quarterly Monetary and Banking Developments Report	Quarterly	—	6	—	—	7	—	—	13	—	—	5	—
Quarterly Inflation Report	Quarterly	—	6	—	—	7	—	—	13	—	—	5	—
Financial Stability Report	Annual	—	—	—	—	17	—	—	—	—	—	—	—
Weekly Money Supply	Weekly	Every Thursday except the official holidays.											

Note: Schedule is posted officially on SAMA's website.

This study also establishes the nature of the relationship between the Saudi and US economies. Saudi Arabia's currency has been pegged to the US dollar since 1986. The exchange rate policy of pegging the Saudi riyal to the US dollar has many advantages. The main advantage is that pricing the main commodity exports of Saudi Arabia (crude petroleum, refined petroleum, petroleum gas, raw aluminium and gold) in US dollars enables the Kingdom to determine budgets and estimate the volume of spending based on estimated revenues. Therefore, pegging the riyal to the strongest global economy represents a positive advantage as an anchor of monetary and financial stability. It also contributes to the stability of the economy and protects the Saudi riyal from rapid fluctuations in the global exchange market. In addition, much of SAMA's currency reserves are in US dollars (worth US$500 billion as of April 2019), and Saudi Arabia has invested a large part of its trade surplus in US shares. Thus, any change in the US currency and economy directly affects the Saudi economy, which in turn may affect the Saudi stock market. Therefore, a number of important US economic announcements are included among the variables to establish the nature of the relationship between stock market volatility and US economic announcements, such as announcements for interest rates, gross national product and GDP. This study uses Bloomberg and Thomson Reuters Eikon as sources for all historical US economic announcements. All of these economic reports/announcements are published outside the trading hours within the schedule's pre-

set days and times. Moreover, because of the time difference between Saudi Arabia and the US, the US economic announcements are issued after the Saudi market closes. Therefore, the stock market reacts to the announcement during the next day's opening hours. The data were collected in a format that will be used for further analysis in EViews and Microsoft Excel.

4.5.4 Standard & Poor's (S&P 500 Index)

The S&P 500 Index is considered the common equity benchmark for observing the US stock market. In addition, the divergent index shows 70% to 75% of the net capitalisation of the US market. It is composed of leading organisations from 110 unique regions of the US economy rather than the 500 largest securities in the US. Given the assorted coverage of sectors, most analysts choose to use the S&P as their own US benchmark index. The process of S&P 500 has been assorted in different regions that differentiate the process from indices, which already constitute different forms on a particular capitalisation of the market (Tu, Hsieh, & Wu, 2016). Because of the capitalisation—that is, the system of weighting used in the S&P 500—larger industries in the capitalised market can have a significant influence on the value of the index. Thus, the main aim of this assessment is to analyse the contribution of the international market to the TASI Index from 2014 to 2019. Therefore, the S&P 500 Index is used as a proper proxy representing the international stock market.

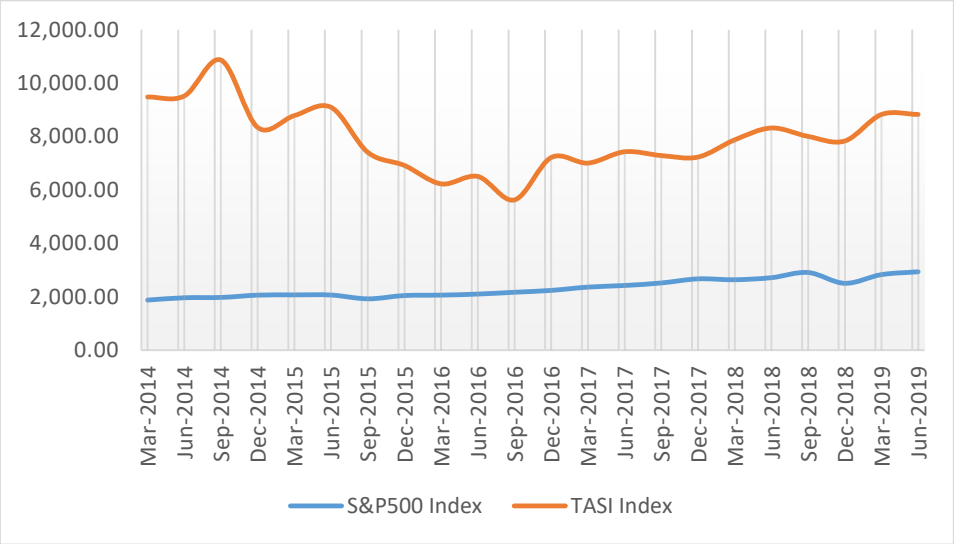

Figure 4.2: The S&P 500 Index and Saudi Stock Market Index 2014–2019

4.5.5 Liquidity

Liquidity defines the extent to which property can be purchased and sold at a desired time and to maintain a balanced price. That is, it is a way that different sellers and purchasers appear, and the transaction can be made easily (Zhang et al., 2016). Liquidity is calculated using the trades volume or pending trades volume in the market. In the process of making investment decisions, investors with reduced resources and skills rely on information from the public. On the other side, skilled investors base their decisions on 'pre-disclosure information' (Amaya, Filbien, Okou, & Roch, 2018). Most researchers have advised that some investors are informed asymmetrically just before the foreseen announcement; thus, they may act differently, which is a matter of deep concern. Glosten and Milgrom (1985) stipulated that a higher number of knowledgeable traders in the market will evaluate the compensation of the market introducer to the additional prices chosen (Gao, Schultz, & Song, 2017). In addition, adverse costs may lower the process of liquidity and affect the 'cost of capital' to industries. High standards disclosure increases the liquidity of the market by enhancing the main depth and lowering the adequate spreads. Researchers have conjectured that government decisions and economic injunctions are commonly used to limit the 'bid–ask spread' and increase the volume of trading in a day of direction (Zhang et al., 2019). This will boost the liquidity of the market and reduce the information imbalance. This study will examine the relationships and bonds between the liquidity of the market and index of the market during the announcement period.

4.5.6 Trading Volume

The trade volume indicates the total number of contracts and shares exchanged between sellers and purchasers during the trading period on a given day. It is a measure of the particular activity of a market. Higher volumes in trading are observed because they refer to high liquidity and good execution in order (Guasoni & Weber, 2017). The volume of trades in every 5- to 6-minute interval is averaged for every sample in a day. The content with information to the event of the public can be sighted through the 'stock returns' and transformation in trading according to the announcement date among different variables. Kandel and Pearson (1995) explained that the process of trading volume with announcements for different types of information is bad and of good significance. Analysis of 'trading volume' emerging from the right 'correction of idiosyncratic' issues introduced by the discovery of information with the context of prices. Though, the volume

of trading reflects on the aspects of traders 'idiosyncratic reactions' (Kim, Kim, & Kim, 2020). Thus, because of the availability of high-frequency market data, this study takes the volume of trades as an independent variable for each 5-minute interval.

4.5.7 Sample Period, Asset Prices, Sampling Frequency and Normalisation

Given that the Saudi stock market has been operating for more than 50 years, it is important to reduce the data sample to a level that is feasible while at the same time providing an accurate picture of the current situation in the stock market. According to Tadawul, high-frequency data for the Saudi stock market are available from 17 April 2014 onwards. Therefore, a sample period from 17 April 2014 to 30 June 2019 was selected, which covers a period of more than 5 years. The total number of trading days in the sample period is between 1,240 and 1,250 days. The last trading day for the study is 30 June 2019. As a result, days on which trading did not occur, or when there was a public holiday or trade was suspended for any reason, are not included in the data sample. It is worth noting that the trading hours on Tadawul are between 10:00 and 15:00 hours, and the market operates 5 days a week from Sunday to Thursday. Therefore, the data used in the study cover this timeframe.

4.5.7.1 Market Price Data

As per the research hypothesis, this study is primarily concerned with the effects on the market index on a particular day. In line with the methodologies presented by Andersen, Bollerslev and Cai (2000) and Hanousek, Kocenda and Kutan (2009) to calculate the market return and volatility of return, the stock market price index TASI will be used in this study. The market index is considered an efficient form of estimating market returns because it can replicate the overall movement of the market with precision. The prediction accuracy of the market return from the aggregated market index is much higher than for any single asset's pricing (Chordia, Goyal, Sadka, Sadka, & Shivakumar, 2009). The index is calculated using standard calculation methods. At the end of 2019, the TASI was composed of 183 companies. According to Saudi Stock Exchange rules, the daily transaction price of shares trading must be up or down 10% from the previous day's closing price to curtail excessive volatility, protect investors from extreme price movements and discourage potential manipulation within the market. The current study also examines the effect of announcements on four of the major sector indices by

measuring the volatility of each sector and making comparisons with the volatility of other industries. The sectors (banks, energy, materials and telecommunications) are sensitive to the announcements being studied and provide a better understanding of the relationship between the sectors and their interaction with public information (Messai & Jouini, 2013). These sectors were selected because they are the most influential on the TASI (materials companies comprise 28.14% of the index and banks 40.16%). This study examines the energy index as one of the sectors related to oil prices on the TASI and because the Kingdom is one of the largest oil-producing countries. Further, the telecommunications sector is considered one of the most active among the TASI market indicators.

4.5.7.2 Sampling Frequency

The study uses high-frequency data from the Saudi Arabian stock market. As discussed above, high-frequency data from the stock market can range from seconds to daily price data. Andersen et al. (2000) used index data in 5-minute intervals to measure Japanese stock market volatility. Their results showed that intraday data contain valuable information about the salient long-lived interdaily volatility dependencies. There are various reasons for selecting 5-minute data intervals in the analysis. High-frequency data are helpful in identifying the U-shape effect on the stock price. Moreover, there is less likelihood of any kind of statistical error when using high-frequency data. Further, high-frequency data are helpful for capturing the immediate effect of public information on the daily stock index. Given the importance of the data frequency, considerable thought must be devoted to determining the sampling frequency. If the interval or frequency of data is too high, it could result in biased outcomes (Bandi & Russell, 2006; Gençay et al., 2001; Peter & Asger, 2006). Thus, after scrutinising the empirical literature related to the field of study, it was determined that a 5-minute price interval was sufficient to capture the required objectives of the study and minimise statistical errors (Bandi & Russell, 2006).

4.5.7.3 Normalisation

Data normalisation is necessary when data may have outliners; hence, the data need to be modified by creating shifted scale data versions to obtain values that allow for more vivid comparisons of the values in the dataset. This aims to eliminate the gross influences that may be inherent because of an anomaly in the time series. Normalisation of the scale and

the values is performed before averaging, with the intention to eventually adjust the entire probability distribution to be aligned with the dataset. There are various types of normalisations in statistics. The dataset used in the current study comprises time-series data, which can have significant influences due to time-series anomaly. The normalisation type used for this research is the coefficient of variation ($\frac{\sigma}{\mu}$), whereby values of residuals are expected to be normalised by normalising the dispersion using the mean μ as a normalisation scale. This means that μ is used especially for the positive distribution (i.e. exponential distribution and Poisson distribution).

4.5.8 Definition and Measurement of Variables

The variables used in the analysis to realise the stated objectives are the TASI to interpret the market return of Tadawul and the volatility of return along with the return from the index in each 30-minute interval. Table 4.4 presents the dependent variables that will be used in the analysis.

Table 4.4: Definition and Measurement of Variables

No	Variables	Symbol	Description
1	Index price	P	Historical price data for the TASI and four major indices (banks, energy, materials and telecommunications) from 1 April 2014 to 30 March 2019.
2	Returns	R	The calculated log return of the TASI, which is measured in 5-minute intervals.
3	Realised volatility	RV	The square root of the realised variance using all available 5-minute returns within a defined period.
4	Rolling realised volatility	RRV	The average of the index return calculated in the 30-minute window, which is based on the realised volatility model.

Moreover, it covers royal decrees and economic announcements for Saudi Arabia and the US from April 2014 to September 2019. There were 429 events (royal decrees = 148, KSA economic announcements = 180, US economic announcements = 101) documented by the Saudi Press Agency, SAMA and Reuters. News regarding royal decrees and economic announcements are produced outside the trading hours of the stock exchange. Before the event day, investors, in general, have no means of anticipating news and announcements, especially in regard to royal decrees. In recent years, investment houses and financial institutions have begun to issue reports and recommendations regarding the financial market and economics that may help market participants make better-informed

decisions. The next subsections examine the yearly, monthly and weekly distribution of the announcement dates.

4.5.8.1 Announcements per Year

Figure 4.3 shows that the number of royal decrees increased up to 2016, which recorded the highest number of decrees. This growth trend can be attributed to the announcement of Vision 2030, which was followed by a raft of reforms as part of an ambitious plan to diversify the Saudi economy away from its dependence on oil to enable economic diversification. In addition to comparisons between economic announcements and last recorded years, this growth trend can be attributed to investors' increased awareness of the importance of timely and accurate information. In addition, the CMA established and enforced disclosure laws and regulations.

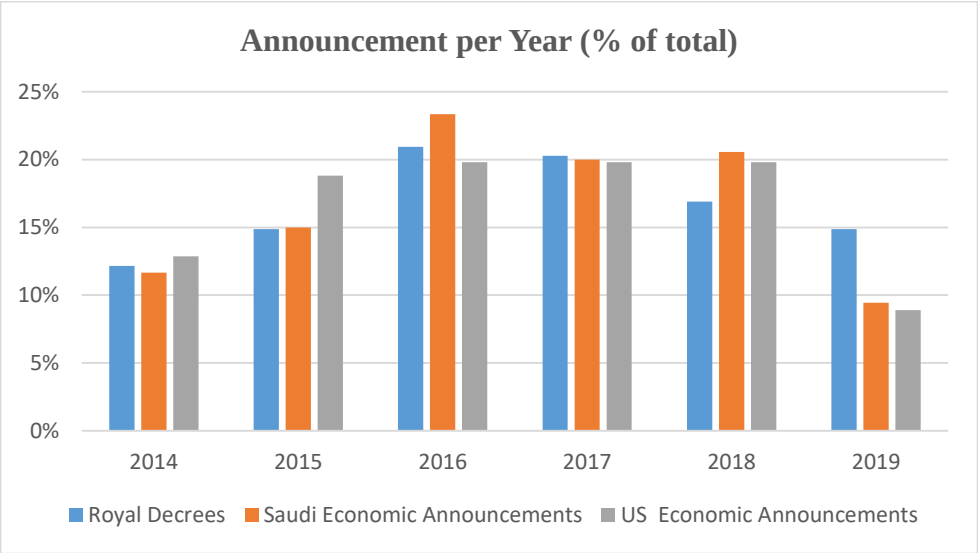

Figure 4.3: Percentage of Announcements per Year

4.5.8.2 Announcements per Month

Figure 4.4 shows the number of announcements per month across the combined royal decrees and Saudi and US economic announcements. The number of announcements is highly concentrated in June for royal decrees and US economic announcements and in March for Saudi economic announcements.

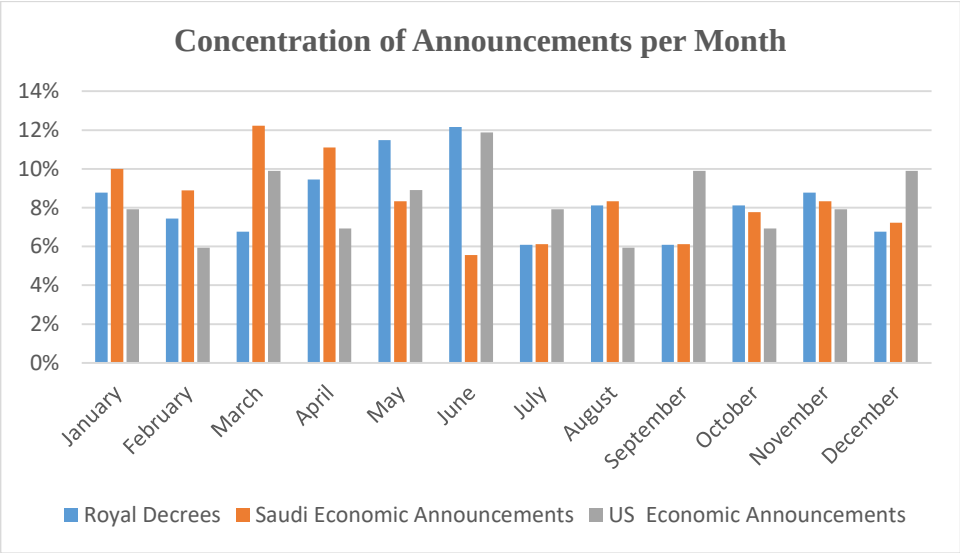

Figure 4.4: Percentage of Announcements per Month

4.5.8.3 Announcements per Week

Announcements were fairly evenly distributed in all weeks throughout the year. Weeks 4 (end January), 10 (mid March), 16 (end April), 19 (mid May), 22, 23 and 25 (June) and 52 (end December) had the highest frequency for royal decrees. In addition, in regard to Saudi economic announcements, Figure 4.5 shows that weeks 9 and 10 (March), 13 (first April), 17 (first May), 44 (first November) and 52 (end December) had the highest announcements, as well as weeks 5 (first February) and 18 (mid May) for US economic announcements.

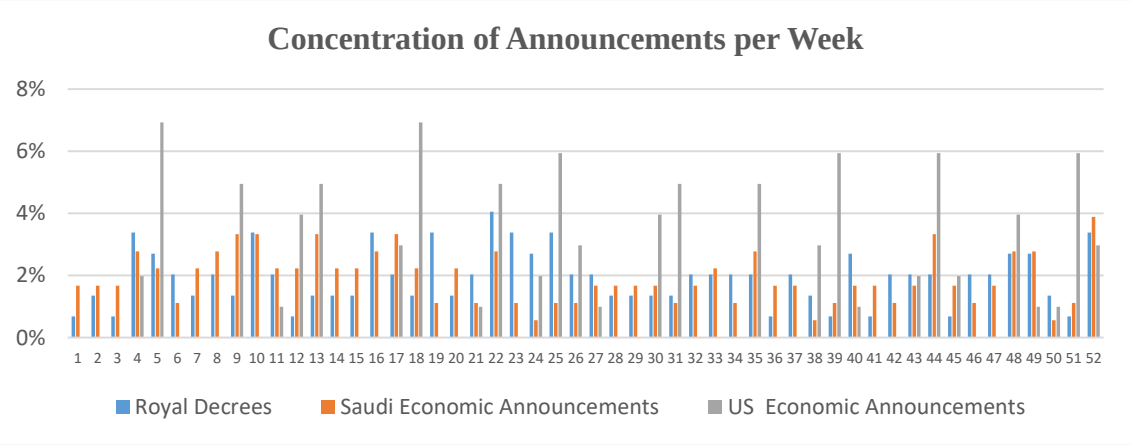

Figure 4.5: Percentage of Announcements per Week

4.5.9 Intraday Returns of the Tadawul All Share Index and Industries

The most important variable used in this study is the TASI return. As previously mentioned, historical data for the TASI offer the best fit for the stated purpose because the key effect of various publicly traded information can be captured within the trading period using historical high-frequency data (French & Roll, 1986). The typical trading hours of Tadawul are Sunday to Thursday, 10:00 until 15:00. Trading does not take place on public holidays. Therefore, the return is calculated based on the data generated in this timeframe. Ederington and Lee (1993) discussed the process of calculating 5-minute interval returns for the index. The formula for calculating the return is as follows:

$$r_{t,i} = r(\Delta t, t_i) = \ln(\frac{p_t}{p_{t-1}}) \quad (4.1)$$

where $r(t_i)$ represents the log return of the asset; Δt is the change in time, which is 5-minute intervals; P_t is the index; and P_{t-1} is the previous trading index. The process of calculating returns starts at 10:00 and ends at 15:00. As a result, the number of price samples for the study is 60 observations per day (which corresponds to sampling every 5 minutes).

4.5.10 Volatility of Tadawul All Share Index Returns

Volatility of returns will be used as the dependent variable in this research. For the purpose of completing the research, it is important to calculate the volatility of the TASI return. RV will also be used to help determine any seasonality and heterogeneity issues in the data (Andersen et al., 2001; Andersen, Bollerslev, Diebold, & Labys, 2003). The volatility of the assets will be calculated using the standard deviation of the assets' return in the set time window. The formula for calculating variance is given as follows (Andersen et al., 2001):

$$RV_t^{(n)} = \sum_{i=1}^{n} r_{t,i}^2 \quad (4.2)$$

where the RV for (t) the time interval of (n) intraday returns an observation. Moreover, this study will estimate rolling realised volatility (RRV) by averaging six uniform observations for a 30-minute window. During the trading day, the process of estimation iterates every 5 minutes. For instance, the first RRV window is from 10:00 to 10:30 following a 5-minute window, the second window is from 10:05 to 10:35 and so on. The

last RRV window of the day is from 14:30 to 15:00. Therefore, the study will use 50 RRV window observations from Sunday to Thursday. As suggested by Gropp and Kadareja (2012) and Smales (2013), the RRV window was computed as follows:

$$RRV_j = \frac{1}{6}\sum_{j=0}^{n} RV_t^{(n)} \quad (4.3)$$

where, RRV_j is the RRV window moving average for each group of six RV observations.

4.5.11 Volatility Estimation Process and Selection of Observations

The formula for calculating the volatility of the stock index was discussed in the previous section, but it is important to determine the observation window for the analysis. Based on previous studies, it was decided that a 30-minute observation window would be used to determine the result. There are several reasons for using 30-minute observation windows; one of the most important reasons is that it is the sweet spot to absorb all of the news and market information for reflecting on the stock index (Ederington & Lee, 1993).

After determining the observation window, it is important to define the sampling frequency. This can be done using either a rolling or non-rolling observation window. For the purpose of this study, a rolling volatility observation window will be used because it provides better exposure to the current market scenario (Gropp & Kadareja, 2012).

4.6 Empirical Model

A common expectation is that the stock market and royal decrees will be positively related because the government usually considers the benefits of the country's economy and its citizens, and this is reflected in the stock market. However, to date, royal decrees have not been addressed in the empirical literature. Therefore, this study will determine the effect of royal decrees on the stock market.

The study will also consider macroeconomic announcements, which will play an important role in realising the stated objectives of the study. It will also establish the relationship between the Saudi and US economies. There are several reasons for studying the effect of the US. The US economy exerts a strong effect on global markets and accounts for 25% of the global economy. Therefore, a number of important macroeconomic announcements are included in the variables to establish the nature of the

relationship between Saudi stock market volatility and Saudi and US macroeconomic announcements. Also, because of Saudi riyal pegged to the US dollar.

This section outlines the econometric methods used in this study to examine the effect of royal decrees and economic announcements on Saudi stock market volatility. A multiple regression model is employed to test the aforementioned variables on the TASI and selected sectors to answer the research questions in the first chapter, following the studies of Basher and Sadorsky (2006), Nandha and Faff (2008) and El-Sharif, Brown, Burton, Nixon and Russell (2005). In addition, this section provides background information on the realised volatility model suggested by Andersen, Bollerslev and Diebold (2007). An augmented Dickey–Fuller (ADF) test will be conducted to identify whether the variables are stationary or non-stationary, because non-stationary variables need to be further examined by evaluating the cointegration using the Johansen test.

4.6.1 Descriptive Analysis: Time Plot

A time plot is one of the most important tools when analysing time-series data. A time plot is a visual illustration of time-series data that is created by plotting the data points (y_t) on the vertical axis and time 't' on the horizontal axis. This plot illustrates crucial aspects of the time-series data, including trends, secular movements, seasonal variation and seasonality effects, cyclical variation, irregular variation and outliers. This plot helps the researcher to decide what type of model is ideally suited, as well as whether the data need to be transformed or normalised to achieve the desired conditions for meaningful evaluation, discussion and analysis.

4.6.2 Unit Root Concept: Augmented Dickey–Fuller Test

A time-series $\{Y_t\}_{t=1}^{N}$ method has a unit root if the time series is non-stationary and shows the trend and linear movements in its mean over time. The time series can be considered stationary if, at the first or second difference, the time series is trendless. However, it can have multiple unit roots if stationarity is observed at more than one differencing.

Generally, time-series variables are non-stationary, which may affect the respective model and result in spurious regression (Granger, 1969). In the majority of the variables, the first or second differenced terms are typically stationary (Ramanathan, 1992).

Therefore, it is crucial to test the macroeconomic variables for stationarity, and for this purpose the ADF test will be used.

The slow deteriorating autocorrelation function (ACF) can help detect the existence of trends and unit roots in a univariate process, consequently suggesting non-stationarity. However, it may have extremely limited power to identify the trends or unit root in the respective process.

Consider the $AR(1)$ series:

$$y_t = \phi y_{t-1} + U_t \tag{4.4}$$

Because we know that if $-1 < \phi < 1$ then y_t is stationary if $\phi = 1, y_t$ is not stationary. Hence, the unit root hypothesis is:

$$H_0: \phi = 1 \; vs$$

$$H_1: \phi < 1$$

Subtract y_{t-1} from (4.4) to obtain:

$$y_t - y_{t-1} = y_{t-1} - \phi y_{t-1} + U_t$$

$$\Delta y_t = (\phi - 1) y_{t-1} + U_t \tag{4.5}$$

Let $\delta = \phi - 1$; hence,

$$\Delta y_t = \delta y_{t-1} + U_t \tag{4.6}$$

Thus, testing for $\phi = 1$ is equivalent to testing for $\delta = 0$.

The ADF test involves checking through and testing the three sets of models:

$$(i) \Delta y_t = (\lambda - 1) y_{t-1} + \sum_{j=1}^{j} \beta_j \, \Delta y_{t-j} + U_t$$

$$(ii) \Delta y_t = \alpha + (\lambda - 1) y_{t-1} + \sum_{j=1}^{j} \beta_j \, \Delta y_{t-j} + U_t$$

$$(iii)\Delta y_t = \alpha + \delta_t + (\lambda - 1)y_{t-1} + \sum_{j=1}^{j} \beta_j \, \Delta y_{t-j} + U_t$$

where Equation (i) depicts an authentic random walk model. The time series with a unit root is called a random walk, whereas a random walk depicts a non-stationary time series. Equation (ii) includes a drift term, whereas Equation (iii) includes the linear time trend as well as the drift term.

One or more of the above equations are involved in the unit root test along with the respective standard errors, as well as comparing the values of the test statistic in the Dickey–Fuller table.

Generally, the majority of economic time-series variables are non-stationary (containing seasonal variations and trends), although a univariate process can be transformed to become stationary by implementing a univariate Box–Jenkins methodology.

Moreover, the time-series data and variables are normally considered the data created by a random stochastic process and comprehended as a sample of the fundamental stochastic process. If the value of the mean, standard deviation and variance are constant over the period, and the covariance value between two periods depends on the lag between the respective periods rather than the actual period calculated based on variance, this stochastic process can rightly be assumed to be stationary.

Let y_t be a stochastic time series with mean $E(y_t) = \mu$

Variance is $V(y_t) = E(y_{t+k} - \mu) = \sigma^2$ and

Covariance is $\gamma_k = E(y_t - \mu)(y_{t+k} - \mu)$

Presume that y_t toy_{t+m} is shifted, where y_t is considered stationary and the means, autocovariance and variance of y_t are equivalent to y_{t+m}. Further, the means, autocovariance and variances would be identical at various intervals if the time series was stationary, although after a difference, a few economic time series are stationary, whereas some are not.

4.6.3 Cointegration

An understanding of cointegration is crucial in time series to demonstrate the presence of a stationary relationship between two or more respective data, and these data can even be non-stationary on an individual basis. Engle and Granger (1987) presented the concept of cointegration to study the long-run equilibrium in a stationary multivariate time-series dataset where a linear series of non-stationary variables are obtained that are, in reality, stationary because these variables are supposedly cointegrated respectively.

Cointegration is used to evaluate economic variables in regard to joint or parallel movements or stochastic from the central equilibrium over time. Further, it can indicate the presence of a stochastic relationship between two non-stationary series, establishing a connection between the respective series via a linear combination and giving integration of order '0' $I(0)$ stationary accordingly. Therefore:

(i) It helps to establish a relationship among non-stationary series such that the relationship is reasonable, sensible and of statistical importance.

(ii) It specifies the error correction mechanism (ECM).

If there is cointegration, it means that there is a long-term relationship between two or more macroeconomic variables.

4.6.4 Multiple Regression Model

Regression analysis is a way of mathematically determining which variables have an effect. In multiple regression analysis, multiple independent variables are used to predict the target variable. There are three major uses for multiple regression analysis. First, it is used to identify the strength of the effect of the independent variables on a dependent variable. Second, it is used to forecast the effects of changes. That is, multiple regression analysis helps understand how much the dependent variable will change when the independent variables are changed. Third, multiple regression analysis predicts trends and future values and obtains point estimates. Thus, it helps determine/find the combination of significant predictors with the highest explanatory power of the variance in the abnormal return. In addition, each significant predictor in this case represents an economic effect on the return volatility.

This study has explored numerous potential independent variables that can explain the variance in the dependent variable. To find the most well-established relationship between the selected factors and return volatility during royal decrees and economic announcements, an OLS linear multiple regression analysis was conducted with the help of the statistical analysis EViews software. By using multiple regression analysis, it is possible to include two or more independent variables at the same time, which helps in determining/finding the combination of significant predictors with the highest explanatory power of the variance in the abnormal return. In addition, each significant predictor in this case represents an economic effect on the return volatility.

Before commencing multiple regression analysis, important conditions need to be met for the dataset to be acceptable. The variables in a regression model must comply with the normality assumption (i.e. the residuals are normally distributed, which can be checked with a normal probability plot in EViews), and the independent variables must be significant and tested for correlation/multicollinearity (see the comprehensive description in the respective subsections above). After the principle of the multiple regression model has been satisfied, regression analysis can be conducted. The general interpretation of a significant variable in multiple regression analysis is as follows. Depending on the signs of the coefficient, the model predicts that there will be a decrease or an increase in the dependent variables for an increase or decrease of one unit in the independent variable.

4.6.5 Model Selections

An OLS regression is run to formulate the first results and estimate the effect of royal decrees and Saudi and US economic announcements on aggregate stock market return volatility. The study estimates the five following OLS regression models:

4.6.5.1 Model 1

Saudi stock market (TASI):

$$\boldsymbol{RRV\_TASI_{j,t}} = c + a_1 TASI\ Liquidity_{j,t} + a_2 TASI\ Trading\ Volume_{j,t} + a_3 S\&P500_{j,t} + \beta_{Royal\ Decrees}\, D_{Royal\ Decrees} + \beta_{SA\ economic\ announcements}\, D_{SA\ economic\ announcements} + \beta_{US\ economic\ announcements}\, D_{US\ economic\ announcements} + \varepsilon_{jt} \quad (4.8)$$

where the dependent variable $RRV\_TASI_{j,t}$ is the RRV window for the TASI in 30-minute intervals. Each RRV window includes six observations in 5-minute intervals based on realised volatility to capture the effect of the persistence of volatility (Andersen, Bollerslev, Diebold, & Vega, 2003; Gropp & Kadareja, 2012; Smales, 2013). The coefficient c is the constant term. The parameter a_1 is expected to have a positive or negative effect on $Liquidity_{j,t}$ on the $RRV\_TASI_{j,t}$. $Liquidity_{j,t}$ is TASI liquidity as an independent variable in the 30-minute window. The parameter a_2 is expected to have a positive or negative effect on $Trading\ Volume_{j,t}$ on the $RRV\_TASI_{j,t}$. $Trading\ Volume_{j,t}$ is the TASI trading volume as an independent variable in the 30-minute window. The parameter a_3 is expected to have a positive or negative effect on $S\&P500_{j,t}$ on the $RRV\_TASI_{j,t}$. $S\&P500_{j,t}$ is the S&P 500 Index as an independent variable in the 30-minute window.

Further, the parameter $\beta_{Royal\ Decrees}$ is expected to have a positive effect on the royal decree type in the rolling window on the $RRV\_TASI_{j,t}$. $D_{Royal\ Decrees}$ is RD*N of the dummy variable that represents the Saudi royal decree and equals 1 if a royal decree is made in the rolling window N and 0 otherwise. The parameter $\beta_{SA\ economic\ announcements}$ has a positive or negative effect of Saudi macroeconomic announcements on the Saudi stock market. In addition, $D_{SA\ economic\ announcements}$ is SA*N of the dummy variable representing Saudi macroeconomic announcements and equals 1 if a royal decree is made in the rolling window N and 0 otherwise. The parameter $\beta_{US\ economic\ announcements}$ has a positive or negative effect for US macroeconomic announcements on the TASI. Similarly, $D_{US\ economic\ announcements}$ is US*N of the dummy variable that represents US macroeconomic announcements and equals 1 if a royal decree is made in the rolling window N and 0 otherwise. ε_{jt} is a random error term.

To determine the effects of royal decrees and economic announcements on the Saudi stock market, this study builds a dummy matrix for three groups of variables: royal decrees, Saudi economic announcements and US economic announcements. A 12 x 3 dummy matrix was created to measure the effect of the announcement from the first window to the twelfth RRV window. For example, when using data on royal decrees, the dummy variables are defined as follows:

$D_{Royal\ Decrees\ 1}$ =1, if royal decree $N1$ (10:30), 0 otherwise.

$D_{Royal\ Decrees\ 2}$ =1, if royal decree $N2$ (10:35), 0 otherwise.

$D_{Royal\ Decrees\ 3}$ =1, if royal decree $N3$ (10:40), 0 otherwise. And so on.

The steps below for creating a dummy for royal decrees table follow a specific example to give the reader a clearer picture of how to measure the dummy data matrix.

Time	RD1	RD2	RD3	RD4	RD5	RD6	RD7	RD8	RD9	RD10	RD11	RD12
10:29:59	1	0	0	0	0	0	0	0	0	0	0	0
10:34:59	0	1	0	0	0	0	0	0	0	0	0	0
10:39:59	0	0	1	0	0	0	0	0	0	0	0	0
10:44:59	0	0	0	1	0	0	0	0	0	0	0	0
10:49:59	0	0	0	0	1	0	0	0	0	0	0	0
10:54:59	0	0	0	0	0	1	0	0	0	0	0	0
10:59:59	0	0	0	0	0	0	1	0	0	0	0	0
11:04:59	0	0	0	0	0	0	0	1	0	0	0	0
11:09:59	0	0	0	0	0	0	0	0	1	0	0	0
11:14:59	0	0	0	0	0	0	0	0	0	1	0	0
11:19:59	0	0	0	0	0	0	0	0	0	0	1	0
11:24:59	0	0	0	0	0	0	0	0	0	0	0	1

4.6.5.2 Model 2

TBNI:

$$\boldsymbol{RRV\_TBNI_{j,t}} = c + a_1 TBNI\ Liquidity_{j,t} + a_2 TBNI\ Trading\ Volume_{j,t} + \beta_{Royal\ Decrees} D_{Royal\ Decrees} + \beta_{SA\ economic\ announcements} D_{SA\ economic\ announcements} + \beta_{US\ economic\ announcements} D_{US\ economic\ announcements} + \varepsilon_{jt} \quad (4.9)$$

4.6.5.3 Model 3

TENI:

$$\boldsymbol{RRV\_TENI_{j,t}} = c + a_1 TENI\ Liquidity_{j,t} + a_2 TENI\ Trading\ Volume_{j,t} + \beta_{Royal\ Decrees} D_{Royal\ Decrees} + \beta_{SA\ economic\ announcements} D_{SA\ economic\ announcements} + \beta_{US\ economic\ announcements} D_{US\ economic\ announcements} + \varepsilon_{jt} \quad (4.10)$$

4.6.5.4 Model 4

TMTI:

$$\boldsymbol{RRV\_TMTI_{j,t}} = c + a_1 TMTI\ Liquidity_{j,t} + a_2 TMTI\ Trading\ Volume_{j,t} + \beta_{Royal\ Decrees} D_{Royal\ Decrees} + \beta_{SA\ economic\ announcements} D_{SA\ economic\ announcements} + \beta_{US\ economic\ announcements} D_{US\ economic\ announcements} + \varepsilon_{jt} \quad (4.11)$$

4.6.5.5 Model 5

TTSI:

$$\boldsymbol{RRV\_TTSI_{j,t}} = c + a_1 TTSI\ Liquidity_{j,t} + a_2 TTSI\ Trading\ Volume_{j,t} + \beta_{Royal\ Decrees} D_{Royal\ Decrees} + \beta_{SA\ economic\ announcements} D_{SA\ economic\ announcements} + \beta_{US\ economic\ announcements} D_{US\ economic\ announcements} + \varepsilon_{jt} \quad (4.12)$$

4.7 Summary

This study uses high-frequency data analysis at 5-minute intervals by estimated rolling volatility window by averaging six uniform observations based on the realised volatility over 30-minute windows to determine the effect of royal decrees and macroeconomic announcements on the volatility of the TASI, and it compares four industrial sectors in the Saudi stock market (banks, energy, materials and telecommunications). The study is exploratory and consists of two parts. The first part focuses on the Saudi stock market (TASI) for the period of April 2014 to June 2019, for which there are 75,000 observations. A multiple linear regression model is applied to answer the first three research questions. The second part analyses four sectors in the Saudi stock market (banks, energy, materials and telecommunications) for the period of January 2017 to June 2017, for which there are 38,000 observations. A multiple linear regression model is used to examine the interaction of the sectors with royal decrees and economic announcements. The descriptive statistics and time plots are analysed first, and then data normalisation is conducted so the data can be modified by creating shifted scaled data versions to reduce outliers caused by anomalies in the time series. This will make the values vividly comparable. Moreover, probabilities, t-statistics, f-statistics, the coefficient of determination and various other data reliability tests will be conducted to ensure that the test results and the research are reliable.

Chapter 5: Data Analysis, Results and Discussion

One of the biggest drawbacks of the EMH is that users and stakeholders often underreact or overreact to news and announcements. Generally, stock prices tend to skyrocket when investors overreact to news that is not anticipated and plummet when investors underreact to anticipated news. This type of behaviour from investors is called irrational because their attitudes towards news overweigh recent information compared with underweighing fundamental and relevant information. Stock prices tend to be consistent in the long run because fundamental information remains the same in the long run.

This chapter will elaborate on the empirical results obtained using the methodology explained in Chapter 4, whereby the model of RRV window was employed to estimate the intraday volatility of the Saudi stock market (TASI) and four sectors (banks: TBNI; energy: TENI; materials: TMTI; telecommunications: TTSI) to answer the research questions (page 21).

To address the aforementioned research questions, this chapter presents the descriptive statistics of the Saudi stock market returns and patterns of the volatility of returns. In addition, explaining the results from the tests will help determine which model to use in the analysis and whether any adjustments have to be made to the selected models to ensure they produce robust results. Thus, statistical tests were performed to help choose the model that was most adequate for this study. These tests were conducted prior to the analysis of the relationship between royal decrees, economic announcements and the stock market because using the wrong model would result in misleading and incorrect results. The first section of this chapter presents the results of the Saudi stock market index and a discussion of the effects of public information arrivals, proxies by royal decrees and economic announcements on the TASI volatility of returns. The second section reviews the results of the chosen sectors and discusses the effects of royal decrees and economic announcements on these sectors.

5.1 Saudi Stock Market Results

5.1.1 Rolling Realised Volatility

This study applied the model of RRV to evaluate the intraday volatility of the TASI for the sample period of 2014–2019, as discussed in Chapter 4. By assuming that the mean of the returns in logarithm form is approximately zero as the data intervals diminish, and by following the theory of quadratic variation, the method that has been applied to calculate the RRV is the mean of squared log returns over 30-minute windows, which iterates every 5 minutes (see Figure 5.1). The current study employs RRV, which is TASI trading volume and TASI liquidity, as well as the S&P 500 Index. In the next section, the volatility of TASI returns is graphically presented, and descriptive statistics are shown for intraday returns.

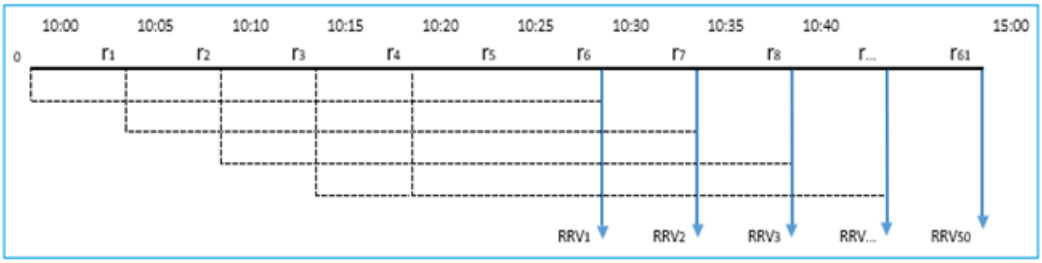

Figure 5.1: Scheme for Collecting RRV Window

5.1.2 Descriptive Statistics of Variables

Table 5.1 presents the descriptive statistics for the period of April 2014 to June 2019 for TASI liquidity, TASI trading volume, TASI and S&P 500 Index. The descriptive statistics present the mean monthly returns and standard deviation, median, skewness and kurtosis, minimum and maximum, Jacque-Bera statistics and p-values of the sample variables.

During the observation period for all sample variables, there are 74,582 volatility observations. The average intraday volatility of TASI returns is 0.00055, the average of TASI liquidity is 0.03839, the mean of TASI volume is 0.03812 and the mean of the S&P 500 Index is 0.00157. The minimum intraday is 0.01021 and the maximum intraday is 7.20981. Given that volatility is measured using standard deviation, the observations show that TASI liquidity has a higher standard deviation than other variables. The selected variables show a positive skewness ranging from 2.20 to 3.66. The recorded kurtosis of the variables ranges from 9.28 to 31.44. This shows that there is a thick tail on

both sides, also known as leptokurtic distribution, and there is a peak around the mean, which implies that the RRV of the variables is not normally distributed. The findings of the volatility and returns are similar to the findings of Gropp and Kadareja (2012) and Andersen, Bollerslev, Diebold and Labys (2003). The Jarque-Bera statistics show that all of the variables are positive and significant, as the respective p-values are less than 0.0001.

Table 5.1: Descriptive Statistics of RRV of Variables, April 2014 to June 2019

	TASI	TASI Liquidity	TASI Volume	S&P 500 Index
Mean	0.00055	0.58971	0.57195	0.00246
Median	0.00048	0.03839	0.03812	0.00157
Maximum	0.01021	7.19620	7.20981	0.02102
Minimum	0.00000	0.00000	0.00000	0.00000
Std. Dev.	0.00053	1.32018	1.27884	0.00264
Skewness	3.66700	2.64095	2.64500	2.20919
Kurtosis	31.44311	9.28039	9.33011	10.06370
Jarque-Bera	2,681,217.00	209,270.50	211,484.30	215,721.70
Probability	0.00000	0.00000	0.00000	0.00000
Sum	41.22941	43,981.98	42,656.87	183.14960
Sum Sq. Dev.	0.02094	129,984.80	121,973.00	0.52053
Observations	74,582	74,582	74,582	74,582

Note: Variables include the Saudi stock market (TASI), TASI liquidity, TASI trading volume and S&P 500 returns.

5.1.3 Tadawul All Share Index Values, Returns and Volatility

Figure 5.2 presents the time-series movements of the TASI returns, index value and volatility for the period 2014–2019. The figure shows that TASI returns were highly volatile from 2014 to 2016, with the TASI price decreasing from 11,000 points in 2014 to 5,500 points in 2016. The most likely reason for the high volatility during that period was the oil crisis in 2014, which not only affected TASI but also affected the economy of Saudi Arabia as a whole, often known as a 'rentier state'[3] for its oil-dependent economy.

[3] A 'rentier state' refers to a country that garners a substantial portion of its income from external sources—most generally from the sales of resources such as oil and gas. Examples of rentier states include oil-producing countries in the Middle East and North Africa region such as Algeria, Iran, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates, as well as a few states in Latin America, all of whom are members of OPEC.

Therefore, fluctuations in oil prices are reflected in the Saudi stock market. To transform the economy and its heavy dependence on oil, the government of Saudi Arabia launched Saudi Vision 2030 through a royal decree in 2016. The announcement was accompanied by a promise to transform the economy from a rentier state to a productivity economy by 2030 through an ongoing commitment by the government. Following the royal decree in 2016, the TASI started recovering and stabilising in the following years, increasing from 5,500 points in 2016 to 9,000 points in 2019. This shows that royal decrees and government announcements have a significant effect on the stock market, and these announcements are highly effective in stabilising the stock market.

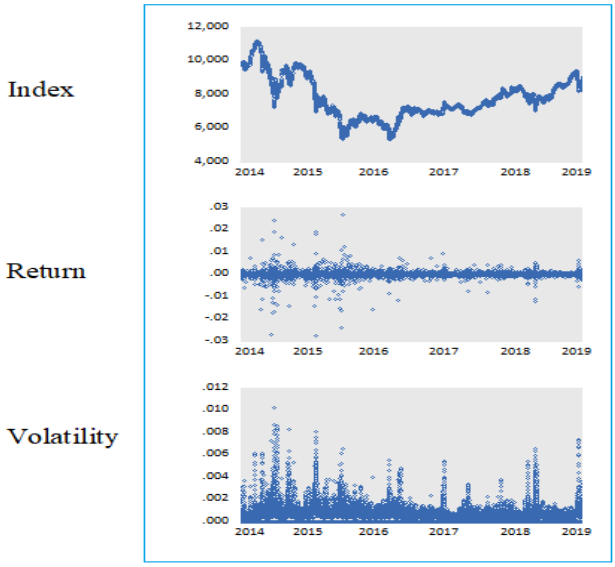

Figure 5.2: TASI Values, Returns and Volatility 2014–2019

5.1.4 Empirical Finding

During the observation period of 2014–2019, this study used the coefficients that resulted from the OLS method with robust standard errors to investigate the effects of economic announcements and royal decrees on TASI volatility. The discussion of the empirical findings is presented in three subsections, which discuss the autocorrelation and stationary tests of volatility and the effects of economic announcements and royal decrees.

5.1.4.1 Unit Root Test

To identify whether a series is stationary, the ADF test is conducted. Table 5.2 shows the results for the unit root test for the variables in the study for the period 2014–2019. The results show that the values for all variables are significantly higher than the critical

values mentioned in the lower part of the table. The p-values of the obtained coefficients are found to be lower than 0.001; however, the conclusion obtained by analysing the coefficient values remains the same even if the verdict is given on behalf of p-values.

The results reveal that none of the variables under study have the unit root; thus, the null hypothesis is rejected at the 1% level of significance. The null hypothesis is also rejected at the 5% and 10% levels of significance. Given that the series for all variables has significantly higher coefficients than critical values, this means that the series is stationary at level (without taking the first difference). When the series is found to be integrated at a lower order than I(1), OLS may be employed, since long-term relationship of turnover and lagged returns are to be analyses, cointegration has an advantage over the OLS to be used.

Table 5.2: Testing the Null Hypothesis of a Unit Root

Testing the Null Hypothesis of a Unit Root (at Level)						
ADF Unit Root Test						
Deterministic Components: Constant						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TASI	−16.30245	−2.566	−2.861	−3.430	0.0000	Stationary
TASI Liquidity	−17.32121	−2.566	−2.861	−3.430	0.0000	Stationary
TASI Trading Volume	−17.39613	−2.566	−2.861	−3.430	0.0000	Stationary
S&P 500 Index	−16.06838	−2.566	−2.861	−3.430	0.0000	Stationary
Deterministic Components: Constant and Trend						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TASI	−16.88919	−3.126	−3.409	−3.958	0.0000	Stationary
TASI Liquidity	−32.55814	−3.126	−3.409	−3.958	0.0000	Stationary
TASI Trading Volume	−32.50723	−3.126	−3.409	−3.958	0.0000	Stationary
S&P 500 Index	−16.06818	−3.126	−3.409	−3.958	0.0000	Stationary
Deterministic Components: None						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TASI	−7.982627	−1.616	−1.940	−2.564	0.0000	Stationary
TASI Liquidity	−5.527951	−1.616	−1.940	−2.564	0.0000	Stationary
TASI Trading Volume	−5.543924	−1.616	−1.940	−2.564	0.0000	Stationary
S&P 500 Index	−10.49861	−1.616	−1.940	−2.564	0.0000	Stationary

Test interpretation: If the computed p-value of a result is lower than the significance level alpha = 5%, as extreme as the sample result if the null hypothesis were true, then the null hypothesis is rejected. Therefore, no unit root is found in the data, which means the data series is stationary.

5.1.4.2 Autocorrelation Test

When using multiple regression models to analyse data, there are some assumptions that should be satisfied. One of these is that the error terms of the dependent variables should be independent of each other. If autocorrelation problems exist, the assumption will no longer be fulfilled and the estimator will not become a best linear unbiased estimator. Therefore, the t-test and F-test will not work properly.

This study uses the serial correlation LM test to check whether autocorrelation problems existed. The null hypothesis of the test is that there is no serial correlation in the residuals up to the specified order. EViews reports a statistic labelled 'F-statistic' and an 'Obs*R-squared' (the number of observations × the R-square) statistic. The statistic has an asymptotic distribution under the null hypothesis.

To test autocorrelation, a scheme of the autocorrelation of disturbances in the alternative hypothesis must be defined. An autocorrelation test illustrates whether the variables are correlated to each other. Table 5.3 shows the results for the correlation LM test for the variables in the study.

Table 5.3: Correlation Analysis of the Variables

Breusch-Godfrey Serial Correlation LM Test			
Null hypothesis: No serial correlation at up to two lags			
F-statistic	144418.5	Prob. F(2,74540)	0.0000
Obs*R-squared	59282.90	Prob. chi-square(2)	0.0000

The results in Table 5.3 show that the model suffers from autocorrelation ($p < 0.000$) and that the variable current value is affected by its previous values.

5.1.4.3 Multiple Regression Models

This section of the analysis focuses on the effects of royal decrees and Saudi and US economic announcements on Saudi stock market returns. The analysis includes TASI liquidity and trading volume, as well as S&P 500 Index. This can identify the relationship between the aforementioned independent variables and TASI. In actual stock markets, most investors are unable to obtain the actual fundamental value, and their expected value will be higher during government policy decisions or economic announcements that can produce positive reactions in financial markets.

To investigate the effects of royal decrees and economic announcements on the TASI return, the multiple regression model is applied to analyse the extent to which these variables affect the movement of the TASI return. To estimate the multiple regression models, the OLS method is applied for 74,582 observations from 17 April 2014 to 30 June 2019. The dependent variable for the model is the TASI return, and the independent variables are royal decree, Saudi economic announcements, US economic announcements, TASI liquidity and TASI trading volume, and S&P 500 Index. Table 5.4 presents the results of the OLS estimation to help understand how royal decrees and economic announcements affect the TASI return, which is the primary concern of the research. The regression output shows an F-statistic of 274.9315 and a probability of 0.0000, which implies that the regression model and the variables as a whole are significant for the model. The R-square for the model is 0.125754 and the adjusted R-square is 0.125297. However, the low R-square does not imply that the model is miss-specified when the regression output of squared returns is considered for the model (Alexander, 2001). The post-estimation tests (i.e. Durbin–Watson) statistic of 0.161294 means that the model does not suffer from autocorrelation. The nature of the dependent and independent variables is discussed below. King (1986) mentioned that "the purpose of regression analysis and of all parametric statistical analyses is to estimate interesting population parameters. The best regression model usually has an R-squared that is lower than could be obtained otherwise" (King, 1986 p. 677).

Table 5.4: Estimated Multiple Regression Models for TASI

Dependent Variable: RRV_TASI				
Method: Least Squares				
Sample: 4/17/2014 11:00 6/30/2019 14:59				
Included observations: 74,582				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000395	2.48E-06	159.4383	0.0000
TASI Liquidity	8.02E-05	0.000291	0.275825	0.7827
TASI Trading Volume	0.001641	0.000299	5.491949	0.0000
S&P 500 Index	0.033098	0.000712	46.51795	0.0000
D RD 1	0.000111	2.95E-05	3.759968	0.0002
D RD 2	0.000122	2.94E-05	4.159076	0.0000
D RD 3	0.000121	2.94E-05	4.107266	0.0000
D RD 4	0.000113	2.94E-05	3.838021	0.0001
D RD 5	0.000106	2.93E-05	3.621835	0.0003
D RD 6	0.000103	2.93E-05	3.523400	0.0004
D RD 7	9.67E-05	2.93E-05	3.297189	0.0010
D RD 8	9.11E-05	2.93E-05	3.105432	0.0019
D RD 9	8.38E-05	2.93E-05	2.858414	0.0043
D RD 10	7.86E-05	2.93E-05	2.678657	0.0074
D RD 11	7.22E-05	2.93E-05	2.463548	0.0138
D RD 12	6.38E-05	2.93E-05	2.174316	0.0297
D ECO SA 1	0.000196	3.09E-05	6.348095	0.0000
D ECO SA 2	0.000185	3.09E-05	5.997158	0.0000
D ECO SA 3	0.000175	3.09E-05	5.680179	0.0000
D ECO SA 4	0.000160	3.09E-05	5.177199	0.0000
D ECO SA 5	0.000147	3.09E-05	4.767558	0.0000
D ECO SA 6	0.000131	3.09E-05	4.246696	0.0000
D ECO SA 7	0.000113	3.09E-05	3.666728	0.0002
D ECO SA 8	9.93E-05	3.09E-05	3.215990	0.0013
D ECO SA 9	8.54E-05	3.09E-05	2.767893	0.0056
D ECO SA 10	7.63E-05	3.09E-05	2.470522	0.0135
D ECO SA 11	6.73E-05	3.09E-05	2.179717	0.0293
D ECO SA 12	6.35E-05	3.09E-05	2.056020	0.0398
D ECO US 1	3.89E-05	5.20E-05	0.746842	0.4552
D ECO US 2	4.15E-05	5.20E-05	0.798340	0.4247
D ECO US 3	3.42E-05	5.20E-05	0.658440	0.5103
D ECO US 4	4.15E-05	5.20E-05	0.797449	0.4252
D ECO US 5	4.69E-05	5.20E-05	0.900819	0.3677
D ECO US 6	5.91E-05	5.20E-05	1.136149	0.2559
D ECO US 7	7.11E-05	5.20E-05	1.366060	0.1719
D ECO US 8	7.35E-05	5.20E-05	1.413422	0.1575
D ECO US 9	7.63E-05	5.20E-05	1.466160	0.1426
D ECO US 10	7.05E-05	5.20E-05	1.356107	0.1751
D ECO US 11	6.07E-05	5.20E-05	1.167062	0.2432
D ECO US 12	4.62E-05	5.20E-05	0.887450	0.3748
R-squared	0.125754	Mean dependent var		0.000553
Adjusted R-squared	0.125297	S.D. dependent var		0.000530
S.E. of regression	0.000496	Akaike info criterion		−12.38101
Sum squared resid.	0.018310	Schwarz criterion		−12.37607
Log likelihood	461740.4	Hannan-Quinn criter.		−12.37949
F-statistic	274.9315	Durbin–Watson stat		0.161294
Prob(F-statistic)	0.000000			

Note: The table reports the estimation results of Equation (4.8).

Table 5.4 shows that the royal decree has a significant and positive effect on the TASI return. This implies that when there is an unscheduled announcement from the government in the form of a royal decree, the expected value for investors increases, resulting in a positive increase in the stock return. This implies that the TASI return positively shifts upwards when there is a royal decree announcement. This has a greater implication for the economic development of Saudi Arabia. As royal decrees increase the TASI return, the government can use this instrument as a tool to stabilise the stock market, attract investors and boost investors' confidence, which will help Saudi Arabia achieve its long-term Vision 2030. Economic announcements by Saudi Arabia also have a positive and significant effect on the index return of the TASI. This implies a positive return for investors because their expected returns increase when Saudi Arabia announces economic indicators through monthly, quarterly, half-yearly and yearly SAMA reports. This has also become an instrument for the government to positively influence the stock market and increase investors' confidence through positive and forward-looking economic announcements that aim to reform the economy. However, the research finds no significant effect of US economic announcements on the TASI return. The Saudi riyal was officially pegged to the US dollar at 1 riyal = 3.75 USD in June 1986, which may indicate that if there an announcement regarding the US economy may affect in some way on Saudi economy even on the Saudi Stock Exchange, as well as considering the strength of the political and economic relationship between Saudi Arabia and the US. However, the results of this study show that US economic announcements do not have a profound effect on the movement of the TASI return; in fact, TASI liquidity does not have a significant effect on the TASI return. This implies that TASI liquidity does not affect the movement of the TASI return significantly. However, the TASI trading volume has a positive and significant effect on the index return of the TASI. This implies that when the trading volume increases, the expected returns increase, resulting in an overall positive movement in the TASI return. The S&P 500 Index also has a positive and significant effect on the TASI return. The S&P 500 Index is a leading equity benchmark for the US stock market. This variable helps in understanding international stock market effects on the TASI return. The diversity and efficiency of the S&P 500 Index mean that it has a significant and positive effect on the TASI return.

Additional analysis is conducted to examine the direct relationship between TASI liquidity and the TASI to ensure the reliability and validity of the findings in relation to TASI liquidity.

Table 5.5: Estimated Multiple Regression Models for TASI

Dependent Variable: RRV_TASI				
Method: Least Squares				
Sample: 4/17/2014 11:00 6/30/2019 14:59				
Included observations: 74582				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000465	2.10E-06	221.5153	0.0000
TASI Liquidity	0.001842	2.09E-05	87.92323	0.0000
R-squared	0.093919	Mean dependent var		0.000553
Adjusted R-squared	0.093907	S.D. dependent var		0.000530
S.E. of regression	0.000504	Akaike info criterion		−12.34627
Sum squared resid	0.018977	Schwarz criterion		−12.34602
Log likelihood	460406.6	Hannan-Quinn criter.		−12.34619
F-statistic	7730.495	Durbin–Watson stat		0.171247
Prob(F-statistic)	0.000000			

Table 5.5 shows that there is an important relationship and influence between liquidity and the general market index for the Saudi stock market when that relationship is directly tested. The next section examines the interaction of sectors in the Saudi stock market with public information.

5.2 Sectors Indices

5.2.1 Rolling Realised Volatility

As discussed in Chapter 4, this study employs the model of RRV to estimate the intraday volatility of TASI returns during the sample period (2017–2019). The study applied RRV to the endogenous variables (TBNI, TENI, TMTI and TTSI). The descriptive statistics and graphical patterns of the volatility of TASI returns during intraday trading are provided in the following sections.

5.2.2 Descriptive Statistics of Sectors

For the period of January 2017 to June 2019, the descriptive statistics for the sectors' indexes are presented in Table 5.6. The descriptive statistics present the mean monthly returns and standard deviation, median, skewness and kurtosis, minimum and maximum, Jacque-Bera statistics and p-values of the sample variables.

During the observation period for all sample variables, there are 37,698 observations. The average volatility of the banks sector TBNI returns is 0.000753, the average of the energy sector TENI returns is 0.001021, the average of the materials sector TMTI returns is 0.000703 and the average of the telecommunications sector TTSI returns is 0.001031.

The minimum intraday for the TTSI sector is 9.04E-06 and the maximum intraday for the TENI sector is 0.026096. Volatility is measured using standard deviation, and the observations show that TASI liquidity has a higher standard deviation than the other variables. The TTSI sector has a higher standard deviation of 0.000910, closely followed by the TENI sector, which has a standard deviation of 0.000857. This implies that the TTSI and TENI sectors are more volatile than the TBNI and TMTI sectors. The skewness ranges from 2.650939 to 2.978825, and the kurtosis of the observed variables ranges from 22.57470 to 28.12802, indicating a tick tail on both sides. The kurtosis and skewness data show that the observed variables are normally distributed across industries.

Table 5.6: Descriptive Statistics of Sectors

	RRV_TBNI	RRV_TENI	RRV_TMTI	RRV_TTSI
Observations	37,698	37,698	37,698	37,698
Mean	0.000753	0.001021	0.000703	0.001031
Median	0.000707	0.000950	0.000705	0.000909
Maximum	0.01546	0.026096	0.020566	0.015809
Minimum	0.000179	7.84E-05	0.000127	9.04E-06
Std. Dev.	0.000589	0.000857	0.000520	0.000910
Skewness	2.666738	2.978825	2.731312	2.650939
Kurtosis	25.99977	26.11926	28.12802	22.57470

5.2.3 Sectors Values, Returns and Volatility

Figure 5.4 presents the time-series movement of returns, index value and volatility for the period 2017–2019 for four sectors—TBNI, TENI, TMTI and TTSI—in the Saudi Stock Exchange. It shows that, across all four industries, the variables were volatile during this period. The index, return and volatility increased and decreased for a considerable period as a result of regional geopolitical developments and fluctuations in oil prices, which are the main determinants of investor sentiment in the Saudi stock market. During the third quarter of 2018, the overall market decreased by 4% (314 points) and continued its decline by 2% (173 points) during the last quarter of 2018. This was in conjunction with a sharp decline in oil prices during the period, in which Brent Crude fell below US$51 a barrel. To address this critical weak link and to make the economy of Saudi Arabia sustainable, the government of Saudi Arabia issued a royal decree regarding a set of economic packages and fiscal initiatives to support the Kingdom's economy in all fields. Moreover, Tadawul and the CMA issued a number of regulatory measures in 2018. In 2019, they announced that the Saudi stock market had been included in the MSCI Emerging Market Index and S&P's Dow Jones Indexes, and four phases have been implemented for the market's accession to the Financial Times Stock Exchange (FTSE) Russell Index. As a result, the stock market and the economy of Saudi Arabia started recovering, and investors started gaining trust in the government's promise to transform and diversify the economy. Therefore, Saudi Arabia's stock market has been positively affected by the government announcement and royal decree.

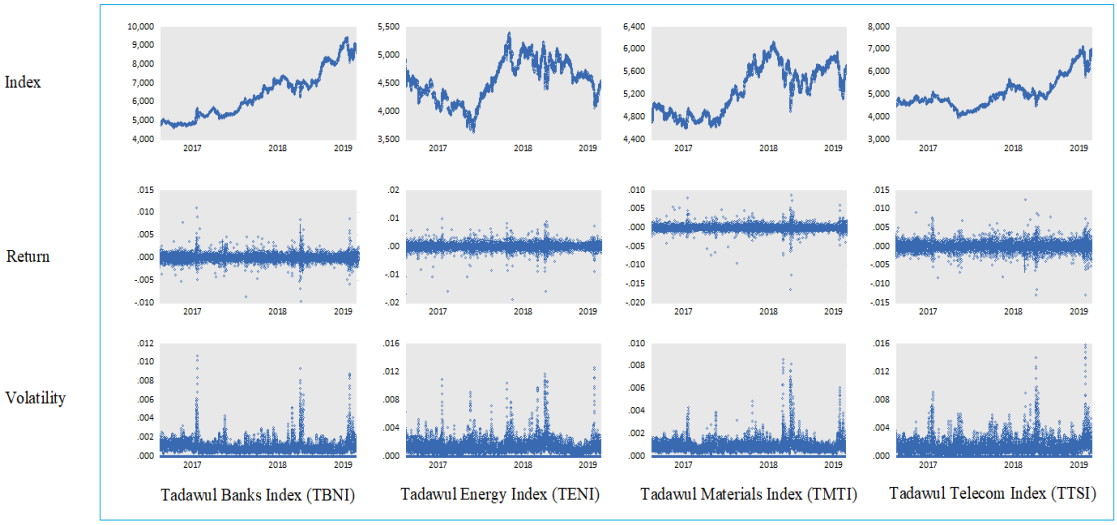

Figure 5.3: Intraday Returns Across Four Selected Sectors, 2017–2019

5.2.4 Empirical Findings

This section presents the empirical findings for the selected variables across the four industries during the period 2017–2019. The first subsection presents the stationarity of the variables using the unit root test, and the second subsection presents the findings of the multiple regression models using the OLS method. The section further uses OLS to estimate and discuss the effects of royal decrees and economic announcements on the four industry indexes in the Saudi stock market.

5.2.4.1 Unit Root Test

To test stationarity and no stationarity for the four sectors' index returns, an ADF test is employed. The results show a significant p-value, which means that all four sub-index variables are stationary. Given that the series for all variables have significantly higher coefficients than critical values, this meant that the series is stationary at level (without taking the first difference). When the series is found to be integrated at a lower order than I(1), OLS may be employed. Therefore, the OLS method is applied to estimate the four sub-indices models to investigate how these sub-indices are affected by the royal decree and economic announcements of the Saudi government.

Table 5.7: Testing the Null Hypothesis of a Unit Root

Testing the Null Hypothesis of a Unit Root (at level)						
ADF Unit Root Test						
Deterministic Components: Constant						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TBNI	−13.67825	−2.566	−2.861	−3.430	0.0000	Stationary
TENI	−15.42696	−2.566	−2.861	−3.430	0.0000	Stationary
TMTI	−14.67421	−2.566	−2.861	−3.430	0.0000	Stationary
TTSI	−15.66844	−2.566	−2.861	−3.430	0.0000	Stationary
Deterministic Components: Constant and Trend						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TBNI	−13.92656	−3.126	−3.409	−3.958	0.0000	Stationary
TENI	−15.43316	−3.126	−3.409	−3.958	0.0000	Stationary
TMTI	−14.68159	−3.126	−3.409	−3.958	0.0000	Stationary
TTSI	−15.72951	−3.126	−3.409	−3.958	0.0000	Stationary
Deterministic Components: None						
Variables	**Test Statistic**	**Critical Value**			**P-value**	**Result**
		10%	**5%**	**1%**		
TBNI	−5.242721	−1.616	−1.940	−2.565	0.0000	Stationary
TENI	−6.345889	−1.616	−1.940	−2.565	0.0000	Stationary
TMTI	−5.176742	−1.616	−1.940	−2.565	0.0000	Stationary
TTSI	−6.542301	−1.616	−1.940	−2.565	0.0000	Stationary

Test interpretation: If the computed p-value of a result is lower than the significance level alpha = 5%, as extreme as the sample result if the null hypothesis were true, then the null hypothesis is rejected. Therefore, no unit root is found in the data, which means the data series is stationary.

5.2.4.2 Multiple Regression Models

This section presents the findings of the multiple regression models to understand the effect of royal decrees and Saudi and US economic announcements on Saudi stock market returns across four industries (TBNI, TENI, TMTI and TTSI). The independent variables are liquidity and trading volume, as well as royal decree, which is the original contribution of the research, and the Saudi and US economic announcements.

Table 5.8 presents the findings of model 1. The results show that TBNI liquidity has a significant and positive effect on the TBNI return. TBNI is also significantly affected by royal decrees and Saudi economic announcements. In contrast, the TBNI trading volume and US economic announcements have an insignificant effect on TBNI volatility.

Table 5.8: Estimated Multiple Regression Models for TBNI

Dependent Variable: TBNI				
Method: Least Squares				
Sample: 1/8/2017 10:00 6/30/2019 14:59				
Included observations: 37,698				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000615	3.63E-06	169.3568	0.0000
TBNI Liquidity	0.002702	0.000325	8.301989	0.0000
TBNI Trading Volume	−0.000341	0.000328	−1.041245	0.2978
D RD 1	9.42E-05	4.69E-05	2.009647	0.0445
D RD 2	0.000115	4.68E-05	2.464238	0.0137
D RD 3	0.000126	4.68E-05	2.690897	0.0071
D RD 4	0.000127	4.68E-05	2.713455	0.0067
D RD 5	0.000129	4.68E-05	2.766859	0.0057
D RD 6	0.000127	4.68E-05	2.726354	0.0064
D RD 7	0.000124	4.67E-05	2.655358	0.0079
D RD 8	0.000120	4.67E-05	2.567213	0.0103
D RD 9	0.000114	4.67E-05	2.435288	0.0149
D RD 10	0.000112	4.67E-05	2.401298	0.0163
D RD 11	0.000101	4.69E-05	2.144611	0.0320
D RD 12	0.000102	4.69E-05	2.169864	0.0300
D ECO SA 1	0.000111	4.74E-05	2.344637	0.0191
D ECO SA 2	0.000126	4.74E-05	2.653061	0.0080
D ECO SA 3	0.000151	4.71E-05	3.196138	0.0014
D ECO SA 4	0.000155	4.71E-05	3.288586	0.0010
D ECO SA 5	0.000155	4.71E-05	3.282913	0.0010
D ECO SA 6	0.000152	4.71E-05	3.223412	0.0013
D ECO SA 7	0.000148	4.71E-05	3.140404	0.0017
D ECO SA 8	0.000136	4.71E-05	2.889342	0.0039
D ECO SA 9	0.000124	4.71E-05	2.623514	0.0087
D ECO SA 10	0.000120	4.71E-05	2.553312	0.0107
D ECO SA 11	0.000120	4.71E-05	2.545770	0.0109
D ECO SA 12	0.000123	4.71E-05	2.608942	0.0091
D ECO US 1	−4.06E-05	8.00E-05	−0.506757	0.6123
D ECO US 2	−8.69E-06	7.99E-05	−0.108743	0.9134
D ECO US 3	1.70E-05	8.01E-05	0.211714	0.8323
D ECO US 4	4.28E-05	8.00E-05	0.534493	0.5930
D ECO US 5	5.96E-05	8.00E-05	0.744776	0.4564
D ECO US 6	8.09E-05	8.00E-05	1.011508	0.3118
D ECO US 7	9.98E-05	8.00E-05	1.247700	0.2121
D ECO US 8	0.000118	8.00E-05	1.476467	0.1398
D ECO US 9	0.000122	8.00E-05	1.519733	0.1286
D ECO US 10	0.000117	8.00E-05	1.464803	0.1430
D ECO US 11	0.000118	8.00E-05	1.471350	0.1412
D ECO US 12	0.000118	8.00E-05	1.469435	0.1417
R-squared	0.125754	Mean dependent var		0.000753
Adjusted R-squared	0.125297	S.D. dependent var		0.000589
S.E. of regression	0.000496	Akaike info criterion		−12.14237
Sum squared resid	0.018310	Schwarz criterion		−12.13354
Log likelihood	461740.4	Hannan-Quinn criter.		−12.13957
F-statistic	274.9315	Durbin–Watson stat		0.146064
Prob(F-statistic)	0.000000			

Note: The table reports the estimation results of Equation (4.9).

Table 5.9 presents the results of multiple regression models using the OLS method to estimate the findings of TENI liquidity, trading volume, royal decrees, and Saudi and US economic announcements. The results show that the TENI return is affected by TENI liquidity, royal decrees and Saudi economic announcements, while the TENI trading volume negatively and significantly affects the TENI return. In contrast, US economic announcements do not have a significant effect on the TENI return.

Table 5.10 presents the findings of model 3. The results show that TMTI liquidity, royal decrees and Saudi economic announcements have a positive and significant effect on the index return of the TMTI, while TMTI trading volume has a negative and significant effect on the TMTI return. In contrast, US economic announcements have an insignificant effect on the TMTI return.

Table 5.9: Estimated Multiple Regression Models for TENI

Dependent Variable: TENI				
Method: Least Squares				
Sample: 1/8/2017 10:00 6/30/2019 14:59				
Included observations: 37,698				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000781	5.28E-06	147.8467	0.0000
TENI Liquidity	0.009834	0.000500	19.67317	0.0000
TENI Trading Volume	−0.005358	0.000488	−10.96877	0.0000
D RD 1	0.000205	6.69E-05	3.063216	0.0022
D RD 2	0.000203	6.69E-05	3.032616	0.0024
D RD 3	0.000204	6.69E-05	3.053699	0.0023
D RD 4	0.000208	6.69E-05	3.109154	0.0019
D RD 5	0.000203	6.69E-05	3.039594	0.0024
D RD 6	0.000206	6.69E-05	3.083427	0.0020
D RD 7	0.000200	6.69E-05	2.988857	0.0028
D RD 8	0.000200	6.69E-05	2.992227	0.0028
D RD 9	0.000200	6.69E-05	2.995120	0.0027
D RD 10	0.000199	6.69E-05	2.976932	0.0029
D RD 11	0.000202	6.69E-05	3.014161	0.0026
D RD 12	0.000200	6.69E-05	2.993001	0.0028
D ECO SA 1	0.000199	7.12E-05	2.797129	0.0052
D ECO SA 2	0.000203	7.11E-05	2.846355	0.0044
D ECO SA 3	0.000223	7.11E-05	3.131680	0.0017
D ECO SA 4	0.000241	7.11E-05	3.383194	0.0007
D ECO SA 5	0.000254	7.11E-05	3.566408	0.0004
D ECO SA 6	0.000253	7.11E-05	3.553792	0.0004
D ECO SA 7	0.000256	7.11E-05	3.594928	0.0003
D ECO SA 8	0.000267	7.11E-05	3.754373	0.0002
D ECO SA 9	0.000280	7.11E-05	3.934739	0.0001
D ECO SA 10	0.000282	7.11E-05	3.964863	0.0001
D ECO SA 11	0.000291	6.76E-05	4.312827	0.0000
D ECO SA 12	0.000292	6.76E-05	4.329143	0.0000
D ECO US 1	−7.50E-05	0.000115	−0.654314	0.5129
D ECO US 2	−5.80E-06	0.000115	−0.050587	0.9597
D ECO US 3	−5.24E-05	0.000120	−0.435310	0.6633
D ECO US 4	−3.04E-06	0.000120	−0.025265	0.9798
D ECO US 5	4.08E-05	0.000120	0.338810	0.7348
D ECO US 6	7.82E-05	0.000120	0.649430	0.5161
D ECO US 7	0.000106	0.000120	0.879781	0.3790
D ECO US 8	0.000127	0.000120	1.052767	0.2925
D ECO US 9	0.000138	0.000120	1.147238	0.2513
D ECO US 10	0.000143	0.000120	1.189990	0.2341
D ECO US 11	0.000102	0.000120	0.848171	0.3963
D ECO US 12	7.11E-05	0.000120	0.590710	0.5547
R-squared	0.128875	Mean dependent var		0.001021
Adjusted R-squared	0.127996	S.D. dependent var		0.000857
S.E. of regression	0.000801	Akaike info criterion		−11.42162
Sum squared resid	0.024132	Schwarz criterion		−11.41279
Log likelihood	215325.1	Hannan-Quinn criter.		−11.41881
F-statistic	146.6130	Durbin–Watson stat		0.127983
Prob(F-statistic)	0.000000			

Note: The table reports the estimation results of Equation (4.10).

Table 5.10: Estimated Multiple Regression Models for TMTI

Dependent Variable: TMTI				
Method: Least Squares				
Sample: 1/8/2017 10:00 6/30/2019 14:59				
Included observations: 37,698				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000587	3.14E-06	186.7286	0.0000
TMTI Liquidity	0.002679	0.000214	12.54425	0.0000
TMTI Trading Volume	−0.000645	0.000228	−2.830669	0.0046
D RD 1	0.000108	4.16E-05	2.594271	0.0095
D RD 2	0.000120	4.16E-05	2.882272	0.0040
D RD 3	0.000134	4.16E-05	3.234061	0.0012
D RD 4	0.000139	4.16E-05	3.355125	0.0008
D RD 5	0.000147	4.16E-05	3.528809	0.0004
D RD 6	0.000145	4.16E-05	3.501287	0.0005
D RD 7	0.000140	4.16E-05	3.362453	0.0008
D RD 8	0.000152	4.13E-05	3.672441	0.0002
D RD 9	0.000141	4.13E-05	3.418007	0.0006
D RD 10	0.000132	4.13E-05	3.209299	0.0013
D RD 11	0.000121	4.13E-05	2.928629	0.0034
D RD 12	0.000114	4.13E-05	2.773004	0.0056
D ECO SA 1	0.000121	4.39E-05	2.753720	0.0059
D ECO SA 2	0.000127	4.39E-05	2.894661	0.0038
D ECO SA 3	0.000131	4.39E-05	2.984769	0.0028
D ECO SA 4	0.000128	4.39E-05	2.922119	0.0035
D ECO SA 5	0.000131	4.39E-05	2.983033	0.0029
D ECO SA 6	0.000124	4.41E-05	2.809696	0.0050
D ECO SA 7	0.000133	4.41E-05	3.013051	0.0026
D ECO SA 8	0.000143	4.41E-05	3.239712	0.0012
D ECO SA 9	0.000154	4.41E-05	3.486957	0.0005
D ECO SA 10	0.000157	4.20E-05	3.727486	0.0002
D ECO SA 11	0.000157	4.20E-05	3.727620	0.0002
D ECO SA 12	0.000158	4.20E-05	3.758398	0.0002
D ECO US 1	8.54E-05	7.07E-05	1.207458	0.2273
D ECO US 2	0.000115	7.07E-05	1.625189	0.1041
D ECO US 3	0.000138	7.07E-05	1.948562	0.0514
D ECO US 4	8.66E-05	7.44E-05	1.165329	0.2439
D ECO US 5	9.08E-05	7.44E-05	1.221027	0.2221
D ECO US 6	9.06E-05	7.44E-05	1.218019	0.2232
D ECO US 7	8.49E-05	7.43E-05	1.141897	0.2535
D ECO US 8	7.43E-05	7.43E-05	0.998837	0.3179
D ECO US 9	4.87E-05	7.44E-05	0.654547	0.5128
D ECO US 10	2.67E-05	7.44E-05	0.358501	0.7200
D ECO US 11	8.98E-06	7.44E-05	0.120770	0.9039
D ECO US 12	−5.90E-06	7.44E-05	−0.079263	0.9368
R-squared	0.097095	Mean dependent var		0.000703
Adjusted R-squared	0.096184	S.D. dependent var		0.000520
S.E. of regression	0.000494	Akaike info criterion		−12.38614
Sum squared resid	0.009198	Schwarz criterion		−12.37731
Log likelihood	233505.3	Hannan-Quinn criter.		−12.38333
F-statistic	106.5717	Durbin–Watson stat		0.155272
Prob(F-statistic)	0.000000			

Note: The table reports the estimation results of Equation (4.11).

Table 5.11 presents the findings of model 4. The results show that TTSI liquidity, royal decrees and Saudi economic announcements have a positive and significant effect on the index return of TTSI, while TTSI trading volume has a negative and significant effect on the TTSI return. In contrast, US economic announcements insignificantly affect the TTSI return.

Table 5.11: Estimated Multiple Regression Models for TTSI

Dependent Variable: TTSI				
Method: Least Squares				
Sample: 1/8/2017 10:00 6/30/2019 14:59				
Included observations: 37,698				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.000808	5.64E-06	143.2777	0.0000
TTSI Liquidity	0.007347	0.000200	36.82295	0.0000
TTSI Trading Volume	−0.003571	0.000196	−18.24923	0.0000
D RD 1	0.000166	7.24E-05	2.299078	0.0215
D RD 2	0.000191	7.23E-05	2.635279	0.0084
D RD 3	0.000201	7.23E-05	2.785230	0.0054
D RD 4	0.000207	7.23E-05	2.859295	0.0042
D RD 5	0.000200	7.23E-05	2.764042	0.0057
D RD 6	0.000188	7.23E-05	2.594715	0.0095
D RD 7	0.000177	7.23E-05	2.443768	0.0145
D RD 8	0.000155	7.23E-05	2.143763	0.0321
D RD 9	0.000148	7.18E-05	2.054632	0.0399
D RD 10	0.000124	7.18E-05	1.730290	0.0836
D RD 11	0.000109	7.18E-05	1.522234	0.1280
D RD 12	0.000104	7.18E-05	1.448524	0.1475
D ECO SA 1	0.000191	7.64E-05	2.494653	0.0126
D ECO SA 2	0.000225	7.64E-05	2.947189	0.0032
D ECO SA 3	0.000238	7.64E-05	3.119794	0.0018
D ECO SA 4	0.000248	7.64E-05	3.253500	0.0011
D ECO SA 5	0.000207	7.67E-05	2.700697	0.0069
D ECO SA 6	0.000174	7.67E-05	2.268040	0.0233
D ECO SA 7	0.000146	7.67E-05	1.898629	0.0576
D ECO SA 8	0.000140	7.31E-05	1.915459	0.0554
D ECO SA 9	0.000126	7.31E-05	1.718333	0.0857
D ECO SA 10	0.000114	7.31E-05	1.559208	0.1190
D ECO SA 11	0.000114	7.31E-05	1.559229	0.1190
D ECO SA 12	0.000111	7.31E-05	1.518989	0.1288
D ECO US 1	−0.000181	0.000123	−1.469206	0.1418
D ECO US 2	−4.95E-05	0.000123	−0.401976	0.6877
D ECO US 3	2.56E-05	0.000123	0.208187	0.8351
D ECO US 4	7.39E-05	0.000123	0.600639	0.5481
D ECO US 5	9.23E-05	0.000123	0.750737	0.4528
D ECO US 6	−1.61E-05	0.000129	−0.124815	0.9007
D ECO US 7	−5.02E-05	0.000129	−0.388099	0.6979
D ECO US 8	−5.27E-05	0.000129	−0.407241	0.6838
D ECO US 9	−5.64E-05	0.000129	−0.436357	0.6626
D ECO US 10	−3.55E-05	0.000129	−0.274039	0.7841
D ECO US 11	6.30E-06	0.000129	0.048695	0.9612
D ECO US 12	5.45E-05	0.000129	0.421079	0.6737
R-squared	0.109113	Mean dependent var		0.001031
Adjusted R-squared	0.108214	S.D. dependent var		0.000910
S.E. of regression	0.000860	Akaike info criterion		−11.27868
Sum squared resid	0.027841	Schwarz criterion		−11.26985
Log likelihood	212630.8	Hannan-Quinn criter.		−11.27587
F-statistic	121.3780	Durbin–Watson stat		0.123576
Prob(F-statistic)	0.000000			

Note: The table reports the estimation results of Equation (4.12).

Table 5.12 compares the findings of the four sub-index models with the original models to help understand the results and compare the findings for internal consistency.

Table 5.12: Comparing the Findings Across Models

Variables	Main Model (Table 5.4)	Model 1 (Table 5.8)	Model 2 (Table 5.9)	Model 3 (Table 5.10)	Model 4 (Table 5.11)
Index Liquidity	Insignificant	Significant	Significant	Significant	Significant
Trading Volume	Significant	Insignificant	Significant	Significant	Significant
S&P 500 Index	Significant	—	—	—	—
Royal Decree	Significant	Significant	Significant	Significant	Significant
SA Economic Announcement	Significant	Significant	Significant	Significant	Significant
US Economic Announcement	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

The first variable is TASI liquidity and respective index liquidity. The results show that TASI liquidity has an insignificant effect on the TASI return. In contrast, respective index liquidity has an insignificant effect on the respective sub-index returns (i.e. banks, energy, materials and telecommunications). The effect of liquidity is consistent for all four models, but the finding is consonant with the results of the main index when testing liquidity while ignoring other variables. The second—variable trading volume—has a significant effect on the TASI return. The results are similar for the other three sub-indices, except for the banking sector, where trading volume has an insignificant effect on the index return. The third variable—S&P 500 Index—has a positive effect on the TASI return. However, in the sub-models, the S&P 500 Index variable has been dropped to ensure the reliability of the findings and to consider the interaction of the sectors in the market. The fourth variable is the royal decree, which is this study's original contribution to the research. The results show that the royal decree has a positive and significant effect on the TASI return. Similar to the finding of the main model, the results of the four sub-models are consistent, meaning that the royal decree has a positive and significant effect on the respective index returns. The fifth variable of the research model is Saudi Arabia economic announcements. The results show that economic announcements by the government of Saudi Arabia during the trading hour have a significant effect on the index return. The results of the four sub-indices also show consistently positive and significant effects on the respective index return. The final variable of the research model—economic announcements by the US—has an insignificant effect on the TASI return. The findings

of the four sub-models also show that US economic announcements do not affect the respective sub-indices.

5.3 Royal Decree and Tadawul All Share Index Return

The first research question of this study is to investigate the extent to which royal decrees in the economic and financial sector contribute to the movement in the TASI. This question is the original contribution of the research because it has not previously been researched in the context of Saudi Arabia. However, Vaughan (2018) mentioned that royal decrees signed by the king of Saudi Arabia regarding the listing of the largest oil company in the Tadawul might affect the behaviour of the stock market. Newspapers often discuss the effect of royal decrees on the stock market, but these press reports are not based on evidence and empirical analysis. The results of this research show that royal decrees have a positive and significant effect on the TASI return, which is consistent and empirical proof of the contents of the press reports. In addition, the results in this study support previous studies that observed the effect of government policy decisions on the stock market (Guo et al., 2019; Sajjad et al., 2012). There is also practical evidence of royal decrees affecting the market index. For instance, the stock market of Saudi Arabia attracted a considerable amount of attention after listing the largest oil company in Saudi Arabia. The move was revealed by Crown Prince Mohammad bin Salman and meant that Saudi Arabia was using its PIF to buy up strategic financial and industrial assets abroad. In an interview with Bloomberg, Prince Mohammad bin Salman said, 'Initial public offering Aramco and transferring its shares to PIF will technically make investments the source of Saudi government revenue, not oil' (Flanders et al., 2018). The findings suggest that royal decrees will be a crucial and positive factor in the future development and efficiency of the Saudi Arabian stock market, as the government is trying to implement new policies and plans through royal decrees as part of the structural plan to reform and diversify the economy in Vision 2030 and NTP 2020, which were announced in 2016. As part of these long-term goals, the stock market needs to reflect on and respond to a series of royal decrees that aim to diversify the economy of the Kingdom of Saudi Arabia by building a number of exclusive economic cities and industrial zones, as well as, increasing the size of the tourism of the country. Therefore, royal decrees are expected to make a significant contribution to the growth of the economy and increase investors' confidence in the stock market. To improve the validity of the findings, this study will review some

figures across announcement days to examine the importance of government decisions to the market index.

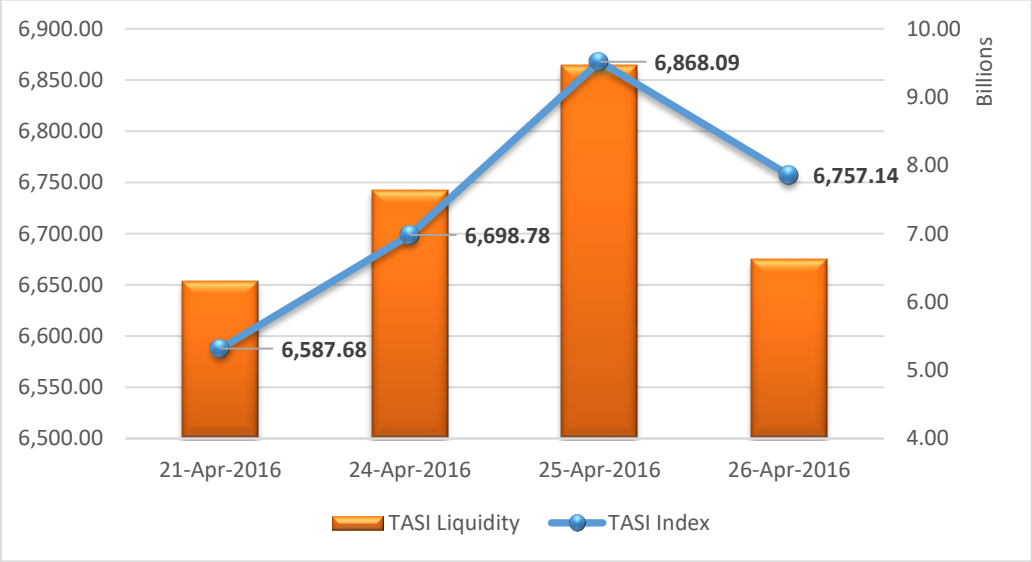

Figure 5.4: TASI and Liquidity When 'Saudi Vision 2030' Was Announced on 25 April 2016

Figure 5.4 shows the reaction of the Saudi stock market to the announcement of Vision 2030. As shown, the stock market increased by 2.5% to close at 6868 points, the highest level since the beginning of January 2016, and with the liquidity of 9.5 billion riyals, the highest since August 2015. Under Vision 2030, Saudi Arabia is aiming to make its stock market more attractive to foreign investors to increase foreign direct investment from 3.8% to 5.7% of GDP by 2030.

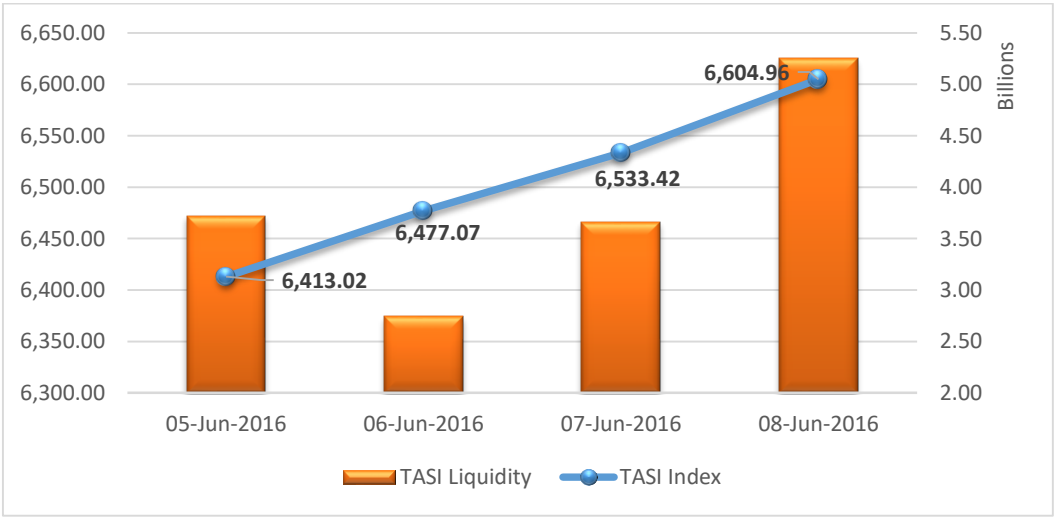

Figure 5.5: TASI and Liquidity When the NTP Was Announced on 6 June 2016

Figure 5.5 shows the TASI reaction after Saudi Arabia's cabinet approved the NTP as part of the Vision 2030 reforms, under which the government aims to triple non-oil revenue and cut public sector wages and subsidies by 2020, and increase the private sector's contribution to the country's GDP. The market climbed as a result of this announcement.

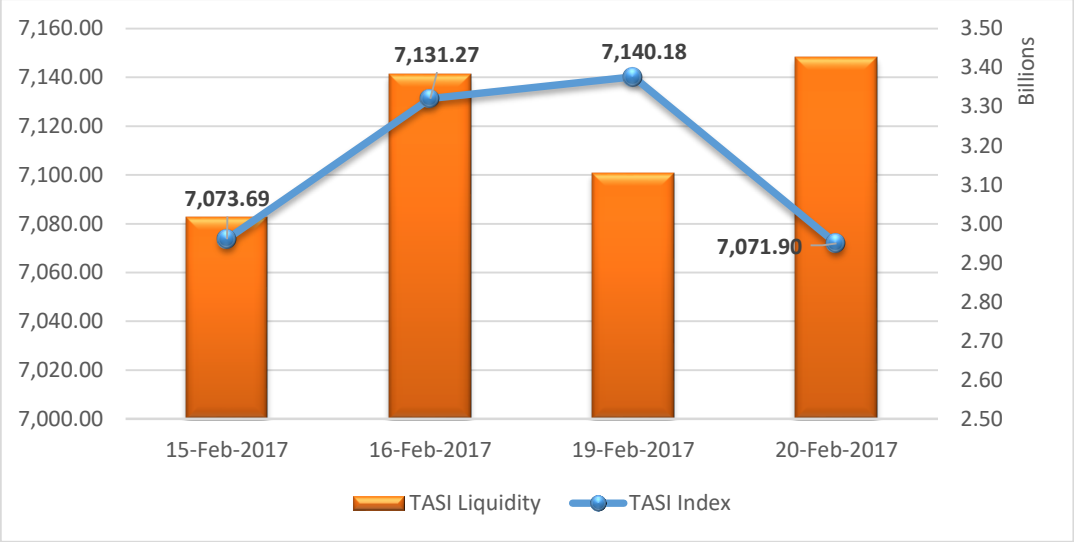

Figure 5.6: TASI Value and Liquidity When Sarah Al-Suhaimi Was Appointed as the New Chairperson of the Saudi Stock Exchange (Tadawul) on 16 February 2017

Figure 5.6 shows the TASI value and liquidity when Sarah Al-Suhaimi was appointed as the new chairperson of the Saudi Stock Exchange (Tadawul) and became the Kingdom's first woman to chair Saudi Arabia's stock exchange. Al-Suhaimi's appointment is in line with an ambitious economic and social reform program announced by the government in Vision 2030. One of its goals is to develop women's role in the economy and increase their participation in the workforce from 22% to 30% in the coming years.

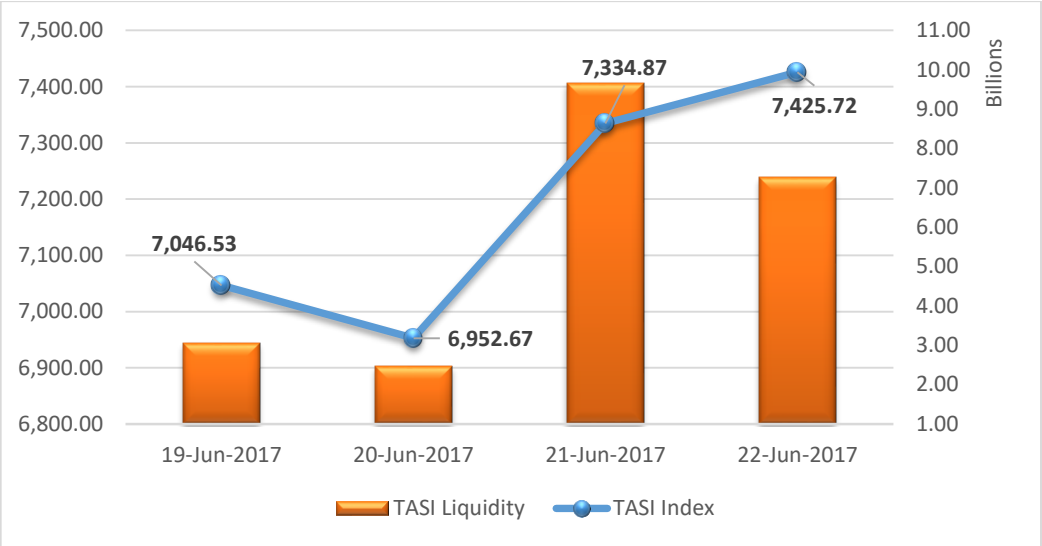

Figure 5.7: TASI and Liquidity When Allegiance Was Pledged to Crown Prince Mohammad bin Salman on 21 June 2017

Figure 5.7 shows that the Saudi market index surged more than 3% in early trade after King Salman issued a royal decree appointing Prince Mohammed bin Salman as crown prince and issued directives for governors and princes to pledge allegiance to the crown prince. Prince Mohammed bin Salman is the driving force behind a number of economic reform initiatives, including the diversification of the country's economy to sources of revenue beyond oil through the Kingdom's ambitious Vision 2030. This move represents a show of support to Mohammed bin Salman's plans to reform Saudi Arabia's economy.

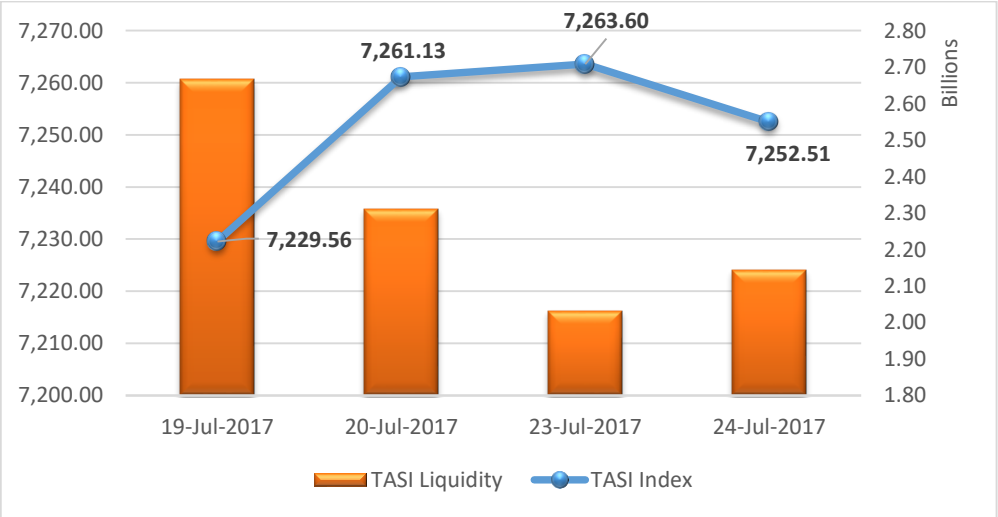

Figure 5.8: TASI Value and Liquidity When the Royal Decree Was Issued by His Excellency Mohammed Al-Kuwaiz as Chairman of the CMA on 20 July 2017

Figure 5.8 shows the TASI value and liquidity when the royal decree appointed His Excellency Mohammed Al-Kuwaiz as chairman of the board of the CMA of Saudi Arabia. El-Kuwaiz has more than a decade of experience in strategy, investments, financial services and corporate governance. He has also served as a consultant of McKinsey & Company and as vice-chairman of the CMA since August 2016.

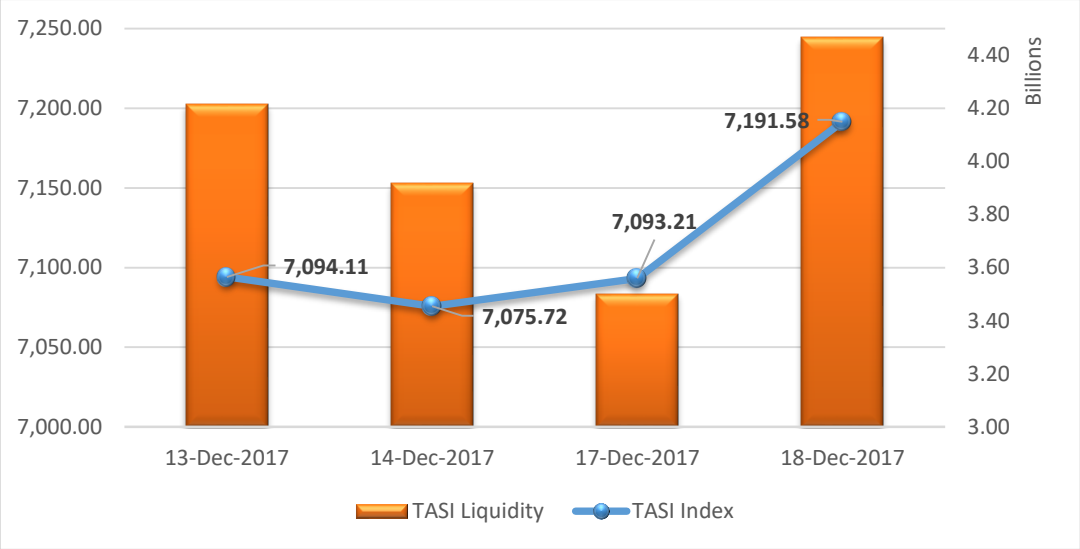

Figure 5.9: TASI Value and Liquidity When a Stimulus Plan for the Private Sector Was Issued by Royal Decree on 14 December 2017

Saudi Arabia has witnessed some ground-breaking economic policies as part of the NTP, such as the announcement of SR 72 billion stimulus package to the private sector by King Salman on 14 December 2017. Figure 5.9 shows the interaction of the TASI after the stimulus plan was announced for the private sector to encourage investments in the country, which will benefit the country's economy through job creation, GDP growth and boosting local industries.

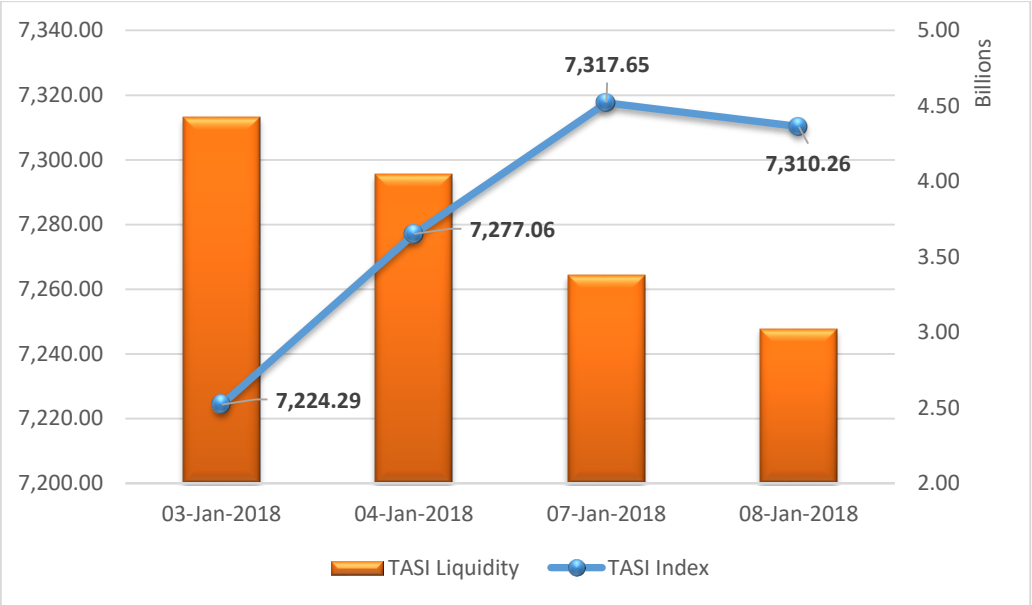

Figure 5.10: TASI Value and Liquidity When a Series of Royal Decrees Was Issued to Order Payment of Several Allowances to State Employees and Military Staff on 5 January 2018

King Salman issued a series of royal decrees to order payment of several allowances to state employees and military staff on 5 January 2018. Figure 5.10 shows the Saudi stock market's reaction to these decisions, which aimed to compensate state employees for the rising cost of living after the government hiked domestic gas prices and introduced a value-added tax (VAT) on a wide range of goods and services as part of a broad reform initiative aimed at diversifying its economy. In addition, Saudi Arabia's cabinet changed the status of Saudi Aramco to a joint-stock company on 1 January 2018, ahead of its planned initial public offering (IPO).

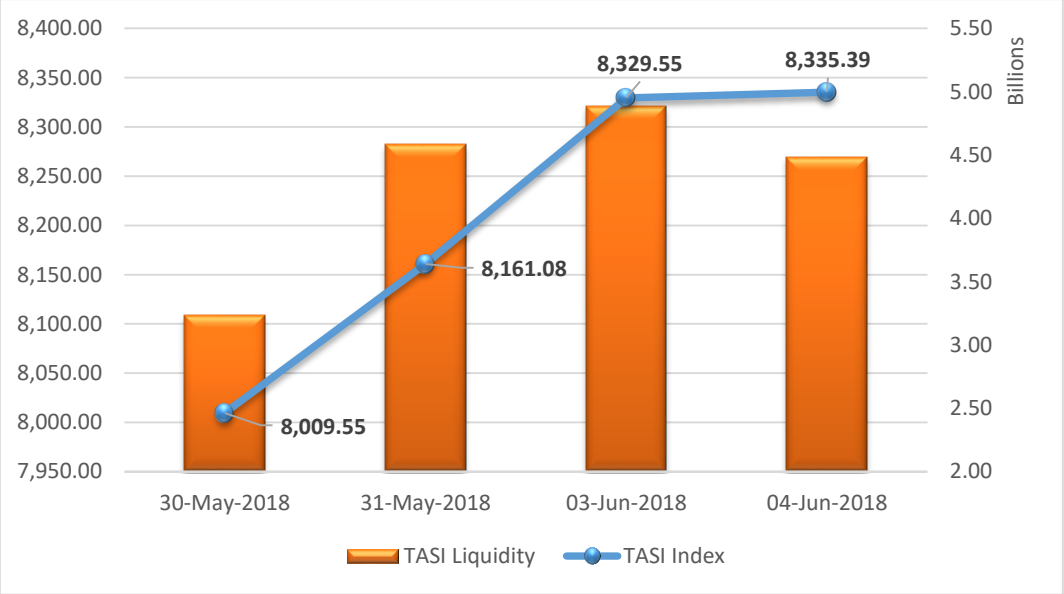

Figure 5.11: TASI Value and Liquidity When a Number of Royal Decrees Were Issued on 1 June 2018 to Reshuffle the Cabinet to Include a Ministry of Culture

Figure 5.11 shows the TASI when King Salman issued a number of decrees on 1 June 2018 to reshuffle the cabinet, which included establishing the Ministry of Culture, which is responsible for activities pertaining to culture, and appointing the minister of culture. The royal order also amended the name of the Ministry of Culture and Information to be the Ministry of Information. In addition, a royal order was issued to establish a Royal Commission on Makkah City and Holy Sites and appoint the members to the board of directors. In addition, a royal order was issued to establish the Council of Royal Reserves at the Royal Court and form their board of directors.

5.4 Saudi Economic Announcement and Tadawul All Share Index Return

The second research question of this study seeks to investigate the effect of Saudi economic announcements on the intraday return volatility of the domestic stock market. The results show that the economic announcements of Saudi Arabia have a positive and significant effect on the TASI. The results of this study agree with those of Alshogeathri (2011), who investigated macroeconomic determinants of the Saudi stock market movements and found a relationship between the Saudi stock market and short-run movements of macroeconomic variables. In addition, the results of this study agree with McQueen and Roley (1993) that nation-wide information and events tend to be

responsible for fluctuations in financial markets. The results also find a positive and significant effect of Saudi economic announcements on the four subsector indices models of TASI (i.e. banks, energy, materials and telecommunications). Prior literature has shown that economic announcements can have a mixed effect on stock market returns depending on the nature of the economic announcement (Lyócsa et al., 2019). Ederington and Lee (1993) found that economic announcements related to employment, PPI, CPI and durable goods orders can affect the stock market. Altavilla et al. (2014) and Hussain (2011) stated that changes in interest rates create a ripple effect in the economy, which increases or decreases the demand for stocks among general investors. In contrast, Bomfim (2003) showed that the stock market is conditionally volatile on days of monetary policy announcements. Haron and Ayojimi (2018) found that tax rate announcements have a significant effect on the stock market because the share price becomes volatile during such announcements. Lyócsa et al. (2019) found an insignificant effect of quantitative easing announcements on stock market volatility, which might be due to the small number of observations. Lyócsa et al. (2019) further found that the volatility of the stock market is higher than usual on days of policy meetings or discussions, and that the stock market is generally stable during monetary policy announcements. The results of this empirical study are consistent with the findings of Lyócsa et al. (2019) and Bomfim (2003). The findings suggest a positive implication of Saudi Arabian economic announcements for intraday return volatility. As part of Saudi Vision 2030, it can be expected that there will be regular macroeconomic announcements, and the stock market will yield positive results as a consequence of such announcements.

5.5 United States Economic Announcements and Tadawul All Share Index Return

The third research question seeks to investigate the effect of US economic announcements on the TASI returns. Balli, Billah, Balli and Gregory-Allen (2020) studied the effect of US and European macroeconomic news on conventional bond and sukuk markets. They found that US and European macroeconomic announcements affect sukuk spreads more than on conventional bond spreads in the GCC. Finta et al. (2019) suggested that there is a spill-over effect of stock market volatility on oil prices and the US and Saudi Arabian stock markets. They took considered oil prices as influence various determinants of expected future cash flows, such as economic growth and inflation, these fluctuations

affect stock prices. The researchers found an association between the US market and oil prices during the overlapping hours with the trading period of the Kingdom of Saudi Arabia. A major aspect of the announcements is related to the price of oil and other associated economic announcements made by the government and economics authorities of the US. Finta et al. (2019) found that volatility in the oil price has a significant effect on the index returns of the TASI. The results imply that by keeping track of the economic announcements and trading behaviour of the US stock market, Tadawul investors can generate high returns. However, the findings of this research contradict the findings of Finta et al. (2019) and show that US macroeconomic are largely insignificant during the observation period, a counterintuitive finding, when confronted with the importance of United States economic news especially on developing countries markets, as their market more sensitive to news of the US economy, that deserves further investigation. This reinforces the results of Haryadi (2016), who found that US economic announcements do not significantly affect the volatility of Indonesian stock market returns. This may be justified by this study's heavy reliance on a small set of high-frequency data through the first trading hours after the announcement. Therefore, the previous studies results are in contrast because based on low-frequency data.

5.6 Royal Decree and Economic Announcement on Subsectors Index Return

The fourth research question aims to understand the effect of royal decrees and economic announcements on the intraday return volatility of the sectors (i.e. banks, energy, materials and telecommunications). Press reports and analyses from financial institutions mentioned that royal decrees might have a positive effect on the intraday return volatility of the sectors. These observations were based on the argument that the king of Saudi Arabia will announce positive news and issue royal decrees that are ambitious and positive to achieve the goals of Vision 2030. Therefore, royal decrees will determine the economic growth of Saudi Arabia in the near future. Similar to royal decrees, Saudi Arabia's economic announcements will be targeted to achieve the goals of Vision 2030, which will improve the stock return of the sub-indices of Tadawul. The findings show that both royal decrees and Saudi economic announcements have a positive and significant effect on the intraday return volatility of the four largest sectors of Tadawul. This suggests that the Saudi stock market integrates the information relating to royal

decrees and Saudi macroeconomic announcements. This will benefit both Tadawul investors and the economy of Saudi Arabia in terms of positive output and index returns through redistribution effects.

The fifth research question of this study aims to empirically investigate how the selected market sectors interact during economic announcements and royal decrees. As discussed and hypothesised in the conceptual framework and literature review section, royal decrees and economic announcements have a positive and significant effect on the volatility return of the selected sectors. The empirical findings show that the index returns of the four sectors (i.e. banks, energy, materials and telecommunications) are highly influenced by economic announcements and royal decrees. For instance, the announcement of the listing of the largest oil company in Saudi Arabia, Aramco, resulted in a significant and sharp increase in intraday volatility returns of Tadawul across all sectors (Kane, 2017), which is a positive indicator of the effect of royal decrees and Saudi economic announcements. The findings are consistent with Lyócsa et al. (2019) and Bomfim (2003), who indicated that economic announcements affect market volatility.

5.7 Summary

This chapter presented the findings, analysis and discussion of the results of this empirical investigation. The research employed multiple regression analysis techniques and used regression models, post-regression estimations, unit root tests and autocorrelation tests to understand the effect of Saudi economic announcements and royal decrees on index returns. The results show that economic announcements and royal decrees have a positive and significant effect on the index return of the TASI and index return volatility of four subsectors. In contrast, US economic announcements have no significant effect on the TASI return. Trading volume and the S&P 500 Index has a significant effect on index returns. Further, liquidity does not affect the TASI, but liquidity has a significant effect on the subsectors. The results complement the existing literature and have positive implications market participants. The government of Saudi Arabia can affect the stock market positively and significantly through economic announcements and royal decrees.

Chapter 6: Conclusion and Recommendations

6.1 Overall Summary

The objective of the research was to investigate the effect of royal decrees and macroeconomic announcements on the equity return volatility in the context of the Saudi Arabian stock market (Tadawul). Macroeconomics variables have become a major part of the literature and how these variables affect the behaviour of stock return volatility. US macroeconomic announcements play a crucial role in determining how the stock market performs in developing economies as well as economies that have a strong trade deal with the US. For example, Ratanapakorn and Sharma (2007) found a positive association between stock price and macroeconomic variables such as inflation, money supply, interest rates and exchange rates, while Haryadi et al. (2014) found that macroeconomic variables had no effect on stock return volatility in the context of Indonesia. As an extension of the research, this study aims to further investigate how economic announcements of both the US and Saudi Arabia affect the return volatility of the TASI. As a result of the strong economic relationship, the interest rate of Saudi Arabia reflects the interest rate applied by the US Federal Reserve, and the exchange rate of Saudi Arabia is pegged compared with that of the US. The US equity and oil market also affects the TASI return. Therefore, this study aims to reveal how economic announcements affect the TASI return volatility.

This study made several important contributions to the literature to the field of financial markets. This study is the first to examine the effect of royal decrees in the capital markets literature. Thus, a major contribution of this research is its empirical investigation of the effect of royal decrees in the context of Saudi Arabia, as no other empirical studies have attempted to address this issue. This is the original contribution of the current research. This study also contributed to the stock markets literature by developing insight into how public event information influence Saudi stock markets. This study added to the literature by examining public events by using high-frequency data from the Saudi stock market. In addition, this study contributed to the methodology by using realised volatility method computed five and thirty-minute intervals as the daily volatility proxy and represents an important contribution to the literature. Therefore, the key motivations for this research are:

- The government of Saudi Arabia aims to increase the welfare of citizens through royal decrees, which are expected to be reflected in stock return volatility as part of Vision 2030 to diversify the economy to reduce the country's dependence on oil revenues and other lucrative offers and attract investment from foreign and institutional investors.
- Prior studies have revealed TASI returns to be volatile, yet the latest information shows that the TASI experienced significant and high increases in stock prices in 2015 after reaching its second-highest peak in 2006. Macroeconomic announcements and royal decrees have led to this tremendous growth, which this research aims to understand through empirical analysis.
- Prior studies have found mixed results regarding information efficiency in the Saudi stock market. Therefore, the current study aims to understand the flow of information efficiency in the stock market.
- Examine the relationship between volatility and royal decrees and macroeconomic announcements by using the intraday patterns of volatility that contributes to provide more efficient information and accurate results by using a rolling volatility method for market index.

Therefore, this study aims to reveal the effect of, and relationship between, royal decrees, macroeconomic announcements and return volatility on the Saudi stock market using evidence from high-frequency data. Further, it examines the TASI and compares the indexes of four industries—banks, energy, materials and telecommunications—to obtain valuable insights into the informational efficiency of the stock market and provide industry-specific analysis to help investors make informed decisions.

The findings of the research have several implications for, and make several contributions to, the expansion and enrichment of existing knowledge in the Saudi stock market regarding how variables such as royal decrees and economic announcements affect stock market volatility. This original study aimed to empirically investigate the effect of royal decrees on stock return volatility, as no other research has empirically investigated this question in the context of Saudi Arabia, which is currently undergoing major economic reforms. As a result, economic announcements and royal decrees are expected to affect stock return volatility. Therefore, an understanding of how royal decrees affect the stock

market in Saudi Arabia will open the door for further research on this topic and will garner attention from academic researchers and Tadawul investors.

To the best of the researcher's knowledge, there are no published studies that consider the Saudi stock market's behaviour using high-frequency data. Therefore, empirical analysis of TASI behaviour was conducted using intraday data. The study used 5-minute intervals to analyse the information to obtain a clearer and more accurate view of market conditions. High-frequency data are commonly used in developed markets. Saudi Arabia is one of the few countries in the world that has an absolute monarchy system of government. All royal decrees are issued and signed by the king of Saudi Arabia. Government policy increases volatilities and correlations among equity markets. Therefore, this study is the first to examine the effect of royal decrees on the Saudi stock market and will contribute to the existing body of knowledge regarding the relationship between the stock market and royal decrees. This study used the rolling volatility windows method to investigate the effect of information and announcements on volatility. This method enabled the researcher to investigate the effect of royal decrees and macroeconomic announcements on the stock market index and compare four industry indexes (banks, energy, materials and telecommunications). Therefore, this research contributes more efficient information to the literature by using the rolling volatility method for the developing economies context to determine how macroeconomic announcements affect this RRV.

This study contributes to existing knowledge regarding the behaviour of the stock market and the role of royal decrees and macroeconomic announcements in the Saudi stock market. The most practical contribution of the study was to provide an overview of the relationship between stock market return volatility and announcements. No previous empirical studies have provided systematic guidance for interested investors. This study will guide them to help make a decision. In addition, the study provides information for policymakers and market regulators by examining the efficiency of the stock market and studying the announcements that may influence the volatility of the Saudi stock market. Further, this study improves the accuracy of the estimated model of market volatility by taking into consideration announcements and contributing to the empirical literature by providing an alternative measure for the TASI volatility of return. Moreover, developers build trading software that caters for a wide range of investors to help anticipate future

movements in the index and stock prices. This study contributes to computerised programming and leads to the consideration of these factors because they may help developers build scalable formulas for commercial trading systems. Therefore, the outcomes of the study are of interest to market participants, market regulators, academic researchers and trading platform developers.

Past empirical studies have found that the stock market Saudi Arabia is still developing, which implies that there is a lack of appropriate organisation to distribute information. The trading volume of the Saudi Stock Exchange is very limited; therefore, it takes a considerable amount of time to adjust information in the market because of a lack of efficiency and organisation. Researchers in prior studies have suggested that the government of Saudi Arabia should take necessary measures to expand the stock market, which would help investors analyse large volumes of data before making an investment decision. This, in turn, would help the market be more efficient in adjusting the information. As part of the economic reforms and Vision 2030, the government aims to expand the economy and lessen its dependency on oil through economic announcements and royal decrees, which are crucial in enhancing the stock price and stock market, from which the government will benefit to a great extent. It is also suggested that the Saudi government should accelerate the pace of privatising government-owned companies and make it easier for companies to list shares. This would increase the supply of shares on the stock market. Further, the Saudi government should pursue initiatives to increase investors' confidence in the market. Empirical studies have also suggested that regulations regarding share trading should be developed and improved in a way that facilitates the easier trading of shares. Most importantly, empirical findings have suggested that three factors must be taken into account if a stock market is to be developed efficiently: strong regulation, disclosure of information and economic stability.

Different announcements, such as earnings and economic announcements, affect the stock price to a great extent. The literature finds that stock prices and returns are affected by different macroeconomic announcements such as employment, CPI and PPI. When monetary policy is announced, volatility is comparatively low. Quantitative easing also increases stock returns, as discussed in the literature review section. However, there is no relevant research in the context of Saudi Arabia regarding how economic announcements affect stock return volatility. Another important aspect of the research is to understand

the effect of royal decrees on stock return volatility, as royal decrees are important and unscheduled announcements by the government of Saudi Arabia. However, these decrees are always strategic decisions aimed at identifying what is best for the country as a whole, including the growth of the economy and the wellbeing of citizens. Stock market investors usually sense the rise in stock prices across industries, trading volume and returns after a royal decree. Press reports also assume that stock returns are positively affected by royal decrees, but there have been no experimental studies to prove this theory. Therefore, this study attempted to address this gap in the literature by studying the effect of royal decrees on stock return volatility of the TASI.

To answer the research questions, this study developed a conceptual framework that depicted the main objective of the study, which was to establish the nature of the relationship between return volatility, royal decrees, and Saudi and US macroeconomic announcements. The relationship between royal decrees and the stock market was tested, and the extent to which macroeconomic announcements issued by Saudi Arabia and the US affect equity returns was investigated. The study included three independent variables to capture previously documented determinants of return volatility. It also analysed four industries in addition to the aggregate TASI by measuring the effect of royal decrees and Saudi and US macroeconomic announcements on the volatility of four stock sector indexes (banks, energy, materials and telecommunications) and then comparing the industries to provide a better guide for investors as well as more depth to the study.

To achieve the objective of the research, high-frequency data for the TASI were collected from Tadawul for the period April 2014 to June 2019. Sector-wise (banks, energy, materials and telecommunications), data were also collected for comparison across sub-indices as well as to the main model. However, because of a change in sector classification, the volatility of the sector data were collected from January 2017 to June 2019. This was because Tadawul did not follow global classification criteria before 2017. The new classification following the GICS allowed the results to be compared across different developing economies of a similar size. All royal decrees were issued outside trading hours. Thus, the market would underreact to royal decrees, which affected the next day's opening price. The Saudi economic indicators data were also collected from SAMA's website which is reported on a weekly, monthly, quarterly and yearly through their website. Bloomberg and Thomson Reuters Eikon were used as sources for all

historical US economic announcements. All of these economic reports/announcements are published outside the trading hours within the schedule's pre-set days and times. Moreover, because of the time difference between Saudi Arabia and the US, the US economic announcements are issued after the Saudi market closes. Therefore, the stock market reacts to the announcement during the next day's opening hours. The data were collected in a format that was used for further analysis in EViews and Microsoft Excel.

Given that the largest stock market in the world is located in the US, it would not be surprising if fluctuations in this market had a considerable effect on the rest of the world's stock markets. Therefore, the study aimed to examine whether the international market contributed to movements of the TASI during the sample period 2014–2019; thus, the S&P 500 price index was used as a proxy for international stock market effects. Additionally, the research investigated the effect of liquidity and trading volume during the trading period to understand how these variables affected the index return. High-frequency data for the Saudi stock market are available from 17 April 2014; therefore, a sample period spanning 17 April 2014 to 30 June 2019 was selected, which is a period of more than 5 years. The total number of trading days in the sample period was between 1,240 and 1,250 trading days. The last trading day for the study was 30 June 2019. As a result, days on which trading did not occur, or when there was a public holiday or trade was suspended for any reason, were not included in the data sample. It is worth noting that the trading hours on Tadawul are between 10:00 and 15:00 hours, and the market operates 5 days a week, from Sunday to Thursday. Therefore, the data used in the study cover this timeframe. The additional variables for the research were liquidity, trading volume, S&P 500 Index and US economic announcements. The research employed a series of statistical techniques to analyse the data, including multiple regression analysis, post-regression diagnostic tests, normality tests, stationarity tests and autocorrelation tests.

The findings showed that TASI trading volume, S&P 500 Index, royal decrees and Saudi economic announcements had a significant effect on the TASI return, while TASI liquidity and US economic announcements had an insignificant effect on the TASI return. For the subsector, index liquidity had a positive and significant effect on index return volatility. Respective sector-wise trading volume had a significant effect on index return volatility, except in the banking sector, where trading volume had a negative effect on

index return volatility. Royal decrees have a significant and positive effect on the respective index volatility. Similarly, Saudi economic announcements have a positive and significant effect on respective index return volatility. However, US economic announcements have an insignificant effect on index return volatility. The findings are consistent with, and complement, the literature.

This study will help to open a new branch of research on royal decrees and how they affect index returns, share prices and other micro- and macroeconomic aspects. The major implication of the findings is that royal decrees and Saudi economic announcements play a key role in the positive return and increase of share price on the TASI, as well as four major subsector indices (i.e. banks, energy, materials and telecommunications). This provides an interesting perspective on how the government of the Kingdom of Saudi Arabia can influence the stock market through royal decrees and economic announcements, which will improve investors' confidence and achieve the goals of Saudi Vision 2030.

6.2 The Implications of Results and Recommendations

The findings of this study provide interesting insights into the stock exchange of Saudi Arabia that not only can open doors for new research opportunities, but also help the government of Saudi Arabia achieve its Saudi Vision 2030. Therefore, the findings of this study have the following implications:

This research study is expected to result in imperative academic as well as practical implications. It ought to heighten the comprehension of the microstructure of the Saudi stock market by exploring the index and its interaction with information activities. Regarding the practical perspectives, this study is expected to offer added measures while evaluating the influence of information influx in the market by exploring fluctuations in patterns of its proxies, such as trading volume and volatility. This study has revealed that Saudi economic announcements and royal decrees bring about an affirmative and vital impact on the Saudi stock market. In the TASI index and all of the segments deliberated, the economic activities encapsulated in the model have been found to be beneficial and essential. It is worth noting that the Saudi government must enact procedures and guidelines that will help the market to become more proficient and re-position it for growth.

This section considers the practical as well as policy implications of the outcomes of this study for market participants as well as regulators.

The results of this study have imperative consequences for predicting equity prices on the Saudi stock market. The study revealed that the behaviour of the stock market can be more rationally elucidated by utilising detailed and accurate modelling. We can revamp the prediction of stock market returns giving due consideration to the royal decrees and economic announcements.

Some market participants perceive volatility as an opportunity for generating profits by implementing specific trading strategies, while others consider volatility as a risk when equity returns are unclear or do not meet expectations. From a diverse viewpoint, market regulators perceive disproportionate volatility as a threat to the impartiality, efficacy and reliability of the market owing to significant and rapid price movements. Not achieving impartiality, efficacy and reliability paves the way to investors and corporations withdrawing from the market, thereby ultimately impacting the general economy. For this reason, a comprehensive understanding of the effects of excessive volatility may better equip regulators to evolve mechanisms to diminish its effect. This study will help the Saudi Capital Market Authority to better understand intraday volatility patterns and whether variations in intraday volatility are the result of reactions to scheduled macroeconomic announcements or trading activities. Bearing in mind the imperative economic effect of information, the Capital Market Authority must augment the execution of information disclosure regulations with the purpose of warranting the quality and speed of information provided to the market.

Pinpointing the royal decrees and economic activities that are the main cause of some of the nonlinear dynamics on the TASI index enable micro predictions to be made by cautiously ensuing the identified actions and envisaging when potentially significant market movements will take place. The results of this study will also be beneficial for stock exchanges and central banks which are endeavouring to preserve orderly markets. Portfolio managers holding assets will be interested in learning to react to macroeconomic news that which help them to construct specialised portfolios.

These findings take care of some of the core queries regarding the role of diverse events in the market. Because the stock market responds to diverse signals, it is imperative to

explore public information events such as economic announcements and royal decrees with the purpose of ensuring more precise market predictions. For example, it is noticeable that technical specialists are more likely to trade during events than other traders. This means that specialists can now make use of signals from technical analysts to predict when the information will transpire. Information regarding the effect of economic announcements and royal decrees on the stock return is capable of facilitating the evolution of future asset pricing theories.

The growth of the Saudi economy directly influences the evolution of the capital market and the influence of economic announcements on capital market development has been highly significant, demonstrating the growing importance of the resilient association between capital market development and economic growth.

The findings of this research study are expected to bestow at least three advantages on market participants.

Firstly, the patterns of intraday volatility offered in this thesis recommend two diverse trading approaches/strategies for two kinds of market participant. Market participants with moderate or conservative risk levels will be able to reduce risk by taking positions when volatility is low and all relevant information has been integrated into the prices. This recommendation is backed by the outcome that trading volume remained high when volatility was low. Furthermore, the findings advocate that the returns data series and the volatility data series are auto-correlated, implying that opportunities emerged for moderate and hostile market participants to undertake money-making trading strategies.

Secondly, royal decrees and all local economic announcements and news significantly influence the volatility of Saudi stock returns. This finding accentuates the significance of macroeconomic announcements and news to which market participants should take note. Moreover, these findings signpost that the market participants must be capable of recognising other factors that influence volatility during the day for the statements having no noteworthy effect.

Finally, the motivation for choosing the recognised model of volatility estimation with high-frequency data utilised in this thesis was that the model can be effortlessly simulated by naive market participants for alike purposes: for example, to evaluate intraday volatility and entice its patterns for stocks of diverse industries or for diverse asset classes.

This study presents added implications for market regulators. The results enable the Saudi stock market to respond efficiently to royal decrees and Saudi economic announcements via the event window. Thanks to some intuitions for financial regulators and policymakers with regards to the impact of economic announcements and royal decrees on market, all of these findings are essential for policymakers and investors. A detailed conjecture of this sort of association may help government agencies to design policies with the purpose of encouraging more capital inflows into financial markets. On the other hand, policymakers need to follow closely the stock market that could be affected by new events or information, so that announcements move regarding stock market shocks could be tailored concerning those findings. Hence, policymakers in Saudi Arabia must remain vigilant when making particular moves because the stock markets will respond to a great extent, consequently making the Saudi stock market more captivating to international investors. Besides, potential investors can presume stock market responses from diverse economic announcements or event shocks on the Saudi market, making their portfolios highly susceptible.

The outcomes of this thesis underpin the significance of royal decrees and economic announcements and news on the unpredictability of stock market returns. At the same time, it may also be lucrative for government policymakers and market regulators who need to be well aware of their impact on the unpredictability of asset returns in the financial market.

In view of the implications, the recommendations for the study includes:

The economic announcements of the Kingdom of Saudi Arabia should reflect the global and domestic economic conditions, as this helps to improve the Tadawul index return. The scheduled announcements help investors to expect a positive outcome, which in turn increases the share price and returns.

1. The government must underpin the efficacy of regulation, omission and monitoring of the stock market with the aim of preventing illicit activities and market manipulation besides augmenting the confidence of individual savers, investors and all participants in the capital market. The rules and regulations of trading on the stock exchange should be revised and enriched in order to make them objective, consistent and systemised with the intention of bestowing support

on the system. The Capital Market Authority must redouble its efforts to offer active and regular monitoring of activities in the stock market to inhibit market abuse besides enforcing market regulations in the event of infringements or wrongdoing. It will heighten the confidence of investors in the market.

2. Authorities must restructure the market procedures and revamp the trading system to help the market participants trade swiftly and economically. The procedure of initial public offerings (IPOs) and transaction execution may possibly be rationalised and risk management systems may also be revamped with the aim of making them effectual and economical for all participants. State-of-the-art infrastructure/technology and information networks must be utilised with the intent of revamping and making market processes more effectual. In addition, fees should be revised and simplified. All of these steps will help to enhance the liquidity of the stock market.
3. The government should privatise some state-owned enterprises and list them on Tadawul. For instance, after the study period of December 2019, by listing the largest oil company in Saudi Arabia (Aramco), the Tadawul index returns jumped by 1.5%. Tadawul recorded an overall increase of 7.19% (562.5 points), which is equivalent to SAR 7 trillion ($1.9 trillion) leap in market capitalisation. This will help retain the confidence of domestic investors and attract foreign investors, and it will help the government reduce its oil dependency and diversify the economy by attracting lucrative foreign investments.
4. Investors should conduct more in-depth analysis using the financial model to understand how royal decrees and economic announcements interact with index returns and improve chances of gaining higher returns, which will have a distribution effect on the stock market. This will help Tadawul to grow further and become more efficient.
5. Future research should use more data on economic announcements and royal decrees to determine how these variables have an interaction effect on stock prices and stock returns.

This study could be extended by including more news announcements related to the military and neighbouring countries. Moreover, analysis could be conducted at the all-industry level. Researchers could also examine the effect of this public information on an individual stock or on portfolios. Further, they could use more countries in the data

sample, such as GCC countries, and test the effect of one country's political news on another.

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Appendices

Appendix 1: Saudi Stock Market Development and Events, 1985–2019

Date	Event
1985	• Official start of the Saudi stock market.
1990	• ESIS (Electronic Security Information System).
2001	• Earning announcements posted on the exchange website with time and date recorded.
2003	• Introduction of Capital Market Law.
2004	• Establishment of the CMA.
2006	• Foreign (residing in Saudi) investors given access to buy shares through certain licensed Saudi investors, who would be the legal owners of the shares. • New corporate governance guidance. • Stock split for the whole market (5:1) to reduce par value and market value. • Changing of trading time (one session per day instead of two sessions).
2007	• The Council of Ministers approved the formation of the Saudi Stock Exchange (Tadawul) in accordance with Article 20 of Capital Market Law establishing Tadawul as a joint-stock company. Tadawul is the sole entity authorised in the Kingdom of Saudi Arabia to act as the Securities Exchange.
2008	• Change in the calculation of the index to reflect only free-floating stock, excluding major ownership (government, foreign partner and 10% ownership). • Swap agreements with non-resident foreign investors (broker retains legal ownership, foreign investor has the economic benefits).
2014	• The Saudi Council of Ministers approved opening the Saudi stock market to foreign financial institutions eligible for direct investment. • Commencement of implementation of procedures for listed companies whose accumulated losses reach 50% or more of their capital.
2015	• Foreign financial institutions start investing in the Saudi stock market by buying and selling in accordance with the rules set by the CMA.

2017	• Amended the number of sectors in the TASI to 20 sectors instead of 15 based on the GICS Level 2 (Industry Group). • Tadawul moved to (T+2) system, and permitting conditional short selling. • Applied the new rule for companies whose accumulated losses reach 20% or more and started to apply the provisions of Article 150 of the Companies Law on companies listed whose accumulated losses reach 50% or more. • Tadawul launched on the Saudi Parallel Market (Nomu) on 26 February. • CMA published the Rules on the Offer of Securities and Continuing Obligations. • CMA Board approved the Listing Rules of the Saudi Stock Exchange (Tadawul).
2018	• Started to allow the entry of buy and sell orders outside the limits of daily fluctuations. • Applied the auction for the closing price calculation instead of the average price calculation for trading volume. • Issued the amended and regulating rules for qualified foreign investors, including new facilities for investors. • MSCI signed an agreement with Tadawul to launch a joint index for the Saudi stock market to develop various investment tools for local and foreign investors.

2019	• Initial public offering (IPO) of 1.5% of Saudi Aramco shares listed on the Saudi market, which was the largest offering in history. • Tadawul launched a derivatives market in 'futures traded index contracts', which is based on the MSCI Tadawul Index. • The Saudi stock market joined emerging market indices, and many new regulations were approved in the market. On 29 August, the inclusion of the Saudi market on the MSCI was completed. On 24 September, the market's accession to the 'FTSE Russell' index was completed, and its accession to the S&P Dow Jones Index was completed. • Index calculation methodology was updated to include equities that can be traded on Tadawul. The following shares were excluded (considered Non Free Float) from all Tadawul indices' calculations: a. A government entity owning 5% or more in a listed company. b. Restricted shares (shares that are not allowed to be traded during a period). c. Shares acquired through buy-back by a listed company. d. Shares owned by members of the Board of Directors. e. Shares representing controlling ownership (30% or more). • Implementation of a new mechanism for large IPOs to enable rapid entry into the TASI. • Tadawul introduced an equity index TASI cap of 15% based on the weights of companies. • Tadawul allowed foreign companies to list on its exchange. • Tadawul allowed firms to have a direct listing on Nomu without an IPO.

Appendix 2: Prominent Historical Royal Decrees and Orders, 2014–2019

Date	Royal Decrees
25 December 2014	Three royal decrees on the state's general budget for the fiscal year 2015 dealt with the revenues and expenditures of municipalities and general organisations whose budgets were annexed to the state's general budget for the fiscal year 2015.
29 January 2015	King Salman of Saudi Arabia announced a major cabinet reshuffle a week after he acceded to the throne. The changes were announced in 34 royal decrees that included restructuring the Council of Ministers, changing the organisational structure of the government and establishing two sub-cabinets of the Kingdom of Saudi Arabia (the Council of Economic and Development Affairs and the Council of Political and Security Affairs).
4 May 2015	Approved the Rules for Qualified Foreign Financial Institutions Investment in Listed Securities.
15 June 2015	Saudi Arabia's stock market opened up to direct foreign investment for the first time on 15 June 2015. This gave international investors direct access to the Middle East's biggest economy, which allowed the Kingdom to attract hundreds of millions of dollars in foreign cash as it pushed to diversify the country's economy.
21 December 2015	A royal decree was issued stipulating the formation of the 1st Court of the Banking Disputes Committee and the 1st Court of the Appeal Committee of Banking Disputes and Violations.
28 December 2015	Fifteen royal decrees were issued on the state's general budget for the fiscal year 2016 to highlight the actual outcomes of the fiscal year 2015 and the national budget for the fiscal year 2016, as well as recent economic developments in the Kingdom of Saudi Arabia that included economic, fiscal and structural reforms.
25 April 2016	King Salman bin Abdulaziz announced cabinet backing for the Saudi Vision 2030 plan's ambitious strategy to restructure the Kingdom's oil-dependent economy, involving diversification, privatisation of massive state assets (including the energy giant Aramco), tax increases, and spending and subsidy cuts. In addition, a package of decisions related to the Saudi Vision 2030 was issued.

7 May 2016	Saudi Arabia's king announced a package of reforms, including restructuring some ministries and government agencies and appointing a number of ministers and officials in line with Saudi Vision 2030. The goals of this stage include the cancellation of the Ministry of Water and Electricity, the amendment of the name Ministry of Commerce and Industry to Ministry of Commerce and Investment, the amendment of the name Ministry of Petroleum and Mineral Resources to Ministry of Energy, Industry and Mineral Resources; and shall be dedicated for energy, and the establishment of the General Authority for Entertainment and the General Authority for Culture. Other reforms include appointing advisors at the Royal Court and relieving many ministers and appointing new ministers to government ministries, such as appointing His Excellency Dr Ahmed Alkholifey as the Governor of SAMA.
6 June 2016	Saudi Council of Ministers approved the NTP, which sets out the goals and targets to be achieved by the Kingdom by 2020. It is an economic action plan put in place by the Saudi Arabian Government as part of its Vision 2030 development plan. This plan is part of Saudi Arabia's efforts to diversify its economic income away from the oil industry.
30 July 2016	Organisational structure of the government was changed. The role of the General Authority of Civil Aviation was activated as an independent legislative body to deepen the organisation's role as a legislator and as a regulator of the air transport industry in the Kingdom.
8 August 2016	Saudi Arabia's king approved proposals to raise a range of government fees, including visa charges and fines for some traffic violations, as well as changes to civil aviation fees as part of an initiative by the Ministries of Finance, Economy and Planning to boost revenues as oil prices fall.
4 September 2016	Approved the amended Rules for Qualified Foreign Financial Institutions Investment in Listed Securities (the 'QFI Rules') and New Saudi Qualified Foreign Investor Rules and IPO Book Building Instructions.
26 September 2016	The cabinet decided to stop and cancel some bonuses and financial benefits by cutting ministers' salaries by 20% and scaling back financial perks for public sector employees, who make up around two-

	thirds of working Saudis. Housing and car allowances for members of the appointed Shura Council were cut by 15%. Overtime bonuses for all are now limited to between 25% and 50% of basic salaries.
31 October 2016	Appointed more ministers and made amendments to the organisation of housing subsidies and the implementation of a mortgage finance product under the name 'Madoom and Moyassar Home Finance', and amendment of the name Saudi Credit and Savings Bank to Social Development Bank.
2 December 2016	Restructured the Consultative Assembly of Saudi Arabia, known as Majlis ash-Shura or Shura Council.
22 December 2016	Eighteen royal decrees issued on the state's general budget for the fiscal year 2017.
22 April 2017	Saudi Arabia's king announced several policies, initiatives and programs to reset expenditures and prioritise and reduce the budget deficit in line with the Saudi Vision 2030. In addition, all allowances, privileges and financial premiums for civil and military state officials that had been previously cancelled, amended or frozen were reinstituted (dated 26 September 2016). In addition, King Salman instructed the minister of finance to disburse a two-month salary as a premium for each participant on the frontline of the Determination Storm and Restoring of Hope operations.
21 June 2017	Appointed Prince Mohammad bin Salman as crown prince.
17 June 2017	King Salman bin Abdulaziz Al Saud issued a royal order amending the name of the Bureau of Investigation and Public Prosecution to the Public Prosecution. Its chairman is called the Public Prosecutor and is directly linked to the king, enjoys full independence and no one shall interfere in its work. In addition, King Salman bin Abdulaziz Al Saud issued a number of royal orders.
26 September 2017	King Salman issued a statement recognising the right of Saudi women to drive in keeping with Sharia. Licences were set to be issued to women starting on 24 June 2018.
4 October 2017	Established a fund called the National Development Fund, which is organisationally linked to the prime minister and undertakes overall supervision of the Saudi Fund for Development, the Saudi Industrial Development Fund, the Agricultural Development Fund, the Social Development Bank, the Human Resources Development Fund and any

	development fund or bank whose linkage is ordered by the prime minister on a proposal by the National Development Fund.
31 October 2017	Announced the establishment of the National Cybersecurity Authority and appointed assistant Al-Ayban as chairman of its board of directors.
4 November 2017	King Salman bin Abdulaziz Al Saud issued a series of anti-graft royal orders to form a supreme committee chaired by the crown prince and the membership of chairman of the Monitoring and Investigation Commission, chairman of the National Anti-Corruption Authority, chief of the General Audit Bureau, attorney general and head of state security. The committee has the right to take precautionary measures until they are referred to the investigating authorities or judicial bodies. It may take whatever measures it deems necessary to deal with those involved in public corruption cases and take what it considers the right of persons, entities, funds, fixed and movable assets, at home and abroad, return funds to the state treasury and register property and assets in the name of state property.
19 December 2017	Eighteen royal decrees issued on the state's general budget for the fiscal year 2018, and the state's revenues and expenditures are estimated.
5 January 2018	King Salman bin Abdulaziz Al Saud issued a number of royal orders. First, the annual bonus for citizens of civil and military employees for the fiscal year 2018 shall be paid as of 1 January 2018. Second, a monthly cost-of-living allowance shall be paid for citizens of civil and military employees. Third, payment of rewards to military personnel serving at the Kingdom's southern frontline. Fourth, increasing the stipend payments for male and female students by 10%. Fifth, the state shall bear the value-added tax (VAT) rather than citizens benefiting from private health services and private education. Sixth, the state shall pay the VAT as a portion of the purchase price of the citizen's first home.
24 April 2018	Approved the executive plan for the Privatization Program, a key plan of the Kingdom's Vision 2030 that aims to increase the efficiency of the national economy's performance and ameliorate the services provided to reach as many beneficiaries as possible. The Privatization Program will increase employment opportunities for the national workforce, attract the latest technologies and innovations, and support

	economic development by involving qualified enterprises in providing these services to increase the private sector's contribution to GDP from 40% to 65% by 2030. The Privatization Program, which targeted various service sectors (e.g. energy, water, transportation, telecommunications, petrochemicals and financial), is based on three basic pillars: laying the legal/regulatory foundations, laying the institutional foundations and directing the main program initiatives.
1 June 2018	King Salman bin Abdulaziz Al Saud issued a royal order to establish the Ministry of Culture, which is responsible for activities pertaining to culture, and appoint the minister of culture. The royal order also amended the name of the Ministry of Culture and Information to the Ministry of Information. In addition, a royal order was issued to establish a royal commission or Makkah City and Holy Sites and appoint the members of the board of directors. In addition, a royal order was issued to establish the Council of Royal Reserves at the Royal Court, and to name Royal Reserves and form their boards of directors.
18 December 2018	Sixteen royal decrees on the state's general budget for the fiscal year 2019 and the state's revenues and expenditures are estimated.
27 February 2019	King Salman reshaped the country's Council of Political and Security Affairs.
23 February 2019	Three royal orders were issued. First, the payment of a month's salary reward to military participants on the frontlines of military actions in the southern boundary of the Kingdom. Second, appointment of Prince Khalid bin Salman bin Abdulaziz Al Saud as deputy minister of defence with the rank of minister. Third, appointment of Princess Rima bint Bandar bin Sultan bin Abdulaziz Al Saud as Ambassador of the Custodian of the Two Holy Mosques to the US with the rank of minister.
19 March 2019	King Salman bin Abdulaziz Al Saud launched four wellbeing projects for the Kingdom's capital, Riyadh, to significantly improve the lives of its citizens, transform the city into an attractive destination and make it one of the world's most liveable cities. The four projects (King Salman Park, Sports Boulevard, Green Riyadh and Riyadh Art) complement the Saudi Vision 2030 'Quality of Life' Program and are

	aligned with the UN's Sustainable Development Goals to create sustainable cities and communities while driving urgent action against climate change.