The Cross-Section of Stock Returns and Factor Premiums in the Saudi Stock Market

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Abstract

The recent reformation and globalisation of the Saudi stock market have underscored the necessity of investigating the patterns that drive market returns, with factor premiums and asset pricing models serving as crucial analytical tools for this purpose. Therefore, this study examines whether the Fama and French (2015) five-factor model (FF5FM) provides a better explanation for the cross-section of stock returns than the Fama and French (1992) three-factor model (FF3FM), and whether the factors utilised in these asset pricing models have a significant premium in the Saudi stock market. Furthermore, this study introduces a new factor, the Islamic premium, to the Fama and French asset pricing models and examines whether this factor has a significant premium or enhances the models' ability to describe the variation in average returns. The research also investigates whether the recent global market integration has altered the significance of the factor premiums and the explanatory power of asset pricing models. Finally, to understand the market behaviour during crises, the impact of COVID-19 on stock performance and factor premiums is analysed.

A one sample t-test is employed first to examine the significance of all factor premiums. Then, the GRS test for portfolio efficiency is used to compare the performance of the asset pricing models and to identify the most effective model based on the lowest GRS value. Then, this study divides the sample period into two subperiods – pre- and post-global integration – to assess the significance of the factor premiums (using a one-sample t-test) and the performance of the asset pricing models (using the GRS test) in each subperiod. Additionally, a two-sample t-test is conducted to ascertain any significant changes in the factor premiums, and robustness checks are performed using monthly/weekly returns and value-weighted/equal-weighted portfolios across all the methods applied in this study. Finally, panel regression analysis and the Wald test are used to examine the implications of COVID-19 on the performance of stocks in the market.

This study finds that the value premium is the only factor that has a significant equity premium across all the examined portfolios. This indicates that future investors in the Saudi stock market could generate higher returns if they invest in stocks with a higher B/M ratio. However, the study also finds that the inverse of the investment premium is significant, which means the stocks with higher investment growth have a significant equity premium. This may be

attributed to investors' potential overreaction to positive news, such as investment growth, and herding behaviour. The study further finds that Fama and French's FF5FM generally outperforms FF3FM, particularly when using factors constructed from the 2 × 3 sort. Conversely, when employing factors from the 2 × 2 sort, the Islamic premium notably enhances the explanatory power of FF5FM and FF3FM.

The study finds evidence that the size effect started to reappear in the market after global integration. More substantial evidence shows that the value premium emerged following changes in market demographics. On the other hand, the inverse of the investment premium was significant before global integration but has disappeared since then. These findings show that after market reforms, investors in the Saudi market have made more informed investment decisions and paid more attention to factor premiums.

The study also found that the best asset pricing model for describing variation in the cross-section of stock returns differed before and after the global market integration. From 2018 onward, incorporating Islamic premiums have improved the explanatory power of the Fama and French asset pricing models. Additionally, value-weighted portfolios always give higher returns than equal-weighted portfolios. This could be due to the poor performance of smaller stocks and higher exposure to larger stocks in value-weighted portfolios.

Finally, there is evidence that Islamic and less profitable stocks performed poorly compared to non-Islamic and more profitable stocks during the COVID-19 crisis, most likely due to liquidity challenges. Most firms experienced a revenue decline during COVID-19, particularly stocks with low profitability, as they already had cash flow issues. However, the limited financial sources available to Islamic stocks compared to non-Islamic stocks worsened their liquidity position and made them more vulnerable.

Declaration of authenticity and authorship

I, Asim Alshaikhmuabrek, declare that the PhD thesis entitled 'The Cross-Section of Stock Returns and Factor Premiums in the Saudi Stock Market' 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: [redacted] Date:08/04/2024

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List of abbreviations, acronyms, and symbols

TASI	Tadawul All Share Index
Numo	Parallel Equity Market Index
SMB	Small Minus Big
HML	High Minus Low
RMW	Robust Minus Weak
CMA	Conservative Minus Aggressive
IMN	Islamic Minus Non-Islamic
RHS	Right Hand Side
LHS	Left Hand Side
B/M	Book to Market
MC	Market Capitalisation
FF3FM	Fama & French Three-Factor Model
FF5FM	Fama & French Five-Factor Model
4FM	Four-Factor Model
6FM	Six-Factor Model
CML	Capital Market Law
GCC	Gulf Cooperation Council
QFI	Qualified Foreign Investors

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Chapter 1: Introduction and motivation

1.1 Introduction

In recent years, some markets in the MENA region have become more globally integrated to attract more investors, such as the Saudi equity market. This change in the market demographics alters the return pattern as the new investors bring new investment strategies and pay more attention to different factor premiums. Examining the asset pricing models and investigating factor premiums helps to understand the pattern of the returns in stock markets.

Therefore, this study investigates the cross-section of stock returns in the Saudi stock market and the factor premiums that may explain the pattern of the returns in the market. The cross-section of stock returns is the return on double- or triple-sorted portfolios, which are portfolios formed by using more than one sort (for example, stocks that have a large market capitalisation and a high book-to-market ratio at the same time). The cross-section of stock returns is vital for estimating the fair value of stocks and measuring excess returns which can be attributed to specific firm characteristics or styles of investing. Essentially, a cross-section helps to understand why some stocks with specific characteristics compensate more returns than others and to identify market factor premiums. Understanding the cross-section of stock returns and factor premiums is critical for decision-makers, including individual investors, portfolio managers, and policymakers.

Discovering factors that could generate equity premiums, referred to as factor premiums in this study, allows investors to identify potential opportunities for outperformance and use such opportunities to construct diversified portfolios that provide better risk-return trade-offs. Many studies (including (Chiah et al., 2016; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 1992, 1993, 1995, 1998, 2006, 2015, 2016; Foye, 2018a, 2018b; Mosoeu & Kodongo, 2020) have found that some stocks with specific firm characteristics have higher returns than others, for instance, small market capitalisation stocks have higher returns compared to large ones.

Investigating the cross-section of stock returns and factor premiums can also provide insight into market trends and conditions. For example, a high value premium, which means that stocks with a high book-to-market ratio have higher returns than those with a low ratio (growth stocks), is a sign of an economic downturn and vice versa (Zhang, 2005). Factor premiums also provide insight into investor behaviour. For example, if the momentum premium is high, it may indicate that investors are making investment decisions according to past performance rather than the fundamentals. Additionally, identifying the factor premiums in the Saudi stock market may help to estimate the level of returns, which is crucial in determining the cost of capital and the cost of equity. Examining the cross-section of stock returns and identifying factor premiums helps policymakers understand market conditions and investment behaviour and develop regulations accordingly.

This chapter presents an introductory overview of this comprehensive study and is organised into a various sections. The second section states the study's aim and objectives, followed by the research question in the third section. The fourth section indicates the contribution to knowledge, and the fifth section explains the practical significance of this study. A quick synopsis of the data, sample, and methodology is provided in Section 1.6. Section 1.7 provides an overview about the impact of COVID-19 on this study and how it was resolved. The thesis structure is presented in Section 1.8, and finally, the last section concludes the chapter.

1.2 Aim and objectives

The Financial Sector Development Program (FSDP) lays out one of the main agendas of Saudi Vision 2030, which aims to be a global leader in the capital market [1]. The FSDP has introduced measures to enhance the global integration of the Saudi stock market. These measures may have substantially affected the growth of the capital market of Saudi Arabia in the last few years and in particular, its global integration[2]. For example, the percentage of foreign investors in the Saudi stock market has increased significantly (see Figure 2.1).

As previous literature indicates, a market with a lower degree of global integration (not fully integrated), such as the Saudi stock market, can offer great diversification opportunities for investors (Bekaert et al., 2009; Click & Plummer, 2005; Lean & Teng, 2013; Patel, 2019, 2021).

[1] For more information about the mission and the objectives of the Tadawul globally: https://www.saudiexchange.sa/wps/portal/saudiexchange/trading/investing-trading/qualified_foreign_investors

[2] In June 2015, foreign investors were allowed for the first time to invest in the Saudi Stock market with some restrictions, and some of those restrictions were lifted in 2016 and 2018 by the Capital Market Authority. More details are in the link below: https://www.saudiexchange.sa/wps/portal/saudiexchange/trading/investing-trading/qualified_foreign_investors

Thus, global investors can capitalize on such opportunities. However, those investors need to understand the pattern of the returns in the Saudi stock market, which can be examined by investigating asset pricing models and factor premiums.

The literature presents some evidence that the entrance of foreign investors can put pressure on certain stocks, which might cause an increase in volatility and generate equity premium. For instance, Jiang and Yamada (2011) find that the size premium greatly correlates with the investment flows of international institutional investors into the Japanese stock market. They find that the investment flows intensify and shift to larger stocks, causing the size premium to be inversed, which means that large market capitalisation stocks have an equity premium over small stocks.

This finding contradicts the size effect discovered by Banz (1981) and empirically examined by (Chiah et al., 2016; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 1992, 1993, 1995, 2015; Foye, 2018a, 2018b; Griffin, 2002; Mosoeu & Kodongo, 2020). The literature presents evidence about the improvements and changes that can occur because of the entry of foreign investors into emerging markets (Alexander et al., 1987; Batten & Vo, 2015; Bekaert & Harvey, 2000; Frenkel & Menkhoff, 2004), but there is very little evidence about the impact of foreign investors on the factor premiums and the cross-section of stock returns. Therefore, it is interesting to examine the implications of the entrance of foreign investors on the factor premiums and the cross-section of stock returns.

Saudi stock market investors are primarily retail investors (see section 2.5.1). The social and religious norms imposed by Saudi Arabian society force some individual investors to invest in Islamic stocks, that is, those that comply with Sharia law. This social norm has led to the classification of stocks in the Saudi stock market as Islamic, mixed, and non-Islamic based on their operational activities and financial income (see section 2.5.2).

Various studies have investigated Islamic stocks with mixed results (Gupta et al., 2014). Some studies find that Islamic stocks are profitable and more volatile in the Saudi stock market than non-Islamic stocks (Al-Awadhi et al., 2018; Canepa & Ibnrubbian, 2014). Narayan and Phan (2017) also find that the premium on Islamic indices is due to risk exposure, rather than mispricing. Contrastingly and more interestingly, Merdad et al. (2015) find a negative “Islamic effect” in the Saudi market, which means that non-Islamic stocks are more profitable in the context of the cross-section of stock returns. Merdad et al. also conclude that the classification of Islamic stocks plays a strong role in capturing the variation in the cross-section of stock returns[3]. These inconclusive results need further investigation.

Given this background, foreign investors' behaviour could aim towards stocks with certain characteristics that are different from domestic investors preferences and might alter the volatility, put price pressure on different stocks, and change the pattern of the returns. Although these behaviours may be contradictory, all investors in the Saudi market need to understand the relationship between risk and returns, which can be investigated by examining factor premiums and asset pricing models. This helps investors to construct more efficient portfolios, manage portfolio risk, and develop investment strategies.

Therefore, this study aims to identify the factor premiums and asset pricing models that describe the average returns in the Saudi stock market and uncover the implications of Islamic stock classification and global integration of the Saudi market on both factor premiums and asset pricing models. This aim is achieved via the following objectives:

- ❖ The first objective is to identify the factors with a significant equity premium in the Saudi equity market, such as size, value, profitability, investment, and Islamic.
- ❖ The second objective is to compare the ability of Fama and French's three- and five-factor models to describe the variation in the cross-section of stock returns in the Saudi equity market.
- ❖ The third objective is to examine whether adding an Islamic factor to the existing Fama and French models can improve the models' ability to describe the variation in the cross-section of stock returns.
- ❖ The fourth objective is to investigate whether the global integration of the Saudi equity market has changed the significance of the factor premiums and the performance of asset pricing models in the Saudi stock market.

1.3 Research questions

The research is built on the framework of the five-factor model of Fama and French (2015) to achieve the above aim and objectives. This approach uses time series regression on the cross-

[3] The sample period of their study covers the period from 2002-2011, while this study covers a different period from 2009 to 2021.

section of stock returns for double-sorted portfolios of different stock characteristics. This framework is the best method to answer the research questions, which are:

1. Do the following factors: size, value, profitability, investment, and Islamic, have a significant equity premium in the emerging stock market of Saudi Arabia?
2. Does the Fama and French five-factor model (FF5FM) improve the ability of the Fama and French three-factor model (FF3FM) to describe the variation in the cross-section of stock returns in the Saudi stock market?
3. Does the Islamic factor improve the ability of the three- and/or five-factor model to describe the cross-section of stock returns in the Saudi stock market?
4. Have these factor premiums and the asset pricing model's ability to describe the variation in the cross-section of stock returns in this study changed significantly since global integration?

1.4 Contribution to knowledge

This study contributes to the literature in various ways. Primarily, it provides new evidence about the implications of global integration on factor premiums and asset pricing models in emerging markets.

Chapter 2 presents evidence of the increase in foreign investors in the last few years (see Figure 2.1). Jiang and Yamada (2011) investigate the implications of international institutional investors' inflow to the Japanese stock market and find that the size premium was highly correlated and inversed. This was caused by new investors' behaviour towards larger stocks and contradicts the size effect discovered by (Banz, 1981) and empirically examined by (Chiah et al., 2016; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 1992, 1993, 1995, 2015; Foye, 2018a, 2018b; Griffin, 2002; Mosoeu & Kodongo, 2020). In a similar way, perhaps new investors' behaviour in the Saudi market also aim toward stocks with certain characteristics that are different from domestic investor behaviour, which might increase volatility and put price pressure on those assets, contributing to a change in equity premiums. The literature offers some evidence about the improvement and changes that may occur because of the entry of foreign investors into emerging markets (Alexander et al., 1987; Batten & Vo, 2015; Bekaert & Harvey, 2000; Frenkel & Menkhoff, 2004), but there is very little evidence about their impact on the factor premiums and the cross-section of stock returns.

Therefore, the investigation of the implications of global integration on factor premiums and the cross-section of stock returns in the Saudi stock market may provide new evidence about emerging markets.

The study also provides new evidence about the role of Islamic stocks in the context of the cross-section of stock returns. Social and religious norms influence domestic investors' behaviour in the Saudi equity market. Saudi investors prefer to buy Islamic stocks over non-Islamic ones and act as noise traders (Canepa & Ibnrubbian, 2014). Palomino (1996) says that the noise traders produce an additional source of systematic risk. The literature presents some evidence that individual domestic investors are noisy traders in the Saudi market (Alkhaldi, 2015; Canepa & Ibnrubbian, 2014). Taking into consideration the findings about the profitability of Islamic stocks due to their risk exposure that comes from their restricted source of income, (Al-Awadhi et al., 2018; Canepa & Ibnrubbian, 2014) emphasize the idea of a systematic risk pattern within the Islamic classification in the Saudi market. Therefore, investigating the equity premium for Islamic stocks as a new factor to explain the variation of the cross-section of stock returns may add new evidence. It may also extend the literature by adding the Islamic factor to the Fama and French (1993, 2015) asset pricing models. A new six- and four-factor model may be better in explaining the pattern of returns in Islamic economies. The equity premium in Islamic classification is not based on economic or accounting factors, unlike the other factors (such as size, value, etc.). This factor therefore offers a qualitative classification base for analysis of equity premium.

The third academic contribution of this study is to assess the applicability of the Fama and French five-factor model in the context of the Saudi stock market. Numerous empirical studies examine this model's ability to describe the variation in the cross-section of stock returns and the significance of factor premiums in developed and emerging markets (Acaravci & Karaomer, 2017; Chiah et al., 2016; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 2015, 2017; Foye, 2018a, 2018b; Huang, 2019; Kubota & Takehara, 2018; Mosoeu & Kodongo, 2020) and conclude that the model is superior and improves on the previous Fama and French three-factor model. The new five-factor model is a useful tool to describe the cross-section of stock returns, which is very important for investment and regulation decisions. However, this area has received less attention in the Saudi equity market and other emerging markets in the Middle Eastern and North Africa (MENA) region.

Emerging markets in the MENA region are relatively new, have low regional and international integration, smaller market capitalisation and fewer listed stocks, a high level of volatility caused by political uncertainty (Chau et al., 2014), rely on service and natural resources industries without a significant manufacturing industry, and have a very high level of retail investors (70% to 90% of investors in Saudi stock markets are individuals)[4]. Therefore, this study provides the literature on asset pricing and cross-section of stock returns with new evidence about the validity of Fama and French three- and five-factor models and the factor premiums in a market with unique characteristics such as the Saudi stock market (see Chapter 2).

The fourth contribution is that the study provides new evidence about variations in equity premium and asset pricing models when different returns frequency and portfolio weighting schemes are used. Various studies show that equal-weighted portfolios consistently outperform value-weighted portfolios (Malladi & Fabozzi, 2017; Pae & Sabbaghi, 2010). Plyakha et al. (2021b) suggest that equal-weighted portfolios reveal much greater volatility and kurtosis. Despite these undesirable characteristics, equal-weighted portfolios exhibit higher Sharpe ratios and more returns than value-weighted portfolios. Taking into consideration that most of the studies in the context of asset pricing and factor premiums use one frequency for the return and one weighting scheme for the portfolio (for example, (Fama & French, 1992, 1993, 1995, 2015; Foye, 2018a, 2018b; Foye & Valentinčič, 2020; Mosoeu & Kodongo, 2020), the use of value- and equal-weighted portfolios in both monthly and weekly data sets provides the literature with evidence and ensure a consistent result. The literature has had a long debate about the performance of equal-weighted versus value-weighted portfolios, however, there is little evidence in the context of the cross-section of stock returns. Therefore, this study provides new evidence about the implications of using different return frequencies and portfolio weighting schemes on factor premiums and asset pricing models.

Lastly, this study sheds light on the impact of the recent COVID-19 pandemic on the cross-section of stock returns on the Saudi stock market. Al-Awadhi et al. (2020) finds that the Chinese stock market is negatively correlated with increased COVID-19 cases. Specifically, large market capitalisation stocks were impacted more than small stocks. Other studies have also shown that the financial markets were negatively correlated with the growth of COVID-

[4] Source: demographic monthly reports of Tadawul’s official website between 2010 to 2021.

19 cases. For instance, Alzyadat and Asfoura (2021); and Atassi and Yusuf (2021) find that the main index of the Saudi stock market was negatively correlated, and all sectors were impacted similarly. Taking into consideration the social and religious norms and the noisy traders in the Saudi market (Alkhaldi, 2015; Canepa & Ibnrubbian, 2014), investors might have panic because the pandemic created a noisy signal in the market and increased market volatility. Those investors were particularly interested in trading mainly in Islamic stocks. Al-Khazali et al. (2014) finds that Islamic indices outperformed non-Islamic ones during the 2008 financial crisis. Therefore, this study examines the impact of COVID-19 on certain stock characteristics (such as market capitalisation, book-to-market ratio, profitability, investment policy, and Islamic compliance) to determine whether these stocks may offer a level of protection in similar circumstances.

In these ways, this investigation adds new evidence and contribute to the existing literature.

1.5 Practical contribution

Lagoarde-Segot and Lucey (2008) study concludes that emerging markets in the MENA region are more developed and predictable than emerging markets in East Europe and Latin America, but remain behind Asian markets. The emerging markets in this region have high profitability; for instance, Saudi Arabia had average stock returns of 36.72%[5] in 2021 alone and 11.17% in the previous 25 years. Although the markets in this region, including the Saudi stock market, have suffered from low global integration, integrating with global markets can significantly improve a young and active market like the Saudi equity market.

Policymakers in Saudi Arabia have realized this problem and therefore they opened the Saudi capital market to qualified foreign investors (QFI) in 2015 (with some restrictions). The government has planned for more regional and global integration aligned with the country's 2030 vision, which involves Saudi Arabia's capital market becoming the leader in the MENA region. The market already shows evidence of becoming more globally integrated, and restrictions were eased on QFIs in 2016 and 2018.

[5] TheGlobalEconomy.com
https://www.theglobaleconomy.com/Saudi-Arabia/Stock_market_return/#:~:text=The%20latest%20value%20from%202021%20is%2036.72%20percent.

Consequently, the number of QFIs has rapidly increased (see Figure 2.1), and the market seems to be slowly becoming a destination for portfolio managers and global investors seeking diversification opportunities. The evidence indicates that emerging markets provide global investors with great diversification opportunities (Bekaert & Harvey, 2000; Gopal et al., 2021). However, incorporating the Saudi market into global markets needs to be backed up by research to help investors understand market behaviour, and there is a need for studies explicitly investigating factors that provide insights into the underlying risks to equity premium that investors are exposed to in the Saudi equity market. Investors and portfolio managers need to know about the fair value of Saudi stocks and what drives certain stocks to be more profitable than others. All this can be determined by investigating the cross-section of stock returns and factor premiums.

This study of the cross-section of stock returns and factor premiums creates insight into returns patterns, underlying associated risks, and trends exhibited by stocks with specific characteristics, such as small market cap stocks, that helps individual and institutional investors to:

(i) identify potential opportunities and risk exposure by understanding the historical returns of stocks with certain factors and characteristics are known to offer higher returns or are exposed to higher risk;

(ii) construct portfolios by targeting particular investments and risk exposures that are tailored to an investor’s risk and returns preference, and tilting the portfolio towards stocks with factors have historically generated higher returns (lower risk);

(iii) evaluate performance by comparing the returns of a portfolio that consists of stocks with specific characteristics and their expected equity premium;

(iv) diversify by incorporating stocks that have factors with low correlations, and

(v) manage risk by using the factor premiums as a framework for potential risk exposure that also drive their premium.

Investigating the cross-section of stock returns and discovering factors with a significant premium in Saudi markets is very important for all investors, especially market newcomers. It can also be used to determine market conditions and trends, for instance, when large market cap stocks suffer more than small market cap stocks, the market trend is downward (Deb & Mishra, 2019).

Examining the cross-section of stock returns to identify the factor premiums in the Saudi market helps policymakers in multiple ways. Factor premiums provide insight into the efficiency of the financial market. If factor premiums consistently earn excess returns, investors can generate higher returns by following certain strategies. Knowing this helps authorities promote or regulate certain investment strategies to prevent illegal market speculation or take steps to mitigate risk. Also, factor premiums can indicate market conditions, as the example given in the previous paragraph about the market trend helps the policymaker to act accordingly, for instance, by stimulating economic growth in the case of low market growth.

Identifying equity premium tailored to the underlying risks in the Saudi market can be used as a benchmark to help investors and policymakers make proper decisions. It determines the cost of equity and allow portfolio managers and investors in Saudi Arabia to identify the equity premium based on the risk associated with the selected investment. This benchmark also helps to determine the cost of capital and the selection of the proper rate when evaluating alternative investments by firm managers. Policymakers in Saudi Arabia need this information to promote the market, handle financial issues, create and apply required financial regulations to the market, and apply pricing regulations on utility and telecommunication services using the average rate of returns in the market as a fair rate of return.

Finally, introducing a new Islamic factor independent of other common factors, such as size, value, and profitability, provides diversification benefits for international investors. This diversification opportunity allows global investors to enhance returns, decrease risk, and help the government attract more investors and expand the market. Other Islamic countries can benefit from this study because they will be able to discover the benefits of Islamic premiums and attract international investors.

1.6 Overview of the sample, data, and research methodology

Obtaining the accurate and efficient results required to meet the study’s objectives cannot be achieved unless the study's sample period is sufficient. The study period must, to a certain extent, have a stable and efficient market. For example, you cannot use data from a period full of unlawful speculation and inside trading with no accounting disclosure requirements, as existed in the Saudi stock market in the past before 2006 and generate accurate results representing today’s market. Therefore, this study relies on data from 2009 onwards, when the

Saudi stock market started to show stability and more regulations were taking place (see section 2.3).

The sample period is from April 2009 to March 2021 and relies entirely on secondary data from multiple sources. All listed stocks from the sample period are used, including stocks in the TASI (Main Index) and the Nomu (Parallel Market). The primary source for the stocks' historical and accounting data is the Eikon DataStream database, and some missing data are obtained from E-Reference Data, which is a database provided by Tadawul, the authorized securities exchange in Saudi Arabia. The Islamic classifications of the stocks are acquired from almaqased.net, and the risk-free rate is obtained from the Saudi Arabian Monetary Authority's official website.

This study employs the framework and statistical methods applied by Fama and French (2015). Additionally, it uses two frequencies, weekly and monthly, to calculate the stock return, and two weighting schemes, equal-weighted and value-weighted, to calculate the return of the portfolios. I apply one-sample and two-sample t-tests to investigate the significance of the factor premiums.

I employ time series regression and the GRS test (Gibbons et al., 1989) to compare the asset pricing models examined in this study. In these models, the dependent variables are the Left-Hand-Side (LHS) portfolios formed from the intersections between stocks with different firm characteristics, and the independent variables are the Right-Hand-Side (RHS) factors instructed from subtracting the returns of some portfolios with certain firm characteristics stocks from the others.

1.7 Covid implications

COVID-19, a virus caused by Severe Acute Respiratory Syndrome (SARS) (Anand et al., 2021) from the Coronaviridae family, was declared a pandemic in March 2020 by the World Health Organization (World Health Organization, 2020). The pandemic triggered an unprecedented global economic crisis. An unexpected COVID-19 recession in the United States started in February 2020, although it was not announced until June 2020 (Campbell et al., 2021). The immediate impact of COVID-19 on the business cycle should be carefully reviewed, considering that factor premiums tend to change over time in different business cycles (Fama & French, 1989). Given that investigating factor premiums in the Saudi stock market is one of most important elements of this study, it is important to examine the impact of COVID-19 on them.

Rouwenhorst (1999) investigates factor premiums in many global markets, and concludes that the sample selection criteria he used led to a sample selection bias. This bias explains his odd results. The importance of sample selection criteria for factor premiums is a good reminder of the significance of the sample period. Considering the negative bias of COVID-19 on stock volatility (see Baek et al. (2020), the question of whether or not to include the period of COVID-19 in this study is raised.

It is vital to investigate the impact of COVID-19 on the returns of the portfolios that form the LHS portfolios and construct the RHS factors. The returns of those portfolios are the input for all the asset pricing models investigated in this study. The main concern is whether the returns for some portfolios are more impacted than others by the growth of COVID-19 cases in Saudi Arabia, which will lead to a biased result. For this reason, I investigate the impact of COVID-19 on those portfolios by using multiple approaches explained in Chapter 8.

1.8 Thesis structure

This thesis is structured to help the subject emerge gradually. The chapters are summarised below:

Chapter 1: Introduction and motivation - this chapter introduces the background information of this study and the motivation behind it. It also states this study's main aim, objectives, and research questions. The contribution to the knowledge and the significance of this study is also included. This chapter also briefly details the sample, data source, and methodology.

Chapter 2: Saudi stock market and the sample period - this chapter gives background information about the history of the Saudi stock market, including the challenges the market went through. Then, the choice of sample period is explained. Finally, the market's regulatory structure and demographics are thoroughly explained.

Chapter 3: Literature review - this chapter comprehensively overviews the literature about factor premiums and asset pricing models.

Chapter 4: Methodology - this chapter discusses the methodology used in this comprehensive study. It explains the data, samples, and data sources. It also explains the asset pricing models, the returns calculation methods, the weighting schemes of the portfolios, the portfolio formation procedure, and the statistical methods for the data analysis.

Chapter 5: **Factor premiums** - the chapter discusses and analyses hypotheses H1 and H3 relating to the significance of factor premiums.

Chapter 6: Asset pricing models - this chapter examines hypotheses H2 and H4 relating to the performance of the asset pricing models in the Saudi market, including the Fama and French models and the models with the additional Islamic factor.

Chapter 7: The impact of the global integration - the impact of global integration on factor premiums and the performance of asset pricing models is examined in this chapter, covering hypotheses H5.1 and H5.2.

Chapter 8: Impact of COVID-19 on the cross-section of returns and factor premiums - this chapter discusses the impact of COVID-19 on the different firm characteristics used to build the LHS portfolios and RHS factors used to examine the hypotheses and to build the asset pricing models.

Chapter 9: Conclusion and implications - this chapter summarises the key findings, discusses the practical contributions, and gives policy recommendations. Additionally, it addresses the limitations of this study and offers recommendations for future research.

1.9 Conclusion

The cross-section of stock returns is an essential tool to understand how certain stocks compensate investors more than others, and is an imperative tool from an investor's perspective. Therefore, this study aims to investigate asset pricing models, Fama and French's three- and five-factor models, that attempt to explain the variation in the cross-section of stock returns in the Saudi context.

However, this study adds a unique new factor, the Islamic factor, to see if it improve the models' ability to explain the pattern of returns in the Saudi stock market. The investigation assesses the ability of the models to describe the variation in the Saudi stock market, the significance of the premium in the models' factors, and the impact of the global integration on asset pricing models and factor premiums. The study period runs from 2009 until 2021, and more justification for the sample period is given in the next chapter (see section 2.3).

This introductory chapter briefly outlined the importance of this study in the context of the Saudi stock market. It was organised in a few sections starting with a brief introduction. The second section presented the research aim and stated the study's objectives. The third section specified the research question this study aims to answer. This was followed by the fourth section discussing the contribution to the knowledge, and then Section 1.5 explained the study's significance. Section 1.6 briefly described the data source, sample, and methodology. Section 1.7 detailed the implications of COVID-19 for the Saudi stock market. Then, section 1.8 explained the structure of this thesis, and finally, the last section concluded the chapter.

Chapter 2: Saudi stock market and the sample period

2.1 Introduction

The preceding chapter outlined the research objectives and questions and the proposed practical and theoretical contributions of the study. It is imperative to gain an understanding of the context of the Saudi stock market to underscore the significance of the objectives specified in the previous chapter. Consequently, Section 2.2 presents the history of the financial market across its different stages. Then Section 2.3 addresses the significant challenges the market has encountered and the implications of those challenges on determining the sample period for this study.

Section 2.4 provides an overview of the regulatory authority and regulations of the capital market, highlighting recent changes and improvements. In Section 2.5 crucial information regarding the characteristics of the Saudi Stock Market is presented, including market demographics, the domination of Saudi retail investors, and recent changes in market demographics. The implications of these changes in market demographics are then briefly discussed. Lastly, Section 2.6 gives a brief overview of Islamic and non-Islamic stocks and the methods employed for this classification. Finally, Section 2.7 concludes this chapter.

2.2 Saudi stock market history

The Saudi stock market (Tadawul) has grown substantially despite its relative youth, prompting Morgan Stanley Capital International (MSCI) to upgrade it to an emerging market in 2018. The Saudi stock market is the largest in the MENA region in terms of market capitalisation and the third largest in listed stocks (see Table 2.1). Although the modern official stock market of Saudi Arabia is relatively young, the informal stock market was established right after the country was united early in the 1930s. From the 1930s until the present, the market has gone through many stages and reformations.

Table 2.1: Market capitalisation and number of listed stocks in MENA region in 2020

No	Country	Market capitalisation (USD)	Listed stocks
1	Saudi Arabia	2429.1	207
2	Iran	1218.39	367
3	United Arab Emirates	294.83	130
4	Qatar	165.39	47
5	Kuwait	105.99	163
6	Morocco	65.57	75
7	Egypt	41.35	240
8	Bahrain	24.61	42
9	Jordan	18.21	179
10	Oman	16.48	111
11	Tunisia	8.57	80
12	Lebanon	6.7	10

Source: TheGlobalEconomy.com

The first stage of the stock market was between 1935 and 1983, and commenced when the Arab Automobile Firm joint-stock company was listed in 1935 (SAMA, 1997). This event marked the birth of the informal stock market of the Kingdom of Saudi Arabia. However, the stock market was not a priority for the government, which was busy with enormous infrastructure projects to develop the country. In the 1950s, four listed businesses worth SAR 941 million distributed 9.3 million shares. In the 1960s, the number increased, and there were 17 publicly traded stocks with a market value of SAR 2.95 billion and 29.9 million shares. Those stocks were in the sectors most needed for ongoing infrastructure projects, the cement and electricity industries.

The most significant increase in the number of stocks was between 1976 and 1980 (SAMA, 1997). During this period, the market witnessed aggressive speculation behaviour caused by economic growth and cash in hand with a lack of proper formal channels for investment (Abdeen & Shook, 1984). Trading was managed by roughly 80 unlicensed stockbrokers due to the lack of regulation (Alkhudairy, 2008). The growing interest in the Saudi stock market caused aggressive speculation. A similar situation happened in the Kuwaiti stock market, which led to the Kuwaiti market crisis in 1982[6]. The government took regulatory action motivated by its responsibility to prevent the public from experiencing similar events. A royal decree was issued in 1983 to form a joint committee of three government bodies[7] responsible for drafting the first stock market regulation. This was the birth of the establishment stage of the Saudi stock market.

This establishment stage refers to the stock market period from 1984 to 2003. The government's first step toward regulating the market was to create a formal trading platform instead of the existing unlicensed brokers. In 1984, the Saudi government granted permission to the Saudi Arabian Monetary Agency (SAMA) to be responsible for creating a safe and regulated trading system. As a result, SAMA blocked stock trading outside 12 designated banks, similar to the trading system in the German stock market at that time (Butler & Malaikah, 1992). In the same year, the Saudi Share Registration Company (SSRC) was established by the 12 banks for clearance and settlements. Although trading was initially over the counter, the SSRC served as a clearing system after executing orders and had a central unit to coordinate daily market orders (Butler & Malaikah, 1992).

SAMA improved the trading system a few times during this stage of the stock market. In 1990, SAMA replaced the old SSRC system with the Electronic Securities Information System (ESIS), an electronic trading platform that serves and coordinates better and faster. This allowed the banks to set up Central Trading Units (CTUs) linked to the SAMA Central System to enable daily electronic transfers of the ownership of the shares (Alkhudairy, 2008). The Tadawul, a digital platform for instant share trading, replaced the ESIS as the primary trading system early in 2001. In contrast to the old system, the new trading platform expedites share transfers and trading cycles. It was efficient, fast, and designed to process a large number of transactions (Ramady, 2010). Introducing Tadawul advanced the trading mechanism in the Saudi market and attracted more investors. However, during this period the market faced many challenges, including improper coordination among government bodies, self-serving agendas (Ramady, 2010), and a lack of transparency (Niblock & Malik, 2007).

An awareness of those issues by Saudi Arabian decision makers led to a new stage of the market, which is the developed stage lasting from 2003 until today. The decision makers realised that

6 This crisis known as Souk Al-Manakh stock market crash, which was unofficial stock market in the state of Kuwait.
7 The Saudi Arabian Monetary Agency, the Ministry of Commerce, and the Ministry of Finance

taking the market to the next level required more in-depth work to improve transparency and independence. Thus, the Capital Market Law (CML)[8] was proclaimed by the Royal Decree No M/30 on 31/7/2003, which included the order to establish the Capital Market Authority. This authority is a new governmental entity with a direct line to the prime minister and complete independence in finance and administration (Capital Market Authority, 2014). The Capital Market Authority is responsible for regulating and monitoring all aspects related to the capital market in Saudi Arabia, including the stock market. By issuing and implementing the CML, the Saudi stock market entered a new era with substantial changes that led to significant growth.

The improvements in the market trading mechanism, including the CML and the establishment of the Capital Market Authority, increased the general public's awareness of stock market trading. The stock market became a new investment opportunity for many Saudis. Therefore, many new investors entered the market daily, and the trading volume increased substantially (Alkhaldi, 2015). This sudden and continued increase in the trading volume allowed the Saudi stock market to jump dramatically in less than four years from 2,518.8 points at the end of 2002, the year before the CML was issued, to 20,634 at the beginning of 2006. The market capitalisation also increased substantially from SAR 282 billion in 2002 to roughly SAR 2,500 billion by the beginning of 2006. Although the market's growth during this time was remarkable, it was a bubble created by speculators, and the market crashed in 2006 when it lost more than 60% of its value (Alkhaldi, 2015).

This catastrophic event was the first massive crash the Saudi stock market had ever had, impacting every household in the country. Alkhaldi (2015) attributes the crash to multiple reasons, but emphasizes speculation as the main reason. The other reason was the lack of transparency and disclosure, leading to violations such as insider trading, price manipulation, false statements, and spreading rumours (Alkhaldi, 2015). All this happened under the supervision of the Capital Market Authority, and no real actions were taken against the unlawful practices. Alkhaldi (2015) argues that the inexperienced Capital Market Authority at the time and the fear of negative consequences that might result from taking harsh actions against these violations worsened the issue. The Capital Market Authority was established a couple of years before this crash happened, and things got out of control while it was forming.

8 The Capital Market Law is formulated to regulate and develop the capital market, to monitor its transactions, to govern the issuing of securities, and to supervise authorised persons licensed by the Capital Market Authority. In addition, it protects investors from illegal and unethical practices in the capital market.

However, late in 2007 the Capital Market Authority announced new restrictions on listed stocks to prevent speculation in the market. For instance, to prevent insider trading throwing the market off balance, information about block holders of listed companies that own more than 5% of the issued shares were obliged to be available. IPOs have become more restricted, and they must provide more accurate and specific information and avoid misleading details. Additionally, the Capital Market Authority issued several significant trading restrictions that apply to listed firms' boards of directors. Further, from late 2009 commercial banks were no longer authorised as intermediaries, and the brokerage industry became more regulated, which resulted in 110 brokerage licences being issued the same year. The new legislation is primarily concerned with ensuring that the same information is available for everyone in the public to prevent insider trading and illegal speculation (Alkhaldi, 2015).

The regulations and improvements increased the market's size and importance regionally and globally. At the end of 2008, the number of listed stocks based on Tadawul's 2008 annual report was 127, increasing by December 2021 to 210 listed firms.

The MSCI[9] Saudi Arabia Index, designed to measure the performance of large and mid-cap segments of the Saudi Arabia stock market, was launched in October 2014. In June 2015, MSCI upgraded those indexes to become Standalone Market Indexes (occurring at the same time as the Saudi stock market was opened to foreign investors). The MSCI Tadawul 30 index was jointly launched by the MSCI and Saudi Tadawul Exchange in December 2018. It targets the top 30 securities of the MSCI Saudi Arabia IMI Index using a free float market cap. Also in the same year, the MSCI upgraded the Saudi stock market into an 'emerging market' and announced the inclusion of the market in MSCI's Emerging Market Index. The Saudi stock market was also included in FTSE Russell and S&P Dow Jones emerging market indices in 2019. This inclusion in global indices mainly developed after the market was opened for qualified foreign investors (QFIs) in June 2015.

Early in 2014, the Capital Market Authority published the draft rules for QFIs[10], and in June 2015, QFIs were allowed to trade in the stock market. The rules relevant to QFIs were amended twice in 2016 and 2018. The QFIs must be institutions such as banks, brokerage firms, insurance companies, government organizations, and other institutions. The QIFs ranged

9 Morgan Stanley Capital International is a very well-known global provider for equity and other index (https://www.msci.com/documents/10199/2cac2742-11e3-4ecb-8884-149b0ac03481)
10 https://cma.org.sa/en/MediaCenter/PR/Pages/press-release-on-ocassion-of-QFI-release.aspx

between 12% and 14% of the total trading in the market based on the weekly report on the 9th of June 2022[11]. More than 2,300 QFIs[12] were trading in the market at the end of 2020, up from 800 at the beginning of 2019[13], and their capital market ownership worth increased to SAR140 Billion[14] from SAR30 Billion at the beginning of 2019[15]. Furthermore, the Capital Market Authority allowed foreign companies to be listed in the Saudi stock market.

This brief section has covered most of the important issues the Saudi stock market faced during its life and the characteristics of each different stage. The next section covers the most challenging issues and events the market has been through, and makes some recommendations about the choice of sample period.

2.3 Market issues and sample period recommendations

The market history outlined in the previous section revealed the numerous challenges faced by the Saudi stock market that included liquidity, trading mechanisms, transparency, insider trading, unethical speculation, the 2006 bubble, rumours, and herding behaviour (Alkhaldi, 2015; Butler & Malaikah, 1992). Saudi Arabia's regulators addressed these issues through reforms and regulations, particularly with the launch of the new digital Tadawul system in late 2001 and the Capital Market Law (CML) in early 2003. These initiatives significantly improved the market and substantially boosted confidence in the market. Thus, the market was quite different after 2003.

Therefore, this study does not include the period before 2003, when the market suffered from many legal issues, such as transparency and illegal speculation. Furthermore, the trading mechanism was not efficient, and all the transactions were done manually. The clearance between brokers was executed after trading hours until the Tadawul system was launched in 2001. The lack of immediate ownership transfer caused issues such as liquidity. Another third reason was the small number of listed stocks (less than 70) which may not be adequate to examine the cross-section of stock returns given that portfolios need a sufficient number of stocks to be formed. Lastly and most importantly, the Saudi Arabian stock market listed stocks

11 https://www.saudiexchange.sa/wps/wcm/connect/d09a988b-7dab-4117-a02b-972553a045ca/Weekly+Trading+and+Ownership+By+Nationality+Report+09-06-2022.pdf?MOD=AJPERES&CONVERT_TO=url&CACHEID=ROOTWORKSPACE-d09a988b-7dab-4117-a02b-972553a045ca-o5nqnc-
12 Annual Report 2020
13 Annual Report 2019
14 Annual Report 2020
15 Annual Report 2019

were not forced to reveal annual financial data before 2003 (Niblock & Malik, 2007; Ramady, 2010). Therefore, there was a lack of transparency and data availability to investigate the market for that period. The absence of transparency in the stock market impacted the market quality and efficacy in multiple ways (Chowdhry & Nanda, 1991; Madhavan, 1995, 1996; Pagano & Röell, 1996). Thus, the inclusion of this period would give imprecise results. It would not be efficient to investigate the Saudi market in this period.

However, the Capital Market Authority was established in early 2003 by Royal Decree No. M/30 and more regulations applied to the market. The market also witnessed a huge increase in capitalisation, and listed stocks doubled in less than six years, from 70 in 2003 to around 140 in 2009. However, the rapid market growth associated with CML issuance and the establishment of the Capital Market Authority in 2003 brought serious problems to the market for a few years, which ended with the market crash in 2006 and was followed by the financial crisis 2008.

The main index of the Saudi market, TASI, expanded significantly from about 2,500 points by the end of 2002 and closed at 4,437 points in 2003. The SAMA annual report attributed the expansion to the increases in market confidence, the growth of the domestic economy, and many new investors (Alkhaldi, 2015). Due to these factors, Saudi Arabia's equity market capitalisation increased rapidly from SAR 20 billion in 2002 to SAR 174 billion at the end of 2005. On 25 February 2006, the TASI registered its highest point in its history – 20,634 points –almost nine times its value in 2002. However, the TASI started to collapse dramatically and lost 50% of its value in two months. By the end of 2006, it had reached 7,933 points. It took about a year for the market to recover, and in 2007, the market showed some stability, but that didn't last long. The 2008 global financial crisis dragged the TASI from about 11,600 points at the beginning of 2008 to 4,150 points almost a year later.

The reasons for this rapid increase and the collapse to the bottom in a few months are attributed to insufficient market infrastructure to support the growth in the market and unsophisticated investors (Alkhaldi, 2015). Alkhaldi also claims that the CMA, as a new entity, was inexperienced and worsened the catastrophic event. Baamir (2008) attributes the catastrophic event to herding behaviour and lack of experience among most investors. Additionally, Baamir (2008) states that the market before the crash in 2006 suffered from price manipulations, illegal speculation, and insider trading. Clearly, the law was not enforced on all investors, as illegal activities were detected in the market; however, action was taken by the Capital Market Authority a couple of years after the crisis (Alkhaldi, 2015; Baamir, 2008). Clearly, the period from 2003 until the end of 2008 was full of illegal trading and high volatility and might provide misleading results if it was included in the present analysis.

In conclusion, studying the stock returns before 2003 is not feasible due to lack of data availability, transparency issues, and the limited number of firms in the market. From 2003 to 2009, the market was inefficient and unstable, and the law was not imposed consistently, allowing illegal trading. Thus, investigating the stock returns of this period will not reflect the contemporary reality in the market and will provide inadequate outcomes. Additionally, the data on Islamic factors was unavailable before 2011 (I had to use the data from 2011 for 2010 and 2009 in this study). Finally, the regulatory structure or legal framework has improved since 2009, which has helped the market to be stable and advance further (explained briefly in the next section).

Therefore, a sample period from 2009 an onwards is more accurate for achieving the aim and objectives of this study and answering the research questions. Additional recommendations regarding the sample period are also outlined in Chapter 8.

2.4 Market legal and operational structure

This section briefly introduces the legal structure of Saudi Arabia's stock market. The current structure was introduced with the issue of the CML in 2003, then with the establishment of the Capital Market Authority, which is a body operated under the auspices of the CML. Later, in 2007, another development occurred when the Saudi stock market (Tadawul) became a joint-stock company. Establishing a committee to resolve securities disputes (CRSD) was another important step in developing the legal structure and reinforcing trust in the market. The following subsections briefly summarize the legal and operational entities of the Saudi equity market.

2.4.1 The Capital Market Law (CML)

The CML[16] was issued in 2003 to provide the capital market in Saudi Arabia with a structure and a clear order (see Section 2.2) The fundamentals and the role of the capital market, which includes the stock market, are defined by the CML. In the history of the Saudi capital market, the CML represents the most significant advance and the cornerstone that means that the Saudi stock market can play a regional and global role today. The CML determines the functions and authority of the institutions within the capital market that operate, supervise, and regulate the capital market. The CML also sets the broad principles for information disclosure for all securities in the capital market. Indeed, the CML fosters market transparency and prevents rumours and the misuse of information flying about in brokerage rooms. Additionally, it clearly defines the duties and responsibilities of any institution in the capital market, whether operational, regulatory, or supervisory, which helps efficiency and creates a more dynamic cycle. The new CML also provides criminal sanctions to ensure market justice, which was previously missing.

The CML fulfils these functions through several organisations, such as the Capital Market Authority, the Saudi Stock Exchange (Tadawul), and the Committee for the Resolution of Securities Disputes.

2.4.2 The Capital Market Authority

The Capital Market Authority was established by order of CML in 2003, and it is the only entity responsible for regulating and monitoring the capital market in Saudi Arabia, including the Saudi stock market. The Capital Market Authority is an independent organisation that reports directly to the prime minister of Saudi Arabia. Under the CML's jurisdiction, the Capital Market Authority manages and supervises the market. The Capital Market Authority's responsibilities under the CML include regulating and developing the capital market, applying appropriate standards and practises for all parties involved in trading securities, enforcing transparency, ensuring fairness and efficiency in securities trading, preventing fraudulent investments, observing and regulating primary and secondary markets, reducing risk in

16 A copy of the CML can be found at https://cma.org.sa/en/RulesRegulations/CMALaw/Documents/CMALaw.pdf

securities transactions, enforcing full information disclosure of all securities in both primary and secondary markets, and monitoring institutional investors.

2.4.3 The Saudi stock exchange (Tadawul)

The Saudi stock market (Tadawul) is a joint-stock company founded in 2007. The Tadawul is a stock exchange that operates from Sunday to Thursday from 10:00 am to 3:00 pm, and is under the direct control of the Capital Market Authority. The Tadawul has undergone many reforms and improvements since its launch; for instance, industry classifications changed twice in 2008 and 2017. Early in 2008, the sectorial classification became 15 sectors instead of the previous 8. In 2017, Tadawul changed its industry classification again to match the global industry classification standard (GICS) to be compatible with global classifications.

The Saudi stock market used to have only one market index, the Tadawul All Share Index (TASI), but the market expanded and now has two types of indices. The main market (TASI) and the parallel market (Nomu) were launched on 26th of February 2017. The Tadawul created the parallel market when it realised it would benefit medium and small enterprises, such as providing other sources to raise capital and improve transparency. The minimum market capitalisation is SAR300 million for a firm to be listed on the TASI, whereas only SAR10 million is needed for those on the parallel market. Firms must offer at least 30% of their shares to be listed in the TASI, whereas in the parallel market firms only need to offer 20%.

2.4.4 The Committee for the Resolution of Securities Disputes (CRSD)

The CRSD[17] is an independent entity that works under the auspices of the CML. This committee acts as a court to resolve disagreements regarding the CML and implement the regulations of the Capital Market Authority. The CRSD deals with disputes and claims about the actions and decisions of the Capital Market Authority and the Tadawul. By the power of the CML, the CRSD has the authority to conduct investigations and take legal action. The ability to impose penalties and grant damages is one of these legal authorities. Due to its capacity to ensure justice in rights violations, such as access to information, the body has contributed to the public's increased trust in the Saudi stock market. According to the CML, any investor engaged in Tadawul business has the legal right to sue another investor or entity,

17 For more information about CRSD: https://crsd.org.sa/en/resolutionscommittee/Pages/default.aspx

including the CMA. Additionally, those who violate the CML are subject to civil lawsuits from individuals. The CRSD and legal rights and protections for the investors have increased the level of trust in the Saudi stock market, contributing to the recent growth of the market.

In conclusion, the development of the legal structure in the Saudi stock market has indeed increased the transparency of the market. This improvement in transparency has allowed the market to become a very important emerging global market and the region's leading market.

However, transparency is not the only thing that has changed in the Saudi market. The market became globally integrated when it opened up for QIF investors in 2015, which has changed the demographics of its investors. It is essential to understand the demographics of the investors in the Saudi stock market and the trading motivation of those investors. The following subsection highlights the most unique characteristics of the market, including the market's demographics and some of the market's trading behaviours, which have some implications for this analysis.

2.5 Saudi stock market characteristics

The Saudi stock market displays a unique combination of characteristics and demographics. First, the market has no short-selling, which is a good tool for improving the efficiency of information in financial markets (Karpoff & Lou, 2010). It also plays a vital role in stabilising the market and correcting mispricing (Hong & Chung, 2003). The market has no dual listing, and all listed stocks are only traded in the Saudi market. Further, the market has no derivatives (although recently they launched futures contracts on the index and a few major stocks[18]. Those contracts are not very active.) There are no stock options, which are essentially used to hedge future price fluctuations of risky stocks, which helps make investment decisions easier.

The tools mentioned above for hedging risk and correcting mispriced assets in the market do not exist in the Saudi market, making investment decisions more challenging, and investors have to bear an additional level of risk. Investors in the Saudi stock market are mainly retail investors[19], who have dominated trading by approximately 90%[20] for many years. For example, retail investors made 88% of buy transactions in 2008 (Canepa & Ibnrubbian, 2014). This is a

18 Those stocks are Al- Rajhi, Aramco, SNB, Alinma Bank, SABIC, STC, Saudi Kayan, Saudi Electricity, Almarai, and Maaden
19 Retail investors are nonprofessional investors who invest in securities individually.
20 This percentage changed after global integration in 2015.

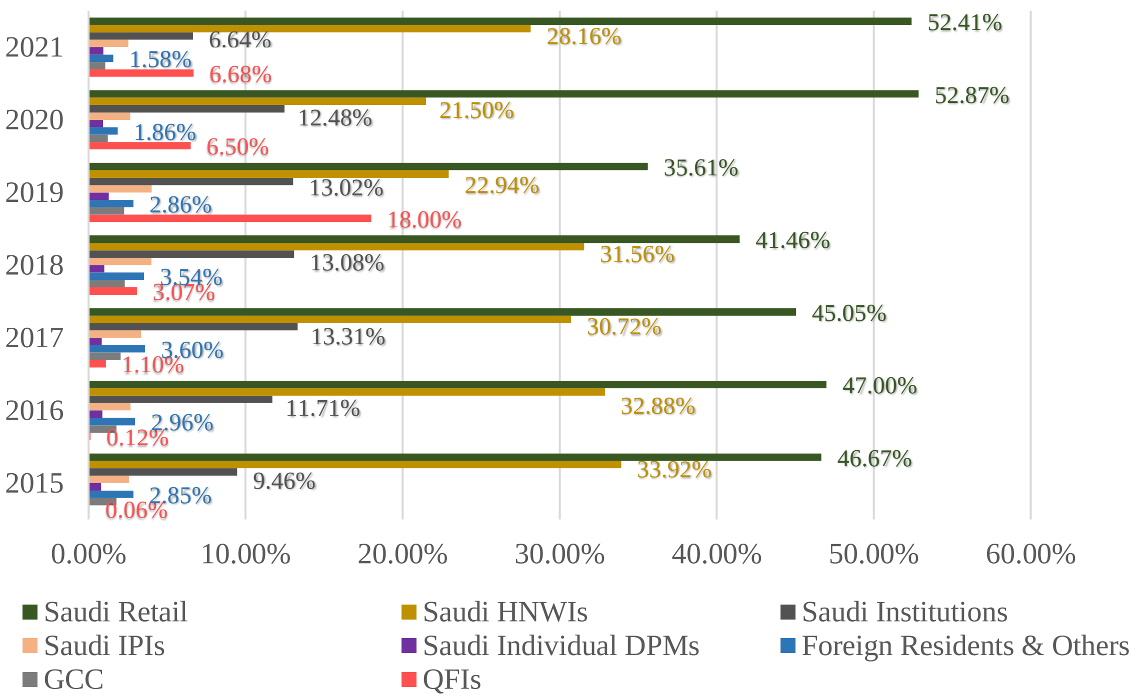
unique factor about market demographics that must be taken into consideration. Once important consequence of this is that the Saudi individual investors who dominate the market are religiously motivated to buy Islamic stocks that comply with Sharia law. The following subsection explains the demographics of the Saudi market since global integration in 2015, and the subsequent subsection introduces the concept of Islamic and non-Islamic stocks.

2.5.1 Saudi stock market demographics

2.5.1.1 The domination of Saudi retail investors (noise traders)

Saudi retail investors have always dominated trading in the Saudi stock market. The total trading percentage of those investors used to be roughly 90%, however, this percentage has ranged between 70% to 80% since global integration in 2015 (see Figure 2.1). Although the percentage of Saudi retail investors has decreased, it is still a huge percentage. It can impact the trading behaviour and drive the market in certain ways. For instance, herding behaviour is well documented in the Saudi market (Rahman et al., 2015; Youssef & Mokni, 2022). These studies conclude that the trading appetite of many investors is unlikely to follow the fundamentals of stocks.

Figure 2.1: Trading by nationality and investor type in the Saudi stock market (2015-2021)



Source: https://www.saudiexchange.sa

Additionally, some studies, such as Alkhaldi (2015), believe that retail investors in the Saudi market are unsophisticated investors and invest based on rumours. All this supports a common idea in the literature that individual investors or retail investors are noise traders (Bange, 2000; Frazzini & Lamont, 2008). The existence of noise traders within this massive percentage of retail traders makes it profitable for investors who trade based on information and fundamentals (Black, 1986). Thus, this unique market characteristic may make it a profitable opportunity for sophisticated investors, and might explain the increase of foreign investors.

2.5.1.2 Changes in market demographics

The domination of Saudi retail investors initially decreased when citizens of Gulf Cooperation Council (GCC) countries and permanent residents were allowed to invest for the first time in the market in 2007. This domination has decreased since global integration in 2015, when professional foreign investors were allowed to trade in the market. Since then, the Saudi Tadawul exchange authority has categorised investors into three main groups based on nationality: Saudis, GCC citizens, and foreigners. Then, each nationality is classified into different groups. Table 2.2 shows all those classifications based on nationality and type of investors. Figure 2.1 shows the total trading percentage for all those categories from 2015 until 2021.

The classification explained in Table 2.2 is represented in Figure 2.1 in percentage terms indicating the annual trading volume for each classified group. However, Saudi institutional groups are all represented together in Figure 2.1 and the GCC groups due to their small trading population. Similarly, the foreign groups are represented by only two groups. The first group is foreign residents and others, including all the groups under foreign classification shown in Table 2.2 except QFIs, and the second group consists of QFIs.

Table 2.2*:* Tadawul classification of investors by nationalities and types

1	**Saudi**	Individuals	Retail
			HNWIs (High net worth investors)
			Individual DPMs (Discretionary portfolio managers)
			IPIs (Individual professional investors)
		Institutions	Corporates
			Mutual funds
			GRE's (Government related entities)
			Institution DPMs (Discretionary portfolio managers)
2	**GCC**	Individuals	
		Institutions	
		DPMs (Discretionary portfolio managers)	
3	**Foreign**	SWAP holders	
		Foreign residents and others	
		QFIs (Qualified foreign investors)	
		Foreign DPMs (Discretionary portfolio managers)	
		Strategic Investors	

Note: Saudi individuals are all considered retail investors except IPIs and individual DPMs, as they are professional traders. The source of this classification comes from the Tadawul monthly reports for trading by nationalities and type of investor.

Figure 2.1 only lists percentages for Saudi retail, Saudi HNWIs, Saudi institutions, foreign residents and others, and QFIs. It can be inferred that GCC investors do not constitute a significant proportion of the market. Also noteworthy is that Saudi retail investors, which includes Saudi retail and HNWIs, are much more prominent in trading volume than Saudi institutions. Foreign residents and other investors also do not have a large percentage of the trading volume, and indeed it has decreased in the last couple of years. On the other hand, the QFIs, investors who joined the market after the global integration in 2015, initially grew slowly and then rapidly increased in 2019. However, the QFI percentages decreased again in 2020 and 2021, possibly due to COVID-19.

2.5.1.3 The implications of market demographic changes

This quick overview of the market trading demographics and in Figure 2.1 shows that Saudi retail investors drive trading in the market; however, this domination has become less in recent years. Both QFIs and Saudi institutions are of secondary importance in the demographic structure of the market. Sophisticated and professional investors are trading in a market still dominated by retail investors who live in a religious social environment, which encourages them to trade only in Shariah-compliant stocks. The religious motivation for them to buy certain stocks limits their list of tradable stocks. It also increases the trading volume and volatility of Islamic stocks. The question arises about the implications of these changes on the cross-section of stock returns and factor premiums in the Saudi market.

Brown (1999) argues that noise traders are irrational investors who trade together on a noisy signal that might cause systematic risk. He concludes that the noisy signal is sentiment, which carries a high risk of volatility. Fama and French (1992, 1993, 2015) argue that factor premiums come from a hidden state variable that represents systematic risk factors. Additionally, Verma and Verma (2007) believe that irrational sentiment has a significant negative impact on the volatility of stock returns.

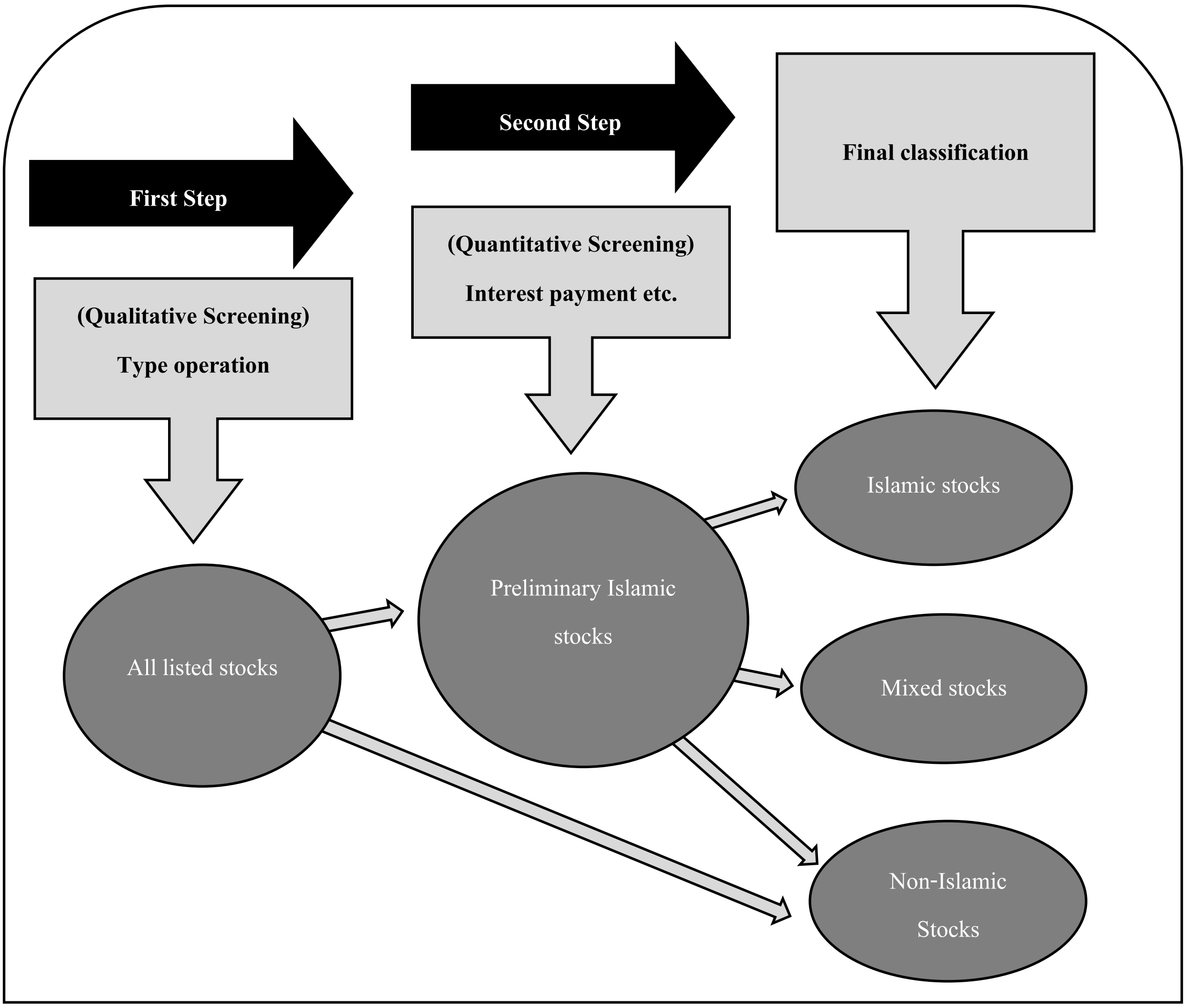
Therefore, this situation and the new changes could cause the factor premiums investigated in this study to change and become significant or insignificant in the Saudi market. Fama and French (1989) indicate the tendency of factor premiums to change over time is impacted by the business cycle. This tendency might be also driven by other factors, such as market demographics and changes in trading behaviour. The potential changes in the factor premiums examined in this study is one of the questions this study aims to answer; therefore, it is imperative to understand this unique situation in the Saudi market. It is also essential to understand the difference between Islamic and non-Islamic stocks, which is covered in the following subsection.

2.5.2 Islamic and non-Islamic stocks

Investors who a motivated to invest according to religious principles privilege Shariah law at the expense of the fundamentals and diversification principles in trading securities. In Saudi Arabia, Shariah advisory committees for Islamic banks and other independent Shariah consultants and advisors yearly publish a list of Islamic, mixed, and non-Islamic stocks. Islamic stocks comply with Sharia law, which means a firm does not engage in certain activities considered unethical according to the Islamic religion when dealing and trading between individuals or entities.

The determination of this compliance comes from qualitative and quantitative screening (Derigs & Marzban, 2008). The qualitative screening excludes certain industries because their operations are not permissible under Sharia Law, such as gambling, alcohol, tobacco, and interest rates (Riba). On the other hand, quantitative screening is concerned with interest income and the firm's financial situation. Sharia Law prohibits interest payments. Thus, quantitative screening is concerned with the level of conventional debt, interest income, and revenue from Riba's impermissible sources. Figure 2.2 demonstrates the two-step screening process for all listed stocks to finally **classify** them into three groups: Islamic, mixed or non-Islamic stocks.

Figure 2.2: The two-step screening process for Islamic stock classification



Note: This figure demonstrates the two-step of screening process for all listed stocks to finally classify them into three groups: Islamic, mixed and non-Islamic stocks.

Therefore, it is a two-step process to categorise stocks into three groups: Islamic, mixed, and non-Islamic. The qualitative screens occur first by allocating stocks directly as non-Islamic stocks or in a preliminary way, as Islamic stocks according to their industry or main business activities. The quantitative screening takes place only on the preliminary Islamic stocks that come from the qualitative screenings. Then, using each firm's accounting data, the 'preliminary Islamic stocks' are reallocated as Islamic, mixed, or non-Islamic. Allocation into these categories is based on the interest payment percentage and interest revenue. Figure 2.2 shows this process. This classification of Shariah compliance for local stocks in the Saudi stock market is annually repeated, and stocks can move from one category to another.

Islamic stocks fully comply with Shariah law, and non-Islamic stocks do not comply with Sharia principles. Mixed stocks are those whose type of business complies with Islamic laws, but a certain percentage[21] of it is financial income that does notfully comply. According to some Shariah scholars, it is permitted to buy those stocks according to Islamic principles. However, they need "dividend purification", which means giving a percentage of the income from non-Islamic income sources, such as interest rates, to charity (Bhatt & Sultan, 2012; Chang et al., 2020; Kr & Fu, 2014). The topic of mixed stocks is controversial, nevertheless, religious investors buy and purify those stocks. Purification is common among retail investors, including corporate and mutual funds, in the Saudi stock market. The purification process and percentage are usually mentioned in an equity fund's annual report (Alotaibi & Hariri, 2020).

2.7 Conclusion

This chapter provided a brief background about the Kingdom of Saudi Arabia's economy, the history of the stock market, the market issues and challenges, the market legal structure, the Saudi stock market's unique characteristics, and Islamic, mixed and non-Islamic stocks.

The second section explained the stock market's history and how it was developed and changed through different stages, making it a globally leading emerging market. This covered the period from 1935 until 1983, when the first informal IPO Arab Automobile Firm joint-stock company was listed. Then, it went through more established stages when the government got more

21 There is a specified percentage that varies between 5% and 33%.

involved and built a trading system in 1984 until the royal decree issued the Capital Market Law (CML) in 2003.

The third section outlined the market's issues and challenges it faced, such as transparency, the 2006 bubble, illegal speculation, insider trading, and the lack of law enforcement. Then, I presented my recommendation for the sample period from 2009 onwards.

The fourth section briefly explained the market's legal and operational structure. This included the Capital Market Law, the Capital Market Authority, the Saudi Stock Exchange (Tadawul), and the Committee for the Resolution of Securities Disputes (CRSD).

The fifth and six sections covered the unique characteristics of the Saudi stock market and the behaviour of local traders towards Islamic and non-Islamic stocks. The fifth section first explained the available securities to trade in the market and how they differ from other exchanges globally. Then, it gave an overview of the type and nationality of the traders and how Saudi retail investors dominate the demographic structure of the market. However, this market domination decreased in recent years since the market became globally integrated in 2015. Then, this section explained the possible implications of these changes in the market demographic structure on factor premiums and the cross-section of stock returns.

Investors who joined the market recently after global integration are professional investors who use different strategies than existing retail investors who follow religious principles in their investment decisions. At the same time, local retail investor sentiment toward certain stocks might increase (decrease) the volatility of stocks considered Islamic (non-Islamic). It is imperative to understand the unique scenario and how Saudi retail investors choose their investments. The chapter finally explained the concept of Islamic and non-Islamic stocks.

Chapter 3: Literature review

3.1 Introduction

In the previous context chapter, the history and characteristics of the Saudi stock market were presented and discussed to reveal the importance of the research objectives. In this chapter, the literature review, the theoretical foundation will be presented to show the importance of this research within the context of asset pricing and the cross-section of stock returns. It will link the literature to the context of the Saudi stock market presented in Chapter 2 to develop the hypotheses. The chapter will cover the most important and relevant parts of the Islamic finance literature, which relate to the return on Islamic stocks, including a comprehensive overview of the Islamic classification process and global and local Islamic returns in Saudi Arabia. Finally, it will shed light on the implications of global integration on emerging markets related to the literature on asset pricing and the cross-section of stock returns. Thus, this chapter is divided into three main sections: asset pricing models, Islamic stocks, and global integration.

The first section, asset pricing models, is the most extended section, with many subsections covering the manifold topics. It starts by explaining the concept of diversification and the development of Markowitz's modern portfolio theory Markowitz (1952, 1959). Then, it covers the development of the Capital Asset Pricing Model (CAPM) and its challenges, critique, and proposed alternatives. The anomalies of the CAPM led Fama and French to develop their three- and five-factor (FF3FM & FF5FM) models. The justification and challenges of Fama and French’s asset pricing models are also stated in this section.

The second section, Islamic stocks, covers the area of Islamic finance which is relevant to this study. This section starts by explaining the concept of Islamic stocks and then explains the process of Islamic classification into Islamic, mixed, and non-Islamic stocks by explaining the two steps of Sharia law screening (qualitative and quantitative). Then, this section discusses the implications of the Islamic screening process on the performance of those stocks in the market. Further, the effect of religion on domestic investors in the Saudi stock market is discussed briefly, and some critical points are presented.

The third and last section, global integration of the financial markets, covers relevant topics about financial market integration. It starts by explaining the concept of global market integration and the benefits of global integration between markets from an investor's point of view and market efficiency. The section also explains the implications that global integration might have for international and domestic investors regarding diversifying portfolios and investment strategies.

In the end, this chapter provides a rich overview of the literature related to the development of asset pricing models, Islamic stocks and determinations, and the implications of the market's global integration on those topics. Those topics represent the main sections of this chapter. Throughout the sections, the narrative concerning these topics will unfold, leading to the development of hypotheses which will be stated at the end of each section.

3.2 Asset pricing models

The foundation of asset pricing models goes back to the development of Markowitz's mean-variance theory Markowitz (1952, 1959), which is built on the simple concept of trading between risk and returns of securities in the financial markets. This development later led to the development of the Capital Asset Pricing Model (CAPM) by Lintner (1965); Mossin (1966); Sharpe (1964). The CAPM asserts that a significant linear relationship exists between a securities' expected return and its market risk (Beta), which is the only factor that can explain the variation in expected average returns.

The model was tested by academicians and practitioners and examined empirically against the data in different contexts, but it failed to prove the significance of the relationship. This failure encouraged many empirical studies to propose alternative models, such as the Arbitrage Pricing Theory (APT) and Intertemporal CAPM (ICAPM); however, those models faced much criticism.

Despite the failure of the CAPM, the investigation of the model proceeded, and many studies discovered a few anomalies to the model in the early 80s. Those anomalies motivated Fama and French (1992, 1993, 1995) to examine them further and propose multifactor models, which comprise the market beta of CAPM and the anomalies. This was the starting point of the revolution in asset pricing models, and many empirical studies have used their framework to propose different asset pricing models. Indeed, Fama and French (2015) recently introduced a five-factor asset pricing model, augmented by some anomalies discovered against their old model. This section is divided into three main subsections, which are the capital asset pricing model; factors (anomalies), and Fama and French's asset pricing models.

3.2.1 Capital asset pricing model (CAPM)

The CAPM of Lintner (1965); Mossin (1966); Sharpe (1964) fundamentally suggests a positive linear relation between expected returns and market risk (beta). Market risk is the only factor explains the variation in expected average returns. The CAPM builds on the seminal work of Markowitz's mean-variance theory Markowitz (1952, 1959) by following the theory's assumption that investors are risk averse and care about the return and risk of one period only. Therefore, investors choose a mean-variance efficient portfolio, which means a portfolio with minimum return variance and maximum expected return for that level of variance. CAPM adds two additional assumptions, firstly that all investors agree on the distribution of asset returns for a specific period, and secondly, that all investors are allowed to lend and borrow at a risk-free rate, which is taken from Tobin (1958) theorem. This was the birth of the first asset pricing model below:

$$E(R_i) = R_f + [E(R_M) - R_f]\,\beta_{i,M}\,, \quad \mathrm{i} = 1, \dots, \mathrm{N} \tag{3.1}$$

$$\beta_{iM} = \frac{cov(R_i, R_M)}{\sigma^2(R_M)} \tag{3.2}$$

This means the expected return on asset i, $E(R_i)$, is the risk-free rate, R_f, plus the market risk premium, $E(R_M) – R_f$, times the beta of asset i in market portfolio M.

The CAPM assumes that all investors have access to lending or borrowing at a risk-free rate and that efficient portfolios are along the efficient frontier curve. Furthermore, the CAPM assumes that investors have homogeneous expectations regarding return distributions, leading to identical portfolios consisting of risky assets and risk-free investments. This common portfolio, known as the tangency portfolio, coincides with the market portfolio M in equation 3.1 (Fama & French, 2004).

3.2.2.1 Empirical tests of CAPM

The early tests of CAPM by Lintner (1965); Mossin (1966); Sharpe (1964) were designed to confirm whether a relation exists between the beta of the model and the expected return, which means there is a risk premium in the market. In other words, the expected return, the cross-section of average asset returns, is linearly related to its estimated beta. This implies that the beta can explain the variation in the cross-section of average returns, and no other variables contribute to this explanatory power. Some empirical tests of CAPM employ both cross-section and time series regression (Friend & Blume, 1970; Jensen et al., 1972), whereas others only use cross-section regression (Douglas, 1967; Fama & MacBeth, 1973; Miller & Scholes, 1972) or, more recently, only time series regression (Stambaugh, 1982). Despite the method used, those empirical tests reject the initial CAPM, as the results indicate that the relation between the beta and average return is flat (Fama & French, 2004), which means there is no strong linear relation between them.

The zero-beta or black version of CAPM seemed to be more promising in the early CAPM tests (Fama & French, 2004). A few studies (Fama & MacBeth, 1973; Gibbons, 1982; Stambaugh, 1982) find that the market proxy represented by the market portfolio on the minimum variance frontier, which means the market proxy can sufficiently explain the expected returns. The success of the black version of CAPM led to numerous studies (Celik, 2012) which investigated and examined CAPM in many markets and some adjustments were made to the original model.

The increased number of studies investigating CAPM and the model's simplicity enhanced its popularity in practice and academia. In the last five decades, the CAPM has become an essential part of any finance curriculum and, in business, has been used as the basis for calculating the cost of capital and equity. However, many empirical studies have found anomalies that can explain the average return better than both CAPM versions, indicating the failure of CAPM. This failure has motivated researchers to propose alternatives to the CAPM. The next section will outline the most important alternative multifactor models. Then, it will explain the anomalies of CAPM discovered in the literature and explore whether they are just anomalies or risk factors.

3.2.2.2 Multifactor models – alternatives to CAPM

The failure of the single-factor CAPM has encouraged the development of multifactor models as alternatives. The first attempt was made by Merton (1973)Merton (1973), who suggested an extension of the original CAPM, the intertemporal capital asset pricing model (ICAPM).

The ICAPM maintains some of the advantages of the original CAPM, such as the model's simplicity and various assumptions. The word 'intertemporal' refers to opportunities for investors in the market over time. The new model assumes that investors share the riskless asset and the tangency portfolio on the mean-variance curve, which differs from the original CAPM market portfolio. This hedging portfolio of investors depends on the correlation between microeconomic and macroeconomic events. This means that hedging portfolios change according to economic figures and expectations. The ICAPM improved the original CAPM, however, the model faced some criticism, such as homogeneous expectations. Furthermore, a new multifactor model, arbitrage pricing theory (APT), was introduced a couple of years later and stole the show.

The APT was introduced by Ross (1976), and its fundamentals were built on the law of one price. This holds that investors are rational actors who will carry out arbitrage opportunities. As a result, an equilibrium in market prices will eventually be realized. The APT is essentially a multifactor model suggesting that the expected return is linearly related to macroeconomic factors. However, the model does not specify those factors, and the relations between different securities and those factors are unequal. Further, the APT relies on CAPM assumptions and the relationships between the expected returns and the asset's beta. APT offers some improvement over the single CAPM and has more explanatory power relating to the asset's returns. However, the main criticism about APT is the ambiguity of the model's specific economic factors, which still require identical expectations of the market portfolios.

It is noticeable that the first two attempts to develop multifactor models, ICAPM and APT, rely on macroeconomic or microeconomic factors. Soon after introducing these models, many studies started to identify firm-specific anomalies, such as the firm's size and book value (see section 3.2.2.1) in the CAPM. The explanatory power of those anomalies inspired Fama and French (1992) to develop the first multifactor model that includes firm-specific factors. They regress the average stock returns on the market beta of CAPM, the size effect of (Banz, 1981), the positive relationship between leverage and returns recorded by Bhandari (1988), the value effect B/M ratio of Stattman (1980), and the earning/price ratio of Basu (1983). The study analyses these factors alone and in combination with each other. When they are used alone, each one of those factors is found to have explanatory power except the beta. The study finds that size and B/M ratio can explain the variation in average returns when used together; however, the beta has little explanatory role. The size and B/M ratio absorbs the role of leveraged/return and earning/price ratio in explaining the NYSE's average returns for 1963-1990. Thus, they conclude that a firm’s size and B/M ratio have the power to explain and represent average stock returns, and they imply that the risks of the stocks are multidimensional if assets are priced rationally. Thus, firm size and B/M ratio are proxies for those dimensions.

The promising results of Fama and French (1992) motivated them to expand their findings further. Thus, Fama and French (1993) analyse more securities besides common stocks, including US government and corporate bonds, and identify five risk factors that explain the average returns on stocks and bonds. Generally, Fama and French (1993) is different than Fama and French (1992) by three things: (i) applied to common stocks and bonds; (ii) new variables explain the returns (proxy factor for unexpected changes in the interest rate and the likelihood of default in bonds besides the size and B/M ratio for common stocks); (iii) time series-regression instead of Fama and MacBeth (1973) cross-section regression. The new variables important for bond returns are regressed on the stocks' returns and vice versa. The goal is to examine any relationship between bonds and common stocks.

Fama and French (1993) argue that size and B/M ratio in time-series regression cannot completely explain average stock returns, unlike the case of the cross-section analysis in Fama and French (1992). Instead, they find that the market return, its beta, and the size and B/M ratio are very good at explaining the cross-section of average returns for the NYSE from 1963 to 1991. This is the birth of their three-factor model, which augments the single factor CAPM with size and value (B/M ratio) factors. The study further tests the hypothesis of zero intercepts in their new three-factor model, which means the model can fully explain the variation in average stock returns. However, this hypothesis is rejected. Regardless of this rejection, academicians and practitioners have widely adopted the three-factor model. Although a few models have been proposed since, the Fama and French three-factor model remains the most common, due to its simplicity and applicability.

One attempt to develop another multifactor model after the introduction of the Fama and French three-factor model is the conditional CAPM by Jagannathan and Wang (1996). Conditional CAPM is closely related to the APT and ICAPM but relies on economic events over a long time period; on the other hand, it is substantially different from the original CAPM. This model has faced some criticism, such as needing a long period of economic events, which is not practical as the economy is not stationary (Phelan, 2016). Indeed, after Fama and French

(1992, 1993, 1995) started the multifactor model revolution using firm-specific factors, the interest in models with economic factors, such as ICAPM, waned in the literature. Many empirical studies were inspired by Fama and French's model, and researchers proposed multifactor models by adding other firm-specific factors or idiosyncratic risks to the market factor to explain average stock returns.

Although the development of multifactor models using firm-specific factors started in the early 90s, the foundation of multifactor models began after discovering anomalies in CAPM in the late 70s and early 80s. The following section discusses these anomalies.

3.2.2 Anomalies or factors

The main challenges for the reliability and applicability of both versions of CAPM became apparent in the early 80s when empirical research discovered other factors that have more explanatory power in expected returns than market beta. Basu (1977) started this questioning when he suggested that the P/E ratio has greater explanatory power and a stronger linear relationship with expected returns than the betas of CAPM.

Next, Banz' discovery of the size effect (Banz, 1981) was one of the biggest challenges that CAPM faced. This study reveals a strong negative relationship between returns and firm size (market capitalisation), which means that small market capitalisation stocks have higher returns than big stocks. Rosenberg et al. (1985)nberg et al. (1985) discovered the value effect soon after, which reveals that there are higher returns for firms with a higher B/M ratio. This indicates a strong relationship between the book value of firms and expected return.

A couple of years later, Bhandari (1988) uncovered another anomaly in the market beta that could explain the variation in the average returns: the debt-equity ratio. This study found that firms with higher debt-equity ratios have higher returns regardless of their market beta. Since the discovery of the relationships between firm characteristics and expected returns, the literature has greatly debated whether these characteristics are risk factors or just anomalies. They are referred to as anomalies in the literature because stocks with specific characteristics have predictive power and earn abnormal returns that asset pricing models cannot explain.

Many studies have attempted to explain these anomalies. Some studies argue that the anomalies are caused by data snooping (Lo & MacKinlay, 1988), whereas others suggest selection bias

(Breen et al., 1989; Kothari et al., 1995). However, there are two eminent schools of thought to explain why these anomalies (factors) explain the variation in expected returns and compensate higher returns.

The first one is the behavioural finance school, which believes that an investor's behavioural bias leads to mispricing. This school argues that the explanatory power and realized returns based on differences between a firm's fundamental characteristics are not risk-related. Rather, this anomaly is due to bias in market pricing and inefficient markets (Haugen & Baker, 1996; Lakonishok et al., 1994). Studies in this field (Bali et al., 2011; Cooper et al., 2008; De Bondt & Thaler, 1985) suggest that the anomalies come from overreactions or underreactions towards certain stocks.

The other school of thought is the rational school or traditional asset pricing model. It argues that each one of those factors or firm characteristics is a proxy for a systematic risk that compensates for taking a higher risk (Carhart, 1997; Fama & French, 1992, 1993, 1995, 1996, 2015, 2016; Zhang, 2005). For instance, these studies assume that the B/M ratio is a proxy for an unknown state variable associated with financial distress. Value stocks (high B/M ratio) compensate investors with higher returns than growth stocks (low B/M ratio) because they are usually distressed and respond fast and poorly to interest rate increases, therefore they are riskier (Zhang, 2005).

The debates between these two schools have not yet been settled. However, the rational school is dominant, with behavioural finance a supplementary, explanation. Although the behavioural finance school has some justification in explaining anomalies such as mispricing resulting from investor behaviour, it lacks comprehensive theories or asset pricing models such as CAPM or multifactor models (for example, the Fama and French asset pricing models). Thus, the rational school is stronger than the behavioural finance school in terms of theory and empirical paradigms used to test anomalies and market efficiency, and benefits from well-documented economic theory. New anomalies continue to be observed each year, and efforts by both schools to resolve them persist.

Indeed, contemporary literature has identified hundreds of factors (anomalies) that have a strong relation with expected returns (Harvey et al., 2016; McLean & Pontiff, 2016). As Cochrane (2011, p. 1047) has said, "now we have a zoo of new factors". The question becomes which of these anomalies is consistent over time and can eliminate the explanatory power of other anomalies. At that point we can consider them as factors instead of anomalies. For this reason, Harvey et al. (2016) conducts multiple testing methods on the existing 316 anomalies proposed by over 300 articles and concludes that many (80–158) are false. Similarly, Hou et al. (2020) replicates over 400 anomalies documented in the literature in the NYSE using newer data. They find that most of the anomalies do not replicate, and the one that replicates the effect is much smaller than originally reported. This might be explained by McLean and Pontiff (2016), who state that anomalies disappear after discovery due to increased trading attention and behavioural finance models of co-movement.

Nevertheless, some recent empirical studies (Chiah et al., 2016; Fama & French, 2015, 2016, 2017; Foye, 2018a, 2018b) find anomalies such as size, value profitability, and investment compensate equity premium and have explanatory power in the average returns better than other anomalies. These studies find these anomalies persist over time and consider them proxies for unknown underlying economic risks. Further, the five-factor asset pricing model proposed by Fama and French (2015) and examined further by Fama and French (2016) holds up against the most persistent anomalies in the literature. They conclude that the list of tested anomalies actually disappeared or became “less anomalous” because “the returns associated with different anomaly variables share factor exposures that suggest they are in large part the same phenomenon”. This means that the anomalies examined against the five-factor model share the same exposure to the underlying economic risks of the model’s factors, except for accruals and momentum anomalies.

As a result of the literature outlined above, this study assumes that these factors give rise to equity premium in the Saudi market. This is expressed in the main hypothesis below.

- ***Hypothesis H1: Factors such as size, value, profitability, and investment have significant premiums on stock returns in the Saudi stock market.***

Hypothesis H1 has sub-hypotheses, which will be outlined in the following sub-sections for each factor.

The development of Fama and French’s asset pricing models, including the five- and three-factor models, have gained influence and acceptance among practitioners and academicians. I believe this influence has taken place for a few reasons. First, a solid theoretical foundation is used to justify their models’ fundamental source. Further, the empirical evidence for Fama and

French's asset pricing models is well-documented in the literature, and the models have been extensively examined in many markets and different periods (see section 3.2.3). Moreover, the anomaly reduction five-factor model addresses the weaknesses that previous three-factor model did not adequately explain. Finally, the model's additional factors to the market returns[22] (size, value, profitability, and investment) have economically rational links. For instance, profitability represents a firm's ability to generate positive cash-flow and earnings. Stocks with higher profitability are more efficient and perform better in economic downturns. Profitability is also key to a stock's market value and an indication of potential growth.

Therefore, this study is built on a foundation of Fama and French's seminal work. The following sections explain the factors in Fama and French's asset pricing models.

3.2.2.1 Size factor

Firm size was one of the first anomalies identified in the literature when Banz (1981) found that firms with small market capitalisation earn higher returns than large market capitalisation firms. This phenomenon is known as the 'size effect' and has been highly regarded in the literature. Banz (1981) examined all the common stocks in the New York Stock Exchange (NYSE) from 1926 to 1976. He allocates stocks into quintiles according to their market capitalisation and finds that stocks in the smallest quintiles earn higher returns than other quintiles regardless of their market beta.

Soon after Banz (1981) discovery, many studies further investigated the role of firm size in the cross-section of expected returns (Chan & Chen, 1988; Chan et al., 1985; Roll, 1981). Reinganum (1981) examines the size effect in NYSE from 1964 to 1979. He divides a sample of more than 500 listed stocks into groups according to their market capitalisation . He finds that the stocks in the smallest group have higher returns than the largest group by more than 1.50% per month.

The studies of Roll (1981), Keim (1983), Basu (1983), and Chan et al. (1985) also examine small stocks in the NYSE from the early 1960s to late 1970s and find that the smallest stocks generate higher returns than the largest stocks. In later years, empirical studies have also examined the size effect in the context of the US market including the 1980s period in their

22 The single factor of CAPM which is the return of the market portfolio.

sample. They also find that small stocks generate higher returns than large stocks (Bhardwaj & Brooks, 1993; Chan & Chen, 1991; Fama & French, 1992, 1993).

Fama and French (1992, 1993, 1995) three-factor asset pricing model shows that a firm's size is important in explaining the cross-section of stock returns. They added the size premium, SMB, which is the return of small MC stocks minus the return of big MC stocks, as one of the factors in their multi-factor model (explained in detail in the following sections).

More recently, some empirical studies have documented abnormal returns (size premium) in small stocks in the US market from the 1990's until 2013 (Fama & French, 2015; Switzer, 2010). Furthermore, the size premium has been documented in other developed markets, such as the UK. The size effect in the UK was first documented by Levis (1985) who finds that the smallest quantile generated higher returns than the largest one between 1962 and 1980. He also documents high volatility and instability in the size effect over the years of his sample. The size premium has also been globally documented in developed and emerging markets (Acaravci & Karaomer, 2017; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 2017; Foye, 2018a; Lin, 2017; Mosoeu & Kodongo, 2020). However, the literature has some contradictory results.

Even though the size premium has been widely discovered and employed as a pricing factor, the concept of firm size presents several puzzles. The size premium demonstrates inconsistency when applied in different periods (Horowitz et al., 2000a; Van Dijk, 2011) and regions (Cakici et al., 2016; Hou et al., 2011). Moreover, several pieces of empirical evidence indicate that the size effect disappeared after it was discovered in the early '80s, and that small firms did not outperform large firms in the 1980s and 1990s (Amihud, 2002; Chan et al., 2000; Dichev, 1998; Hirshleifer, 2001). The size premium also tends to be strong and positive in a bull market and close to zero during a bear market (Hur et al., 2014). Further, some studies (Chordia & Shivakumar, 2002; Conrad & Kaul, 1998)) challenge the concept that large firms should be less risky, which the rational school of asset pricing models proposes. They say that large stocks that have recently grown in market value are riskier. More recently, Herskovic et al. (2023) found the size premium insignificant in specific economic conditions in the U.S. market. We can see that the literature doubts the consistency of the size premium, specifically since the early 80s.

More recently, Astakhov et al. (2019) conducted a meta-analysis of 1746 estimates from over a hundred studies that investigated the impact of firm size on stock returns, and they make several interesting findings. They conclude that the size premium may disappear in some estimations and studies due to their short horizon. Indeed, the size premium did decrease in the 1980s and 1990s. They also argue that the size premium may have reappeared, but this cannot be confirmed due to the lack of recent studies investigating the size premium which could be included in their meta-analysis. They also find a strong linear relationship between firm size and NYSE stock returns.

Hou and Van Dijk (2019) also recently investigated the disappearance of the size effect in various developed[23] and emerging[24] markets. They attribute the disappearance to the negative (positive) shocks to the profitability of small (large) firms. After adjusting for profitability shocks' impact on the price, they find that the size effect is strong in developed markets and more robust in emerging markets. Similarly, Cheema et al. (2021) find the size effect has remerged after adjusting for profitability shocks and is strong in Japanese stock markets.

The popularity of the three-factor model enhanced the size effect's importance in the literature. Thus, many studies tried to deconstruct the size effect. In one early explanation, Arbel et al. (1983) suggests that the size effect comes from neglected firms because their future value is unknown; thus, investors ask for higher returns. Merton (1987) agrees that this compensation of returns is associated with uncertainty about the future of small firms, which means the size premium is a risk premium and not a kind of market efficiency. Roll (1981) believes that the size anomaly results from trading infrequency that causes risk-adjusted to be mis-assessment in short interval data and leads to mispricing in small firms. However, some other studies believe the source of the size premium is purely economic (Avramov & Chordia, 2006; Chan & Chen, 1991; Daniel & Titman, 1997). They argue that small firms are more sensitive to economic conditions and business cycles due to poor performance and financial status. In a different behavioural finance approach, Daniel et al. (1998) argue that two psychological investor biases, investor overconfidence about private information and self-attribution, cause securities to be mispriced.

23 Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom.
24 Brazil, Chile, China, Colombia, Egypt, India, Indonesia, Malaysia, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, South Korea, Taiwan, Thailand, and Turkey

In more recent studies, Amihud (2002) and Pástor and Stambaugh (2003) argue that the size premium is not real and might result from data mining. Further, Zhang (2006) uses information asymmetry to argue that a firm's size is represented by the information available and future value uncertainty. He claims that small firms provide poor information for investors, which is reflected in irrational stock pricing and causes higher returns. Moreover, Campbell and Vuolteenaho (2004) call the stock cash flow 'bad beta' and the discount rate 'good beta'. They argue that the risk associated with a long-term investment is determined by these betas and not by the overall market beta. They imply that small firms have higher cash flow (bad beta), indicating poor performance and higher risk; therefore, rational investors ask for higher returns so that they can endure higher bad beta. More recently, Van Dijk (2011) proposes the same argument and believes that size premium is due to incomplete information about small firms. Moreover, Hur et al. (2014) find that small firms compensated higher returns during a recession and attribute it to their higher risk during bad economic conditions.

Empirical evidence suggests the size premium exists in different countries and periods, which means it is persistent over time and across regions. Although the literature does not settle on a specific cause for the size premium, and there is still an ongoing debate, the more plausible explanation is that of the rational school mentioned previously (see section 3.2.2). They suggest that a firm's size is a proxy for an unknown systematic risk factor because those firms are financially distressed (Fama & French, 1992, 1993, 1995, 2006, 2015, 2016; Vassalou, 2003). This explanation is logical for two reasons. The first is associated with the basic concept of higher risk higher return. Secondly, small stocks typically face greater challenges, such as limited resources, increased vulnerability to economic fluctuations, and higher business failure rates; therefore, they are financially distressed.

In conclusion, the size premium has been documented in several emerging and developed markets over several periods. Although the literature has some evidence about the disappearance of the size effect after its discovery in the 1980s, the most recent literature argues that this is not entirely accurate (Alaoui Taib & Benfeddoul, 2023; Astakhov et al., 2019; Cheema et al., 2021; Hou & Van Dijk, 2019).

In the case of the Saudi stock market, the size premium is statistically significant at 10% (Alkhareif, 2016) between January 1999 and December 2014. As far as I know, no other study has documented the Saudi size premium in different periods. Thus, it would be interesting to determine if the size premium is still significant in the Saudi stock market, especially since the entry of foreign investors into the market in 2015.

The empirical findings in many markets for the size premium, as discussed in detail above, strengthen the argument that it is part of a broader phenomenon rather than an anomaly confined to a single market (see section 3.2.2). Therefore, this premium should be present in the Saudi stock market, and this study assumes the size premium is significant in the Saudi stock market for the period from 2009 until 2021, as expressed in the sub-hypothesis below:

- ***Hypothesis H1.1: The size factor has a significant premium on stock returns in the Saudi stock market.***

3.2.2.2 Value factor

The first discovery of this factor as an anomaly in CAPM was made by Basu (1977) and Rosenberg et al. (1985). They found that stocks with higher B/M ratio (value stocks) generate higher returns than those with lower B/M ratio (growth stocks), referred to in the literature as the ‘value effect’. Value stocks are considered undervalued in the market compared to their intrinsic value, thus potentially generating higher returns. In contrast, a growth stock already has a high market value, so they do not compensate with higher returns in the future.

Investing in value stocks has gained in popularity among practitioners and seems to be a good investing strategy (Chan & Lakonishok, 2004). The earlier study of L. Chan et al. (1991) about the Japanese stock market was the first to suggest such a strategy.

A surge of attention in academia towards value and growth originated from the influential works of Fama and French (1992, 1993), who find a strong positive relationship between the B/M ratio and stock returns. They find that the value premium is significant in the NYSE and positively related to stock returns. This was the first introduction of the FF3FM, which holds that the value premium, market return, and size premium best describe the average returns in NYSE. They allocate stocks into different portfolios according to their B/M ratio and find that the portfolios with a high B/M ratio have higher returns than the lowest ratio. Then, they construct a factor called HML, the return difference between portfolios with a high B/M ratio and a low ratio. This is the third factor in their three-factor model (the others are market return and size premium).

These findings about the relationship between the B/M ratio and stock returns have led to many studies which further investigate the roots of this phenomenon in the stock market. Capaul et al. (1993) finds that value stocks outperform growth stocks in five major stock markets[25] including Japan. Further, Fama and French (1993) again find a significant value premium using different methods than their original (1992) paper, but their sample excludes financial stocks. A few years later, Barber and Lyon (1997) document a significant value premium in financial firms in the US stock market. Moreover, Fama and French (1995) find a relationship between the B/M ratio and profitability. Fama and French (1998) also examine the value premium internationally[26] and find that value portfolios for almost all countries in the sample generate equity premium.

Using an earlier sample from 1929 to 1963, Davis et al. (2000) also find that the value premium is robust in the US stock market. More recently, many studies find the value premium to be significant in the US stock market and other international markets (Dirkx & Peter, 2018; Fama & French, 2015, 2017; Foye, 2018a, 2018b; Linnainmaa & Roberts, 2018; Mosoeu & Kodongo, 2020)).

However, the literature has not settled on a final explanation about the root cause of the value effect, that is, the relationship between the B/M ratio of the firms and stock returns. There are several explanations, which are either risk-based or asset mispricing. Lakonishok et al. (1994) argue that the value trading strategy is profitable because it contradicts other naive investors' strategies. Similarly, Gregory et al. (2001) say value stocks reward higher returns because investors wrongly extrapolate stocks' past performance. Both studies attribute the higher returns in value stocks to mispricing. They argue that extrapolative expectations lead investors to inappropriately heavily invest in growth stocks (low B/M ratio) and neglect value stocks (value stocks) assuming that past performance will persist. This causes growth stocks to be overpriced (and value stocks to be underpriced). Then a correction occurs which generates higher returns for value stocks.

Porta et al. (1997) argue that higher returns in value stocks are due to mispricing and earnings surprises, which are systematically more positive for stocks with a higher B/M ratio. Gregory et al. (2003) also investigates whether an abnormal return in value stocks is due to fundamental

25 Those markets are the U.K., Germany, France, and Switzerland.
26 United States, Japan, UK, France, Germany, Italy, Netherlands, Belgium, Switzerland, Sweden, Australia, Hong Kong, and Singapore.

risks or investor mispricing. They conclude that there is no evidence for risk-based explanations and attribute the outperformance of value stocks to mispricing. In the same vein, the studies of Athanassakos (2009) on the Canadian stock market and Lettau and Wachter (2007) on the US stock market reject the risk-based assumption of the source of the abnormal returns in value stocks and suggest that mispricing has occurred. They argue that investors create a systematic error by investing in growth (glamour) stocks and ignoring value stocks; thus, value stocks became underpriced and generate higher returns when the correction comes.

However, an opposing interpretation suggests that value stocks outperform growth stocks because they are riskier and, therefore, have higher returns. Although these studies agree that the source of abnormal returns in value stocks is risk-based, they have different explanations for the source of risk. For instance, Chen et al. (2008) argue that the value premium is countercyclical, and that value stocks are riskier than growth stocks in bad economic conditions, meaning the value premium is a risk-based return. Many studies cite the relation between the value premium and business cycle to support a risk-based explanation of the value stocks (Akbas et al., 2010; Aretz et al., 2010; Petkova, 2006)). The most common risk-based explanation is that value stocks are riskier because they are financially distressed. Some studies attribute the distress to their high operating leverage (Novy-Marx, 2011; Zhang, 2005), while others say it is because they have higher cash-flow risk (Campbell & Vuolteenaho, 2004; Da & Warachka, 2009). Further, Fama and French (1992, 1993, 1995, 1998, 2015) suggest that the B/M ratio is a proxy for an unknown state variable linked to financial distress. Despite these explanations, a value premium seems to persist over time (Aretz et al., 2010; Zhang, 2005), although the business cycle might impact on the magnitude of the premium (Chen et al., 2008). The persistence of the value premium has been documented in many developed and emerging markets in different periods.

The value premium or (value effect) is apparently robust across the markets and in multiple periods tested in the literature. Many studies suggest that the value premium is persistent over time (Fama & French, 1992, 1993, 1995, 1998, 2015; Zhang, 2005)) and represents some market risk factor. However, there is some debate in the literature about the root cause of this phenomenon.

In the case of the Saudi stock market, the value premium has not been deeply investigated. Even in their recent study, Alshammari and Goto (2022) specifically focused on examining factor premiums in the Saudi stock market but did not investigate the value premium. Alkhareif (2016) is the only relevant study and this study finds that a value premium was statistically significant between January 1999 and December 2014. Taking into consideration that the Saudi market only became globally integrated in 2015, and since then, the market has witnessed an increased number of foreign investors (see section 2.5.1), examining the value premium for the period between 2014 and 2021 will add new evidence to the relevant literature. It is also interesting to examine whether the value premium is redundant, as suggested by Fama and French (2015), or if it persists, as found in studies such as Ekaputra and Sutrisno (2020) in the emerging markets like Indonesia and Singapore.

Finally, the empirical findings in many markets including Saudi market for the value premium, as discussed in detail above, strengthen the argument that it is part of a broader phenomenon rather than an anomaly confined to a single market (see section 3.2.2). Therefore, this premium should be present in the Saudi stock market, and this study assumes that the value premium is statistically significant in the emerging stock market of Saudi Arabia according to the evidence mentioned above and this is reflected in the following hypothesis:

- ***Hypothesis H1.2: The value factor has a significant premium on stock returns in the Saudi stock market.***

3.2.2.3 Profitability factor (operating profit)

A firm's profitability is another factor that compensates for abnormal returns and persists over time (Fama & French, 2015, 2016). The fundamental risk of this factor is derived from the dividend discount models of Miller and Modigliani (1961). The expected dividend of a stock determines its expected return; therefore, the dividend payment is one of the fundamental factors that impact the stock’s price. Firms with high profitability usually have high market capitalisation and low B/M ratio, which means they are less distressed, have a low level of leverage, and have a longer cash flow duration. Thus, explaining the size and value factors as proxies for an unknown state variable related to financial distress (Fama & French, 1992, 1993, 1995, 1996) does not apply to these firms. Then the question for a risk-based explanation becomes, if profitability is a risk factor or proxy for some unknown risk factor, what is the source of risk? Fama and French (2006, 2015) use valuation theory to argue that profitable firms should have higher expected returns if we control for the B/M ratio. If two firms have the same B/M ratio and different expected profitability, the higher expected profitability will have a higher expected return. Thus, if pricing is rational, a higher expected return is linked to higher profitability, indicating more risk is involved. In Fama and French (2015) paper, they still argue that risk for the profitability factor is a proxy for an unknown state variable related to some source of risk but not necessarily related to financial distress.

Although this explanation of risk does not have a strong foundation, the profitability factor is robust and consistent over time (Ball et al., 2015; Fama & French, 2015; Novy-Marx, 2013). Novy-Marx (2013) holds that the profitability factor covers most earning-related anomalies in the asset pricing models and many unrelated anomalies. He also says that a profitability strategy (that is, a long position on profitable stocks) generates higher average returns and works as a hedging strategy. He shows that the variation in average returns is high between portfolios sorted based on profitability, specifically in a portfolio that controls for the B/M ratio. Then, he concludes that more profitable firms generate higher returns than unprofitable firms, even if the profitable firms have a low B/M ratio and higher market capitalisation . Thus, the profitability strategy is a growth strategy and provides a hedging opportunity for value investors. He suggests that mixing both strategies is beneficial by providing higher returns and can be insurance against a value strategy, as the value stocks are riskier (see section 3.2.2.2). Moreover, profitable firms have been proven to compensate consistently higher returns than less profitable firms in many different markets, and profitability has been used as a factor in many asset pricing models.

The literature presents much evidence that profitable firms earn higher returns. Haugen and Baker (1996) find a positive relationship between the profitability of a firm and its future stock returns. They conclude that profitable firms have higher growth rates than less profitable firms. A similar result is found by Cohen et al. (2002), who conclude that the past high profitability of a firm indicates future growth and profitability. More recently, Hou et al. (2014) developed a q-factor asset pricing model, which is comprised of the market factor (excess market return), size factor, investment factor, and profitability factor. They prove that this model can describe the cross-section of average returns and can eliminate the power of half of the 80 anomalies tested. Indeed, they suggest that many of these anomalies are just manifestations for profitability and investment effects. The conclusion is that a firm's profitability is positively correlated with expected returns, and the q-factor model is the best within the profitability category. Similarly, Fama and French (2015) use the dividend discount model of Miller and Modigliani (1961) to develop their five-factor asset pricing model that includes the profitability factor. They find a strong positive relationship between the profitability of firms and stock returns. Moreover, other studies in the literature (Chiah et al., 2016; Fama & French, 2017; Foye, 2018a, 2018b; Mosoeu & Kodongo, 2020) find the profitability factor to be robust in many emerging and developed markets.

Many studies find that the profitability premium is robust and agree with the risk-based explanation (Ball et al., 2015; Fama & French, 2015; Hou et al., 2014; Novy-Marx, 2013), although Lam and Wei (2011) attribute it to mispricing or irrational reasoning. The rational school (risk-based) has a more plausible explanation (see section 3.2.2) and there is no strong evidence to believe it is mispricing. However, the real debate in the literature is about the best way to measure a firm's profitability that can be used to represent this factor.

There are multiple ways to measure a firm's profitability, such as gross profit, operating profit, and net profit. Novy-Marx (2013) suggests that gross profit better represents a firm's profitability. He claims that gross profit is the cleanest accounting measurement representing the firm's true economic profit and argues that if you go further down the income statement, it becomes more 'polluted'. Thus, using the gross profit at the top of the income statement is better. Although his statement seems to be true, gross profit does not really represent the firm's profitability, as some industries endure higher operating expenses.

On the other hand, Ball et al. (2015) find a stronger link between the firm's operating profit and its expected returns. They argue that operating profit represents a firm's profitability better than gross profit and does not ignore other expenses in the same period. Similarly, Fama and French (2015) recommend using operating profit to measure a firm's profitability and construct their profitability factor in the proposed five-factor asset pricing model.

Therefore, this study will investigate the robustness of the profitability premium, recently examined in the context of the Saudi stock market by Alshammari and Goto (2022) , who found it to be significant and persistent. However, it is noted that their study included data before 2009, which may introduce biases (see section 2.3). Based on the existing literature regarding the robustness of the profitability premium and the empirical findings in many markets, including the Saudi market, as discussed in detail above, this emphasises and strengthens the argument that the profitability premium is part of a broader phenomenon rather than an anomaly confined to a single market (see Section 3.2.2). Therefore, this study assumes the significance of the profitability premium in the Saudi stock market during the period under examination. Operating profit, following recommendations from Ball et al. (2015); Fama and French (2015), serves as the measure of firm profitability. Accordingly, this study will test the following hypothesis:

- ***Hypothesis H1.3: The profitability factor has a significant premium on stock returns in the Saudi stock market.***

3.2.2.4 Investment factor (growth in total assets)

The asset pricing literature suggests that stocks with low investment levels have higher average returns, and a linear negative relationship exists between the investment level and average returns (Fama & French, 2015; Hou et al., 2014).

The investment or growth in total assets is one of the anomalies that has been discovered more recently and added to the previously explained factors. The first clear discovery of this phenomenon was by Titman et al. (2004), who find a negative relationship between capital investment and expected stock returns. A few years later, Cooper et al. (2008) argue that the findings of accrual anomaly (Fairfield et al., 2003) and equity issue effects on stock returns (Pontiff & Woodgate, 2008) represent asset contraction and expansion. They suggest using the change in total assets as an aggregate measurement for both. They apply the change in total assets to represent the investment level of the firm and use simple yearly percentage changes in total assets to measure the growth. They find that low-growth asset firms have significantly higher expected returns in the United States stock market. This phenomenon is sometimes referred to in the literature as the growth effect, and is robust in most of the portfolios examined (Cooper et al., 2008; Fama & French, 2015; Hou et al., 2014), although it is weaker in large market capitalisation firms' portfolios.

A firm's investment as a factor has been examined using different measurements and found to be significant and negatively correlated with average stock returns. For instance, Hirshleifer et al. (2004) find that net operating asset (NOA) is significant in predicting expected returns. They report that NOA is better than other examined variables, such as operating accrual for predicting stock returns. Titman et al. (2004) uses the abnormal capital investment of a firm to measure the impact of the growth in the firm's investment, and documents a negative relationship with stock returns. Xing (2008) uses capital expenditure as a proportion of net book value to measure the investment and finds that portfolios with low investment growth compensate for more returns than high growth portfolios. He also mentions that the value effect disappears after controlling for the changes in investment growth. This could imply a high correlation or relationship between investment growth and a firm’s value (B/M ratio). Chen et al. (2011) uses the investment-to-asset ratio (the annual change of gross property, plant, equipment, and change of inventory) divided by the lagged book value, to measure the investment of the firms. They find that the mean return of portfolios with low investment levels generate higher abnormal returns than portfolios with higher growth in investment.

These findings about investment (growth effect) prompt researchers to incorporate this factor into newly proposed asset pricing models. For example, Chen et al. (2011) argue that Fama and French (1993, 1995) has many anomalies, so they develop an alternative three-factor model. Their model consists of the market return similar to Fama and French and two additional factors: return on equity (ROE) and investment growth. ROE represents the firm's profitability, replacing the size and B/M ratio in the Fama and French models (see section 3.2.3) with profitability and investment factors. They find that firms with low investments growth compensate more returns. They conclude that the new model reduces the magnitude of abnormal returns derived from other anomalies and better describes the variation in average returns.

Similarly, Hou et al. (2014) criticise Fama and French (1993, 1995) three-factor model and introduce a q-factor model that consists of market returns, size, profitability, and investment factors. They say that this four-factor model can capture the anomalies that Fama and French (1993, 1995) model cannot . They also find that low-investment firms compensate for higher returns. A year later, Fama and French (2015) introduced their new five-factor model by incorporating profitability and investment factors into their original Fama and French (1993, 1995) three-factor model. They argue that the new five-factor model reduces the number of anomalies in the previous model and improves its ability to explain variations in the cross-section of stock returns.

It would appear that the investment level of a firm plays a crucial role in expected returns. The literature offers a ton of evidence that firms with low investment levels compensate higher returns in emerging and developed markets (Chen et al., 2011; Chiah et al., 2016; Cooper et al., 2008; Fama & French, 2015; Foye, 2018a, 2018b; Hirshleifer et al., 2004; Hou et al., 2014; Kubota & Takehara, 2018; Mosoeu & Kodongo, 2020; Titman et al., 2004), although some studies in developing markets find that low investment firms do not significantly compensate higher returns (Huang, 2019; Kubota & Takehara, 2018). It is therefore interesting to examine the investment factor in the emerging market of Saudi Arabia, particularly after the global integration of the market that occurred in 2015.

Finally, the empirical findings in many markets for the existence of the investment premium, as discussed in detail above, strengthen the argument that the investment premium is part of a broader phenomenon rather than an anomaly confined to a single market (see Section 3.2.2). Thus, I will assume that firms with low levels of investment (growth in total assets) offer higher abnormal returns than the firms with higher investment levels, and I therefore propose the following hypothesis:

❖ ***Hypothesis H1.4: The investment factor has a significant premium on stock returns in the Saudi stock market.***

This section has covered the most important anomalies (size, value, profitability, and investment) discovered to be present in the CAPM of Lintner (1965); Mossin (1966); Sharpe (1964). It has explained how these anomalies have become factors in many asset pricing models.

Some of the most influential asset pricing models are those of Fama and French. This study follows these models' empirical and methodological work, and the next section explains those models in depth.

3.2.3 Fama and French's asset pricing models

Fama and French have introduced two asset pricing models, the three- and five-factor models. The Fama and French (1992, 1993, 1995) three-factor asset pricing model fundamentally augmented the single-factor CAPM with two additional factors related to firm size and B/M ratio. This model became a benchmark in asset pricing and has been widely used, although it has faced many challenges. Those challenges started soon after the model's introduction when many studies criticised the base assumption of the model and its credibility. The most prominent challenges arose when many empirical studies found anomalies to the model similar to CAPM (see section 3.2.1). In response, Fama and French developed a five-factor asset pricing model. In this section, I start by explaining the fundamentals of the FF3FM, then explain the criticisms and challenges the model faced, and how those challenges have led to the introduction of the new FF5FM.

3.2.5.1 Fama and French's three-factor asset pricing model (FF3FM)

Fama and French (1993) build their multifactor asset-pricing model on the empirical work of CAPM. They employ the CAPM single factor, the excess market return and its beta, with the other two factors being firm size and B/M ratio. The first factor is the size premium, which is the equity premium in small market capitalisation stocks over large stocks, and the other one is the value premium, which is the returns of value stocks over growth stocks. Value stocks have a high B/M ratio, and growth stocks have a lower ratio. Previously, firm size and B/M ratio were anomalies to the CAPM (see section 3.2.1); however, Fama and French (1992, 1993, 1995) incorporate them as factors in their new model. In their arguments, these two factors absorb all the other anomalies' explanatory power for average returns. Thus, these two factors and the CAPM single factor can describe average stock returns. The new model's equation is (Fama & French, 2004):

$$E(R_{it}) - R_{ft} = \beta_{iM}\left[E(R_{Mt}) - R_{ft}\right] + \beta_{is}E(SMB_t) + \beta_{ih}E(HML_t) \qquad (3.3)$$

In this model, the first component, $[E(R_{Mt}) - R_{ft}]$, is the excess return of the market portfolio, which is the CAPM single factor. The second factor (SMB_t), which means small minus big, is the return of diversified portfolios formed from small market capitalisation stocks minus the return of diversified portfolios of big stocks. The third factor (HML_t), which means high minus low, is the return of diversified portfolios formed from high B/M ratio stocks minus the return of diversified portfolios of low B/M ratio stocks.

Although Fama and French (1993) argue those new variables have explanatory power in their new asset-pricing model, these factors are not state variables. They argue that the size and value premiums are proxy for undefined state variables that generate systematic risk not captured by the market beta. They support this argument by finding a higher (lower) correlation among small (large) market capitalisation stocks and a higher (lower) correlation among high (low) B/M ratio stocks. Fama and French (1995) also claim that firm size and B/M ratio have patterns in the economic fundamentals.

Fama and French (1993, 1995) rely on the criterion of zero alpha in their time-series regression (Fama & French, 1995):

$$R_{it} - R_{ft} = \alpha + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}(SMB_t) + \beta_{ih}(HML_t) + \varepsilon_{ih} \quad (3.4)$$

This implies that the average excess return ($R_{it} - R_{ft}$) can be fully captured if the alpha is not distinguishable from zero. In equation 3.4, Fama and French (1993, 1995) regress the excess market return of 25 portfolios formed from the intersection of five size and five B/M ratio stocks[27]. Although Fama and French (1993, 1995) reject this hypothesis, FF3FM outperforms CAPM's ability to describe the variation in the expected returns. Regardless of the failure of the zero-alpha hypothesis, the model was adopted by academicians and practitioners and became a benchmark. It is undeniably the most influential asset pricing model in the literature.

There are many reasons why this model gained popularity and was widely adopted. The model's simplicity, generated from CAPM, makes it easy to understand and apply. It has been empirically examined (Faff, 2001; Fama & French, 1992, 1993, 1995, 1998, 2008; Gaunt, 2004; Griffin, 2002)) and shown to better explain the cross-sectional variation in stock returns compared to CAPM. The model can also be applied to any market and can be used to design investment strategies that outperform traditional ones. This has made the model popular for portfolio optimization, asset allocation decisions, and risk management. In the academic field, Fama and French asset pricing models are the foundation for most of the work in asset pricing and the cross-section of stock returns. Most of the research in this field is built upon their framework and has tried to extend it to incorporate additional factors to improve its explanatory power.

However, the model has faced some criticisms, and many anomalies were found which argued against its adoption. For instance, some studies (for example, (Black, 1993)and (MacKinlay, 1995)argue that the explanatory power of the three-factor model derives simply from data snooping. Kothari et al. (1995) uses Fama and French's analysis with an alternative data source and finds the B/M ratio does not have explanatory power. Thus, they claim that the data[28] obtained by Fama and French (1992, 1993) is biased. However, those studies are very sceptical and rely on rejecting the zero alpha hypothesis to assume the model cannot thoroughly explain average returns. For instance, Black (1993, p. 76) says, "I especially attribute their results to

27 All stocks are allocated into size (market capitalisation) quintiles that run from micro-small stocks to large stocks. Then all stocks are allocated into value (B/M ratio) quintiles.

28 The data source of those studies is acquired from COMPUSTAT which is a global database for statistical, financial, market information since 1962.

data mining when they attribute them to unexplained ‘price factors’, or give no reasons at all for the effects they find.".

The most significant challenges the model faces are the discovery of anomalies. Empirical studies suggest the use of other firm-specific characteristics such as accrual anomaly (Fairfield et al., 2003; Hirshleifer et al., 2004), investment growth (Chen et al., 2011; Cooper et al., 2008), and profitability (Hou et al., 2014; Novy-Marx, 2013). This development in the literature has led Fama and French to acknowledge that the three-factor model has some limitations. They therefore developed their latest five-factor model Fama and French (2015). This model is essentially the three-factor model plus the profitability divestment factors discussed in the sections above. The following section explains the fundamentals of the FF5FM and why profitability and investment factors were chosen among all other anomalies discovered in the literature.

3.2.5.2 Fama and French’s five-factor asset pricing model (FF5FM)

Various researchers believe that the new FF5FM is a huge improvement to the FF3FM’s ability to describe the variation in the cross-section of average returns in different markets (Chiah et al., 2016; Fama & French, 2015, 2017; Foye, 2018a, 2018b; Mosoeu & Kodongo, 2020), which is one of the hypotheses examined by this study. The FF5FM acknowledges that most of the variation in average returns that is related to profitability and investment is left unexplained by the FF3FM. They support their argument by using Miller and Modigliani (1961) dividend discount model where M_t, the market value of a firm’s stock at time t is calculated, as shown in equation 3.5:

$$M_t = \sum_{\tau=1}^{\infty} E\ (d_{t+\tau}\ )/(1+r)^{\tau} \tag{3.5}$$

Where:

$d_{t+\tau}$	=	the expected dividend per share for the period $t+\tau$, and
r	=	the internal rate of return on expected dividends, the long-term average of expected returns.

Equation 3.5 emphasizes that if two stocks at time *t* have different price values, *Mt*, but the same expected dividend, $dt+\tau$, the stock with a lower (higher) price has a higher (lower) long-term average of expected returns. Fama and French (2015) extract the implication from equation 3.5 and came up with equation 3.6:

$$M_t = \sum_{\tau=1}^{\infty} E\,(Y_{t+\tau} - dB_{t+\tau}\,)/(1+r)^{\tau} \qquad (3.6)$$

Where:

$Y_{t+\tau}$	=	equity earnings for the period $t+\tau$;
$dB_{t+\tau}$	=	the change in book equity ($B_{t+\tau}$ - $B_{t+\tau-1}$), and
r	=	the internal rate of return in expected cash flow to shareholders.

Instead of directly using the expected dividends, $d_{t+\tau}$, as in the original Miller and Modigliani (1961) dividend discount model, they use the equity earnings, $Y_{t+\tau}$, minus the change in book equity, $dB_{t+\tau}$, which in reality is equal to expected dividends. Fama and French (2015) support their argument by dividing both sides of equation 3.6 on the book equity by time *t* to develop equation 3.7:

$$\frac{M_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} E\,(Y_{t+\tau} - dB_{t+\tau}\,)/(1+r)^{\tau}}{B_t} \qquad (3.7)$$

This manipulation of the original Miller and Modigliani (1961) dividend discount model in equations 3.6 and 3.7 reveals the relationships between expected returns and book-to-market ratio, expected profitability, and expected investment. Fama and French (2015) offer various statements about equation 3.7 to prove the relationships between the expected returns and factors used in their new 5FM as follows (Fama & French, 2015, p. 2):

- If we hold everything constant in Equation 3.7, but M_t, the market cap, and r, the internal rate of return, then a lower value of M_t implies a higher expected return. Similarly, a higher book-to-market ratio on the left side of Equation 3.7 means a higher expected return.
- If we hold everything constant in Equation 3.7 but $Y_{t+\tau}$, future equity earnings, and r, the expected stock returns, then higher expected earnings (profitability) imply higher expected stock returns.
- If we hold B_t, M_t, and $Y_{t+\tau}$ constant in Equation 3.7, then higher $dB_{t+\tau}$, expected growth in book equity (investment), means lower expected returns.
- Therefore, we can see from the statements above that all the factors, (M_t) market cap, (M_t/B_t) book-to-market ratio, ($Y_{t+\tau}$) expected profitability, and ($dB_{t+\tau}$) expected growth in book equity (investment) have a strong relationship with the expected stock returns.

Fama and French (2015) use the same methods to test the hypothesis of zero alpha in FF3FM to compare it with CAPM, but this time the comparison is between FF5FM, FF3FM, and CAPM. They use Gibbons et al. (1989) GRS test to test the alpha of group portfolios and the individual alpha for each regression (see section 4.6.3) set out in equation 3.8 below[29]:

$$R_{it} - R_{Ft} = \alpha_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i\, HML_t + r_i RMW_t + c_i CMA_t + e_{it} \quad (3.8)$$

$R_{it} - R_{Ft}$ is the excess return of a double and triple sorted portfolio that needs to be explained by the model's factors, which are: (i) excess market returns $(R_{Mt} - R_{Ft})$ (the excess return of all the stocks in the sample); (ii) size SMB_t (the difference in the mean return between portfolios of small and large market capitalisation stocks); (iii) value HML_t (the difference in the mean return between portfolios of high and low B/M ratio stocks); (iv) profitability RMW_t (the difference in the mean return between portfolios of robust and weak profitability stocks), and (v) investment CMA_t (the difference in the mean return between portfolios of conservative and aggressive[30] stocks).

One of the objectives of this study is to compare the ability of FF5FM and FF3FM to explain the variation in the cross-section of average returns in the Saudi stock market. According to the literature, FF5FM offers a huge improvement to FF3FM in different emerging and developed markets (Chiah et al., 2016; Fama & French, 2015, 2017; Foye, 2018a, 2018b; Mosoeu & Kodongo, 2020). Thus, this study assumes that by following the methods mentioned above,

29 From "A five-factor asset pricing model." E. Fama, & K. French, 2015, Journal of Financial Economics, 116 (1), 1-22. (http://dx.doi.org/10.1016/j.jfineco.2014.10.010)
30 Conservative and aggressive investment policy measured by the growth in total asset every year.

FF5FM outperforms FF3FM in the context of the Saudi stock market. This is reflected in the following hypothesis:

- ***<u>Hypothesis H2: Fama and French's (2015) five-factor asset pricing model can better describe the variation in the cross-section of average returns than Fama and French's (2012) three-factor asset pricing model.</u>***

Fama and French (1992, 1993, 1995, 2015) empirical work has become the foundation for most of the research on the cross-section of stock returns and asset pricing models. It has motivated many empirical studies (Chen et al., 2011; Hou et al., 2014) to examine and add new factors to find a model that can best describe the returns in different stock markets. It has inspired this study to propose a new country-specific factor, the Islamic factor, and examine whether adding this additional factor to FF3FM and FF5FM offers any improvements to the original models. The following section presents the foundation for this factor's development in the context of Saudi Arabia's stock market.

3.3 Islamic stocks

The definition of Islamic stocks is simple - stocks that comply with the Sharia law. The main principle of Sharia law is to promote social well-being and prohibit harm. Therefore, Sharia law prohibits gambling, non-halal products (tobacco, alcohol, pork, etc.), immoral entertainment, and interest rates (Riba). This means any firms that generate profits from these activities are considered non-Islamic stocks. This includes conventional banks and insurance companies. Interest rates, called Riba in Sharia law, are prohibited and are a central concern from the Islamic finance perspective that operates in a global economy based on this concept. Additionally, some scholars (Iqbal & Mirakhor, 2011, p. 130 and 370; Naughton & Naughton, 2000) consider excessive speculation, short-selling, and derivatives (swap, future, options, etc.) trading prohibited by Sharia law. Thus, any firms involved in these activities is a non-Islamic stock.

To better understand Islamic and non-Islamic stocks, we must familiarize ourselves with the origin of Sharia law and its main divisions. Sharia law has two major divisions: (i) Fiqh Al-Mu'amalat, which means the jurisprudence of transactions and dealing with each other, and (ii) Fiqh Al-Ibaadat, concerned with worship. Sharia law concerning Islamic finance comes under the first division, Fiqh Al-Mu'amalat. It has evolved through history to accommodate the changes in business transactions and ways of dealing. Sharia Law originated from revealed and derived knowledge of Islam (Rizaldy & Ahmed, 2019). Revealed knowledge, the primary source, comes from the Quran and the Hadith[31] of the prophet Mohammed (peace and blessings of Allah be upon him). Derived knowledge is the knowledge of Muslim jurists who use 'Usul Al-Fiqh' derived from the revealed sources to set Sharia rules (Rizaldy & Ahmed, 2019). However, Muslim jurists sometimes have different interpretations, which may lead to conflicts. For instance, scholars in Islamic finance do not have a final word about trading in derivatives such as options and futures contracts. However, there is a strong agreement about the prohibition of interest rates (Riba).

Islamic finance has a general method to allocate stocks into Islamic and non-Islamic stocks based on qualitative and quantitative screening (see Figure 2.2). Nevertheless, scholars have different opinions about the percentages allowed in the quantitative screening. The first (qualitative) screening eliminates stocks whose primary business involves impermissible activities such as trading in alcohol, tobacco, porn, gambling, and interest rates (Riba). Thus, conventional banks and insurance are considered non-Islamic stocks because their main activities involve interest rates and Gharar[32]. Therefore, according to the main business activities of the stocks, they are allocated into two groups: non-Islamic and 'preliminarily' Islamic. The second screening only focuses on 'preliminarily' Islamic stocks by screening their financial statements and income. Then, according to the compliance level with Sharia law in their financial statements and income, they are allocated as either Islamic, Mixed, or non-Islamic stocks.

Islamic stocks in the second screening means their financial statement and income fully complies with Sharia law and have no income from impermissible sources. Mixed stocks comply with Sharia law but occasionally engage in forbidden transactions (Ho, 2015). In this case, investors can buy these stocks but must purify them (Bhatt & Sultan, 2012; Chang et al., 2020; Kr & Fu, 2014). This means investors must do 'dividend purification', a common practice in Islamic finance, by giving a percentage of the income from non-Islamic sources to charity. Finally, non-Islamic stocks exceed the maximum permissible threshold of non-Islamic sources in their financial statements and income.

31 The record of things said or done by prophet Mohammed (peace and blessings of Allah be upon him).
32 Means uncertainty and deception in Islamic finance which is prohibited.

Scholars apply quantitative screening using multiple tools to measure Sharia compliance, such as interest, liquidity, debt, and impermissible screens (Derigs & Marzban, 2008; Ho, 2015). The maximum allowable percentage from each screening is open to debate. Some scholars are conservative and set tight rules and percentages, whereas others are more relaxed and flexible. This is another example of the dispute between Muslim jurists and scholars in Islamic finance indicated earlier. However, Derigs and Marzban (2008) present the following moderated percentage for screenings:

- Liquidity screening: liquid assets (accounts receivable, cash, and short-term investment) must not exceed 50% of the total asset.
- Interest screening: interest income is to be less than 5% of total revenue.
- Debt screening: the total debt must not exceed 30% of the firm's total value.
- Impermissible screening: the source of income from non-Islamic sources must not exceed 5% of the total revenue.

From the Islamic finance perspective, gains should come from illiquid assets, such as trading and production, representing real economic activities. Interest and debt screens are concerned with the amount of interest payments (inflow or outflow) the business has, which is entirely prohibited in Islam.

This section presented an overview of the concept of Islamic stocks and the process of categorising stocks into Islamic and non-Islamic. The following section concentrates on the role of Islamic returns in the literature.

3.3.1 Islamic stock returns

Islamic stocks have some common characteristics, for instance, lower debt compared to non-Islamic stocks (Bin Mahfouz & Ahmed, 2014), strong interactions in returns and volatility (Shahzad et al., 2017), and price co-movement and liquidity (Alhomaidi et al., 2018).

The screening process reduces the asset universe for religious investors. However, the accounting-based screening during the quantitative screening eliminates or at least reduces the number of bad investments and enhances economic efficiency. For instance, debt screening eliminates stocks with a large amount of debt, which is an indicator of future bad performance. The rule that the liquidity ratio must not exceed 50 per cent of the total asset encourages firms to be more productive and efficient. Thus, firms with a lower liquidity ratio potentially perform well and generate more stock returns. Scholars conclude that the principle of Sharia law has positive implications for the economy and stock returns. For instance, Zaher and Kabir Hassan (2001) argue that the prohibition of interest rates makes a firm's returns dependent on productivity, which makes the economy more efficient.

Pepis and de Jong (2019) investigate the long-term performance of Sharia-compliant stocks in US stock markets, which is a relatively large sample. They conclude that stocks which comply with the percentage in the quantitative screens generate higher returns, regardless of whether the stock complies with Sharia law. Further, they find that fully Sharia-compliant stocks increase long-term returns on assets (ROA) and sales (ROS). They recommend that adhering to quantitative Sharia screening (for liquidity, debt, and interest) leads to a successful long-term portfolio management strategy. A similar result is obtained by Bousalam and Hamzaoui (2016), who conclude that the screening process makes Sharia compliant portfolios more diversified and profitable in the Moroccan stock market.

On the other hand, some studies argue that the constraints imposed by the quantitative screens on stocks make Islamic stocks underperform. Farooq and Alahkam (2016) argue that a portfolio with only Islamic stocks is more likely to affect risk-adjusted returns negatively. They investigate Islamic stocks in different markets[33] in the MENA region and find that they generate less returns than non-Islamic stocks by 0.1051 basis points. They claim that the constraints imposed by low liquidity and low debt gives them disadvantages compared to non-Islamic stocks. Moreover, Rana and Akhter (2015) find that Sharia compliant assets underperform compared to their non-Islamic counterparts in the Pakistani stock market. More recently, Ahmed Bhutto et al. (2021) conclude that Islamic portfolios underperform against non-Islamic stocks using the mean-variance optimization framework.

Other studies argue that the process of purification for impermissible sources of income also impacts on portfolio returns. Hutchinson et al. (2018) examine the implications of purification on the performance of a set of portfolios using different purification methods, and find that purification always negatively impacts portfolio returns. Interestingly, Erragragui and

33 Bahrain, Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, and United Arab of Emirates.

Lagoarde-Segot (2016) find no evidence of different performance between Islamic and non-Islamic stocks in 24 indices in eight countries between 2007 and 2014.

These inconclusive findings may be attributed to the different performance of Islamic stocks due to changes in economic cycles and market trends. In an earlier paper, Hussein and Omran (2005) find that Islamic indices yield significantly high returns during a bull market and negative returns in a bear market. Erragragui et al. (2018) also conclude that Islamic stocks respond to a bearish market differently than their non-Islamic counterparts. Further, some studies find that Islamic stocks act differently during a crisis or when the market turns down.

3.3.2 Islamic stock performance during the 2008 financial crisis

Islamic stocks play an important global role in emerging and developed stock markets. The literature alleges that Islamic stocks and indices perform better than their conventional or non-Islamic counterparts during a recession or economic crisis. For instance, Chapra (2011) argues that precisely because Islamic principles include a low level of debt and restrictions on short sales, they promote increased discipline in the market, and reduce financial instability. He also indicates that the financial crisis in 2008 would have been prevented, if Islamic principles had been more wide-spread, due to the lack of market discipline in the financial market because of the excessive lending and high debt ratio.

Hasan and Dridi (2011) compare Islamic and conventional banks during the 2008 financial crisis. They find that Islamic and conventional banks behave differently with regard to profitability, credit and asset growth, and external ratings. Islamic banks are generally more favourable to external credentials. In terms of profitability, the study concludes that the Islamic bank mechanism helped to reduce the adverse impact of the crisis on the banks' profitability. However, the profitability of some Islamic banks decreased due to their risk management practices. Finally, Islamic banks generally performed better regarding credit and asset growth, contributing to financial and economic stability (Hasan & Dridi, 2011).

Al-Khazali et al. (2014) compare Islamic and conventional Dow Jones indices between 1996-2012 for Japan, UK, USA, Asia Pacific, Developed, Emerging, Europe, and Global. They conclude that Islamic indexes mostly outperformed conventional (non-Islamic) indexes in the 2008 global financial crisis. Thus, Islamic-compliant investment is a good strategy during an economic meltdown. Further, Jawadi et al. (2014) examine the financial performance of

Islamic and conventional indices in the US, Europe and globally before and after the 2008 financial crisis. They claim that Islamic stock indices were less impacted by the 2008 global financial crisis. Additionally, Ho et al. (2014) examine multiple Islamic indexes[34] against their non-Islamic counterpart in the same country. They find that Islamic indices outperformed their non-Islamic counterpart during the financial crisis, but arrived at inconclusive results for other periods. They attribute this to the conservative Sharia investment policy and the fact that they depend less on debt.

More recently, (Erragragui et al., 2018) compare the performance of the Islamic socially responsible investment (SRI), and conventional indexes for each country in their sample[35]. The results indicate that Islamic indexes are less impacted by systematic risks than SRI and conventional indexes during a bearish period. In another recent study, Naeem et al. (2021) examine the linkage between the returns of gold and the Dow Jones World Islamic Index. They find that the Islamic index and gold reveal the same pattern of returns during extreme market conditions, however they take a different direction in normal conditions. They conclude that Islamic investment, like gold, is a good hedging investment during uncertainty and bad market conditions.

These findings about the outperformance of Islamic indices are robust in the literature. Some studies have tried to examine Islamic stocks. For instance, Narayan and Phan (2017) examine the profitability of a set of portfolios formed of Islamic stocks and their profit determinations. They found the profitability of these portfolios compensates for some systematic risk and is not mispricing. Further, Narayan et al. (2017) examine whether over 2000 Islamic stocks have a financial news risk premium in multiple developed and emerging markets[36]. They find that only 45 per cent of the stocks were impacted by the financial news, and the profit gained in those stocks is a risk premium related to the financial news.

On the other hand, Álvarez-Díaz et al. (2014) compare the predictability of the Dow Jones Islamic market index with the Dow Jones industrial average using different approaches. They find that the predictability of the Islamic index differs from that of the conventional index due to its different characteristics. Among other conclusions, they argue that Islamic investments

34 The United States, United Kingdom, Switzerland, France, India, Indonesia, Malaysia, and Hong Kong.
35 Developed markets: Australia Canada, Japan UK, and USA. Emerging markets: Brazil, India, and South Africa.
36 1360 stocks from developed markets and 706 stocks from emerging markets. 350 stocks from European countries, 78 stocks from Australia, 986 Asian countries, 50 stocks from African countries, and the reset Americans stocks for about 602 stocks.

do not perform better than conventional ones, and they may not be a good diversification strategy during a financial crisis. Erragragui and Revelli (2016) also analyze the performance of SRI and Islamic indexes and their unethical and non-Islamic counterparts in the context of the US stock markets and discover no differences . More recently, Ben Rejeb and Arfaoui (2019) conclude that Islamic stock indexes were not immune to the global financial crisis and are more volatile than their counterparts. They study multiple Dow Jones Islamic market (DJIM) indices (global, Emerging, Arab, GCC, Canada, UK, US, Europe, and Asia-Pacific). They conclude that Islamic indexes do not act differently from their conventional counterparts during a financial crisis and do not outperform in informational efficiency, although Islamic indexes are more volatile.

These contradictory results about Islamic equity performance may be for many reasons. First, they could be due to changing economic cycles or using different periods, markets, and analysis approaches, a common problem in many research areas. However, the key here is the quantitative screening process (see sections *.* and *.*). The percentage for each type of screening (liquidity, interest, debt, and impermissible) is not fixed, and more conservative scholars set a lower percentage. In contrast, other scholars are more flexible and allow a higher percentage. These different opinions in the selection foundation for Islamic investment in different countries can cause contradictory results.

3.3.3 Islamic stocks in Saudi Arabia

Like other countries, Saudi Arabia has different and often inconclusive opinions about what counts as an Islamic stocks. Some scholars and advisors are more conservative, such as Dr. Muhammad S. Al Osaimi, the owner of Almaqased.net which is the source of the Islamic classification in this study. The claim that Almaqased is more conservative is based on the number of Islamic stocks in his list being less than other lists produced by a banks' Sharia committee, such as Alinma Bank and Bank Albilad. This study uses the Almaqased list only because the data is available.

The profitability of Islamic stocks has been documented in different studies using different methodologies. For instance, Canepa and Ibnrubbian (2014) investigate Islamic stocks in the Saudi stock market between 2002-2008 and apply sectorial analysis using the stochastic dominance method to compare the returns in all sectors. They conclude that religious norms significantly influence stock prices in the Saudi market. They also show that Islamic stocks have higher returns and volatility than their non-Islamic counterparts. Al-Awadhi et al. (2018) examines the Islamic returns in an extended period between 2004-2014 in the Saudi stock market. They apply a different method, panel regressions, and find that Islamic stocks have higher returns than non-Islamic stocks. They attribute the higher returns to religious investors' higher trading volume in those stocks.

On the other hand, Merdad et al. (2015) find a negative Islamic effect in the cross-section of stock returns in the Saudi stock market from 2002 to 2010. They form multiple double-sorted portfolios by the intersections of small, medium, and large market capitalisation stocks and Islamic, mixed, and non-Islamic stocks. Then, the mean differences between Islamic and non-Islamic portfolios are calculated. They conclude that non-Islamic stocks generate higher returns, although the mean returns are only statistically significant at 10%.

Regardless of the different periods and analysis methods applied in these studies, an inconsistent result in one market makes it questionable. More importantly, these studies emphasize the influence of religion on Saudi individuals that extends to their investment decisions in the stock market, as documented in many studies (for example (Medhioub & Chaffai, 2018). Most traders in the Saudi market are individual Saudi retail investors (see Figure 2.1). These individuals are motivated by their religion to invest only in Islamic stocks.

Some studies allege that buying Islamic stocks based on faith is a herding behaviour (Canepa and Ibnrubbian (2014). They examine herding behaviour among investors in the Saudi market, proving the presence of such behaviour, and describing them as noise traders. Palomino (1996) supports the theory that noise trading explains market anomalies. He suggests that noise traders might generate higher returns than rational investors, which comes from deviating from the Nash equilibrium caused by noise volume. Moreover, Fama and French (1992, 1993, 1995, 2015) consider some of the anomalies (size, value, profitability and investment) factors that represent a pattern of unknown systematic risk in the market (see section 3.2.2). They augment their models by adding those factors.

It would appear that the Islamic returns in the Saudi market may indicate some unknown risk source that compensates for abnormal returns. Erragragui et al. (2018) proves that Islamic equities are associated with lower systemic risk. Thus, the returns for Islamic stocks may be a valuable factor to add to the FF3FM and FF5FM that would improve the models' ability to describe average returns in the Saudi market. These assumptions are supported by, first, the evidence of the profitability of the Islamic stocks in Saudi Arabia and other markets, as mentioned in previous paragraphs. Then, the domination of religious investors acting as noise traders that cause volatility and compensate with higher returns. Further, Islamic returns may be associated with an unknown risk derived from the restrictions imposed by Sharia law, prohibition of interest rates, and debt, which leads to minimizing the source of funds needed for their operation and, therefore, bearing a higher risk. Accordingly, this study assumes that Islamic stocks compensate investors with significantly higher returns than non-Islamic stocks in the Saudi stock market, which is expressed in the following hypotheses:

- ***Hypothesis H3: The Islamic factor has a significant premium on stock returns in the Saudi Stock market.***
- ***Hypothesis H4: Adding the Islamic factor to the three- and/or five-factor models will improve the models' ability to describe the variation in the cross-section of average returns in the Saudi stock market.***

3.4 Financial market global integration

The global integration of financial markets is the process of linking and harmonizing those markets by allowing the smooth flow of capital and investments across a market's national borders. Globally integrating a financial market brings benefits, but the risks must also be considered.

The most important benefit of integrating a global financial market is enhanced market efficiency (Gehringer, 2013; Rizvi & Arshad, 2017). It enables the flow of information and capital across the market, enhances liquidity and opportunities, and gives investors access to a broader range of securities and tools for portfolio diversification. Moreover, financial market integration helps economic growth. Many studies (Bekaert et al., 2005; Masten et al., 2008) using different samples and methods find a significant positive relationship between economic growth and the level of financial market integration.

However, global integration has potentially negative implications for financial markets, such as increased market volatility (Zhang et al., 2021), which might lead to contagion effects (Agénor, 2003). Global integration also causes high co-movement with global markets (Jiang et al., 2017), which has implications for portfolio risk management. Although global integration provides a significant incentive for investors seeking international investment opportunities, co-movement with global markets reduces the diversification benefits the market offers to foreign investors. Co-movement with international markets caused by global integration and the diversification opportunities brought in by it have been investigated in different markets and periods in the literature.

Global diversification reduces portfolio risk and is better than diversified domestic portfolios (Bahlous & Mohd. Yusof, 2014). These global diversification benefits have been identified and documented in many earlier studies (Erb et al., 1994; Grubel, 1968; Karolyi & Stulz, 1996; Levy & Sarnat, 1970; Longin & Solnik, 1995), although these benefits may be conditional on low equity correlations between markets. Moreover, the literature presents strong evidence that a market with a lower degree of global integration (not fully integrated) presents greater diversification opportunity (Click & Plummer, 2005; Lean & Teng, 2013; Longin & Solnik, 1995; Patel, 2019, 2021). Therefore, cross-country correlations and co-movements among markets indicate global integration between those markets (Berben & Jansen, 2005; Yu et al., 2010).

Co-movement and correlation between equity markets driven by global integration have been documented in the literature (Jiang et al., 2017; Johnson & Soenen, 2003; Pretorius, 2002; Tavares, 2009). The undesirable implications of co-movement are indicated in the title of Beine et al. (2010)'s publication, "The dark side of the global integration: Increasing tail dependence". As the title implies, this study finds that increases in global integration decrease return distributions. The study used daily data from 1976 to 2006 from 17 different countries[37].

More recently, Gkillas et al. (2019) investigate the size of global integration and co-movement across sixty-eight international emerging and developed markets for the period 2000-2017. They find that national macro-economic variables can explain the size of global integration and co-movement of stocks in equity market. Therefore, international investors should consider national macro-economic conditions when looking for international diversification opportunities.

However, co-movement and correlations between financial markets are not necessarily signs of high integration or diminishing diversification benefits. The globalisation of financial markets has not led to significant changes in the correlations among those markets (Bekaert et

37 Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Italy, Japan, Netherlands, South Africa, Singapore, Switzerland, United Kingdom, and United States.

al., 2009). For instance, the correlations of the Saudi stock market with different global financial markets have been high recently (Tissaoui & Azibi, 2019). This was long before the market was opened for the QFIs in June 2015 (Rehman et al., 2014).

Moreover, the literature has some precautions regarding investment strategies in the presence of foreign investors or a high level of global integration. For instance, firm characteristics (size, value, liquidity, etc.) play a crucial role in diversifying portfolios internationally. Cho et al. (2015) find a connection between firm characteristics and co-movement in integrated markets. They suggest that different styles of portfolios demonstrate different co-movements globally and regionally, which significantly impact the performance of diversification.

Additionally, foreign investors usually have a different style of investment (for example, small or big / value or growth stocks) that might change investing behaviour, put price pressure on those stocks, and increase (decrease) volatility. For instance, Jiang and Yamada (2011) study on the Japanese stock market find that the size premium highly correlates with the investment inflow of international institutional investors. The study finds that these investors' appetite intensified and shifted into larger stocks and the size premium was inversed, which meant the large market capitalisation stocks had equity premium over the small stocks. This finding runs counter to the size effect discovered by (Banz, 1981) and examined extensively (see section 3.2.2). Therefore, domestic investors should be aware of the inflow of foreign investment in the equity market.

Consequently, the recent developments in the Saudi stock markets that allow QFIs to enter and trade in a market dominated by Saudi Retail investors (see section 2.5.1) is likely to have some implications. At this stage, policymakers in Saudi Arabia have explicitly put up some barriers to QFIs to protect local investors, although eventually they plan to open the market freely. Policymakers clearly announce those explicit barriers in Saudi Arabia; however, implicit barriers, such as asymmetric information and corporate governance (Carrieri et al., 2013), cannot be perceived as clearly.

In response to the barriers, international investors may develop a different investment style than the one they use domestically. For instance, they might follow a growth strategy (stocks with a low B/M ratio). At the same time, they know that a value strategy (high B/M ratio) is more profitable (see section 3.2.2.2) because growth stocks are larger firms and reveal more information. It is documented that international investors in emerging and developed markets invest in large firms because they have low asymmetry information (Batten & Vo, 2015; Diyarbakirlioglu, 2011; Kim & Yoo, 2009), although small firms are thought to be more profitable in the long run (Acaravci & Karaomer, 2017; Cox & Britten, 2019; Dirkx & Peter, 2018; Fama & French, 2017; Foye, 2018a; Lin, 2017; Mosoeu & Kodongo, 2020). Intuitively, this could mean that international investors do not look for long-term investments.

Therefore, international investors in the Saudi stock market might develop investment strategies that run counter to the strategies that have been proven to be profitable, such as small market cap, value stocks, etc., as discussed earlier in this chapter. These international investors trade in a market dominated by domestic retail investors who are highly influenced by religion to buy stocks that comply with Sharia law, as discussed in the previous section. These domestic investors are sometimes called noise traders (Bange, 2000; Frazzini & Lamont, 2008).

Since this study examines factors related to small market capitalisation and value stock and covers the period before and after allowing international investors into the Saudi market, it is essential to examine the implications of international investors on these factors and the asset pricing models examined in this study. Thus, this study assumes that the mean of the factor premiums examined in hypothesis H1 and the models' ability to describe the variation in the average returns in hypotheses H2 and H4 have changed due to the recent global integration in the Saudi stock market, which is expressed in the following hypotheses:

- ***Hypothesis H5.1: The mean of the factor premiums (size, value, profitability, investment, and Islamic) has significantly changed due to the global integration of the Saudi stock market.***
- ***Hypothesis H5.2: The performance of asset pricing models (FF3FM, FF5FM, 4FM, and 6FM) has changed due to the global integration of the Saudi stock market.***

3.5 Conclusion

This literature review chapter provided the theoretical foundations and practical implications of asset pricing and the cross-section of stock returns. It was divided into three major sections: asset pricing models, Islamic stocks, and global integration. It presented tailored hypotheses for each section.

The first section was about developments in asset pricing models. It covered the development of the asset pricing models from the development of the modern portfolio theory of Markowitz (1952, 1959) to the introduction of the Fama and French (2015) five-factor asset pricing model. The hypotheses about the factor premiums and the asset pricing models' ability to describe the variation in the Saudi stock market were stated at the end of each subsection.

The second section introduced the concept of Islamic stocks and explained the process of categorising stocks into Islamic, mixed, and non-Islamic stocks. It clarified some of the implications of Islamic equities in global markets, including the role of Islamic stocks as a hedging tool during economic downturns. It also covered the specific role of Islamic stocks in Saudi stock markets and how they could be incorporated as one factor in proposed asset pricing models.

The last section briefly presented some of the consequences documented in the literature about the role of foreign investors in global markets. The implications of global integration on diversification opportunities were also discussed. Then, the implication of the entry of foreign investors into the Saudi market is critically discussed in relation to the literature.

The evolving asset pricing literature has motivated many studies to propose models that better describe the relationship between risk and returns. This started with CAPM and led to alternatives such as APT and ICAPM, and then settled upon multifactor models that use firm-specific characteristics. This trajectory has encouraged this study to propose an Islamic factor as an additional factor to improve Fama and French's three- and five-factor models. The foundation of this Islamic factor comes from the influence of individual investors who trade in stocks according to their degree of compliance with Islamic Sharia rules. However, the influence of the factor may have changed due to the demographic changes in the Saudi stock market. Thus, the study is motivated to investigate the implications of this change on factor premiums and asset pricing models.

The next chapter will explain the methodology that will be used to examine the hypotheses outlined in this chapter.

Chapter 4: Methodology

4.1 Introduction

This chapter explains the methodology and methods applied to examine the hypotheses developed in the literature review, answer the research questions, and fulfil the aim which was established in the first chapter. This chapter will also clarify aspects of the data collection and manipulation, such as the sample period, the frequencies, and the methods used to calculate the return for formed portfolios.

Influenced by the empirical research of Fama and French (1992, 1993, 1995, 1996, 1998, 2015), this study applies the methodology of the cross-section of stock returns. All the listed stocks in the Saudi stock market are allocated into different groups according to different firm characteristics (market capitalisation, book-to-market ratio, profitability, investment, and compliance with Sharia law). The allocation of all listed stocks is repeated independently for each characteristic, and the intersection between the groups allows the formation of different portfolios. The intersection means the same stock falls into two different groups simultaneously.

The returns of these portfolios are used as dependent (left-hand-side portfolios) and independent (right-hand-side factors) variables. After forming specific portfolios and using their mean returns as left-hand-side (LHS) portfolios and right-hand-side (RHS) factors, I will perform a one-sample t-test to examine the significance of the equity premiums in the RHS factors.

The study also tests the performance of the three- and five-factor asset pricing models of Fama and French (FF3FM and FF5FM) on the Saudi stock market (Tadawul) to determine whether adding the Islamic factor to both models improves their performance. I will employ Gibbons et al. (1989) GRS test of portfolio efficiency. I will also use OLS regression with Newey and West (1987) standard error to further investigate the models' performance. I will also employ one-sample t-tests and GRS tests to assess the implications of global integration by examining two periods before and after global integration. Additionally, I will use a two-sample t-test to determine whether the factor premiums' significance varies due to global integration.

The study uses both monthly and weekly frequencies for estimation purposes and examination of factor premiums. Hence, it will be a comprehensive study of the cross-section of average returns in the Saudi stock market (Tadawul). These steps allows for a robustness check and the ascertainment of consistent results.

Finally, this study applies two different methods to calculate the returns of formed portfolios: value-weighted and equal-weighted returns. Although the value-weighted return, which uses market capitalisation as a weight of the stock returns, is the conventional method in empirical asset pricing and the cross-section of average returns, the equal-weighted method is increasingly being preferred. This step is vital because changes in factor premiums and asset pricing model efficacy can be revealed when different methods are used to calculate a portfolio's return. It also helps to check the robustness and the consistency of results regarding the use of monthly and weekly data.

The chapter is structured as follows. Section 4.2 presents the data source, the sample selected, and the data frequency, which are monthly and weekly. Section 4.3 briefly overviews the Fama and French three- and five-factor Models and the factors included. Section 4.4 covers the Islamic factor proposed by this study and the specifications for the new four- and six-factor models expanded from the original Fama and French models. Section 4.5 explains in detail the portfolio formation and returns, which are used as dependent and independent variables in the time series models used in this study. Section 4.6 describes and justifies this study's analysis methods. Finally, Section 4.7 concludes the chapter.

4.2 Data and sample

This study applies to all listed stocks in the emerging equity market of Saudi Arabia that are included in the TASI and Nomu indices (see section 2.4.3) and uses secondary data that is publicly available from different sources. Although the stock market in Saudi Arabia was officially established in the early 1980s, this study covers only the period from 1/04/2009 to 31/04/2021 for reasons mentioned in Chapter 2 (see section 2.3). The following subsection identifies the source of the data.

4.2.1 Data collection

This study relies entirely on secondary data that is publicly available from multiple sources and comprises all listed stocks within the sample period, including active and dead stocks, to avoid survivorship bias. Table 4.1 shows the sources of the data and their periods. The annual data in panel A is used to categorize stocks into different groups and then form the required portfolios, which are explained in the following sections. Panels B and C display the source of the monthly and weekly adjusted closing prices of all listed stocks, which will be used to calculate the returns for all listed stocks under examination. As mentioned in the introduction to this chapter, this study uses monthly and weekly frequencies for estimation purposes and to identify factor premiums. Finally, panel D indicates the source of the SAMA one-month treasury bill, which is used to calculate the excess returns for some portfolios.

Table 4.1: Data sources

No	Data	Period	Sources
Panel A: Annual data of all listed stocks			
1	Common shares outstanding	31/12/2008 to 31/21/2020	Eikon DataStream database and E-reference data
2	Total assets	31/12/2007 to 31/12/2020	
3	Total liabilities	31/12/2008 to 31/21/2020	
4	Operating profit	31/12/2008 to 31/21/2020	
5	Islamic classifications	01/04/2011 to 01/04/2020	almaqased.net
Panel B: Monthly data of all listed stocks			
6	Price	30/03/2009 to 30/03/2021	Eikon DataStream database
Panel C: Weekly data of all listed stocks			
7	Prices	1/04/2009 to 06/04/2021	Eikon DataStream database
Panel D: One-month treasury bill			
8	SAMA treasury bill	30/03/2009 to 30/03/2021	Saudi Arabian Monetary Authority's official website

The annual data in panel A, except for the Islamic classification, is mostly obtained from the Eikon database, however, some missing data from Eikon is replaced by data from the E-reference database provided by the official website of the Saudi Stock Exchange (Tadawul). In a few cases, some of the annual data was taken directly from the annual reports of some stocks included in this study. I investigated all possible data sources to avoid dropping stocks due to unavailable data because the number of stocks in the market is relatively small, and dropping stocks might affect the accuracy. The last part of the annual data is the Islamic classification obtained from the Almaqased website. Finally, panels B and C's monthly and weekly adjusted closing prices are obtained from the Eikon database. The SAMA treasury bill in panel D is taken from the Saudi Arabian Monetary Authority's official website.

4.2.2 Stock returns

After all the data is acquired, the first step is to calculate the return of all listed stocks included in this study for the sample period. The historical price of all listed stocks collected weekly and monthly is used to calculate the return. Indubitably, calculating historical returns is key to understanding and predicting future stock returns, which is a central issue in empirical finance. Thus, finding a suitable method to calculate historical returns is vital.

Finance literature has long debated the best approach to calculate historical stock returns (Jacquier et al. (2003); Hudson and Gregoriou (2015). However, this study uses logarithmic returns because they meet the study's objectives. Strong (1992, p. p. 535) concludes that logarithmic returns are preferable for theoretical and empirical reasons. Theoretically, logarithmic returns are advantageous when analyzing multi-sub-period returns, and this study has 12 sub-periods. Empirically, logarithmic returns are usually normally distributed, which helps with the normality assumption when estimating asset pricing models in this study. Logarithmic returns also prevent stock prices from turning negative in security returns models and provide a suitable compounding basis for calculations (Hudson & Gregoriou, 2015; Kliger & Gurevich, 2014).

Logarithmic returns are approximately equal to simple returns[38], but a stock's simple mean return and logarithmic mean return varies significantly over the same period (Hudson & Gregoriou, 2015). Hudson and Gregoriou (2015) have mathematically proven that this difference is due to the relationship between variance and the mean expected return for each method. The mean calculation for both methods relies on the relationship between risk and return, and Fergusson and Platen (2006) conclude that using log returns provides a good risk estimate. Therefore, using log returns gives an adequate mean return to address this study's

38 Simple return is calculated as $R_{i,t} = \frac{(P_{i,t} - P_{i,t-1})}{P_{i,t-1}}$

objectives that rely on mean returns. In this regard, the log returns are expressed as the logarithm of the security price on month/week t divided by the price on the previous month/week *t-1*. The returns of stocks are assessed in equation 4.1:

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \tag{4.1}$$

Where:

ln	=	the natural log;
$P_{i,t}$	=	the monthly/weekly adjusted closing price of stock i on month/week t;
$P_{i,t-1}$	=	the monthly/weekly adjusted closing price of stock i on the previous month/week t-1.

4.2.3 Monthly and weekly frequencies

Using monthly data is the conventional method in the cross-section of average returns and asset pricing models, however, some studies use weekly data (Appiah-Kusi and Menyah (2003); Iqbal and Brooks (2007); Chai et al. (2017);). Since the vast majority of the cross-section of average returns studies in the finance literature use monthly data, other data frequency needs more attention, particularly weekly data. Weekly data has less noise than daily data and more time intervals than the monthly frequency. The sample period of this study is relatively short compared to most cross-sections of stock returns studies. In such circumstances, weekly data will give more time intervals in the time series analysis, offering more degrees of freedom and more confidence in the result.

This study is a comprehensive analysis of the cross-section of average returns in the Saudi market and therefore tries to look at all the possible ways to test the hypotheses. Thus, examining more than one frequency helps the robustness check and whether we have consistent results for the hypotheses. It also helps to comprehend the variation in the cross-section of average returns and the factor premiums in the dominant growing equity market of Saudi Arabia in the Middle East.

Therefore, this study uses both monthly and weekly returns to form portfolios and construct the factors used as inputs for the asset pricing model. Accordingly, the stock return is calculated in (4.1) using monthly and weekly adjusted closing prices collected from the data sample mentioned in Table 4.1. The monthly adjusted closing price, the last trading day of every month, is utilised to calculate monthly returns from 30/04/2009 to 30/03/2021. Every Tuesday, the weekly adjusted closing price is used to calculate the weekly returns from 07/04/2009 to 06/04/2021. Tuesday was chosen for calculating the return to avoid the weekend effect, which is known to cause negative returns on Mondays and positive returns on Fridays (Keim & Stambaugh, 1984). (The weekend in Saudi Arabia is different than most of the world – it used to be on Thursday and Friday, and the first day of the week was Saturday. However, a Royal decree changed the weekend to Friday and Saturday with the first week starting on Sunday, 23 June 2013.) Thus, for most of the sample period Tuesday is in the middle of the week and away from any weekend effect.

The Fama and French asset pricing models are explained and presented in the following section.

4.3 Fama and French asset pricing models

Following the stock returns calculated using the method and frequencies explained above, all listed stocks are allocated into different portfolios based on their firm's characteristics. The annual data in Table 4.1 helps calculate firm characteristics value and form portfolios from all the listed stocks of the Saudi stock market (explained in depth in section 4.5 on portfolio formation). The mean return of the portfolios is the input for all the asset pricing models, including Fama and French's asset pricing models FF3FM and FF5FM, discussed in subsections 4.3.1 and 4.3.2.

This study is influenced by the development of the Fama and French (1992, 1993, 1995, 2015) asset pricing models. However, some changes have been made. These changes include, for instance, the new weekly frequency suggestion and the new country-specific factor explained in section 4.4 (the Islamic factor). The following subsections briefly explain Fama and French's three- and five-factor asset pricing models and their factors.

4.3.1 Fama and French's three-factor model (FF3FM)

The Fama and French (1992, 1993, 1995) FF3FM was based on the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), and Black (1972). The model comprises (i) the market excess return factor (R_m-R_F), which is the mean return of all stocks in the sample minus the risk-free rate; (ii) the size factor (SMB), which is the mean return of small market capitalisation stocks minus big ones, and (iii) the value factor (HML), which is the returns of the stock with high B/M ratio minus low stocks.

The specification of FF3FM used in this study follows the model in the original Fama and French (1992, 1993, 1995) empirical studies, shown in equation 4.2 below:

$$R_{it} - RF_t = \alpha_i + b_i\,(RM_t - RF_t) + s_i\,SMB_t + h_i\,HML_t + e_{it} \qquad (4.2)$$

Where:

R_{it}	=	the return on portfolio *i;*
RF_t	=	the risk-free return for period *t;*
α_i	=	the intercept of the portfolio *i;*
RM_t	=	the return on the market portfolio;
SMB_t	=	the mean return on small market capitalisation portfolios minus the mean return on big market capitalisation portfolios;
HML_t	=	the mean return on high B/M ratio portfolios minus the mean return on low B/M ratio portfolios;
b_i, s_i, and h_i,	=	the parameters of the model's factors; and
e_{it}	=	the zero-mean residual.

4.3.2 Fama and French's five-factor model (FF5FM)

The new FF5FM is a huge improvement to the original FF3FM's ability to describe the variation in the cross-section of average returns, and the new additional factors in the model have a significant premium. The new model consists of the same factors in FF3FM with two additional factors: (i) the profitability factor (RMW), which is the mean return of high profitability (robust) stocks minus low profitability (weak) stocks, and (ii) the investment factor (CMA), which is the mean return of low investment growth (conservative) stocks minus high investment growth (aggressive) stocks. The FF5FM specification used in this study is presented in equation 4.3 and is similar to the specification of FF3FM in equation 4.2 plus the additional new factors, RMW and CMA:

$$R_{it} - RF_t = \alpha_i + b_i\,(RM_t - RF_t) + s_i\,SMB_t + h_i\,HML_t + r_i\,RMW_t + c_i\,CMT_t + e_{it} \qquad (4.3)$$

Where:

RMW_t	=	the mean return on robust (high profitability) portfolios minus the mean return on weak (low profitability) portfolios, and
CMA_t	=	the mean return on conservative (low investment growth) portfolios minus the mean return on aggressive (high investment growth) portfolios.

All other specifications are equivalent to the specifications in equation 4.2.

Lastly, this study proposes a new factor more tailored to the Saudi stock market: the Islamic factor. Following the development of Fama and French's asset pricing models, this factor is the mean return of Islamic stocks minus the mean return of non-Islamic stocks, and is presented in the following section.

4.4 The Islamic factor (IMN)

The Islamic factor is a unique country-specific factor proposed in this study. It aims to investigate whether it is significant as an equity premium and whether it has a capacity to enhance the explanatory power of the Fama and French asset pricing models in the Saudi market's average returns. The factor input in the model is the mean return on the portfolios of Islamic stocks minus the mean return of non-Islamic stocks, referred to in this study as IMN. Islamic stocks that comply with Sharia law were explained in Chapter 2 (see section 2.5.2). The process of allocating stocks into Islamic, mixed, and non-Islamic is shown in Figure 2.2 in Chapter 2 (see section 2.5.2). The historical data about Islamic, mixed, and non-Islamic stocks is obtained from the Almaqased Economy Advisory website (almaqased.net). Due to limitations in the availability of data, the historical data of the Islamic classification in 2011 has been used for the previous two years, 2010 and 2009. There have been changes in compliance with Sharia law by firms in recent years , which can be seen when firms move from being in mixed stocks to Islamic stocks or vice versa. However, moving from Islamic to non-Islamic rarely occurs within two years, thus, relying on 2011 for both 2009 and 2010 data is reasonably accurate.

The Islamic factor IMN is combined with the original FF3FM, which produces a proposed four-factor model, 4FM. The specification of 4FM is identical with FF3FM in equation 4.2 plus the new factor IMN, as shown in equation 4.4:

$$R_{it} - RF_t = \alpha_i + b_i\,(RM_t - RF_t) + s_i\,SMB_t + h_i\,HML_t + i_i\,IMN_t + e_{it} \quad (4.4)$$

Where:

IMN_t = the mean return on Islamic portfolios minus the return on non-Islamic portfolios.

All other specifications are identical with the specifications in equation 4.2.

The other proposed model with the Islamic factor as an additional factor is the six-factor model 6FM. Similar to 4FM, 6FM is the original FF5FM plus the proposed Islamic factor IMN. Thus, the specification of the 6FM model is identical with FF5FM in equation 4.3 plus the new IMN factor, displayed in equation 4.5:

$$R_{it}-RF_t= \alpha_i + b_i\,(RM_t - RF_t) + s_i\,SMB_t +h_i\,HML_t +r_i\,RMW_t +c_i\,CMT_t + i_i\,IMN_t+e_{it} \quad (4.5)$$

Where

IMN = the mean return on Islamic portfolios minus the mean return on non-Islamic portfolios.

All other specifications are similar to equation 4.3.

4.5 Portfolio formation

The inputs of the asset pricing models examined and proposed by this study, which were explained in sections 4.3 and 4.4, are the excess mean return of the LHS portfolios and the mean return of the RHS factors. The LHS portfolios represent the dependent variables or the cross-section of stock returns under investigation in this study, and the RHS factors are the explanatory variables.

The LHS portfolios are formed from the intersections of all listed stocks sorted into different groups multiple times (explained in the following subsection). The RHS factors are constructed by combining and subtracting the returns of different formed portfolios similar to the LHS portfolios. The RHS factors are excess market return (R_M - R_F), size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN) in the asset pricing models.

The portfolios are formed at the beginning of the sample period (end of March 2009) and then reformed annually in April every year t using the accounting data for the fiscal year t-1. All listed stocks are included in this study, which includes active and dead stocks. The stocks in year t must have accounting data for fiscal year t-1. Any stocks listed after the portfolio formation in year t will be included in year t+1 only if they have accounting data available for fiscal year *t* by the time of portfolio formation in year *t+1*. All stocks with missing accounting data were dropped from the study for that year. Also, the stocks that were postponed from trading for more than six consecutive months were dropped from that period. Table 4.2 shows the number of stocks used every year of the sample period in this study.

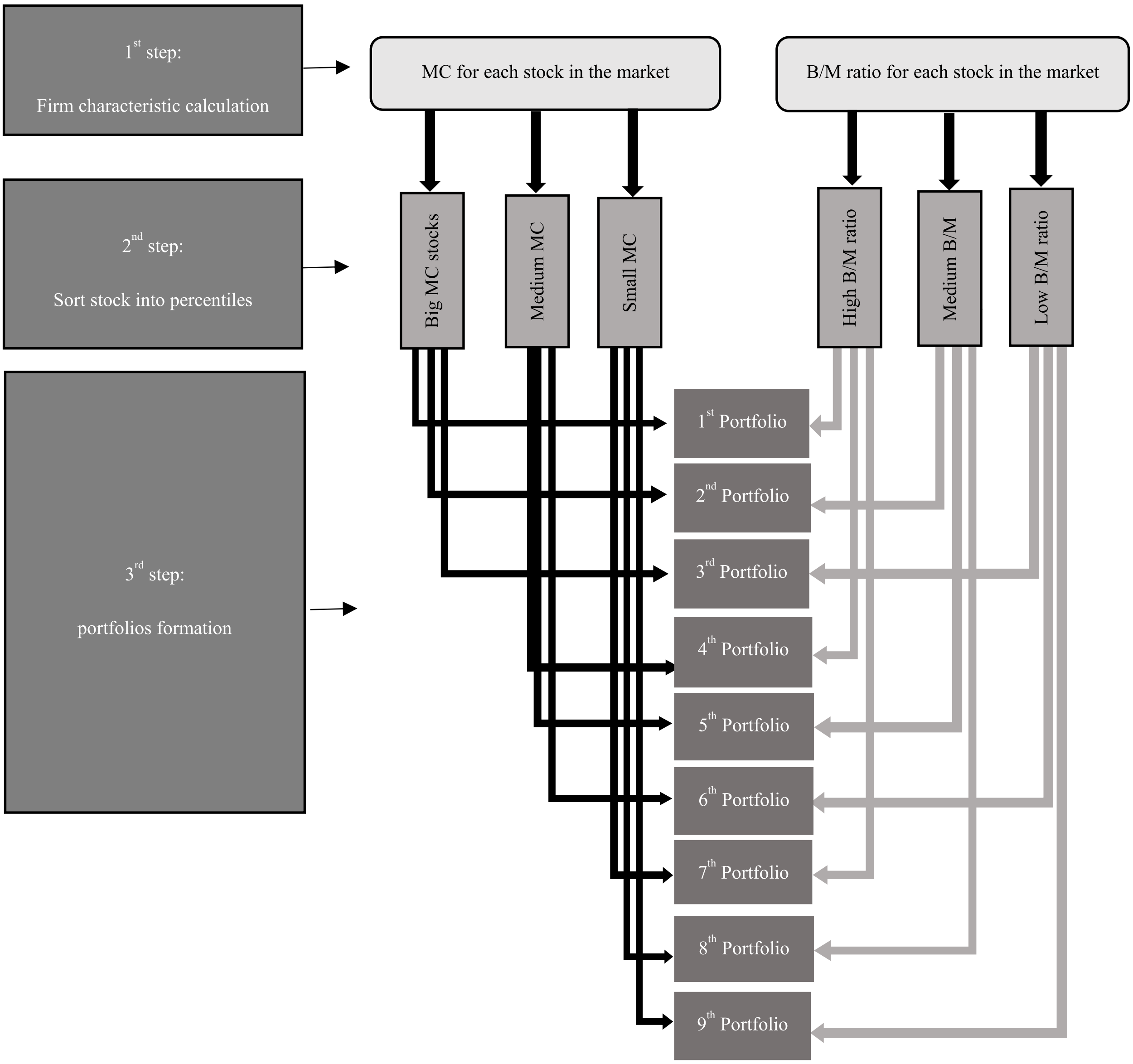
Table 4.2: Number of listed stocks included in the study annually

No	Year	Number of listed stocks
1	Begins April 2009	116
2	Begins April 2010	124
3	Begins April 2011	140
4	Begins April 2012	144
5	Begins April 2013	146
6	Begins April 2014	154
7	Begins April 2015	158
8	Begins April 2016	163
9	Begins April 2017	168
10	Begins April 2018	178
11	Begins April 2019	178
12	Begins April 2020	178

Note: The number of stocks for every year is not all listed stocks, but only the qualified stocks

The original study of Fama and French (1992, 1993, 1995, 2015) excluded financial firms from their research when they used FF3FM and FF5FM. Most studies investigating the cross-section of average returns in major global stock markets follow the same approach, excluding financial firms. Fama and French (1992, 1993, 1996, 2015) exclude stocks in the financial industry due to their high financial leverage compared to other stocks from other industries, which is likely to indicate financial distress (Fama & French, 1992, p. 429). However, financial firms are included in this study due to the large number of those stocks in the Saudi market (more than 30% of the market is the financial industry). It would be meaningless to drop 30 per cent of the market from a market with so few stocks because they might be financially distressed.

Figure 4.1: Portfolio formation between MC and B/M ratios



Note: this is just an illustration of the steps of the LHS portfolio formation from the intersections between market capitalisation MC and book-to-market (B/M) ratio

The formation of LHS portfolios and the portfolios used to construct the RHS factors are formed slightly differently. However, the steps are quite similar. The difference only concerns the number of percentile groups used each time and how the stocks are sorted.

As Figure 4.1 illustrates, the formation of the portfolios needed in this study is generally done following a three-step process, which is:

- Step 1: calculating the firm characteristics for all listed stocks (for example, the market capitalisation and book-to-market ratio for each listed stock);
- Step 2: sorting listed stocks into percentiles according to each firm characteristic calculated and the breakpoint specified (for example, small/medium/big market capitalisation stocks and high/medium/low book-to-market ratio stocks), and
- Step 3: forming portfolios from the intersections between stocks falling in two different group percentiles.

The example in Figure 4.1 is about forming portfolios between the intersections of MC and B/M ratio sorts. This illustration first calculates the MC and B/M ratio for each stock. Then, in the second step, all listed stocks are ranked into three percentile groups according to their MC value, and then all listed stocks are ranked once again according to their B/M ratio. Since all listed stocks are ranked twice, the same stock must fall in one group of MC and one group of B/M ratio. The last step to form the portfolio from the intersection between one group of MC and one group of B/M ratio. The intersection means the same stocks fall at the same time into these two groups. For instance, the 1st portfolio in Figure 4.1 is formed from stocks that fall into the top MC percentile group, and at the same time, those stocks fall into the top B/M ratio.

A portfolio formed using double sorts (for example, an MC sort and B/M ratio sort), as explained in Figure 4.1, is called a double-sorted portfolio. The portfolios used in this study are all double-sorted. The first sort is always MC, and the second is B/M ratio, profitability, investment growth, or Islamic classification. The Islamic classifications do not follow the percentiles sorting procedure that Figure 4.1 illustrates. Rather, they are sorted into three groups (see section 2.5.2).

Since the formation of LHS portfolios and portfolios used to form RHS factors are different, the following two subsections explain each one. The next subsection explains the portfolio formation and the construction of the RHS factors, and the following subsection goes over the formation of LHS portfolios.

4.5.1 Right-hand-side (RHS) factors

The RHS factors (independent variables) used in this study are size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN). Sorting stocks into portfolios to construct the RHS factors mentioned above involves a few steps. The first step is calculating all listed stocks' MC, B/M ratio, profitability, and investment growth value. These calculations are repeated annually for each year of the study sample. MC for stock *i* at year *t* is the market price of the stock *i* at the beginning of April in year *t* multiplied by the common shares outstanding in the annual report of year *t-1*. The B/M ratio for stock *i* at year *t* is calculated as the book of value of equity of stock *i* at the end of year *t-1* divided by its MC at the end of year *t-1*. Profitability for stock *i* at year *t* is the operating profit of stock *i* at the fiscal year *t-1* divided by its book value of equity at the end of year *t-1*. The investment growth for stock *i* at year *t* is the change of its total assets between the fiscal year *t-2* and year *t-1* divided by the total assets of fiscal year *t-2*. Table 4.3 shows the equations for all of these calculations.

Table 4.3: Firm characteristics calculations

Variable		Calculation
Market capitalisation (size)	=	(Stock price $_{i,t}$ * Common share outstanding $_{i,t\text{-}1}$)
Book-to-market ratio (value)	=	(Total book value $_{i,t\text{-}1}$ / Market capitalisation $_{i,t\text{-}1}$)
Profitability	=	(Operating Profit $_{i,t\text{-}1}$ / Total book value $_{i,t\text{-}1}$)
Investment	=	(Total asset $_{i,t\text{-}1}$ – Total asset $_{i,t\text{-}2}$) / Total asset $_{i,t\text{-}2}$

The second step after making the calculations is sorting all listed stocks into different percentile groups according to the value of those calculations. The Islamic factor does not need any calculation as it comes sorted into three groups by Almaqased.net.

Sorting the stocks into groups involves two different sorts – the first sort is 2 × 3, and the second is 2 × 2. These two sorts have different diversification techniques. The 2 × 3 sort technique uses only 60% of the stocks because of the exclusion of the stocks in the medium percentile group, whereas the 2 × 2 sort includes all the stocks (more explanation about the exclusion and the construction of the RHS factors is provided in the following subsections).

Fama and French (2015) examine both sorts and suggest that the independent factors based on the 2 × 2 sort are better diversified and represent all listed stocks, so examining these two different sorts is important. Accordingly, this study has two sets of RHS factors, the first set constructed using the 2 × 3 sort and the second using the 2 × 2 sort. The first set of RHS factors, the 2 × 3 sort, is used to examine all the hypotheses in this study, whereas the 2 × 2 sort is used to examine only hypotheses 1, 3, and 5.1 (see Chapter 3).

The Fama and French (2015) five-factor model used three different sorts: 2 × 3, 2 × 2, and 2 × 2 × 2 × 2, but because the Saudi stock market is a small market, the third sort would leave too few stocks in some portfolios.

The following two subsections explain the two sorts that I am using.

4.5.1.1 The sort of 2 × 3 factors

The first sort used to construct the RHS factors is the 2 × 3, which means 2 groups of the first sort and 3 groups of the second sort. The first sort is always MC, and the second is each one of the other firm characteristics included in Table 4.3 plus the Islamic factor. Therefore, all listed stocks are first sorted based on the value of the calculation in Table 4.3 into two groups of MC. Then, all listed stocks are sorted again into three percentile groups: B/M ratio, profitability, and investment for every year of the study sample. This means that for every year, we have two groups of MC for all listed stocks (small (S) and big (B) stocks); three groups of B/M ratio for all listed stocks (high (H), medium (M), and low (L) stocks); three groups of profitability for all listed stocks (robust (R), medium (M), and weak (W) stocks); three groups of investment growth for all listed stocks (aggressive (A), medium (M), and conservative (C) stocks); and three groups of Islamic classification for all listed stocks (Islamic (I), mixed (M), non-Islamic (N) stocks) that come already sorted into these groups from the sources mentioned previously (see section 2.5.2). Table 4.4 shows these groups and the breakpoints for each group.

The Fama and French (1992, 1993, 2015) studies use the NYSE median as a breakpoint for small and big stocks. Employing the same method in a small emerging market like the Saudi stock market will leave very few stocks in the small MC group. Therefore, this study uses a different breakpoint. The big stocks constitute the top 90% of total market capitalisation, and the lowest 10% are the small stocks. This breakpoint has been commonly used in many studies, especially in emerging markets with fewer stocks (for example, Cakici et al. (2013) and Foye

(2018a). The breakpoint for the B/M ratio sort is the 30th and 70th percentiles of the B/M ratio. The stocks with a value in the top 70th percentile of the B/M ratio are sorted together, those between the 70th and 30th percentile are sorted together, and finally, stocks with a value lower than the 30th percentile are in one sort. The breakpoints and procedure of the B/M ratio are applied to profitability and investment. Finally, the Islamic classification from Almaqased Advisory is already sorted into three groups: Islamic, mixed, and non-Islamic stocks.

Table 4.4: Sorting all listed stocks into groups and their breakpoints for the 2 × 3 sort type

	Sort	**Breakpoints**	**Groups**		
Panel A			**Top 90% of MC (1)**	**Lower 10% of MC (2)**	
1	Market capitalisation (size) sort	MC: Big stocks constitute the top 90% of the total market cap; the rest are small stocks.	Big stocks (B)	Small stocks (S)	
Panel B			**Greater > 70th (1)**	**70th-30th (2)**	**30th >Lower (3)**
2	Book-to-market ratio (Value) sort	B/M: 30th and 70th percentiles	High B/M stocks (H)	Medium B/M stocks (M)	Low B/M stocks (L)
3	Profitability sort	prof: 30th and 70th percentiles	Robust prof. stocks (R)	Medium prof. stocks (M)	Weak prof. stocks (W)
4	Investment sort	Inv: 30th and 70th percentiles	Aggressive inv. stocks (A)	Medium inv. stocks (M)	Conservative inv. stocks (C)
Panel C			**Almaqased classification (1)**	**(2)**	**(3)**
5	Islamic sort	Islamic: Almaqased.net	Islamic stocks (I)	Mixed stocks (M)	Non-Islamic stocks (N)

Note: Panel A shows the groups of market capitalisation, MC, small (S), and big (B) stocks. Panel B displays the groups of book-to-market ratio, B/M, high (H), medium (M); and low (L) stocks; profitability, prof, robust (R), medium (M), and weak (W); investment, Inv, aggressive (A), medium (M), and conservative (C). Panel C shows the Islamic classification groups as follows: Islamic (I), mixed (M), and non-Islamic (N).

The third and final step is forming the portfolios that are needed to construct the RHS factors from the intersection between the first sort (the two groups of MC small (S) and big (B) stocks) and the second sort (three groups for each one of the following characteristics: B/M ratio, profitability, investment, and Islamic). This means, for instance, that the stocks in the first sort (MC) that are considered small (S) and the same stocks in the second sort (B/M Ratio) that are considered high (H) will form a portfolio named Small and High (SH). Consequently, four intersections emerge, which are:

- The intersection between two groups of MC and three groups of B/M ratio generates six portfolios: small high (SH), small medium (SM), small low (SL), big high (BH), big medium (BM), and big low (BL) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{B/M} = (SH + SM + SL)/3 – (BH + BM + BL)/3$

  Value factor: $HML = (SH + BH)/2 – (SL + BL)/2$

- The intersection between two groups of MC and three groups of profitability generates six portfolios: small robust (SR), small medium (SM), small weak (SW), big robust (BR), big medium (BM), and big weak (BW) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{Prof} = (SR + SM + SW)/3 – (BR + BM + BW)/3$

  Profitability factor: $RMW = (SR + BR)/2 – (SW + BW)/2$

- The intersection between two groups of MC and three groups of investment generates six portfolios: small aggressive (SA), small medium (SM), small conservative (SC), big aggressive (BA), big medium (BM), and big conservative (BC) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{Inv} = (SA + SM + SC)/3 – (BA + BM + BC)/3$

  Investment factor: $CMA = (SC + BC)/2 – (SA + BA)/2$

- The intersection between two groups of MC and three groups of Islamic classification generates six portfolios: small Islamic (SI), small mixed (SM), small non-Islamic (SN), big Islamic (BI), big mixed (BM), and big non-Islamic (BN) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{Is} = (SI+SM+SN)/3 – (BI+BM+BN)/3$

  Islamic factor: $IMN = (SI+BI)/2 – (SN+BN)/2$

Since four SMB factors are constructed in each group intersections above, the simple average of these four SMB factors is calculated to become the SMB factor used in this study. Table 4.5 shows all the factors, their breakpoints, and how they are calculated.

Table 4.5*: Construction of size, value, profitability, investment, and Islamic factors derived from the 2× 3 sort*

Sorts	Breakpoints	Factor components
2 × 3 sorts on: MC and B/M; MC and prof; MC and inv; and MC and Islamic.	- MC: Big stocks constitute the top 90% of the total market cap; the rest are small stocks.	$SMB_{B/M}$ =(SH+SM+SL)/3 – (BH+BM+BL)/3 SMB_{Prof} =(SR+SM+SW)/3 – (BR+BM+BW)/3 SMB_{Inv} =(SA+SM+SC)/3 – (BA+BM+BC)/3 $SMB_{Islamic}$ =(SI+SM+SN)/3 – (BI+BM+BN)/3 SMB=($SMB_{B/M}$+ SMB_{Prof}+ SMB_{Inv}+ $SMB_{Islamic}$)/4
	- B/M: 30^{th} and 70^{th} percentiles.	HML= (SH+BH)/2 – (SL+BL)/2
	- Prof: 30^{th} and 70^{th} percentiles.	RMW= (SR+BR)/2 – (SW+BW)/2
	- Inv: 30^{th} and 70^{th} percentiles.	CMA = (SC + BC)/2 – (SA + BA)/2
	- Islamic: Almaqased Classification.	IMN = (SI+BI)/2 – (SN+BN)/2

Note: Independent sorts are used to assign all listed stocks into the first sort of two market capitalisation, MC, groups and then the second sort of three groups for each one of the following factors: book-to-market ratio, B/M, profitability (Prof), investment (Inv) and Islamic. The intersection between the first and second sorts of groups forms the portfolios. The portfolios are labelled using two letters. The first letter always defines the first sort of the MC group, small (S) or big (B). The second letter defines the second sort for each one of the following: B/M group, high (H), medium (M), or low (L); prof. group, robust (R), medium (M), or weak (W); inv. group, aggressive (A), medium (M), or conservative (C); or Islamic group, Islamic (I), mixed (M), or non-Islamic (N). The factors are SMB (small minus big), HML (high minus low), RMW (robust minus weak), CMA (conservative minus aggressive), and IMN (Islamic minus non-Islamic). Since the SMB factor is constructed multiple times from each intersection of the MC groups and the groups of B/M, prof., inv., or Islamic, the simple average of all SMB factors is taken as the SMB factor in this study.

4.5.1.2 The sort of 2 × 2 factors

In this sort, all listed stocks are sorted based on the calculation in Table 4.3 into two groups of MC. Then, all listed stocks are sorted into two groups based on each of the following characteristics: B/M ratio, profitability, and investment. This means we have two groups of MC for all listed stocks (small (S) and big (B) stocks); two groups of book-to-market ratio for all listed stocks (high (H) and low (L) stocks); two groups of profitability for all listed stocks (robust (R) and weak (W) stocks); two groups of investment growth for all listed stocks (aggressive (A) and conservative (C) stocks); and finally, two groups of Islamic classification for all listed stocks (Islamic (I) and non-Islamic (N) stocks) that come already sorted into these groups from the source mentioned previously. Table 4.6 shows these groups and the breakpoints for each group.

Table 4.6*: Sorting all listed stocks into groups and their breakpoints derived from the 2 × 2 sort type*

	Sort	Breakpoints	Groups	
Panel A			**Top 90% of MC (1)**	**Lower 10% of MC (2)**
1	Market capitalisation (size) sort	MC: Big stocks constitute the top 90% of the total market cap; the rest are small stocks.	Big stocks (B)	Small stocks (S)
Panel B			**Greater than 50th (1)**	**Lower than 50th (2)**
2	Book-to-market ratio (value) sort	B/M: 50th percentiles	High B/M stocks (H)	Low B/M stocks (L)
3	Profitability sort	Prof: 50th percentiles	Robust prof. stocks (R)	Weak prof. stocks (W)
4	Investment sort	Inv: 50th percentiles	Conservative inv. stocks (C)	Aggressive inv. stocks (A)
Panel C			**Almaqased classification** (1)	(2)
5	Islamic sort	Islamic: Almaqased.net	Islamic stocks (I)	Non-Islamic stocks (N)

Note: Panel A shows the groups of market capitalisation, MC, small (S), and big (B) stocks. Panel B displays the groups of B/M ratio, high (H) and low (L) Stocks; profitability (Prof) robust (R) and weak (W); investment (Inv) aggressive (A) and conservative (C). Panel C shows Islamic classification groups: Islamic (I) and non-Islamic (N).

The breakpoint in the 2 × 2 sort for MC sort is similar to the 2 × 3 sort explained above, although the B/M ratio, profitability, investment, and Islamic have different breakpoints in this sort. The breakpoint of the B/M ratio sort is the 50th percentile. The stocks with a value in the top 50th percentile of the B/M ratio are sorted together, and the stocks with a value below the 50th percentile are sorted into one group. The breakpoint and procedure of the B/M ratio are applied to profitability and investment. The Islamic classification from Almaqased Advisory sorts into three groups: Islamic, mixed, and non-Islamic stocks. However, if we recall from Chapter 2 (see section 2.5.2), mixed stocks can be purified and then considered Islamic stocks. Thus, mixed stocks are also considered Islamic stocks, leaving us with only two groups: Islamic and non-Islamic.

The third and final step in this process is portfolio formation to construct the independent variables. This formation comes from the intersection between the first sort of two groups of MC (small (S) and big (B) stocks) and the second sort of two groups for each one of the following: B/M ratio, profitability, investment, and Islamic. For example, the intersection between the small (S) MC group and high (H) B/M ratio group form a portfolio with only the stocks falling at the same time in the small (S) MC and high (H) B/M ratio groups and it excludes other stocks in both groups. Accordingly, the following intersections emerge:

- ❖ The intersection between two groups of MC and two groups of B/M ratio generates four portfolios: small and high (SH), small low (SL), big high (BH), and big low (BL) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{B/M} = (SH + SL)/2 – (BH + BL)/2$
  Value factor: $HML = (SH + BH)/2 – (SL + BL)/2$

- ❖ The intersection between two groups of MC and two groups of profitability generates four portfolios: small robust (SR), small weak (SW), big robust (BR), and big weak (BW) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{Pro} = (SR + SW)/2 – (BR + BW)/2$
  Profitability factor: $RMW = (SR + BR)/2 – (SW + BW)/2$

- ❖ The intersection between two groups of MC and two groups of investment generates four portfolios: small aggressive (SA), small conservative (SC), big aggressive (BA), and big conservative (BC) portfolios. The returns of those portfolios help to generate:

  Size factor: $SMB_{Inv} = (SA + SC)/2 – (BA + BC)/2$
  Investment factor: $CMA = (SC + BC)/2 – (SA + BA)/2$

- The intersection between two groups of MC and two groups of Islamic classification generates four portfolios: small Islamic (SI), small non-Islamic (SN), big Islamic (BI), and big non-Islamic (BN) portfolios. The returns of those portfolios help to generate:

  Size factor: SMB_{Is} = (SI + SN)/3 – (BI + BN)/3

  Islamic factor: IMN = (SI + BI)/2 – (SN + BN)/2

Again, because four size factors (SMB) are constructed each time with B/M ratio, profitability, investment, and Islamic factors, the simple average of these four size factors is calculated to become the size factor used in this study. Table 4.7 shows all the factors, their breakpoints, and how they are calculated.

Table 4.7*: Construction of size, value, profitability, investment, and Islamic factors derived from 2×2 sorts*

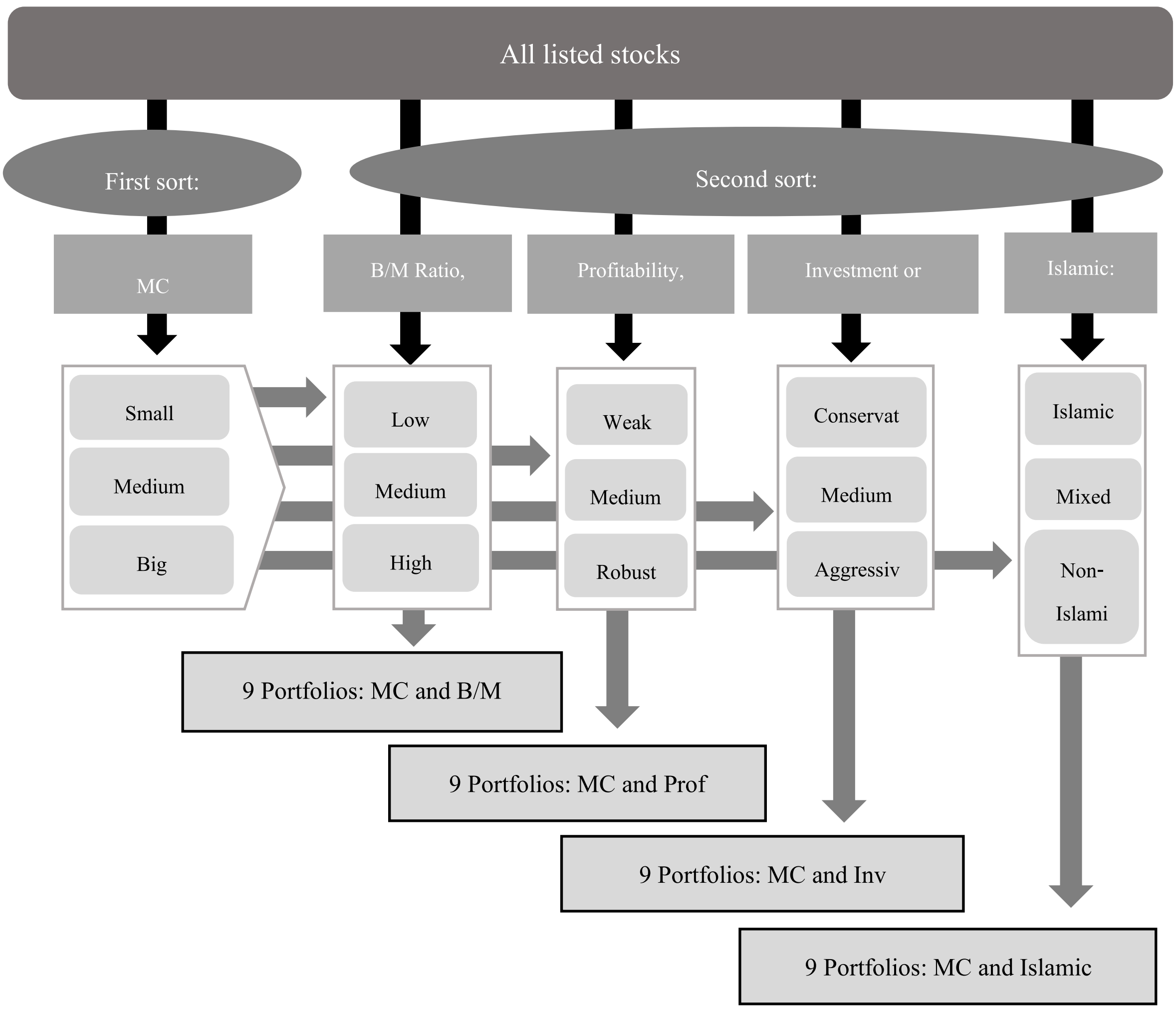
Sorts	Breakpoints	Factors components
2 × 2 sorts on: MC and B/M; MC and prof; MC and inv; and MC and Islamic	MC: Big stocks constitute the top 90% of the total market cap; the rest are small stocks.	$SMB_{B/M}$ =(SH+SL)/2 – (BH +BL)/2 SMB_{Prof} =(SR+SW)/2 – (BR+BW)/2 SMB_{Inv} =(SA+SC)/2 – (BA+BC)/2 $SMB_{Islamic}$ =(SI+SN)/2 – (BI+BM+BN)/2 SMB=($SMB_{B/M}$+SMB_{Prof}+SMB_{Inv}+$SMB_{Islamic}$)/4
	B/M: 50th percentiles	HML= (SH+BH)/2 – (SL+BL)/2
	Prof: 50th percentiles	RMW= (SR+BR)/2 – (SW+BW)/2
	Inv: 50th percentiles	CMA = (SC + BC)/2 – (SA + BA)/2
	Islamic: Almaqased classification	IMN = (SI+BI)/2 – (SN+BN)/2

Note: Independent sorts are used to assign all listed stocks into the first sort of two market capitalisation, MC, groups and then the second sort of two groups for each one of the following factors: book-to-market ratio, B/M, profitability (Prof), investment (Inv), and Islamic. The intersection between the first and second sorts form the portfolios. The portfolios are labelled using two letters. The first letter always defines the first sort of MC group, small (S) or big (B). The second letter defines the second sort for each one of the following: B/M group, high (H) or low (L); prof group, robust (R) or weak (W); inv group, aggressive (A) or conservative (C); or Islamic group, Islamic (I) or non-Islamic (N). The factors are SMB (small minus big), HML (high minus low), RMW (robust minus weak), CMA (conservative minus aggressive), and IMN (Islamic minus non-Islamic). Since the SMB factor is constructed multiple times from each intersection of the MC groups and the groups of B/M, prof, inv, or Islamic, the simple average of all SMB factors is constructed and considered as the SMB factor in this study.

4.5.2 Left-hand-side (LHS) portfolios

In the previous subsections, in-depth explanations have been provided about the construction of the RHS factors, which represent the explanatory inputs of the asset pricing models examined in this study. In contrast, this subsection explains the formation of the LHS portfolios. The excess returns of LHS portfolios are the dependent variable input in the proposed asset pricing models, which is the cross-section of average return that I aim to explain in this study. These LHS portfolios are formed from the intersection between the first sort of three MC groups for all listed stocks and the second sort of three groups for each one as follows: B/M ratio, profitability, investment, and Islamic classification for all listed stocks. Thus, we have four intersections and nine portfolios for each one. Those intersections and portfolios are illustrated in Figure 4.2.

Figure 4.2: LHS portfolios formed from the intersections of two sorts



Like the portfolio formation for the RHS factors (independent variables), the first step is to calculate the market capitalisation, book-to-market ratio, profitability, and investment growth for all listed stocks annually, as shown in Table 4.3. The second step is to sort all the listed stocks into three equal quantiles based on the calculations of the previous step. Table 4.8 shows these groups and their breakpoints in the first sort (three groups of MC) and the second sort (three groups for each one of the following: B/M ratio, profitability, investment, and Islamic).

Table 4.8*: Stocks sorted into three quantiles based on each firm's characteristics*

	Sort	Breakpoints	Groups		
Panel A			**Greater than 66.67th (1)**	**66.67th - 33.33rd (2)**	**Less than 33.33rd (3)**
1	MC sort	33.33rd and 66.67th percentiles	Big stocks (B)	Medium stocks (M)	Small stocks (S)
2	B/M ratio sort		High stocks (H)	Medium stocks (M)	Low Stocks (L)
3	Profitability sort		Robust stocks (R)	Medium stocks (M)	Weak stocks (W)
4	Investment sort		Aggressive stocks (A)	Medium stocks (M)	Conservative stocks (C)
Panel B			**Almaqased classification** **(1)**	**(2)**	**(3)**
5	Islamic sort	Almaqased.net	Islamic stocks (I)	Mixed stocks (M)	Non-Islamic stocks (N)

Note: Panel A shows the groups of market capitalisation, MC, small (S), Medium (M), and big (B); book-to-market ratio, B/M, high (H), medium (M); and low (L) stocks; profitability, robust (R), medium (M), and weak (W); investment, aggressive (A), medium (M), and conservative (C). Panel B shows the Islamic classification groups Islamic (I), mixed (M), and non-Islamic (N).

In the first sort (MC sort), the stocks in the top third percentile are sorted together, the stocks in the middle third percentile are sorted together, and similarly for the stocks in the bottom third percentile. Similarly, in the second sort, all the listed stocks are sorted together using the same breakpoints for the B/M ratio, profitability, and investment. Islamic stocks are already sorted into three groups and do not need breakpoints (see section 2.5.2).

The third and final step is forming the LHS portfolios (dependent variables). This formation comes from the intersection of the first sort (MC) and the second sort (B/M ratio, profitability, investment, or Islamic sort). The intersection means the same stocks fall into different groups simultaneously and produce nine portfolios for each intersection. Table 4.9 shows these portfolios.

Table 4.9*:* LHS portfolios formed from the intersections between three groups of two sorts

Panel A: MC and B/M ratio portfolios				
B/M →		**Low**	**Medium**	**High**
	Small	(1) S/L	(2) S/M	(3) S/H
MC →	Medium	(4) M/L	(5) M/M	(6) M/H
	Big	(7) B/L	(8) B/M	(9) B/H
Panel B: MC and profitability portfolios				
Profitability →		**Weak**	**Medium**	**Robust**
	Small	(1) S/W	(2) S/M	(3) S/R
MC →	Medium	(4) M/W	(5) M/M	(6) M/R
	Big	(7) B/W	(8) B/M	(9) B/R
Panel C: MC and investment portfolios				
Investment →		**Conservative**	**Medium**	**Aggressive**
	Small	(1) S/C	(2) S/M	(3) S/A
MC →	Medium	(4) M/C	(5) M/M	(6) M/A
	Big	(7) B/C	(8) B/M	(9) B/A
Panel D: MC and Islamic portfolios				
Islamic →		**Islamic**	**Mixed**	**None-Islamic**
	Small	(1) S/I	(2) S/M	(3) S/N
MC →	Medium	(4) M/I	(5) M/M	(6) M/N
	Big	(7) B/I	(8) B/M	(9) B/N

Note: Independent sorts are used to assign all listed stocks into the first sort of three market capitalisation, MC, groups, and then the second sort of three groups for each of the following factors: B/M ratio, B/M, profitability, investment, and Islamic. The intersection between the first and second sorts forms the portfolios. The portfolios are labelled using two letters. The first letter always defines the first sort of MC group: small (S), medium (M), or big (B). The second letter defines the second sort for each one of the following: B/M group, high (H), medium (M), or low (L); profitability group, robust (R), medium (M), or weak (W); investment group, aggressive (A), medium (M), or conservative (C); or Islamic group, Islamic (I), mixed (M), or non-Islamic (N).

Finally, asset pricing tests are conducted on the nine portfolios from each intersection to examine whether the asset pricing models can explain the variation in the cross-section of average returns. The studies of Fama and French (1992, 1993, 2015) use 25 portfolios formed from the intersection of five groups of MC and five groups of B/M ratio, profitability, or investment. However, these studies were applied to the NYSE, which has more than 2000 listed stocks, whereas the Saudi stock market has less than 200 listed stocks. Using the 25 portfolios, similar to Fama and French (1992, 1993, 2015) approach on the Saudi stock market would leave some portfolios with too few stocks. Further, this study applies two weighting schemes to calculate the returns of LHS portfolios and the RHS factor, which are explained in the following section.

4.5.3 Value-weighted vs. equal-weighted portfolios

The final and last step after forming all the necessary portfolios to construct the RHS factors and LHS portfolios, is to calculate the average return of the portfolios. The conventional way to calculate the average return is using the value-weighted average using market capitalisation. However, some studies such as (Chan & Chui, 1996; Diether et al., 2002) use equal-weighted portfolios while other studies use both methods of calculating the average returns of the portfolios (for example, Bali and Cakici (2008). It is important to mention that using value-weighted or equal-weighted averages to calculate portfolio returns is controversial in the literature.

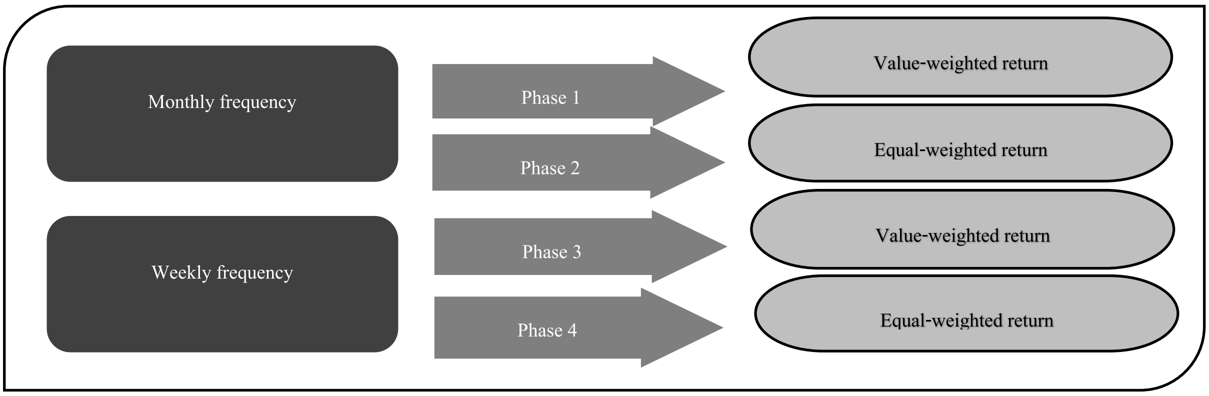
The recent study by Plyakha et al. (2021a) investigates whether weighting methods used in portfolio returns influence the results of asset pricing tests. They find that equal-weighted averages outperform value-weighted averages in terms of total mean return, which they attribute to the high exposure to systematic risk factors in equal-weighted portfolios. They also conclude that the choice of weighting methods is likely to lead to different inferences of asset pricing tests. Since this study relies on the mean return to answer whether size, value, profitability, investment, and Islamic factors have significant premiums, using both equal- and value-weighted returns would be interesting. It is also interesting to find out if the inferences of asset pricing tests applied in this study differ when different weighting methods are used. Since this is a comprehensive analysis of the cross-section of average returns in the Saudi market, it is important to test both methods and check for consistent results.

Therefore, this study applies both equal- and value-weighted returns to answer the research questions. This means that the returns of the portfolios formed to construct the RHS factors and LHS portfolios are calculated using value-weighted returns using market capitalisation weight and then calculated again using equal-weighted returns. Then, all the hypotheses are tested using the returns of both methods.

4.6 Data analysis methods

In the previous sections, asset pricing models proposed in this study and their inputs were explained . This section describes how to use those asset pricing models and their inputs and justifies the statistical methods chosen in this study. As mentioned previously in this chapter, this study uses monthly and weekly frequencies and, at the same time, uses equal- and value-weighted returns on all portfolios formed for independent and dependent variables. Therefore, this study uses four separate phases, as shown in Figure 4.3, and all the research questions are answered separately in each phase.

Figure 4.3: The four phases used in the study



4.6.1 One-sample t-test on factor premiums

The one-sample t-test is used to test hypothesis H1 and its sub-hypotheses and hypothesis H3, which propose that the following factors have equity premium in the Saudi stock market: size premium (SMB), value premium (HML), profitability premium (RMW), investment premium (CMA), and Islamic premium (IMN).

- ***Hypothesis H1: Factors such as size, value, profitability, and investment have significant premiums on stock returns in the Saudi stock market.***
- ***Hypothesis H3: The Islamic factor has a significant premium on stock returns in the Saudi Stock market.***

- ***<u>Hypothesis H5.1: The mean of the factor premiums (size, value, profitability, investment, and Islamic) has significantly changed due to the global integration of the Saudi stock market.</u>***
- A significant premium means that the average return in those factors is significantly greater than zero. To test the significance of the premium in those factors throughout the sample period from 30/04/2009 to 30/03/2021 for monthly frequency (144 observations) and from 07/04/2009 to 06/04/2021 for weekly frequency (624 observations), the t-test based on the variance and the mean for the average return of each factor is calculated according to equation 4.6, explained by (Dixon & Massey Jr, 1983, pp. 121-130):

$$t_{AR} = [\overline{AR} - \mu_{AR}] \ / \ S_{AR} \quad (4.6)$$

$$S_{AR} = \sqrt{\frac{\sum_{i=1}^{N} \left(AR_{i,t} - \overline{AR}_t\right)^2}{N_t - 1}} \qquad where\ i = 1,2,\dots,N_t \quad (4.7)$$

Where:

t_{AR}	=	the t-test statistics for the average return;
$\overline{AR}$	=	the average return for each factor;
μ_{AR}	=	the hypothesized mean, which is zero;
S_{AR}	=	the standard deviation of the average return for each factor, and
N	=	the sample size.

In this test, I examine whether the sample's mean equals a known value, the hypothesis value of zero, with the assumption that the variance is unknown (Dixon & Massey Jr, 1983). Thus, the hypothesis tested here is whether the average return in those factors is significantly greater than zero:

The null hypothesis H_0 : AR = 0

The alternative hypothesis H_1 : AR > 0

4.6.2 Two-sample t-test to compare the factor premiums before and after global integration

The t-test of two sample means examines the equality of the means for two independent samples before and after global integration. This test is used to further examine hypothesis 5.1, which tests whether global integration has changed the premium in the factors examined in this study.

- ***<u>Hypothesis H5.1: The mean of the factor premiums (size, value, profitability, investment, and Islamic) has significantly changed due to the global integration of the Saudi stock market.[39].</u>***

Two specific time points are used, June 2016 and February 2018[40], to examine the influence of global integration on the significance of factor premiums in the Saudi stock market. Therefore, the return for each one of the RHS factors is divided into two groups before and after global integration at each time point for both monthly and weekly frequencies, as Table 4.10 shows.

Table 4.10: Selected sample for monthly and weekly observations before and after global integration

Frequency	**Periods**	
Panel A	**April 2009 - May 2015**	**June 2015 – April 2021**
Monthly frequency	74 Observations	70 Observations
Weekly frequency	321 Observations	303 Observations
Panel C	**April 2009 – January 2018**	**February 2018 – April 2021**
Monthly frequency	106 Observations	38 Observations
Weekly frequency	458 Observations	166 Observations

Note: The specific time points represent opening the market for the first time to QFIs in June 2015, amending the rules of the QFIs by lowering the value of their assets under management to $1 billion rather than $4 billion in September 2016, and then amending further the assets under management to $500 Million.

Next, the two-sample t-test is conducted for each factor premium between the groups of observations before and after global integration (as displayed in Table 4.10) to examine whether the equity premium has changed. To calculate the two-sample t-test, the means and the standard deviation of both samples are used for each factor in equation 4.8, as explained by Hoel (1984, pp. 140-161):

$$t_{\mathrm{ARB-ARA}} = \frac{\overline{\mathrm{ARB}} - \overline{\mathrm{ARA}} - \mu_{\mathrm{AR}}}{(s^2_{\mathrm{ARB}} / n_{\mathrm{ARB}} + s^2_{\mathrm{ARA}} / n_{\mathrm{ARA}})^{1/2}} \quad (4.8)$$

39 This hypothesis also examined using a one-sample t-test explained in the previous subsection by comparing the t-value result for the periods in Table 4.10 before and after independently.

40 In June 2015, Qualified Foreign Investors (QIFs) were allowed for the first time on the Saudi capital market. In February 2018, the Capital Market Authority eased some of the restrictions on QFIs and lowered the amount under management for them to only $500 million dollars.

Where:

$t_{\text{ARB}-\text{ARA}}$	=	the t-test statistics for the average return;
$\overline{\text{ARB}}$	=	the average return for each factor before global integration;
$\overline{\text{ARA}}$	=	the average return for each factor after global integration;
μ_{AR}	=	the hypothesized difference between $\overline{\text{ARB}}$ and $\overline{\text{ARB}}$, which is zero;
s_{ARB}	=	the standard deviation of the sample before global integration;
n_{ARB}	=	The sample size before global integration;
s_{ARA}	=	the standard deviation of the sample after global integration, and
n_{ARA}	=	the sample size after global integration.

In this test, we examine whether the sample means are equal between two samples, assuming that the standard deviation of both samples is unequal. Thus, the hypothesis tested here is whether the average return before global integration is equal to the average return after global integration for all factors examined in this study:

The null hypothesis $H_0: \overline{\text{ARB}} = \overline{\text{ARA}}$

The alternative hypothesis $H_1: \overline{\text{ARB}} \neq \overline{\text{ARA}}$

4.6.3 GRS test for portfolio efficiency

This section explains the Gibbons et al. (1989) GRS test applied to examine the models' performance. This test has the ability to examine a combination of intercepts against zero for a group of estimated portfolios using one of the asset pricing models. If the model sufficiently describes the return in those portfolios, then we cannot reject the joint-zero hypothesis of the GRS test. The GRS test is employed for further examination of hypotheses 2, 4, and 5.2, which address the ability of proposed models to explain the variation in the cross-section of average returns.

- ***Hypothesis H2:*** ***<u>Fama and French's (2015) five-factor asset pricing model can better describe the variation in the cross-section of average returns than Fama and French's (2012) three-factor asset pricing model.</u>***

- ***Hypothesis H4:*** ***Adding the Islamic factor to the three- and/or five-factor models will improve the models' ability to describe the variation in the cross-section of average returns in the Saudi stock market.***
- ***Hypothesis H5.2:*** ***The performance of asset pricing models (FF3FM, FF5FM, 4FM, and 6FM) has changed due to the global integration of the Saudi stock market.***

This test allows us to compare the performance of the asset pricing models proposed in this study. The GRS test is one of the most important and heavily used in the asset pricing literature (for example, Fama and French (1993). The importance of this test derives from its ability to jointly calculate the intercepts of nine LHS portfolios for each model. Therefore, for each model proposed in this study (FF3FM, 4FM, FF5FM, and 6FM), I will conduct the GRS test with each combination of nine LHS portfolios (formed on MC and B/M ratio, MC and profitability, MC and investment, and MC and Islamic). Thus, the GRS F-test statistic calculated in this study is described in equation 4.14 below:

$$F = \frac{T\ (T-N-K)}{N(T-K-1)}\left(1\ +\ \bar{r}'\widehat{\Omega}^{-1}\bar{r}_p\right)^{-1}\widehat{\alpha'}_0\,\hat{\Sigma}^{-1}\hat{\alpha}_0 \sim F(N, T-N-K) \tag{4.14}$$

The $\widehat{\Omega}$ is the sample variance-covariance matrix of $\hat{r}_{pt}$ defined as follows:

$$\widehat{\Omega} = \frac{1}{T-1}\sum_{t=1}^{T}\left(\tilde{r}_{pt} - \bar{r}_p\right)\left(\tilde{r}_{pt} - \bar{r}_p\right)' \tag{4.15}$$

Where:

T	=	the number of observations in the time series;
N	=	the number of portfolios;
K	=	the number of factors in the model;
$\bar{r}_p$	=	the vector sample mean for $\tilde{r}_{pt} \equiv (\tilde{r}_{1t},\ \tilde{r}_{2t}, \dots, \tilde{r}_{kt})$
$\hat{\alpha}$	=	the vector of intercept estimated from individual time series regression (N × 1).

The objective of the GRS F-test here is to examine whether the combination of nine LHS portfolios is mean-variance efficient by testing whether the intercept of those portfolios is jointly equal to zero. The GRS test assumes there is $r_{f,t}$ risk-free rate, and $r_{i,t}$ is the excess return for N portfolios where t is time and (i = 1, …, N). The excess returns are represented by K vector $r_{p,t}$ using the following relationship:

$$r_{i,t} = \alpha_i + B_i' r_{p,t} + \epsilon_{i,t}, t = 1, \ldots, T \quad (4.16)$$

The GRS F-test uses this relationship to define the excess return $r_{i,t}$ on asset i ($i = 1, \ldots, N$), which is the nine LHS portfolios in this study, to examine whether the portfolios are mean-variance efficient by testing the hypothesis:

The null hypothesis $H_0 : \alpha_i = 0$

The alternative hypothesis $H_1 : \alpha_i \neq 0$

The concept is to determine whether the asset pricing model completely captures the cross-section of average returns in the combined nine LHS portfolios. The intercepts for these LHS portfolios jointly have to be indistinguishable from zero to be mean-variance efficient. Even if the hypothesis is rejected for all models, it is possible to compare the models' efficacy for each combination of the nine LHS portfolios using the GRS value and the mean absolute alpha for each asset pricing model.

4.6.4 Asset pricing model estimation using OLS

After conducting the GRS for the portfolio efficiency test explained above, the next step is estimating the returns for each LHS portfolio with different asset pricing models. Although this step is not part of the hypothesis testing, the individual intercept in these regressions gives insight into the GRS result. Thus, the ordinary least square (OLS) technique is used to test and evaluate the proposed asset pricing models specified in Table 4.11.

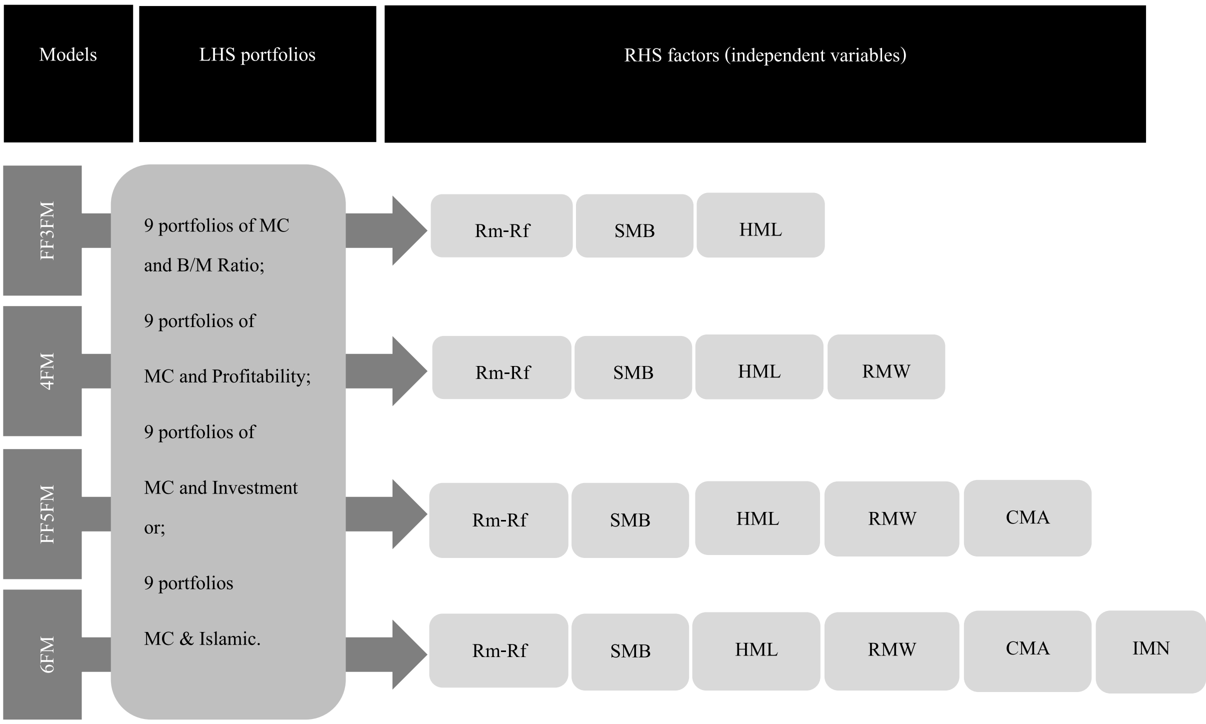
Table 4.11: Asset pricing models used in this study

The model	The specifications of the models
FF3FM	$R_t - RF_t = \alpha + b\,(RM_t - RF_t) + s\,SMB_t + h\,HML_t + e_t$
4FM	$R_t - RF_t = \alpha + b\,(RM_t - RF_t) + s\,SMB_t + h\,HML_t + i\,IMN_t + e_t$
FF5FM	$R_t - RF_t = \alpha + b\,(RM_t - RF_t) + s\,SMB_t + h\,HML_t + r\,RMW_t + c\,CMT_t + e_t$
6FM	$R_t - RF_t = \alpha + b\,(RM_t - RF_t) + s\,SMB_t + h\,HML_t + r\,RMW_t + c\,CMT_t + i\,IMN_t + e_t$

Note: FF3FM is the Fama and French three-factor model; 4FM is FF3FM plus Islamic factor; FF5FM is the Fama and French five-factor model, and 6FM is FF5FM plus Islamic factor.

In the asset pricing models, the RHS factors in each model is regressed on the excess returns of the left-hand-side (LHS) portfolio. This study estimates the excess return of nine LHS portfolios formed on MC and B/M ratio, nine LHS portfolios formed on MC and profitability, nine LHS portfolios formed on MC and investment, and nine LHS portfolios formed on MC and Islamic classification for each model (see Table 4.11). The RHS factors are market premium (RM_t - RF_t), which is the excess market return of all stocks in the sample; size premium (SMB_t) which is the return of small minus the return of large market cap stocks; value premium (HML_t) which is the return of value stocks minus the return of growth stocks; profitability premium (RMW_t) which is the return of robust profitability stocks minus the return of weak profitability stocks; investment premium (CMT_t) which is the return of conservative investment growth minus the return of aggressive investment growth stocks; and finally Islamic premium (IMN_t), which is the return of Islamic stocks minus the return of non-Islamic stocks. Figure 4.4 shows the LHS portfolios and the RHS factors in each model.

Figure 4.4: LHS portfolios and RHS factors



The OLS estimation technique assumes the exogeneity of regressors, the homoscedasticity of the variance across all observations in the model, and independent error terms (no autocorrelation). The exogeneity assumption of the regressors is essential for model estimation and indicates that the model's conditional mean and linearity are correctly specified. The assumptions of constant covariance and no autocorrelation state the estimators' variance–covariance matrix. Under these assumptions, the estimates are asymptotically normally disturbed, and the OLS estimator is fully efficient (Cameron & Trivedi, 2010).

However, the OLS estimator sometimes suffers from heteroscedasticity in the variance and the presence of autocorrelation in the residual. Heteroscedasticity means that the variance is not constant, violating one of the above assumptions. This study applied Newey and West (1987) robust standard errors to overcome the issues associated with heteroscedasticity and autocorrelation when one or both of these assumptions are eased. The robust standard errors technique can resolve autocorrelation and the heteroscedasticity of the variance by using White (1980) matrix formula. Newey and West (1987) calculate the estimates as shown in the equations below:

$$\hat{\beta}_{\mathrm{OLS}} = (\mathrm{X}'\mathrm{X})^{-1}\mathrm{X}'\mathrm{y} \tag{4.9}$$

$$\widehat{\mathrm{Var}}\,(\hat{\beta}_{\mathrm{OLS}}) = (\mathrm{X}'\mathrm{X})^{-1}\mathrm{X}'\hat{\Omega}\mathrm{X}\,(\mathrm{X}'\mathrm{X})^{-1} \tag{4.10}$$

To account for the heteroscedastic variance and following the estimates in equation 4.10, the Newey and West robust standard errors used White (1980) formula for the variance estimates using equations 4.11 and 4.12:

$$\mathrm{X}'\hat{\Omega}\mathrm{X} = \mathrm{X}'\hat{\Omega}_0\mathrm{X} = \frac{n}{n-k}\sum_i \hat{\mathrm{e}}_i^2 \mathrm{x}_i'\mathrm{x}_i \tag{4.11}$$

$$\hat{\mathrm{e}}_i = \mathcal{Y}_i - \mathrm{X}_i\,\hat{\beta}_{\mathrm{OLS}} \tag{4.12}$$

Where:

X_i	=	the ith row of the X matrix;
n	=	the number of observations, and
k	=	the number of predictors in the model.

The problem with the serial correlation in the residuals is that standard errors are corrected for one lag using Newey and West's (1987) estimators for the variance, as shown in equation 4.13:

$$\mathrm{X}'\hat{\Omega}\mathrm{X} = \mathrm{X}'\hat{\Omega}_0\mathrm{X} = \frac{n}{n-k}\sum_{l=1}^{m}\left(1-\frac{l}{m+1}\right)\sum_{t=l+1}^{\mathrm{n}} \hat{e}_t\,\hat{e}_{t-l}\,(\mathrm{X}'_t\mathrm{X}_{t-l} + \mathrm{X}'_{t-l}\mathrm{X}_t) \tag{4.13}$$

Where:

X_t	=	the row of the X matrix observed at time *t;*
m	=	the number of lags;
n	=	the number of observations, and
k	=	the number of predictors in the model.

The asset pricing model is well specified in empirical asset pricing if the model's intercept is indistinguishable from zero (Jensen et al., 1972). A non-zero intercept means the asset pricing model is incomplete, and more factors are needed to explain the cross-section of average returns. That's why Fama and French (1992, 1993, 1995) argue that CAPM is incomplete, as the zero-intercept hypothesis is significantly rejected in an OLS regression of the model.

4.7 Conclusion

This chapter described in detail the methodology and methods used and provided justifications for the appropriateness of using specific methodologies. An explanation of the data sample used in this study and the secondary data source was also specified. Moreover, a justification was provided for using two data frequencies (monthly and weekly) and value- and equal-weighted returns for the portfolios. Next, the portfolio formation was explained in depth for the LHS portfolios (dependent variables) and the RHS factors (independent variables) used in the asset pricing models proposed in this study.

This study follows the cross-section of average return methodology and is influenced by the studies of Fama and French (1992, 1993, 1995, 2015). Specifically, the Fama and French (1993) FF3FM and Fama and French (2015) FF5FM asset pricing models are used. Therefore, a brief explanation of these two models was provided, and a proposed new factor (the Islamic factor), was introduced as an additional factor to FF3FM and FF5FM to create 4FM and 6FM.

The last section of this chapter explained the data analysis methods used to examine the hypotheses. First, parametric tests were explained and justified, including the one-sample t-test and two-sample t-test. Then, the specification and justification of the asset pricing models estimation using the OLS technique and Newey and West (1987) robust standard errors were given. Further, I elaborated on the efficiency test of portfolios, the GRS test, and its application in this research. The Stata/IC 16.1 software has been used for all the data analysis in this research and to sort all the stocks into the previously mentioned portfolios.

Chapter 5: Factor premiums

5.1 Introduction

This chapter utilizes the methodology explained in the previous chapter to test the hypotheses I have discussed in Chapter 3, about the significance of factor premiums in the Saudi stock market. This chapter is the first of three empirical analysis chapters. It specifically investigates the significance of the factor premiums related to hypotheses H1 and H3. The relevant factors are size, value, profitability, investment, and Islamic. Both H1 and H3 assume that these factors have a significant premium in the Saudi stock market. The null (alternative) hypothesis is that the mean return in each factor is equal to (greater than) zero, which is tested using the one-sample t-test. Thus, the factor premium is significantly greater than zero if the null hypothesis is rejected.

For each factor, I examine the hypothesis by using two return frequencies (monthly and weekly), two portfolio weighting schemes (value- and equal-weighted) and two sorts (2 × 3 and 2 × 2). Hypothesis H1 has four sub-hypotheses for each factor and accordingly each is presented in a separate section. Hypotheses H1 and H3 are:

- ***Hypothesis H1: Factors such as size, value, profitability, and investment have significant premiums on stock returns in the Saudi stock market.***
- ***Hypothesis H3: The Islamic factor has a significant premium on stock returns in the Saudi Stock market.***

This chapter tests these hypotheses by examining the summary statistics of the factor premiums, including t-statistics and the correlation between the factors. The examination of the summary statistics of factor premiums is conducted on the factors formed using two returns frequencies (monthly and weekly), two portfolio weighting schemes (equal- and value-weighted), and two sorts (2 × 3 and 2 × 2).

The remainder of this chapter is organised as follows: Section 5.2 covers the correlations between factors and the correlation between the different versions of the same factors. Section

5.3 discusses excess market returns (market risk premium). Sections 5.4 to 5.7 cover size, value, profitability, investment, and Islamic premium, respectively. Lastly, Section 5.8 concludes this chapter.

5.2 Correlation between factors

It is important to identify any significant interdependence or influence among factors under examination that might substantially impact the accuracy of the study results. Therefore, the correlations conducted in this study are examined not only between factors but also between the two versions of the same factor. As described in the methodology chapter (see section 4.5.1), the RHS factors (factor premiums) are constructed using two different sorts (2×3 and 2×2). Further, this study applies two methods of correlation as a robustness check: the standard Pearson (1896) correlation designed to identify the strength of a linear relationship and Spearman (1961) rank correlations to identify monotonicity in the relationships between factors.

5.2.1 Correlation between the two versions of the same factor

This subsection covers the correlation between the two versions of the same factor; for instance, the correlation between the SMB factor formed using the 2×3 sort and the SMB factor formed using the 2×2 sort. Table 5.1 shows the correlations between the two versions of the same factor using 2×3 and 2×2 sorts. Each panel in this table shows the correlations between factors constructed using different returns frequency and weighting schemes. The table shows, in general, a strong positive correlation between the two versions of the same factors in each panel, which is somewhat expected. Further, the table shows that the two versions of the SMB factor have the strongest correlations among other factors in other columns. On the other hand, the weakest correlation is between the versions of the CMA factor, however it is still strong (around 0.7 to 0.8).

Table 5.1: Correlations between different versions of the same factor (April 2009-March 2021)

	SMB		HML		RMW		CMA		IMN	
	2×3	**2×2**	**2×3**	**2×2**	**2×3**	**2×2**	**2×3**	**2×2**	**2×3**	**2×2**
Panel A: Monthly value-weighted										
2×3		0.99		0.85		0.89		0.74		0.93
2×2	0.99		0.87		0.90		0.72		0.93	
Panel B: Monthly equal-weighted										
2×3		0.99		0.92		0.94		0.85		0.95
2×2	0.99		0.92		0.95		0.90		0.96	
Panel C: Weekly value-weighted										
2×3		0.99		0.83		0.84		0.72		0.90
2×2	0.99		0.85		0.86		0.69		0.92	
Panel D: Weekly equal-weighted										
2×3		0.99		0.91		0.88		0.81		0.93
2×2	0.99		0.92		0.91		0.83		0.95	

Note: The grey highlighted column shows the Spearman rank correlation for the two different versions of the same factor, and the nonhighlighted column represents the same thing using standard Pearson correlation. This correlation uses the entire time series in this study for each method represented in panels A, B, C, and D. The factors are size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN).

Although strong correlations were expected between the two versions, this extreme level of correlation is surprising. The two different versions of the same factor are constructed from different numbers of stocks. In the 2×3 sort, almost 40% of stocks in the sample were excluded, except in the SMB factor. On the other hand, all stocks were included in the 2×2 sort for all factors (see section 4.5.1.2). For this reason, the expectation was to see lower correlations between the two versions of the same factor. However, the strong correlations between the two versions of the SMB are understandable, since neither sort excludes any of the stocks from the sample. Further, it is noticeable that the correlations in the value-weighted panels are lower than their equal-weighted counterparts for each factor in the table, except for the SMB. Since I use market capitalisation in the value-weighted portfolios, the smaller stocks in those portfolios are more correlated than the small ones.

5.2.2 Correlation between different factors

This subsection uses the correlation between the identified factors to assess the appropriateness of using those factors to analyse the developed hypotheses in the Saudi stock market. Unlike the previous section that examined the correlation between the two versions of the same factor, this section examines the correlation between different factors.

The correlations between factors are presented in Table 5.2 for monthly returns and Table 5.3 for weekly returns. The factors in both tables are the excess market return (R_M-R_F), size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN). The correlation between factors is measured by using both the 2 × 3 and 2 × 2 sorts. Panel A represents the factors constructed by using value-weighted portfolios, whereas Panel B shows the factors from equal-weighted portfolios. Similar to Table 5.1, the grey highlighted area shows the Spearman rank correlation, and the counterpart area in the matrix exhibits the standard Pearson correlation.

Table 5.2: Correlations between factors, April 2009-March 2021 (monthly)

	2 × 3 Sort						**2 × 2 Sort**					
	R_M-R_F	**SMB**	**HML**	**RMW**	**CMA**	**IMN**	**R_M-R_F**	**SMB**	**HML**	**RMW**	**CMA**	**IMN**
Panel A: Value-weighted												
R_M-R_F		0.01	0.28	-0.21	0.14	-0.33		-0.01	0.26	-0.26	0.19	-0.25
SMB	0.08		-0.07	-0.53	0.09	-0.21	0.06		-0.13	-0.51	0.05	-0.29
HML	0.27	-0.07		-0.15	0.42	0.00	0.22	-0.19		-0.26	0.50	0.15
RMW	-0.28	-0.59	-0.10		-0.17	0.47	-0.28	-0.57	-0.17		-0.23	0.43
CMA	0.18	0.01	0.39	-0.23		-0.08	0.19	0.04	0.56	-0.23		-0.05
IMN	-0.36	-0.26	0.05	0.54	-0.13		-0.25	-0.32	0.30	0.45	0.02	
Panel B: Equal-weighted												
R_M-R_F		0.53	0.21	-0.57	0.22	-0.36		0.52	0.19	-0.60	0.21	-0.31
SMB	0.62		-0.14	-0.55	0.15	-0.27	0.62		-0.18	-0.55	0.14	0.28
HML	0.15	-0.17		-0.20	0.38	0.09	0.11	-0.21		-0.25	0.32	0.15
RMW	-0.61	-0.64	-0.17		-0.24	0.41	-0.62	-0.64	-0.24		-0.24	0.37
CMA	0.26	0.19	0.33	-0.26		0.05	0.23	0.18	0.30	-0.27		-0.02
IMN	-0.43	-0.30	0.11	0.46	-0.01		-0.37	-0.30	0.22	0.39	-0.01	

Note: The grey highlighted columns show the Spearman rank correlation between the factors, and the unhighlighted columns represent the same thing using standard Pearson correlation. This correlation uses the monthly time series for each method represented in panels A and B. The factors are excess market return (R_M-R_F), size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN).

Panel A of Table 5.2 shows that the excess market return is negatively correlated with RMW and IMN and positively correlated with the rest. Similarly, the SMB is negatively correlated with RMW and IMN plus the HML and positively with the rest. The HML shows a negative correlation with SMB and RMW, and is positively correlated with the other factors. The RMW is negatively correlated with all factors except the IMN. On the other hand, CMA is positively correlated with all factors except for RMW and IMN. Finally, the IMN positively correlates with HML and RMW, whereas the other factors are negative.

The correlations between factors of both sorts are the same with only two exceptions. The first one is between SMB and R_M-R_F, (0.01 and -0.01 for 2 × 3 and 2 × 2, respectively). This is obviously because the correlation is very close to zero. However, the correlation between CMA and IMN is -0.13 and 0.02 for 2 × 3 and 2 × 2, respectively, which is considered a big difference. This is expected, as the sorts have different structures and numbers of stocks.

Panel A of Table 5.2 indicates that the correlations between factors are generally low for the 2 × 3 and 2 × 2 sorts. Most of the correlations range from 0.5 to -0.5; however, some correlations are slightly outside this range, for example, the correlation between RMW and both SMB and IMN factors. The strongest correlation is between RMW and SMB for the 2 × 3 sort (-0.59). However, this is unsurprising, as small stocks tend to be less efficient and have lower profitability. Moreover, this level of correlation is not considered very strong and is widely accepted in the cross-section of stock returns. Also, a higher correlation is expected, since factors are constructed from the same sample. For instance, Fama and French (2015) five-factor model delivered a correlation between HML and CMA of 0.7 and proceeded to build upon their model.

Panel B in Table 5.2 shows the correlations between factors similar to panel A, but using an equal-weighted portfolio. The correlation signs between all factors in panel B are similar to their counterpart in panel A; however, there are a couple of exceptions. The modest ones are the correlations between IMN and CMA in both sorts, which is because they are close to zero and the range is very small. The correlation between SMB and the excess market return in 2 × 2 sort also shows a different sign. This is because the correlation between those factors is close to zero in the value-weighted portfolios counterpart in panel A. A more extreme outcome is between IMN and SMB in the 2 × 2 sort, where the correlation is 0.28 in the value-weighted and -0. 29 in the equal-weighted. This could mean that most of the mixed stocks are small size stocks. In the 2 × 2 sort, the mixed stocks are considered to be Islamic stocks (see section 4.5.1.2).

The correlations between factors mostly range from 0.5 to -0.5, which is expected. For instance, the correlations between SMB and R_M-R_F are 0.62 and 0.53 for Spearman rank and standard Pearson, respectively. Similarly, the correlations between RMW and both SMB and the excess market return range from -0.55 to -0.64.

We can also see that the correlations in panel B of Table 5.2 (equal-weighted) are mostly stronger than their counterpart in panel A (value-weighted). As mentioned previously, this is due to the stronger correlations in the small market capitalisation stocks, and it appears clearly when the weight of the asset is distributed equally. Further, most differences between the factors' correlations in the equal-weighted setting are stronger than value-weighted on average by ± 0.1, although some are stronger (roughly by ± 0.3). The only extreme cases are the correlations between excess market return and SMB and the correlations between IMN and SMB in the 2 × 2 sort.

Table 5.3 shows the same correlation as Table 5.2, but weekly returns are used to construct the factors. Panel A presents the correlations for the factors constructed using value-weighted portfolios and panel B for those generated from equal-weighted portfolios. The correlations between the factors in both panels are generally very low and range from 0.5 to -0.5. The correlation signs between factors in Table 5.3 are similar to their counterparts in Table 5.2, except for the cases where the correlations are very close to zero.

Table 5.3: Correlations between factors, April 2009-March 2021 (weekly)

	2 × 3 Sort						2 × 2 Sort					
	R_M-R_F	SMB	HML	RMW	CMA	IMN	R_M-R_F	SMB	HML	RMW	CMA	IMN
Panel A: Value-weighted												
R_M-R_F		-0.11	0.09	-0.03	0.02	-0.27		-0.13	0.09	-0.04	0.03	-0.14
SMB	-0.02		-0.08	-0.39	-0.02	-0.20	-0.05		-0.16	-0.42	0.04	-0.25
HML	0.14	-0.10		-0.12	0.35	-0.01	0.12	-0.20		-0.17	0.40	0.17
RMW	-0.08	-0.43	-0.09		-0.15	0.34	-0.07	-0.47	-0.13		-0.20	0.28
CMA	-0.03	-0.02	0.34	-0.20		0.01	0.02	0.06	0.46	-0.20		0.06
IMN	-0.33	-0.23	0.03	0.36	-0.01		-0.18	-0.28	0.21	0.27	0.07	
Panel B: Equal-weighted												
R_M-R_F		0.42	0.01	-0.37	0.06	-0.33		0.42	-0.01	-0.39	0.08	-0.26
SMB	0.51		-0.22	-0.43	0.05	-0.25	0.51		-0.28	-0.46	0.10	-0.28
HML	-0.01	-0.26		-0.14	0.28	0.13	-0.07	-0.32		-0.15	0.24	0.22
RMW	-0.43	-0.50	-0.12		-0.21	0.31	-0.46	-0.53	-0.13		-0.24	0.22
CMA	0.01	0.09	0.26	-0.21		0.12	0.05	0.17	0.23	-0.25		0.08
IMN	-0.37	-0.27	0.17	0.32	0.12		-0.30	-0.30	0.26	0.24	0.08	

Note: The grey highlighted columns show the Spearman rank correlation between factors and the nonhighlighted columns represent the same thing using standard Pearson correlation. This correlation uses the weekly time series for each method represented in panels A and B. The factors are excess market return (R_M-R_F), size (SMB), value (HML), profitability (RMW), investment (CMA), and Islamic (IMN).

The correlations in Table 5.3 are generally stronger between the factors constructed using equal-weighted portfolios in Panel B than their counterparts in Panel A. The variations in the correlation magnitudes are roughly ± 0.15 on average. The only exceptions can be found in the correlations between the excess market return and both SMB and RMW in the two sorts, which exceeded the average by ± 0.30. These observations, in general, are similar to those in Table 5.2.

In summary, the correlations between the 2 × 3 and 2 × 2 sorts of the same factor presented in Table 5.1 are high and range from 0.70 to 0.90. This is to be expected, as the factors are constructed from stocks that have similar firm characteristics, but the 2 × 3 sort excludes 40% of the stocks, and the 2 × 2 sort includes all stocks. The only exception is for the two versions of the SMB, which is 0.99. The reason for these stronger correlations is the inclusion of all stocks in both versions of the SMB.

The correlations between different factors are presented in Table 5.2 and 5.3 for monthly and weekly returns, respectively. The correlations between factors are generally not strong and range from 0.5 to -0.5 with a few exceptions but still within an accepted level. The observations in all tables of the correlations between the factors constructed using equal-weighted portfolios are mostly stronger than their value-weighted counterparts. This means that smaller stocks are more correlated than the larger ones. In value-weighted portfolios, the impact of the smaller stocks slightly disappears as their weight becomes less within the portfolio.

Therefore, I can confirm that the factors do not have strong correlations. The analysis therefore proceeds to the examination of factor premiums, presented in the following sections. The first factor discussed is excess market return.

5.3 Excess market return (market risk premium)

In the preceding section, the correlation between factors was evaluated, setting the stage for the primary focus of this chapter: examining the significance of the factor premiums. This investigation begins with evaluating excess market returns, which denote the difference between the return of the overall market and a risk-free rate. Conventionally, excess market return has served as the major risk factor in single-factor models, with additional factors like size and value subsequently incorporated into multifactor models such as the Fama and French models. Thus, this study investigates the mean return of the excess market return, examining whether it is significantly greater than zero by applying a one-sample t-test. While the assessment of the market risk premium's significance is not explicitly outlined in hypotheses H1 and H2, I did initially assume its significance. The market risk premium warrants thorough examination and evaluation because it is important to represent the market portfolio and it is an essential factor in the asset pricing models under examination.

The excess market return or the market risk premium in this study is the excess return on the market portfolio that consists of all listed stocks over the risk-free-rate of SAMA treasury bills. In other words, it is the return on almost all the risky assets in the Saudi equity market. The risk exposure for these assets includes diversified and undiversified risks. Therefore, according to the theoretical assumption of higher return for higher risk, the market return should have a significant premium that compensates investors in the equity market for taking relatively higher risk than the risk-free-rate. The risk premium logically varies among different global equity markets and should be according to the risk exposure in each specific market and economy. Damodaran (2020, p. 31) states that the actual equity risk premium historically ranges from 3% to 12%.

Table 5.4*:* Summary statistics in percentages for the excess market return, April 2009-March 2021

	Value-weighted		Equal-weighted	
	(1)	**(2)**	**(3)**	**(4)**
	Monthly	**Weekly**	**Monthly**	**Weekly**
Mean	0.68	0.16	0.33	0.08
Standard deviation	5.65	2.78	7.13	3.16
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(1.4555)	(1.4468)	(0.5585)	(0.6238)
p-value	0.07	0.07	0.29	0.27

This table presents summary statistics of the R_M-R_F (excess market return) factor during the entire sample period. The summary statistics include the mean return, standard deviation, one-sample t-test (t-statistics), and p-value. The sample includes all listed stocks in the Saudi stock market from April 2009 to March 2021 (excluding new IPOs).

Table 5.4 shows the summary statistics of the market risk premium (equity risk premium), including the arithmetic mean in the Saudi equity market from April 2009 to the end of March 2020. In this table, the monthly and weekly return frequencies are used, and for each frequency, the return of the market portfolio is calculated using value- and equal-weighted methods.

Column 1 shows the result of the monthly value-weighted return of the market portfolio (market risk premium), which is the main theme of this study. The average return of this portfolio during the study sample is 0.68% monthly, or about 8% annually, and the t-statistics in parenthesis is 1.45. It is significant at 10%, which is higher than the expected significant level of 5%.

Similarly, column 2 represents the weekly value-weighted return on the market portfolio for the same period. The average weekly return in column 2 is 0.16%, which is about 8% annually, and is similar to the return on the monthly value-weighted portfolio in column 1. It also has a similar t-statistics value in parenthesis and is significant at the same level. However, the dispersion of the return measured by the standard deviation shows that weekly frequency varies less and is close to its average compared to the return on the monthly value-weighted portfolio.

The standard deviations are 5.65 and 2.78 for monthly and weekly returns. This dispersion could be inferred from the range between the maximum and minimum values for both frequencies, as the range is smaller in the weekly frequency.

Columns 3 and 4 in Table 5.4 show the summary statistics for monthly and weekly frequency on the return of equal-weighted portfolios. The average return on both portfolios is exactly half of its counterpart in the value-weighted portfolios, and the t-statistics in both frequencies for equal-weighted portfolios are insignificant. This is a surprising result, as the expectation was that market risk premium would be significantly greater than zero for all frequencies and weighting schemes of the portfolio returns. More importantly, the literature has a considerable amount of evidence that the average return on equal-weighted portfolios outperforms the return on value-weighted portfolios (Atchison et al., 1987; Breen et al., 1989; Fama & French, 2008; Grinblatt & Titman, 1989; Lessard, 1976; Malladi & Fabozzi, 2017; Ohlson & Rosenberg, 1982; Pae & Sabbaghi, 2010; Plyakha et al., 2021a; Roll, 1981; Whited & Wu, 2006). This outcome is generally attributed to diversification and risk distribution among securities in equal-weighted portfolios. In this case, the only plausible explanation for the underperformance of equal-weighted portfolios is the higher returns in small stocks. Small stocks do not account for their total return in the value-weighted portfolios, as their weight within the portfolio is just a fraction. On the other hand, the returns in equal-weighted portfolios are equally distributed and calculated, so the higher returns of the small stocks are more pronounced.

Table 5.5 presents the periodic summary statistics of the market portfolio through the years of the sample period for both frequencies (weekly and monthly) and the equal- and value-weighted portfolio schemes. The table shows that the annual mean return of market value-weighted portfolios in both frequencies is mainly higher than their counterpart in equal-weighted portfolios. This finding is similar to what I found in Table 5.4 for the whole sample; however, the mean return of the equal-weighted portfolios is higher in 2011 and the last two years of the sample period. Further, the equal-weighted portfolio's standard deviation is also high, which means a higher dispersion. The highest return for all frequencies and weighting schemes was recorded in the first and last years of the sample period. In contrast, Table 5.5 indicates a poor performance in the mean return for all portfolios in the middle of these years. The worst year was 2015. This bad performance, specifically in 2015, could be related to the dramatic drop in oil prices, a major income source for the Saudi economy, which started in the middle of 2014 and continued until the beginning of 2015.

Table 5.5: Periodic mean and standard deviation for excess market return in percentages (market risk premium) (R_M-R_F)

	Value-weighted				Equal-weighted			
	(1) Monthly		(2) Weekly		(3) Monthly		(4) Weekly	
t	M_t	SD_t	M_t	SD_t	M_t	SD_t	M_t	SD_t
2009	3.5	6.8	0.8	3.3	2.2	7.1	0.5	3.0
2010	-0.1	6.1	0.0	3.7	-1.2	6.6	-0.3	3.7
2011	1.3	4.6	0.3	1.7	3.1	6.1	0.7	2.3
2012	-0.6	4.2	-0.1	1.7	-0.6	6.7	-0.1	2.6
2013	2.4	1.9	0.5	1.4	1.6	2.5	0.3	1.7
2014	-0.6	7.2	0.0	4.0	-0.7	8.2	0.0	4.6
2015	-2.1	7.5	-0.5	3.4	-3.8	9.9	-0.9	4.3
2016	1.2	6.6	0.2	2.5	0.3	9.8	0.0	3.5
2017	1.1	4.2	0.3	1.8	-0.2	3.3	0.0	1.8
2018	0.9	3.4	0.2	2.1	-0.8	3.4	-0.2	2.2
2019	-2.7	6.2	-0.6	3.3	-1.7	7.4	-0.4	3.5
2020	3.9	4.3	0.9	2.5	5.8	8.2	1.4	2.7

Note: This table presents the annual mean return (M_t) of the year (t) for the excess market return R_M-R_F in percentages during the sample period and their standard deviation (SD_t). The sample includes all listed stocks in the Saudi stock market with available data from April 2009 to March 2021 (excluding new IPOs).

In conclusion, the excess market return, or the market risk premium, the mean return of the market portfolio for the whole sample, is significantly greater than zero at 10% for both frequencies of the value-weighted portfolios and around 8% annually. I expected the market risk premium to be significantly greater than zero (at least at 5%). This low result could be attributed to the fact that the sample period is only 12 years, and the market performed poorly during this period.

Furthermore, the equal-weighted portfolios had a very low mean return (almost half of the value-weighted portfolios return). They are not significantly greater than zero and they have a higher standard deviation. This is an interesting result, as most of the studies in the literature find that equal-weighted portfolios outperform value-weighted portfolios, which contradict the findings of this study. This result could be due to the high exposure of value-weighted portfolios to large market capitalisation stocks that are more profitable than small stocks. This contradictory finding is supported by Fletcher (2011) who finds high returns for different portfolio strategies, including the performance of value-weighted over the equal-weighted portfolio on the UK stock market.

Finally, it is important to mention that the market risk premium is an influential factor from an investor's perspective and works as a benchmark. The market risk premium is essentially the average return of all listed stocks without diversification; accordingly, investing in stocks with a specific characteristic provides a higher premium in a well-diversified portfolio. This diversification is discussed in-depth in relation to the factor premiums in the following sections, starting with the size premium.

5.4 Size premium (SMB)

This section covers the size premium in the Saudi equity market, which is the equity premium that the small market capitalisation stocks generate over the large market capitalisation stocks. The literature describes this anomaly as the size effect, which mainly means that risk-adjusted stock returns increase as firm size decreases. It was discovered by Banz (1981) and Keim (1983) and has persisted over the years. Therefore, this study developed hypothesis H1.1, that the size premium is significantly greater than zero in the Saudi equity market.

- ***Hypothesis H1.1: The size factor has a significant premium on stock returns in the Saudi stock market.***

This hypothesis is tested using one-sample t-tests on the mean return of the size premium throughout the sample period. The size premium is the return of portfolios of small market capitalisation stocks minus the return of large stocks. This study uses two return frequencies (monthly and weekly); two weighting schemes (equal- and value-weighted), and two sorts (2 × 3 and 2 × 2) to construct the size factor and examine the significance of its premium.

The summary statistics of SMB are shown in Table 5.6, which includes all versions of the SMB factor constructed from the various methods. Panel A shows the result of the value-weighted portfolios, and columns 1 and 2 show the monthly results of the two sorts, 2 × 3 and 2 × 2, consecutively. Although the monthly mean returns of the 2 × 2 sort in column 2 are slightly higher, the mean return for both sorts in columns 1 and 2 are quite similar (around 0.2% a month and 2.4% annually). This is a very low mean return, particularly in contrast with the mean return in the market premium, the benchmark, from the previous section (see Table 5.4), which is four times higher than the mean return of the SMB. The market premium is the return of all listed stocks.

However, in this case, firm size does not offer better diversification or higher return. Therefore, it is unsurprising to see a very low t-value for both sorts, which indicates that the mean return for the size premium is not significantly greater than zero. In the same panel, the other columns, 3 and 4, show the weekly results for both sorts. The mean return for both sorts is almost equal, but the 2 × 2 sort is slightly higher, just like the findings in the monthly mean return. Further, the weekly mean rerun for both sorts is very low and does not provide any equity premium. The t-value is also insignificant for both sorts, meaning they are not significantly greater than zero.

Table 5.6: Summary statistics in percentages for the returns of the size factor (SMB), April 2009-March 2021

	Monthly		**Weekly**	
	(1)	**(2)**	**(3)**	**(4)**
	2 × 3 Sort	**2 × 2 Sort**	**2 × 3 Sort**	**2 × 2 Sort**
Panel A:	**Value-weighted**			
Mean	0.20	0.24	0.04	0.05
Standard deviation	4.10	4.22	1.72	1.78
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(0.58)	(0.69)	(0.59)	(0.69)
p-value	0.28	0.24	0.28	0.24
Panel B:	**Equal-weighted**			
Mean	0.03	0.05	0.005	0.008
Standard deviation	4.33	4.45	1.76	1.83
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(0.09)	(0.14)	(0.07)	(0.12)
p-value	0.46	0.44	0.47	0.45

Note: This table presents the summary statistics of the SMB factor during the entire sample period. The summary statistics include the mean return in percentages, standard deviation, one-sample t-test (t-statistics), and p-value. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021 (excluding new IPOs).

Panel B of Table 5.6 shows the summary statistics of the SMB constructed from equal-weighted portfolios for both sorts and return frequencies. The mean return in all columns of this panel is at least five times less than their counterpart value-weighted portfolios in panel A. Therefore, the mean return of the SMB equal-weighted portfolios is even lower and offers no premium in the Saudi equity market. It is to be expected that the result of the t-value of all columns in panel B will be very low and insignificant, which means the mean return in all those portfolios is not significantly greater than zero. The finding that the return of equal-weighted portfolios is lower than that of the value-weighted portfolios is consistent with the result in the market risk premium in the previous section. This also supports the argument about the higher returns of small stocks and the high exposure of the large market capitalisation stocks in the value-weighted portfolios discussed above (see section 5.3).

Table 5.7: Periodic mean and standard deviation in percentages for the monthly returns of the size factor (SMB)

	Value-weighted				**Equal-weighted**			
	(1) 2 × 3 sort		**(2) 2 × 2 sort**		**(3) 2 × 3 sort**		**(4) 2 × 2 sort**	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	-0.6	3.9	-0.8	3.9	0.0	4.2	0.1	4.5
2010	-0.7	1.3	-0.8	1.5	-1.2	2.3	-1.3	2.5
2011	2.3	3.4	2.5	3.4	1.9	4.5	2.0	4.6
2012	0.8	4.6	1.1	4.8	0.3	4.7	0.5	4.8
2013	-0.7	3.3	-0.7	3.4	-1.8	3.3	-1.9	3.4
2014	1.2	4.3	1.3	4.3	0.1	5.3	0.1	5.4
2015	-0.8	3.9	-0.9	4.1	-0.7	4.5	-0.6	4.7
2016	-0.6	5.0	-0.5	5.1	-0.5	5.3	-0.5	5.4
2017	-1.0	4.9	-0.9	5.3	-0.9	3.8	-0.9	3.9
2018	-1.9	3.3	-1.8	3.5	-1.5	3.2	-1.5	3.2
2019	1.9	3.8	2.2	3.7	1.0	3.5	1.1	3.5
2020	2.4	5.0	2.3	5.1	3.5	5.3	3.4	5.3

Note: This table presents the annual mean return (M_t) in percentages for the year (*t*) for the monthly SMB factor during the sample period and their standard deviation (SD_t). The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021 (excluding new IPOs).

For further investigation of the mean return for the size factor SMB, I calculate the annual periodic summary statistics for every year in the sample period. Table 5.7 displays the monthly return for the portfolios with two types of sorting and two types of weighting scheme. The best performance in terms of the mean return for all portfolios in Table 5.7 was in 2011 and the last two years of the sample period, 2019 and 2020. The poor performance for all portfolios between 2012 and 2018 is noteworthy, although the value-weighted portfolios of the two sorts performed very well in 2014.

Recalling the periodic performance of the market return in the previous section, the mean return of the equal-weighted portfolio was higher than the value-weighted only in 2011 and in the last two years, 2019 and 2020 (see Table 5.5). However, the mean return for SMB is higher in the value-weighted portfolios for all these years except in 2020. This indicates a high exposure in the value-weighted portfolios of the market return to large market capitalisation stocks. However, large stocks were eliminated in the portfolios of the size factor, therefore, their returns are higher than their counterpart of market return portfolios.

Furthermore, Table 5.8 shows the periodic weekly return of portfolios corresponding to those in Table 5.7 and shows, in general, similar results. Therefore, diversification using firm's size to generate equity premium is not a sophisticated strategy in the Saudi stock market.

These findings about the mean return in size premium in different types of portfolios confirm that there is no size effect in the Saudi equity market. Therefore, hypothesis H1.1, which concerns the significance of size premium in the Saudi market, is rejected. This is an unexpected result, as the study assumed the significance of the size premium based on the evidence in the literature that has found a size premium in many developed and emerging markets (Cox & Britten, 2019; Fama & French, 1992, 1993, 1995, 2015; Foye, 2018b; Mosoeu & Kodongo, 2020). Indeed, Chen et al. (1986) argue that size may be the best explanation for expected returns, and the studies of Fama and French (1992, 1993) describe the size factor as the most prominent factor, after market returns. Stambaugh and Yuan (2017) emphasize that SMB is an important supplement to the market return factor. Such empirical and theoretical research motivated this study to investigate and assume the significance of the size premium in the Saudi market, which has been found to be false.

Table 5.8: Periodic mean and standard deviation in percentages for the weekly returns of the size factor (SMB)

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M** $_t$	**SD** $_t$	**M** $_t$	**SD** $_t$	**M** $_t$	**SD** $_t$	**M** $_t$	**SD** $_t$
2009	-0.1	1.7	-0.2	1.8	0.0	1.6	0.0	1.7
2010	-0.1	1.3	-0.2	1.4	-0.3	1.5	-0.3	1.6
2011	0.5	1.3	0.5	1.4	0.5	1.7	0.5	1.8
2012	0.1	1.8	0.2	1.9	0.0	1.9	0.1	2.0
2013	-0.1	1.5	-0.1	1.5	-0.4	1.6	-0.4	1.6
2014	0.3	1.8	0.3	1.9	0.1	2.0	0.1	2.1
2015	-0.2	1.9	-0.2	2.0	-0.1	2.0	-0.1	2.0
2016	-0.2	1.8	-0.1	1.9	-0.2	1.9	-0.2	1.9
2017	-0.2	1.8	-0.2	1.9	-0.2	1.7	-0.2	1.8
2018	-0.4	1.9	-0.4	1.9	-0.3	1.6	-0.3	1.6
2019	0.5	1.6	0.5	1.6	0.2	1.6	0.3	1.6
2020	0.5	1.9	0.5	2.0	0.8	1.9	0.8	1.9

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the weekly SMB factor during the sample period and their standard deviation (SD_t). The sample includes all listed stocks with available data in the Saudi stock market from April 2009 to March 2021 (excluding new IPOs).

There are a couple of explanations for insignificance of the size premium in this study. Firstly, the occurrence of the size effect is inconsistent in the literature. It was prominently documented until the 80s (Banz, 1981; Fama & French, 1992, 1993, 1995), however, a few more recent studies suggest the disappearance of the size effect in the 1980's and 1990's (Dichev, 1998; Dimson & Marsh, 1999; Horowitz et al., 2000a, 2000b), which then reappeared after 2000 (Van Dijk, 2011). The inconsistent occurrence of the size effect may apply to the Saudi equity market and cause the size premium to be insignificant.

Considering that the Saudi stock market is so young and perhaps it has never had a size effect. Although Alkhareif (2016) finds a significant size premium at 10% in the Saudi equity market, his study includes the period before 2009 when the bubble happened and the market was unstable (see section 2.3). This contradictory finding has a plausible explanation. Small market capitalisation stocks usually have higher forward earnings growth than large stocks, and earnings growth is positively correlated with average return (Penman & Reggiani, 2022), which explains the size effect puzzle in the literature. Considering the rapid increase in the Saudi market from 2,400 in 2003 to over 20,000 points in 2006, a period included in Alkhareif (2016) study, small firms' earnings growth and average returns may have been precipitously boosted over the large stocks. As mentioned earlier (see section 2.3), including the era before 2009 is misleading.

A recent study by Song (2022) presents a very appealing explanation connecting herding behaviour and the size premium. The study finds that the herding effect (Banerjee, 1992) dissuades investors from investing in large market capitalisation stocks. Further, they conclude that the size premium results from the herding behaviour toward small-size stocks. The herding behaviour is well-documented among investors in the Saudi equity market. Balcilar et al. (2013) discovers a strong herding behaviour in the Saudi stock market during certain times; Salem (2019) also finds evidence of herding behaviour in the Saudi market among investors. More interestingly, Rahman et al. (2015) finds a herding behaviour among Saudi investors, the domination of the market investors, regardless of the market conditions. They also examine this behaviour in different stock categories, such as stock size and book-to-market ratio, and find that investors herd each other despite firm characteristics. They conclude that Saudi investors behave indifferently toward important stock characteristics and are likely to be noisy traders.

Although herding behaviour is strongly present in the Saudi market, it is unlikely to operate in favour of common fundamental movements such as small firm size. Also, Saudi investors may aim at large market capitalisation stocks due to their excellent performance, yet no evidence can be inferred here for such behaviour. The significance of the size premium for the Saudi market might never have existed, due to irrational herding behaviour. Therefore, we can confidently reject hypothesis H1.1 about the significance of the size premium in the Saudi market.

5.5 Value premium (HML)

This section examines the significance of the value premium in the Saudi equity market using one-sample t-tests on the mean return of value factor portfolios. Value stocks have a high book-to-market ratio compared to growth stocks. Empirical studies have documented that value stocks reliably have higher returns than growth stocks, which is known in the literature as the value effect (L. K. Chan et al., 1991; Fama & French, 1992, 1993, 1998, 2015). The empirical evidence motivated me to examine the existence of this phenomenon and the significance of the value premium in the Saudi equity market. Therefore, hypothesis H1.2 proposes the significance of the value premium in the Saudi stock market:

- ***Hypothesis H1.2: The value factor has a significant premium on stock returns in the Saudi stock market.***

The value premium (HML) is the return of portfolios with high B/M ratio stocks minus the return of portfolios with low B/M ratio stocks. This study uses two return frequencies, portfolio weighting schemes, and sorts to construct the value factor and examine the value premium. The first sort, 2 × 3, excludes 40% of the listed stocks in the study sample that are considered medium B/M ratio stocks, whereas the second sort, 2 × 2, includes all listed stocks (see section 4.5.1.2).

Table 5.9 presents the summary statistics of the value factor HML and its one-sample t-test statistics. Panel A shows the results of the value factor constructed using value-weighted portfolios. The monthly results are represented in columns 1 and 2 for each sort, whereas the 3 and 4 columns show the weekly results for each sort.

The monthly mean return of the value factor over the entire sample period in columns 1 and 2 is 0.40% for both sorts (4.8% annually). The t-value shows a significant premium at 10% for the 2 × 3 sort and 5% for the 2 × 2 sort. Although the mean return for both sorts is exactly 0.40% a month, the t-value is higher in the 2 × 2 sorts. The differences in the t value are caused by the high standard deviation in the 2 × 3 sort, which is about 3.39, whereas the standard deviation is only 2.32 in the 2 × 2 sort. Higher dispersion in the monthly return in the 2 × 3 sort could be attributed to less portfolio diversification. More than 600 stocks were excluded, which are used to construct the value factor in this sort.

Table 5.9: Summary statistics in percentages for the returns of the value factor (HML), April 2009-March 2021

	Monthly		Weekly	
	(1)	**(2)**	**(3)**	**(4)**
	2 × 3 Sort	**2 × 2 Sort**	**2 × 3 Sort**	**2 × 2 Sort**
Panel A:		**Value-weighted**		
Mean	0.40	0.40	0.10	0.09
Standard deviation	3.39	2.32	1.53	1.10
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(1.42)	(2.05)	(1.57)	(2.09)
p-value	0.08	0.02	0.06	0.02
Panel B:		**Equal-weighted**		
Mean	00.47	00.43	00.11	00.10
Standard deviation	03.12	02.15	01.44	01.04
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(1.79)	(2.40)	(1.94)	(2.41)
p-value	0.04	0.004	0.03	0.008

Note: This table presents the summary statistics of the HML factor during the entire sample period. The summary statistics include the mean return in percentages, standard deviation, one-sample t-test (t-statistics), and p-value. All listed stocks with available data are used to construct the 2 × 2 sort of the HML factor from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

Columns 3 and 4 show the weekly result, and their mean weekly return is 0.10% and 0.09% per week for 2 × 3 and 2 × 2 sorts respectively (roughly 5% annually for both sorts). The t-value is also significant, at 10% for the 2 × 3 sort and 5% for the 2 × 2 sort, which is identical to the monthly return result. The standard deviation is also higher in the 2 × 3 sort.

The summary statistics result on panel B of Table 5.9 is for HML constructed using equal-weighted portfolios. Columns 1 and 2 in panel B show that the mean monthly return for the 2 × 3 and 2 × 2 sorts is 0.47% and 0.43% respectively, higher than 5% annually for both sorts. The t-value is significant (at least 5% in the 2 × 3 sort and at 1% in the other sort). It is also noticeable that the standard deviation is lower in the 2 × 2 sort due to the well-diversified portfolios in this sort. Therefore, the mean weekly returns in columns 3 and 4 in panel B have a significant t-value at the same level as their corresponding monthly returns. The mean weekly return for 2 × 3 and 2 × 2 sorts is 0.11% and 0.1, slightly higher than 5%. The standard deviation is also higher in the 2 × 3 sort.

Considering the results from Table 5.9 of the summary statistics for the value factor HML, it can be confirmed that the value premium is significant in the Saudi stock market. The t-value of the mean return in all weighting schemes, return frequencies, and different sorts are significant, although the t-value in the 2 × 3 sort of the value-weighting scheme is only significant at 10%. This means the difference in the mean returns between stocks with a high B/M ratio and a low ratio is greater than zero. Therefore, hypothesis H1.2 about the significance of the value premium in the Saudi stock market cannot be rejected.

Furthermore, the returns of the stocks with a high B/M ratio show stability over time as the standard deviation is relatively low compared with other factors. It is also interesting that the mean return of the value premium in the equal-weighted portfolio is similar to, or slightly higher than, the value-weighted portfolio in Table 5.9, given that size and excess market return factors reveal the mean return of the value-weighted is always higher than the equal-weighted. This study expected consistency in the performance of the mean return for the portfolios of the same weighting scheme. A possible explanation may be the poor performance of smaller value stocks within the portfolio, which means they do not contribute higher returns in equal-weighted portfolios. At the same time, the large-value stocks underperformed in the portfolio, so the exposure of the large stocks is not strong in the value-weighted portfolio. However, this surprising result is not related to the hypotheses in this study and is outside the scope of this research.

To further investigate the value factor, the periodic summary statistics for monthly returns are given in Table 5.10. The result in columns 1 and 2 is for HML constructed using value-weighted portfolios, whereas columns 3 and 4 are for HML constructed from equal-weighted portfolios. The two sorts are also used for each weighting scheme.

The first thing to note is that the periodic monthly mean return is negative in only two years (2012 and 2014). This means the performance of stocks with a high B/M ratio is better than the lower ratio and generates more returns. Recalling the results from the excess market return section, the periodic monthly mean returns in Table 5.5 are negative for five years in columns 1 and 2 for the value-weighted portfolio and seven years in columns 3 and 4 for the equal-weighted portfolio. The size factor has more than six years of negative monthly mean returns in Table 5.7 of the periodic summary statistics (see previous section). It is also clear that the value factor has a lower standard deviation in the periodic table than the previous two factors (size and market return), which means less variability around the mean and more stability.

Table 5.10*:* Periodic mean and standard deviation in percentages for the monthly returns of the value factor (HML)

	Value-weighted				**Equal-weighted**			
	(1) 2 × 3 sort		**(2)** 2 × 2 sort		**(3)** 2 × 3 sort		**(4)** 2 × 2 sort	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	1.6	4.0	1.6	3.5	0.6	2.8	0.6	2.7
2010	0.3	2.0	0.0	1.0	1.0	1.6	0.5	1.1
2011	0.5	4.0	0.5	3.1	0.4	5.0	0.2	3.4
2012	-2.1	3.8	-1.5	2.4	-2.1	3.0	-1.4	1.7
2013	1.3	2.1	1.0	1.7	1.4	2.2	1.4	1.8
2014	-1.2	3.8	-0.4	2.2	-0.4	3.2	0.0	2.4
2015	0.9	3.8	0.8	2.3	0.5	2.6	0.3	1.9
2016	0.6	2.4	0.8	2.1	1.2	2.6	0.9	1.9
2017	1.0	3.1	0.2	1.9	1.4	2.9	1.1	1.9
2018	1.1	3.1	0.3	2.4	1.3	3.3	0.6	2.3
2019	0.3	4.1	0.7	2.2	0.1	3.3	0.5	1.7
2020	0.6	3.3	0.7	1.6	0.3	3.4	0.4	1.9

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the monthly HML factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the HML factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

Further, the periodic summary statistics for weekly returns of the value factor displayed in Table 5.11 columns 1 and 2 show the result of the factor constructed using value-weighted portfolios. Columns 3 and 4 show the result of the factor constructed using equal-weighted portfolios. The two sorts are used in both panels for each weighting scheme.

Table 5.11: Periodic mean and standard deviation in percentages for the weekly returns of the value factor (HML)

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M*t***	**SD*t***	**M*t***	**SD*t***	**M*t***	**SD*t***	**M*t***	**SD*t***
2009	0.3	1.9	0.3	1.5	0.1	1.6	0.1	1.2
2010	0.1	1.3	0.0	0.7	0.2	1.2	0.1	0.8
2011	0.1	1.4	0.1	1.1	0.1	1.6	0.0	1.2
2012	-0.4	1.7	-0.3	1.2	-0.5	1.4	-0.3	1.0
2013	0.3	1.3	0.2	1.0	0.3	1.5	0.3	1.1
2014	-0.2	1.7	-0.1	1.3	0.0	1.4	0.0	1.1
2015	0.1	1.8	0.1	1.3	0.1	1.7	0.0	1.3
2016	0.2	1.2	0.2	1.0	0.3	1.2	0.2	0.9
2017	0.2	1.3	0.1	0.9	0.3	1.3	0.3	0.9
2018	0.3	1.4	0.1	0.9	0.3	1.4	0.1	1.0
2019	0.1	1.5	0.2	1.0	0.0	1.3	0.1	0.8
2020	0.2	1.7	0.2	1.2	0.1	1.6	0.1	1.1

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the weekly HML factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the HML factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

The weekly periodic result is the same as the monthly periodic result (see Table 5.10). The standard deviation is lower than the corresponding frequency in the excess market return and size factors, and there are only two years or less with a periodic negative mean. Interestingly, the periodic weekly mean return of equal-weighted portfolios in panel B has only one year, with a negative mean return compared to two negative mean returns in panel A of value-weighted portfolios. This might be due to the fact that weekly data frequency has more information than monthly data and, therefore, the negative returns are flattened within the portfolios. It also indicates that the returns of equal-weighted portfolios outperformed the value-weighted portfolios in B/M ratio portfolios.

The significance of the value premium in the Saudi stock market is not a surprising result. The value premium, generated from the value effect, is one of the most well-documented premium factors in the cross-section of stock returns and is significantly greater than zero in many global stock markets. This compensation premium comes from the outperformance of the value stocks with a high B/M ratio over growth stocks with a lower ratio.

Many studies have tried to explain compensation in value stocks by relating it to financial fundamentals and macroeconomic conditions. Fama and French (1992, 1993, 1995) argue that value stocks are fundamentally riskier and that the B/M ratio is a proxy for some hidden systematic risk, such as the risk of fluctuation in the aggregate economic cycle (suggested by Cochrane (1999); Jagannathan and Wang (1996); Lettau and Ludvigson (2001); Lustig and Van Nieuwerburgh (2005); Petkova and Zhang (2005); Yogo (2006), the displacement risk (Gârleanu et al., 2012), or the long run consumption risk (Bansal et al., 2009; Bansal et al., 2005; Hansen et al., 2008).

De Bondt and Thaler (1985) and Lakonishok et al. (1994) suggest that growth stocks underperform value stocks because irrational investors use ‘naive’ strategies by investing in those stocks and have too great an expectation about their future growth. These investors buy (sell) growth (value) stocks because they have done very well (poorly) in the past, and so they expect them to do well in the future. Investors with naive strategies assume a trend in stock prices and overreact to either positive or negative news, irrespective of the price. As a result of overbuying (overselling) growth (value) stocks by these investors, growth (value) stocks become overpriced (underpriced). Then, investors with contrarian strategies outperform the market because they invest in underpriced stocks and neglect overpriced stocks.

These naive strategies, described by Lakonishok et al. (1994), are the same as Shiller et al. (1984) popularity theory and noise trading (Black (1986). The existence of noise traders is well-documented in the Saudi stock market (Benlagha & Hemrit, 2018; Rahman et al., 2015), which suggests that naive strategies of holding growth stocks have existed for a long time in the Saudi market. Therefore, this seems to be a plausible explanation for the existence of the value effect and the significance of the value premium in the Saudi stock market.

In summary, the mean return of the value factor is significantly greater than zero during the sample period. This means the value premium is significant, regardless of the reasons for the premium existence. Thus, this study cannot reject hypothesis H1.2 about the significance of the value premium, as its mean is significantly greater than zero in all versions examined.

5.6 Profitability premium (RMW)

This section examines the significance of the profitability premium in the Saudi stock market, which is the premium in the return of stocks with high profitability minus the return of stocks with low profitability. The significance of this premium is assessed by using a one-sample t-test on the mean return of the profitability factor RMW, which is essentially the difference in the mean return between robust and weak stocks in terms of operating profit. In recent years, empirical research has suggested that stocks with higher profitability have higher returns in the cross-section of average returns (Fama & French, 2006, 2015; Novy-Marx, 2013). A few studies find the profitability premium to be significant in the market examined (Chiah et al., 2016; Foye, 2018a, 2018b). The evidence in the literature about the profitability premium challenges this study to examine this factor in the context of the Saudi stock market. I expected to find this premium significant, as is reflected in hypothesis H1.3:

- ***Hypothesis H1.3: The profitability factor has a significant premium on stock returns in the Saudi stock market.***

The profitability premium is the return from portfolios of high-profitability stocks minus the return from portfolios of low-profitability stocks. This study uses two ways to construct the profitability factor: 2 × 3 and 2 × 2 sorts. The first sort, 2 × 3, excludes 40% of the listed stocks in the study sample that are considered medium profitability stocks, whereas in the second sort, all listed stocks are included (see section 4.5.1.2). Examining the significance of the profitability premium is applied to the two types of sorts using monthly and weekly frequencies and the value- and equal-weighted schemes.

The summary statistics of the profitability factor RMW are shown in Table 5.12, and panel A shows the factors that were constructed by using value-weighted portfolios. Column 1 shows the factor constructed using monthly return frequency and 2 × 3 sort, and the mean return is -0.40% a month (about -5% annually).

Table 5.12: Summary statistics in percentages for the profitability factor (RMW), April 2009-March 2021

	Monthly		Weekly	
	(1)	**(2)**	**(3)**	**(4)**
	2 × 3 Sort	**2 × 2 Sort**	**2 × 3 Sort**	**2 × 2 Sort**
Panel A:		**Value-weighted**		
Mean	-0.40	-0.20	-0.09	-0.04
Standard deviation	4.39	3.14	1.87	1.31
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(-1.14)	(-0.77)	(-1.17)	(-0.76)
p-value	0.87	0.78	0.88	0.77
Panel B:		**Equal-weighted**		
Mean	-0.02	0.02	-0.01	0.004
Standard deviation	3.86	2.86	1.68	1.22
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(0.53)	(0.07)	(-0.11)	(0.09)
p-value	0.53	0.47	0.54	0.46

Note: This table presents the summary statistics of the RMW factor during the entire sample period. The summary statistics include the mean return in percentages, standard deviation, one-sample t-test (t-statistics), and p-value. All listed stocks with available data are used to construct the 2 × 2 sort of the RMW factor from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

It is disturbing to find a negative mean return for stocks with high profitability in the Saudi market. The factor constructed from the 2 × 2 sort and monthly frequency in column 2 is better, but still negative, with a mean return of -0.20% a month (about 2.5% negative annually). The mean weekly return for both sorts in columns 3 and 4 also shows negative results, although the annual return is slightly less than the counterpart sort in the monthly frequency. The t-value is insignificant in all columns in panel A, although it is higher in columns 1 and 3 of the 2 × 3 sort and close to being significant. The standard deviation is also higher in the 2 × 3 sort for both frequencies and weighting scheme. Further, the mean return of the RMW factor using equal-weighted portfolios is lower than the one used for the value-weighted portfolios, which is similar to the market and SMB premiums.

The results from Table 5.12 reveal an unexpected finding that stocks with both current and previous high profitability do not necessarily yield higher returns in the future. This surprising outcome is emphasized by the negative size of the mean return, implying that weaker stocks yield positive returns.

Essentially, the RMW is constructed by subtracting the returns of robust stock portfolios from weak stock portfolios. Conversely, the inverse of this factor construction yields returns for weak stocks subtracted from robust stocks, resulting in a positive, but not statistically significant, mean return. Consequently, these findings suggest that the mean return of robust stocks with higher profitability is not significantly greater than zero, meaning that hypothesis H1.3 is rejected.

Table 5.13*: *Periodic mean and standard deviation in percentages for monthly returns of the profitability factor (RMW)

	Value-weighted				**Equal-weighted**			
	(1) 2 × 3 sort		**(2) 2 × 2 sort**		**(3) 2 × 3 sort**		**(4) 2 × 2 sort**	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	-0.5	5.8	0.0	3.4	-0.7	5.4	-0.2	3.5
2010	0.3	3.3	0.4	1.6	0.8	3.2	0.6	1.9
2011	-3.1	4.5	-2.1	2.6	-1.8	4.3	-1.6	3.0
2012	-0.9	5.6	-0.3	3.5	0.6	4.4	0.5	3.2
2013	0.4	2.6	0.5	2.0	0.6	2.6	0.8	1.9
2014	-0.8	4.5	-0.6	3.6	1.1	3.6	0.8	3.1
2015	0.5	5.6	-0.1	3.2	0.2	4.7	-0.3	2.9
2016	-0.2	3.1	-0.4	2.9	-0.6	3.1	-0.5	2.5
2017	0.3	3.6	0.5	2.1	-0.1	2.6	0.2	1.7
2018	1.4	2.3	1.3	1.7	0.8	1.3	1.0	0.9
2019	-1.6	2.3	-0.8	2.1	-0.2	3.2	-0.1	2.4
2020	-1.0	6.9	-0.9	6.1	-1.1	6.1	-1.0	5.2

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the monthly RMW factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the RMW factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

To further examine the profitability premium, I present the periodic summary statistics in Table 5.13 for the RMW factor using monthly returns. The results of the RMW constructed using value-weighted portfolios is represented in columns 1 and 2, whereas columns 3 and 4 show the result from using an equal-weighted portfolio.

Table 5.14: Periodic mean and standard deviation in percentages for the weekly returns of the profitability factor (RMW)

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	-0.1	2.1	0.0	1.4	-0.1	1.8	0.0	1.3
2010	0.1	1.6	0.1	1.3	0.2	1.7	0.1	1.2
2011	-0.7	1.8	-0.4	1.1	-0.4	1.8	-0.4	1.1
2012	-0.2	2.4	-0.1	1.5	0.1	2.1	0.1	1.5
2013	0.1	1.4	0.1	1.1	0.2	1.2	0.2	1.0
2014	-0.2	1.9	-0.2	1.5	0.2	1.8	0.1	1.5
2015	0.2	2.4	0.0	1.5	0.1	2.1	0.0	1.5
2016	0.0	1.3	-0.1	1.0	-0.1	1.3	-0.1	1.0
2017	0.1	1.8	0.1	1.2	0.0	1.5	0.1	1.0
2018	0.3	1.4	0.3	1.0	0.2	1.0	0.2	0.8
2019	-0.4	1.6	-0.2	1.2	-0.1	1.3	0.0	0.9
2020	-0.2	2.3	-0.2	1.7	-0.3	1.9	-0.2	1.5

Note: This table presents the annual mean return (M_t) in percentages of the year (t) for the weekly RMW factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the RMW factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

The mean return in columns 1 and 2 is negative for at least half of the periods for both sorts. We can also see a higher standard deviation in the year with a negative mean return. Similar results are also shown in columns 3 and 4 using equal-weighted portfolios and at least half of the period recorded a negative mean return annually with a higher standard deviation. Moreover, the periodic summary statistics for the RMW factor using weekly returns displayed in Table 5.14; columns 1 and 3, show the factor generated from value-weighted portfolios, whereas columns 3 and 4 are from equal-weighted portfolios. The summary statistics of the weekly returns in Table 5.14 are almost identical to the monthly return results in Table 5.13.

The summary statistics of the RMW factor in Table 5.12 and its periodic summary statistics in Tables 5.13 and 5.14 clearly show that stocks with higher profitability does not necessarily mean higher returns in the future. Surprisingly, the stocks with robust profitability exhibited lacklustre performance throughout the study period. In 2018, stocks with robust profitability demonstrated a mean monthly return of 1.4%, which is a respectable figure. However, the subsequent years witnessed returns significantly below this threshold, and primarily dwell in negative territory. This outcome contradicts theoretical expectations and empirical findings in numerous studies examining firms' higher profitability returns in many global markets (e.g., Ball et al., 2015; Fama & French, 2015; Hou et al., 2014; Novy-Marx, 2013). The seminal work of Fama and French (2015) five-factor asset pricing models suggests the superior performance of stocks with higher profitability. Their findings encouraged many studies to examine this superiority in developed and emerging markets worldwide (e.g., Chiah et al., 2016; Foye, 2018a; Foye, 2018b).

One possible theoretical explanation for the insignificance of the RMW factor stems from its conflict with HML. This is indicated in Tables 5.2 and 5.3, which state that RMW and HML factors are always negatively correlated. As explained earlier (see section 5.4), value stocks with lower B/M ratios have historically yielded higher returns than growth stocks. Simultaneously, most growth stocks tend to be large and profitable companies. Within the context of the risk-based explanation for the value strategy (see section 3.2.2), value firms are often more financially distressed and exhibit higher risk profiles, which justifies their higher returns. Consequently, in theory, the coexistence of value and profitability premiums is incompatible.

The concurrent presence of these two premiums has presented challenges to the existing literature, prompting recent studies to rationalize their coexistence (e.g., Hackbarth & Johnson, 2015; Kogan et al., 2022). Hackbarth and Johnson (2015) explore the coexistence of profitability and value premiums within a diverse range of firms. They categorize US stock market firms into panels based on different degrees of systematic risk and cyclicality. Within each panel, they observe the presence of both these premiums. However, it is important to note that controlling for systematic risk and cyclicality becomes challenging in smaller markets, such as the Saudi stock market, due to the limited number of listed firms.

Similarly, Kogan et al. (2022) argue that both factors exhibit distinct risk exposures and cyclicality patterns. They observe that both factors negatively loaded on aggregate technology shocks, with profitability positively loading on systematic profit shocks. In contrast, the value factor negatively loads on profit shocks, primarily because of the high profits associated with growth stocks. They conclude that the negative loading of the value factor contributes to the negative correlation between these two factors. Nevertheless, they find that controlling for the cyclicality of variable costs, a significant factor in both profitability and technology shocks, using a simulated method of moments helps generate value and profitability premiums. However, it's worth noting that these analytical methods may be better suited to larger stock markets and may present challenges in markets with fewer listed firms, such as the Saudi market (Cai et al., 2017).

In conclusion, the profitability premium was examined using multiple sorts, return frequencies and portfolio weighting schemes. There is no evidence that the profitability premium has existed in the Saudi stock market. The literature has long debated the coexistence of profitability and value premiums, and that debate remains inconclusive. However, in some studies, the coexistence of both premiums is documented. In some markets, the coexistence of both factors is conditional on controlling certain characteristics.

Other major stock markets have recorded the absence of profitability premiums, such as the German, Japanese and Chinese stock markets (Cai et al., 2017; Dirkx & Peter, 2020; Kubota & Takehara, 2018). The current study finds the profitability premium negative and insignificant in the context of the Saudi stock market. Therefore, hypothesis H1.3 about the significance of the profitability premium in the Saudi stock market is rejected.

5.7 Investment premium (CMA)

This section examines the significance of the equity premium on stocks with lower (conservative) investment growth over stocks with higher (aggressive) growth, known as the investment premium. The investment premium is the difference in the mean returns of conservative stock portfolios from aggressive stock portfolios. The investment premium is examined in a similar way to the other factor premiums in this study by using two of sorts (2 × 3 and 2 × 2); two return frequencies (weekly and monthly), and two weighting portfolio schemes (equal- and value-weighted). I also employ the one-sample t-test to examine the significance of the mean return of the investment factors, expressed in the following hypothesis:

- ***Hypothesis H1.4: The investment factor has a significant premium on stock returns in the Saudi stock market.***

The summary statistics for the return of the investment factor are shown in Table 5.15, including the mean return, t-statistics, standard deviation, etc. Panel A represents the result of the factor constructed using value-weighted portfolios, whereas panel B shows the result of the equal-weighted portfolios. Columns 1 and 2 represent the monthly returns for both sorts, and 3 and 4 are the weekly returns for both sorts in each panel.

Table 5.15: Summary statistics in percentages for the investment factor (CMA), April 2009-March 2021

	Monthly		**Weekly**	
	(1)	**(2)**	**(3)**	**(4)**
	2 × 3 Sort	**2 × 2 Sort**	**2 × 3 Sort**	**2 × 2 Sort**
Panel A:		**Value-weighted**		
Mean	-0.30	-0.11	-0.08	-0.03
Standard deviation	03.14	02.15	1.39	1.00
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(-1.13)	(-0.61)	(-1.45)	(-0.84)
p-value	0.87	0.73	0.93	0.79
Panel B:		**Equal-weighted**		
Mean	-0.25	-0.28	-0.06	-0.07
Standard deviation	2.56	1.84	1.12	0.84
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(-1.20)	(-1.86)	(-1.41)	(-2.04)
p-value	0.88	0.97	0.92	0.98

Note: This table presents the summary statistics of the CMA factor during the entire sample period. The summary statistics include the mean return in percentages, standard deviation, one-sample t-test (t-statistics), and p-value. All listed stocks with available data are used to construct the 2 × 2 sort of the CMA factor from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

In all columns of panel A, the mean return has a negative sign, which means that stocks with aggressive investment growth have a positive and higher return. Column 1 has an extreme value of the monthly mean return of -0.3%, whereas column 2 for the 2 × 2 sort is only -0.11%. This makes sense because the 2 × 2 sort is more diversified, while the 2 × 3 sort excludes 40% of the stocks in the study sample. The annual mean return of the investments factor is -3.6% for the 2 × 3 sort and -1.32% for the 2 × 2 sort.

On the other hand, the weekly mean return in columns 3 and 4 is -0.08% and -0.03% (annually -4.16% and -1.56% respectively). Thus, the extreme value of the mean return annually is in column 3. It is also noticeable in panel A that the standard deviation decreases as we move from columns 1 to 4. This is expected, as the weekly setting of the investment factor should be lower than its monthly counterpart. Also, the 2 × 2 sort always has better diversification and therefore has a lower dispersion around the mean.

In Table 5.15, panel B reports the summary statistics of the investment factor using equal-weighted portfolios. Similar to panel A, all the mean return values have a negative sign. The monthly mean returns in columns 1 and 2 are -0.25 and -0.28, respectively, which is -3% and -3.6 annually for each column. On the other hand, the weekly mean return in columns 3 and 4 are -0.06 and -0.07 respectively, which makes them -3.12% and -3.64 annually. Thus, the extreme value of the mean return is in column 4 and the second extreme value is in column 2. We can see that the standard deviation is highest in column 1, and the value decreases as we move right to the next column, which is similar to panel A result.

In panel A of Table 5.15, it's notable that the highest mean return is in column 3, with the t-value in parentheses being high and approaching significance. Similarly, panel B of Table 5.15 exhibits very high t-values in parentheses for columns 4 and 2. Additionally, the t-value for column 3 is moderately high, and the t-value for column 1 is nearly high. However, despite these observations, the associated p-values fail to reach significance—in fact, they are far from being significant. This is attributed to the nature of the alternative hypothesis testing, which focuses on the positive side of the distribution—the mean return of the investment factor being greater than zero. Consequently, while the average returns in the columns mentioned above have high t-values, which means they are distinguishable from zero, their negative sign means the null hypothesis cannot be rejected in favour of the alternative.

Conversely, the noteworthy t-values from panels A and B confirm a significant premium associated with the inverse of the investment premium in the Saudi stock market. This premium, derived from the difference in mean returns between low-investment (conservative) and high-investment (aggressive) stock portfolios, reveals a distinct pattern. Upon reversing the investment premium—subtracting the mean return of aggressive stocks from conservative stocks—a consistent positive trend emerges across columns. As a result, columns previously marked by high t-values exhibit significant p-values, reflecting positive mean returns significantly greater than zero. Hence, rejecting the null hypothesis is warranted, indicating the significance of the inverse investment premium in the Saudi market.

As a result, the mean return of four of the eight methods used to construct the inverse of the investment premium will have a significant t-test against the value of zero. This means the average returns for the inverse of the investment factor is significantly greater than zero and has a positive significant premium in the Saudi stock market. The significance of this inverse premium is more pronounced in the factors constructed by using equal-weighted portfolios. In contrast, the factors constructed from value-weighted portfolios are insignificant, except in the factor formed using 2×3 sorts of the weekly return and at level 10%. In the end, we can say that although the expectation is that the investment premium is significant in the Saudi market, the results reveal the significance of the inverse of the investment premium, which runs counter to many findings in the literature (see section 3.2.2.4).

To further investigate this surprising result, I examined the annual mean return and the standard deviation for the investment factor throughout the sample period. Table 5.16 shows the annual mean returns and the standard deviation for the investment factor constructed using monthly returns. Columns 1 and 2 show the result for investment factors constructed from 2×3 and 2×2 sorts by using value-weighted portfolios consecutively and similarly for columns 3 and 4 using equal-weighted portfolios.

Table 5.16*: Periodic mean and standard deviation in percentages for the monthly returns of the investment factor (CMA)*

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M *t***	**SD *t***	**M *t***	**SD *t***	**M *t***	**SD *t***	**M *t***	**SD *t***
2009	-0.2	5.6	1.1	2.9	-0.6	3.2	-0.3	2.2
2010	-0.3	3.0	-0.5	2.2	0.0	3.3	-0.3	2.6
2011	-0.3	2.4	0.4	1.7	0.3	2.8	0.5	1.6
2012	-0.7	3.9	-0.7	2.2	-0.9	2.6	-0.7	1.7
2013	0.0	2.5	-0.1	1.9	-0.1	1.8	-0.4	1.6
2014	-2.5	2.1	-2.2	2.0	-1.6	1.4	-1.5	1.4
2015	-0.5	2.6	0.8	2.2	-0.8	3.2	-0.4	2.2
2016	-1.0	3.3	-0.3	1.7	-0.5	2.1	-0.3	1.3
2017	1.0	3.3	0.8	2.2	0.3	2.5	0.3	2.0
2018	0.6	2.2	0.1	1.1	0.3	2.3	-0.2	1.4
2019	-0.7	2.1	-1.1	1.8	-0.7	1.5	-0.8	1.4
2020	1.1	2.8	0.5	2.0	1.2	3.0	0.7	2.1

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the monthly CMA factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the CMA factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

The annual mean return in column 1 was mostly negative during the sample period (only one-third was positive). On the other hand, column 2 displays a more positive annual mean return, which is about half of the years in the study sample. Further, the standard deviation in column 2 always has a lower level, confirming better diversification in the 2 × 2 sort. However, it is noticeable that when both sorts have positive signs in the same year, the 2 × 3 sort has a higher return. This might contradict the idea of better diversification in the 2 × 2 sort, but it also means that 40% of stocks excluded from the 2 × 3 sort performed poorly in those years. Moreover, the results in columns 3 and 4 for the equal-weighted portfolios are different. The 2 × 3 sort in column 3 has more positive signs than the 2 × 2 sort, but the standard deviation is still higher annually in the 2 × 3 sort.

Correspondingly, Table 5.17 shows the result of the annual mean return of the weekly investment factor. The results in this table are almost identical to the results in Table 5.16. The 2 × 3 sort in column 1 has more negative annual mean returns than the 2 × 2 sort in column 2, and the standard deviation is lower in the 2 × 2 sort. However, the 2 × 3 sort performed better in the years when both sorts had a positive sign. A similar result can be seen in columns 3 and 4, where the 2 × 3 sort in column 3 performed better, and column 4 has more negative mean return. Since this is a weekly return, we can see the value of the mean return is lower than their corresponding values in Table 5.16. We can therefore conclude from Tables 5.16 and 5.16 that the CMA factor performed best regarding the mean returns in 2017, 2018, and 2020. The bull market in this period might have helped generate that good performance, as the market increased from 7,000 points in 2017 to 8,700 by the end of 2020 but slightly dropped in 2019[41].

Table 5.17*: Periodic mean and standard deviation in percentages for the weekly returns of the investment factor (CMA)*

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	-0.1	2.3	0.2	1.5	-0.1	1.4	-0.1	1.1
2010	-0.1	1.1	-0.1	1.1	0.0	1.2	-0.1	1.0
2011	-0.1	1.0	0.0	0.8	0.0	1.1	0.1	0.8
2012	-0.1	1.6	-0.1	1.0	-0.2	1.2	-0.1	0.8
2013	0.0	1.1	0.0	0.8	0.0	1.0	-0.1	0.8
2014	-0.6	1.1	-0.5	0.8	-0.4	0.9	-0.3	0.6
2015	-0.2	1.7	0.2	1.2	-0.2	1.4	-0.1	1.1
2016	-0.2	1.3	-0.1	0.9	-0.1	0.9	-0.1	0.8
2017	0.2	1.3	0.1	0.9	0.1	1.1	0.1	0.8
2018	0.2	1.1	0.0	0.8	0.1	0.9	-0.1	0.7
2019	-0.2	1.2	-0.3	1.0	-0.2	1.0	-0.2	0.6
2020	0.2	1.4	0.1	1.0	0.3	1.1	0.2	0.8

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the weekly CMA factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the CMA factor annually from April 2009 to March 2021. The 2 × 3 sort excludes 40% of the stocks, and new IPOs are initially excluded.

41 https://www.saudiexchange.sa/

The overall results of Tables 5.15 to 5.17 confirm the significance of the inverse investment premium in the Saudi stock market. However, hypothesis 1.4 is rejected, as the investment premium is insignificant in the Saudi market. The literature presents much evidence that stocks with lower investment rates have an equity premium (see section 3.2.2.4). There are two major schools of thought that explain this premium. The rational school argues that high costs of capital lead to low investment due to low net present values and lower return and vice versa (Hou et al., 2014). On the other hand, the behavioural explanation suggests that it is mispricing because investors often overestimate the future potential of glamour stocks due to their impressive past growth, which leads to the stocks being overvalued (Lakonishok et al., 1994). Further, firms tend to seek external financing for investments when their stocks are overvalued, leading to a negative relationship between corporate financing/investments and future stock returns (Baker & Wurgler, 2002; Polk & Sapienza, 2008). However, neither explanation seems to fit the situation in the Saudi stock market. This study finds a premium in the inversed investment factor significantly greater than zero, which means that stocks with higher investment growth (growth stocks) generate higher returns.

5.8 Islamic premium (IMN)

This section investigates the significance of an equity premium in Islamic stocks. The literature suggests that Islamic stocks yield higher returns than their non-Islamic counterparts (see section 3.3.1). For this reason, I proposed and constructed an Islamic factor by following the cross-section of the stock return method. The Islamic factor is the mean return on Islamic stock portfolios minus the mean return on non-Islamic stock portfolios, which is the return differences between those portfolios. The Islamic factor is constructed in multiple ways by using two of sorts (2 × 3 and 2 × 2); two returns frequencies (weekly and monthly), and two weighting portfolio schemes (equal- and value-weighted). The significance of the premium means the return difference between Islamic and non-Islamic portfolios is significantly greater than zero. The t-test against the zero is employed to examine hypothesis H3:

- ***Hypothesis H3: <u>The Islamic factor has a significant premium on stock returns in the Saudi Stock market.</u>***

The summary statistics of the mean return for the Islamic factor are presented in Table 5.18, which covers all the methods used to construct the Islamic factor. Panel A represents the factors constructed by using value-weighted portfolios. As the table shows, the mean returns in columns 1 and 2 represent the factors constructed from monthly returns for the two different sorts, which have a negative sign. The standard deviation of the mean returns in both columns is relatively high, whereas the t-statistics in both columns are very low. This means the mean returns fluctuated during the year of the sample and are generally not significantly greater than zero. On the other hand, columns 3 and 4 show the result of the factors constructed using weekly returns, and the mean returns of both columns also have a negative sign. The standard deviation for both columns is also very high and has a low t value, which means the mean return is not significantly greater than zero.

Table 5.18: Summary statistics in percentages for the returns of the Islamic factor (IMN), April 2009-March 2021

	Monthly		**Weekly**	
	(1)	**(2)**	**(3)**	**(4)**
	2 × 3 Sort	**2 × 2 Sort**	**2 × 3 Sort**	**2 × 2 Sort**
Panel A:	**Value-weighted**			
Mean	-0.20	-0.25	-0.04	-0.05
Standard deviation	3.39	3.49	1.53	1.53
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(-0.72)	(-0.86)	(-0.66)	(-0.83)
p-value	0.76	0.80	0.74	0.79
Panel B:	**Equal-weighted**			
Mean	0.20	0.15	0.04	0.03
Standard deviation	3.14	3.12	1.46	1.44
t-statistics (H_0: Mean =0, H_a: Mean> 0)	(0.76)	(0.58)	(0.76)	(0.59)
p-value	0.27	0.76	0.22	0.28

Note: This table presents the summary statistics of the IMN factor during the entire sample period. The summary statistics include the mean return in percentages, standard deviation, one-sample t-test (t-statistics), and p-value. All listed stocks with available data are used to construct the 2 × 2 sort of IMN factor from April 2009 to March 2021. The 2 × 3 sort excludes mixed stocks, and new IPOs are initially excluded.

Panel B in Table 5.18 shows the summary statistics of the factors constructed using equal-weighted portfolios. Unlike the result from panel A, the mean return for all columns has a positive sign. This is due to the high exposure of large market capitalisation stocks with negative returns in value-weighted Islamic portfolios. On the other hand, in the equal-weighted portfolio settings, when the portfolio's return is calculated equally, this exposure disappears, and we have an overall positive return. However, the t-value of the mean return in all columns is still too small, and the standard deviation is high (although slightly lower than that of the value-weighted portfolios). We can also see that the spread between the maximum and minimum values of the mean return is larger in equal-weighted portfolios than value-weighted portfolios for all table columns. The overall result from Table 5.18 indicates that the returns on the Islamic stocks in the Saudi stock market are not significantly greater than zero; therefore, there is no premium on those stocks.

To further investigate the Islamic premium in the Saudi stock market, I calculated the periodic mean return and its standard deviation of the Islamic factor throughout the years of the sample. Table 5.19 represents the periodic mean return and standard deviation of the Islamic factor constructed using monthly returns. Columns 1 and 2 show the mean return for the factor constructed from the value-weighted portfolios of the two sorts used. In contrast, columns 3 and 4 show the result of the factors from equal-weighted portfolios. It is clear that the mean returns in columns 1 and 2 have more negative value throughout the years of the sample than columns 3 and 4 which represent the equal-weighted portfolios. This confirms the high exposure to the large market capitalisation in value-weighted portfolios of Islamic stocks. There was a positive mean return in only three years in the value-weighted portfolios, while the equal-weighted portfolios had only four years of negative mean return out of the 12 years of the sample. The standard deviation is mostly lower in the equal-weighted rather than the value-weighted portfolios. It’s also noticeable that the mean return is usually higher in the 2×2 sort than in the 2×2 sort. This means that the mixed stocks, which are considered Islamic in the 2×2 sort (see section 4.5.1.2), usually have a positive return.

Table 5.19*: Periodic mean and standard deviation in percentages for the monthly returns of the Islamic factor (IMN)*

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**	**M_t**	**SD_t**
2009	-0.2	4.5	0.6	5.8	0.0	5.6	0.5	6.1
2010	0.7	2.8	0.9	2.5	0.7	3.4	1.0	3.0
2011	-0.1	3.5	-0.4	3.6	0.9	3.2	0.3	3.4
2012	-0.5	4.4	-1.0	4.4	0.3	2.7	-0.3	2.9
2013	0.6	3.0	0.9	2.5	0.9	3.1	1.1	2.8
2014	-2.4	1.7	-2.2	2.1	-0.2	1.8	-0.1	2.0
2015	-0.2	4.0	0.0	4.0	0.0	3.8	0.2	3.5
2016	-0.3	3.3	-0.1	3.3	-0.7	3.4	-0.6	3.2
2017	-1.3	3.5	-1.6	3.5	-0.8	2.4	-1.1	2.1
2018	0.3	1.7	-0.3	1.9	0.2	1.9	-0.2	1.9
2019	1.3	3.3	0.9	3.2	1.3	1.6	1.1	1.6
2020	-0.3	3.9	-0.5	3.5	-0.1	3.5	0.0	3.0

Note: This table presents the annual mean return (M_t) in percentages of the year (*t*) for the monthly IMN factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the IMN factor annually from April 2009 to March 2021. The 2 × 3 sort excludes mixed stocks, and new IPOs are initially excluded.

Table 5.20 shows the periodic mean return and the standard deviation of the Islamic factor throughout the years of the sample by using weekly returns. Similar to Table 5.19, columns 1 and 2 represent the value-weighted portfolios of both sorts, while 3 and 4 display the results of the equal-weighted portfolios. The mean return on the equal-weighted portfolios has less negative mean return than their counterpart value-weighted results. However, the negative mean return is less pronounced in the weekly returns than the monthly returns represented in Table 5.19. Further, and unlike the result in Table 5.19, the mean return of the 2 × 2 sort is not always higher than the 2 × 3 sort in both weighting scheme portfolios. It is also apparent that the standard deviation does not vary between the two sorts. This could be attributed to the intervals in weekly returns not being large enough to capture variation in the mean returns.

Table 5.20: Periodic mean and standard deviation in percentages for the weekly returns of the Islamic factor (IMN)

	Value-weighted				Equal-weighted			
	(1) 2 × 3 sort		(2) 2 × 2 sort		(3) 2 × 3 sort		(4) 2 × 2 sort	
t	**M *t***	**SD *t***	**M *t***	**SD *t***	**M *t***	**SD *t***	**M *t***	**SD *t***
2009	0.0	2.0	0.1	2.2	0.0	2.5	0.1	2.5
2010	0.1	1.8	0.2	1.7	0.2	1.9	0.2	1.8
2011	0.0	1.3	-0.1	1.4	0.2	1.5	0.0	1.6
2012	-0.1	1.7	-0.2	1.8	0.1	1.3	0.0	1.3
2013	0.1	1.2	0.2	1.2	0.2	1.1	0.2	1.1
2014	-0.6	1.3	-0.5	1.5	0.0	1.2	0.0	1.2
2015	0.0	1.9	0.1	1.8	0.1	1.5	0.1	1.5
2016	-0.1	1.5	-0.1	1.4	-0.2	1.3	-0.2	1.3
2017	-0.2	1.3	-0.3	1.2	-0.1	1.2	-0.2	1.0
2018	0.0	0.9	-0.1	0.8	0.0	0.9	-0.1	0.9
2019	0.3	1.6	0.2	1.5	0.3	1.3	0.3	1.3
2020	-0.1	1.5	-0.1	1.4	0.0	1.3	0.0	1.3

Note: This table presents the annual mean return (M_t) in percentages of the year (t) for the weekly IMN factor during the sample period and their standard deviation (SD_t). All listed stocks with available data are used to construct the 2 × 2 sort of the IMN factor annually from April 2009 to March 2021. The 2 × 3 sort excludes mixed stocks, and new IPOs are initially excluded.

In conclusion, the results from Tables 5.18 to 5.20 confirm that the Islamic factor does not have any premium in the stock market of Saudi Arabia. This conclusion is reached from the results of all different weighting schemes, returns frequencies and sorting types. The cross-section of stock returns on Islamic stocks is too small and not greater than zero in all portfolios formed for this purpose. Additionally, the mean return of Islamic stocks always has a negative value, which means the inverse of Islamic stocks, the non-Islamic factor, has a positive return. However, the positive returns on non-Islamic stocks are still too small to be significantly greater than zero. Thus, there is no return pattern in the Islamic classification in the Saudi market. Although this is a surprising result, the previous evidence proves there is no significant premium in Islamic stocks.

This finding runs counter to the studies which suggest that Islamic stocks usually outperform non-Islamic stocks (although some studies have suggested otherwise, see section 3.3.2).

Specifically, Merdad et al. (2015) construct a 'Islamic risk factor,' similar to the one constructed in this study. However, this factor is the difference in the mean return between conventional (non-Islamic) and Islamic portfolios, which is the opposite of the Islamic factor constructed in this study. They find this factor to be significantly greater than zero, and suggest that religious investors be wary of a 'negative Islamic effect.' The result of this study rejects the significance of their negative Islamic effect. This conflicting result might be due to the inclusion of the period before 2009 when the Saudi market was unstable and full of rumours (see section 2.3). The rejection of this negative Islamic effect is confirmed in the results of Tables 5.18 to 5.20. On the contrary, non-Islamic stocks have a positive return although it is not significantly greater than zero, which means there is no significant premium for Islamic or non-Islamic stocks.

The literature cites much evidence that Islamic stocks usually perform better than non-Islamic stocks, (see section 3.3.2). This literature motivated me to take the initiative to investigate the context of the cross-section of stock returns in the Saudi stock market and challenge Merdad et al. (2015) negative Islamic effect. However, the surprising result is that no significant premium or risk pattern is found based on the Islamic classification of stocks in the Saudi market.

This finding may be attributed to the limitations inherent in the Islamic classification sources, which is one of the main limitations of this study. It is an old practice in the Saudi stock market that the Saudi Arabian religious financial advisory classifies stocks into Islamic, mixed and non-Islamic. This is usually done by professional independent advisories, e.g., Almaqased (the source of Islamic classification in this study), Shariah committees in most banks or brokers in Saudi Arabia, and even by some individuals. All of these sources produce independent lists of Islamic, mixed and non-Islamic stocks every year, and there are usually some contradictions because some are stricter than others. For example, it appears that the banks' Shariah Committees are less strict than individual scholars. This difference in restriction is evidenced by the higher number of stocks classified as Islamic by the banks' Shariah Committees compared to individuals such as Dr. Muhammad S. Al-Osaimi, the owner of Almaqased.net. In 2022, Dr. Muhammad's list classified only 167 stocks as Islamic[42] out of the total listed

[42] Dr. Muhammad's list

stocks in the Saudi stock market, whereas the Shariah Committees of Alinma Bank classified 227 stocks as Islamic [43].

Initially, I wanted to follow these more flexible lists, however, a bank's Shariah Committee list is only available a couple of years back and so does not cover the entire period of this study. Many Islamic stocks in the less strict lists are classified as non-Islamic in the strict lists such as the one followed in this study. This list allocation might be the reason for the disappearance of the premium in the Islamic stocks, as many were allocated to non-Islamic stocks by the list applied in this study. With this caveat, this study confirms that there is no premium in Islamic stock returns, therefore, hypothesis H3 is rejected.

The discussion of the factor premiums is now complete, and the following section concludes the chapter by highlighting the most important findings.

5.9 Conclusion

This chapter addresses two main hypotheses of this study: H1 and H3, which investigate the factor premiums in the Saudi stock market. The main objective of these hypotheses is to determine the significance of those factors on equity premiums. The factors in hypothesis H1 are size, value, profitability and investment factors, while hypothesis H3 is concerned with the significance of the Islamic factor to the premium. A t-test was applied to test that those factors are significantly greater than zero.

The study used two return frequencies, two portfolio weighting schemes and two different sorts to construct each factor. These different construction methods produced eight versions for each factor to achieve robustness and consistency checks for the analysis. The results of this empirical analysis have delivered conflicting results with the literature and brought new evidence to light. They are summarised below:

- **The size premium** (SMB) is insignificant in all versions used to form the SMB. This means the return on small market capitalisation stocks is not significantly greater than zero in the Saudi market. This lack of significance may stem from the documented variability of the size premium, which has shown periods of disappearance and resurgence in literature (Blitz

[43] Alinma List 2022

& Hanauer, 2020; Esakia et al., 2019; Van Dijk, 2011). The literature has documented the disappearance of the size premium from the late 80s and its recent reappearance. Additionally, herding behaviour towards trading in larger market capitalisation stocks may contribute to the absence of the size premium in the Saudi market.

- **The value premium,** denoting the premium in the returns of value stocks with a high B/M ratio over the return of growth stocks with a low B/M ratio, is confirmed by this study to be notably significant. Remarkably, the value premium is the only factor in the study to exhibit a significant premium across all eight methods employed to construct the factor. The robust consistency of the findings underscores the substantial compensation and consistently higher returns observed among stocks with elevated B/M ratios in the Saudi market. This phenomenon underscores the enduring appeal and potential profitability associated with value investment strategies within the dynamic context of the Saudi stock market.
- **The profitability premium,** the mean return on the robust stocks with high profitability minus the weak stocks with low profitability stocks in the Saudi stock market, is not found to be significantly greater than zero, indicating the absence of a significant profitability premium. The literature documents that the coexistence of value and profitability premiums is problematic (Kogan et al., 2022), although this coexistence is confirmed in other studies (Hackbarth & Johnson, 2015). Therefore, a strong and consistent value premium in the Saudi stock market documented in this study might be why the profitability premium is insignificant; however, this is not confirmed. This study can only confirm that the profitability premium is insignificant in the market. Further discussions about the reason for insignificant profitability premiums and the coexistence of value and profitability premiums can be found in the profitability premium section.
- **The investment premium** investigated in this study, which is the return on low-investment (conservative) stocks minus the return on high-investment (aggressive) stocks, is found to be insignificant. However, the inverse of the investment factor in this study is significant, meaning the return on aggressive stocks over conservative stocks has a premium that is significantly greater than zero. The inverse factor's significance is more pronounced when the factor is constructed from equal-weighted portfolios. Although this is against many findings in the literature (Hou et al., 2014; Leite et al., 2018; Titman et al., 2004), the inverse of the investment premium has generated a significant equity premium in the Saudi market in the past 15 years.

- **The Islamic premium**, the mean return of the portfolios of Islamic stocks minus the mean return of non-Islamic stocks, is also insignificant in the Saudi stock market. Although some studies find that Islamic stocks have a risk pattern in some stock markets (Al-Awadhi et al., 2018; Ali et al., 2022; Merdad et al., 2015; Narayan et al., 2017; Zaremba et al., 2020), this study can confirm that the Islamic classification in the Saudi stock market has no pattern. However, this study suggests that using different allocations or less strict Islamic classification of stocks than the one used in this study might produce different results. This study uses one of the strictest lists in the Saudi market due to the unavailability of other less stringent lists.

Although this study found most of the factor premiums insignificant, McLean and Pontiff (2016) suggest that most factor premiums disappear after being discovered in the literature. They say that the average factor premium experiences a significant 58% decline, attributed to both statistical biases and the influence of sophisticated traders on stock prices. Combined with the estimated statistical bias suggests there is a publication effect of approximately 32%. Their findings provide evidence that some or all of the initial cross-sectional factors are likely due to mispricing and shifts in correlations with other premiums before and after publication.

The factor premiums are well-documented, significant, and pronounced in many major and developed markets, such as the US stock markets. The US market is very large and has many different types of securities, and investors are more sophisticated than traders in smaller markets. On the other hand, a small market compared to the US market, such as the Saudi stock market, might not have all the factor premiums the US market has. However, I can confirm that stocks with higher B/M ratios have a significant premium in the Saudi market, and those with high investment (aggressive) stocks also have a significant premium. Further, Foye (2018a) investigates some of the factor premiums in smaller markets, and some were found to be insignificant in some globally emerging markets. In conclusion, finding a significant factor premium in one market does not necessarily mean it is significant in other markets.

In the next chapter, all the factor premiums will be employed in the multiple asset pricing models to see whether they can explain the variation in the cross-section of stock returns in the Saudi market.

Chapter 6: Asset pricing models

6.1 Introduction

This chapter will first present and discuss the returns of left-hand-side (LHS) portfolios that are formed from the intersection of MC and one other firm characteristic, such as B/M ratio, profitability, investment, and Islamic classification. For instance, an intersection of big MC and high B/M ratio stocks means this portfolio has stocks that fall simultaneously in both categories (see section 4.5.2).

Section 6.3 will examine hypotheses H2 and H4 using Gibbons et al. (1989) GRS portfolio efficiency test of the joint zero intercepts on each group of nine portfolios produced from each intersection. After examining the hypotheses, Section 6.4 will discuss the regression details for the asset pricing models for each portfolio. This section focuses on the individual intercepts of those models, providing meaningful insights that complement the results obtained from the GRS test. Given that the GRS test in the prior section examines a group of intercepts, looking into individual intercepts offers further insights into the conclusions drawn from the GRS test results. The concluding remarks are presented in Section 6.5.

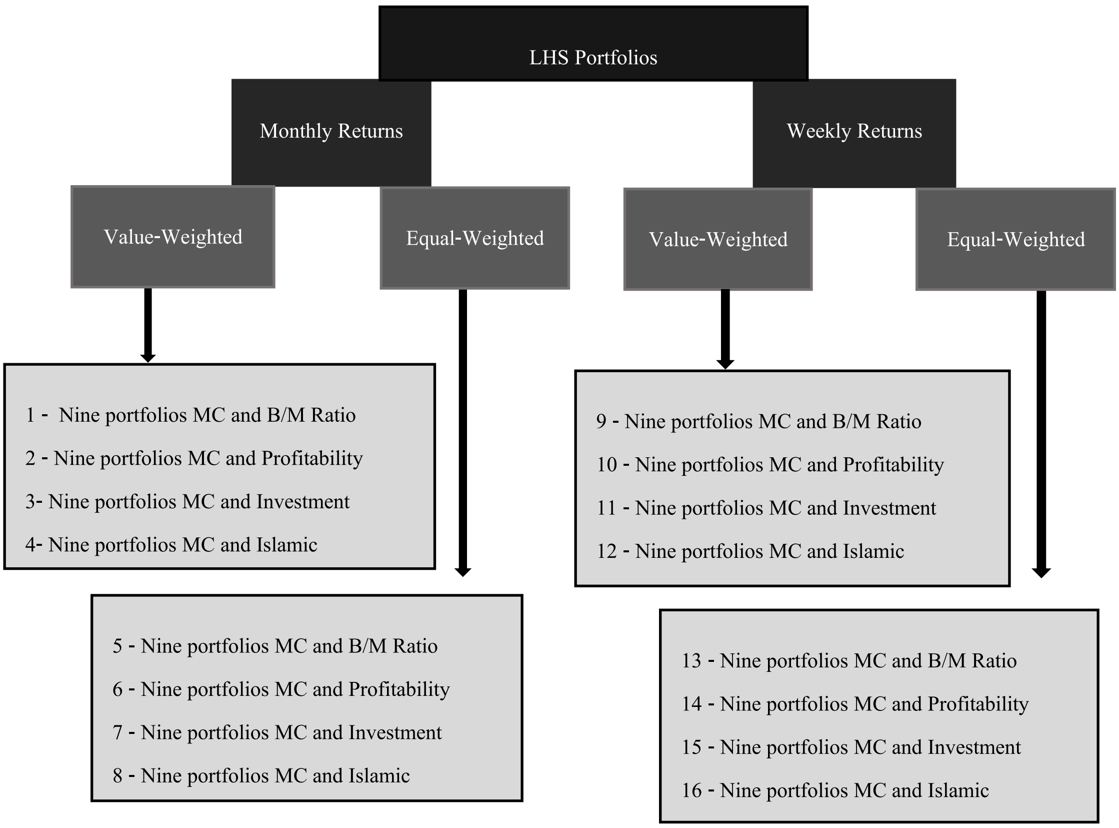
The factor premiums discussed and analysed in the previous chapter are used as the right-hand-side (RHS) factors representing the independent variables in the asset pricing models examined in this chapter. Those factors (size, value, profitability, investment, and Islamic premiums) are employed to explain the return of the left-hand-side (LHS) portfolios used as dependent variables. The hypotheses to be examined are H2 and H4:

- ***Hypothesis H2: Fama and French's (2015) five-factor asset pricing model can better describe the variation in the cross-section of average returns than Fama and French's (2012) three-factor asset pricing model.***
- ***Hypothesis H4: Adding the Islamic factor to the three- and/or five-factor models will improve the models' ability to describe the variation in the cross-section of average returns in the Saudi stock market.***

These hypotheses will be assessed to determine which model best describes the variation in the cross-section of stock returns in the Saudi stock market. Thus, I will examine multiple asset pricing models with different sets of RHS factors to estimate the returns of those LHS portfolios and to examine the hypotheses. The base model is Fama and French (1993, 1995) three-factor model (FF3FM), which includes the size and value factors, including excess market return. Then I will employ Fama and French (2015) five-factor model (FF5FM), which is augmented by profitability and investment factors, to examine whether these additional factors will improve FF3FM's ability to describe the variation in the LHS portfolios. Finally, I will add the Islamic factor to FF3FM and FF5FM to produce models 4FM and 6FM, to examine whether this new additional factor improves the models' explanatory power.

The asset pricing model that describes the variation in the cross-section of stock returns is the one that has a zero intercept (see section 4.6.4). Still, we need to examine this hypothesis for each model on a group of different portfolios to determine the models' performance. Hence, the GRS test, which has the ability to test the zero-intercept hypothesis for a group of portfolios, will be applied to each intersection's nine LHS portfolios.

Figure 6.1: 16 sets of portfolios



There are four intersections of MC and one of the other four firm characteristics mentioned above, which means we have four sets of nine LHS portfolios. However, the four sets of LHS portfolios were formed in multiple ways using two return frequencies (monthly and weekly) and two weighting schemes (value- and equal-weighted). This means there are four sets formed four times using different methods. Therefore, there are 16 sets of portfolios, as Figure 6.1 shows. Each method of forming portfolios produces four sets of different nine LHS portfolios. The GRS test is conducted on each group of the nine portfolios using their counterpart four sets of RHS factors.

Furthermore, we have four sets of RHS factors, each representing one of the asset pricing models employed in this study: FF3FM, FF5FM, 4FM, and 6FM. I will examine each model with the 16 sets of nine portfolios shown in Figure 6.1, which results in 64 GRS tests. Additionally, there are two versions of the RHS factors formed using two different sorts, 2 × 3 and 2 × 2, and the models are examined using both sorts. This gives a total of 128 GRS tests to find the best model among those versions of the RHS factors and LHS portfolios. The next section presents and discusses the returns of LHS portfolios that we aim to estimate and explain using the asset pricing models.

6.2 The returns of the left-hand-side (LHS) portfolios

The LHS portfolios are the dependent variables that the procedure aims to explain using the asset pricing models. In this section, the mean return of the LHS portfolios formed from all the intersections mentioned above, using monthly/weekly returns and value/equal weighted portfolios, is presented and discussed. The monthly average returns of the portfolios are presented in Table 6.1. This table has four panels for each of the nine portfolios formed from the intersection of MC and one other firm characteristic.

Panel A in Table 6.1 shows the average monthly excess returns (one-month SAMA treasury bill rate) for nine (value- and equal-weighted) portfolios from the intersection of independent sorts of stocks into three MC groups (small, medium, and big) and three B/M ratio groups (high, medium, and low). The average return of those portfolios in panel A is typically higher in the top row than the bottom one, except in the first column. This means the returns of small stocks are consistently higher than those of big stocks, which could be explained as a size effect. However, the size effect is not strong and persistent, as the mean return should always decrease as we move from the top (small stocks) to the bottom (big stocks). The problem always occurs with medium size stocks, as sometimes the mean returns are higher than the small stocks (like in the first column) or lower than big stocks, especially in the high B/M ratio portfolios. The average return also increases in the same row from left to right as the B/M ratio rises (the value effect).

Table 6.1*:* Average monthly excess returns for portfolios formed on MC and one other factor (B/M, profitability, investment, and Islamic), April 2009-March 2021

		Value-weighted			Equal-weighted		
		Mean %			**Mean %**		
Panel A: MC-B/M portfolios							
B/M →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	0.89	1.31	1.18	0.19	0.73	0.82
MC →	Medium	1.00	0.52	0. 81	0.04	0.08	0.36
	Big	0.52	0.33	1.18	0.23	-0.04	0.70
Panel B: MC-profitability portfolios							
Profitability →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	1.01	1.30	1.17	0.29	0.72	1.02
MC →	Medium	1.45	0.69	0.58	0.12	0.24	0.14
	Big	0.71	0.84	0.56	0.32	0.49	0.18
Panel C: MC-investment portfolios							
Investment →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	1.18	1.26	0.10	0.48	0.66	0.44
MC →	Medium	0.71	0.69	1.00	0.00	0.20	0.33
	Big	0.42	0.70	0.70	0.08	0.18	0. 52
Panel D: MC-Islamic portfolios							
Islamic →		**Islamic**	**Mixed**	**None**	**Islamic**	**Mixed**	**None**
	Small	1.24	1.02	1.01	0.75	0.70	0.23
MC →	Medium	0.73	0.53	1.39	0.28	0.15	0.09
	Big	0.68	0.66	0.52	0.29	0.35	0.20

Note: This table represents the monthly returns in percentages for the nine LHS portfolios formed from the intersection between MC and B/M, profitability, investment or Islamic classification. At the end of March every year, stocks are allocated independently into 3 MC groups, 3 B/M groups, 3 profitability groups, and 3 investment groups using 3 equal quantiles. The intersections between the MC groups and one of the other groups produce 9 (MC-B/M) portfolios in panel A, 9 (MC-Profitability) portfolios in panel B, and 9 (MC-Investment) portfolios in panel C. In panel D, the portfolios formed on (MC-Islamic) follow the same procedure for the MC sort, but in the second sort, all listed stocks come sorted into Islamic groups from Almaqased.com.

Panel B in Table 6.1 shows the average monthly excess returns for the nine portfolios formed from MC and profitability. Similar to panel A, small stocks mostly have higher returns than big stocks, and we can see a sort of size effect, but medium stocks are always problematic. There is no consistency in the level of average returns based on profitability from low to high or vice versa. Further, panel C in Table 6.1 displays the returns of the nine portfolios formed from MC and investment. The size effect does not clearly appear, and the small stocks do not always have higher returns, especially in the high investment portfolios. Finally, panel D in Table 6.1 shows the average returns of portfolios formed from MC and Islamic classifications. The average return of small stocks is higher than big stocks, but medium stocks are always tricky. Sometimes, they have returns that are higher than small or lower than big stocks.

On the other hand, Table 6.2 shows the average weekly excess returns of the nine portfolios formed from different intersections, as the panels indicate, including value- and equal-weighted portfolios. The general observations about the size and value effect in Table 6.1 also apply here. The size effect is inconsistent, and medium stocks are always tricky, but small stocks generally have higher returns than larger ones. To an extent, this is not surprising as the results from the previous chapter indicate that the size premium is insignificant. The value effect is also unclear, since the average returns in panel A in Table 6.2 do not follow a consistent order from the right to the left of each row. Panel A in both Tables 6.1 and 6.2 shows that the average return in high B/M portfolios is mostly higher than in low B/M portfolios. Still, medium stocks are generally lower than low stocks, which seems to contradict the value effect. Thus, I conclude that the value effect isn't clearly shown in these LHS portfolios. Even for the portfolios formed from other intersections (profitability, investment, and Islamic), there is no specific order that the returns follow from right to left in the portfolio matrix.

Table 6.2: Average weekly excess returns for portfolios formed on MC and one other factor (B/M, profitability, investment, and Islamic), April 2009-March 2021

		Value-weighted			Equal-weighted		
			Mean			Mean	
Panel A: MC-B/M portfolios							
B/M →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	0.20	0.31	0.27	0.04	0.17	0.18
MC →	Medium	0.23	0.13	0.18	0.01	0.02	0.09
	Big	0.12	0.08	0.28	0.05	-0.00	0.17
Panel B: MC-profitability portfolios							
Profitability →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	0.22	0.28	0.31	0.07	0.16	0.23
MC →	Medium	0.33	0.17	0.14	0.04	0.06	0.03
	Big	0.17	0.20	0.14	0.07	0.12	0.04
Panel C: MC-investment portfolios							
Investment →		**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
	Small	0.26	0.28	0.24	0.11	0.14	0.11
MC →	Medium	0.15	0.17	0.24	-0.00	0.06	0.08
	Big	0.10	0.16	0.17	0.02	0.04	0.12
Panel D: MC-Islamic portfolios							
Islamic →		**Islamic**	**Mixed**	**None**	**Islamic**	**Mixed**	**None**
	Small	0.28	0.26	0.22	0.17	0.17	0.05
MC →	Medium	0.18	0.13	0.28	0.06	0.04	0.02
	Big	0.16	0.15	0.13	0.07	0.08	0.05

Note: This table represents the weekly returns in percentages for the nine LHS portfolios formed from the intersection between MC and B/M, profitability, investment or Islamic classification. At the end of March every year, stocks are allocated independently into 3 MC groups, 3 B/M groups, 3 profitability groups, and 3 investment groups using 3 equal quantiles. The intersections between the MC groups and one of the other groups produce 9 (MC-B/M) portfolios in panel A, 9 (MC-Profitability) portfolios in panel B, and 9 (MC-Investment) portfolios in panel C. In panel D, the portfolios formed on (MC-Islamic) follow the same procedure for the MC sort, but in the second sort, all listed stocks come sorted into Islamic groups from Almaqased.com and do not follow the quantiles sort.

In conclusion, the returns of those portfolios do not follow a specific order. However, small MC and high B/M ratio stocks usually exhibit higher returns. Furthermore, the average returns within these portfolios are consistently higher in the value-weighted portfolios than their equal-weighted counterparts. This disparity may come from the higher exposure of larger stocks in the value-weighted portfolio, which tend to yield higher returns than smaller stocks. Also, the underperformance of smaller stocks is less pronounced in the value-weighted portfolios than the equal-weighted ones. The observations from the returns of the LHS portfolios in Tables 6.1 and 6.2, which are the dependent variables in the asset pricing models, are crucial for the GRS test to assess those models' performance related to hypotheses H2 and H4 in the following section.

6.3 The GRS test for portfolio efficiency to compare asset pricing models

This section covers the GRS tests of portfolio efficiency for all asset pricing models examined in this study to evaluate their ability to explain the variation in the returns of the LHS portfolios discussed in the preceding section. The zero intercept hypothesis for a set of portfolios is examined jointly. This means that the GRS is conducted on a different set of nine portfolios using various weighting schemes and return frequencies for each asset pricing model. The section has four sub-sections that discuss the results of the GRS test using (i) monthly return and value-weighted portfolios; (ii) monthly return and equal-weighted portfolios; (iii) weekly return value-weighted portfolios, and (iv) weekly return and equal-weighted portfolios.

6.3.1 Monthly returns and value-weighted portfolios

The monthly return and value-weighted portfolios are represented in Table 6.3, with each panel representing a set of nine LHS portfolios. Panel A shows the result of the set of portfolios from the intersection between the MC and B/M ratio. The p-value for all asset pricing models is insignificant in the 2 × 3 sort and significant in the 2 × 2 sort except in the 4FM. Therefore, a null hypothesis of joint zero intercepts for all the tests with an insignificant p-value cannot be rejected. This means that models with insignificant p-values can describe the variation in the cross-section of stock returns in the Saudi stock market. However, it is imperative to establish which model is the best compared to other models in this panel for each sort. The best model is easy to identify in the 2 × 2 sort, 4FM, because it is the only model with an insignificant p-value. On the other hand, all the asset pricing models in the 2 × 3 sort have an insignificant p-value, meaning they all can describe the returns in those portfolios. In this case, the best model is the model with the lowest GRS F-statistics, which is FF5FM.

Table 6.3: The GRS test for portfolio efficiency to compare models (monthly value-weighted)

	2 × 3 sort			2 × 2 sort		
	GRS (F-statistic)	**A|αᵢ|**	**p(GRS)**	**GRS (F-statistic)**	**A|αᵢ|**	**p(GRS)**
Panel A: MC & B/M ratio						
(FF3FM)	1.39	0.0020	0.1991	2.02	0.0022	0.0413
(FF5FM)	***1.16***	***0.0019***	***0.3238***	2.21	0.0025	0.0255
(4FM)	1.39	0.0020	0.2016	***1.90***	***0.0022***	***0.0574***
(6FM)	1.17	0.0019	0.3219	1.98	0.0023	0.0464
Panel B: MC & profitability						
(FF3FM)	0.40	0.0016	0.9318	0.62	0.0014	0.7769
(FF5FM)	***0.32***	***0.0013***	***0.9669***	0.72	0.0017	0.6879
(4FM)	0.41	0.0015	0.9257	***0.53***	***0.0013***	***0.8500***
(6FM)	0.34	0.0012	0.9609	0.55	0.0013	0.8338
Panel C: MC & investment						
(FF3FM)	0.48	0.0015	0.8850	0.52	0.0015	0.8538
(FF5FM)	***0.30***	***0.0011***	***0.9724***	0.52	0.0015	0.8538
(4FM)	0.49	0.0014	0.8757	0.60	0.0017	0.7981
(6FM)	0.30	0.0011	0.9726	***0.43***	***0.0015***	***0.9181***
Panel D: MC & Islamic						
(FF3FM)	0.93	0.0015	0.5005	***1.07***	***0.0016***	***0.3893***
(FF5FM)	***0.79***	***0.0014***	***0.6209***	1.14	0.0021	0.3399
(4FM)	1.15	0.0015	0.3327	1.29	0.0015	0.2480
(6FM)	1.00	0.0014	0.4457	1.20	0.0014	0.2984

Note: The italicised, bolded, and underlined values indicate the best model in each panel for each sort. The table shows the portfolio efficiency GRS test using monthly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table reports (a) GRS F-statistics, testing whether the expected values of all nine intercepts estimated are jointly zero under the following null hypothesis: [$H_0 : \alpha_i = 0$], (b) A|αi|, the mean absolute alpha, (c) p(GRS), the GRS F-statistics p-value, the null is rejected at 5%.

Panel B in Table 6.3 shows the result of the GRS test for the set of nine LHS portfolios from the intersection between MC and profitability. The p-value in this panel is insignificant for the asset pricing model in both sorts, which means the null hypothesis of zero intercepts for this group of portfolios cannot be rejected. This indicates that all the models can describe the variation in the cross-section of returns on this set of portfolios. Since the aim is to find the best model among all those models, I must choose the model with the lowest GRS F-statistics value and mean absolute alpha, which means the intercepts in this model are indistinguishable from zero (Fama & French, 2015). In this case, the best models for the 2 × 3 and 2 × 2 sorts are FF5FM and 4FM, respectively, which is similar to the previous result from panel A.

Panel C shows the GRS test result for the portfolio formed from the intersection between MC and investment. The panel shows that all the p-values are insignificant for all asset pricing models. In this case, the null hypothesis of zero intercepts for this set of portfolios using all the asset pricing models cannot be rejected, which is similar to panel B. Also, identical to the last panel, all the models can describe the variation in those portfolios. However, this panel has different results regarding the best model that describes the variation in the Saudi stock market's cross-section returns. In the case of the 2 × 2 sort, the best model is the 6FM that augments the FF5FM with the Islamic factor. In the 2 × 3 sort, the FF5FM and 6FM models have the same explanatory power.

Lastly, panel D represents the GRS test for the portfolios formed from the intersection between MC and Islamic. In this panel, all the asset pricing models have an insignificant p-value, which means they all have the power to explain the variation in the cross-section of stock returns in the Saudi stock market. Since part of this set of portfolios used Islamic classification, the expectation was that one of the models augmented by Islamic factors would have the best explanatory power. However, this is not the case, and unlike other panels in this table, the best model is the FF3FM in the 2 × 2 sort. On the other hand, FF5FM is the best model for the 2 × 3 sort, which is similar to the other panels.

In conclusion, the model that can best describe the variation in the cross-section of stock returns using monthly returns and value-weighted portfolios is the FF5FM in all panels of this table for the 2 × 3 sort. Although the 6FM in some panels has almost the same value as the GRS test and mean absolute intercept for the FF5FM, the 6FM does not offer any improvements. Therefore, hypothesis H2 cannot be rejected, which means that FF5FM is an improvement over FF3FM in the Saudi stock market. The results also mean that hypothesis H4 is rejected in the 2 × 3 sort, as the Islamic factor in 4FM and 6FM does not improve the explanatory power of either FF3FM or FF5FM (the GRS test is always higher or the same in the models with Islamic factor).

On the other hand, the 2 × 2 sort has a different result, in which hypothesis H2 is rejected, as FF5FM always has higher GRS F-statistics and mean absolute alpha than FF3FM. However, in this sort, hypothesis H4 cannot be rejected, except for the set of portfolios formed from the intersection between MC and Islamic in the last panel. In panels A and B, both 4FM and 6FM have a GRS value lower than FF3FM and FF5FM respectively, which means the Islamic factor improves the explanatory power of the Fama and French models.

In panel C, hypothesis H4 is confirmed only for 6FM, as its value is lower than FF5FM, which means 6FM can better describe the variation in the cross-section of average returns in the Saudi stock market. Finally, both hypotheses H2 and H4 are rejected in panel D, as the best model in this panel is FF3FM.

The following subsection covers the GRS tests for the portfolios similarly formed using monthly returns, but with equal-weighted portfolios instead of value-weighted ones.

6.3.2 Monthly returns and equal-weighted portfolios

This subsection shows the results of the GRS F-statistics and the mean absolute intercept for the set of portfolios formed using monthly returns and equal-weighted portfolios. Table 6.4 displays the GRS results in four panels for each set of nine portfolios and asset pricing models. Panel A shows the result for the portfolios formed from the intersection between the MC and B/M ratio. In this panel, the joint zero intercepts hypothesis is rejected in FF5FM and 6FM, as the p-value is significant for both models' GRS tests for both sorts. FF3FM best describes the variation in both sorts, as the GRS test has the lowest value. This means FF5FM does not offer any improvement to FF3FM, and similarly, adding the Islamic factor to both FF3FM and FF5FM does not improve these models' explanatory power. Therefore, hypotheses H2 and H4 are rejected.

The result from panel B represents the set of portfolios formed from the intersection between MC and profitability. In this panel, the zero intercept hypothesis for this group of portfolios is not rejected, because the p-value is insignificant for all the asset pricing models, meaning that all the models can fully describe the variation in the average return in those portfolios. However, the best model is the one with the lowest GRS F-statistics value, which is FF5FM for the 2 × 3 sort. On the other hand, the best model for the 2 × 2 sort is 6FM, which means that the Islamic factor improves the ability of FF5FM to describe the average returns in those portfolios.

Table 6.4: The GRS test for portfolio efficiency to compare between models (monthly equal-weighted)

	2 × 3 Sort			2 × 2 Sort		
	GRS (F-statistic)	A|αi|	p(GRS)	GRS (F-statistic)	A|αi|	p(GRS)
Panel A: MC & B/M ratio						
(FF3FM)	***<u>1.64</u>***	***<u>0.0020</u>***	***<u>0.1086</u>***	***<u>1.51</u>***	***<u>0.0019</u>***	***<u>0.1494</u>***
(FF5FM)	2.01	0.0024	0.0431	2.10	0.0027	0.0337
(4FM)	1.85	0.0023	0.0653	1.58	0.0020	0.1270
(6FM)	2.19	0.0025	0.0264	2.11	0.0029	0.0344
Panel B: MC & profitability						
(FF3FM)	0.80	0.0020	0.6165	1.06	0.0022	0.3932
(FF5FM)	***<u>0.55</u>***	***<u>0.0019</u>***	***<u>0.8309</u>***	0.86	0.0022	0.5657
(4FM)	1.01	0.0023	0.4376	1.09	0.0022	0.3752
(6FM)	0.86	0.0022	0.5655	***<u>0.84</u>***	***<u>0.0021</u>***	***<u>0.5756</u>***
Panel C: MC & investment						
(FF3FM)	1.28	0.0021	0.2548	1.29	0.0021	0.2484
(FF5FM)	***<u>0.98</u>***	***<u>0.0018</u>***	***<u>0.4562</u>***	1.00	0.0020	0.4440
(4FM)	1.43	0.0024	0.1830	1.33	0.0022	0.2271
(6FM)	1.08	0.0020	0.3798	***<u>0.98</u>***	***<u>0.0019</u>***	***<u>0.4571</u>***
Panel D: MC & Islamic						
(FF3FM)	0.71	0.0014	0.7001	***<u>0.73</u>***	***<u>0.0013</u>***	***<u>0.6838</u>***
(FF5FM)	1.03	0.0017	0.4220	1.64	0.0021	0.1116
(4FM)	***<u>0.65</u>***	***<u>0.0014</u>***	***<u>0.7507</u>***	0.81	0.0013	0.6036
(6FM)	1.01	0.0019	0.4352	1.70	0.0020	0.0947

Note: The italicised, bolded, and underlined values indicate the best model in each panel for each sort. The table shows the portfolio efficiency GRS test using monthly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C) and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table reports (a) GRS F-statistics, testing whether the expected values of all nine intercepts estimated are jointly zero under the following null hypothesis: [$H_0 : \alpha_i = 0$], (b) A|αi|, the mean absolute alpha, (c) p(GRS), the GRS F-statistics p-value, the null is rejected at 5%.

Panel C represents the results for the set of portfolios from the intersection between MC and investment. In this panel, we can see that the p-value is insignificant in all the GRS tests, which means all the models can describe the variation in the cross-section of return in those portfolios. This panel has the same result as Panel B. This means that FF5FM has the best explanatory power in the 2 × 3 sort, and 6FM is the best among the models in the 2 × 2 sort. We can also see that FF5FM has a GRS value (1.00) that is very close to the 6FM GRS value (0.98), which means the improvement to the model is not huge.

Finally, panel D shows the result of the GRS test for the set of portfolios formed from the intersection between MC and Islamic classification. The result in this panel also indicates that the joint zero intercepts hypothesis cannot be rejected, as the p-value is insignificant for all the GRS tests conducted. However, the model that can best describe the variation in those portfolios is 4FM in the 2 × 2 sort. Although FF3FM and 4FM have the same mean absolute alpha, 4FM has the lowest GRS F-statistics and has better explanatory power. On the other hand, FF3FM has the best explanatory power among the models examined in the 2 × 3 sort.

To sum up, the results of the GRS tests using monthly returns and equal-weighted portfolios indicate that this study cannot reject hypothesis H2 in panels B and C for both 2 × 3 and 2 × 2 sorts, because the GRS F-statistics for FF5FM are always lower than for FF3FM. However, this hypothesis was rejected in the other panels for both sorts.

Hypothesis H4 in panel D of the 2 × 3 sort cannot be rejected. 4FM and 6FM, in this case, have a GRS value lower than FF3FM and FF5FM, respectively. This means these models, augmented by the Islamic factor, have better explanatory power than Fama and French's models in the cross-section of stock returns in the Saudi stock market. Moreover, hypothesis H4 cannot be rejected in the 2 × 2 sort on panels B and C, as 6FM always has a lower GRS value than FF5FM. Therefore, it has better explanatory power than the other models. However, hypothesis H4 for this sort is rejected in panels A and D. In other words, adding the Islamic factor to FF3FM and FF5FM does not improve these models' explanatory power.

The following subsection discusses the results of the GRS tests for portfolios formed using weekly returns and value-weighted portfolios.

6.3.3 Weekly returns and value-weighted portfolios

The monthly returns were used to form LHS portfolios to examine asset pricing models' performance in the previous two subsections. This and the following subsection use weekly returns for the same purposes. This subsection discusses the GRS tests for a set of portfolios formed using weekly and value-weighted returns. They are shown in Table 6.5, which includes the two sorts, 2 × 3 and 2 × 2. In this table, panel A shows the result of the portfolios formed from the intersection between the MC and B/M ratio. The joint zero intercepts hypothesis was not rejected for this set of portfolios in the 2 × 3 sort. The p-value in all asset pricing models of this sort is greater than the 5% critical value. This means that all models have a significant explanatory power in the cross-section of stock returns in the Saudi stock market. The best model among these models is FF5FM, because it has the lowest GRS F-statistics.

On the other hand, we can reject the zero intercept hypothesis for the group of portfolios in the 2 × 2 sort using all asset pricing models except for the 4FM model. The p-value for the 4FM is greater than 5%, which means it is the only model that can describe the variation in the average returns of those portfolios in Panel A. Therefore, the best model that can describe the variation in the cross-section of stock returns in the 2 × 2 sort is 4FM.

Panel B shows the result of the portfolios formed from the intersection between the MC and profitability. The p-value in this panel is greater than the critical value of 5%, so the null hypothesis of joint zero intercepts for this set of portfolios in both sorts is not rejected. This means all the models can explain the variation in the cross-section of stock return in the Saudi stock market. However, the best model in the 2 × 3 sort is FF5FM, where the GRS test value is lowest, which means this model performs better than other models. On the other hand, the best model in the 2 × 2 sort is 4FM, as this model has the lowest GRS F-statistics, which means this model has better explanatory power than other models.

The result of the GRS tests for the set of portfolios formed from the intersection between MC and investment is displayed in panel C. Similar to the result in panel B, the null hypothesis of the joint zero intercepts for all the tests conducted in this panel is not rejected. The p-value for all tests is higher than the critical value of 5%, implying that all the models in this panel can explain the cross-section of stock returns on this set of portfolios. Since all the models have explanatory power, we have to look at the best model with the lowest GRS F-statistics value. In this case, the best model in the 2 × 3 sort is FF5FM and 6FM is the best in the 2 × 2 sort.

Table 6.5: The GRS test for portfolio efficiency to compare between models (weekly value-weighted)

	2 × 3 sort			2 × 2 sort		
	GRS (F-statistic)	**A|αᵢ|**	**p(GRS)**	**GRS (F-statistic)**	**A|αᵢ|**	**p(GRS)**
Panel A: MC & B/M ratio						
(FF3FM)	1.41	0.0005	0.1798	1.95	0.0005	0.0432
(FF5FM)	***<u>1.25</u>***	***<u>0.0005</u>***	***<u>0.2622</u>***	2.07	0.0005	0.0298
(4FM)	1.41	0.0005	0.1788	***<u>1.89</u>***	***<u>0.0005</u>***	***<u>0.0501</u>***
(6FM)	1.26	0.0005	0.2564	2.02	0.0003	0.0343
Panel B: MC & profitability						
(FF3FM)	0.52	0.0004	0.8634	0.59	0.0004	0.8014
(FF5FM)	***<u>0.49</u>***	***<u>0.0004</u>***	***<u>0.8809</u>***	0.74	0.0004	0.6668
(4FM)	0.54	0.0004	0.8435	***<u>0.53</u>***	***<u>0.0004</u>***	***<u>0.8520</u>***
(6FM)	0.51	0.0004	0.8644	0.68	0.0004	0.7287
Panel C: MC & investment						
(FF3FM)	0.73	0.0004	0.6785	0.82	0.0004	0.5943
(FF5FM)	***<u>0.33</u>***	***<u>0.0003</u>***	***<u>0.9651</u>***	0.57	0.0004	0.8238
(4FM)	0.73	0.0004	0.6812	0.80	0.0004	0.6145
(6FM)	0.33	0.0003	0.9635	***<u>0.52</u>***	***<u>0.0004</u>***	***<u>0.8567</u>***
Panel D: MC & Islamic						
(FF3FM)	0.80	0.0003	0.6128	0.81	0.0003	0.6052
(FF5FM)	***<u>0.69</u>***	***<u>0.0003</u>***	***<u>0.7167</u>***	***<u>0.71</u>***	***<u>0.0004</u>***	***<u>0.6993</u>***
(4FM)	1.11	0.0003	0.3559	1.19	0.0003	0.2954
(6FM)	1.03	0.0003	0.4123	1.14	0.0003	0.3334

Note: The italicised, bolded, and underlined values indicate the best model in each panel for each sort. The table shows the portfolio efficiency GRS test using weekly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C) and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table reports (a) GRS F-statistics, testing whether the expected value of all nine intercepts estimated are jointly zero under the following null hypothesis: [$H_0 : \alpha_i = 0$], (b) A|αi|, the mean absolute alpha, (c) p(GRS), the GRS F-statistics p-value, the null is rejected at 5%.

Finally, the last panel in this table, panel D, represents the result of the GRS test for portfolios formed using MC and Islamic classification. The results indicate that the null hypothesis of the zero intercepts for this set of portfolios is not rejected, as the p-value is higher than 5% in both sorts. In this case, all the models can explain the cross-section of average returns in this panel; thus, we need to find the best model among them based on the lowest GRS F-statistics. Although the expectation was that 4FM or 6FM would emerge as the best model due to the portfolios' formation using Islamic classification, the best model is FF5FM in both sorts.

In summary, the outcomes of the GRS tests presented in Table 6.5 yield distinct results for hypotheses H2 and H4. First, this study cannot reject hypothesis H2 across all panels of the 2 × 3 sort and in panels C and D of the 2 × 2 sort. This is because of the consistently lower GRS F-statistics for FF5FM over FF3FM. Conversely, we can reject hypothesis H4 for all the panels in the 2 × 3 sort, as 4FM and 6FM always have higher GRS F-statistics than FF3FM and FF5FM, meaning the Islamic factor does not offer any improvements to those models. Hypothesis H4 is not rejected in the 2 × 2 sort for all panels except panel D. The GRS F-statistic value in those panels is lower in 4FM and 6FM than in FF3FM and FF5FM, respectively. However, this is not the case in panel D, where both models (FF3FM and FF5FM) have lower GRS values than 4FM and 6FM. Thus, this hypothesis is rejected, as the additional Islamic factor in 4FM and 6FM in panel D of 2 × 2 sort does not improve the models' ability to describe the variation in the cross-section of stock returns in the Saudi market.

The following subsection covers the GRS test result using weekly returns and equal-weighted portfolios.

6.3.4 Weekly returns and equal-weighted portfolios

This subsection is the last one that examines the GRS for the joint zero intercepts hypothesis for the set of portfolios using weekly and equal-weighted returns. Table 6.6 shows the result of the GRS tests for these sets of portfolios and has four panels for each intersection, similar to the previous tables in this section. Panel A shows the result for the set of portfolios from the intersection between the MC and B/M ratio. This panel indicates that the joint zero intercepts hypothesis for all asset pricing models in the 2 × 3 sort was not rejected, as the p-value is higher than 5%. On the other hand, this hypothesis is rejected in the 2 × 2 sort for FF5FM and 6FM, as their p-value is lower than the 5% critical value. However, in the two other models, this hypothesis is not rejected, as the p-value indicates. Therefore, all the models can describe the variation in the cross-section of stock returns except for FF5FM and 6FM in the 2 × 2 sort. Following the same procedure for choosing the best model among those models, since FF3FM has the lowest GRS F-statistics in the 2 × 3 sort, it is the best model within this sort. Similarly, FF3FM has the lowest GRS F-statistics value in the 2 × 2 sort, and therefore it is the best model.

Table 6.6: The GRS test for portfolio efficiency to compare between models (weekly equal-weighted)

	2 × 3 sort			2 × 2 sort		
	GRS (F-statistic)	A|α_i|	p(GRS)	GRS (F-statistic)	A|α_i|	p(GRS)
Panel A: MC & B/M ratio						
(FF3FM)	***1.74***	***0.0005***	***0.0771***	***1.83***	***0.0005***	***0.0595***
(FF5FM)	1.74	0.0005	0.0759	1.93	0.0005	0.0454
(4FM)	1.82	0.0005	0.0614	1.86	0.0005	0.0549
(6FM)	1.84	0.0005	0.0581	2.00	0.0006	0.0371
Panel B: MC & profitability						
(FF3FM)	0.89	0.0005	0.5302	1.32	0.0005	0.2192
(FF5FM)	***0.73***	***0.0004***	***0.6849***	***1.01***	***0.0005***	***0.4257***
(4FM)	1.02	0.0005	0.4216	1.40	0.0005	0.1860
(6FM)	0.91	0.0005	0.5108	1.15	0.0005	0.3248
Panel C: MC & investment						
(FF3FM)	1.38	0.0005	0.1946	1.37	0.0005	0.1973
(FF5FM)	***1.02***	***0.0004***	***0.4250***	***0.87***	***0.0004***	***0.5539***
(4FM)	1.63	0.0005	0.1024	1.48	0.0005	0.1495
(6FM)	1.20	0.0004	0.2891	1.02	0.0004	0.4179
Panel D: MC & Islamic						
(FF3FM)	0.65	0.0003	0.7491	***0.70***	***0.0003***	***0.7084***
(FF5FM)	0.92	0.0004	0.5076	1.21	0.0004	0.2829
(4FM)	***0.62***	***0.0003***	***0.7806***	0.74	0.0003	0.6723
(6FM)	0.86	0.0004	0.5646	1.25	0.0004	0.2583

Note: The italicised, bolded, and underlined values indicate the best model in each panel for each sort. The table shows the portfolio efficiency GRS test using weekly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C) and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table reports (a) GRS F-statistics, testing whether the expected values of all nine intercepts estimated are jointly zero under the following null hypothesis: [$H_0 : \alpha_i = 0$], (b) A|αi|, the mean absolute alpha, (c) p(GRS), the GRS F-statistics p-value, the null is rejected at 5%.

The result in panel B shows the result for the set of portfolios formed from the intersection between MC and profitability. In this panel, the p-value is always greater than the 5% critical value, the joint zero intercepts hypothesis for all asset pricing models is not rejected. Thus, all the models have a significant explanatory power in the cross-section of stock returns. In this case, we need to find the best model that can explain the variation in the cross-section of stock returns, which has the lowest GRS F-statistics value. Therefore, the best model is FF5FM in both sorts. This is the first time that a model has emerged that is the best for both sorts in all GRS test results in panel B for the previous tables.

The set of portfolios from the intersection between MC and investment is presented in panel C, and this panel has a result similar to panel B. Since all the p-values in this panel are greater than 5%, the joint zero intercepts hypothesis is not rejected. This means all the models can explain the variation in the cross-section of stock returns. The best model among those models is the one with the lowest GRS test value, which is FF5FM for both sorts. This is a similar result to the one in panel B, but the GRS tests here have slightly higher values.

Lastly, panel D shows the result for the set of portfolios formed from the intersection between MC and Islamic. In this panel, the zero intercept hypothesis for this group of portfolios is not rejected, since the p-value is greater than the critical value. This means that all the asset pricing models can explain the average return in the cross-section of stock returns, which is similar to the other panels in this table, except panel A. However, this panel exhibits different results about the best model. The best model in the 2 × 3 sort is 4FM, which means the Islamic factor improves the explanatory power of the FF3FM. This is the second time this study has found 4FM to be the best model in the 2 × 3 sort in all tables of the GRS test. On the other hand, the best model in the 2 × 2 sort is FF3FM. However, 4FM has a GRS value very close to FF3FM.

In summary, the GRS F-statistics results for portfolios of weekly and equal-weighted returns reveal different findings. First, hypothesis H2 cannot be rejected in panels B and C for both sorts, indicating that FF5FM consistently improves FF3FM's ability to explain the variation in the cross-section of stock returns. The lower GRS F-statistics values for FF5FM in these panels signify enhanced explanatory power due to the inclusion of two additional factors. However, hypothesis H2 is rejected in panels A and C for both sorts, as FF5FM fails to demonstrate improvements over FF3FM in those portfolios. On the other hand, hypothesis H4 cannot be rejected only in panel D for the 2 × 3 sort because 4FM and 6FM exhibit GRS F-statistics lower than their FF3FM and FF5FM counterparts, which means the additional Islamic factor improves the explanatory power of 4FM and 6FM in this specific panel. However, this hypothesis is rejected in other panels for both sorts.

It appears that the GRS test results indicate different results according to return frequencies and the portfolio weighting schemes. This result is summarised and presented in Table 6.11 in the last section of this chapter. For further details about the findings of the previous GRS tests, the following section investigates the individual intercepts of all examined asset pricing models with each LHS portfolio, using monthly and value-weighted returns only.

6.4 Regression details for the asset pricing models

In the previous section, the performance of asset pricing models is assessed through the GRS test for portfolio efficiency to examine hypotheses H2 and H4 using different return frequencies and weighting schemes. The GRS test is used to examine the joint zero-intercepts hypothesis for the nine time-series regressions that estimate the returns for different sets of nine LHS portfolios.

This section looks into the single intercepts from each regression and evaluates the intercepts for each asset pricing model accordingly. The model with the lowest absolute intercept value is the best model for explaining the average return. Including effective factors should bring the intercept absolute value closer to zero (Fama & French, 2015, 2017; Griffin, 2002). Therefore, this section uses the individual regression details, specifically the intercepts of the estimated return for each LHS portfolio, to draw a final conclusion from the results of the hypothesis examined in the previous section. However, there is no hypothesis to examine in this section; rather, it provides more details about the earlier findings in the GRS section. (This section only considers monthly value-weighted portfolios using the 2 × 3 sort to avoid excessive and unnecessary tables.)

This section is organised into four subsections representing each set of the nine portfolios from each intersection. The next section covers the nine portfolios from the MC and B/M ratio intersection.

6.4.1 Market capitalisation and book-to-market ratio (MC and B/M ratio)

The regression details in Table 6.7 pertain to the nine sets of LHS portfolios formed through the intersection of MC and B/M ratio. The panels from A to C represent the regression for FF3FM, FF5FM, 4FM and 6FM respectively. Each panel shows the regression's intercepts, α, and the t value of those intercepts, α (t), organised in a matrix from left to right to represent portfolios ranging from low to high B/M ratio stocks and from top to bottom to represent small to big MC stocks. These regressions are estimated to assess the asset pricing models' performance and compare them based on the lower absolute value of the intercept. A lower intercept indicates that the model more effectively captures the variation in the cross-section of stock returns in the Saudi stock market. As in panel A, the intercepts of FF3FM do not follow any order or value according to the stocks from small to big or low to high. Further, the intercepts in this panel are mostly low and statistically insignificant except for the medium and high B/M ratio (value) stocks in the bottom row of the big stocks. Those two portfolios are problematic and reject FF3FM's explanatory power as their intercepts are -0.0028 (t = -2.16) and 0.0030 (t = 2.29), respectively.

On the other hand, the intercepts in panel B for FF5FM show that, in general, these intercepts are lower than their counterpart in FF3FM. This is more pronounced in the value stocks than in the intercept matrix's left side and bottom row. The intercept of this particular portfolio has a lower value of 0.0024 (t = 1.81) and is insignificant. This means that the additional two factors in FF5FM reduce the problem we found in FF3FM and improve the model's ability to describe the variation within this portfolio. However, the other portfolio that creates a problem for FF3FM, medium large stocks, still has a high intercept value of 0.0025 (t = -2.02) and significant t value, but is lower than its counterpart portfolio in panel A. This means the FF5FM improves on the explanatory power of FF3FM for this specific portfolio as the absolute value of the intercept is closer to zero.

The intercepts in panel C, representing 4FM, show no sign of improvement over the intercepts in panel A of FF3FM. The intercepts in panel C almost have the same value as their counterpart in panel A, meaning that the additional Islamic factor in 4FM does not improve the model's explanatory power. Additionally, the intercepts in panel D have almost the same value as their counterpart intercepts in panel B of FF5FM. Therefore, adding the Islamic factor to FF5FM does not improve the model's explanatory power in the Saudi stock market by following the concept that including effective factors gets the intercepts closer to zero (Griffin, 2002).

Table 6.7: The intercepts of the regression for nine monthly value-weighted (MC-B/M ratio) portfolios, April 2009-March 2021

Value →	Low	Medium	High	Low	Medium	High
Panel A: FF3FM intercept (R_M-R_F, SMB, and HML)						
Size ↓		***α***			***α(t)***	
Small	-0.0011	0.0017	0.0009	(-0.26)	(0.58)	(0.33)
Medium	0.0037	-0.0029	-0.0021	(1.43)	(-1.58)	(-1.39)
Big	0.0004	-0.0028*	0.0030*	(0.25)	(-2.16)	(2.29)
Panel B: FF5FM intercept (R_M-R_F, SMB, HML, RMW, and CMA)						
		α			***α(t)***	
Small	-0.0006	0.0012	0.0011	(-0.16)	(0.38)	(0.39)
Medium	0.0044	-0.0026	-0.0017	(1.64)	(-1.41)	(-1.05)
Big	0.0005	-0.0025*	0.0024	(0.33)	(-2.02)	(1.81)
Panel C: 4FM intercept (RM-RF, SMB, HML, and IMN)						
		α			***α(t)***	
Small	-0.0014	0.0015	0.0009	(-0.34)	(0.51)	(0.32)
Medium	0.0037	-0.0028	-0.0020	(1.44)	(-1.56)	(-1.36)
Big	0.0004	-0.0028*	0.0030*	(0.28)	(-2.16)	(2.27)
Panel D: 6FM intercept (RM-RF, SMB, HML, RMW, CMA, and IMN)						
		α			***α(t)***	
Small	-0.0007	0.0011	0.0011	(-0.18)	(0.38)	(0.40)
Medium	0.0043	-0.0025	-0.0016	(1.80)	(-1.40)	(-1.07)
Big	0.0005	-0.0025*	0.0024	(0.35)	(-2.04)	(1.81)

Note: The LHS variables are the monthly excess returns of the 9 (MC-B/M ratio) portfolios. The RHS variables are the excess market return RM - R_F, the size factor SMB, the value factor HML, the profitability factor RMW, the investment factor CMA, and the Islamic factor IMN by using 2 × 3 sort for each factor. *t* statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In conclusion, the results in Table 6.7 indicate that the intercepts in panel B for FF5FM have the lowest value compared to other panels in the table. The results also show that panels C and D intercepts have the same value as their comparable intercepts in panels A and B, respectively. By following the lower intercept concepts for each regression to evaluate the performance of each asset pricing model, we can confidently say that FF5FM generally has lower intercepts. Therefore, FF5FM has better explanatory power than the other models, and the additional Islamic factor does not improve FF3FM's and FF5FM's explanatory power. This is aligned with the result from Table 6.3 for the 2 × 3 sort in the previous section, where the GRS tests support the superiority of FF5FM explanatory power over FF3FM and lack evidence of improvements by adding the Islamic factor.

The following subsection discusses the regression details for the nine LHS portfolios formed from the intersection between MC and profitability.

6.4.2 Market capitalisation (MC) and profitability

This subsection presents the regression details for the nine LHS portfolios formed from the intersection of MC and profitability. As mentioned earlier, these regression details are only for monthly returns and value-weighted portfolios. The aim is to compare the individual intercepts for each asset pricing model regression examined in the previous section using the GRS test. Table 6.8 shows the intercepts α and $\alpha(t)$ for each regression in a matrix from top to bottom representing small to big MC stocks and from left to right to illustrate portfolios ranging from low to high profitability stocks. Panels A, B, C and D in this table show the results for FF3FM, FF5FM, 4FM and 6FM, respectively.

Panel A in Table 6.8 shows the intercepts for FF3FM, and all of them are close to zero. It is also noticeable that none of the intercepts has a significant (t) value, indicating that FF3FM can describe the variation in the returns of those portfolios. However, the intercepts shown in panel B generally have lower absolute intercept values than their counterparts in panel A. Lower intercepts indicate a better ability to describe the variation in average returns, therefore FF5FM has a better ability to explain the variation within these portfolios. Although the regression intercepts in panel A for FF3FM have insignificant (t) values, meaning that FF3FM can describe the cross-section of stock returns, FF5FM has better explanatory power.

Table 6.8: The intercepts of the regression for nine monthly value-weighted (MC-profitability) portfolios, April 2009-March 2021

Profitability→	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Panel A: FF3FM intercept: R_M-R_F, SMB, and HML						
Size ↓		***α***			***α(t)***	
Small	-0.0010	0.0012	0.0031	(-0.30)	(0.43)	(0.85)
Medium	0.0033	-0.0016	-0.0011	(0.86)	(-1.03)	(-0.52)
Big	-0.0009	0.0014	-0.0004	(-0.30)	(0.84)	(-0.62)
Panel B: FF5FM intercept (R_M-R_F, SMB, HML, RMW, and CMA)						
		α			***α(t)***	
Small	-0.0008	0.0008	0.0025	(-0.29)	(0.30)	(0.68)
Medium	0.0023	-0.0010	-0.0004	(0.65)	(-0.63)	(-0.23)
Big	-0.0026	0.0011	-0.0001	(-1.07)	(0.64)	(-0.07)
Panel C: 4FM intercept (RM-RF, SMB, HML, and IMN)						
		α			***α(t)***	
Small	-0.0013	0.0011	0.0031	(-0.40)	(0.38)	(0.83)
Medium	0.0031	-0.0015	-0.0009	(0.84)	(-1.09)	(-0.45)
Big	-0.0010	0.0013	-0.0004	(-0.33)	(0.80)	(-0.56)
Panel D: 6FM intercept (RM-RF, SMB, HML, RMW, CMA, and IMN)						
		α			***α(t)***	
Small	-0.0008	0.0008	0.0025	(-0.30)	(0.29)	(0.68)
Medium	0.0022	-0.0010	-0.0004	(0.64)	(-0.71)	(-0.21)
Big	-0.0025	0.0010	-0.0000	(-1.08)	(0.62)	(-0.06)

Note: The LHS variables are the monthly excess returns of the nine (MC-Profitability) portfolios. The RHS variables are the excess market return RM - R_F, the size factor SMB, the value factor HML, the profitability factor RMW, the investment factor CMA, and the Islamic factor IMN by using 2 × 3 sort for each factor. *t* statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The intercepts in panel C, representing the regression of the 4FM augmented FF3FM with the Islamic factor, almost have the same value as the comparable intercepts in panel A of FF3FM. This indicates that adding the Islamic factor in 4FM does not improve FF3FM's ability to describe the variation within those portfolios. Similarly, the intercepts in panel D, representing 6FM (extending FF5FM with the Islamic factor) have a similar value to their corresponding panel B for FF5FM. Therefore, we can have a level of confidence that Islamic factors do not improve the explanatory power of FF3FM or FF5FM in these cross-section portfolios. This also confirms the earlier observations in the GRS test section, as illustrated in Table 6.3 for the 2×3 sort, where FF5FM enhances the explanatory power of FF3FM. Conversely, the Islamic factor does not improve the explanatory power of either FF3FM or FF5FM.

The following subsection shows the regression details for the portfolios formed from the intersection between MC and investment.

6.4.3 Market capitalisation (MC) and investment

This section represents the regression details for the nine LHS portfolios produced from the intersection between allocating stocks into MC and investment stocks. Similar to the previous subsections, these regression details are only for monthly and value-weighted portfolios. The intercepts α and $\alpha(t)$ of those regressions are presented in Table 6.9, and each panel represents a different asset pricing model. The matrix in this table, from top to bottom, represents small to big MC stocks and, from left to right, illustrates portfolios ranging from low to high investment growth stocks.

The matrix in panel A on Table 6.9 shows the intercepts for FF3FM on the nine LHS portfolios. On the other hand, Panel B displays the intercepts for FF5FM on the same portfolios. The intercepts in both panels are not statistically significant as the $\alpha(t)$ is below the significant value for each portfolio. This means that both models can describe the variation in the cross-section of stock returns within those portfolios. However, the intercepts for FF5FM have mostly lower values than their equivalent intercepts for FF3FM, except for the small stocks on the first row. This indicates that FF5FM has more explanatory power than FF3FM, which means that the additional two factors in FF5FM improve the explanatory power of FF3FM in most of the estimated portfolios.

Panels C and D show the intercepts for 4FM and 6FM that augment the Fama and French asset pricing models with the Islamic factor. The intercepts in panel C have the same value as those in panel A (FF3FM), which means the Islamic factor does not improve FF3FM's ability to describe the variation in the cross-section of stock returns in those portfolios.

Table 6.9: The intercepts of the regression for nine monthly value-weighted (MC-investment) portfolios, April 2009-March 2021

Investment→	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Panel A: FF3FM intercept (R_M-R_F, SMB, and HML)						
Size ↓		***α***			***α(t)***	
Small	0.0006	0.0018	0.0002	(0.19)	(0.61)	(0.05)
Medium	-0.0029	-0.0016	0.0027	(-1.39)	(-0.74)	(1.20)
Big	-0.0025	0.0001	0.0008	(-0.92)	(0.07)	(0.58)
Panel B: FF5FM intercept (R_M-R_F, SMB, HML, RMW, and CMA)						
		α			***α(t)***	
Small	0.0014	0.0020	-0.0014	(0.50)	(0.71)	(-0.43)
Medium	-0.0009	-0.0006	0.0015	(-0.47)	(-0.26)	(0.71)
Big	0.0011	-0.0002	-0.0008	(0.51)	(-0.15)	(-0.74)
Panel C: 4FM intercept (RM-RF, SMB, HML, and IMN)						
		α			***α(t)***	
Small	0.0004	0.0017	-0.0002	(0.14)	(0.58)	(-0.04)
Medium	-0.0029	-0.0014	0.0028	(-1.43)	(-0.69)	(1.22)
Big	-0.0027	0.0001	0.0009	(-0.98)	(0.05)	(0.62)
Panel D: 6FM intercept (RM-RF, SMB, HML, RMW, CMA, and IMN)						
		α			***α(t)***	
Small	0.0014	0.0020	-0.0015	(0.50)	(0.72)	(-0.42)
Medium	-0.0009	-0.0005	0.0015	(-0.48)	(-0.24)	(0.71)
Big	0.0010	-0.0002	-0.0008	(0.50)	(-0.17)	(-0.72)

Note: The LHS variables are the monthly excess returns of the nine (MC-investment) portfolios. The RHS variables are the excess market return RM - R_F, the size factor SMB, the value factor HML, the profitability factor RMW, the investment factor CMA, and the Islamic factor IMN by using 2 × 3 sort for each factor. *t* statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Correspondingly, the intercepts in panel D are almost equal to those in panel B (FF5FM), meaning that the additional Islamic factor does not improve the explanatory power of FF5FM. Therefore, we conclude from these regression details that FF5FM has better explanatory power than FF3FM, and the Islamic factor does not improve on FF3FM or FF5FM's ability to describe the variation of the returns in those portfolios. These findings support the results from the previous section of the GRS test.

The last subsection about regression details presents the LHS portfolios formed from the intersection between MC and Islamic stocks.

6.4.4 Market capitalisation (MC) and Islamic stocks

This section provides regression details for the nine LHS portfolios resulting from the intersection between allocating stocks into MC and Islamic stocks. Similar to the preceding subsections, these regression details pertain only to monthly and value-weighted portfolios. The intercepts α and $\alpha(t)$ for these regressions are displayed in Table 6.10, with each panel representing a different asset pricing model. The matrix in this table, arranged from top to bottom, signifies small to large market capitalisation (MC) stocks. At the same time, from left to right, it is organised into portfolios of Islamic, mixed and non-Islamic.

Panel A of Table 6.10 displays the intercepts for FF3FM across the nine LHS portfolios. Panel B presents the intercepts for FF5FM on the same portfolios. Notably, the intercepts in both panels are statistically insignificant, as evidenced by the $\alpha(t)$ values. Consequently, both models effectively capture the variation in the cross-section of stock returns within these portfolios. However, the intercepts for FF5FM generally exhibit lower values than their FF3FM counterparts, with a couple of exceptions in the first row of the matrix for the small stocks in the first row. Following the concept that a lower absolute value of the intercept means a more effective model, FF5FM has greater explanatory power than FF3FM. The implication is that the additional two factors introduced in FF5FM enhance the model's ability to explain variations in stock returns across most estimated portfolio returns.

Panels C and D depict the intercepts for 4FM and 6FM respectively, which augment the Fama and French asset pricing models by including an Islamic factor. In panel C, the intercept values align with those in panel A (about FF3FM), indicating that the Islamic factor does not improve FF3FM's ability to describe the variation in the cross-section of stock returns within those portfolios. Similarly, in panel D, the intercepts closely mirror those in Panel B (about FF5FM), suggesting that the additional Islamic factor does not improve the explanatory power of FF5FM according to the concept of the lower absolute value of the intercept when an effective factor is included in the model.

Table 6.10: The intercepts of the regression for nine monthly value-weighted (MC-Islamic) portfolios, April 2009-March 2021

Islamic →	**Islamic**	**Mixed**	**None**	**Islamic**	**Mixed**	**None**
Panel A: FF3FM intercept (R_M-R_F, SMB, and HML)						
Size ↓		***α***			***α(t)***	
Small	0.0014	-0.0005	-0.0001	(0.52)	(-0.15)	(-0.02)
Medium	-0.0005	-0.0037	0.0043	(-0.27)	(-1.81)	(0.80)
Big	0.0010	-0.0004	-0.0017	(0.63)	(-0.30)	(-0.76)
Panel B: FF5FM intercept (R_M-R_F, SMB, HML, RMW, and CMA)						
		α			***α(t)***	
Small	0.0017	-0.0001	-0.0009	(0.67)	(-0.03)	(-0.23)
Medium	0.0004	-0.0032	0.0035	(0.24)	(-1.54)	(0.66)
Big	0.0002	-0.0001	-0.0004	(0.91)	(-0.89)	(-0.20)
Panel C: 4FM intercept (RM-RF, SMB, HML, and IMN)						
		α			***α(t)***	
Small	0.0014	-0.0003	-0.0007	(0.51)	(-0.11)	(-0.17)
Medium	-0.0003	-0.0035	0.0035	(-0.16)	(-1.78)	(0.89)
Big	0.0011	-0.0004	-0.0021	(0.80)	(-0.25)	(-0.95)
Panel D: 6FM intercept (RM-RF, SMB, HML, RMW, CMA, and IMN)						
		α			***α(t)***	
Small	0.0018	-0.0000	-0.0010	(0.70)	(-0.00)	(-0.29)
Medium	0.0005	-0.0031	0.0031	(0.32)	(-1.64)	(0.77)
Big	0.0014	-0.0012	-0.0006	(1.04)	(-0.86)	(-0.32)

Note: The LHS variables are the monthly excess returns of the 9 MC-Islamic portfolios. The RHS variables are the excess market return RM - R_F, the size factor SMB, the value factor HML, the profitability factor RMW, the investment factor CMA, and the Islamic factor IMN by using 2x3 sorts for each factor. *t* statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In summary, the regression details lead to the conclusion that FF5FM exhibits superior explanatory power compared to FF3FM, and the inclusion of the Islamic factor does not enhance the abilities of either FF3FM or FF5FM to describe the variation in returns within the specified portfolios. These findings reinforce the results obtained from the GRS test in the previous section. These results are summarised and discussed further in the last section of this chapter.

6.5 Conclusion

This chapter evaluated the performance of the proposed asset pricing models to examine hypotheses H2 and H4. The performance is assessed according to the models' ability to describe the variation in the cross-section of stock returns represented on different sets of LHS portfolios formed from multiple intersections. Therefore, this chapter first presented and discussed the returns of the LHS portfolios that need to be explained by the asset pricing models.

Then, in the next section, the GRS was conducted to examine hypotheses H2 and H4 using multiple methods (monthly and weekly returns, equal- and value-weighted portfolios, and 2 × 3 and 2 × 2 sorts) of constructing the RHS factors and forming the LHS portfolios.

The regression details, specifically the intercepts of those regressions, were also discussed and represented in a separate section to gain deeper insight and support the findings of the models' performance using the GRS test. The regression details were limited to the RHS factors and LHS portfolios formed from monthly and value-weighted returns using the 2 × 3 sort. The summary of the findings for the hypotheses examined using the GRS tests was presented in Table 6.11 for all return frequencies, weighting schemes, and sorts. These findings are summarised and discussed in the following paragraphs.

First of all, hypothesis H2 cannot be rejected for almost all the portfolios formed using 2 × 3 sort except for the portfolios formed from (MC and B/M Ratio) and (MC and B/M Islamic) using equal-weighted portfolios, as indicated in panels B and D. This means that FF5FM outperforms FF3FM in those portfolios, which is initially expected in H2, except for the mentioned equal-weighted portfolios. The equal-weighted approach is always biased towards smaller stocks, which worsens in a market dominated by a few large market capitalisation stocks, such as the Saudi stock market (Alsharif, 2021). Indeed, Fama and French (1993, 2015) find that smaller stocks are always the main problem in asset pricing models. Since equal-weighted portfolios are usually dominated by smaller stocks and small stocks are always problematic to the asset pricing models, this might explain why the equal-weighted portfolios are rejected. Chiah et al. (2016) conducts GRS tests using value- and equal-weighted approaches on the Australian stock market, which is similar to the market capitalisation structure in the Saudi stock market, and finds that the GRS test rejects the equal-weighted portfolios more than the value-weighted ones.

Table 6.11: The summary results of the hypotheses H2 and H4 examined using the GRS Test

Nine portfolios	2 × 3 sort			2 × 2 sort		
	Best model	H2	H4	Best model	H2	H4
Panel A: Monthly value-weighted						
MC and B/M ratio	FF5FM	Can't Reject	Reject	4FM	Reject	Can't Reject
MC and profitability	FF5FM	Can't Reject	Reject	4FM	Reject	Can't Reject
MC and investment	FF5FM	Can't Reject	Reject	4FM	Reject	Can't Reject
MC and Islamic	FF5FM	Can't Reject	Reject	FF3FM	Reject	Reject
Panel B: Monthly equal-weighted						
MC and B/M ratio	FF3FM	Reject	Reject	FF3FM	Reject	Reject
MC and profitability	FF5FM	Can't Reject	Reject	6FM	Can't Reject	Can't Reject
MC and investment	FF5FM	Can't Reject	Reject	6FM	Can't Reject	Can't Reject
MC and Islamic	4FM	Reject	Can't Reject	FF3FM	Reject	Reject
Panel C: Weekly value-weighted						
MC and B/M Ratio	FF5FM	Can't Reject	Reject	4FM	Reject	Can't Reject
MC and Profitability	FF5FM	Can't Reject	Reject	4FM	Reject	Can't Reject
MC and Investment	FF5FM	Can't Reject	Reject	6FM	Can't Reject	Can't Reject
MC and Islamic	FF5FM	Can't Reject	Reject	FF5FM	Can't Reject	Reject
Panel D: Weekly equal-weighted						
MC and B/M Ratio	FF3FM	Reject	Reject	FF3FM	Reject	Reject
MC and Profitability	FF5FM	Can't Reject	Reject	FF5FM	Can't Reject	Reject
MC and Investment	FF5FM	Can't Reject	Reject	FF5FM	Can't Reject	Reject
MC and Islamic	4FM	Reject	Can't Reject	FF3FM	Reject	Reject

Note: This table shows the summary results of hypotheses H2 and H4 using the GRS test of portfolio efficiency.

Table 6.11 also shows that hypothesis H2 is mostly rejected for the 2 × 2 sort, except for the equal-weighted portfolios that cannot be rejected for the same hypothesis in the 2 × 3 sort. This exception includes the weekly value-weighted portfolios for (MC and investment) and (MC and Islamic), but most of the value-weighted portfolios were rejected in the 2 × 2 sort. This confirms the findings above about the bias in equal-weighted portfolios towards smaller stocks. The 2 × 2 sort includes all the stocks in the study sample when the factors are constructed, whereas 2 × 3 excludes about 40% of the stocks considered medium market capitalisation stocks (see section 4.5.2.1). Fama and French (2015) use the 2 × 3 sort as the main method in their models but clearly state that they would have liked to use the 2 × 2 sort, because it provides more diversification to the factors as it includes all the stocks in the sample.

Further, the GRS test for the factors constructed from the 2 × 2 sort was mainly higher than their counterpart test for factors constructed from the 2 × 3 sort in the five-factor model of Fama and French (2015). Mosoeu and Kodongo (2020) examine the viability of FF5FM on geographically diversified portfolios using both 2 × 2 and 2 × 3 sorts. They find that the GRS value is mostly lower in the factors generated from the 2 × 2 sort. However, the findings in this study reveal the opposite, where the GRS test for the models using 2 × 2 sort is much higher than the 2 × 3 sort. In some cases, the p-value is lower than 5%, which offers compelling evidence against the zero intercepts hypothesis and rejects the model, whereas this rarely happens in the 2 × 3 sort. The likely explanation is that the medium stocks eliminated in the 2 × 3 sort are problematic to the asset pricing models in this study.

Lastly, we can see from the result in Table 6.11 that hypothesis H4 that the Islamic factor improves the conventional asset pricing models FF3FM and FF5FM is rejected for almost all models and different sets of portfolios in the 2 × 3 sort. On the other hand, this hypothesis cannot be rejected in most of the models formed using the 2 × 2 sort. This does not apply to panel D in the 2 × 2 sort, although the portfolios in this panel are formed using the Islamic classification. The expectation was that the model with the Islamic factor would outperform other models due to the similarity between the portfolios used to construct the Islamic factors and form the portfolios in this panel.

The plausible explanation for rejecting hypothesis H4 in the 2 × 3 sort only is that the factors formed using the 2 × 2 sort have better diversification, because they include all of the stocks in the sample (Fama & French, 2015), and the Islamic factor adds more diversification to their model. Therefore, the explanatory power of the models was enhanced when factors formed from 2 × 2 were used as hypothesis H4 cannot be rejected in most panels for his sort. This also means a return pattern for Islamic stocks existing in the Saudi stock market might have been caused by an investment strategy or investor behaviour towards buying Islamic stocks. Although the Islamic premium is not significantly greater than zero (see previous chapter), the pattern of the returns for Islamic stocks exists in the market.

Finally, findings from examining hypotheses H2 and H4 in this chapter have many implications. Firstly, validating FF5FM and FF3FM , the global benchmark for expected returns, enhances investor confidence and promotes the efficacy of the market moving mechanism in the Saudi stock market. Secondly, the model can be used as a benchmark for portfolio managers to evaluate the performance of their portfolios. This leads to more refined asset allocation strategies to allocate assets based on a deeper understanding of various risk factors and potentially achieve better risk-adjusted returns. Thirdly, using asset pricing models as a benchmark in the Saudi market helps determine the cost of capital and equity, allowing policymakers to set fiscal and monetary policy.

However, it is imperative to know whether any structural changes in the market have implications for asset pricing models and factor premiums. For instance, the global integration of the market is a substantial structural change that potentially leads to changes in the pattern of returns. Therefore, the following chapter covers the final hypothesis, hypothesis H5, about the implications of global integration on the Saudi stock market on factor premiums and the performance of asset pricing models.

Chapter 7: The impact of global integration

7.1 Introduction

As global financial markets become increasingly interconnected, it is crucial to understand how global integration influences the efficacy of asset pricing models in capturing the variation in the average returns.

The significance of the factor premiums and the performance of asset pricing models have been examined comprehensively in Chapters 5 and 6. This examination covered the period between 2009 and 2021, and during this period, the Saudi market became globally integrated in June 2015. There were still some restrictions on foreign investors, but those restrictions eased in 2018 (see section 2.5.1). This chapter aims to comprehensively examine the impact of global integration on the factor premiums and the performance of asset pricing models in the Saudi stock market. This examination will compare factor premiums and asset pricing performance pre and post globalisation in June 2015 and pre and post globalisation enhancement in January 2018.

Global integration of the capital market improves market efficiency by enhancing liquidity and facilitating the mechanism of price discovery through the participation of foreign investors from around the globe (Dabwor et al., 2022). Liquidity and market performance changes should lead to stock market movements and have implications for stock returns. Specifically, in the Saudi stock market, a foreign investor's decision to sell and buy influences market performance, and those investors are more likely to make their decisions according to the performance of the market index (Almutiri, 2020). Therefore, the question about global integration for this study is whether there are any changes in the factor premiums in the Saudi stock market and whether they impact the asset pricing models' performance. Therefore, this chapter will examine the following hypotheses:

- ***Hypothesis H5.1: The mean of the factor premiums (size, value, profitability, investment, and Islamic) has significantly changed due to the global integration of the Saudi stock market.***

- ***Hypothesis H5.2: The performance of asset pricing models (FF3FM, FF5FM, 4FM, and 6FM) has changed due to the global integration of the Saudi stock market.***

Globalisation started in the Saudi stock market in June 2015, and enhanced further by easing the restrictions in January 2018. Therefore, this study first compares the changes in factor premiums and the asset pricing model performance by dividing the sample into two subperiods: April 2009 to May 2015 and June 2015 to March 2021. Then the whole period is divided into two subperiods, April 2009 to Jan 2018 and February 2018 to March 2021, to examine the effects of the easing of restrictions.

I will examine the possible changes in the mean of the factor premiums in H5.1 by using a one-sample t-test once on subperiods pre and post globalisation in June 2015, and I will repeat the examination for subperiods pre and post globalisation enhancement in January 2018. Then I will compare whether the mean returns for those factor premiums significantly changed before and after those events.

I will then conduct a further examination of the same hypothesis H5.1 using a two-sample t-test, which hypothesizes that the mean returns for each factor premium are equal pre and post globalisation in June 2015 or pre and post globalisation enhancement in January 2018.

Finally, I will employ the GRS test, used to assess the asset pricing models' performance in Chapter 6, to assess the models' performance pre and post globalisation in June 2015 and pre and post globalisation enhancement in Jan 2018 to examine hypothesis H5.2. This means that the GRS test is employed for the period before and after globalisation, for June 2015 and Jan 2018 separately, then the results will be compared to determine if there were any changes in the models' performance (further explanation is provided in the specific sections).

This analysis of global integration follows the same process that has been applied throughout this study by examining all hypotheses using factor premiums and asset pricing models formed using monthly and weekly returns, value- and equal-weighted portfolios, and 2×3 and 2×2 sorts.

The remainder of this chapter is organised as follows: factor premiums variation (hypothesis H5.1) is examined in the following section, with each factor premium represented in separate subsections. This is followed by the examination of the variation of the asset pricing models section to test hypothesis H5.2, which is organised in four subsections representing the returns frequencies and weighting schemes used: (i) monthly value-weighted, (ii) monthly equal-weighted, (iii) weekly value-weighted, and (iv) weekly equal-weighted.

7.2 Factor premiums and global integration

This section examines hypothesis H5.1 which concerns the potential variation in factor premiums resulting from global market integration. The study employs two methods to analyse each factor premium (size, value, profitability, investment, and Islamic) during these events. The first method involves conducting one-sample t-tests of the mean for two periods before and after global integration to determine if the mean returns significantly differ. This is done separately for the period before June 2015 and from that date onward, as well as before February 2018 and from that date onward.

The second method entails two-sample t-tests to examine whether the mean returns before and after the specified dates (June 2015 and February 2018) are equal. These two methods are conducted using two return frequencies (monthly/weekly), two weighting schemes (value/equal) portfolios, and two sorts (2 × 3 and 2 × 2), resulting in a total of eight different versions for each factor.

The first factor premium discussed in this chapter is the size premium.

7.2.1 Size premium (SMB)

The size premium (SMB), the equity premium in small market capitalisation stocks, was found to be insignificant in the Saudi stock market for the whole sample period of this study (see section 5.4). There are many potential reasons for the non-existence of a size premium in the Saudi stock market, which were discussed in the factor premiums chapter (see section 5.4). However, the global integration of the market, which commenced in June 2015 and was amplified in February 2018, reshaped the market segments. This change in market demographics may influence return patterns because of new investment strategies, particularly with increased emphasis on factor premiums. A factor such as the size premium has been historically recognised and found significant in many markets. Therefore, this study tests the hypothesis that the change in the market demographics caused by the global integration of the market might have led to a change in the significance of the size premium in the Saudi market.

Table 7.1: Averages, standard deviation, and t-statistics for the size premium (SMB) in pre and post globalisation periods [H_0: μ (SMB) = 0, and H_α: μ (SMB) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 - May 2015 (pre-globalisation)								
Mean %	0.0034	0.0007	-0.0011	-0.0002	0 .0037	0.0008	-0.0008	-0.0002
Std Dev	0.0366	0.0158	0.0416	0.0172	0.0377	0.0165	0.0430	0.0179
t-statistics	0.7971	0.8338	-0.2333	-0.2548	0.8484	0.8556	-0.1683	-0.1888
p-value	0.2140	0.2025	0.5919	0.6005	0.1995	0.1964	0.5666	0.5748
Panel B: June 2015 – March 2021 (post-globalisation)								
Mean %	0.0005	0.0000	0.0018	0.0004	0.0011	0.0002	0.0020	0.0004
Std Dev	0.0455	0.0186	0.0453	0.0182	0.0468	0.0190	0.0463	0.0187
t-statistics	0.0910	0.0503	0.3419	0.3441	0.1967	0.1624	0.3562	0.3556
p-value	0.4639	0.4800	0.3667	0.3655	0.4223	0.4356	0.3614	0.3612

Note: This table presents the summary statistics of the SMB factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (SMB) = 0, and H_α: μ (SMB) > 0], and (d) p-value. n this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021 excluding new IPOs.

Table 7.1 shows the summary statistics for the one-sample t-test of the size premium for two separate periods pre and post globalisation in June 2015. Panel A shows the result before global integration, and panel B shows the result afterwards. The mean returns of the SMB are higher in panel A than in panel B for the factors constructed from value-weighted portfolios and lower and negative for equal-weighted portfolios. The t-value in the bottom row of each panel shows no significant value in any version of the factor. The t-value is not even close to being significant, so the hypothesized value of zero for the mean return of the SMB cannot be rejected. The mean returns of the size premium are very close to zero for both periods. Therefore, investing in small market capitalisation stocks does not compensate for higher returns, and the change in global integration does not have a huge impact on the size premium (which was found to be insignificant for the entire sample period, as discussed in section 5.4).

Table 7.2: Averages, standard deviation, and t-statistics for the size premium (SMB) across the pre and post globalisation enhancement periods [H_0: μ (SMB) = 0, and H_α: μ (SMB) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 – January 2018 (pre-globalisation enhancement)								
Mean %	0.0000	-0.0000	-0.0028	-0.0006	0.0003	0.0000	-0.0027	-0.0006
Std Dev	0.0400	0.0168	0.0427	0.0177	0.0414	0.0175	0.0443	0.0185
t-statistics	0.0101	-0.0375	-0.6815	-0.7839	0.0827	0.0207	-0.6210	-0.7154
p-value	0.4960	0.5149	0.7515	0.7833	0.4671	0.4917	0.7320	0.7626
Panel B: Feb 2018 – March 2021 (post-globalisation enhancement)								
Mean %	0 .0074	0.0016	0.0091	0.0020	0.0083	0.0018	0.0094	0.0020
Std Dev	0.0442	0.0183	0.0444	0.0173	0.0444	0.0185	0.0445	0.0176
t-statistics	1.0338	1.1255	1.2650	1.4674	1.1571	1.2519	1.3078	1.4921
p-value	0.1540	0.1310	0.1069	0.0721	0.1273	0.1062	0.0995	0.0688

Note: This table presents the summary statistics of the SMB factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentages, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (SMB) = 0, and H_α: μ (SMB) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Panel B in Table 7.2 shows the summary statistics and t-value for the size premium SMB pre and post the easing of restrictions on foreign investors in 2018. It can clearly be seen in Table 7.2 that the mean returns for all SMB versions are higher in the second period in panel B, which differs from the Table 7.1findings about the size premium for the period pre and post June 2015. Also, the t-value for the period from 2018 and onwards in panel B is much higher than the ones in panel A. Additionally, the t-value for the return in the SMB formed using weekly returns and the equal-weighted portfolio in Panel B is statistically significant for both sorts. At the same time, there is not significant differences in the standard deviations for the corresponding versions of the SMB in either period in panels A and B, which means there are no special or sudden changes in circumstances or increases in volatility. Therefore, I infer that a size premium is starting to reappear in the market as the *t*-value increases as the market becomes more globally integrated.

In contrast, the factors in Table 7.1 are not significant after global integration in 2015, which can possibly be attributed to a lower number of foreign investors because of the restrictions imposed by local authorities until they were eased in 2018. The size premium seems to evolve, so it may be stronger and clearer in the future when more years are included in the analysis.

Table 7.3: Two sample t-tests of the size premium (SMB) across multiple periods (H_0: mean difference = 0)

	2 × 3 sort				**2 × 2 sort**			
	V-W		**E-W**		**V-W**		**E-W**	
	Monthly (1)	**Weekly (2)**	**Monthly (3)**	**Weekly (4)**	**Monthly (5)**	**Weekly (6)**	**Monthly (7)**	**Weekly (8)**
Panel A: April 2009-May 2015 pre-globalisation and June 2015-March 2021 post-globalisation								
Mean diff %	0.0029	0.0007	-0.0030	-0.0006	0.0026	0.0006	-0.0028	-0.0006
t-statistics	0.4199	0.4915	-0.4104	-0.4258	0.3685	0.4266	-0.3771	-0.3888
p-value	0.6753	0.6233	0.6821	0.6704	0.7131	0.6698	0.7067	0.6976
Panel B: April 2009 - Jan 2018 pre-globalisation and Feb 2018 – April 2021 post-globalisation								
Mean diff %	-0.0074	-0.0016	-0.0119	-0.0026	-0.0080	-0.0018	-0.0121	-0.0026
t-statistics	-0.9046	-1.0036	-1.4363	-1.6606	-0.9699	-1.0784	-1.4414	-1.6433
p-value	0.3693	0.3165	0.1559	0.0978	0.3359	0.2818	0.1543	0.1013

Note: This table represents the summary statistics of the SMB factor for two independent samples' t-test to examine the following null hypothesis (H_0: mean difference = 0). Mean diff % is the percentage difference in the mean returns of the two samples, t-Statistic is the t-value from a two-sample t-test, and the p-value indicates evidence against the null hypothesis.

The implications of global integration on the size premium are investigated further by conducting a two-sample t-test between two periods pre and post global integration in 2015 and globalisation enhancement in 2018. Table 6.3 displays the summary statistics of the two-sample t-test. Panel A presents the results for pre/post June 2015, while panel B presents the results for pre and post January 2018. The result in panel A shows that there is no significance in the p-value for all the versions of the SMB, as they are all greater than 10%. Therefore, the null hypothesis is not rejected, which means there are no significant changes in the mean return for all SMB versions pre and post June 2015.

On the other hand, panel B shows the two-sample t-test for pre and post global integration enhancement in Jan 2018, and we can see that column 4 for the weekly equal-weighted portfolio in the first sort is significant at 10%. This means that the mean returns of the SMB changed after the global integration enhancements in 2018. Further, we can see that the p-value in the same panel in column 8 for the weekly version of the SMB is very close to being significant. These are similar results to the findings in Table 7.2, where the size premium seems to be reappearing from the beginning of 2018, possibly caused by the global integration of the market.

As previously discussed, (see sections 3.2.2.1 and 5.4), the disappearance and reappearance of the size premium has been debated for a long time in the literature (Blitz & Hanauer, 2020; Esakia et al., 2019; Van Dijk, 2011). Although the appearance and disappearance of size premium is puzzling, the literature has no evidence about the implications of market globalisation on this disappearance or reappearance. The concurrence of the appearance of the size premium in the Saudi market with the enhancement of the global integration of the market raises questions about whether the phenomena could be related.

Recalling the result from Table 7.2 for the size premium after January 2018, the SMB versions in columns 4 and 8 were significant, and the rest were insignificant for the same period. On the other hand, in the previous period, all the SMB versions were insignificant. Furthermore, Table 7.3 confirms that the size premium is significantly different between the periods before and after January 2018 in two versions of the SMB, which indicates that the SMB seems to be emerging in the Saudi stock market. Therefore, we can confirm that the size premium significantly changed between those two periods due to global integration, specifically in the versions of the SMB that showed significant changes in Tables 7.2 and 7.3. According to this result, hypothesis H5.1 is not rejected for those versions of the SMB. However, for the versions of the SMB that do not show changes in the mean return before and after the globalisation of the market in Tables 7.1, 7.2, and 7.3, hypothesis H5.1 that global integration causes a variation in the size premium is confidently rejected. The following section evaluates globalisation's impact on the value premium.

7.2.2 Value premium (HML)

This section examines the variation in the significance of the value premium in the Saudi stock market. Similar to the previous section about SMB, I examine HML using a one-sample t-test and a two-sample t-test. For each test, the examination is applied pre and post the two global integration events in June 2015 and January 2018.

Chapter 5 on factor premiums reveals that the value premium is the only factor with a significant equity premium in all versions examined. The only other factor that is significant is the inverse of the investment premium. This section investigates whether the equity premium in value stocks is due to global integration or has existed long before the integration.

Table 7.4: Averages, standard deviation, and t-statistics for the value premium (HML) pre and post globalisation [H_0: μ (HML) = 0, and H_α: μ (HML) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 – May 2015 (pre-globalisation)								
Mean	0.0016	0.0005	0.0020	0.0005	0 .0027	0.0006	0.0025	0.0006
Std Dev	0.0365	0.0159	0.0327	0.0148	0.0260	0.0115	0.0237	0.0107
t-statistics	0.3881	0.5361	0.5372	0.6406	0.9072	1.0113	0.9051	0.9423
p-value	0.3494	0.2961	0.2964	0.2611	0.1836	0.1563	0.1842	0.1734
Panel B: June 2015 – March 2021(post-globalisation)								
Mean	0.0065	0.0015	0.0074	0.0017	0.0053	0.0012	0.0062	0.0015
Std Dev	0.0310	0.0148	0.0300	0.0141	0.0200	0.0105	0.0189	0.0100
t-statistics	1.7586	1.7483	2.104	2.1699	2.2114	2.0024	2.7491	2.5580
p-value	0.0415	0.0407	0.0195	0.0154	0.0152	0.0231	0.0038	0.0055

Note: This table presents the summary statistics of the HML factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (HML) = 0, and H_α: μ (HML) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Table 7.4 shows the result of the HML factor pre and post the June 2015 establishment of international investment. Panel A shows the result for the period before global integration in 2015, where all p-values are insignificant, indicating that the mean returns for all value premium versions were not significantly greater than zero. In contrast, panel B shows the results after June 2015, where all p-values are significant and below 5%, signifying that mean returns for all value premium versions are significantly greater than zero. This suggests that growth stocks generated significant abnormal returns after June 2015. Therefore, the hypothesis that global integration in June 2015 led to a variation in the significance of the value premium cannot be rejected.

Table 7.5 presents summary statistics for value premium variations due to global integration enhancement pre and post Jan 2018. Panel A shows the result before January 2018, where all the p-values are significant for 10% in the 2 × 2 sort except for columns 1 and 2. The p-values in the same panel for the 2 × 2 sort are significant, at least at 5%. This indicates that the mean returns associated with the significant p-values are greater than zero in panel A.

Table 7.5: Averages, standard deviation, and t-statistics for the value premium (HML) pre and post the globalisation enhancement [H_0: μ (HML) = 0, and H_α: μ (HML) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 – January 2018 (pre-globalisation enhancement)								
Mean	0 .0034	0.0014	0.0044	0.0010	0.0037	0.0009	0.0041	0.0009
Std Dev	0 .0339	0.0153	0.0310	0.0145	0.0241	0.0112	0.0223	0.0107
t-statistics	1.0394	1.1105	1.4743	1.5232	1.6739	1.6765	1.9018	1.8719
p-value	0.1505	0.1337	0.0717	0.0642	0.0495	0.0491	0.0300	0.0309
Panel B: Feb 2018 – March 2021 (post-globalisation enhancement)								
Mean	0 .0056	0.0014	0.0053	0.0014	0.0048	0.0011	0.0048	0.0012
Std Dev	0 .0342	0.0155	0.0323	0.0141	0.0210	0.0104	0.0192	0.0094
t-statistics	1.0187	1.1923	1.0139	1.2424	1.4171	1.3315	1.5344	1.6176
p-value	0.1575	0.1174	0.1586	0.1079	0.0824	0.0924	0.0667	0.0538

Note: This table presents the summary statistics of the HML factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (HML) = 0, and H_α: μ (HML) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Panel B in Table 7.5 shows the summary statistics for the value premium versions after January 2018, where the p-values are significant only in the 2 × 2 sort. It is notable that these p-values are significant only at 10% and barely significant in columns 5 and 6. This indicates a variation in the significance of the value premium before and after global integration, which means that the hypothesis about a variation in the factor premium significance pre and post globalisation cannot be rejected.

To examine the variation in the value premium caused by globalisation, I conducted a two-sample t-test, presented in Table 7.6. Panel A displays the results for the two sample periods before and after June 2015, while panel B presents the results before and after January 2018. The results from both panels show no significant p-values for any versions of the HML, which means there is no significant difference in the mean return for the value premium pre and post globalisation. Therefore, the hypothesis that the globalisation of the Saudi stock market caused changes in the mean return of the value premium is rejected.

Table 7.6: Two sample t-test of value premium HML across multiple periods (H_0: mean difference = 0)

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: April 2009-May 2015 pre-globalisation and June 2015-March 2021 post-globalisation								
Mean diff %	-0.0049	-0.0010	-0.0054	-0.0012	-0.0025	-0.0006	-0.0037	-0.0009
t-statistics	-0.8641	-0.8222	-1.0415	-1.0617	-0.6638	-0.6382	-1.0441	-1.0849
p-value	0.3890	0.4113	0.2994	0.2888	0.5080	0.5236	0.2983	0.2784
Panel B: April 2009 - Jan 2018 pre-globalisation and Feb 2018 – April 2021) post-globalisation								
Mean diff %	-0.0022	-0.0006	-0.0009	-0.0003	-0.0011	-0.0002	-0.0006	-0.0002
t-statistics	-0.3448	-0.4597	-0.1439	-0.2551	-0.2776	-0.2181	-0.1702	-0.2738
p-value	0.7313	0.6461	0.8861	0.7988	0.7821	0.8275	0.8653	0.7844

Note: This table represents the summary statistics of the HML factor for two independent samples' t-test to examine the following null hypothesis (H_0: mean difference = 0). Mean diff % is the percentage difference in the mean returns of the two samples; the t-statistic is the t-value from a two-sample t-test, and the p-value indicates evidence against the null hypothesis.

In conclusion, the results from Table 7.6 using a two-sample t-test indicate no variation in the value premium before and after globalisation. On the other hand, the results from Tables 7.4 and 7.5 confirm that the globalisation of the Saudi stock market caused some variation in the significance of the value premium. There is strong and sufficient evidence in both Tables 7.5 and 7.4 not to reject hypothesis H5.1.

The value premium was insignificant in most versions of HML before globalisation and significant in almost all versions of HML post-globalisation. This might be due to the changes in Saudi market demographics and the behaviour of investing in value stocks, since foreign investors prefer value stocks over growth stocks (Vo, 2015). That is why the value premium is stronger since the market started to be globally integrated. Therefore, we cannot reject hypothesis H5.1 as the value premium significantly changed before and after globalisation. The following subsection examines the implications of global integration for another factor premium, profitability.

7.2.3 Profitability premium (RMW)

This section investigates the variation in the significance of the profitability premium caused by global integration. This examination is conducted using one- and two-sample t-tests for pre and post June 2015 and pre and post January 2018. The summary statistics for the RMW are presented in Table 7.7 for pre and post June 2015. Panel A shows the result for the RMW before the global integration. None of the p-values indicate any significance in the mean return in any of the versions of the RMW. Panel B also shows similar results, and even the mean returns in this panel are very close in value to those corresponding to panel A. This is not surprising, as this premium was insignificant in all versions of the sample (see section 5.6).

Table 7.7: Averages, standard deviation, and t-statistics for the profitability premium (RMW) pre and post globalisation [H_0: μ (RMW) =0, and H_α: μ (RMW) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 - May 2015 (pre-globalisation)								
Mean	-0.0070	-0.0015	0.0010	0.0002	-0.0033	-0.0007	0.0013	0.0003
Std Dev	0.0450	0.0189	0.0395	0.0176	0.0291	0.0133	0.0283	0.0129
t-statistics	-1.3415	-1.4001	0.2139	0.2243	-0.9740	-0.9566	0.3968	0.4090
p-value	0.9080	0.9188	0.4156	0.4113	0.8334	0.8303	0.3463	0.3414
Panel B: June 2015 – March 2021 (post-globalisation)								
Mean	-0.0012	-0.0002	0.0015	-0.0004	-0.0007	-0.0001	-0.0010	-0.0002
Std Dev	0.0428	0.0184	0.0378	0.0156	0.0337	0.0129	0.0291	0. 0114
t-statistics	-0.2353	-0.2236	-0.3434	-0.4226	-0.1739	-0.1023	-0.2893	-0.3418
p-value	0.5927	0.5884	0.6338	0.6636	0.5688	0.5407	0.6134	0.6336

Note: This table presents the summary statistics of the RMW factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (RMW) = 0, and H_α: μ (RMW) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Examining the variation in the profitability premium pre and post global integration is expanded by investigating the variation pre and post January 2018 when restrictions on foreign investors were eased. The result of this examination is presented in Table 7.8, where panel A shows the result before easing the restrictions on foreign investors and panel B afterwards. The p-values for both panels are not significant at any level. Thus, the null hypothesis that says the mean return for all versions of the RMW factor is equal to zero pre and post globalisation cannot be rejected.

Table 7.8: Averages, standard deviation, and t-statistics for the profitability premium (RMW) across two distinct periods: [H_0: μ (RMW) = 0, and H_α: μ (RMW) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
Panel A: April 2009 – January 2018 (pre-globalisation enhancement)								
Mean	-0 .0044	-0.0009	0.0004	0.0000	-0.0025	-0.0005	0.0030	0.0001
Std Dev	0 .0443	0.0189	0.0386	0.0173	0.0288	0.0130	0.0273	0.0126
t-statistics	-1.0150	-1.0703	0.1049	0.0432	-0.9136	-0.8703	0.1152	0.1049
p-value	0.8438	0.8575	0.4583	0.4828	0.8185	0.8077	0.4543	0.4583
Panel B: Feb 2018 – March 2021 (post-globalisation enhancement)								
Mean	-0 .0037	-0.0007	-0.0020	-0.0004	-0.0006	-0.0000	-0.0002	-0.0000
Std Dev	0 .0433	0.0180	0.0390	0.0145	0.0379	0.0134	0.0325	0.0111
t-statistics	-0.5265	-0.4850	-0.3227	-0.3226	-0.0949	-0.0476	-0.0312	-0.0076
p-value	0.6992	0.6859	0.6256	0.6263	0.5375	0.5190	0.5124	0.5030

Note: This table presents the summary statistics of the RMW factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (RMW) = 0, and H_α: μ (RMW) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs .

The analysis of the fluctuation in the significance of the profitability premium in the Saudi market before and after globalisation is carried further through a two-sample test. This examination allows us to assess whether the average returns in the profitability premium exhibit significant differences pre- and post-globalisation. The findings of the two-sample t-test for the periods before and after June 2015 and January 2018 are presented in Table 7.9. The result in this table for both panels of the different time frames of globalisation shows no significant difference in the mean return. Therefore, the significance of the profitability premium did not change due to the globalisation of the Saudi stock market, and there is no significant profitability premium pre and post globalisation. This means that hypothesis H5.1 about the profitability premium is confidently rejected. In other words, global integration did not change or cause fluctuations in the profitability premium.

Table 7.9: Two sample t-test of the profitability premium RMW across multiple periods (H_0: mean difference = 0)

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
Panel A: April 2009-May 2015 pre-globalisation and June 2015-March 2021 post-globalisation								
Mean diff %	-0.0058	-0.0012	0.0025	0.0006	-0.0026	-0.0006	0.0023	0.0005
t-statistics	-0.7943	-0.8300	0.3933	0.4507	-0.4942	-0.6028	0.4828	0.5326
p-value	0.4283	0.4068	0.6947	0.6523	0.6220	0.5469	0.6300	0.5945
Panel B: April 2009 - Jan 2018 pre-globalisation and Feb 2018 – April 2021 post-globalisation								
Mean diff %	-0.0007	-0.0003	0.0024	0.0004	-0.0020	-0.0005	0.0005	0.0001
t-statistics	-0.0814	-0.1609	0.3311	0.2869	-0.2919	-0.3980	0.0796	0.0652
p-value	0.9353	0.8723	0.7416	0.7743	0.7715	0.6909	0.9369	0.9480

Note: This table represents the summary statistics of the RMW factor for two independent samples t-test to examine the following null hypothesis (H_0: mean difference = 0). Mean diff % is the percentage difference in the mean returns of the two samples, the t-Statistic is the t-value from a two-sample t-test, and the p-value indicates evidence against the null hypothesis.

In conclusion, global integration did not affect the profitability premium. This factor premium has already been found insignificant in the Saudi stock market for the whole period (see Chapter 5). This means a firm's profitability is not reflected in the pattern of stock returns in the Saudi market. Further, the globalisation of the market and the resulting changes in market demographics do not seem to change this factor. Therefore, profitability remains insignificant for the whole period and the sub-periods before and after globalisation. Hypothesis H5.1 is confidently rejected.

The following section examines the impact of globalisation on the investment premium.

7.2.4 Investment premium (CMA)

This section examines the variation in the significance of the investment premium caused by Saudi stock market globalisation using two methods similar to the factor premiums examined in the previous sections. The first method is the one-sample t-test and the second is the two-sample t-test. The findings indicate that investment premium for the whole period in the Saudi stock market is insignificant. However, the inverse of the investment premium is very significant (see section 5.7). The investment premium is an abnormal equity return in firms with lower investment growth than those with higher growth. The investment premium is often significant across various developed and emerging markets.

A distinct scenario has unfolded in the Saudi stock market, because this study has uncovered a significant premium in the inverse of the investment premium (see section 5.7). This phenomenon may be attributed to specific trading behaviours exhibited by local investors who perceive stocks with high investment growth as indicative of future strong performance. Thus, increased trading volume in such stocks could have generated abnormal returns in the inverse of the investment premium. In this section, I will examine whether there were any changes in the significance of the investment premium or the premium inverse pre and post globalisation.

Table 7.10 presents the summary statistics for the investment premium before and after June 2015. Panel A displays the results for the pre-globalisation period, where all mean returns in the first row are negative. Additionally, most p-values are higher than 95%, indicating significance in the inverse of the investment premium[44]. I employed a one-tailed approach in the t-test with the null hypothesis H_0 stating that the mean return equals 0, and the alternative hypothesis H_a suggesting that the mean return is greater than 0, thus focusing on the positive side of the distribution.

Conversely, the inverse of the investment premium for all versions of the CMA in panel A exhibits the same mean return and *t*-value in the first and third rows but with a positive value for both. Furthermore, the p-values for the inverse of the investment premium in the table complement the p-values in Table 7.10, as I analyse the tail on the opposite side of the distribution. This means that the inverse of the investment premium is significant at 5%, and the mean return is significantly greater than zero.

44 The p-value for the reverse premium is equal to 1 minus the current p-value in each version of the CMA.

Table 7.10: Averages, standard deviation, and t-statistics for the investment premium (CMA) pre and post globalisation [H_0: μ (CMA) = 0, and H_α: μ (CMA) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 - May 2015 (pre-globalisation)								
Mean	-0.0066	-0.0015	-0.0049	-0.0011	-0.0030	-0.0007	-0.0045	-0.0010
Std Dev	0.0340	0.0144	0.0257	0.0113	0.0235	0.0104	0.0190	0.0086
t-statistics	-1.6657	-1.9011	-1.6315	-1.8322	-1.1163	-1.2761	-2.0520	-2.1796
p-value	0.9501	0.9709	0.9465	0.9661	0.8660	0.8986	0.9781	0.9850
Panel B: June 2015 – March 2021 (post-globalisation)								
Mean	0.0008	-0.0000	-0.0001	0.0001	0.0010	0.0001	-0.0011	-0.0003
Std Dev	0.0280	0.01345	0.0254	0.0110	0.0191	0.0096	0.0178	0.0082
t-statistics	0.2531	-0.0739	-0.0321	-0.1121	0.4215	0.1691	-0.5259	-0.6464
p-value	0.4005	0.5294	0.5128	0.5446	0.3374	0.4329	0.6997	0.7408

Note: This table presents the summary statistics of the CMA factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (CMA) = 0, and H_α: μ (CMA) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Panel B of Table 7.10 displays the results for the CMA post-globalisation. The findings suggest that the CMA was insignificant during this period, as indicated by the low t-value and a p-value exceeding the significance threshold. Moreover, the inverse of the investment premium also lacks significance during this period. Notably, the mean return for all the versions of the investment premium is higher than their counterparts in panel A (the pre-globalisation period). This observation suggests a possible emergence of the investment premium in the Saudi stock market. While there is no definitive evidence to support this assumption yet, the improvement in the mean returns of the CMA is evident across all versions. This improvement could be attributed to increased attention to factor premiums by current and recent investors in the market.

Further investigations of the variation in the investment premium for the periods before and after globalisation, particularly the enhancement of global integration in January 2018, are presented in Table 7.11. Panel A shows the results for all versions of the CMA before the enhancement of global integration. In this panel, the mean return is negative for all factor versions. The t-values also indicate significance, but the p-values are not significance because the hypothesis (H_0: μ (CMA) = 0, and $H_α$: μ (CMA) > 0) looked at one tail (positive side) of the distribution and the mean returns for all RMW versions are negative. Thus, the inverse of the investment premium is significant as its complementary p-value is lower than 5%.

On the other side of the distribution, the p-values at the bottom row of the panel do not demonstrate significance. This aligns with the results in Table 7.1, which indicate that the mean return on the investment premium is not significantly greater than zero. In contrast, the inverse of the premium is significant and statistically greater than zero. On the other hand, panel B for the period after enhanced globalisation reveals no significant value for both the investment premium and its inverse, mirroring the results obtained in panel B of Table 7.10.

Table 7.11: Averages, standard deviation, and t-statistics for investment premium (CMA) pre and post the globalisation enhancement [H_0: μ (CMA) = 0, and $H_α$: μ (CMA) > 0]

	2 × 3 sort				**2 × 2 sort**			
	V-W		**E-W**		**V-W**		**E-W**	
	Monthly (1)	**Weekly (2)**	**Monthly (3)**	**Weekly (4)**	**Monthly (5)**	**Weekly (6)**	**Monthly (7)**	**Weekly (8)**
Panel A: April 2009 – January 2018 (pre-globalisation enhancement)								
Mean	-0 .0058	-0.0014	-0.0048	-0.0011	-0.0011	-0.0003	-0.0037	-0.0008
Std Dev	0 .0329	0.0144	0.0258	0.0114	0.0227	0.0104	0.0186	0.0088
t-statistics	-1.8184	-2.1403	-1.939	-2.1644	-0.5154	-0.6736	-2.028	-2.0732
p-value	0.9641	0.9836	0.9724	0.9845	0.6963	0.7496	0.9775	0.9806
Panel B: Feb 2018 – March 2021 (post-globalisation enhancement)								
Mean	0 .0049	0.0009	0.0039	0.0008	-0.0010	-0.0004	-0.0005	-0.0002
Std Dev	0 .0253	0.0124	0.0242	0.0105	0.0180	0.0091	0.0176	0.0073
t-statistics	1.2065	0.9610	0.9826	1.0072	-0.3415	-0.5158	-0.1957	-0.4107
p-value	0.1176	0.1690	0.1661	0.1577	0.6327	0.6967	0.5770	0.6591

Note: This table presents the summary statistics of the CMA factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (CMA) = 0, and $H_α$: μ (CMA) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

The last examination of the variation in the investment premium is performed using a two-sample t-test, with the results presented in Table 7.12. Panel A of this table represents the findings for the two samples pre and post June 2015. The p-values indicate insignificant results, suggesting that the hypothesis of equal mean returns in both periods cannot be rejected. However, in panel B (before and after January 2018) of Table 7.12, the p-values show significant values in the first four columns of the investment premium formed using the 2 × 3 sort. This implies that the null hypothesis of equal mean returns in the investment premium for both periods before and after globalisation for the versions of the premium in columns 1 to 4 in panel B is rejected. However, we cannot reject the hypothesis in panel B for the versions of the premium formed using the 2 × 2 sort.

Table 7.12: Two sample t-test of the investment premium (CMA) across multiple periods (H_0: mean difference = 0)

	2 × 3 sort				**2 × 2 sort**			
	V-W		**E-W**		**V-W**		**E-W**	
	Monthly (1)	**Weekly (2)**	**Monthly (3)**	**Weekly (4)**	**Monthly (5)**	**Weekly (6)**	**Monthly (7)**	**Weekly (8)**
Panel A: April 2009-May 2015 pre-globalisation and June 2015-March 2021 post-globalisation								
Mean diff %	-0.0074	-0.0015	-0.0048	-0.0011	-0.0040	-0.0008	-0.0034	-0.0007
t-statistics	-1.4340	-1.3179	-1.1209	-1.2139	-1.1268	-1.0418	-1.1027	-1.1020
p-value	0.1538	0.1880	0.2642	0.2252	0.2618	0.2979	0.2720	0.2709
Panel B: April 2009 - Jan 2018 pre-globalisation and Feb 2018 – April 2021 post-globalisation								
Mean diff %	-0.0108	-0.0024	-0.0087	-0.0020	-0.0001	0.0001	-0.0031	-0.0006
t-statistics	-2.0690	-2.0144	-1.8697	-2.0312	-0.0386	0.0457	-0.9234	-0.8809
p-value	0.0416	0.0448	0.0658	0.0431	0.9693	0.9635	0.3590	0.3790

Note: This table represents the summary statistics of the CMA factor for two independent samples t-test to examine the following null hypothesis (H_0: mean difference = 0). Mean diff % is the percentage difference in the mean returns of the two samples, the t-statistic is the t-value from a two-sample t-test, and the p-value indicates evidence against the null hypothesis.

In conclusion, the investment premium is insignificant for the whole sample period discussed in Chapter 5 and is also insignificant for subperiods before and after globalisation. Therefore, hypothesis H5.1 is explicitly rejected. However, the inverse of the investment premium, which was significant in the whole sample discussed in Chapter 5, varied significantly for the periods before and after globalisation. The results from Tables 7.10 to 7.12 indicate that the inverse of the investment premium is significant for the period before globalisation, but this significance disappeared after globalisation. This might be due to the changes in the market demographics caused by globalisation and might cause, in the long run, an investment premium in the Saudi stock market to emerge. In conclusion, hypothesis H5.1 about the variation of the investment premium is rejected, because it shows no changes pre and post globalisation.

The final factor premium, the Islamic premium, is discussed in the following subsection.

7.2.5 Islamic premium (IMN)

The Islamic premium is the last factor premium to test for any variation before and after global integration. Similar to previous factor premiums, this examination employs one- and two-sample t-tests for the pre and post global integration periods. The results in Table 7.13 depict the one-sample t-test for the periods before and after June 2015. Panel A displays the results for the Islamic premium before June 2015, with p-values for all versions indicating an insignificant premium. Similarly, panel B, representing the period after global integration, shows p-values for all versions, indicating an insignificant mean return. This suggests that the Islamic premium is not statistically greater than zero for pre and post globalisation periods in all versions. Therefore, the Islamic premium before and after global integration has a similar value close to zero.

Table 7.14 represents the summary statistics of the Islamic premium before and after January 2018, when global integration was further enhanced. The results indicate a similar result to that found in Table 7.13. This means the mean return in all versions of the Islamic premium for both periods is indistinguishable from zero. However, we can see that the mean returns in panel B are slightly better than their counterparts in panel A in Table 7.14. This may be attributed to investors in the Saudi stock market paying more attention to the premium in Islamic stocks, realising their importance as hedges against global risk (Ho et al., 2014; Jawadi et al., 2014).

Table 7.13: Averages, standard deviation, and t-statistics for the Islamic premium (IMN) pre and post globalisation [H_0: μ (IMN) = 0, and H_α: μ (IMN) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 - May 2015 (pre-globalisation)								
Mean	-0.0034	-0.0007	0.0039	0.0009	-0 .0021	-0.0004	0.0039	0.0009
Std Dev	0.0344	0.0159	0.0338	0.0162	0.0370	0.0165	0.0350	0.0162
t-statistics	-0.8592	-0.8102	0.9913	0.9610	-0.4927	-0.4521	0.9510	0.9637
p-value	0.8035	0.7908	0.1624	0.1686	0.6881	0.6742	0.1724	0.1680
Panel B: June 2015 – March 2021 (post-globalisation)								
Mean	-0.0006	-0.0007	-0.0001	-0.0000	-0.0029	-0.0006	-0.0010	-0.0002
Std Dev	0.0336	0.0146	0.0286	0.0128	0.0328	0.0140	0.0265	0.0122
t-statistics	-0.1404	-0.0843	-0.0011	-0.0073	-0.7387	-0.7517	-0.3067	-0.3150
p-value	0.5556	0.5336	0.5004	0.5029	0.7687	0.7736	0.6200	0.6235

Note: This table presents the summary statistics of the IMN factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (IMN) = 0, and H_α: μ (IMN) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

Table 7.14: Averages, standard deviation, and t-statistics for the Islamic premium (IMN) pre and post globalisation enhancement [H_0: μ (IMN) = 0, and H_α: μ (IMN) > 0]

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009 – January 2018 (pre-globalisation enhancement)								
Mean	-0 .0041	-0.0008	0.0012	0.0003	-0.0034	-0.0007	0.0011	0.0002
Std Dev	0 .0351	0.0159	0.0337	0.0154	0.0371	0.0161	0.0340	0.0153
t-statistics	-1.1958	-1.1127	0.3759	0.3851	-0.9544	-0.9014	0.3281	0.3193
p-value	0.8828	0.8668	0.3539	0.3502	0.8290	0.8161	0.3717	0.3748
Panel B: Feb 2018 – March 2021 (post-globalisation enhancement)								
Mean	0 .0036	0.0008	0.0041	0.0009	0.0001	-0.0000	0.0027	0.0006
Std Dev	0 .0302	0.0132	0.0240	0.0121	0.0282	0.0127	0.0220	0.0116
t-statistics	0.7416	0.7495	1.0655	0.9613	0.0281	-0.0284	0.7684	0.7205
p-value	0.2315	0.2273	0.1468	0.1689	0.4889	0.5113	0.2236	0.2361

Note: This table presents the summary statistics of the IMN factor during two different periods represented in each panel. The summary statistics include (a) Mean %: the mean return in percentage, (b) Std Dev: standard deviation, (c) t-statistics: one-sample t-test [H_0: μ (IMN) = 0, and H_α: μ (IMN) > 0], and (d) p-value. In this table, "V-W" means value-weighted portfolios and "E-W" represents equal-weighted portfolios. The sample includes all listed stocks with available data in the Saudi stock markets from April 2009 to March 2021, excluding new IPOs.

The last examination of the Islamic premium variation in the Saudi market is conducted using two-sample t-tests. The results of this test is presented in Table 7.15, where panel A shows the result of the two-sample t-test for the periods before and after June 2015. The result indicates no significant value, and therefore, the null hypothesis cannot be rejected, which means that the mean returns for both periods are equal. Therefore, there is no variation in the Islamic premium in these two periods. Similarly, the results in panel B for the pre and post market globalisation periods show no significant differences in the mean returns of all versions of Islamic premium. Thus, the null hypothesis cannot be rejected, as the mean returns in those periods are equal. I conclude that there is no variation in the Islamic premium caused by global integration.

Table 7.15: Two sample t-test of the Islamic premium (IMN) across multiple periods (H_0: mean difference = 0)

	2 × 3 sort				2 × 2 sort			
	V-W		E-W		V-W		E-W	
	Monthly (1)	Weekly (2)	Monthly (3)	Weekly (4)	Monthly (5)	Weekly (6)	Monthly (7)	Weekly (8)
Panel A: April 2009-May 2015 pre-globalisation and June 2015-March 2021 post-globalisation								
Mean diff %	-0.0029	-0.0006	0.0039	0.0009	0.0008	0.0002	0.0048	0.0011
t-statistics	-0.5072	-0.5291	0.7481	0.7510	0.1334	0.1539	0.9391	0.9540
p-value	0.6128	0.5969	0.4556	0.4530	0.8941	0.8777	0.3493	0.3405
Panel B: April 2009 - Jan 2018 pre-globalisation and Feb 2018 – April 2021 post-globalisation								
Mean diff %	-0.0073	-0.0016	-0.0029	-0.0006	-0.0036	-0.0006	-0.0016	-0.0004
t-statistics	-1.2910	-1.2598	-0.5744	-0.5278	-0.6124	-0.5263	-0.3411	-0.3661
p-value	0.2004	0.2086	0.5671	0.5979	0.5419	0.5990	0.7337	0.7145

Note: This table represents the summary statistics of the IMN factor for two independent samples t-test to examine the following null hypothesis (H_0: mean difference = 0). Mean diff % is the percentage difference in the mean returns of the two samples, the t-statistic is the t-value from a two-sample t-test, and the p-value indicates evidence against the null hypothesis.

The Islamic premium was the last factor premium I examined for a variation caused by the global integration of the Saudi stock market. The results indicate no variation in this premium pre and post market globalisation. This examination uses two methods, but both tests show no significant result about different values in the mean returns in Islamic premium before and after global integration.

The next section investigates any variation in the asset pricing models' performance due to market globalisation by examining hypothesis H5.2.

7.3 Global integration and asset pricing models’ performance (GRS test)

The previous section examined whether the global integration of the Saudi market might have caused any variation in factor premiums. Similarly, this section examines the variability of asset pricing models' performance (FF3FM, FF5FM, 4FM, and 6FM) due to the global integration of the market. Thus, we assess the models’ performance pre and post market globalisation and pre and post market globalisation enhancement. The hypothesis under examination in this section is hypothesis H5.2:

❖ ***Hypothesis H5.2: The performance of asset pricing models (FF3FM, FF5FM, 4FM, and 6FM) has changed due to the global integration of the Saudi stock market.***

The models' performance across the entire sample was previously assessed in Chapter 6 using Gibbons et al. (1989) GRS test of portfolio efficiency. Model performance is measured by the model's ability to capture average returns. According to Fama and French (1993, 1995, 2015), if an asset pricing model fully captures returns, the regression intercept of that model's regression should be close to zero. The GRS test assesses the null hypothesis of joint zero intercepts for asset pricing model regression on the excess returns of group portfolios.

In this study, the portfolios are the set of nine LHS portfolios formed from different intersections (see section 4.5.2). If the GRS rejects the null hypothesis of joint zero intercepts for the asset pricing model, the model has failed to describe the average excess returns in those portfolios.

The GRS test value is also used to rank models, with the best model having the lowest GRS test value (Fama & French, 2015; Foye, 2018a). The variation in model performance is assessed according to the lowest GRS test and whether the model with the lowest GRS value differs before and after global integration.

This section is organised into four subsections, each one representing different return frequencies and weighting schemes used to form the LHS portfolios and construct the RHS factors, which are monthly value-weighted, monthly equal-weighted, weekly value-weighted, and weekly equal-weighted. The first subsection assesses the performance of the asset pricing models pre and post globalisation using monthly and value-weighted LHS portfolios and RHS factors.

7.3.1 Asset pricing models using monthly returns and value-weighted portfolios

This subsection presents findings regarding the performance of asset pricing models before and after globalisation, using monthly returns and value-weighted portfolios. Table 7.16A displays the results for periods before and after June 2015, while Table 7.16B presents results for periods before and after January 2018. Each table comprises four panels, corresponding to different groupings of RHS portfolios based on intersections. Within each panel, tests are conducted for each asset pricing model evaluated in this study (FF3FM, FF5FM, 4FM, 6FM).

In Table 7.16A, the GRS examines the hypothesis of joint zero intercepts across nine LHS portfolios formed from various intersections represented in each section. All panels show p-values exceeding 5%, indicating that the null hypothesis of zero intercepts cannot be rejected. Therefore, all models can explain variation in average returns within LHS portfolios.

Additionally, the optimal model (see the bold and underlined text in the table) is identified by the lowest GRS value in each panel for each sort for the pre and post globalisation periods. The main goal is to examine the hypothesis that the performance of the asset pricing models has changed due to global integration. This is measured by whether the best model remains the same before and after global integration.

The results in panel A in Table 7.16A demonstrates that the model exhibiting the best performance remains consistent pre and post globalisation for the 2 × 3 and 2 × 2 sorts. Likewise, in panel B, the superior model remains the same for both periods within the 2 × 3 sort but differs in the 2 × 2 sort. Conversely, in panels C and D, the best model pre and post globalisation varies pre and post globalisation across all the sorts. Although the performance of some models remains unaffected by global integration, more than half of the models examined display changes in their performance before and after globalisation. Consequently, it is demonstrated that global integration has changed the performance of asset pricing models applied to the LHS portfolios and RHS factors formed using monthly returns and value-weighted portfolios.

Table 7.16A: The GRS test for the pre and post globalisation periods [H_0: $\alpha_i = 0$] (monthly value-weighted)

	April 2009 - May 2015 pre-globalisation				June 2015 – March 2021 post-globalisation			
	2 × 3 sort		2 × 2 sort		2 × 3 sort		2 × 2 sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.11	0.36	1.31	0.25	1.14	0.35	1.56	0.15
(FF5FM)	*0.82*	*0.60*	1.15	0.34	***1.09***	***0.38***	1.69	0.11
(4FM)	1.15	0.34	1.31	0.25	1.18	0.32	1.46	0.19
(6FM)	0.83	0.59	***1.12***	***0.36***	1.13	0.35	***1.39***	***0.21***
Panel B: MC & profitability								
(FF3FM)	0.68	0.72	1.11	0.37	0.74	0.67	0.72	0.69
(FF5FM)	*0.53*	*0.84*	0.91	0.52	***0.71***	***0.70***	0.97	0.47
(4FM)	0.68	0.72	1.09	0.38	0.82	0.59	***0.65***	***0.75***
(6FM)	0.53	0.85	***0.89***	***0.54***	0.80	0.62	0.71	0.70
Panel C: MC & investment								
(FF3FM)	0.92	0.51	0.93	0.50	***0.36***	***0.95***	0.54	0.84
(FF5FM)	*0.51*	*0.86*	0.68	0.72	0.58	0.80	1.42	0.20
(4FM)	0.91	0.52	0.92	0.51	0.43	0.91	***0.47***	***0.89***
(6FM)	0.51	0.86	***0.66***	***0.74***	0.62	0.77	1.11	0.37
Panel D: MC & Islamic								
(FF3FM)	0.81	0.61	0.96	0.48	***0.64***	***0.75***	***0.72***	***0.68***
(FF5FM)	***0.72***	***0.69***	***0.68***	***0.72***	0.72	0.68	1.21	0.30
(4FM)	0.92	0.51	1.15	0.34	0.79	0.62	0.90	0.53
(6FM)	0.78	0.63	0.81	0.60	1.08	0.39	1.53	0.16

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 - May 2015 and June 2015 – March 2021), using monthly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C) and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

Table 7.16B is similar to Table 7.16A. It conducts GRS statistics tests to examine the asset pricing models' performance pre and post globalisation using monthly returns and value-weighted portfolios, but it examines the period pre and post globalisation enhancement in January 2018.

Analysis of the joint zero intercepts hypothesis reveals that all the models' p-values exceed 5%, indicating that the hypothesis cannot be rejected, and suggesting that all models effectively explain variation in the cross-section of average returns for RHS portfolios. The lowest GRS value identifies the best model (highlighted in bold and underlined for each sort within each panel). While panel A shows consistent best model performance before and after globalisation, panels B, C, and D exhibit variations in the model performance pre and post globalisation.

Table 7.16B: The GRS test for the pre and post globalisation enhancement periods [H_0: $\alpha_i = 0$] (monthly value-weighted)

	April 2009 – January 2018 pre-globalisation enhancement				Feb 2018 – March 2021 post-globalisation enhancement			
	2 × 3 Sort		2 × 2 Sort		2 × 3 Sort		2 × 2 Sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.17	0.32	1.47	0.17	0.84	0.59	1.64	0.15
(FF5FM)	0.82	0.59	1.57	0.13	0.73	0.67	1.65	0.16
(4FM)	1.08	0.38	***1.30***	***0.25***	0.71	0.69	***1.52***	***0.19***
(6FM)	*0.76*	*0.65*	1.41	0.19	***0.62***	***0.76***	1.56	0.18
Panel B: MC & profitability								
(FF3FM)	0.97	0.47	1.60	0.12	1.58	0.17	1.22	0.32
(FF5FM)	0.40	0.93	1.56	0.13	2.30	0.04	0.82	0.60
(4FM)	0.83	0.59	***1.38***	***0.21***	***1.44***	***0.22***	1.13	0.38
(6FM)	*0.34*	*0.95*	1.40	0.20	2.23	0.06	***0.78***	***0.64***
Panel C: MC & investment								
(FF3FM)	0.60	0.79	0.73	0.68	0.90	0.53	0.88	0.55
(FF5FM)	*0.27*	*0.98*	0.55	0.83	0.87	0.56	1.10	0.40
(4FM)	0.68	0.72	0.81	0.81	0.85	0.57	***0.81***	***0.61***
(6FM)	0.32	0.97	***0.54***	***0.84***	***0.79***	***0.63***	1.04	0.44
Panel D: MC & Islamic								
(FF3FM)	1.05	0.40	1.18	0.32	***0.81***	***0.61***	***0.80***	***0.62***
(FF5FM)	***0.79***	***0.62***	1.06	0.40	0.82	0.61	1.23	0.32
(4FM)	1.13	0.35	1.21	0.30	0.81	0.61	0.84	0.58
(6FM)	0.85	0.57	***1.03***	***0.42***	0.74	0.67	1.66	0.16

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – Jan 2018 and Feb 2018 – March 2021), using monthly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

The results of Table 7.16B confirm those of Table 7.16A, suggesting that global integration has changed asset pricing model performance. Hence, hypothesis H5.2 cannot be rejected for monthly returns and value-weighted portfolios forming LHS portfolios and RHS factors.

I will next present a similar examination of model performance pre and post globalisation using monthly returns and equal-weighted portfolios.

7.3.2 Asset pricing models using monthly returns and equal-weighted portfolios

In the previous subsection, the GRS test was employed to assess the performance of asset pricing models pre and post globalisation, utilising LHS portfolios and RHS factors formed from monthly returns and value-weighted portfolios. In this subsection, a similar analysis is conducted on LHS portfolios and RHS factors formed using monthly returns and equal-weighted portfolios. The GRS examinations conducted in Table 7.17A and Table 7.17B aim to test the joint zero intercepts hypothesis to identify the model with the best performance and determine whether the models' performance has been influenced by global integration. The change in the models' performance is indicated by whether the same model exhibits the best performance both pre and post globalisation or not.

Table 7.17A presents GRS tests conducted pre and post globalisation in June 2015. Except for panel D, all panels indicate that the best model differs before and after globalisation in both sorts. Particularly, 4FM consistently performs best across all periods and sorts in panel D for portfolios formed from the intersection of MC and Islamic classification.

Table 7.17A: The GRS test for pre and post globalisation periods [H_0: $\alpha_i = 0$] (monthly equal-weighted)

	April 2009 - May 2015 pre-globalisation				June 2015 – March 2021 post-globalisation			
	2 × 3 Sort		2 × 2 Sort		2 × 3 Sort		2 × 2 Sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.28	0.26	1.25	0.28	***1.27***	***0.27***	***2.03***	***0.05***
(FF5FM)	1.19	0.31	***1.06***	***0.40***	1.69	0.11	3.52	0.00
(4FM)	*1.16*	*0.33*	1.21	0.30	1.52	0.16	2.05	0.04
(6FM)	1.18	0.32	1.09	0.38	1.86	0.08	3.52	0.00
Panel B: MC & profitability								
(FF3FM)	***0.29***	***0.97***	0.38	0.94	0.77	0.64	1.06	0.40
(FF5FM)	0.17	0.99	***0.22***	***0.99***	***0.74***	***0.67***	1.07	0.40
(4FM)	0.41	0.92	0.49	0.88	0.95	0.49	1.02	0.44
(6FM)	0.37	0.94	0.32	0.96	0.83	0.59	***1.01***	***0.44***
Panel C: MC & investment								
(FF3FM)	1.80	0.08	1.82	0.08	***0.25***	***0.98***	***0.41***	***0.92***
(FF5FM)	1.51	0.16	***1.25***	***0.16***	0.36	0.95	0.72	0.69
(4FM)	1.49	0.17	1.62	0.13	0.43	0.91	0.44	0.90
(6FM)	*1.37*	*0.22*	1.47	0.18	0.45	0.90	0.71	0.69
Panel D: MC & Islamic								
(FF3FM)	0.89	0.54	0.83	0.59	0.41	0.92	0.56	0.82
(FF5FM)	0.94	0.49	1.13	0.36	0.48	0.88	1.45	0.19
(4FM)	***0.54***	***0.84***	***0.67***	***0.73***	***0.41***	***0.93***	***0.54***	***0.84***
(6FM)	0.74	0.67	1.28	0.27	0.49	0.87	1.37	0.22

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 - May 2015 and June 2015 – March 2021), using monthly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

Table 7.17B displays the GRS tests for periods pre and post January 2018 when enhanced global integration started. The results show that the best model before January 2018 differs from the periods after this date, except for the 2 × 3 sort in panel C. The vast majority of the

GRS tests in Tables 7.17A and 7.17B indicate that the model with the best pre-globalisation performance differs from post-globalisation, suggesting that there was a change in asset pricing model performance due to global integration.

Table 7.17B: The GRS test for pre and post globalisation enhancement periods [H_0: α_i = 0] (monthly equal-weighted)

	April 2009 – Jan 2018 pre-globalisation enhancement				Feb 2018 – March 2021 post-globalisation enhancement			
	2 × 3 Sort		2 × 2 Sort		2 × 3 Sort		2 × 2 Sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.49	0.16	1.29	0.25	***<u>0.42</u>***	***<u>0.91</u>***	0.95	0.50
(FF5FM)	***<u>1.44</u>***	***<u>0.18</u>***	1.27	0.26	0.94	0.51	2.85	0.02
(4FM)	1.58	0.13	1.32	0.23	0.64	0.75	***<u>0.94</u>***	***<u>0.51</u>***
(6FM)	1.51	0.15	***<u>1.24</u>***	***<u>0.28</u>***	1.04	0.44	2.79	0.02
Panel B: MC & profitability								
(FF3FM)	0.68	0.73	0.77	0.64	0.75	0.66	0.91	0.53
(FF5FM)	***<u>0.45</u>***	***<u>0.90</u>***	0.66	0.74	***<u>0.70</u>***	***<u>0.70</u>***	0.88	0.55
(4FM)	0.85	0.57	0.80	0.62	0.99	0.47	***<u>0.86</u>***	***<u>0.57</u>***
(6FM)	0.62	0.78	***<u>0.64</u>***	***<u>0.76</u>***	0.96	0.49	0.90	0.54
Panel C: MC & investment								
(FF3FM)	1.54	0.14	1.56	0.14	0.40	092	0.56	0.82
(FF5FM)	***<u>0.93</u>***	***<u>0.49</u>***	1.02	0.43	***<u>0.37</u>***	***<u>0.94</u>***	***<u>0.39</u>***	***<u>0.93</u>***
(4FM)	1.56	0.14	1.54	0.15	0.71	0.69	0.56	0.81
(6FM)	0.94	0.49	***<u>0.98</u>***	***<u>0.46</u>***	0.65	0.74	0.46	0.89
Panel D: MC & Islamic								
(FF3FM)	***<u>1.06</u>***	***<u>0.40</u>***	***<u>1.00</u>***	***<u>0.45</u>***	0.97	0.48	1.01	0.45
(FF5FM)	1.21	0.29	1.56	0.14	***<u>0.76</u>***	***<u>0.65</u>***	***<u>0.91</u>***	***<u>0.53</u>***
(4FM)	1.07	0.39	1.27	0.26	1.27	0.30	1.46	0.22
(6FM)	1.2	0.30	2.03	0.04	1.15	0.37	2.05	0.08

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – Jan 2018 and Feb 2018 – March 2021), using monthly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

Consequently, hypothesis H5.2 in this thesis about the changes imposed by the global integration on the performance of asset pricing models is confirmed. This finding aligns with the results of examining the same hypothesis using LHS portfolios and RHS factors formed from monthly and value-weighted returns in the previous subsection.

The next subsection examines hypothesis H5.2 with a similar analysis but employs weekly and value-weighted returns for the RHS factors and LHS portfolios.

7.3.3 Asset pricing models using weekly returns and value-weighted portfolios

In the previous two subsections, the impact of the global integration of the Saudi stock market on the performance of asset pricing models was assessed using the LHS portfolio and RHS factors formed from monthly and value-weighted returns, as well as equal-weighted returns. In this subsection, the same examination is conducted on the LHS portfolio and RHS factors using weekly returns and value-weighted returns. Table 7.18A represents the results for globalisation pre and post June 2015, and Table 7.18B shows the result for the globalisation enhancement pre and post January 2018.

The GRS test examines the hypothesis of the joint zero intercepts. As the p-values exhibit values higher than 5%, which means all models can explain the variation in the cross-section of average returns in both Tables 7.18A and 7.18B (see below), the hypothesis cannot be rejected.

Table 7.18 A: The GRS test for pre and post globalisation periods [H_0: $\alpha_i = 0$] (weekly value-weighted)

	April 2009 - May 2015 pre-globalisation				June 2015 – March 2021 post-globalisation			
	2 × 3 sort		2 × 2 sort		2 × 3 sort		2 × 2 sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	0.72	0.68	***<u>0.89</u>***	***<u>0.54</u>***	1.41	0.18	1.74	0.08
(FF5FM)	***<u>0.60</u>***	***<u>0.80</u>***	1.08	0.37	***<u>1.36</u>***	***<u>0.20</u>***	1.76	0.07
(4FM)	0.72	0.69	0.87	0.55	1.48	0.15	1.69	0.09
(6FM)	0.60	0.79	1.09	0.37	1.44	0.17	***<u>1.68</u>***	***<u>0.09</u>***
Panel B: MC & profitability								
(FF3FM)	0.79	0.62	0.90	0.52	***<u>0.89</u>***	***<u>0.53</u>***	0.93	0.50
(FF5FM)	***<u>0.61</u>***	***<u>0.78</u>***	***<u>0.71</u>***	***<u>0.70</u>***	1.00	0.44	1.10	0.36
(4FM)	0.81	0.61	0.91	0.51	0.97	0.46	***<u>0.88</u>***	***<u>0.54</u>***
(6FM)	0.61	0.78	0.73	0.68	1.09	0.37	1.03	0.42
Panel C: MC & Investment								
(FF3FM)	1.09	0.37	1.13	0.34	***<u>0.41</u>***	***<u>0.93</u>***	0.46	0.90
(FF5FM)	***<u>0.60</u>***	***<u>0.80</u>***	***<u>0.85</u>***	***<u>0.57</u>***	0.50	0.87	0.57	0.82
(4FM)	1.08	0.37	1.11	0.35	0.46	0.90	***<u>0.42</u>***	***<u>0.92</u>***
(6FM)	0.60	0.80	0.85	0.57	0.54	0.84	0.50	0.87
Panel D: MC & Islamic								
(FF3FM)	0.53	0.85	0.56	0.83	***<u>0.88</u>***	***<u>0.54</u>***	***<u>0.85</u>***	***<u>0.57</u>***
(FF5FM)	***<u>0.48</u>***	***<u>0.89</u>***	***<u>0.33</u>***	***<u>0.96</u>***	1.03	0.42	1.10	0.36
(4FM)	0.77	0.65	0.76	0.66	0.97	0.46	1.07	0.38
(6FM)	0.70	0.70	0.50	0.87	1.22	0.28	1.55	0.13

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – May 2015 and June 2015 – March 2021), using weekly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

Table 7.18 B: The GRS test for pre and post globalisation enhancement periods [H_0: $\alpha_i = 0$] (weekly value-weighted)

	April 2009 – Jan 2018 pre-globalisation enhancement				Feb 2018 – March 2021 post-globalisation enhancement			
	2 × 3 sort		2 × 2 sort		2 × 3 sort		2 × 2 sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.27	0.25	1.69	0.09	0.85	0.57	1.26	0.26
(FF5FM)	1.02	0.42	1.84	0.06	0.91	0.52	1.27	0.25
(4FM)	1.19	0.30	***1.57***	***0.12***	***0.75***	***0.66***	***1.25***	***0.27***
(6FM)	***0.99***	***0.45***	1.73	0.08	0.80	0.62	1.29	0.24
Panel B: MC & profitability								
(FF3FM)	1.07	0.38	1.40	0.18	***1.14***	***0.34***	1.06	0.40
(FF5FM)	0.62	0.78	1.27	0.25	1.15	0.33	***0.86***	***0.56***
(4FM)	0.96	0.47	1.25	0.26	1.24	0.28	1.12	0.35
(6FM)	*0.60*	*0.79*	***1.17***	***0.31***	1.30	0.24	0.92	0.50
Panel C: MC & investment								
(FF3FM)	0.94	0.49	1.17	0.31	0.81	0.61	0.67	0.73
(FF5FM)	0.44	0.91	0.95	0.48	0.81	0.61	1.17	0.31
(4FM)	0.92	0.50	1.12	0.34	***0.75***	***0.66***	***0.66***	***0.74***
(6FM)	***0.42***	***0.92***	***0.90***	***0.53***	0.77	0.64	1.19	0.30
Panel D: MC & Islamic								
(FF3FM)	0.85	0.57	0.85	0.57	1.19	0.30	***1.27***	***0.26***
(FF5FM)	***0.48***	***0.88***	***0.72***	***0.69***	1.22	0.28	1.59	0.12
(4FM)	0.91	0.52	0.86	0.56	***1.01***	***0.43***	1.43	0.18
(6FM)	0.62	0.78	0.75	0.66	1.08	0.38	1.74	0.08

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – Jan 2018 and Feb 2018 – March 2021), using weekly returns and value-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

In order to examine whether global integration has impacted on a model's performance, a comparison is made to determine the best model before globalisation is the same after globalisation. The model with the lowest GRS test value, which is considered the model with the best performance compared to other asset pricing models, is bolded and underlined in the tables. Both tables 7.18A and 7.18B show that the best model before global integration is different than the one after the integration, with only one exception in panel A in both tables. This confirms that global integration has impacted the asset pricing models' performance. Therefore, hypothesis H5.2 is confirmed. This is similar to the result obtained from the previous section involving a similar hypothesis.

The next and last subsection examines the impact of global integration on the performance of the asset pricing models by using weekly returns and equal-weighted portfolios.

7.3.3 Asset pricing models using weekly returns and equal-weighted portfolios

In the previous three subsections, the performance of the asset pricing models is examined pre and post globalisation. It would appear that global integration does impact the models' performance. This section examines the variation in the performance of the asset pricing models pre and post globalisation. Again, this section uses the GRS test that examines the joint zero intercepts hypothesis to evaluate model performance. Then I rank the models according to the lowest GRS value, highlighting the best model.

Table 7.19A presents the result of the GRS test pre and post globalisation in June 2015. Panel A in Table 7.19A shows that the p-values are greater than 5% except for the asset pricing models after globalisation in the 2×2 sort. This means that the asset pricing models represented in the last two columns in panel A fail to explain the variation in average returns, and the joint zero intercepts hypothesis is rejected. This means that global integration has changed the ability of the asset pricing models in this panel to explain the variation in the cross-section of average returns in the Saudi market. Furthermore, we can see that the models with the best performance (bolded and highlighted in the table), are not the same pre and post globalisation in every panel, except for panel C.

Table 7.19 A: The GRS test for pre and post globalisation periods [H_0: $\alpha_i = 0$] (weekly equal-weighted)

	April 2009 – May 2015 pre-globalisation				June 2015 – March 2021 post-globalisation			
	2 × 3 sort		2 × 2 sort		2 × 3 sort		2 × 2 sort	
	GRS	**P- value**	**GRS**	**P- value**	**GRS**	**P- value**	**GRS**	**P- value**
Panel A: MC & B/M ratio								
(FF3FM)	1.02	0.43	1.03	0.41	***1.55***	***0.13***	***1.89***	***0.05***
(FF5FM)	1.04	0.41	10.8	0.38	1.59	0.12	1.97	0.04
(4FM)	***0.89***	***0.53***	***0.95***	***0.48***	1.72	0.08	1.89	0.05
(6FM)	0.92	0.50	1.04	0.41	1.79	0.07	2.05	0.03
Panel B: MC & profitability								
(FF3FM)	***0.27***	***0.98***	***0.32***	***0.97***	1.02	0.42	1.59	0.12
(FF5FM)	0.27	0.98	0.37	0.95	***0.93***	***0.49***	***1.38***	***0.20***
(4FM)	0.35	0.96	0.42	0.92	1.08	0.38	1.56	0.13
(6FM)	0.40	0.93	0.51	0.87	1.00	0.43	1.39	0.19
Panel C: MC & investment								
(FF3FM)	1.45	0.16	1.46	0.16	0.67	0.73	0.77	0.64
(FF5FM)	***1.15***	***0.33***	***1.17***	***0.31***	***0.65***	***0.75***	***0.61***	***0.79***
(4FM)	1.49	0.15	1.47	0.16	0.77	0.64	0.76	0.65
(6FM)	1.17	0.31	1.23	0.28	0.74	0.67	0.64	0.76
Panel D: MC & Islamic								
(FF3FM)	0.54	0.85	0.53	0.85	***0.55***	***0.83***	0.64	0.76
(FF5FM)	0.64	0.76	0.85	0.57	0.58	0.82	0.64	0.76
(4FM)	***0.42***	***0.92***	***0.44***	***0.91***	0.56	0.83	***0.61***	***0.78***
(6FM)	0.48	0.89	0.85	0.57	0.58	0.81	0.63	0.76

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – May 2015 and June 2015 – March 2021), using weekly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

The GRS tests for the asset pricing models for the periods pre and post globalisation enhancement are shown in Table 7.19B. Unlike Table 7.19A, the joint-zero hypothesis cannot be rejected in all panels of Table 7.19B. This means that all the models have the ability to describe the average returns in the Saudi stock market. However, the model with the best performance is different pre and post globalisation, except for the 2 **× 2** sort in panel D. This means the vast majority of the GRS tests indicate that global integration has changed the performance of the asset pricing models in the Saudi stock market.

Table 7.19B: The GRS test for pre and post globalisation enhancement periods [H_0: α_i = 0] (weekly equal-weighted)

	April 2009 – Jan 2018 (pre-globalisation enhancement)				Feb 2018 – March 2021 (post-globalisation enhancement)			
	2 × 3 sort		2 × 2 sort		2 × 3 sort		2 × 2 sort	
	GRS	P- value	GRS	P- value	GRS	P- value	GRS	P- value
Panel A: MC & B/M ratio								
(FF3FM)	1.51	0.14	1.54	0.13	***0.67***	***0.74***	0.92	0.51
(FF5FM)	***1.32***	***0.22***	***1.39***	***0.19***	0.85	0.57	1.23	0.28
(4FM)	1.54	0.13	1.53	0.13	0.74	0.67	***0.91***	***0.51***
(6FM)	1.35	0.21	1.39	0.19	0.92	0.51	1.30	0.24
Panel B: MC & profitability								
(FF3FM)	0.79	0.62	0.88	0.54	0.61	0.78	1.15	0.33
(FF5FM)	***0.72***	***0.69***	***0.85***	***0.57***	0.58	0.81	1.05	0.40
(4FM)	0.84	0.58	0.89	0.53	0.62	0.77	1.11	0.36
(6FM)	0.79	0.62	0.87	0.55	***0.57***	***0.82***	***0.98***	***0.46***
Panel C: MC & investment								
(FF3FM)	1.72	0.08	1.72	0.08	***0.41***	***0.92***	***0.44***	***0.91***
(FF5FM)	***0.95***	***0.48***	***1.08***	***0.38***	0.43	0.92	0.73	0.68
(4FM)	1.80	0.06	1.73	0.08	0.54	0.84	0.51	0.87
(6FM)	1.00	0.43	1.09	0.37	0.57	0.82	1.03	0.41
Panel D: MC & Islamic								
(FF3FM)	***0.85***	***0.57***	***0.85***	***0.57***	1.16	0.32	***1.09***	***0.37***
(FF5FM)	0.98	0.45	1.25	0.26	1.16	0.32	1.15	0.33
(4FM)	0.87	0.55	0.92	0.51	1.12	0.35	1.47	0.16
(6FM)	0.97	0.46	1.35	0.21	***1.10***	***0.36***	1.47	0.16

Note: The table shows the portfolio efficiency GRS test for two separate periods (April 2009 – Jan 2018 and Feb 2018 – March 2021), using weekly returns and equal-weighted portfolios for the asset pricing models (FF3FM, FF5FM, 4FM and 6FM) to explain the excess returns on nine MC and B/M ratio portfolios (panel A), nine MC and profitability portfolios (panel B), nine MC and investment portfolios (panel C), and nine MC and Islamic portfolios (panel D). For each sort 2 × 3 and 2 × 2, the table presents (a) the GRS F-statistics of portfolio efficiency to examine whether the regression intercepts of all portfolios are jointly equal to zero under the following null hypothesis: [H_0: $\alpha_i = 0$], and (b) the p-value of the GRS statistic, with rejection occurring at $p < 0.05$.

The results from Tables 7.19A and 7.19B indicate that global integration has altered the ability of asset pricing models to describe average returns in the Saudi market. Therefore, hypothesis H5.2 is confirmed. This is similar to the results obtained in the previous three subsections.

7.4 Conclusion

This chapter examined the effects of globalisation on the Saudi stock market, which was initiated in June 2015 and further enhanced in January 2018. For this purpose, the entire sample was divided into two subsamples before and after June 2015. Then, the entire sample was divided again into two subsamples before and after January 2018 to examine the effect of the globalisation enhancement.

Hypothesis H5.1 is concerned with the effects of globalisation on the factor premiums and I employed two statistical methods to test it. The first method was the one-sample t-test, conducted separately for the subperiods before and after globalisation in June 2015. Then I compared the results of the t-value from those two distinct periods for any significant changes. Similarly, I used a one-sample t-test for the subperiods before and after the globalisation enhancement in Jan 2018.

The second method was the two-sample t-test, where the two subsamples before and after globalisation in June 2015 were examined. Then, similarly, the two subsamples before and after globalisation enhancement in Jan 2018 were examined. The statistical test in both the one- and two-sample t-tests is used to determine if there was a significant shift in the mean returns of the factor premiums following globalisation due to the integration of the Saudi market.

The second hypothesis examined in this chapter is H5.2, which is about the impact of globalisation on the performance of the asset pricing models. This hypothesis was examined by employing the same GRS test method used in Chapter 6. The GRS test evaluates portfolio efficiency by testing the hypothesis of joint zero intercepts across a set of portfolios. A failure to reject this hypothesis suggests that the model effectively explains the variation in these portfolios' returns. Furthermore, models can be ranked based on their GRS test values, with the lowest value indicating superior performance. Thus, the GRS test initially identified models that performed well, as evidenced by an inability to reject the null hypothesis. In cases where multiple models meet this criterion, they are ranked by ascending GRS test values. Accordingly, this GRS test was conducted separately for each subperiod pre and post globalisation in June 2015, and the best model before and after globalisation were compared. If the best model was (was not) the same before and after globalisation, the global integration did not impact (did impact) the asset pricing model's performance. A similar procedure was conducted using the GRS tests separately for the subperiods before and after globalisation enhancement in January 2018.

This examination of the effect of global integration on the Saudi stock market presents many new findings about factor premiums and asset pricing model performance. The major findings are:

- **Emergence of a size premium:** The result of the one-sample t-test post January 2018 reveals a noteworthy emergence of a significant size premium. This size premium was insignificant before and after the onset of global integration in June 2015. This suggests a relationship between higher global integration and the size premium, with changing market demographics potentially influencing return patterns and pushing the size premium to be more evident and persistent. Since the globalisation of the market is relatively recent, more market integration in the next few years will give a clearer image of the emergence of a size premium. Thus, there is some evidence of the implications of globalisation on factor premiums, and hypothesis H5.1 about the size premium cannot be rejected.
- **Value premium post globalisation:** The findings indicate a significant change in the mean returns of the value premium, which was found to be significant post globalisation (June 2015 and January 2018). This indicates that value stocks generated significant abnormal returns after this event. This means that global integration has changed investor behaviour towards investing in value stocks. Hence, we have strong evidence about the implication of globalisation on factor premiums, and hypothesis H5.1 about the value premium is confirmed.
- **The inverse of the investment premium:** The inverse of the investment premium is found to be significant for the entire sample. However, a dissection of this premium inverse pre and post globalisation indicates that it was only significant before globalisation. This means the inverse of the investment premium disappears after it has existed in the market, possibly due to changes in market demographics imposed by globalisation. Therefore, globalisation has altered this factor premium, and hypothesis H5.1 is confirmed.

- **Asset pricing performance:** GRS tests for all asset pricing models were conducted on models built in four ways: monthly value-weighted, monthly equal-weighted, weekly value-weighted, and weekly value-weighted, which resulted in more than 500 GRS tests on eight different tables. The results of all those tests confirm that the models perform differently for all subsampled pre and post globalisation periods. This means that globalisation has altered the performance of those models. Therefore, hypothesis H5.2 is confirmed.

Chapter 8: Impact of COVID-19 on the cross-section of returns and factor premiums

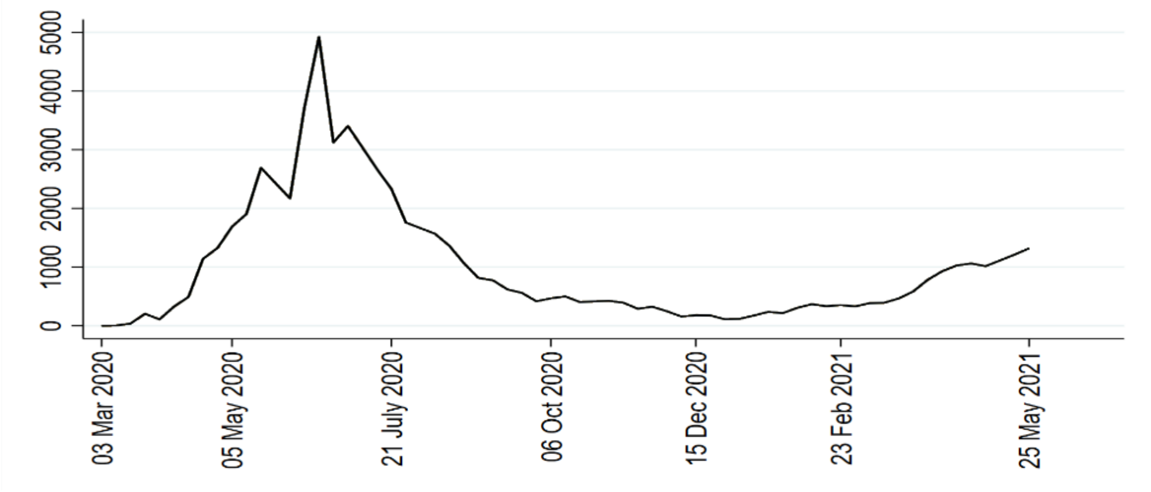
8.1 Introduction

This chapter will investigate how factor premiums and asset pricing models, discussed in previous chapters, were impacted by the recent COVID-19 global crisis. Given that the recent COVID-19 pandemic had profound effects on the global economy, it is imperative to explore the effects of such a crisis on factor premiums. Therefore, this chapter sets out to investigate the impact of COVID-19 on the performance of all listed stocks in Saudi Arabia and analyse how this impact varies among firms based on their characteristics, such as MC, B/M ratio, profitability, growth of investment and compliance with Sharia law. Hence, these characteristics are the foundation for forming the LHS portfolios and constructing the RHS factors used to examine the hypotheses.

Therefore, this chapter tests the hypothesis that the growth in COVID-19 confirmed cases impacted overall stock returns, and whether this impact varied according to different firm characteristics. The primary goal is to evaluate stock vulnerability during financial crises and to determine whether including the COVID-19 year in the sample period of this thesis introduces any biases.

In order to capture any variation in the impact of COVID-19 according to firm characteristics, the entire sample is divided into three subsamples for each firm characteristic, using two quantile breakpoints (see Table 8.2). This stratification enables an examination of potential variations among firms. Next, I will use independent panel regression for each subsample and employ the Wald test to examine the equality of COVID-19 coefficients between the subsamples' regression. This procedure provides meaningful insights into the impact of the pandemic across different groups of firm characteristics.

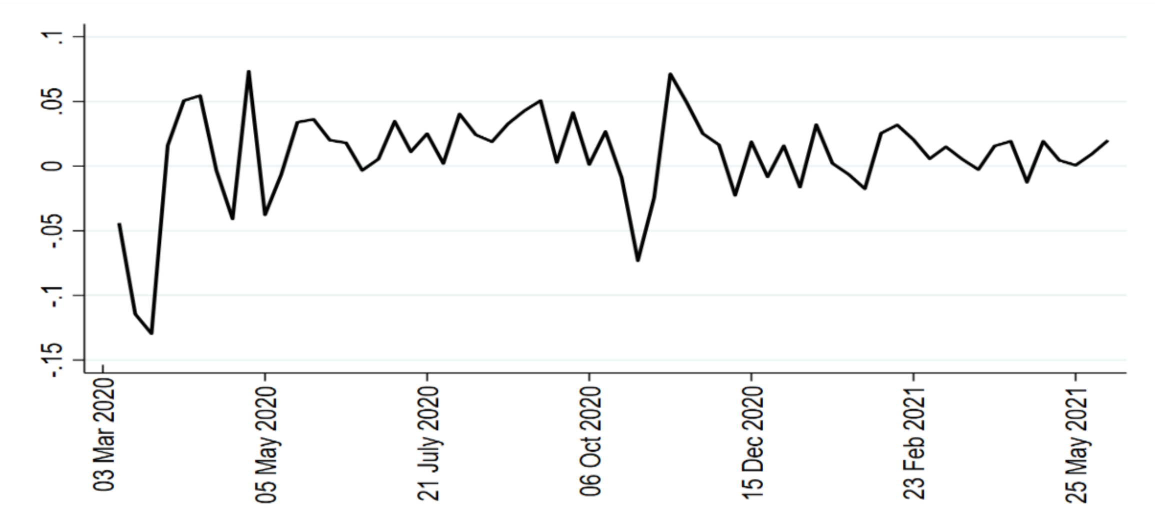
Figure 8.1: Weekly active confirmed COVID-19 cases (03/03/20 to 25/05/21)



COVID-19 is a virus from the Coronaviridae family caused by severe acute respiratory syndrome (Anand et al., 2021). It was declared a pandemic in March 2020 by the World Health Organization (2020). The Saudi government introduced strict measures to protect citizens from the spreading disease soon after the pandemic declaration. In the early stages, the weekly number of active confirmed COVID-19 cases rapidly increased throughout the country (see Figure 8.1), and the Tadawul All Share Index (TASI) recorded a 25% loss.

However, the sharp drop in market performance was short-lived, and the index started to show positive momentum earlier than other global markets (see Figure 8.2). Even though the market recovered from the losses within a few months, a more volatile market was evident during the rest of the period.

Figure 8.2: Weekly average return of all listed stocks (03/03/20 to 25/05/21)



The pandemic triggered an unprecedented global economic crisis and a virtual shutdown of all commercial activities. Ben Bernanke, the former chair of the US Federal Reserve, declared that COVID-19 had initiated a situation similar to the Great Depression of the 1930s—causing an extreme tightening of the global economy and financial stress (Ryssdal & Wiles, 2020). Most studies investigating the impact of the pandemic on the stock markets have documented overall adverse stock price reactions to the immediate shocks of COVID-19 (Al-Awadhi et al., 2020; Dörr et al., 2022; Li et al., 2022; Naidu & Ranjeeni, 2023; Setiawan et al., 2022; Xu, 2021). More particularly, researchers (Alqadhib et al., 2022; Alzyadat & Asfoura, 2021; Atassi & Yusuf, 2021; Sayed & Eledum, 2021) who examine the implications of COVID-19 for the Saudi stock market find that COVID-19 had a negative impact on the main index of the market.

The spread of COVID-19 caused a shock to most firms' revenues (Mazur et al., 2021). Indeed, some studies find that the first year of the pandemic was financially worse than some of the previous global financial crises (Chen & Yeh, 2021; Li et al., 2022). This situation created challenges for some firms that were financially vulnerable. Small capitalisation firms usually suffer more during financial crises than large ones that have more cash, liquid assets, and access to external financial resources or assets (Knudsen, 2019). Similarly, value stocks with a high B/M ratio are usually financially distressed (Zhang, 2005), unlike growth stocks with a lower ratio. Further, weak stocks with less profitability have poorer liquidity than robust stocks with higher profitability (Novy-Marx, 2013), therefore, they should be more sensitive to financial difficulties. In the same vein, stocks with high (aggressive) investment growth have less cash in hand than stocks with less (conservative) investment growth (Hou et al., 2014). For this reason, aggressive stocks may face more financial difficulties during a crisis. Finally, the literature has documented that Islamic equities outperform non-Islamic ones during financial crises (Ho et al., 2014; Jawadi et al., 2014). Thus, Islamic stocks may perform better than their non-Islamic counterparts in a crisis such as the COVID-19 situation.

Therefore, investigating the implications of COVID-19 on a firm’s characteristics is vital. It helps identify vulnerable firms and the level of immunity of other firms that are financially strong or more stable.

The remainder of this chapter is organised as follows. Section 8.2 presents the data, followed by section 8.3 which explains the methodology applied in this analysis. Section 8.4 discusses and presents the results, and is followed by the conclusion .

8.2 Data sources

This section presents the data and the statistics of this analysis, which includes the weekly data for 183 listed stocks in the Saudi stock market covering the period from 3 March 2020 to 25 May 2021. This period spans more than 62 weeks, and provides an extensive dataset to analyse the financial performance and market dynamics of the selected companies during the COVID-19 epidemic. The data was extracted from Eikon's DataStream database and includes stock price, number of outstanding shares, total book value, operating income, and the total assets of each listed firm. The data relating to the classification of stocks based on Islamic compliance was extracted from the Almaqased Economic Advisory website[45]. Statistics regarding daily active confirmed cases of COVID-19 were obtained from the King Abdullah Petroleum Studies and Research Center.

Table 8.1: Statistics for weekly variables (03/03/20 to 25/05/21)

Panel A: Summary statistics							
Variables	**Observations**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Skew.**	**Kurt.**
Returns	11284	0.008	0.059	-0.407	0.495	0.374	9.918
COVID-19	11284	0.1	0.429	-0.623	2.028	2.317	10.534
Brent	11284	0.002	0.129	-0.588	0.413	-1.104	10.916

Panel B: Correlation matrix			
Variables	**Returns**	**COVID-19**	**Brent**
Returns	1.0000		
COVID19	-0.1881	1.0000	
Brent	0.2707	-0.1183	1.0000

Note: The returns are the natural log for the weekly returns of all listed stocks; COVID-19 is the natural log for the weekly growth of COVID-19 confirmed cases, and Brent is the natural log of the weekly growth in Brent oil prices.

Figure 8.1 reveals that the first couple of months of the pandemic witnessed a huge jump in confirmed cases, which then started to decrease. Controlling the highly contaminating disease in such a short period can be attributed to the safety measures implemented by local authorities. The disease data in Figure 8.1 can be compared to Figure 8.2, which shows the weekly average returns in the Saudi stock market between 03/03/2020 to 25/05/2021. There was a huge drop

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in the first couple weeks of the pandemic around the declaration of COVID-19 as a global pandemic. After that, average returns show more stability throughout the entire sample.

The summary statistics of the data are shown in panel A of Table 8.2, and the correlation matrix between variables is presented in panel B. The correlation matrix shows no significant relationships between variables. Further, panel A shows that the observations of each variable are 11284, which means the panel data is strongly balanced. The next section explains the methodology used to manipulate the data.

8.3 Methodology

This study uses several hypotheses to examine how COVID-19 affected Saudi market returns. The first hypothesis examines whether the growth in COVID-19 cases negatively impacted the overall stock returns using the panel regression presented in equation 8.1. Further analyses have been conducted on whether there is any variation in the impact of COVID-19 depending on different firm characteristics. For this purpose, the entire sample was divided into three subsamples for each firm characteristic, and then the returns of those subsamples are estimated by equation 8.1. Finally, I used the Wald test to compare the magnitude of the COVID-19 coefficient on the subsamples.

In equation 8.1, the weekly returns of the stocks serve as the dependent variable, while the weekly growth of COVID-19 confirmed cases is the primary testing variable. Since the oil price is a significant determinant of the Saudi economy, this analysis used the weekly growth of the Brent oil price as a control variable. Thus, the following model is estimated (Cameron & Trivedi, 2010, p. 232):

$$R_{i,t} = \alpha + \beta_1\, COVID19_t + \beta_2\, Brent_t + u_{i,t}. \qquad (8.1)$$

$$u_{i,t} = \mu_i + \nu_{i,t}. \qquad (8.2)$$

Where:

$R_{i,t}$	=	the weekly return of stock *i* on week *t*;
α	=	the intercept of all stocks;

β_1	=	the coefficient of the explanatory variable $COVID19_t$, which is the natural log for the growth in total confirmed cases of COVID19 in week *t*;
β_2	=	the coefficient of the control variable $Brent_t$, which is the natural log of the Brent oil price in week *t*; and
$u_{i,t}$	=	the error term, which comprises μ_i and ν_{it}.

In this case, μ_i is constant over time and accounts for individual-specific effects, which are not included in the regression, and ν_{it} is the usual disturbance that varies over time and across individual stocks (Baltagi, 2008). The assumption here is that the error term is uncorrelated with the regressors in the model (Cameron & Trivedi, 2005, p. 699). The variables used as the main inputs in the pooled OLS model given in equation 8.1 are calculated using the equations below:

Weekly stock return:

$$R_{i,t} = ln\ (P_{i,t} / P_{i,t-1}). \tag{8.3}$$

Where:

$P_{i,t}$	=	the adjusted closing price of stock i in week t, and
$P_{i,t-1}$	=	the adjusted closing price of stock i in week t−1.

Growth of COVID-19 cases:

$$COVID19_t = ln\ (C_t / C_{t-1}). \tag{8.4}$$

Where:

$C_{i,t}$	=	the number of cases in week t, and
$C_{i,t-1}$	=	the number of cases in week t−1.

Change in the global oil price:

$$Brent_t = ln\ (BP_t / BP_{t-1}). \tag{8.5}$$

Where:

$BP_{i,t}$	=	the closing price of Brent oil in week t, and

$BP_{i,t}$ = the closing price of Brent oil in week t−1.

Using the model in equation 8.1, I first estimate the overall returns of all listed stocks in a one-panel regression. Next, I estimate the returns of each sub-sample of firm characteristics, explained in the subsection below.

8.3.1 Measuring the impact of COVID-19 stock returns based on firm characteristics

This section explains the method used to measure the variation in the effect of COVID-19 based on different firm characteristics such as MC, B/M ratio, profitability, investment and Islamic compliance. To identify the variation, the stocks in the study sample are allocated into three sub-samples using two quantile breakpoints for each characteristic (35th and 65th). Table 8.2 shows those subsamples. For Islamic compliance, three sub-samples are identified based on the classifications of the Almaqased Advisory Center and allocated to three groups, which are Islamic (I), mixed (M), and non-Islamic (N) stocks.

Table 8.2: Sub-samples based on firm characteristics

Firms characteristics	**Quantile breakpoints for the sub-samples**		
	Below 35th	**Between 35th and 65th**	**Above 65th**
MC	Small stocks	Medium stocks	Large stocks
B/M ratio	Growth stocks	Medium stocks	Value stocks
Profitability	Low-profit stocks	Medium stocks	High-profit stocks
Investment	Conservative stocks	Medium stocks	Aggressive stocks

Note: All listed stocks are divided independently into three sub-samples for each firm characteristic.

These sub-samples allow the examination of whether the effect of the growth of COVID-19 cases in the returns vary according to each firm characteristic's subsamples. Therefore, the returns of each subsample are estimated using equation 8.1. Next, I examine whether the estimated coefficients for the $\beta COVID19_t$ in equation 8.1 across related sub-samples from Table 8.2 are equal or not. For instance, in the three subsamples of MC (small, medium, and large stocks), three coefficient equality tests are conducted, which are:

$$\beta\ COVID19_{\text{small}} - \beta\ COVID19_{\text{medium}} = 0$$

$\beta\ COVID19_{\text{small}} - \beta\ COVID19_{\text{large}} = 0$

$\beta\ COVID19_{\text{medium}} - \beta\ COVID19_{\text{large}} = 0.$

Since there are several combinations of tests using three different subsamples for each firm characteristic, the first subsample in each test is referred to as subsample1, and the second is subsample2 in the following null hypothesis (*H0:* $\beta\ COVID19_{subsample1} - \beta\ COVID19_{subsample2} = 0$) that rejects the null if the Z-score in equation 8.6 is larger than the appropriate χ_1^2 threshold (Clogg et al., 1995; Weesie, 1999). The test is separately applied for each of the two sub-samples in each firm characteristic, which means three tests are conducted for each characteristic.

$$z = \frac{\widehat{\beta}\ (COVID19_{subsample1}) - \widehat{\beta}\ (COVID19_{subsample2})}{\left[\ \widehat{\sigma}^2_{\widehat{\beta}\ (COVID19_{subsample1})} + \widehat{\sigma}^2_{\widehat{\beta}\ (COVID19_{subsample2})}\right]^{1/2}}. \qquad (8.6)$$

Where:

Z	=	the test statistics,
$\widehat{\beta}\ \text{COVID19}_{\text{subsample1}}$ and $\widehat{\beta}\ COVID19_{subsample2}$	=	the estimated coefficients for the two different groups employed for the comparison;
$\widehat{\sigma}^2_{\widehat{\beta}\ (COVID19_{subsample1})}$	=	the coefficient variance of the first group, and
$\widehat{\sigma}^2_{\widehat{\beta}\ (COVID19_{subsample2})}$	=	the coefficient variance of the second group.

This technique of examining the equality of the coefficients has been widely applied (e.g., Paternoster et al., 1998; Sloat et al., 2020). More relevantly, this comparison method between the slopes was employed recently to examine the impact of increasing COVID-19 cases on the mutual fund industry's performance in Saudi Arabia (Alqadhib et al., 2022).

8.4 Empirical analysis

The regression results presented in Table 8.3 reveal how the overall market reacted to the change in COVID-19 cases. The model is first estimated using the weekly stock returns of all firms listed on the Saudi stock exchange as a dependent variable, and the growth in COVID-19 cases and the change in Brent oil price are the explanatory variables presented in Column

1. Then, the model estimates the same weekly returns using the interaction term between COVID-19 and the Brent oil price in Column 2. Since the model only examines the impact of COVID-19 and ignores other factors that can explain the returns, both regression models show a low R-squared value. However, the high 'F' statistics for both estimations indicate that the model is reasonably valid. As expected, COVID-19 recorded statistically significant negative coefficients in both regressions. Despite the current analysis using all listed stock returns, the findings are consistent with other research (Alzyadat & Asfoura; Atassi & Yusuf) that investigate the effect of COVID-19 on the Saudi stock market's main index, TASI

Table 8.3: The impact of COVID-19 on overall returns (03/03/20 to 25/05/21)

	(1) **Main model**	**(2)** **Interaction model**
α	0.0102***	0.0102***
	(0.0004)	(0.0004)
COVID19	-0.0219***	-0.0167***
	(0.0015)	(0.0014)
Brent	0.1159***	0.0803***
	(0.0040)	(0.0048)
COVID19 & Brent		0.0679***
		(0.0077)
R-square	0.0980	0.1031
F-statistic	509.18	343.96

Note: This table shows the coefficients of the panel regression results for the stock returns of all listed stocks in the Saudi market. The robust standard errors are in parentheses while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels. The dependent variable is $R_{i,t}$, the weekly return of stock *i* at day *t*. α is the intercept, COVID19 is the natural log for weekly growth in total confirmed cases of COVID19, and Brent is the natural log of weekly growth in the Brent oil price.

The results also show that the weekly change in the Brent oil price had a positive relationship with the returns, which is to be expected since the oil industry remains a major part of Saudi Arabia's economy. Column 2 in Table 8.3 shows the results of the interaction between COVID-19 and the Brent price in the returns and indicates a significant positive relationship, and that the R squared is greater than that in the model in Column 1. The magnitude of the interaction coefficient is almost half of the impact of the Brent oil price in the model without the interaction term, which makes sense because the negative impact of COVID-19 wiped out part of the effect of the Brent oil price. This means that in circumstances similar to COVID-19, if the oil price continues to increase, the increase in coronavirus cases will not significantly affect stock returns.

Moving on to the primary objective of this chapter, which is to investigate the impact of COVID-19 on firm characteristics, the sample was divided into three sub-samples based on market capitalisation (MC), B/M ratio, profitability, investment growth, and Islamic compliance. This division allows for an examination of COVID-19's effect on firms according to their distinct characteristics. The subsequent subsections will present the results and discussion of the regression analyses for each characteristic, commencing with an analysis of the influence of COVID-19 case growth on different market capitalisation (MC) stocks.

8.4.1 Analysis of COVID-19 impact based on market capitalisation

The market capitalisation of publicly listed companies, frequently used as a proxy for a firm's size, has been recognised as a key determinant influencing stock market returns (e.g., Fama & French, 2015). Following previous work, this research used MC to measure firm size. The study sample is divided into three sub-samples: small, medium, and large. By applying regression analysis, this investigation aims to uncover how the impact of COVID-19 varies across these different groups.

The estimated coefficients for the equation for these sub-samples and the results of the overall sample are presented in Table 8.4. These results indicate that irrespective of a firm's size, the performance of all firms was negatively affected by the changing number of COVID-19 cases. However, the sub-sample representing medium size firms recorded the highest negative coefficients among the three sub-samples.

To further investigate the effect, I employed the Wald test to examine the coefficients equality hypothesis between market capitalisation groups. Table 8.5 summarises these hypotheses. The table shows that the equality test hypothesis between (small and medium) and (medium and large) is rejected, because the p-value is significant and lower than 5%. However, the equality of the coefficients between small and large groups is not rejected. According to the magnitude of the COVID-19 coefficient of the medium group in column 3 of Table 8.4 and the equality test in Table 8.5, the conclusion emerges that stock returns in the medium capitalisation group were more severely affected by the growth of COVID-19 cases than the other two groups

Table 8.4: COVID-19 impact on stock returns across various market capitalisations (03/03/20 to 25/05/21)

	(1) All listed stocks	(2) Small stocks	(3) Medium stocks	(4) Large stocks
α	0.0102***	0.0143***	0.0107***	0.0055***
	(0.0004)	(0.0007)	(0.0006)	(0.0005)
COVID19	-.0219***	-.0186***	-.0294***	-0.0176***
	(0.0015)	(0.0024)	(0.0025)	(0.0025)
Brent	0.1159***	0.1093***	0.1178***	0.1207***
	(0.0040)	(0.0059)	(0.0058)	(0.0087)
Observations	11284	3782	3782	3720
R-square	0.0980	0.0581	0.1317	0.1473
F statistics	509.18	155.61	256.38	130.19

Note: column 1 represents the coefficients of the panel regression for all listed stocks together, whereas columns 2, 3, and 4 represent the groups of small, medium, and large market capitalisation stocks, respectively. The robust standard errors are in parentheses while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t}$, the weekly return of stock *i* at day *t*.

Table 8.5: Equality test of COVID-19 estimated coefficients for the sub-samples – MC

(H0: β *COVID-19*$_{\text{1st-subsample}}$ - β *COVID-19*$_{\text{2nd-subsample}}$ = 0)

Groups compared	Chi2	p value	Decision
Small$_{(1st)}$ & medium$_{(2nd)}$	9.82***	0.0017	Null rejected
Small$_{(1st)}$ & large$_{(2nd)}$	0.09	0.7679	Null cannot be rejected
Medium$_{(1st)}$ & large$_{(2nd)}$	11.40***	0.0007	Null rejected

Note: This table shows the equality test of the coefficients between all market capitalisation groups (small, medium, and large). Chi-square, p-value, and decisions are shown in the table. The null is rejected if the p-value is lower than 5%. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using suest and test commands.

This finding differs from that of Al-Awadhi et al. (2020), who find that the impact of COVID-19 on large market capitalisation stock was greater than that on other groups of stocks. However, this could be due to investor preference to take risks and buy small stocks or play safe and buy large stocks, resulting in the neglect of medium stocks in the Saudi market.

8.4.2 Analysis of COVID-19 impact based on B/M ratio

This ratio, which compares a company's book value to its market value, offers insights into the perceived value of a firm's tangible assets relative to its market valuation. As previously explained, this analysis divides the study sample into three sub-samples: value stocks, medium stocks, and growth stocks, to examine whether COVID-19's influence on stock returns differs based on the B/M ratio. In this context, I predicted that firms with higher B/M (value stocks) ratios would experience a different impact on their returns' performance than those with lower ratios (growth stocks and medium stocks). Existing literature on stock returns claims that value stocks usually outperform growth stocks. It has also been argued that value stocks yield higher returns and carry a higher risk because they are financially distressed (Asness et al., 2013; Fama & French, 1998). The regression results presented in Table 8.6 for all sub-samples record significant negative coefficients, indicating that irrespective of the B/M ratio of stocks, all were equally affected by COVID-19 (also see Table 8.7).

Table 8.6: COVID-19 impact on stock returns across various B/M ratios (03/3/20 to 25/5/21)

	(1) All listed stocks	(2) Growth	(3) Medium	(4) Value
α	0.0102***	0.0093***	0.0099***	0.0114***
	(0.0004)	(0.0009)	(0.0007)	(0.0007)
COVID19	-0.0219***	-0.0234***	-0.0200***	-0.0223***
	(0.0015)	(0.003)	(0.0025)	(0.0021)
Brent	0.1159***	0.0976***	0.1203***	0.13***
	(0.0040)	(0.0059)	(0.0073)	(0.0068)
Observations	11284	3782	3782	3720
R-square	0.098	0.0801	0.0966	0.122
F statistics	509.18	140.37	185.99	234.29

Note: Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of growth, medium and value stocks, respectively. The robust standard errors are in parentheses while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t}$, which is the weekly return of stock *i* at day *t*.

Table 8.7: Equality test of COVID-19 estimated coefficients for the sub-samples – B/M ratio

(H0: β COVID-191st-subsample - β COVID-192nd-subsample = 0)

Groups compared	Chi2	P value	Decision
$Growth_{(1st)}$ & $medium_{(2nd)}$	0.78	0.3771	Null cannot be rejected
$Growth_{(1st)}$ & $value_{(2nd)}$	0.09	0.7614	Null cannot be rejected
$Medium_{(1st)}$ & $value_{(2nd)}$	0.50	0.4814	Null cannot be rejected

Note: This table shows the equality test of the coefficients between all B/M ratio groups (growth, medium, and value). Chi-square, p-value, and decisions are shown in the table. The null is rejected if the p-value is lower than 5%. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using suest and test.

8.4.3 Analysis of the COVID-19 impact based on profitability

The impact of COVID-19 on stock returns appears to be intricately linked to the profitability of companies. Those with higher pre-pandemic profitability are expected to demonstrate greater resilience, potentially weathering the challenges more effectively than their less profitable rivals.

Table 8.7: COVID-19 impact on stock returns across firms with various levels of profitability (03/3/20 to 25/5/21)

	(1) All listed stocks	(2) Low	(3) Medium	(4) High
α	0.0102***	0.0135***	0.0093***	0.0078***
	(0.0004)	(0.0007)	(0.0006)	(0.0007)
COVID19	-0.0219***	-0.0261***	-0.0207***	-0.0187***
	(0.0015)	(0.0023)	(0.0027)	(0.0026)
Brent	0.1159***	0.1171***	0.1237***	0.1067***
	(0.0040)	(0.0059)	(0.007)	(0.0077)
Observations	11284	3782	3782	3720
R-square	0.098	0.0883	0.113	0.0994
F statistics	509.18	208.25	227.90	107.86

Note: Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent groups of low, medium, and high profitability stocks, respectively. The robust standard errors are in parentheses while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t}$, the weekly return of stock *i* at day *t*.

In order to explore the responses of profitable firms to the changes induced by COVID-19, this research estimates equation 8.1 for three sub-samples (low, medium, and highly profitable stocks). These sub-samples are chosen according to the profitability levels of individual firms. The results shown in Table 8.7 record statistically significant negative coefficients with the change in COVID-19 cases irrespective of their profitability. However, the magnitude of the COVID-19 coefficient for the low profitability group is stronger.

The outcomes of the Wald test suggest that the estimated coefficients for less profitable firms and their highly profitable counterparts are unequal (see Table 8.8). This finding agrees with the hypothesis that highly profitable firms would exhibit greater resilience than less profitable ones in the face of COVID-19.

Table 8.8: Equality test of COVID-19 estimated coefficients for the sub-samples – profitability

(H0: β *COVID-19*$_{\text{1st-subsample}}$ - β *COVID-19*$_{\text{2nd-subsample}}$ = 0)

Groups compared	Chi2	P value	Decision
Low$_{(1st)}$ & Medium$_{(2nd)}$	2.44	0.1183	Null cannot be rejected
Low$_{(1st)}$ & High$_{(2nd)}$	4.60	0.0319**	Null rejected
Medium$_{(1st)}$ & High$_{(2nd)}$	0.27	0.6036	Null cannot be rejected

Note: This table shows the equality test of the coefficients between all profitability groups (low, medium, and high). Chi-square, p-value, and decisions are shown in the table. The null is rejected if the p-value is lower than 5%. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using suest and test commands.

8.4.4 Analysis of COVID-19 impact based on investment growth

Contemporary literature has identified investment growth, or the expansion of total assets, as a novel factor influencing stock returns (Fama & French, 2015; Foye, 2018a; Hou et al., 2014). Empirical evidence from the literature indicates that a firm's investment exhibits a risk pattern in which stocks associated with higher investment tend to carry lower expected returns because of reduced risk exposure and vice versa (e.g., Chen et al., 2011; Cooper et al., 2008; Hou et al., 2014; Titman et al., 2004). In contrast, firms with higher investment growth tend to experience elevated market valuation, reflecting investor optimism about their potential for future profitability.

However, a notable aspect of this paradigm is a company's cash position. The concept is intuitive—a decrease (increase) in investment often corresponds to an increase (decrease) in available cash. In this light, it is conceivable that firms characterised by higher investment growth may experience varying effects from external shocks such as the spread of COVID-19. Specifically, these companies might suffer heightened vulnerability to such adverse events because of their lower cash reserves during times of crisis.

However, the findings derived from the estimated regression results for equation 8.1 displayed in Table 8.9 reveal no substantial distinctions between the estimated coefficients among the three sub-samples: conservative, medium, and aggressive. Additionally, the outcomes of the Wald test statistics in Table 8.10 suggest similar results.

Table 8.9: COVID-19 impact on stock returns across various investment growth paradigms (03/3/20 to 25/5/21)

	(1) **All listed stocks**	**(2)** **Conservative**	**(3)** **Medium**	**(4)** **Aggressive**
α	0.0102***	0.0122***	0.0099***	0.0085***
	(0.0004)	(0.0008)	(0.0007)	(0.0007)
COVID19	-0.0219***	-0.0226***	-0.0223***	-0.0207***
	(0.0015)	(0.0023)	(0.0029)	(0.0024)
Brent	0.1159***	0.1215***	0.1077***	0.1184***
	(0.0040)	(0.0072)	(0.0059)	(0.0075)
Observations	11284	3782	3782	3720
R-square	0.098	0.0975	0.0965	0.1007
F statistics	509.18	154.14	236.23	137.06

Note: Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent groups of conservative, medium, and aggressive investment growth stocks, respectively. The robust standard errors are in parentheses, while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t}$, the weekly return of stock *i* at day *t*.

Table 8.10: Equality test of COVID-19 estimated coefficients for the sub-samples – investment

(H0: β *COVID-19*$_{1st\text{-}subsample}$ - β *COVID-19*$_{2nd\text{-}subsample}$ = 0)

Groups compared	Chi2	P value	Decision
Conservative$_{(1st)}$ & Medium$_{(2nd)}$	0.01	0.9410	Null cannot be rejected
Conservative$_{(1st)}$ & Aggressive$_{(2nd)}$	0.32	0.5734	Null cannot be rejected
Medium$_{(1st)}$ & Aggressive$_{(2nd)}$	0.18	0.6741	Null cannot be rejected

Note: This table shows the equality test of the coefficients between all investment groups (conservative, medium, and aggressive). Chi-square, p-value, and decisions are shown in the table. The null is rejected if the p-value is lower than 5%. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using suest and test commands.

It would appear that the detrimental impact of COVID-19 was not substantially influenced by the extent of investment activities undertaken by firms. This phenomenon could stem from the homogeneity in risk exposure spanning investment growth categories or the dominant influence exerted by market sentiment and external macroeconomic factors, which might overshadow the effects of investment growth dynamics.

8.4.5 Analysis of COVID-19 impact based on Islamic compliance (Islamic stocks)

The literature has presented conflicting outcomes regarding the performance of Islamic stocks during financial crises. Some studies have asserted that Islamic equity performance during these periods does not significantly differ from that of their conventional counterparts (Ajmi et al., 2014; Álvarez-Díaz et al., 2014; Erragragui & Revelli, 2016). Conversely, other investigations posit that Islamic equity exhibits stronger resilience during crises (Al-Khazali et al., 2014; Ghazali et al., 2015; Ho et al., 2014; Jawadi et al., 2014). Recent studies have examined Islamic stocks' performance during the COVID-19 pandemic, highlighting their superior performance compared with non-Islamic stocks (Ali et al., 2022; Salisu & Sikiru, 2020; Setiawan et al., 2022). Consequently, Saudi market-based religious investors need to comprehend the implications of COVID-19 for Islamic stocks.

For this purpose, I estimated equation 8.1 separately for the three sub-samples: Islamic, mixed, and non-Islamic stocks. As shown in Table 8.11, the estimated regression coefficients show that changes in COVID-19 case numbers negatively affected the stock market returns of all three groups. However, the magnitude of the COVID-19 coefficient for the Islamic stocks group was the largest.

Table 8.11: Sharia law compliance and COVID-19

	(1) All listed stocks	(2) Islamic	(3) Mixed	(4) Non-Islamic
α	0.0102***	0.0105***	0.0106***	0.0091***
	(0.0004)	(0.0006)	(0.0009)	(0.0008)
COVID19	-0.0219***	-0.0248***	-0.0219***	-0.0156***
	(0.0015)	(0.0023)	(0.0027)	(0.0023)
Brent	0.1159***	0.1093***	0.1132***	0.1336***
	(0.0040)	(0.0047)	(0.0078)	(0.0098)
Observations	11284	5270	3534	2480
R-square	0.098	0.1006	0.0913	0.1069
F statistics	509.18	293.07	127.54	118.37

Note: Column 1 represents the coefficients of the panel regression for all listed stocks, whereas columns 2, 3, and 4 represent the groups of Islamic, mixed, and non-Islamic stocks, respectively. The stocks are allocated into these groups according to Almaqased Advisory classifications. The robust standard errors are in parentheses while the asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is $R_{i,t}$, the weekly return of stock i at day t.

Table 8.12: Equality test of COVID-19 estimated coefficients for the sub-samples – Islamic

(H0: $\beta\ COVID\text{-}19_{1st\text{-}subsample} - \beta\ COVID\text{-}19_{2nd\text{-}subsample} = 0$)

Groups compared	Chi2	P value	Decision
Islamic$_{(1st)}$ & mixed$_{(2nd)}$	0.67	0.4140	Null cannot be rejected
Islamic$_{(1st)}$ & non-Islamic$_{(2nd)}$	8.05	0.0046***	Null rejected
Mixed$_{(1st)}$ & non-Islamic$_{(2nd)}$	3.15	0.0757*	Null rejected

Note: This table shows the equality test of the coefficients between all Islamic groups (Islamic, mixed, and non-Islamic). Chi-square, p-value, and decisions are represented in the table. The null is rejected if the p-value is lower than 5%. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Stata/IC 16.1 was used to conduct these tests using suest and test commands.

Further, the Wald test indicates that the adverse impact of COVID-19 on Islamic stocks was more significant than on non-Islamic stocks (see Table 8.12). This outcome is inconsistent with other studies that find that the former performed better during COVID-19. This result may be related to industry composition, diversification and flexibility of investments, and the global economic exposure of non-Islamic stocks.

8.5 Conclusion

This chapter investigated the potential negative impact of the growth in COVID-19 cases from 3/3/2020 to 25/5/2021 on overall stock returns in the Saudi market. Additionally, it explored whether this impact varied across stocks with different characteristics, including market capitalisation (MC), B/M ratio, profitability, investment growth, and compliance with Sharia law (Islamic stocks).

The findings revealed that the increasing number of COVID-19 cases adversely affected every stock in the market. Notably, the impact was more pronounced on medium market capitalisation stocks than small and large ones, possibly due to investor neglect of medium stocks. Investors tend to take higher risks with small market capitalisation stocks or adopt a risk-averse approach by investing in larger stocks.

Low-profitability stocks suffered more significantly from the growing COVID-19 cases than high and medium profitability stocks. This may be attributed to a potential lack of liquidity, precisely when it was needed. Lastly, non-Islamic stock returns were less affected than Islamic and mixed stock returns, with Islamic stocks being the most impacted by the pandemic. This could be attributed to Islamic stocks' additional risks, including limited financial sources, especially during the downturn in most firms' revenues caused by COVID-19 (Canepa & Ibnrubbian, 2014).

The findings in this analysis carry significant implications for investors and policymakers. Firstly, any diversification strategy implemented during a crisis must carefully account for the liquidity positions of the assets involved. Recognising the differential impact on stocks with varying characteristics, particularly in market capitalisation and profitability, becomes crucial for effective risk management. For investors with a religious motivation to invest in Islamic stocks, heightened caution is advised, especially in scenarios resembling the challenges posed by COVID-19. The vulnerability of Islamic stocks during the pandemic emphasises the need for a thorough evaluation of the associated risks of any Islamic stocks. I also suggest that stocks with low profitability are not a good investment choice in a situation similar to the COVID-19 pandemic. Investors should be aware of the risk involved.

On the other hand, policymakers may consider implementing measures to enhance the liquidity of financial markets and ensure sufficient liquidity during crises. Policymakers should be prepared to cooperate with financial institutions to develop innovative financial instruments designed to improve liquidity and provide additional stability during times of crisis. This initiative should include Islamic finance instruments to benefit Islamic stocks that are most vulnerable during difficult times. Policymakers’ efforts should continuously update and adapt regulatory frameworks, collaborate closely with regulatory bodies, and invest in public education programs to inform market participants about the risks and consequences associated with varying stock characteristics during challenging economic periods. By taking these proactive steps, policymakers can contribute to the financial market’s overall stability and integrity, fostering an environment that promotes investor confidence during crises.

Lastly, the decision to exclude the COVID-19 year from the thesis analysis is confirmed, recognising the unusual fluctuation in stock returns across firms with different characteristics during this period. This exclusion is essential as it ensures the reliability and stability of the portfolios used as primary inputs in the thesis analysis, maintaining the integrity of the overall research framework.

The forthcoming chapter presents the conclusion of this thesis, summarising the overarching implications and the significant findings.

Chapter 9: Conclusion and implications

9.1 Introduction

This chapter concludes the comprehensive analysis of the cross-section of stock returns in the Saudi stock market.

In the preceding chapters (5 to 8), the study findings were comprehensively presented and discussed. Chapter 5 investigated the significance of factor premiums such as size, value, profitability, investment, and Islamic in the equity market of Saudi Arabia. Chapter 6 examined the ability of the asset pricing models employed in this study, FF3FM, FF5FM, 4FM and 6FM, to explain the variation in the cross-section of stock returns in the Saudi market. Chapter 7 investigated the impact of global integration on the significance of the factor premiums and asset pricing models' performance by examining the subsamples pre and post globalisation. Finally, in Chapter 8 the impact of COVID-19 on the returns of different firm characteristics was examined, which were used to construct the factor premiums and LHS portfolios employed to examine the asset pricing performance.

This chapter summarises the findings of the previous four chapters, discusses the implications and limitations of the study, and provides suggestions for future research, and ultimately, I will determine how the research objectives introduced in Chapter 1 have been met:

- ❖ The first objective is to identify the factors with a significant equity premium in the Saudi equity market, such as size, value, profitability, investment, and Islamic.
- ❖ The second objective is to compare the ability of Fama and French's three- and five-factor models to describe the variation in the cross-section of stock returns in the Saudi equity market.
- ❖ The third objective is to examine whether adding an Islamic factor to the existing Fama and French models can improve the models’ ability to describe the variation in the cross-section of stock returns.
- ❖ The fourth objective is to investigate whether the global integration of the Saudi equity market has changed the significance of the factor premiums and the performance of asset pricing models in the Saudi stock market.

The remainder of this chapter is organised as follows: Section 9.2 reviews and discusses the objectives related to the factor premiums and the key findings. Section 9.3 presents the objectives and main findings related to the performance of asset pricing models. Section 9.4 reviews the objectives and main findings related to the impact of global integration on factor premiums and asset pricing models. Section 9.5 covers the main findings about the impact of COVID-19 on stock returns and factor premiums in the Saudi market. Section 9.6 explains the practical contributions and presents policy recommendations. Section 9.7 outlines the overall limitations of this study. Finally, Section 9.8 suggests areas for further research.

9.2 The significance of factor premiums in the Saudi stock market (April 2009-March 2021)

The first objective of this study was to identify the factors that have a significant equity premium in the Saudi stock market for the entire sample period from April 2009 to March 2021. Those factors are essentially constructed similarly to the portfolio formation and are: (i) size premium is the returns of small MC stocks minus big MC stocks, (ii) value premium is the returns of high B/M ratio stocks minus low stocks, (iii) profitability premium is the returns of robust (profitable) stocks minus weak stocks, (iv) investment premium is the returns of conservative (low investment growth) stocks minus aggressive stock, and (v) Islamic premium is the return of Islamic stocks minus non-Islamic. Hypotheses H1 and H3 assume that factors such as size, value, profitability, investment, and Sharia compliance (Islamic) have significant premiums on the stock return in the Saudi stock market. This means that the mean return of those factors should be significantly greater than zero when a one-sample t-test is applied. The t-test against the zero value was applied for each factor independently to determine whether the mean return on this factor was significantly greater than zero. The following subsections explain the findings of those examinations, starting with the size premium.

9.2.1 The significance of the size premium (SMB)

The findings revealed that the size premium was insignificant, suggesting that the return on small market capitalisation stocks does not significantly exceed zero. One potential reason for this observation may lie in the historical trajectory of the size premium, which exhibited strength until the 1980s and early 1990s before its disappearance (Blitz & Hanauer, 2020; Van Dijk, 2011). However, some recent studies have highlighted the reappearance of the size premium, affirming its significance in subsequent periods (Esakia et al., 2019). Thus, it is common for the size premium to disappear in many developed markets. The size premium might have disappeared during the period under examination in this study but might reappear in the future.

The disappearance of the size premium in the Saudi market may be due to the herding behaviour documented in the Saudi market (Balcilar et al., 2013; Salem, 2019). Song (2022) links herding behaviour with the size premium when he finds that investors follow each other in ignoring large market capitalisation stocks, which accumulate the size premium in the market. Rahman et al. (2015) also supports the findings about herding behaviour, showing that investors are indifferent towards stock characteristics and have a tendency towards noise trading in the Saudi market. Therefore, the insignificance of the size premium in the Saudi market may be influenced by irrational herding behaviour towards large market capitalisation stocks or other stock characteristics that alter the size premium.

9.2.2 The significance of the value premium (HML)

The premium in value stocks with a high B/M ratio was significant, meaning the mean return was greater than zero across all portfolios of the Saudi stock market examined in this study. Exceptionally, this premium stands out as the only factor consistently demonstrating the significance of its mean returns across all eight methods employed for factor construction. This robust consistency underscores the compelling nature of the value premium within the Saudi stock market. Essentially, it indicates that stocks characterised by a high B/M ratio consistently offer a compensatory higher return, fostering a tangible edge in investment opportunities within the Saudi stock market.

The value premium is consistent and significant in many developed and emerging markets. Thus, it is not surprising to find it significant in all methods used to form the HML. There is a logical explanation for why the value premium is consistent and significant in the Saudi market. Chan and Lakonishok (2004); and Lakonishok et al. (1994) argue that growth stocks tend to underperform value stocks due to irrational investors using naive strategies that rely on robust past performance and overly optimistic future expectations. These investors overreact to news, causing growth stocks to become overpriced. Conversely, contrarian investors outperform by avoiding overpriced stocks. The prevalence of noise traders in the Saudi market, documented by Benlagha and Hemrit (2018); and Rahman et al. (2015), suggests that these naive strategies have persisted, providing a plausible explanation for the value effect and the significance of the value premium in the Saudi stock market.

9.2.3 The significance of the profitability premium (RMW)

The return from high profitability stocks was expected to be significantly greater than zero in this study. However, the findings indicated that the mean return for profitable stocks in the Saudi stock market was not significantly greater than zero, meaning there was no profitability premium. Thus, stocks with higher profitability do not necessarily compensate with higher returns in the Saudi stock market.

The profitability premium has been found to be significant in many markets and has been documented globally (Kogan et al., 2022; Novy-Marx, 2013). The plausible reason for the profitability premium not being significant in the Saudi market is that the coexistence of value and profitability premiums is quite challenging as they are negatively correlated (Kogan et al., 2023). Therefore, the strong and consistent value premium that was found in the Saudi stock market might be why the profitability premium is insignificant. Accordingly, this study confirms that the profitability premium is insignificant and does not feature in the return's patterns of the Saudi stock market.

9.2.4 The significance of the investment premium (CMA)

The investment premium, which is the return on low-investment (conservative) stocks minus the return on high-investment (aggressive) stocks, was found to be insignificant. However, the investigation of the investment premium revealed an interesting finding, which was the significance of the inverse of the investment premium. This means that the return on aggressive stocks minus the return on conservative stocks generated a premium that was significantly greater than zero.

This may be due to the fact that investors are attracted to stocks with higher investment growth, which is a sign of good performance in the past that might lead to good performance in the future. This may lead to higher investment growth stocks being more attractive, and the higher demand for those stocks yielding higher returns and generates equity premium. Lakonishok et al. (1994) suggest that investors usually overestimate the future potential of glamour stocks with high investment growth, driven by their remarkable past growth, and resulting in the overvaluation of these stocks. However, this behaviour might have changed, as the inverse of the investment premium started to disappear since the global integration of the Saudi market, discussed in Chapter 7 and briefly presented in the following subsections.

9.2.5 The significance of the Islamic premium (IMN)

This study investigated the pattern of the return of Islamic and non-Islamic stocks, and found that neither has an equity premium in the Saudi stock market. Although some studies, such as Canepa and Ibnrubbian (2014); and Merdad et al. (2015), find that Islamic classification do have a risk pattern in the Saudi stock market, this study confirms that Islamic classification in the Saudi stock market has no implications on the returns pattern.

However, Islamic classifications for stocks might result in different allocations, and less strict Islamic classifications of stocks might produce different lists of Islamic stocks (Rizaldy & Ahmed, 2019). This means that some Shariah committees are less strict when evaluating the financial position and the amount of debt the stocks have and allocating them to the Islamic stock category, which ends up in more Islamic stocks (see section 2.5.2). A less strict list with more Islamic stocks might yield higher and significant Islamic premiums. It is important to mention that this study uses one of the strictest lists in the Saudi market due to data unavailability for other less stringent lists, which might be the reason why the Islamic premium was insignificant in this study.

9.3 The performance of the asset pricing models

In the preceding section, the findings related to the first objective of this study were outlined, focusing on identifying factor premiums in the Saudi market. This section addresses the objectives concerning the performance of asset pricing models, precisely their capacity to explain variations in average returns in the Saudi market. This study addressed two objectives related to the performance of asset pricing models, which are explained alongside the corresponding findings addressing those objectives in the subsequent subsections.

9.3.1 Comparing the performance of Fama and French's three- and five-factor models

The second objective of this study was to compare the ability of Fama and French's three- and five-factor models (FF3FM and FF5FM) to describe the variation in the cross-section of stock returns in the Saudi market. The main goal of this objective was to examine whether FF5FM outperforms FF3FM's explanatory power for the average returns for the LHS portfolios designed for this purpose.

Hypothesis H2 assumed that FF5FM could better describe the variation in the cross-section of average returns than FF3FM. This hypothesis was examined using the GRS test for portfolio efficiency, which used a joint-zero hypothesis to assume the model could describe the return variation in a group of different portfolios. Next, the GRS test was used to rank the models according to their GRS value, where the lowest GRS value indicates the best performance. This study ran 64 GRS tests using different asset pricing models using the sets of LHS portfolios constructed from different return frequencies, weighting schemes, and sorts.

The results of those tests indicated that FF5FM mostly outperforms FF3FM when the factors in the models were constructed using the 2×3 sort. However, the FF5FM rarely showed any improvements to FF3FM when the 2×2 sort is used to construct the factors, except in a few tests. It is important to mention that the 2×3 sort excludes almost 40% of the stocks when building the factors used in the models, whereas 2×2 sort includes all the stocks. The results from the models using factors that include all the stocks in the sample were more valuable, because those models were built on more diversified factors and better represented the stocks in the market. Therefore, we can say that FF5FM does not improve on FF3FM in the Saudi stock market unless we use the 2×3 sort to build the model.

This mixed result is not surprising, as FF5FM has shown different results when applied to various markets. Foye (2018a) finds that FF5FM outperforms FF3FM in Latin American markets and underperforms in Asian markets. Kubota and Takehara (2018) study about the Japanese market finds that FF5FM does not offer any improvements over FF3FM. However, some other studies find that FF5FM improves FF3FM's explanatory power and outperforms it in terms of the GRS value (Dirkx & Peter, 2018; Fama & French, 2017; Foye, 2018b).

9.3.2 Comparing the performance of FF3FM and FF5FM with 4FM and 6FM

The third objective of this thesis was to examine whether adding an Islamic factor to the existing Fama and French FF5FM and FF3FM models could improve the model's ability to describe the variation in the cross-section of stock return in the Saudi market. Thus, hypothesis H4 assumed that adding the Islamic factor to the Fama and French asset pricing models would improve the models' explanatory power in the Saudi stock market. This hypothesis was examined using the same method of the GRS test for portfolio efficiency, which was used to compare the performance of FF5FM and FF3FM. The total number of GRS tests conducted to examine the improvement of the models is 64 tests using different return frequencies, weighting schemes, and sorts.

The result indicated that the Islamic factor does not improve the models' explanatory power in the cross-section of average returns when the models are built on factors formed using the 2 × 3 sort. Although there were a couple of exceptions in the GRS tests suggesting the Islamic factor improved the models, the vast majority of the tests in the 2 × 3 sort indicated no improvement. Conversely, the test results on the models built on factors using the 2 × 2 sort indicated that the Islamic factor did improve the models' explanatory power (although with some exceptions).

As mentioned in the preceding section, the factors formed using the 2 × 2 sort better represented the stocks, as it included all the stocks in the sample, whereas the 2 × 3 sort excluded almost 40% of the stocks. Therefore, the Islamic factor does have an explanatory power over the movement of stock returns in the Saudi market.

Other studies have introduced valuable factors to the multiple asset pricing models and improved the model's explanatory power. For instance, adding investment growth to FF3FM by Chen et al. (2011); and Cooper et al. (2008), and profitability by Hou et al. (2014); and Novy-Marx (2013) were huge improvements to the FF3FM that led to the introduction of FF5FM. More recently, Dirkx and Peter (2020) and Dhaoui and Bensalah (2017) have added momentum and sentiment factors to the FF5FM. Researchers have always aimed to find the ultimate model that best explains average returns by adding new factors to existing models. This is similar to the motivation for adding the Islamic factor.

9.4 The impact of global integration

The fourth objective was to investigate whether the global integration of the Saudi stock market changed factor premiums and the ability of asset pricing models to describe the variation in the cross-section of average return. To date, the literature lacks similar studies.

Therefore, this study examined the direct impact of globalisation on factor premiums and asset pricing models. The Saudi capital market became globally integrated when the market opened for foreign investors for the first time in June 2015. Then, in January 2018, the integration was further enhanced when the authorities in the Saudi market eased some of the restrictions on foreign investors. Therefore, the factor premiums and the asset pricing models' performance were examined twice: (i) pre and post the global integration in June 2015; and (ii) pre and post globalisation enhancement in January 2018. The next subsection reports the findings about the factor premiums affected by globalisation: size, value, and investment premiums. (The findings indicated that globalisation is irrelevant to profitability and Islamic premiums, thus they are not discussed.)

9.4.1 Global integration and factor premiums

Hypothesis H5.1 suggests that the mean return of the factor premiums significantly changes due to global integration. Examining this hypothesis was undertaken using two methods: one-sample and two-sample t-tests. In the one-sample t-test, the examination is conducted for pre and post globalisation, and then the results are compared, whereas the two-sample t-tests utilise the two periods before and after globalisation and give the final result. The examination of the implications of global integration on factor premiums reveal some interesting findings, outlined below.

- **The size premium (SMB)** is emerging in the Saudi market. The one-sample t-test post January 2018 showed that the size premium was significant in three SMB versions out of four formed from equal-weighted portfolios, whereas the other four versions of the SMB formed using value-weighted portfolios were insignificant for that period. Further, the size premium remained insignificant before and after the global integration in June 2015, but the enhancement of globalisation in January 2018 seems to have caused the size premium to reappear. This means that small MC stocks compensated higher returns than large MC stocks, which were significantly greater than zero for the period after January 2018. Therefore, I conclude that changes in market demographics may be influencing returns patterns and pushing the size premium to be more evidential and persistent. The relationship between global integration and the emergence of the size premium might be clearer with more market integration in the next few years.

- **The value premium (HML)** was significant in all versions used to form the HML factor post globalisation in June 2015 and January 2018, which indicates that value stocks generated significant abnormal returns after globalisation reforms. Thus, the changes in market demographics likely influenced returns patterns, potentially increasing the evidence and persistence of the value premium. Demographic shifts may be affecting investor sentiment and preferences, affecting the returns of value stocks relative to growth stocks. Specifically, these changes have led to increased demand for value stocks and enhanced the value premium. On the other hand, the value premium was insignificant for the subsamples before globalisation in Jun 2015 and Jan 2018. This means that investors neglected the value premium before globalisation and it did not generate any equity premium in the Saudi market. Therefore, we can say that global integration has changed investor behaviour towards investing in value stocks and has altered the influence of factor premiums, specifically the value premium, in the Saudi market.
- **The 'inverse' of the investment premium,** which was significant for the entire sample**,** was significant before globalisation and after globalisation enhancement. Therefore, globalisation or globalisation enhancement did not directly affect the investment premium. The inverse of the investment premium pre and post globalisation and globalisation enhancement, was only significant before those events. This means the inverse of the investment premium disappeared after it had existed, possibly due to changes in market demographics imposed by globalisation.

9.4.2 Global integration and asset pricing model performance

Hypothesis H5.2 assumes that a model’s ability to explain the variation in the cross-section of stock returns has changed due to global integration. Thus, GRS tests for portfolio efficiency examined globalisation's impact on asset pricing model’s performance. Model performance was assessed in separate subsamples before and after globalisation in June 2015. Similarly, performance was evaluated again in other subsamples for the pre and post globalisation enhancement period in January 2018. GRS tests were conducted on asset pricing models constructed in four ways: monthly value-weighted, monthly equal-weighted, weekly value-weighted, and weekly equal-weighted, resulting in over 500 GRS tests. Most of those tests confirmed the differences in model performance across all subsamples before and after globalisation and globalisation enhancement in June 2015 and January 2018, indicating that globalisation has indeed altered the performance of these asset pricing models. It has already documented that the factor premiums changed due to globalisation and globalisation enhancement in the Saudi market. Therefore, it was to be expected that the performance of the asset pricing models built on those factors would also perform differently pre and post globalisation.

9.5 COVID-19 and firm characteristics

Finally, this study investigated the impact of the growth of COVID-19 cases on overall stock returns in the Saudi market and whether this impact varied across stocks with different characteristics, including market capitalisation (MC), book-to-market (B/M) ratio, profitability, investment growth, and compliance with Sharia law (Islamic stocks). Panel regressions and Wald tests were employed to examine the effect of COVID-19 on overall stock returns and specific firm characteristics.

The findings indicated that the increasing number of COVID-19 cases had a significant adverse effect on every stock in the market. This effect was particularly pronounced on medium market capitalisation stocks compared to small and large ones, potentially due to investor neglect of medium stocks. Investors appear inclined to take higher risks with small market capitalisation stocks or adopt a risk-averse approach by investing in larger stocks. Furthermore, low-profitability stocks suffered more significantly from the growing COVID-19 cases than high- and medium-profitability stocks, possibly due to a lack of liquidity precisely when needed.

Non-Islamic stock returns were less affected than Islamic and mixed stock returns, with Islamic stocks being the most impacted by the pandemic. The finding that Islamic stocks are not a good hedge in difficult times is similar to the suggestion of Álvarez-Díaz et al. (2014), who argue that Islamic equity does not necessarily perform better during crises, supported by other studies, for example Ben Rejeb and Arfaoui (2019); and Erragragui and Revelli (2016). The poor performance of Islamic stocks may be attributable to the additional risks associated with Islamic stocks, including limited financial sources, especially during a downturn in most firms' revenues caused by COVID-19 (Canepa & Ibnrubbian, 2014).

9.6 Practical contributions and policy recommendations

The insights derived from this thesis have broad implications on several practical fronts, emphasizing its role in improving investment decision-making processes. These practical implications are significant for two primary stakeholder groups: investors (domestic and foreign), portfolio managers, and policymakers. The implications related to investors are addressed in the practical contribution subsection below, and the policy recommendations subsection presents the implications for policymakers.

9.6.1 Practical contribution (investors and portfolio managers)

Primarily, the findings of this study about the performance of factor premiums and asset pricing models provide valuable assistance to investors and portfolio managers. The first important finding is the persistent equity premium in value stocks with a high B/M ratio, and the compensation to investors of higher returns compared to other stocks in the Saudi market. The other factor premiums investigated in this study do not show any significant premium. This means investing in stocks such as small market capitalisation stocks or robust (higher profitability) stocks, which are globally thought to compensate for higher equity premiums, will not generate any profit in the Saudi market.

This information about the factor premiums is essential from the investor perspective. It helps investors and portfolio managers with portfolio construction by tilting towards factors which have historically provided higher returns, such as the value premium in the Saudi market. Thus, investors can potentially enhance their portfolio's risk-adjusted returns by investing in value stocks. Furthermore, factor premiums usually work as a benchmark in the market, and this helps investors and portfolio managers with performance evaluation. For instance, the return on a portfolio that exceeds the value premium in the Saudi stock market is considered a good performance.

Furthermore, the findings about asset pricing models' performance confirm the superiority of the Fama and French five-factor model, and improved asset pricing models with the Islamic premium are valuable for investment decision-making processes. Therefore, investors and portfolio managers who use these asset pricing models will be able to evaluate their portfolio performance, enhance portfolio construction, and improve their risk management more successfully.

The findings about the impact of global integration on factor premiums also offer valuable insights for investors, for instance, the emergence of the size premium in the Saudi market and the disappearance of the inverse of the investment premium. The analysis of the factor premiums before and after globalisation help to better understand the underlying drivers of stock market returns and identify market inefficiencies or anomalies. Investors should be aware of the impact of globalisation on factor premiums that might be subject to fluctuations due to the ongoing change in the market demographics that lead to the change in investor sentiment. Specifically, investors and portfolio managers should watch for potential abnormal returns in small market capitalisation stocks and be aware of the disappearance of the inverse of the investment premium that used to exist in the Saudi stock market. Also, they should be aware of any potential changes in the pattern of returns due to changes in the degree of globalisation in the Saudi market.

Finally, the varying impact of COVID-19 on different firm characteristics highlights the importance of diversification in investment portfolios. Investors can mitigate risk by diversifying across stocks with different market capitalisations, profitability levels, and compliance classifications. This approach can help cushion against adverse market movements and improve overall portfolio resilience. Investors should also be aware of Islamic stocks' vulnerability in the Saudi stock market in future financial crises similar to COVID-19. This is important because many studies in the literature indicate that Islamic equity is a safe haven in challenging times.

9.6.2 Policy recommendations

This research assists policymakers to improve their regulatory efforts and oversight activities. I will make a few recommendations to help with market stability and enhance market proficiency. These findings are motivated by a desire to promote stability and continuous expansion of the equity market of Saudi Arabia. Consequently, this study proposes the following regulatory reforms.

- **Enhancing market integration efforts:** The impact of global integration on factor premiums and asset pricing model performance underscores the importance of ongoing efforts to enhance market integration and openness to a wider range of investors, which leads to more stability and efficacy. For instance, the emergence of the size premium, the strong appearance of the value premium, and the disappearance of the illogical inverse of the investment premium that was significant in the pre-globalisation market are mainly driven by the openness of the contemporary market. Therefore, policymakers should pursue policies to attract foreign investment, improve market infrastructure, and harmonise regulatory frameworks to facilitate greater participation and liquidity in the Saudi stock market.
- **Promoting Sharia-compliant investing:** Despite the insignificant Islamic premium observed in the Saudi stock market, this factor improves Fama and French's asset pricing models' explanatory power, which means Islamic stocks play some role in the pattern of returns in the Saudi market. Therefore, policymakers should support Sharia-compliant investing by fostering an enabling regulatory environment and promoting awareness of Islamic finance principles among investors. This may involve streamlining Islamic finance regulations, expanding the range of Sharia-compliant investment products, and providing incentives for Islamic financial institutions to participate in the capital market. Taking advantage of the huge market for Islamic investment in a country where the Islamic religion plays a crucial part in its structure will expand market participants, liquidity and size. The market will become the first destination for such investments and expand remarkably.
- **Improving risk management practices:** The differential impact of COVID-19 on stocks with different characteristics underscores the importance of robust risk management practices among investors and corporations. For instance, the vulnerability of Islamic stocks and those with low profitability due to a lack of liquidity could be managed better. This would have avoided the poor performance during the COVID-19 crisis by providing vulnerable firms with a contingency plan. Thus, policymakers and regulators should adopt best practices in risk management, including stress testing, scenario analysis, and contingency planning, to help mitigate the adverse effects of future crises on market participants and the broader economy.
- **Enhancing data availability and supporting academic research:** Reformation and ongoing global market integration seem to be the priority for the decision-makers in Saudi Arabia, who want to make the market the biggest player in the MENA region and one of

the biggest globally. However, this cannot be achieved without collaboration between the market authority and academia and publicly making market performance data available. Specifically, the data about the factor premiums in the market and changes that might happen in those premiums annually should be more widely available. Moreover, data related to Islamic stocks should be available and more organised, facilitating more rigorous empirical research and analysis of Islamic stocks. Information about Islamic stocks and factor premiums is valuable from the investor perspective, and this study has comprehensively tried to point them out. Nevertheless, this study recommends a more continuous effort by policymakers to enhance market efficacy and participation.

9.7 Limitations of the study

9.7.1 Data availability

The main limitation related to data availability in the Saudi stock market, particularly concerning Islamic stocks, lies in the lack of and poor quality of accessible data. Islamic stock information is provided by Shariah committees and financial advisories in Saudi Arabia, and there is no proper regulation. These advisories produce lists that classify stocks into Islamic, mixed, and non-Islamic groups, with varying degrees of strictness. However, obtaining these lists, particularly those with less strict criteria, is challenging due to limited data availability. While I was able to obtain historical lists spanning almost ten years, they were only available from the strictest list. Access to less strict lists would have allowed for a more thorough analysis, potentially yielding different outcomes, particularly regarding the mean return for the Islamic factor. Consequently, this data constraint posed significant challenges and is a major limitation of the study, underscoring the complexities of accessing historical data on Islamic stocks in the Saudi market.

9.7.2 Limited listed stocks

The Saudi stock market is relatively small in terms of the number of listed stocks compared to developed and even some emerging markets, with only roughly 200 listed stocks. Most similar studies are conducted on markets with a larger number of listed stocks. Therefore, it is important to acknowledge the inherent limitations stemming from this characteristic of the Saudi stock market.

The limited number of listed stocks in the market poses a challenge in achieving robust statistical significance and generalizability of the findings. With a smaller sample size, the study may struggle to capture the full spectrum of factors influencing stock returns. This study tried to overcome this issue by using multiple methods to make the analysis more robust (monthly and weekly returns, value- and equal-weighted portfolios, and 2×3 and 2×2 sorts).

Further, the small number of listed stocks in the Saudi market may make constructing well-diversified portfolios challenging, which are essential for effectively testing asset pricing models and factor premiums. Nevertheless, the portfolios constructed in this study did attain the minimum efficient number of stocks that were required for appropriate testing.

9.8 Future research

While this analysis comprehensively examines factor premiums and asset pricing models within the Saudi market, numerous avenues for future research remain unexplored. As such, I will now highlight the potential directions for subsequent studies that can enrich our understanding of the dynamics at play in this market.

Firstly, as more years of data accumulate in the Saudi stock market, conducting a similar study on factor premiums and asset pricing models in future will allow longitudinal trends to be tracked and assess the stability of observed findings over time. Expanding the study's timeframe can provide deeper insights into the persistence of factor premiums and the efficacy of asset pricing models across varying market conditions and economic cycles. Furthermore, the current study sample period is relatively small, and a longer data series will allow for more robust statistical analysis. This will enable researchers to draw more reliable conclusions about the factors driving stock returns in the Saudi market. Therefore, future researchers can validate current findings, identify potential changes in factor performance, and refine investment strategies accordingly.

Future research could also expand the examination of the impact of globalisation on factor premiums within the Saudi market through the application of diverse methodologies. As the degree of globalisation is annually increasing in the Saudi market, researchers can employ innovative analytical techniques, such as econometric modelling and machine learning algorithms, to better understand how globalisation shapes factor premiums and asset pricing dynamics in the Saudi context. Furthermore, extending this investigation towards major emerging markets such as China and other markets that have experienced significant integration into the global marketplace is an attractive idea. This will enhance our understanding of the complex relationship between globalisation, factor premiums, and asset pricing models on a global scale.

Moreover, conducting similar studies in other countries of the Gulf Cooperation Council (GCC) would deliver important new information. The region lacks similar studies, and investigating regional countries such as the United Arab Emirates, Qatar, Kuwait, Bahrain, and Oman would allow the GCC region to compare and contrast factor premiums and asset pricing models across multiple markets.

Analysing the collective performance of factor premiums and asset pricing models across the GCC region can provide insights into commonalities and differences in market dynamics, regulatory environments, and investor behaviour. Moreover, exploring factors in individual markets and regional impact can inform investors and policymakers about broader trends and investment opportunities within the GCC. Thus, researchers can enhance their understanding of factor-based investing in the GCC context and facilitate cross-border investment strategies tailored to the unique characteristics of the region's markets.

A further innovative avenue for future research could involve applying machine learning algorithms to analyse factor premiums and asset pricing models in the Saudi market and potentially across the GCC region. Thus, researchers can uncover complex return patterns and interactions among factors that traditional statistical methods may overlook by employing advanced artificial intelligence and machine learning techniques. Machine learning is known for its ability to identify non-linear relationships, detect subtle anomalies, and predict future stock return trends more accurately. It can integrate alternative data sources such as sentiment analysis from social media, satellite imagery for economic activity, or alternative financial data, enriching the analysis and providing new insights into the drivers of factor premiums. This interdisciplinary approach combines finance, data science, and artificial intelligence to enhance our understanding of market dynamics and inform more sophisticated investment strategies tailored to the unique characteristics of the Saudi and GCC markets

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