

# **Shariah-compliant Five-factor Pricing Model: Implementation on the Saudi Arabian Stock Market**

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Islamic Finance Management

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## **Abstract**

The development of Islamic finance necessitates the availability of shariah-compliant asset pricing models that capture the relevant sources of systematic risk for which investors must be compensated. This study extends Fama and French (2015) five-factor model by replacing risk-free rate with return on AAA Sukuk and the market portfolio factor with Shariah-compliant market portfolio. The model was tested using ten-year monthly data from 2007 to 2016 on non-financing firms listed on Saudi Stock exchange. The model inputs were returns on mimicking portfolios that proxy for the relevant underlying sources of risk that affect cross-section of returns. Excluding market portfolio factor, the independents portfolios were obtained from double sort of the listed firms on size and each of book-to-market value, profitability, and investment; the dependent portfolios were created from the double sort of firms on size and book- to-market value. For estimation, generalized method of moments was applied. The test results indicate that all factors in the model explain returns on small size portfolios, while in case of on big size; high BM only investment factor was found significant in explaining the returns. The model of this study is expected to provide investors with a robust tool in investigating the sources of systematic risk and make investment decisions based on their risk-return preferences.

**Keyword:** Shariah-compliant pricing model, AAA Sukuk, Five factors pricing model, Asset pricing.

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## CHAPTER ONE: INTRODUCTION

Islamic or Ethical Finance has been growing rapidly in the last thirty years. In order to build an independent entity for the Islamic finance and not being driven as subsidiary of the conventional, many fields and aspects have to be developed to be shariah-compliant. Asset pricing is one of the essential fields that have to be modified due to the fact that investment decisions making and measuring of the performances is relied on the pricing or valuating models.

In 1964 CAPM was introduced as the one factor-pricing model based on the statistical relation of beta (representing associated risk) and required rate of return. CAPM model is an extension of Mean-Variance theory by Markowitz (1959); CAPM is linear relationship between expected returns and market risk of a security. (Banz, 1981)

However, according to Hanugen and Baker there are common firms' characteristics that able to explain the differences in expected returns on stocks. (Hanugen & Baker 1996) Accordingly, Fama and French in 1993 introduced the multifactor pricing model, arguing that the differentials in stock returns are risk premiums that consistent with multifactor pricing model. The size as the difference on small firm's stock returns minus the returns for big firms (SMB) is the additional pricing factor to the market in CAPM. Moreover, the as difference of return on firm's stocks with high book to market ratio minus the returns on firms with low book to market ratio (HML) is the third pricing factor. (Fama and French, 1993.) Finally, in 2015 Fama and French developed the five-factor pricing model to add the profitability and investment factors.

Apparently, previous studies on Saudi Arabia have been concentrating on the Capital Asset Pricing Model (CAPM); moreover, Saudi Arabian market as an Islamic and emerging market has not been tested for any of the shariah-Compliant pricing models.

This study is testing the performance of shariah-compliant five factor model on the Saudi Arabian capital market. Data is including all the listed companies in Saudi exchange (Tadawul) from 2007 to 2016. Based on shariah modifications for asset pricing in the literature review discussion, two shariah-compliant models were tested: AAA Sukuk rate of return and removed risk-free rate models. The study results illustrate that the shariah-compliant five factor pricing models are significantly explain the average return on four sized-value portfolios. Moreover, the shariah-compliant five factor model outperform the three factors model.

## 1.1 RESEARCH PURPOSE AND OBJECTIVES

Due to the need of advanced pricing model considering the Islamic law and shariah boundaries, the propose model is an Islamic version of Fama and French 2015 model. In testing the applicability of the propose models, the following sub objective is set:

- To investigate whether market, size, book to market, profitability and investment are pervasive and priced in the stock returns in Saudi Market.

## 1.2 RESEARCH SIGNIFICANCE AND CONTRIBUTION:

Considering the Saudi Arabian market as testing ground of the models is one of the main distinguished aspects of the study. The Saudi exchange market (Tadaweul) is an emerging market and the largest among the MEANA. However, there are special characteristics that distinguish the Saudi market; in Saudi's exchange, trading, investing and transaction must be within the Shariah boundaries. Islamic Law prohibits three major elements

in any transaction: Interest rate, uncertainty events and non-halal products such as alcohol and Pork. Therefore, in creating portfolio all investments must go through screening process to be proving its applicability for Islamic investing.

Moreover, Saudi economy has no assessment for taxation on income or enterprises. However, there is Zakat Rate, which is based on the asset value and not the profit obtained; the 2.5% can be considered as tax for holding assets such as Gold or any type of investment. In details, the return from the zakat goes to the poor people as symbol of responsibility from the rich people to the poor ones.

Since that the five factor pricing model is recently introduced by Fama and French (2015), this study contribution is testing the five-factor on Saudi Arabia and with consideration to the Islamic law. Two main proposed Shariah-compliant are tested.

### **1.3 RESEARCH QUESTIONS:**

The research questions are aligned with the literature review and objective of the study. The following are the main questions:

1. Whether the Shariah-compliant five-factor models explain the return of stocks in Saudi market?
2. Whether the five factors: market, size, MB, profitability and investment are pervasive priced the stock returns of the non-financial firms, listed in Saudi exchange?
3. Dose the five factor model perform better than Fama and French three factors model (1993).

## **1.4 ORGANIZATION OF THE THESIS**

The following chapter is the literature review, which address the rational of the five factor models and its link to the returns on the stocks. Moreover, the discussion of the Shariah-compliant modification in the pervious studies is included. The third chapter is the methodology: Data and sample explanation, Shariah-compliant modifications followed by the factors portfolio constructions. The fourth chapter is the result and discussions of the GMM regressions and the descriptive statistics. Finally, the fifth chapter is including the study implication, limitations and general conclusion.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 INTRODUCTION

The concept and models of the asset pricing has been evolving for more than fifty years. The main concept is based and extends of the Markowitz's mean variance theory (MVT). In 1964 the Capital Asset Pricing Model was introduced as the one factor model, considering only the return on market as pricing factor (I Heshmat, 2012). Further the three factors model by Fama and French was introduced in 1993 to include the size and value factors to the equation. Recently Fama and French proposed the five factor pricing model, which consider the profitability and investment as pricing factors additional to the market, size and value.

Based on the applicability of the five factor model on the US market by Fama and French (2015), The researchers had tests different sets of constructing the portfolios; in order to determine the suitable sorting for this model. Accordingly, they suggested the use of the 2×2 sort because the others options eliminate the medium group in calculating the excess returns. Expectantly, the five-factor model outperforms the three and four- factor models (Fama & French, 2015)

The literature review chapter is consists of five main sections. The first section is an introduction to the asset pricing models, and includes the evolving of the asset pricing models since 1964 as CAPM to the recent five factor model 2015. Section 2 addresses and discusses the pricing five factors rationales individually based on pervious studied. The study hypotheses are aligned with each factor rationale. Section 3 discusses and argues the modifications of the pricing models in pervious studies to be Shariah compliant models.

Section 4 is explaining the pervious studies on testing the pricing models on the Saudi Arabia market. In section 5, includes the recent studies for testing the five factor model in different economies.

## **2.2 LITERATURE ON RETURN ON MARKET FACTOR:**

The return on market was the first pricing factor introduced in Capital Asset Pricing Model by William Sharpe (1964) and John Lintner (1965). The model was a development of the Mean-variance model by Markowitz (1959), which depends on a statistical theory that investors are always willing to minimize the investment variance (Risk) for their required level of return. Precisely, theses choices of investments are portfolios that located on the efficient frontier (minimum variance frontier).

According to CAPM, there are two main assumptions that CAPM suggests. First, investors can borrow or lend at Risk-free rate (Elbannan, 2014), which considered as the minimum required rate of return, and the risk-free rate is the intercept of the Capital Market Line. Secondly, the one factor model assumes that all investors are homogenous in their expectations to result in identical expectations of the expected returns. (Elbannan, 2014)

Based on the theorem of separation by Tobin (1958), investors combine the investment of efficient portfolio (risky assets) and risk-free asset, which is linked to CAPM equation:

$$\text{CAPM} = E (R_i) = R_f + \beta [E (R_M) - R_f]$$

The Beta equation:

$$\beta_{iM} = \text{COV} (R_i R_M) / \sigma^2 (R_M)$$

### 2.2.1 RECENT IMPLIMENTATIONS:

The return on the market is based on solid concept of finance; moreover, in the recent tests for the pricing models starting with the one factor model to the five factor illustrate the factor significance; however, when the market return factor as in CAPM compared with performance in explaining the average returns on the portfolios, the three and five-factor models outperform the market solely. (Zaremba, Czapkiewicz, 2016)

H1: The market return portfolio is a priced factor in asset pricing in Saudi market

### 2.3 LITERATURE ON FIRMS' SIZE FACTRO:

As first to propose the size effect on the average return was in 1981 by Banz, the study conducted on all firms listed in NYSE for the period of forty years to conclude that small firms (lower market capitalization) have higher risk-adjusted return than the big firms ( High market capitalization). The theoretical explanation for the result is the trade of between available information and the investors' willingness to hold the common stock. Precisely, small firms have limited information accuses to the investors, which make the stocks are undesirable to hold. (Banz 1978).

Moreover, in 1993, Fama and French have proved the effectiveness and relevance of the Size and book to market factors to the stock's average return. The study was time series for twenty-seven years to indicates that these two factors (size, BE/ME) are able to explain the average return combined and not independently. (Fama&French, 1993). These two researchers in 1992 have documented the size factor by the rational that small firms are subjected to a

longer low earning in depression than big firms, which links the size with common risk factor that explains the negative relationship of the size and return on stock.

Based on the purpose of providing the economic foundation for the relation between the size, BE/BM factors and the stocks' return as in 1992b, Fama& French in 1995 researchers linked in their study the fundamentals factors (size, Me/MB) in earning to the fundamentals factors in stocks return. To indicate that Size and market factors for earning is linked to the market and size factors in stocks' return.

The use of small mines big firms portfolios based on the evidence that was given by Huber-man and Kandel (1987); SMB portfolios is constructed to capture the co-variation in small stock returns that is compensated in average return and not recognized by the market return. (Fama & French, 1996).

#### 2.3.1 RECENT IMPLIMENTATIONS:

The majority tests of the size factor in different economics and since the mid of 70s up to 2017 illustrate that the size of the firms is one of the major pricing factors in determining the expected stock returns. Recently, Durand, Limkriangkrai and Chai in 2016 had proved the size-pricing factor in their study, applying the mimicking factor portfolios approach adapted by Fama and French 1993.

H2: The size portfolio is a pervasive priced factor in asset pricing in Saudi Arabia market.

## 2.4 LITERATURE REVIEW ON MARKET TO BOOK RATIO FACTOR:

The book to market ratio is a stock's value function based on two components: the book value and growth, sorting the stocks in two groups: value stocks (high BE/BM) and growth stock (low BE/BM).

The two researchers Fama and French in 1992 showed a strong relation among the average returns and the BE/ME ratio. Rationally, Firms with high BE/ME ratio (lower prices comparing to its book value, undervalued stocks) tends to have higher returns. In the contrary, low BE/BM ratio (Higher price relative to its book value, overvalued stocks) have lower average return. Fama & French calculated BE/BM in 1993 by dividing the book common equity value by the market equity value (market capitalization; price per share multiplied by the number of outstanding shares)

For the purpose of linking the book to market factor with economical foundation (firms earnings) Fama and French in 1995 explained that firms with high BE/ME ( low stock's price relative to its book value) are associated with low earnings and considered as distressed firms. However, the firms with low BE/ME indicate high average return in capital, and tend to be more profitable.

In align with all the previous studies in testing the BE/ME factor, portfolios of Size-BE/ME are constructed annually; then, the high minus low portfolio is considered to be the pricing factor. Therefore, based on the evidence documented in Chan and Chen (1991), using HML to explain returns is to capture the co-variation in returns related to relative distress that is compensated in average return and not recognized by the market return. (Fama&French, 1996)

Mathematically proved by Fama and French in 2006 that higher ratio of the book to market is associated by higher expect return on the stocks. Based on the concept of the dividend discounted mode, which conclude that the present price is depend on the expected dividends by the following equation:

$$M_t = \sum_{\tau=1}^{\infty} E(D_{t+\tau})/(1+r)^\tau,$$

Precisely, in substituting the dividend with the earning minus the change of the book equity and then dividing the equation by the present book equity to be:

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

#### 2.4.1 RECENT IMPLIMENTATIONS:

The value pricing factor (Market to book ratio) in the three-factor model, which test for the market, size and value pricing factors jointly, had been documented in most studies as a significant factors in determining the expected returns on the stocks. (Fama, French, 1993) However, with the addition of the Profitability and investment factors to the pricing model, Fama and French in 2015 find that the Market to book ratio is redundant factor with the existence of the profitability and investment. (Fama, French, 2015). In result, the recent studies that testing the five-factor model are in intention to indicate whether the value-pricing factor is redundant according to their market pricing of equities. Recently, CHIAH, CHAI, ZHONG, LI in 2015 documented that book to market factor remains its explanatory power even with the existence of the profitability and investment pricing factors according to the Australian market. Indeed, the study of CHIAH, CHAI, ZHONG, LI in 2015 supports the explanation giving by Fama and French in 2015, associated the result of redundancy of the ME/BE with economy of the USA and data sample. (Fama, French, 2015)

H3: The book to market portfolio is a pervasive priced factor in asset pricing in Saudi market.

## 2.5 LITERITUER ON THE PROFITABILITY PRICING FACTOR:

Profitability was tested and linked to the expected return of the stocks in several previous studies. In 1996 Haugen and Baker tested the profitability measures as predictive factors in valuating the stocks. The study addressed the net earning to book equity, total sale to total asset, operating income to total asset, and operating income to total sale to indicate the relationship of the firms profitability and the expected return on its stocks. Moreover, applying the Vector auto-regression in testing the profitability of the firm proves that profitability is on of the factors that have impact on the risk-adjusted return of the stock in the market. (Cohen, Gompers, Vuolteenaho, 2002)

As discussed in the pervious section, Fama and French 2006 provided a mathematical prove for the link between the profitability of the firms and the expected return on the stocks based on some modification for the dividend discounted model; with controlling of the growth of the book equity due to reinvestment and the B/M, firms with higher profitability implies higher expected stock return. (Fama& French, 2006).

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

H4: The profitability portfolio a pervasive priced factor in asset pricing in Saudi market.

## 2.6 LITERITUER ON THE INVESTMENT PRICING FACTOR:

Based on the dividend discounted model and controlling for the earning to book equity and B/M, Fama and French 2006 indicated that Firms with high expectation in book equity growth due to reinvestment, tend to have lower expected return on stocks.

Precisely, the external financing is linked to the expected stock return based on the use of the proceeds. Richard, Sloan, 2003 documented that there is a significant negative relation between the stock returns and funding the operating assets, which is defined as the necessary assets in generating revenue. (accountingtools, 2012). Moreover, funding the financial assets results in less significance negative relation with the expected stock returns. Also, in the growth in operating assets that are funded with the retained earning is highly negatively correlated with the stocks returns (Richardson, Sloan, 2003).

H5: The Investment portfolio a pervasive priced factor in asset pricing in Saudi market.

## **2.7 Shariah-compliant modifications:**

Since the Islamic principle is based on real transaction and rate of returns, the interest that is used in the conventional system, regarding pricing or measuring for performance, is not acceptable. Therefore, the cost of capital in Islamic finance can be represented as the rate of return on risk comparable investments. (Zamer, 1999). At the earliest stage in modifying the asset pricing model to be compliant with the Shariah principles is applying the Tobin q theory in calculating the required rate of return. (Zamer, 1999). The Tobin q theory links the profitability with the investment to market to replacement ratio in calculating the firms cost of capital or required rate or return. Zamer in 1999 documented that the use of pricing model based on q has less error measurements than capital assets and arbitrage models.

Regarding the shariah Pricing modification, early as 1987 Tomkins and Karim documented the elimination of the Risk-free rate from CAPM with the assumption of highly competitive securities market. Therefore, the capital market line will have a zero intercept leading the portfolios to be associated with the cash holding and the risky assets.

Precisely, the removal of the risk-free rate is based on linearity of the securities return and their covariance. (Tomkins & Karim, 1987)

Moreover, a further option in modifying the pricing model, Sadaf and Andleeb in 2014 had suggested a modification of the Capital Asset Pricing Model to be Shariah-compliant; Sadaf and Andleeb argued the substitution of the Risk-free element in CAPM equation to the inflation factor. The researchers argument was based on linking the Risk-Free rate with time value of money. Since the investor is ceding his/her current need with the future potential to buy the same commodity with respect to the inflation factor. ( Sadaf & Andleeb, 2014). Comparability, Hanif in 2011 has divided the RF rate into two components: the compensation for the time value of money and the inflation rate that also involved in the returns fluctuating of risk-free assets (securities). Since the time value of money concept is not applicable for Islamic finance principle, which considers the money as medium of exchange and not commodity, the second component (inflation rate) appeared to be acceptable. The inflation rate that replaced the Risk-free rate had an additional rational according to (Hanif, 2011), arguing that it is the state's responsibility to maintain the citizens' purchasing power and bears the inflation factor fluctuation.

Moreover, Ashker in 1987 suggested the use of the Zakat rate as the minimum required rate of return in order to cover the zakat percentage that is pied on the investment, which is 2.5% of net value, and above the zakat rate is considered as the risk premium. (Ashker, 1987). To conclude that the expected return is associated with the risk premium of that security and the zakat rate that need to be paid.

In addition, in 2010 was the suggestion of substitution the Risk-free rate from CAPM equation to the rate of Nominal Gross domestic product growth. The replacement

was based on linking the debt servicing with the NGDP to alter the CAPM equation to be as follow: (Shaikh, 2010). The evidence for substituting the Risk-free rate with the nominal GDP is movement of the both variables (Nominal interest rate, Nominal GDP) together for the period of thirty-eight years (1970-2008) for a group of big economies as America, Canada, Britain and China. (Shaikh, 2010)

However, recently in 2016 a study for Shabir, Hamid and Meera argued the modifications validity for the previous suggestions of the Risk- free rate component. Indeed, since that CAPM is an extend application of the mean variance theory (MVT) by Markowitz, which is based on the diversification of risk by combining uncorrelated risky assets in the portfolio, with an addition of the combination to be with risk-free asset that investors must be compensated for. With respect to the opportunity cost, Inflation, Zakah rate, and nominal GDP are not factors that assets can earn from. (Shabir, Hamid, Meera, 2016). In the other hand, researchers suggested using the AAA Sukuk as risk-free rate since its volatility is not based on interest or LIBOR, instead it depends on the contract and the underlying asset of the Sak and with concept of profit and loss sharing. The paper indicates that the Shariah- compliant model showed significance of explaining the Islamic stock's return like the conventional CAPM toward the conventional stocks.

H6: The shariah- compliant five-factor model explains the expected return in the Saudi stock market.

## **2.8 IMPLEMENTATIONS OF THE ASSET PRICING MODELS ON THE SAUDI'S MARKET:**

In 2012, Heshmat documented a study on the validity of the capital Asset Pricing Model on the Saudi's market as an emerging market, the study included daily

return on the stocks of all listed companies in the Saudi's Exchange (Tadaweul) for the period of 2003 to 2009 including 70 companies. Moreover, the researcher used the Saudi Treasury bill rate as the risk-free rate in CAPM and SASEIDX return as proxy for the return on market component. The three moment CAPM was tested; Mean, Variance and Skewness with the regression model. Also, a dummy variable is added to the equation testing the market performance condition;  $R_m = 1$  when the market excess return is positive while  $R=0$  when the market excess return is negative. The paper finds that there is non-linearity with positive and weak relation between the returns and Beta in Saudi's market. In addition the Skewness has shown little significance while Kurtosis is positively related with returns. Moreover, regarding the market performance condition, there are significant positive/negative relationships between beta and return in up/down markets. (Heshmat, 2012)

In 2015, Aldaarmi, Abbod implemented two models in the Saud's market: Capital Asset Pricing Model and Fama& French three-factor model 1993 . This paper investigates the ability of three-factor model in explaining the stocks' return movements within the Saudi exchange market. The study also included all the listed companies in the Sausi Exchange (Tadawul), including weighted average excess monthly returns on all stocks for the period of 2007 to 2011. The study illustrates that Fama and French model is more significance (outperform) than CAPM in explaining the returns. Moreover, the researchers had suggested a study that considers the shariah prospective for either for the macro or micro level.

## **2.9 TESTING THE FIVE-FACTOR PRICING MODEL:**

In response to the announcement of Fama and French five-factor model since 2015, researchers from all over the world are testing the performance of the F&F model with addition of the profitability and investment factors.

The first introduce of the five-factor model was by Fama and French to add the profitability, which is measured by the return on equity, and the investment factor, expressed as the asset growth. The researchers documented the rationales in involving the two additional factors to the pricing equation to conclude that the five-factor model outperforms the three-factor in 1993. The study included the return of all the stocks in NYSE, AMEX and NASDAQ for the period 1963-December 2013. Applying the method of Fama and French 1993 in constructing the portfolios for both sides dependent and independent; however, the sort in construction the portfolios of 2×2 was suggested as better approach to follow (Fama & French, 2015)

As response to the announcement of the five-factor model, researchers tempted to test the model in different economics; however, these five factors have not been tested in an emerging market jointly before 2015. Since the documenting of the five-factor model by Fama and French and in support of testing the model, there are four main studies investigating the model performance. On the Australian equity market a study had been conducted with data range from 1982 to 2013, and firms included are chosen based on the data availability; Resulting in a support of the five-factor model and illustrate its outperformance among the other pricing models (four and three factor). In the contrary to Fama and French 2015 result, CHIAH, CHAI, ZHONG, LI proved that the book to market factor is no redundant and has its explanatory power in determining the stocks'

returns even with the present of the profitability and investment factors. (CHIAH, CHAI, ZHONG, LI, 2016)

In testing the five-factor model in the emerging market, Zaremba and Czapkiewicz in 2016 tested the performance of the three main models in asset pricing: CAPM, Three-factor and Five-factor model. The study covered the most important emerging markets in Europe: Hungary, Republic, Russia, Poland and Turkey. In over all, the five-factor model documented as the most suitable pricing model for this data sample and markets.

In 2017 Fama and French conducted the international implementations of the five-factor model, including Asia pacific, Europe and North America. However, commonly “the five factor model showed failure in capturing the low average return of small stocks whose return behave like those of low profitability firms that invest aggressively.”(Fama, French, 2017)

#### SUMMARY:

Aligning with the discussion in the literature review, hypothesis for each pricing factor is tested in the study to indicate the explanatory power of each: Market, Size, Value, Profitability and Investment as pricing factors. Two suggestions of Shariah modifications are tested in the study: the risk-free rate represented by the AAA Sukuk rate or return and the removal of the risk-free rate based on the assumption of holding cash and investing in risky assets

## CHAPTER THREE: METHODOLOGY

### 3.1 INTRODUCTION:

This study is conducted on the purpose of testing a Shariah-compliant five factors pricing model on the Saudi Arabia stock market. The conventional five factor pricing model was introduced by Fama and French in 2015, and it been tested globally (internationally) on developed markets such as USA (Fama, French, 2015) and emerging markets as Australia and China (Zaremba, Czapkiewicz, 2016; CHIAH, CHAI, ZHONG, LI, 2015; Guo, Yongjie Zhang, WeiZhang, Han Zhang, 2017)

The five-factor model (2015) is addressing the underlying risk factors that associated with the average returns on the stocks; these risk factors are the access return on market MKT to be the first factor introduced in CAPM (1964). The value risk factor is represented as the book to market ratio. Also, Fama and French documented the firm's size risk factor as pricing factor in 1993. In addition, due the solid litterateur on the association of the profitability and investment factors with the average stocks returns (J. COOPER, GULEN, J. SCHILL, 2008; Fama& French, 2006) , Fama and French included these two factors in their study (Fama, French, 2015) as risk factors of returns on stocks.

This chapter is organized as first representing the data and sample, which explains the included date and sample period. Following, the data of the Shariah-compliant five factor pricing model as AAA Sukuk rate of return. Finally, the last section is for explaining the mimic portfolios constructions over the ten period processes and the dependent variables.

### 3.2 DATA AND SAMPLE:

This study is testing the performance and the explanatory power of the five pricing factors, introduced by Fama and French 2015 on the Saudi Arabia stock market. Accounting and stock returns data are collected from the professional database Bloomberg. (Fama & French, 2012; Shabir, Hamid, Meera, 2016). The data sample is conducted over the period of ten years from 2007 to 2016, Moreover; the study sample includes all the stocks traded in the Saudi Arabia Stock Exchange (Tadawul) (Aldaarm, Abbod & Salameh, 2015). However, according to the study purpose in testing a Shariah-compliant pricing model, the sample only included the non-financial firms. (Shabir, Hamid, & Meera, 2016) Twelve financial institutions are eliminated: Al Rajhi Bank, Alawwal Bank, Alinma Bank, Arab National Bank, Bank Al Bilad, Bank Al Jazira , Banque Saudi Fransi, National Commercial Bank, Riyadh Bank, Samba financial Group, The Saudi British Bank and The Saudi Investment Bank. Even for the conventional implementation, the financial firms were excluded due to the high leverage. (Fama & French, 1992)

**Table 1: Listed of the financial firms that excluded of the sample.**

Excluded Financial Firms	
Al Rajhi Bank	Alawwal Bank
Alinma Bank	Arab National Bank
Bank Al Bilad	Al Jazira Bank
Banque Saudi Fransi	National Commercial Bank
Riyadh Bank	Samba financial Group
The Saudi British Bank	The Saudi Investment Bank

Precisely, data is been taken on two stages: annually and monthly. Data on annual basis as the market capitalization, book to market value, profitability as return on equity and asset growth of the firms represents the investment factor, for the purpose of construction the portfolios factors. (Fama & French 2015, 1993; Banz, 1981)

In addition, monthly closing prices of the all the listed stocks in Tadawul for the period of ten years (2007-2016). The monthly return on all the stock is be taken as function of the close prices first different following the equation: (Aldaarm, Abbod & Salameh, 2015; Heshmat, 2012; YANG, YIN, WANG & JI, 2016)

$$R_{ti} = (P_{ti} - P_{ti-1}) / P_{ti-1}$$

Following the same equation in calculating the returns of the last prices, the monthly return on Tadawul All Share Index (TASI) is being considered as the market return factor in the pricing model for the period of 2007 to 2016.

**Table 2: Numbers of firms in each factor portfolio per annum based on the data availability.**

<b>Factor/Year</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>HML</b>	82	99	116	123	134	142	146	153	159	157
<b>RMW</b>	72	74	80	95	100	115	111	120	121	125
<b>CMA</b>	77	86	101	119	125	139	145	153	159	157

\*Excluding firms is based on the data availability

### **3.3 SHARIAH COMPLIANT FIVE-FACTOR PRICING MODEL:**

In the purpose of modification of the pricing model to be shariah compliant, many empirical studies have been conducted. All studies agreed on the prohibition of the risk-free rate element in the pricing model since it represent the investment on interest bearing assets such as the Treasury bills and corporate bonds. However, most of the studies have

not give attention to necessity of pricing model inputs (stocks) to be shariah compliant. (Shabir, Hamid & Meera, 2016)

Therefore, this study is based on the assumption of the compliance of all the stocks listed in Tadawul with the Shariah principles. Indeed, the shariah screening has two main components (Screening stages). Mainly, the line of business or the firms activities and production should be shariah compliant such as not engaging in the production or distributing non-Halal products: alcohol- Pork. (Giorgioni & Kok, 2009) Since all the non-Halal products are prohibited to produce, sell or use and consume in the Saudi Arabia region, all the firms are passing the first stage of the Shariah screening. Secondly, the financial screening for liquidity and interest to total revenue purification ratio are not applied on the sample of this study due reliance of the Saudi market on the equity and Sukuk for trading, and role of non-interest bearing current accounts among all the banking sector.

Therefore, this study suggests two options on the modifications on the five-factor pricing model. The study is testing the performance of the five factor-pricing model with two main equations. (Shabir, Hamid & Meera, 2016)

Substituting the Risk-free rate in the model by the rate of return on the AAA Sukuk traded in the Saudi Market. The AAA Sukuk used in this study is issued by the Islamic Development Bank located in Jeddah in Jun of 2012 and matures in Jun 2017.

$$R_i - AAASukuk = \alpha_i + \beta_i (R_m - AAASukuk) + \gamma_i R_{smb} + \delta_i R_{hml} + \rho_{pum} + \rho_{lmh} + \epsilon_i^{(1)}$$

Another modification, this study is testing for the Shariah compliant pricing model with the removal of the risk free rate of the pricing equation based on the assumption of holding cash and investing in risky assets by Lintner (1965)

$$R_i = \alpha_i + \beta_i (R_m) + \gamma_i R_{SMB} + \delta_i R_{HML} + R_{RM} + R_{CMA} + \epsilon_i \quad (2)$$

Models (1) and (2) are being tested in this study as Shariah compliant of the five factors pricing model. However, due to the data availability the model of the AAA Sukuk rate of return is tested over four years and six months of monthly returns. Model (2) with the cash investment option is tested over ten years from 2007 to 2016.

In the purpose of testing the performance of the shariah compliant five factor pricing model a null model is being tested too. The three factor-pricing model by Fama and French 1993 is considered as the null model. (Zaremba, Czapkiewicz, 2016) Accordingly, the firm's size and value are pricing factors in addition to the market factor by CAPM (1964) in explaining the average return on stocks (Fama & French, 1993).

$$R_i - AAASukuk = \alpha_i + \beta_i (R_m - AAASukuk) + \gamma_i R_{smb} + \delta_i R_{hml} + \epsilon_i \quad (3)$$

$$R_i = \alpha_i + \beta_i (R_m) + \gamma_i R_{smb} + \delta_i R_{hml} + \epsilon_i \quad (4)$$

Models (3) and (4) are the shariah compliant three factors model to be tested as the null model of the five factors model. Indeed, according to the pervious studies in

comparing the performance of the three and five factors models, the five factors indicates higher explanatory power in explaining the average return on stocks.

### **3.4 MIMICKING FACTORS CONSTRUCTIONS:**

Based on the directions of Fama and French 1993 and 2015, set of portfolios are constructed to represent the monthly average returns for each of the four factors: Size, BE/ME, Profitability and investment; however, the market return factor is been taken as the monthly returns of TASI. Pervious studies tested sets of different sorts of portfolios construction as 2×3 (Shabir, Hamid & Meera, 2016), and 2×2. (Fama & French, 2015) However, the 2×2 sort of portfolio documented better diversification then 2×3 (Fama & French, 2015); the rational is that in the other sorts as 2×3, it excludes 40% of the stocks as medium values while the 2×2 include all the stocks in the market as big and small or high and low. The factors portfolios are constructed on the basis of sized-BE/BM, sized-Profitability and sized-Investment in purpose to mimic the underlying these risk factors (Fama & French, 1993)

SMB is the size pricing factor as an average returns on the small firms' stocks minus the average return on the big firms' stocks. The sortation of the small and big is based on the Mean of the firms' market capitalization (Price of the stock multiplied by the number of outstanding shares).

HML factor is the average return of firms' stocks with high book to market ratio mins the average return on firms' stocks with low book to market ration. The BE/ME is a function of the Common equity over the market capitalization of the firm.

$$\frac{BE}{ME} = \frac{\text{total common equity}}{\text{market capitalisation}}$$

HML is sized factor of BE/ME. The firms are sorted as big and small based on the mean of market capitalization; then, four BE/ME portfolios are constructed as SL, SH, BL, BH. In details, SL is the average monthly returns on the stocks of small firms with low book to market ratio. SH, average return for the small firms with high book to market ratio. BL, is the average return on stocks of big firms with low book to market value. BH is the average return on stocks of big firms with high BE/ME.

RMW is the pricing factor of profitability as the average monthly stocks' returns on firms with high profitability minus the average returns on the stocks of firms with low profitability. According to Fama and French (2015), the profitability factor is function of the total revenue minus cost of good sold, minus selling, general and administrative expenses, minus interest expenses divided by book equity. The return on equity ROE is the proxy of capturing the profitability factor as function of: (CHIAH, CHAI, ZHONG & LI, 2015)

$$ROE = \frac{NPBT}{SHEQ}$$

NPBT is symbol of net profit before tax, divided by total shareholders equity (SHEQ). This study considers the normalized ROE on annual basis for construction the sized-profitability portfolios. Moreover, firms with negative ROE are excluded from the RMW portfolios.

Constructing RMW, the firms are identified as small and big firms based on the mean of their market capitalization; followed the size sorting, firms are classified as high

and low based on the mean of ROE value. In result, four diversified portfolios are constructed: SR, SW, BR, and BW. SR is a portfolio of small firms with high profitability while SW is for small firms with weak profitability ratios. BR is a portfolio of big firms with high profitability while BW is for big firms with weak profitability ratio. (Fama & French, 2015; CHIAH, CHAI, ZHONG & LI, 2015)

CMA is the investment pricing factor. Since the investment factor reversely correlated with the expected returns on Stocks, CMA is the diversified portfolio of average return on firms with low (conservative) investment minus the average return on firms with high (Aggressive) investment. The investment factor is represented as “the change in total asset from fiscal year ending in tear t-2 to the fiscal year ending in t-1, divided by t-2 total asset.” (Fama & French, 2015)

The asset growth is been taking as the proxy of the investment factor; asset growth is function of total asset t divided by the total asset of the previous period, minus 1:

$$Asset\ Growth = \frac{total\ asset\ t}{total\ asset\ t - 1} - 1$$

The asset growth data was collected from the Professional Database Bloomberg on annual basis for constructing the CMA portfolios. In result, four sized-asset growth portfolios are constructed: SC, SA, BC and BA. The SC is the average stocks returns on Small firms with low asset growth while the SA is the average return on Small firms with high (Aggressive) asset growth ratio. BC is the average returns on big firms with low (conservative) asset growth. BA is the average stocks return on big firms with high asset growth.

**Table 3: Portfolio construction formulas**

Sort	Break points	factors components
2×2 sorts	Size, median	$SMB = (SH+SL+SR+SW+SC+SA)/6 - (BH+BL+BR+BW+BC+BA)/6$
Size and BE/ME,	BE/ME, median	$HML = (SH+BH)/2 - (SL+BL)/2$
Size and Profitability	ROE, median	$RMW = (SR+BR)/2 - (SW+BW)/2$
Size and Investment	AG, median	$CMA = (SC+BC)/2 - (SA+BA)$

Construction of the Size, BE/ME, Profitability and Investment factors. The independent are SMB: the sum averaged of small firms portfolios minus the sum averaged of the big firms portfolios. HML: the average sum of the sized high portfolios minus the sum average of sized low portfolios. RMW: the average sum of the robust ROE (R) minus the sum average of the weak (W) ROE portfolios. CMA: the sum average of the conservative (C) minus the sum average of aggressive (A) portfolios

### 3.5 DEPENDENT VARIABLES:

As dependent variables of the five factor pricing model, the four diversified average returns of sized-BE/ME factor are tested: SL, SH, BL and BH. According to Fama & French (2015), the five-factor pricing model should be able to explain the average return on any of the diversified portfolios.

Generalized Methods of Moments (GMM) is used in testing the two Shariah-compliant suggested pricing models for the five factors, AAA Sukuk rate of return and Cash assumption models. For to separated periods: Four years and seven months (54 months) for the AAA Sukuk return model, and ten years period for cash (Removed of Risk-free rate) assumption model. The GMM is a regression that dose not required the normal distribution of the data , and the Ordinary least squares is considered as GMM estimator for in case on uncorrelated independents variables with the residual (Aldaarm,

Abbod & Salameh, 2015), and heteroscedasticity consistent estimation. (Shabir, Hamid & Meera, 2016).

In testing the GMM, the null model for each testing period is tested to compare the performance of the Five-factor model (2015) over the three-factor model (1993). In result, eight regressions are estimated for each testing period (54 months & Ten years); precisely, each model is tested for four dependent variables individually.

### **3.6 SUMMARY:**

The study is including all the listed firms in Tadawul for the period of ten years from 2007 to 2016. However, all twelve financial firms listed in Tadawul were excluded out of the study for the purpose of testing a Shariah-compliant model. AAA Sukuk rate of return for the period of 54 months (four years and seven months) is considered as return of risk-free return. The study is testing two separate period due to the data availability: a shariah-compliant five factor with AAA Sukuk rate of return of the 54 months and ten years for the shariah-complaint five factor with removing the risk-free rate from the equation.

Construction the factor portfolios has two stages: the first stage in based on annul data of the market capitalization (Size) , book to market ratio,(BE/ME), profitability(ROE) and investment(asset growth). The annual portfolios are constructed as Sized-BE/ME, Sized-ROE and Sized- Asset growth. Stage 2 is taking the monthly average returns on these portfolio to construct SMB, HML, RMW and CMA.

## CHAPTER FOUR: RESULT AND DISCUSSION

### 4.1 DESCRIPTIVE STATISTICS:

In testing the shariah compliant pricing models, There are two propose models with the rate of return on AAA Sukuk traded in the Saudi Market is being tested for the period of four years and 7 months (54 months), and the remove of the Risk-free rate based on the assumption of holding cash and investing in risk assets. Accordingly, the four factors (SMB, HML, RMW and CMA) are the same in both Shariah-compliant models. The modification affects the market factor as (Rm-AAA) and the dependent variables as (Ri-AAA). Data for the period of 54 months is not normally distributed. Jarque-Bera is a normality test based on testing the Skewness as to be zero and the excess kurtosis to be zero (Normally distributed); significant p-value rejects the null hypothesis to indicates the non- normality distribution of the data.

**Table 4: table of statistics descriptive of the models independents variables**

Factor/Statistics	Mean	Max	Min	Std. dev.	Skewness	Kurtosis	Jarque-Bera	P-Value	Obs
Market-AAA	0.000262	0.211573	-0.141973	0.063332	0.959690	4.956801	16.90446	0.000213	54
Market	0.000211	0.209479	-0.141134	0.063039	0.946312	4.908217	16.25246	0.000296	54
SMB	-0.008680	0.137765	-0.123410	0.042303	0.264095	4.871450	8.122579	0.017227	54
HML	0.013602	0.129513	-0.040096	0.035003	0.768286	3.789616	6.715230	0.034818	54
RMW	0.005295	0.042092	-0.039900	0.018459	-0.112440	2.332150	1.117339	0.571970	54
CMA	0.003906	0.220302	-0.174134	0.066441	-0.074868	4.7667863	7.082463	0.028978	54

\* note: Statistics Descriptive for AAA sukuk (54 months) Market –AAA. The Model of the Risk free rate removed (cash) is represented as Market.

The market factor mean in with removing the risk–free rate is 0.000211, and with the AAA Sukuk is 0.000262. Difference between the market and market–AAA is significantly small for Max, Min, Std, Skewness, Kurtosis and Jarque-Bera values. The small difference

is rational and expected due to the low of AAA Sukuk rate of return that associated with its level or risk; as in table 6 , the mean of the AAA rate of return is  $-0.0000507$  and Max as  $0.006479$ .

The mean value is the central tendency of the data giving the HML factor the highest average returns by  $0.013602$  and SMB as the lowest average returns by  $-0.00868$ . Moreover, the Stander deviation represents the spread of the variables from the mean which range between  $0.0633$  and  $0.035003$ . Skewness of the both shariah compliant models data is acceptable to range between  $0+$  and  $0-$  (Standardly  $1, -1$ ). However the Kurtosis is not following the Skewness due to the ranging between  $4.9$  and  $3.7$ , except for the Profitability data ( RMW) with  $2.33$ . Accordingly, the Jarque- Bera p-values are significant at  $5\%$ , rejecting the null hypotheses of J-B test to conclude that data is not normally distributed. However, Profitability (RMW) p-value is not significant by  $0.5719$  and normally distributed.

**Table 5: Dependent variables for the AAA Sukuk rate of return and the Risk-free rate removed (cash)**

	BH	BH-AAA	BL	BL-AAA	SH	SH-AAA	SL	SL-AAA
Mean	0.005137	0.005188	0.021065	0.021116	-0.000501	-0.000450	0.002986	0.003036
Std. Dev	0.076580	0.076637	0.063987	0.063928	0.089012	0.089115	0.092173	0.092269
Skewness	-0.455728	-0.431725	-0.281300	-0.271137	-0.777244	-0.754280	-0.278605	-0.279112
Kurtosis	4.310918	4.224455	4.682676	4.579324	3.988896	3.921367	4.183764	4.102288
Jarque-Bera	5.735834	5.050878	7.082819	6.273731	7.637285	7.030503	3.851506	3.434969
P-Value	0.056817	0.311282	0.028972	0.043419	0.021958	0.029740	0.450279	0.179517

The dependent variables consist of eight different diversified portfolios based on the size and BE/ME ratio. BH, BL, SH and SL are average return on the four sized-Be/ME as dependents variables for the Shariah compliant Cash assumption pricing model. However, the BH-AAA, BL-AAA, SH-AAA and SL-AAA are the excess monthly returns of the AAA Sukuk rate of return as the function of  $R_i$ -AAA rate or return.

According to the statistic descriptive of the Removed risk-free model and the zero  $-$ beta portfolio dependent variables, there is no significant difference in mean between

each average monthly return portfolios and excess average monthly return portfolios: BH, BH-AAA; BL, BL-AAA; SH-SH-AAA and SL, SL-AAA. The data spread from their mean as stander deviations range between 0.06 and 0.09. Moreover, Skewness values are acceptable for all the variables to range between -0.2 and -0.4. However, Kurtosis values do not follow the Skewness and range between 3.9 and 4.6. Even though Kurtosis values for all the variables is out of the stander range (2,-2) , the p-Values of some of the variables is not significant to indicates that BH-AAA, SL and SL-AAA are normally distributed.

**Table 6: Descriptive statistics of the independent Pricing model: Market, SMB, HML, RMW and CMA for the period of ten years.**

<b>Statistics</b>	<b>Market</b>	<b>SMB</b>	<b>HML</b>	<b>RMW</b>	<b>CMA</b>
<b>Mean</b>	0.003507	-0.006762	0.013433	0.003818	0.003844
<b>Median</b>	-0.007724	-0.008582	0.013001	0.009319	0.007339
<b>Max</b>	0.346830	0.139468	0.129513	0.057523	0.220302
<b>Min</b>	-0.163854	-0.139493	-0.139078	-0.109135	-0.251857
<b>Std. Dev</b>	0.075488	0.049497	0.044856	0.027673	0.072232
<b>Skewness</b>	1.016903	0.261580	-0.202510	-1.031992	-0.200414
<b>Kurtosis</b>	6.092557	3.991680	4.126574	5.448396	4.537826
<b>Jarque-Bera</b>	68.50139	6.285627	7.166048	51.27336	12.62787
<b>P-Values</b>	0.000000	0.043161	0.027792	0.000000	0.001811

For the period of ten years, the holding cash assumption instead of the Risk-free rate in pricing model is applied as a Shariah- compliant five factor pricing model. The statistical descriptive table indicates a range of the data variables means from -0.00676 (SMB) to 0.013 (HML). The explanatory variables spread from their means (Stander deviations) ranges between 0.049(SMB) to 0.075 (Market). The Skewness for SMB, HML and CMA is acceptable to range between 1, -1. However, the market and RMW are put of the stander range by 1.0169 and -1.03199 respectively. The Kurtosis values for the five

factors are out of the acceptable range (2, -2). Accordingly, the J-B test for normality indicates that all the data sample of the five factors is not normally distributed with 5% significance.

**Table 7: correlations between different factors**

	<b>Market</b>	<b>SMB</b>	<b>HML</b>	<b>RMW</b>	<b>CMA</b>
<b>Market</b>	1.0000	-0.302646	0.276535	0.257366	-0.921105
<b>SMB</b>	-0.302646	1.00000	-0.880030	-0.432522	0.388264
<b>HML</b>	0.276535	-0.880030	1.0000	0.555471	-0.402271
<b>RMW</b>	0.257366	-0.432522	0.555471	1.0000	-0.351018
<b>CMA</b>	-0.921105	0.388264	-0.402271	-0.351018	1.0000

The correlation between the different factors is acceptable and rational. However, the investment (CMA) factor is high reversely correlated with the market by -0.921105. Moreover, BE/ME factor (HML) is also have significant reversed correlation by -0.88 with size factor (SMB). Precisely, there is no significantly positive correlation among the five factors that my cause excluded one of the left hand side portfolios.

#### 4.2 STATIONARITY TEST:

Each time series factor data of the five factors is tested for the stationarity using augmented Dickey-Fuller (ADF) by E-views. In result, Market, SMB, HML, RMW and CMA are stationary at level. For the shariah-compliant AAA Sukuk returns model, AAA Sukuk rate of return is tested for stationary; AAA rate of return is stationary at level.

**Table 8: ADF Stationarity test**

	<b>Market</b>	<b>SMB</b>	<b>HML</b>	<b>RMW</b>	<b>CMA</b>	<b>AAA-rate</b>	<b>Market-AAA</b>
<b>t-Stat</b>	-9.423569	-9.436697	-10.25192	-10.80995	-9.653033	-7.884803	-6.04054
<b>Prob.</b>	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000	0.00000

All the five factors: Market, SMB, HML, RMW and CMA are stationary at level. Moreover AAA-rate of return and the market excess average returns for the AAAsukuk shariah-compliant pricing model is stationary at level.

### 4.3 EMPIRICAL RESULTS

The study is testing the proposed Shariah-compliant pricing models in the Saudi Arabian market. The study is over two periods; the four years and seven months (54 months) as the AAA Sukuk returns five factors pricing model. Ten years from 2007 to 2016 for the removed risk-free rate five factor pricing model. The null model as the Three-factors by Fama & French 1993 is tested for each study period. Result of the GMM regression is represented for the four and half year period followed by the ten-year period result.

### 4.4 FOUR YEAR AND SEVEN MONTHS DATA

HYPOTHESES TESTING:

**Table 9: GMM results for the AAA Sukuk return Pricing Model: coefficients and Adj-R<sup>2</sup>**

Portfolios		C. SCFF		D. SCTF	
		C	ADJ-R <sup>2</sup>	C	ADJ-R <sup>2</sup>
SH	Coef.	0.009674	0.983960	0.012571	0.950541
	t-stat	5.269534		4.605346	
SL	Coef.	0.006493	0.986537	0.009275	0.943084
	t-stat	3.578975		3.502788	
BH	Coef.	0.005976	0.972781	0.009098	0.908712
	t-stat	2.811836		3.284518	
BL	Coef.	0.013372	0.943943	0.016043	0.899740
	t-stat	5.623223		5.019268	

Table 9: \*Note: SCFF is the Shariah-compliant Five Factors model. SCTF is the shariah-compliant Three Factors model. Result for the period of four years and seven months (54 months). Intercepts and Adj-R<sup>2</sup> values determine the performance of the model (the factor jointly) in explaining the average return of the four LHS portfolios

The test result of the shariah-compliant five factors model, with AAA Sukuk, rejects the null hypothesis of the zero coefficient among all the four tested portfolios; Adj-R<sup>2</sup> for

the four regressions range as 0.98 for SH and SL, 0.97 and 0.94 for BH and BL respectively.

In fully capturing of returns, the asset pricing model intercept is indistinguishable from zero (Fama& French, 2015). Accordingly, the intercepts of the four regressions are different from zero by 0.009, 0.006, 0.005 and 0.013 for the SH, SL, BH, and BL respectively. However, the intercept for the average returns on big firms with low book to market ratio is 0.01; statistically, due the low stander error value (0.002), the t-Stat value is inflated to 5.623. Precisely, the model Performance in explaining the average returns is less performing as the firms increased in their size and decreased in its value (BE/ME) as the BL portfolio. Due the significant of the model, the null hypothesis of proposed Shariah-compliant pricing model with AAA Sukuk rate of return is rejected.

The coefficients of the market portfolio range from  $-0.413177$  (BL) to  $-0.1715$  (SL) among the four regressions and significant at 1% level; the null hypothesis of the market as pricing factor is rejected. Moreover, the size factor coefficients among the SH, SL, BH and BL vary between  $-0.12007$  (BH) to  $1.884$  (SL) with significance level of 1%; in details, the size factor explaining power of the average return on big firms with high BE/ME is significant with 5% level. The 1 and 5% significances over the four tested portfolios illustrate that the size factor null hypothesis is rejected, and size pricing factor do exist.

HML pricing factor coefficients has minimum of  $-0.7397$  (SH) and max of  $0.8677$  (BL). The coefficients are significant at 1% level; indicating the rejection of the null BE/ME pricing hypothesis. Moreover, the investment factor (CMA) coefficients slightly differ in explaining the average returns over the four tested portfolios (LHS) from  $0.583$

(BL) to 0.820 for (BH); the null pricing hypothesis for investment factor is rejected with 1% level of significance among all the tested portfolios (LHS). In the other hand, the profitability factor is not existed. The Profitability coefficients range between  $-0.152$  (SL) to  $0.177$ (BL) with relative out of stander range for the t-statistic value as (2.  $-2$ ). Based on the coefficients, t-Stat and the P-value, the null hypothesis of the profitability-pricing factor is accepted.

The three factors shariah-compliant with AAA Sukuk rate of return (SCTF) is a null model for the five factors shariah compliant. SCTF is slightly underperforming the five factors. In details, the explanatory power of the three factor model in explaining the average return on the small firms with high book to market ratio is  $0.95$  (Adj- $R^2$ ) while the  $R^2$  for the five factor is  $0.98$ . Decreasingly, as the firms tend to grow in size,  $R^2$  is decreasing; especially for big firms with low BE/ME. In respond, the coefficients of the intercepts are not significantly distinguished of the five factors intercepts. For the null model (three factors), market factor is significant in all the four tested portfolios; resulting in rejection the null hypothesis of the market as pricing factor. However, Size and book to market ratio factors' coefficient and p-value are significant at level 1% except for the (BH) big firms with high book to market ratio. The P-value of the size factor in explaining the average return on BH is not significant. In over all, the null pricing hypothesis for the size and BE/ME is rejected in explaining the SH, SL and BL.

**Table 10: GMM results for the AAA Sukuk Pricing Model**

Portfolio LHS	A. SCFF model with AAA Sukuk rate of return					B. SCTF Model with AAA Sukuk		
	Ri- AAASukuk = $\alpha_i + \beta_i (R_m - AAASukuk) + \gamma_i R_{smb} + \delta_i R_{hml} + \rho_{pum} + R_{lmh} + \epsilon_i$					Ri- AAASukuk = $\alpha_i + \beta_i (R_m - AAASukuk) + \gamma_i R_{smb} + \delta_i R_{hml} + \epsilon_i$		
	Market	SMB	HML	RMW	CMA	Market	SMB	HML
SH Coef	-0.349318	0.353181	-0.739726	0.066240	0.702308	-1.039586	0.354801	-0.710860
t-stat	-4.622260	4.179873	-6.835605	0.571395	10.00730	-18.27765	3.516456	-5.267078
SL Coef	-0.171526	1.884379	0.783327	-0.152698	0.793172	-0.957204	1.874133	0.755681
t-stat	-2.872995	19.95363	6.524083	-1.285452	15.82694	-16.73834	8.917507	3.312992
BH Coef.	-0.285459	-0.120071	-0.347165	-0.045371	0.820822	-1.095503	-0.124695	-0.345944
t-stat	-4.628927***	-2.089048**	-3.547873***	-0.353913	14.76748***	-19.37265	-0.793987	-1.929554
BL Coef	-0.413177	0.826433	0.867713	0.177851	0.583794	-0.983669	0.834297	0.924223
t-stat	-3.518672	5.247665	4.964041	1.082629	5.486323	-15.32213	8.040734	6.533130

Table 9: \*Note: Panel A SCFF is the Shariah-compliant Five Factors model. Panel B, SCTF is the shariah-compliant Three Factors model. SCFF and SCTF are tested for four years and seven months period over four main diversified portfolios: SH, small firms with high BE/ME; SL, small firms with low BE/ME; BH, big firms with high BE/ME and BL, big firms with low BE/ME. Factors significance is addressed by the coefficient, t-stat and p-values for each factor with each LHS portfolios.

#### 4.5 THE TEN-YEAR PERIOD RESULT:

The test results for the Shariah-compliant five factors model with cash asset investment assumption reject the null hypothesis of the zero coefficients over the four tested portfolios (LHS). The four LHS portfolios are SH, SL, BH and BL. The model is illustrating the significance of the Shariah-compliant five factors in explaining the average returns of four different diversified portfolios. The performance indicator is the model intercept and Adj- R<sup>2</sup> for the four regressions (Fama& French, 2015).

In a complete explaining of the average returns on the LHS portfolios, model's intercept must be indistinguishable from zero. The four regression intercepts are close to zero, and range as 0.0077 (SH), 0.00506(SL), 0.0002101 (BH) and 0.013334 (BL). Moreover, the Adj-R<sup>2</sup> for the four regressions range between 0.98 (SL) to 0.93 (BL); the lowest R<sup>2</sup> is for explaining the returns on big firms with low market to book ratio, and highest is in explaining the return on small firms with low book to market ratio. Aligning with result of the AAA Sukuk modified pricing model, the explaining power of the average return on the LHS portfolios is tend to decrease as the firms grow in size.

The market pricing factor coefficient and p-values are significant at 1% level for the four tested portfolios. Market coefficients range from -0.5037 (BH) to -0.2447; in result, the null hypothesis of the market as pricing factor is rejected significantly over the four regressions.

The size factor (SMB) coefficients range as 0.260 (SH), 2.327(SL), 0.102(BH) and 0.4181(BL). Relatively, t-stat and p-values indicate the significance of the size factor at 5% level except for BH portfolio, big firms with high market to book ratio. However, the null hypothesis of the size as pricing factors is rejected for stocks of small firms (High &Low BE/ME) and big firms with low book to market ratio.

BE/ME pricing factor (HML) coefficients range as -0.744 (SH), 1.266(SL), 0.096 (BH) and 0.415 (BL). Statically, P-value and t-Stat indicates the significance of the coefficients at 1% level for small firms with high and low BE/ME and at 5% level for big firms with low book to market ratio. In the other hand, HML factor is not exist for the portfolio of the big firms with high BE/ME (BH). Accordingly, the pricing null hypothesis for the BE/ME is rejected for SH, SL, and BL and accepted for BH.

Profitability factor (RMW) coefficients maxes in big firms with low BE/ME (BL) as 0.3509 and reach minimum in small firms with low BE/ME (SL). According to the coefficients' p-value the pricing factor is significant in explaining the average return on SH, SL and BL portfolios; however, the profitability factor is not exists for big firms with high profitability. Therefore. The significance level of the profitability factor on the three LHS portfolios indicates the rejection of the null hypothesis; in the other hand, the null hypothesis is accepted for return on big firms with high book to market ratio.

CMA, the investment factor results in significant coefficients at level 1%: 0.573 (SH), 0.742(SL), 0.531 (BH) and 0.616 (BL). In the contrary, (BH) the other three pricing factors (Size, BE/ME and Profitability) failed to explain the average stocks returns for big firms with high book to market ratio

The null model to the shariah-compliant five factors (SCFF), eliminating risk-free rate, is the Shariah-compliant three factors (SCTF). The two models (five and three factors) are tested over the same period with eliminating the Risk-free rate of the equations.

The SCTF model tests result in significant t-stat at 1% level against the four LHS portfolios. Aligning with five factors performance tendency, SCTF tends to perform less as the firms grow in size and decrease its BE/ME ratio. However, SCTF model is underperforming the SCFF slightly according to the Adj-R<sup>2</sup> and intercepts. Precisely, the Adj- R<sup>2</sup> is decreasing as 0.95 for SH and SL and 0.89 and 0.87 for BH and BL respectively. SCTF intercepts differ slightly from zero comparing to the SCFF: 0.013 SCTF while the SCFF is 0.0077, and tendencies continue over the four regressions

Market pricing factor is significantly different than zero as p-values for all the four LHS portfolios, proofing that the return on market is a pricing factor. Moreover, the size factor

(SMB) result in significant coefficients between 1% level as for Small firms with low BE/ME, and 5% level for SH and BL. However, the size pricing factor doesn't exist for big firms with high BE/ME. In sum, for SL, SH and BL the null hypothesis is rejected; in the other hand, null is accepted for BH portfolio.

HML, the value pricing factor results indicates the coefficients significance at 1% and 5% level. However, the value factor failed in explaining the average return on big firms with high book to market ratio.

**Table 11: GMM results for the Cash Pricing Model**

Portfolios	A. SCFF model with Risk-free Rate Removed					B. SCTF Model with Risk-free Rate Removed		
	$R_i = \alpha_i + \beta_i (R_m) + \gamma_i RSMB + \delta_i RHML + RRM + RCMA + \epsilon_i$					$R_i = \alpha_i + \beta_i (R_m) + \gamma_i Rsmb + \delta_i Rhml + \epsilon_i$		
	Market	SMB	HML	RMW	CMA	Market	SMB	HML
SH Coef	-0.400188	0.260307	-0.744186	0.140546	0.573973	-0.877900	0.215625	-0.888903
t-stat	-5.602123	2.931812	-6.782617	1.983628	5.729613	-22.93848	3.131074	-10.05345
SL Coef	-0.244751	2.327906	1.266478	-0.210642	0.742904	-0.881854	2.207746	0.892863
t-stat	-4.392570	12.12519	6.935590	-2.772922	15.96063	-16.61720	12.74687	5.516252
BH Coef.	-0.503724	0.102481	0.096107	-0.069831	0.531681	-0.955812	0.029334	-0.132877
t-stat	-5.145047	0.917032	0.656856	-0.605338	4.136595	-21.39545	0.293645	-1.063114
BL Coef	-0.296653	0.418133	0.415521	0.350924	0.616265	-0.799989	0.401917	0.355071
t-stat	-4.397363	2.924501	3.007163	4.926370	7.013948	-19.69836	3.459758	3.118033

Table 11: \*Note: Panel A SCFF is the Shariah-compliant Five Factors model. Panel B, SCTF is the shariah-compliant Three Factors model. SCFF and SCTF are tested for ten years period over four main diversified portfolios: SH, small firms with high BE/ME; SL, small firms with low BE/ME; BH, big firms with high BE/ME and BL, big firms with low BE/ME. Factors significance is addressed by the coefficient, t-stat and p-values for each factor with each LHS portfolios.

**Table 12: COEFFICIENTS AND Adj-R<sup>2</sup> for cash model**

Portfolios		C. SCFF		D. SCTF	
		C	ADJ-R <sup>2</sup>	C	ADJ-R <sup>2</sup>
SH	Coef.	0.007717	0.976219	0.013777	0.952510
	t-stat	4.916737		7.785566	
SL	Coef	0.005066	0.982728	0.013558	0.953361
	t-stat	3.347050		5.458814	
BH	Coef.	0.0002101	0.931042	0.008044	0.899678
	t-stat	0.867280		3.347780	
BL	Coef.	0.013334	0.935073	0.019510	0.871708
	t-stat	7.888540		9.489727	

Table 12: \*Note: SCFF is the Shariah- compliant Five Factors model. SCTF is the shariah-compliant Three Factors model. Result for the period of ten years. Intercepts and Adj-R<sup>2</sup> values determine the performance of the model (the factor jointly) in explaining the average return of the four LHS portfolios

## **CHAPTER 5: IMPLICATIONS, RECOMMENDATION AND CONCLUSION**

### **5.1 Introduction:**

The purpose of this study is testing the performance of proposed shariah-compliant five-factor model on the Saudi Arabian stock market. Regarding the Shariah-modification of the pricing factor equation, two models options are tested. Moreover, a null model as three factors pricing model (Fama & French, 1993) tested with each proposed model. in result, the five factors model (Fama& French, 2015) is outperforming the three factors model.

Chapter 5 includes the study implication, limitation and general conclusion. The implication of the study is based on the degree of beneficiary of the study result in pricing and valuating equities in the Saudi market with respect to the Islamic law and boundaries. Data availability is one of the major limitation of the study; in addition, the limit of time, based on the number of observation of the study and long process of the methodology, the study address and test for further complications. The following is the recommendations for future work. Finally, general conclusion of the study objectives and findings is included.

### **5.2 IMPLICATION:**

The study has future implication of the field of finance and asset pricing and valuation field in particular. With the rapid development of the Islamic finance, and the difference between Islamic and conventional in assets nature and the capital market law, the need for Shariah compliant asset pricing model is being rising.

### **5.3 LIMITATION:**

The major limitation of this study is the data availability. Previous studies in testing the asset pricing models in the region of Saudi Arabia calculated the data from Saudi Exchange (Tadawul). (Aldaarm, Abbod & Salameh, 2015; Heshmat, 2012). However, the data in this study is collected from the Professional Database Bloomberg due to some technical issues in Tadawul.

Moreover, the study is considering all the stocks and listed firms in Tadawul as sample tests; accordingly, the study could discuss other aspects in asset pricing and test for CAPM to compare the performance of the three main pricing models: CAPM, Three-factors and five factors models. However, due to the time limitation to work and submit thesis as partial requirement for master degree with one semester, the other objectives are held as future works.

### **5.4 CONCLUSION**

Asset pricing is a developing field in finance; researchers have been addressing the trade-off between required return and its associated risks. Precisely, Fama and French introduced the Five-factor model (2015) for asset pricing by adding the profitability and investment as pricing factors. Nowadays, many researchers are testing the performance of the five-factor model internationally.

This study is testing the five-factor model on the Saudi capital market; however, due to the Islamic law and culture that lead the trade and economy in Saudi Arabia, the asset-pricing model must be tested within the shariah boundaries. Accordingly, the study proposed two modified five-factor asset-pricing models. The AAA Sukuk model represented as the rate of

return on AAA Sukuk as substitution of the risk-free rate element in the Pricing equation, and the assumption of holding cash as risk-free investment with investing in risky assets (remove the risk-free rate from the pricing equation). The AAA Sukuk five-factor model is been test over four years and seven months (54 months) due to the data availability, and pricing model with the cash assumption is tested over ten-year period.

As result, the AAA Sukuk portfolio five factors model is significant in explain the average returns on four different diversifies portfolios constructed as sized-BE/ME portfolios: SL, SH, BL and BH. Moreover, the Market, size, value and investment factor are significant as pricing factors in explaining the average returns on the sized-BE/ME portfolios. However, the profitability factor failed in explain the average returns of all the four LHS portfolios, which illustrate that the profitability is not a pricing factor in the Shariah-compliant with AAA Sukuk- five factors model.

Comparing the performance of the null model (three factor) with the five factors indicates that the five-factor model is outperforming the three-factor in the explaining the average returns on the Sized- BE/ME portfolios. Moreover, the size and value factors in the three-factors model failed in explaining the average return on big firms with high BE/ME ratio.

The five factors model with cash assumption investment is tested over ten years, resulting in high significant  $\text{adj-R}^2$  in explaining the average returns on the four LHS portfolios. In addition, the five factors are significant with 1 to 5% level as pricing factors. However, the size, value and profitability are failed in explaining the average return on big

firms with high book to market ratio. Interestingly, only the investment factor that explained the average returns on big firms with high value with 1% level of significance.

In comparing the null model, the five-factor is also outperforming the three factors in explaining the LHS average returns; market factor in the three factors is highly significant as pricing factor. Moreover, the size and value factor are significant as pricing factors even though both factors (size & value) failed also in explaining the average returns of big firms with high book to market ratio. The five factors model is outperforming the three factors is an aligning result with recent studies. (Fama & French, 2015; Guo, WeiZhang, Yongjie Zhang, Han Zhang, 2017; Zaremba, Czapkiewicz, 2016)

In over all, the two proposed models are significant as Shariah-compliant five factors pricing model. However, there is a tendency in a decrease of the  $Adj-R^2$  as the firms grow in size; there is reverse relationship between the firms size and the ability of explain the average returns in the five factors pricing model.

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