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# Do Stock Market Risk Factors Explain Mutual Fund Returns? Evidence from Saudi Arabia

**Bader Jawid Alsubaiei**

Department of Finance, Business School, King Faisal University, Al Ahsa, Saudi Arabia

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## ABSTRACT

This paper examines the risk factors of the Saudi Arabian equity market using an extensive data set. The study demonstrates which risk factors explain mutual fund returns in the largest mutual fund market in the Middle East, a fast-growing economy and a major player in the oil market. This paper also assesses the global and emerging market risk factors. This study analyzes 256 equity funds that operated in Saudi Arabia from January 2006 to July 2017. Time series regression models (e.g., the CAPM, the Fama and French three-factor model and the Carhart four-factor model) are used. In addition, modified versions of the asset pricing models were applied by adding stock market volatility and oil market volatility. The results indicate that the single-factor model, representing the market portfolio, captures most of the mutual funds' excess returns. Size, value and momentum factors do not enhance the explanatory power of mutual fund returns significantly. The emerging market risk factors capture a small portion of the return variations where most effects were explained by the market risk factor. In explaining these results, we emphasize the important implications for investors, academics and regulators to better understand the risk factors that drive fund returns in a fast-growing emerging market.

**KEYWORDS**

Equity funds, market risk, market volatility, oil volatility, performance, asset pricing

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## 1. Introduction

The mutual fund industry has attracted the interest of academics and financial market participants due to the rapid growth of total assets under management over recent decades. The finance literature has provided a large body of work on mutual fund performance from different aspects (e.g., Cuthbertson *et al.*, 2016; Wang *et al.*, 2018; Wulfmeyer, 2016). The existing literature provides a sufficient analysis of developed markets, whereas emerging markets have received relatively little attention despite their accelerated growth, dynamic change and rapid influence on the world economy. Market risk is one of the major determinants of asset returns. Thus, this paper aims to identify what risk factors capture fund returns in Saudi Arabia by applying multiple asset pricing models: the capital asset pricing model (CAPM), the Fama and French three-factor model and the Carhart four-factor model. The motivation of this study is driven by the significant role that the mutual fund sector plays in the Saudi Arabian financial market due to the management skills provided by professionals. Therefore, providing evidence on what risk factors should be included to estimate abnormal returns in Saudi Arabia enables asset management companies and investors to better evaluate the return performance.

We investigate the mutual fund industry in Saudi Arabia for several reasons. First, Saudi Arabia is an influential market in the world economy as the largest oil exporter worldwide, which highlights its economic role in supplying oil to the leading global economies. Second, its financial market is the largest in the GCC (Gulf Cooperation Council) region and the Middle East. Third, this work is going to be the first extensive empirical work that provides evidence for the risk factors that explain the return movements of the mutual fund sector in Saudi Arabia. Seminal studies have explored mutual fund performance in terms of both the time-series and cross-sectional dimensions (e.g., Carhart, 1997; Fama and French, 1993; Grinblatt and Titman, 1992; Jensen, 1968; Sharpe, 1966). The capital asset pricing model, three-factor model and four-factor model have been tested widely using global samples. We provide evidence on whether these models capture the common return movements. Furthermore, we examine whether the stock market volatility or oil market volatility increases the explanatory power of the time-series regressions. Finally, we have applied the global and emerging market factors as proxies to represent the Saudi Arabian stock market risk factors.

This paper contributes to the literature in three main ways. First, our sample includes all existing funds in the investigated period, which provides an extensive research background of the mutual fund market in Saudi Arabia. To the best of our knowledge, previous studies that investigate the asset pricing model in the context of Saudi Arabian mutual fund return do not include all operating funds in the market. Second, Cheng *et al.* (2010) indicate that the Saudi Arabian stock market is primarily segmented from international markets and can be affected by regional and global factors, so this paper contributes to the finance literature by providing evidence of an emerging market. Finally, the findings shed light on the behavior of mutual fund return movements and whether risk returns that explain the movements of return variations in developed markets are applicable in emerging markets.

The approach that is used to test asset pricing models is the average returns following Fama and French (1993). We use the time-series regressions of the monthly excess return of funds on the market portfolio and mimicking portfolios for size, value and momentum. Time-series regressions provide clear evidence of the sensitivity to risk factors such as the R-squared values to indicate whether risk factors explain common variation in equity fund returns. The findings suggest that the single-factor model (market portfolio) captures most of the return variations, estimated by value-weighted average return. Second, the results of applying the three-factor and four-factor models are in line with the previous model, which indicates that the market index explains most of the common variations of funds' excess returns.

Corresponding Author: Badr Jawid Alsubaiei 00966544949552, balsubaiei@kfu.edu.sa

Third, we include the stock market volatility of the local stock market in the time-series regressions to determine whether it enhances the explanatory power of the model. The findings provide further evidence that local stock market return captures about 35% of the mutual funds' excess return variations by itself and adds approximately 4% if it is included with the market portfolio. Finally, the oil market volatility is included in our tests due to the vital role the oil market has in the Saudi Arabian economy. The results suggest that oil market return has a negative impact on the fund performance, which is in line with the literature that suggests a negative relationship between the stock market and the oil market (e.g., Alsubaiei *et al.*, 2020; Diaz *et al.*, 2016; Kang *et al.*, 2015). However, the oil volatility index does not capture a significant amount of the funds' return variations. As a result, the findings in this paper suggest that the market portfolio and stock market volatility capture approximately 90% of the mutual funds' excess returns in Saudi Arabia, indicating that these two risk factors should be included to estimate the funds' abnormal return.

Our findings have important implications for (i) investors to improve their understanding of the risk factors that should be considered when evaluating their funds' return performance, which would make them more informed about funds' management performance to better allocate their assets (e.g., individuals would have more information on what drives the mutual funds' returns and whether the result is produced by fund management or the market), and (ii) academics and financial market authorities to enhance their understanding of the behavior of funds' returns in a major emerging market and to provide new evidence on the extant risk-adjusted performance model (the four-factor model) that has proved its significance in developed markets.

The remainder of this paper is organized as follows. Section 2 briefly discusses the related literature. Section 3 presents the inputs of the regressions. Section 4 describes the data and model specifications. Section 5 discusses the main findings. Section 6 examines the robustness checks. Section 7 provides concluding statements.

## 2. Literature Review

There is rapid growth in the finance literature to evaluate mutual fund performance. However, a clear agreement is yet to emerge on funds' abnormal returns because researchers are still trying to develop the asset pricing model (Fama and French, 2015). The seminal work of Jensen (1968) investigated the relationship between the returns of mutual funds with similar risk by applying the single-factor model, which includes the market excess return. Then, Grinblatt and Titman (1989) examine funds' abnormal returns by applying Jensen's single-index measure with four sets of benchmarks, which shows the significant role the market portfolio plays in explaining mutual fund returns. Fama and French (1993) developed the three-factor model, which adds the size and value risk factors to the return evaluation. Recent studies have examined the mutual funds' performance by applying the three-factor model. With a sample including five European mutual fund markets, Otten and Bams (2002) determine the explanatory power of the risk factors as ranging from 76% to 97%. The Carhart (1997) four-factor model has been applied widely in the finance literature to evaluate mutual funds' abnormal returns, which adds the momentum anomaly to the assets pricing model. Ferreira *et al.* (2012) examine the determinants of the mutual fund performance of 26 countries using the Carhart four-factor model, and the results show that the Carhart model captures 74% of the return for the Taiwanese market (minimum) and 94% of the return for the Thai market (maximum), while the total explanatory power is 87%.

Emerging markets are different from developed markets in terms of market influencers and whether or not they are segmented or integrated with the world economy, and such markets have received less scholarly attention than developed markets. Białkowski and Otten (2011) examine the performance of the Polish mutual fund sector as an emerging market by applying the four-factor model. Their results suggest that the Carhart model explains approximately 92% of the domestic equity and 68% of international equity, and the sample is free of survivorship bias. Huij and Post (2011) examine the performance of emerging equity mutual funds in the US and use the single-factor and four-factor models. Their results suggest that the single-factor model captures 88% to 97% of the variations, whereas the four-factor model explains between 90% and 97% of the return movements. This indicates that applying the Carhart model does not increase the explanatory power significantly.

The recent trend in the literature focuses on the importance of volatility as a measure of risk due to its role in affecting investors' behavior and the market direction. Busse (1999) suggests that mutual fund performance is associated with market volatility, and a recent paper by Wang *et al.* (2018) provides evidence of investors' reaction to the volatility level of the market. Jordan and Riley (2015) investigate the relationship between funds' performance with market volatility. They applied the four-factor model, and their findings suggest that portfolio volatility is a predicator of fund abnormal return. The explanatory power of the risk factors varies from 75% to 96%, and low (high) market volatility is associated with a positive (negative) abnormal return. Hu *et al.* (2014) study the effect of diversification on returns and find that well-diversified funds are less affected in high market volatility conditions.

The existing work that has covered the Saudi Arabian stock market is very limited. For example, Salameh (2020) investigates the application of asset pricing models in the Saudi exchange where his data includes only 44 observations over less than three years. The findings suggest that the Fama and French model is the best model to be applied. Aldaarmi *et al.* (2015) apply the multiple asset pricing model to the Saudi Arabian stock market. Their empirical analysis covers only 60 monthly periods, and they find that the three-factor model has the best explanatory power in explaining return variations. As a result, this paper investigates the application of different asset pricing models, including other risk factors, to ascertain the best model that can explain the mutual fund return variations.

## 3. Inputs to Time-Series Regressions (Factors Definition)

### 3.1. Fund Return and Risk Portfolios:

First, we test the single-factor model following the CAPM developed by Sharpe (1964). The capital asset pricing model indicates whether the market portfolio captures the common excess return variation. The excess return is developed based on the value-weighted average of funds. Jensen (1968) applies the CAPM to measure portfolio performance and estimates funds' abnormal returns:

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \varepsilon_i \qquad t = 1, 2, \ldots . T \tag{1}$$

Where $r_t$ is the value-weighted fund returns, and where the return is winsorized at the top and bottom 1% to avoid extreme negative return in some periods. $RF_t$ is the risk-free rate of return that is the US three-month T-bill return; the risk-free rate that is applied is the US T-bill due to the integration between the US and Saudi Arabia economies. According to the US Treasury Department, Saudi Arabia was the 10th largest foreign holder of US government bonds by the middle of 2018. Furthermore, the exchange rate between the local currency and US dollars has been fixed since 1981, demonstrating the

significant relationship between these markets (Aleisa and Diboogˆlu, 2002). $Rm_t$ is the return on market index, the Saudi Tadawul All Share Index (TASI).

There is theoretical and empirical evidence that shows the single-factor model ignores other important risk factors that can capture common return variations, such as macroeconomic financial market factors. Therefore, Fama and French (1993) extended the asset pricing model by including two additional risk factors, which are size (SMB) and book-to-market ratio (HML), in addition to the market proxy. As a result, the risk-adjusted fund performance is calculated as follows:

$$r_t - RF_t = \alpha + \beta_0(Rm_t - RF_t) + \beta_1 SMB + \beta_2 HML + \varepsilon_t \qquad t = 1, 2, \ldots . T \qquad (2)$$

Where *SMB* (eq.4) is the return of the equal-weighted average on the three small stock portfolios minus the average of the returns on the three big stock portfolios; *HML* (eq.5) is the equal-weighted average of the returns for the two top market value portfolios minus the average of the returns for the two low market value portfolios.

Based on market value, firms that have a market value above the median are classified as big. Also, based on book-to-market value, firms within the top 30th percentile are classified as high, firms within the middle 30th percentile are classified as medium and firms within the bottom 30th percentile are classified as low. To construct the Fama risk factors (SMB and HML), six value-weighted portfolios are developed: (i) SL, which is the return of small firms in terms of market value and low firms in terms of book-to-market value, (ii) SM , which is the return of small firms in terms of market value and medium firms in terms of book-to-market value, (iii) SH, which is the return of small firms in terms of market value and high firms in terms of book-to-market value, (iv) BL, which is the return of big firms in terms of market value and low firms in terms of book-to-market value, (v) BM, which is the return of big firms in terms of market value and medium firms in terms of book-to-market value and (vi) BH, which is the return of big firms in terms of market value and high firms in terms of book-to-market value.

Then, Carhart (1997) adds the momentum anomaly (MOM) (eq.6) in addition to the three factors to enhance the pricing error and to capture cross-sectional variation in the returns. Carhart's four-factor model has become one of the most applied models in the mutual fund literature to estimate mutual fund abnormal returns (Ferreira *et al.*, 2012; Otten and Bams, 2002). As a result, the fund performance calculation is the following:

$$r_t - RF_t = \alpha + \beta_0(Rm_t - RF_t) + \beta_1 SMB + \beta_2 HML + \beta_3 MOM + \varepsilon_t \qquad t = 1, 2, \ldots . T \qquad (3)$$

Where MOM (eq.6) is the average return on the portfolios of the highest 30% return minus the average return on the portfolios with the lowest 30% return.

The MOM portfolio represents the momentum by estimating stock market firms' top winners and losers. Firms within the top 30th percentile are classified as winners and firms within the bottom 30th percentile are classified as losers. We develop four value-weighted return portfolios: (i) SW, which is the return of small firms in terms of market value and firms that perform well, (ii) BW, which is the return of big firms in terms of market value and firms that perform well, (iii) SL, which is the return of small firms in terms of market value and firms that perform poorly and (iv) BL, which is the return of big firms in terms of market value and firms that perform poorly.

$$SMB = 1/3(Small\ Low + Small\ Medium + Small\ High) - 1/3(Big\ Low + Big\ Medium + Big\ High) \quad (4)$$

$$HML = \tfrac{1}{2}(Small\ High + Big\ High) - \tfrac{1}{2}(Small\ Low + Big\ Low) \quad (5)$$

$$MOM = \tfrac{1}{2}(Small\ Winners + Big\ Winners) - \tfrac{1}{2}(Small\ Losers + Big\ Losers) \quad (6)$$

Table 1 reports the summary statistics for the Saudi Arabian market, global market and emerging market risk factor. Table 1.A indicates that there are low correlations between the Saudi Arabian market factors where the average return of the market index is negative. Table 1.B and Table 1.C present the summary statistics of the global and emerging four-factor model that is provided from Kenneth R. French's website. The global portfolio includes the developed markets of 23 countries, whereas the emerging portfolio represents 27 developing countries, including Saudi Arabia. The correlations between the market return and other factors are still low, with the highest correlation between market excess return and the size factor being 45%.

Table 1 also shows summary statistics for stock market volatility and oil market volatility. All provided data are monthly bases for the period from the beginning of 2006 to July 2017. The Saudi Arabian stock market (TSAI) has volatility of approximately 5%. The realized volatility has a negative mean of 9%. Figure 1 illustrates the fluctuations in the local stock market return and the movements of stock market volatility. Figure 2 exhibits the line chart of the crude oil index return and the fluctuations of oil market volatility.

**Table 1: Summary statistics of the four-factor model, January 2006 to July 2017**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| SARMRF | 139 | -0.016 | 0.085 | -0.3 | 0.177 |
| SASMB | 139 | -0.01 | 0.081 | -0.455 | 0.277 |
| SAHML | 139 | -0.023 | 0.05 | -0.274 | 0.087 |
| SAMOM | 139 | 0.199 | 0.087 | 0.098 | 0.725 |
| GRMRF | 139 | 0.535 | 0.045 | -0.195 | 0.115 |
| GSMB | 139 | -0.015 | 0.015 | -0.035 | 0.039 |
| GHML | 139 | -0.001 | 0.017 | -0.046 | 0.048 |
| GMOM | 139 | 0.278 | 0.036 | -0.244 | 0.092 |
| ERMRF | 139 | 0.72 | 6.377 | -27.29 | 17.98 |
| ESMB | 139 | 0.05 | 1.717 | -6.94 | 4.21 |
| EHML | 139 | 0.397 | 1.572 | -3.06 | 4.36 |
| EMOM | 139 | 0.584 | 2.953 | -14.92 | 5.43 |
| Stock Market Volatility | 139 | 0.0598 | 0.0458 | 0.0125 | 0.2612 |
| Oil Market Volatility | 139 | 0.094 | 0.0457 | 0.0307 | 0.297 |

Mean is the average of our sample, Std. Dev. is the sample standard deviation and Min and Max are minimum and maximum values, respectively. RMRF is the stock market index return minus the T-bill return. SMB and HML are the Fama and French factors (size and book-to-market). MOM is a factor representing return momentum. When prefixed by 'SA' these factors represent the Saudi Arabian market, prefixed by 'G' these factors represent the global market, when prefixed by 'E' these factors represent the emerging markets. Stock market information is based on the Saudi Arabian market index (TASI), and oil prices information is from the S&P GSCI crude oil excess return.

### 3.2. Volatility Measures:

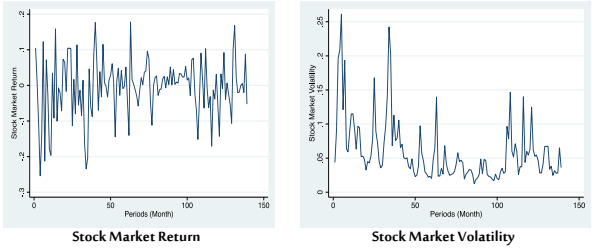
This paper includes the volatility of the stock market and oil market to investigate whether they explain the common return variation in the Saudi Arabian mutual funds. We compute the uncertainty based on the realized volatility (following, for example, Christiansen *et al.*, 2012; French *et al.*, 1987; Paye, 2012; Schwert, 1989). Realized volatility provides estimations closer to normality due to the inclusion of the total squared daily return to approximate the standard deviation of the equity or commodity benchmark for the frequency in the study. The first volatility estimation is based on the local stock market (i.e., TASI) to explore whether market risk captures some of the excess return movements because French *et al.* (1987) find a significant relationship between equity market returns and market volatility. The second volatility estimation is the oil market because the literature indicates a significant relationship between the oil market and the equity market (e.g., Diaz *et al.*, 2016; Kang *et al.*, 2015). We use the S&P Dow Jones Index because it provides a reliable benchmark for crude oil market performance over time.[1] The S&P GSCI crude oil index excess return is applied to calculate oil market volatility, which represents a portfolio of crude oil futures contracts' return by using the world production weighted basis as its weighting method and return on daily contracts as its calculation base (*S & P GSCI Crude Oil*, 2017). As a result, we estimate the volatility variable is as follows:

[1] According to the S&P Dow Jones Indices website, "The index comprises the principal physical commodities that are traded in active, liquid futures markets. In addition to numerous related and sub-indices calculated on a single-component and multi-currency basis, thematic baskets such as biofuel and petroleum are available."

$$\textbf{Realized volatility}_{i,t} = \ln \sqrt{\sum_{t}^{M_t} R_t^2} \qquad t = 1, 2, \ldots \ldots, T \qquad (7)$$

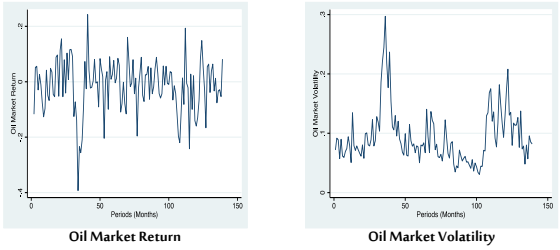
Where R is the daily continuously compounded return in the month t for the stock market and crude oil market, and $M_t$ represents the number of trading days in the month.

**Figure 1: Saudi Arabian stock market return and volatility by month - Jan. 2006 to July 2017**




Stock Market Return | Stock Market Volatility

**Figure 2: Oil market return and volatility by month - January 2006 to July 2017**




Oil Market Return | Oil Market Volatility

# 4. Overview of Mutual Fund Data, Model Specifications and Hypotheses

### 4.1. Data Description:

This paper focuses on open-end equity mutual funds in the Saudi Arabian market to determine the optimal asset pricing model. Mutual fund data are extracted from the Lipper for Investment Management database. Our sample spans all equity funds that are available from the beginning of 2006 until mid-2017. There are 256 equity funds that are operated in the Saudi Arabian mutual fund industry, of which 175 are currently active. There are 121 funds that invest only in the Saudi Arabian stock market, which counts for approximately 50% of the total sample. We apply monthly data in this paper following the literature (e.g., Barber *et al.*, 2016; Ferreira *et al.*, 2012). Monthly data are suitable for our analysis due to the following reasons: (i) the required data for the Saudi Arabian market are poor for less than a monthly basis and (ii) monthly data can capture higher mutual fund return movements because it mitigates any bid-ask effect biases in the daily data (Arouri and Nguyen, 2010). Finally, our sample is free of survivorship bias because we include all available equity funds that have existed in our sample period.

Table 2 presents the summary statistics for the mutual fund sample included in this paper. On average, mutual fund returns experience a slightly positive monthly return close to zero (0.07%), which is a raw return before adjusting for the risk-free rate. The risk-adjusted return (excess return) is −0.7% per month. The fund size has a net asset value of 0.1%, where the total asset value at the end of our sample is US$33 million. Moreover, the average fund age is about nine years, and the oldest fund has been operating for more than 25 years.

**Table 2: Summary statistics of mutual fund performance and other variables, January 2006 to July 2017**

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Raw return | 19,900 | 0.0007 | 0.078 | -2.354 | 0.580 |
| Risk-adj. return | 19,900 | -0.007 | 0.062 | -0.277 | 0.143 |
| Size | 18,413 | -0.012 | 0.257 | -6.806 | 13.935 |
| Age | 256 | 8.676 | 6.477 | 0 | 25 |

*Obs. is the number of observations for the study period, Mean is the average of our sample, Std. Dev. is the sample standard deviation and Min and Max are minimum and maximum values, respectively. Raw return is the return of fund i in period t before adjusting for the risk-free rate and risk factors, Risk-adj. Return is the excess return, Size is the log of the total fund asset of fund i in period t, and Age is the total years since the fund launched.*

### 4.2. Model Specification:

We apply the time-series regressions approach because the main finding in the regressions is the R-squared, which indicates the explanatory power of the risk factors included. Times-series models vary based on the risk factors used in the regressions. This paper tries to provide evidence on whether mimicking portfolios for risk factors related to the equity market capture the variations of the mutual fund returns. The calculations are as follows:

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \varepsilon_t \quad t = 1, 2, \ldots . T \qquad (8)$$

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \beta_2 SMB + \beta_3 HML + \varepsilon_t \quad t = 1, 2, \ldots . T \qquad (9)$$

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \varepsilon_t \quad t = 1, 2, \ldots . T \qquad (10)$$

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \beta_5 SMV_t + \varepsilon_t \quad t = 1, 2, \ldots . T \qquad (11)$$

$$r_t - RF_t = \alpha + \beta_1(Rm_t - RF_t) + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \beta_5 OMV_t + \varepsilon_t \quad t = 1, 2, \ldots . T \qquad (12)$$

Where $r_t$ is the value-weighted return of fund $i$ in month $t$ in excess of the risk-free rate, $RF_t$ is the risk-free rate of the return, $Rm_t$ is the return on the market index (TASI), $SMB$ is the size risk factor (eq.4), $HML$ is the book-to-market ratio risk factor (eq.5), $MOM$ is the momentum anomaly risk factor (eq.6), $SMV_t$ is the stock market volatility at a month (eq.7) and $OMV_t$ is the oil market volatility at a month (eq.7).

### 4.3. Hypotheses:

The capital asset pricing model indicates whether the market portfolio captures the common excess return variations by itself. We hypothesize the following:

- H1: The market return has significant explanatory power in explaining the mutual fund return variations.

The four-factor model includes size, book-to-market ratio and momentum as risk factors to explain return variations. We hypothesize the following:

- H2: The four-factor model has significant explanatory power in explaining the mutual fund return variations.

Stock market volatility and oil market volatility have a significant relationship with equity market returns, as suggested in the existing literature. Therefore, we anticipate that these risk factors can improve the explanatory power of the mutual fund return variations. We hypothesize the following:

- H3: The stock market volatility and oil market volatility have significant explanatory power in explaining the mutual fund return variations.

# 5. Empirical Findings

### 5.1. Local Risk Factors:

This section provides the initial empirical analysis of the factors that explain mutual fund returns in Saudi Arabia. This paper uses a time-series regression approach following Fama and French (1993) for equity funds. Table 3 presents the time-series regression results for the four risk factors on equity funds' excess returns in Saudi Arabia (eq.8). The first model is based upon the market proxy (TASI) following the seminal work of Jensen (1968), which applies the single-factor model to evaluate portfolios' abnormal returns. The regression results reveal that market proxy captures about 88% of the variation of funds' excess returns by itself. In specifications 2 and 3 of Table 3, we include the size effect (ME) and value effect (BE/ME) as proposed by Fama and French (1993) to enhance the explanatory ratio on the mutual fund returns to generate an accurate estimation of abnormal returns. Surprisingly, the three-factor model does not better explain the variation of the fund returns than the single-factor model because the R-squared does not increase significantly when

we add the Fama and French factors.

**Table 3: Times-series regressions of funds' excess returns on three-factor model**

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| SARMRF | 0.727*** | | | 0.729*** | | 0.708*** |
| | (0.034) | | | (0.040) | | (0.038) |
| SASMB | | 0.070 | | -0.035 | | -0.041 |
| | | (0.121) | | (0.040) | | (0.038) |
| SAHML | | | 0.398** | 0.014 | | -0.027 |
| | | | (0.153) | (0.053) | | (0.056) |
| SAMOM | | | | | -0.351*** | -0.066** |
| | | | | | (0.075) | (0.032) |
| Constant | 0.001 | -0.011* | -0.002 | 0.001 | 0.059*** | 0.012** |
| | (0.002) | (0.006) | (0.006) | (0.002) | (0.012) | (0.005) |
| Observations | 139 | 139 | 139 | 139 | 139 | 139 |
| R-squared | 0.879 | 0.007 | 0.091 | 0.881 | 0.216 | 0.886 |

*This table reports time-series regressions of mutual fund value-weighted excess returns on the Fama and French three risk factors. Detailed definitions of variables are in Table 1. Constant is the intercept of the model. Observations are the number of observations in each model. R-squared is the coefficient of determination. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.*

Models 4–6 provide the results by adding another risk factor, which is the momentum anomaly. The Carhart (1997) four-factor model improves the pricing error, which has become the most applied model to calculate mutual fund performance (Ferreira *et al.*, 2012; Otten and Bams, 2002). Overall, the findings in model 1 suggest that fund return is significantly related to the local market momentum, which explains about 21% by itself. However, when we run the time-series regressions of all risk factors (Carhart four-factor model), the overall explained variation is approximately 89%, which means there is a minimal impact compared to the market portfolio (88%).

Recent literature has provided evidence on the importance of volatility as a measure of risk and how the return movement can be directed by market uncertainty (e.g., Alkhaldi, 2015; Kang *et al.*, 2015; Liu, 2014; Nazlioglu *et al.*, 2015). Therefore, we add the market price volatility and oil market volatility in our time-series regressions to investigate whether these uncertainty indexes explain some of the mutual fund return variation in Saudi Arabia.

Table 4 includes the results of whether the volatility affects the equity funds' excess returns. Model 1 includes the market volatility and shows that it captures a significant portion of the return variations by itself. The R-squared is about 35%, which means that it is a key risk factor that should be considered when the mutual fund abnormal return is estimated. The findings indicate the strong negative relationship with market volatility, which confirms the conclusions of existing studies (e.g., French *et al.*, 1987; Hammoudeh *et al.*, 2009). We run a robustness check of the relationship between market volatility and value-weighted excess returns by applying the GARCH model, and the result is in line with the time-series findings. Models 2 and 3 include the four-factor model and market volatility, and the results show that market volatility has a significant impact on mutual fund return. The model explanatory power increased to 90%.

**Table 4 : Times-series regressions of funds' excess returns on stock market volatility**

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| SARMRF | | 0.668*** | 0.669*** | | 0.705*** | 0.669*** |
| | | (0.034) | (0.034) | | (0.038) | (0.035) |
| SASMB | | -0.017 | -0.016 | | -0.031 | -0.016 |
| | | (0.030) | (0.032) | | (0.041) | (0.034) |
| SAHML | | -0.018 | -0.014 | | -0.022 | -0.014 |
| | | (0.046) | (0.050) | | (0.056) | (0.050) |
| SAMOM | | | 0.008 | | -0.053 | 0.008 |
| | | | (0.033) | | (0.033) | (0.033) |
| Stock Market Volatility | -0.063*** | -0.018*** | -0.018*** | | | -0.018*** |
| | (0.010) | (0.004) | (0.004) | | | (0.005) |
| Oil Market Volatility | | | | -0.318* | -0.071 | -0.000 |
| | | | | (0.177) | (0.060) | (0.063) |
| Constant | -0.201*** | -0.055*** | -0.058*** | 0.019 | 0.017** | -0.058** |
| | (0.033) | (0.014) | (0.017) | (0.016) | (0.007) | (0.023) |
| Observations | 139 | 139 | 139 | 139 | 139 | 139 |
| R-squared | 0.349 | 0.901 | 0.901 | 0.048 | 0.888 | 0.901 |

*This table reports time-series regressions of mutual fund value-weighted excess returns on the Fama and French three risk factors. Detailed definitions of variables are in Table 1. Stock Market Volatility is the realized volatility which is the sum of trading days' squared return in a month on TASI (Tadawul All Share Index). Oil Market Volatility is the realized volatility which is the sum of trading days' squared return in a month on the S&P GSCI crude oil excess return. Constant is the intercept of the model. Observations are the number of observations in each model. R-squared is the coefficient of determination. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.*

Model 4 indicates whether the oil market volatility explains some of the return variations. Oil market volatility is included due to the important role Saudi Arabia plays in the oil sector as well as the dependence of the local market on oil. The findings show that oil market volatility, which is estimated by realized volatility, explains approximately 5% of the mutual fund market variations. This result can be attributed to the fact that stock market volatility is directly related to the oil market, and the movement is already reflected in the local stock market; this finding is in line with existing work, which finds the spill-over from the oil market to the stock market in Saudi Arabia and in other markets. However, model 5 shows that oil market volatility has a smaller contribution in capturing the variation in equity fund returns, which suggests that the inclusion of oil market volatility when estimating mutual fund abnormal returns does not provide a significant influence.

To provide better estimates, we ran further tests that included other risk factors. Approximately 50% of the mutual funds under investigation invest in international markets. As a result, we include the global risk factors in our regressions to determine whether some of the return variation can be explained**.** Table 5 presents multiple regressions for local risk factors and global risk factors on equity funds raw returns in Saudi Arabia. Model 1 shows that the market portfolio captures a very small part of the equity market variations where the R-squared is about 4%. The findings show that adding the global market portfolio to the regression does not increase the percentage of explained variations. Model 5 includes four risk factors for the local market and global market, and the findings indicate that there is no added benefit from the global risk factors because the R-square (89%) is similar to Table 4 (without global risk factors).

**Table 5: Times-series regressions of funds' excess returns on global risk factors**

| VARIABLES | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| GRMRF | 0.267* | 0.259** | 0.253* | 0.229* | -0.012 |
| | (0.137) | (0.131) | (0.133) | (0.136) | (0.059) |
| GSMB | | 0.261 | 0.272 | 0.264 | 0.155 |
| | | (0.389) | (0.383) | (0.386) | (0.123) |
| GHML | | | 0.075 | -0.004 | 0.026 |
| | | | (0.281) | (0.303) | (0.131) |
| GMOM | | | | -0.109 | -0.046 |
| | | | | (0.155) | (0.073) |
| SARMRF | | | | | 0.706*** |
| | | | | | (0.037) |
| SASMB | | | | | -0.042 |
| | | | | | (0.039) |
| SAHML | | | | | -0.029 |
| | | | | | (0.055) |
| SAMOM | | | | | -0.067** |
| | | | | | (0.033) |
| Constant | -0.013** | -0.013** | -0.013** | -0.012** | 0.013** |
| | (0.006) | (0.006) | (0.006) | (0.006) | (0.005) |
| Observations | 139 | 139 | 139 | 139 | 139 |
| R-squared | 0.034 | 0.037 | 0.037 | 0.040 | 0.888 |

*This table reports time-series regressions of mutual fund value-weighted excess returns on the Fama and French three risk factors. Global factors are obtained from the Kenneth R. French website. Constant is the intercept of the model. Observations are the number of observations in each model. R-squared is the coefficient of determination. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.*

Finally, our results suggest that the market portfolio proxy has the largest power to explain the mutual fund returns in Saudi Arabia. This finding is in line with Fama and French (1993), who find that market return explains between 80% and 90% of the stock market variations. Stock market volatility also has a significant role in capturing the return variation. Combining both risk factors (market portfolio and market volatility) explains approximately 90% of the mutual fund excess returns (market risk-adjusted return). Therefore, these two risk factors should be included to estimate fund abnormal returns (alpha) to identify funds that outperform their benchmarks.

### 5.2 Emerging Market Risk Factors:

Fama and French developed a proxy to represent the risk factors of emerging markets that allows practitioners in those countries to have ready estimations for their local risk markets. Therefore, time-series regressions are run by applying the emerging markets risk factors to represent the Saudi Arabian stock market. The reason for applying these regressions is to diagnose whether our main findings persist and to address whether emerging market risk factors capture most of the equity mutual funds' returns variations in Saudi Arabia. If the risk factors do explain a large share of the return movement, we provide evidence to apply them in future studies rather than estimate the risk factors for the local market individually.

Model 1 in Table 6 tests the single-factor model, which is the market

portfolio on the mutual funds' excess returns. The regression results reveal that the market portfolio of Saudi Arabian stocks explains about 25% of the variations, which is significantly less than the local estimations of the market return, which captures about 88%. Specifications 2 and 3 include the size effect and value effect, respectively, as proposed by Fama and French (1993), whereas model 4 includes the momentum effect as proposed by Carhart (1997). The results show that estimating the abnormal return from the four-factor model does not provide a larger explanation of the value-weighted fund returns. As a result, the single-factor model captures most of the market return movements when we use the emerging risk factor, which confirms our previous findings. Model 5 shows evidence that stock market volatility does explain a significant part of the return movements. The direction of the relationship is negative, as suggested in the literature.

**Table 6: Times-series regressions of funds' excess returns on emerging risk factors**

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| ERMRF | 0.005*** | 0.005*** | 0.006*** | 0.006*** | 0.003*** | 0.005*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| ESMB | | 0.002 | 0.002 | 0.002 | -0.002 | 0.002 |
| | | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) |
| EHML | | | -0.004 | -0.005 | -0.001 | -0.005 |
| | | | (0.004) | (0.004) | (0.003) | (0.005) |
| EMOM | | | | -0.002 | -0.004** | -0.002 |
| | | | | (0.002) | (0.002) | (0.002) |
| Stock Market Volatility | | | | | -0.058*** | |
| | | | | | (0.010) | |
| Constant | -0.015*** | -0.015*** | -0.014*** | -0.013*** | -0.187*** | -0.013** |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.031) | (0.006) |
| Observations | 139 | 139 | 139 | 139 | 139 | 139 |
| R-squared | 0.252 | 0.253 | 0.261 | 0.265 | 0.518 | 0.168 |

*This table reports time-series regressions of mutual fund value-weighted excess returns on the Fama and French three risk factors. Detailed definitions of variables are in Table 1. Emerging factors are obtained from Kenneth R. French's website. Stock Market Volatility is the realized volatility which is the sum of trading days' squared return in a month on TASI (Tadawul All Share Index). Constant is the intercept of the model. Observations are the number of observations in each model. R-squared is the coefficient of determination. Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.*

To validate the results, we reran a times-series regression after removing all the funds that do not invest only in the Saudi Arabian market. Specification 6 confirms the previous findings on whether the emerging markets' risk factors serve as proxies, which leads us to the following conclusions. First, funds that invest in other markets besides the Saudi Arabian market have a minimal share of the mutual fund industry in Saudi Arabia, and we find similar results when the international funds are excluded. Second, the emerging market risk factors capture a small size of the return variations compared to the local market risk factors, which suggests estimating the index of the investigated local market. Finally, the only factor that shows a major relation with the funds' excess returns is the market portfolio, which confirms our main findings.

## 6. Robustness Checks

This section conducts several robustness checks of our main analysis.[2] We first exclude funds that do not invest strictly in the Saudi Arabian stock market, which removes roughly 50% of the main sample. The regression results indicate that the market portfolio captures approximately 90% of the variation of funds' excess returns by itself, which confirms our previous findings where the single-factor model explains most mutual fund return variations even after including other risk factors.

Moreover, we use excess returns on five portfolios formed by size as our dependent variables in the time-series regressions. The funds are ranked in five size quintiles based on their size in millions. Then, we estimate the value-weighted excess monthly return for funds at the same level of size from January 2006 to July 2017. The findings demonstrate that market proxy is the key factor that has a persistent, significant relation with all funds' portfolios. Second, it provides evidence of a strong positive relationship, which indicates the dominant impact of the stock market on mutual fund returns. Finally, the explanatory power of market factors increases with the large funds as it indicates that R-squared increases with larger portfolios (87%).

## 7. Conclusion

The main purpose of this study is to identify the risk factors that capture the common return variations in the Saudi Arabian mutual funds market. Our study contributes to the existing literature in different aspects. First, we provide evidence on the asset pricing models in a major emerging market where the result can be applied in similar markets. Second, the findings indicate a significant explanatory power of the local market volatility, which suggests adding the volatility of the stock market to the model. Third, the most important risk factor that captures the highest percentage of the return variations is the market portfolio, which is the local market excess return. This key result is in line with the finance literature, which shows the important role of the market return in explaining the return movements. Finally, the emerging market risk factors can be used as a proxy to represent the Saudi Arabian market because they explain a significant amount of the returns. All tests are robust to different model specifications and generate consistent outcomes.

A notable implication of our results is that it can be used in any work that has expected returns, such as evaluating abnormal performance (skills) and selecting portfolios. Consequently, asset managers should take advantage by applying the best model to estimate performance and anticipate the fluctuations caused by risk factors. Asset management firms and mutual fund companies should also include stock market volatility in their estimations to measure mutual fund performance. Finally, investors and financial market regulators will be able to judge managers' skills by estimating the performance of managed portfolios to know whether they can beat the market or generate abnormal returns greater than passive funds.

## Biography

**Bader Jawid Alsubaiei**

*Department of Finance, Business School, King Faisal University, Al Ahsa, Saudi Arabia, 00966544949552, balsubaiei@kfu.edu.sa*

Dr. Alsubaiei is an assistant professor, the CEO of the Endowment and Investment Fund at King Faisal University and the Director of Investment and Recourses Development. He obtained his PhD in finance from Loughborough University in the UK and his master's degree with distinction from Brandeis University in the US. He worked as a part-time lecturer in finance at Loughborough University. His research interests focus on financial markets, asset pricing and investment portfolios. He has published many papers in leading journals and conferences (e.g., the European Journal of Finance).

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