Chapter 4

The Comparative Performance Evaluation of Shari'ah-Compliant Asset Pricing Model and Alternative Fama-French Factor Models: Evidence from Turkey

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Abstract

This study investigates the validity of the Shari'ah-Compliant Asset Pricing Model (S-CAPM) and alternative Fama-French Factor Models, as well as the comparative performance evaluations of these models, in explaining the variation in stock returns in the BIST Participation All Index. The validity and comparative performance of the S-CAPM and alternative Fama-French Factor Models are measured using adjusted R^2, mean absolute intercept, GRS F-test statistic, and the probability value of the GRS-F test. The empirical findings of the study, based on the S-CAPM and alternative Fama-French Factor Models using the return mudharabah (RMDZ) instead of the risk-free rate as suggested by Faisol, Nidar, and Herwany (2022), indicate that the S-CAPM RMDZ, S-FF3F RMDZ, S-FF5F RMDZ, and S-FF6F RMDZ are valid for the BIST Participation All Index. Among these models, the S-FF6F RMDZ performs better in explaining the variation in stock returns. To test the robustness of the empirical findings for the S-CAPM and alternative Fama-French Factor Models with RMDZ, the study also employs S-CAPM and alternative Fama-French Factor Models created using the inflation rate instead of the risk-free rate, as proposed by Hanif (2011), in the BIST Participation All Index. The empirical findings confirm the results obtained from the S-CAPM and alternative Fama-French Factor Models with RMDZ. To the best of our knowledge, this is the first study to test the S-FF6F model. Additionally, the study presents an alternative asset pricing model for the S-CAPM. Besides, this study makes significant contributions to the field of finance, particularly in the context of Islamic finance.

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https://doi.org/10.58830/ozgur.pub105.c516

1. Introduction

Islamic capital markets emerged globally in the 1990s, serving to facilitate investment activities and enhance efficiency in resource and capital management (Wahyudi and Sani, 2014, p. 33). Among the prominent financial instruments in Islamic capital markets are sukuk, mutual funds, and stocks. In recent years, Islamic stock indices have been established to enable investors with Islamic sensitivities to earn interest-free and halal profits through stock market investments. To cater to the needs of these investors, major stock index providers such as the Financial Times Stock Exchange (FTSE), Dow Jones (DJ), Standard & Poor's (S&P), and Morgan Stanley Capital International (MSCI) offer shari'ah-compliant stock indices. Similarly, various countries have developed national shari'ah-compliant indices, including the Karachi Meezan Index in Pakistan, the Jakarta Islamic Index in Malaysia, and the Borsa Istanbul (BIST) Participation Index in Turkey. Investors seeking to invest their savings in Islamic stock markets anticipate returns commensurate with their investment and risk, similar to investors in conventional stock markets (Guclu, 2020, p. 575).

In the finance literature, numerous theories have been formulated to establish the relationship between expected return and risk. The pioneering work of Markowitz (1952) introduced Modern Portfolio Theory (MPT), which examined the connection between the risk of a financial asset and its expected return. Subsequently, Sharpe (1964) and Lintner (1965) expanded upon MPT and developed the Capital Asset Pricing Model (CAPM). The CAPM, in its explanation of the variation in expected returns on assets, is based on two key findings: (i) the expected return on an asset is a positive linear function of its market beta, and (ii) the market beta alone adequately accounts for the differences in expected returns across assets in the cross-section.

Since the 1960s, several extensions of the CAPM have been developed to explain the variation in expected asset returns (Makwasha et al., 2019, p. 6460). Numerous academic and empirical studies have been conducted on the CAPM, and the general finding from these studies is that the CAPM is mostly insufficient to explain the variation in asset returns (Acaravci and Karaomer, 2017, p. 135). Fama and French (1992) proposed that the cross-sectional variation in asset returns is captured by size (market value), Book to Market equity (BE/ME), and earnings-price ratios. Fama and French (1993) investigate the relationship between stock returns and macro variables. They found that size and BE/ME ratios were two important variables that affect asset returns. Thus, they build the Fama-French Three Factor (FF3F) model by adding two more factors to the CAPM.

Fama and French (1993) asserted that the FF3F model outperformed the CAPM in explaining the variation in asset returns. Subsequently, numerous studies have been conducted to assess the significance of these factors in different time periods and markets. Charitou and Constantinidis (2003) and Walid and Ahlem (2009) compared the performance of the CAPM and FF3F models in the Japanese stock market. Gokgoz (2008) conducted a similar analysis in the Turkish stock market, while Dolinar (2013) examined the Croatian stock market. In all cases, the findings indicated that the FF3F model exhibited superior performance in explaining the variation in stock returns compared to the CAPM.

Fama and French (2015) determined that the FF3F model was inadequate in explaining the variation in asset returns concerning investment and profitability. Consequently, they expanded on their previous work and introduced the Fama-French Five Factor (FF5F) model by incorporating the profitability and investment factors into the existing FF3F model.

Fama and French (2015) utilized the FF5F model to examine the average stock returns of Compustat stocks traded on the NYSE, AMEX, and NASDAQ stock markets from July 1963 to December 2013. Their findings indicated that the FF5F model provided a superior explanation for the variation in asset returns compared to the FF3F model. Numerous scholars and researchers have also employed the FF5F model to analyze the variation in asset returns and conducted comparisons with other models. Martins and Eid Jr. (2015) conducted a comparison of the FF3F and FF5F models in the Brazilian stock market and found that the FF5F model outperformed the FF3F model in explaining the variation in stock returns. Similarly, Acaravci and Karaomer (2018) compared the CAPM, FF3F, and FF5F models in the Turkish stock market, and their results indicated that the FF5F model exhibited better performance in explaining the variation in stock returns compared to the CAPM and FF3F models.

In a recent study, Fama and French (2018) expanded their previous FF5F model by introducing a momentum factor, UMD (up minus down), sourced from Jegadeesh and Titman (1993), resulting in the FF6F model. Dogan, Kevser, and Leyli (2022) conducted a test on the Turkish stock market, comparing the CAPM, FF3F model, FF4F model, FF5F model, and FF6F model to explain the variation in stock returns. Their findings indicated that the FF6F model provided a superior explanation for the variation in stock returns compared to the other models. In a separate analysis, Dirkx and Peter (2020) examined the German stock market and tested the FF6F model's ability to explain the variation in stock returns. Their results revealed

that the momentum factor did not possess significant explanatory power within the FF6F model.

This study contributes significantly to the existing literature in multiple ways. Firstly, while previous research has primarily focused on conventional CAPM and Fama-French factor models to explain asset return variations, this study breaks new ground by examining the shari'ah-compliant asset pricing model (S-CAPM) and alternative Fama-French Factor models. These models are specifically designed to explain the variation in stock returns within the BIST Participation All Index, considering the prohibition of interest in Islamic transactions. Notably, this study pioneers the testing of the S-FF6F model, a unique addition to the literature. Secondly, the application of the S-CAPM and alternative Fama-French models, incorporating novel parameters, in the BIST Participation All Index can serve as a valuable exemplar for the development and implementation of innovative asset pricing models in the domain of Islamic finance. Furthermore, the empirical findings obtained from this study hold considerable potential for informing future research efforts in this area. Researchers can build upon these findings to expand the body of knowledge. Ultimately, the insights generated by this study have practical implications, benefiting investors with varying beliefs and expectations. By catering to their specific needs, these findings can guide decision-making and enhance investment strategies.

The structure of this paper is organized as follows: In Section 2, we provide a comprehensive review of the relevant literature, highlighting the key studies and theories that underpin our research. Section 3 is dedicated to explaining the data, model, and methodology employed in our analysis. We outline the sources of data, describe the model used, and present the methodology followed to conduct our investigation. Moving forward, Section 4 presents the empirical results derived from our study. We present and analyze the findings, drawing meaningful insights from the data and discussing their implications. Finally, in Section 5, we offer concluding remarks that summarize the main findings of our research, discuss their significance, and suggest avenues for future research in this field. By organizing the paper in this manner, we aim to provide a clear and logical structure that guides readers through our study, facilitating a comprehensive understanding of our research objectives, methodologies, and outcomes.

2. Literature Review

Using the risk-free rate in calculating the expected return of assets is a key aspect of the CAPM, the FF3F model, the FF5F model, and the FF6F model.

However, in Islamic finance, where interest is prohibited in all transactions, this approach has been criticized. Several scholars, including Tomkins and Karim (1987), El-Ashker (1987), Shaikh (2010), Hanif (2011), Derbali, El Khaldi, and Jouini (2017), and Faisol, Nidar, and Herwany (2022), have proposed shari'ah-compliant alternative models that replace the risk-free rate with different variables. The shari'ah-compliant asset pricing model (S-CAPM) serves as an alternative to the conventional asset pricing model and is developed by incorporating the principles of Islamic finance. In creating the S-CAPM, the assumptions of the Islamic finance system are revised. The assumptions on which the S-CAPM is based are (Derbali, El Khaldi, and Jouini 2017, s. 530): (a) the absence of transaction costs, (b) the assets being infinitely divisible and marketable, (c) homogeneous expectations among investors, (d) the inability of investors to influence stock prices through their buying and selling actions, and (e) investors making decisions based on the expected values and standard deviation of asset returns.

By introducing the S-CAPM, which aligns with Islamic finance principles, researchers aim to provide a model that addresses the limitations of conventional asset pricing models and caters to the unique requirements of Islamic finance. This approach ensures compliance with Islamic principles while considering the expected returns and risk of assets in investment decision-making.

Tomkins and Karim (1987) proposed a new model which was shari'ah-compliant, by removing the concept of risk-free rate in the CAPM.

$$R_i = \beta_i(R_m)$$

where R_i is the return on asset i, R_m is the returns on the market portfolio, and β_i is the beta of the asset i.

El-Ashker (1987) suggested a shari'ah-compliant new model which replaces the risk-free rate in the CAPM by using the zakat (Z) component.

$$R_i = R_z + \beta_i(R_m - R_z)$$

where R_i is the return on asset i, R_z is the zakat rate, R_m is the returns on the market portfolio, and β_i is the beta of the asset i.

Shaikh (2010) proposed a shari'ah-compliant new model which replaces the risk-free rate in the CAPM by using the Nominal Gross Domestic Product (NGDP).

$$R_i = R_{NGDP} + \beta_i(R_m - R_{NGDP})$$

where R_i is the return on asset i, R_{NGDP} is the NGDP growth rate, R_m is the returns on the market portfolio, and β_i is the beta of the asset i.

Hanif (2011) suggested a shari'ah-compliant new model which replaces the risk-free rate in the CAPM by using the inflation rate.

$$R_i = R_{inflation} + \beta_i(R_m - R_{inflation})$$

where R_i is the return on asset i, $R_{inflation}$ is the inflation rate, R_m is the returns on the market portfolio, and β_i is the beta of the asset i.

Derbali, El Khaldi, and Jouini (2017) propesed a shari'ah-compliant new model which replaces the risk-free rate in the CAPM by using the sukuk.

$$R_i = R_s + \beta_i(R_m - R_s)$$

where R_i is the return on asset i, R_s is the return sukuk, R_m is the returns on the market portfolio, β_i is the beta of the asset i.

Faisol, Nidar, and Herwany (2022) propesed a shari'ah-compliant new model which replaces the risk-free rate in the CAPM by using the profit-sharing approach (mudharabah).

$$R_i = R_{RMDZ} + \beta_i(R_m - R_{RMDZ})$$

where R_i is the return on asset i, R_{RMDZ} is the return mudharabah, R_m is the returns on the market portfolio, and β_i is the beta of the asset i.

Dar and Hanif (2012) conducted a comparative study of the S-CAPM Inflation model and the conventional CAPM on the Karachi Stock Exchange from July 2001 to June 2010. Their findings revealed that the S-CAPM Inflation model outperformed the conventional CAPM in explaining the variation in stock returns. In a similar vein, Sadaf and Andleeb (2014) assessed the validity of the S-CAPM Inflation model on the Karachi Stock Exchange from March 2012 to March 2013, and their findings confirmed the model's validity in that specific context. Hakim, Hamid, and Mydin (2016) examined the performance of the S-CAPM Sukuk model against the conventional CAPM on the Malaysian Stock Exchange from January 2012 to December 2014. Their results demonstrated that the S-CAPM Sukuk model outperformed the conventional CAPM in explaining shari'ah-compliant stock returns. Effendi (2016) compared the S-CAPM without risk-free, the S-CAPM Zakat, and the S-CAPM Inflation models on the Jakarta Islamic Index from 2011 to 2015. The results indicated that the S-CAPM Inflation model performed better than both the S-CAPM Zakat and the S-CAPM without risk-free models in explaining stock returns. Furthermore, Comlekci and Sondemir (2020) tested the validity of the

S-FF3F Inflation model on the BIST Participation 30 index from December 2011 to December 2017, and their findings confirmed the model's validity for that particular index. In another study, Rehan, Chhapra, Mithani, and Patoli (2021) compared the conventional CAPM with several S-CAPM models, including the S-CAPM without risk-free, the S-CAPM Zakat model, the S-CAPM NGDP model, and the S-CAPM Inflation model on the Pakistan Stock Exchange from January 2001 to December 2018. They found that the S-CAPM models could serve as alternatives to the conventional CAPM. Finally, Ozer, Oncu, Ozer, and Comlekci (2021) assessed the performance of the FF5F model alongside the S-FF5F Inflation model on the Kuala Lumpur Composite index, the Karachi Meezan index, the Jakarta Islamic index, and the BIST Participation 30 index from 2012 to 2020. The results indicated that both the FF5F model and the S-FF5F Inflation model performed similarly in explaining the variation in stock returns.

3. Data Model and Method

This study has two primary objectives. Firstly, it aims to investigate the validity of the S-CAPM and alternative Fama-French Factor Models in the BIST Participation All Index. Secondly, it aims to explore the comparative performance evaluation of the S-CAPM and alternative Fama-French Factor Models in the same index. To assess the comparative performance of these models, several metrics are employed, including adjusted R^2 (R^2adj.), mean absolute intercept, the GRS test statistic proposed by Gibbons et al. (1989), and the associated probability (p)-value of the GRS test. The data used in this study were obtained from the Financial Information News Network (FINNET) website and comprise information on companies traded in the BIST Participation All Index. The market return data were derived from the FINNET website, specifically the BIST Participation 30 Index. As for the risk-free rate, the returns of profit-sharing (mudharabah) from Islamic banking in Turkey were utilized, and these data were collected from the Participation Banks Association of Turkey website.

This study employs the S-CAPM and Alternative Fama-French Factor Models, developed based on the use of return mudharabah instead of the risk-free rate as suggested by Faisol, Nidar, and Herwany (2022). The analysis focuses on the BIST Participation All Index and covers the period from July 2012 to June 2022. The regression equations for the S-CAPM and alternative Fama-French Factor Models are presented as follows:

S-CAPM RMDZ: $$R_{it} - RMDZ_t = \alpha_i + \beta_{1i}(R_{mt} - RMDZ_t) + \varepsilon_{it} \quad (1)$$

S-FF3F RMDZ: $R_{it} - RMDZ_t = \alpha_i + (R_{mt} - RMDZ_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \varepsilon_{it}$ (2)

S-FF5F RMDZ: $R_{it} - RMDZ_t = \alpha_i + (R_{mt} - RMDZ_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \beta_{4i}(RMW_t) + \beta_{5i}(CMA_t) + \varepsilon_{it}$ (3)

S-FF6F RMDZ: $R_{it} - RMDZ_t = \alpha_i + (R_{mt} - RMDZ_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \beta_{4i}(RMW_t) + \beta_{5i}(CMA_t) + \beta_{6i}(UMD_t) + \varepsilon_{it}$ (4)

To construct the factors, this study utilizes three factors, five factors, and six factors proposed by Fama and French (1993; 2015; 2018); size (SMB), value (HML), profitability (RMW), investment (CMA), and momentum (UMD). Independent sorts are employed to categorize stocks into two size groups and three groups based on book-to-market equity (BE/ME), operating profit (op.), investment (invs.), and momentum portfolios. In terms of BE/ME portfolios, stocks are classified as high (H), middle (M), or low (L). For operating profit portfolios, stocks are categorized as robust (R), middle (M), or weak (W). Regarding investment portfolios, stocks are grouped as conservative (C), middle (M), or aggressive (A). Similarly, momentum portfolios divide stocks into winners (U), middle (M), or losers (D). All the factors are derived from the intersection of six (2x3) portfolios, following the approach outlined by Fama and French (1993; 2015; 2018).

The SMB is measured by three size factors $SMB_{BE/ME}$, $SMB_{Op.}$, $SMB_{inv.}$ given by;

$SMB_{BE/ME} = (SxH + SxM + SxL)/3 - (BxH + BxM + BxL)/3$

$SMB_{Op.} = (SxR + SxM + SxW)/3 - (BxR + BxM + BxW)/3$

$SMB_{inv.} = (SxC + SxM + SxA)/3 - (BxC + BxM + BxA)/3$

The final factors SMB, HML, RMW, CMA, and UMD are derived as;

$SMB = (SMB_{BE/ME} + SMB_{Op.} + SMB_{inv.})$

$HML = (SxH - SxL)/2 + (BxH - BxL)/2$

$RMW = (SxR - SxW)/2 + (BxR - BxW)/2$

$CMA = (SxC - SxA)/2 + (BxC - BxA)/2$

$UMD = (SxU - SxD)/2 + (BxU - BxD)/2$

4. Findings

Table 1 presents the descriptive statistics for monthly factor returns from July 2012 to June 2022. The results reveal that the UMD factor exhibits the lowest return, while the CMA factor demonstrates the highest return.

Similarly, the UMD factor shows the lowest standard deviation, while the CMA factor exhibits the highest standard deviation. These findings highlight the variations in returns and risk levels across the different factors during the specified time period.

Table 1. Descriptive statistics

	R_m – RMDZ	SMB	HML	RMW	CMA	UMD
Mean	-0.039	0.013	0.002	0.017	0.032	-0.001
Std. Dev.	0.067	0.066	0.101	0.171	0.252	0.073

Table 2 presents the correlation matrix among the factors. Notably, the CMA factor exhibits positive correlations with RMW (0.83), HML (0.38), SMB (0.48), and UMD (0.09) factors, while showing a negative correlation with the R_m – RMDZ (-0.01) factor. These findings indicate a strong positive relationship between the CMA factor and the RMW, HML, and SMB factors. Furthermore, this correlation suggests that investments play a significant role in firm performance.

Table 2. Correlations

	R_m – RMDZ	SMB	HML	RMW	CMA	UMD
R_m – RMDZ	1					
SMB	-0.013	1				
HML	-0.064	0.289	1			
RMW	-0.100	0.312	0.448	1		
CMA	-0.016	0.487	0.382	0.831	1	0.091
UMD	-0.2322	-0.0109	0.3446	0.1349	0.0957	1

Table 3 presents the estimation results of the S-CAPM and alternative Fama-French Factor Models utilizing RMDZ. Notably, all models exhibit statistically significant F-statistic values, indicating the overall significance of the models. Furthermore, there is no evidence of autocorrelation in the regression models. The regression intercepts (α) are found to be statistically equal to zero, suggesting no pricing error in any of the regression models. Moreover, the coefficients β_1, β_2, β_3, β_4, β_5, and β_6 are positive and statistically significant in all models, indicating their significant contribution to the models.

Table 3. Estimation findings of the models (RMDZ)

R_{it} – $RMDZ_t$	α	β_1	β_2	β_3	β_4	β_5	β_6	DW	F-statistic
S-CAPM RMDZ	0.048 (1.442)	0.408 (1.192)[c]						2.028	13.564 [0.000][a]
S-FF3F RMDZ	0.003 (0.805)	0.512 (0.188)[c]	1.956 (1.949)[c]	1.009 (1.926)[c]				1.887	17.256 [0.000][a]
S-FF5F RMDZ	0.186 (0.162)	0.586 (4.546)[a]	0.158 (1.989)[b]	0.036 (1.965)[b]	0.510 (6.850)[a]	0.981 (14.229)[a]		2.236	402.752 [0.000][a]
S-FF6F RMDZ	0.011 (1.32)	0.625 (5.164)[a]	0.144 (1.913)[c]	0.017 (1.922)[c]	0.463 (5.624)[a]	1.023 (13.450)[a]	0.212 (2.033)[b]	2.258	342.547 [0.000][a]

Note:The probability values are presented in brackets, while the T-statistics are enclosed in parentheses. The T-statistics are calculated using Newey-West standard errors. Statistical significance at the 1%, 5%, and 10% levels is denoted by ([a]), ([b]), and ([c]), respectively.

The GRS-F test statistic is utilized to assess the S-CAPM and alternative Fama-French Factor Models under the null hypothesis (H_0) that all α_i coefficients derived from the multiple factor models are equal to zero ($\alpha_i = 0$). The GRS-F test helps identify the best model based on the highest p-value and the lowest test statistic. Additionally, the evaluation of the models considers the average absolute value of the intercepts ($A|\alpha_i|$) and the average adjusted R^2. The preferred model is characterized by the lowest $A|\alpha_i|$ value and the highest average adjusted R^2, indicating its superior performance.

Table 4. The Comparative performance evaluation of models (RMDZ)

R_{it} – $RMDZ_t$	$A\|\alpha_i\|$	GRS	GRS p-value	$A(R^2_{adj.})$
S-CAPM RMDZ	0.0221	1.3706	0.1712	0.2247
S-FF3F RMDZ	0.0165	1.1455	0.3252	0.3186
S-FF5F RMDZ	0.0045	1.0974	0.3679	0.8836
S-FF6F RMDZ	0.0053	1.0048	0.4584	0.8913

Note: $A|\alpha_i|$ is the average absolute intercept value for a set of regressions. GRS is the F-statistic value of the GRS test. GRS p-value is the probability value for the GRS-F statistic. $A(R^2_{adj.})$ is the average adjusted R^2.

Table 4 indicates the comparative performance evaluation of the S-CAPM and alternative Fama-French Factor Models which used RMDZ. According to GRS and GRS p-values of the S-CAPM RMDZ, the S-FF3F RMDZ, the S-FF5F RMDZ, and the S-FF6F RMDZ, the null hypothesis is accepted

for the S-CAPM RMDZ, the S-FF3F RMDZ, the S-FF5F RMDZ, and the S-FF6F RMDZ. In other sayings, it is determined that the S-CAPM RMDZ, the S-FF3F RMDZ, the S-FF5F RMDZ, and the S-FF6F RMDZ are valid for the BIST Participation All Index since there are no pricing errors in the models. Looking at GRS and GRS p-value in Table 4, the S-FF6F RMDZ has a lower GRS and higher GRS p-value than other models. Similarly, considering $A|\alpha_i|$ and $A(R^2_{adj.})$, the S-FF6F RMDZ has a lower $A|\alpha_i|$ and higher $A(R^2_{adj.})$ than other models. The S-FF6F is the best-performing model among the S-CAPM RMDZ, the S-FF3F RMDZ, and the S-FF5F RMDZ. Besides, the S-FF5F RMDZ performs higher than the S-FF3F RMDZ and the S-CAPM RMDZ. As a result, it is understood that the best model developed in the research study is the S-FF6F RMDZ.

4.1. Robustness Checking

In order to assess the robustness of the S-CAPM and alternative Fama-French Factor Models using RMDZ, this study introduces an additional analysis. The S-CAPM and alternative Fama-French Factor Models, incorporating the inflation rate instead of the risk-free rate as proposed by Hanif (2011), are applied to the BIST Participation All Index for the period spanning from July 2012 to June 2022. The inflation rate, obtained from the Central Bank of the Republic of Turkey, is utilized as the risk-free rate in these models. This analysis aims to further validate the performance and reliability of the S-CAPM and alternative Fama-French Factor Models when employing the inflation rate as a substitute for the risk-free rate. The regression equations for the S-CAPM and alternative Fama-French Factor Models are as follows:

S-CAPM Inflation: $$R_{it} - Inf_t = \alpha_i + \beta_{1i}(R_{mt} - Inf_t) + \varepsilon_{it} \quad (5)$$

S-FF3F Inflation: $$R_{it} - Inf_t = \alpha_i + \beta_{1i}(R_{mt} - Inf_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \varepsilon_{it} \quad (6)$$

S-FF5F Inflation: $$R_{it} - Inf_t = \alpha_i + \beta_{1i}(R_{mt} - Inf_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \beta_{4i}(RMW_t) + \beta_{5i}(CMA_t) + \varepsilon_{it} \quad (7)$$

S-FF6F Inflation: $$R_{it} - Inf_t = \alpha_i + \beta_{1i}(R_{mt} - Inf_t) + \beta_{2i}(SMB_t) + \beta_{3i}(HML_t) + \beta_{4i}(RMW_t) + \beta_{5i}(CMA_t) + \beta_{6i}(UMD_t) + \varepsilon_{it} \quad (8)$$

Table 5 presents the estimation results of the S-CAPM and alternative Fama-French Factor Models utilizing the inflation rate as a substitute for the risk-free rate. In all models, the F-statistic values demonstrate statistical significance, indicating a strong overall model fit, while the absence of autocorrelation confirms the reliability of the estimates. Furthermore, the

regression intercepts (α) values are statistically indistinguishable from zero, suggesting no pricing errors in any of the regression models. Additionally, the coefficients β_1, β_2, β_3, β_4, β_5, and β_6 exhibit positive signs and are statistically significant across all models, further supporting the validity of these factors.

Table 5. Estimation findings of the models (Inflation)

$R_{it} - Inf_t$	α	β_1	β_2	β_3	β_4	β_5	β_6	DW	F-statistic
S-CAPM Inflation	0.048 (1.442)	0.408 (1.192)[a]						2.028	13.564 [0.000][a]
S-FF3F Inflation	0.016 (0.558)	0.499 (1.176)[c]	2.061 (1.949)[c]	1.086 (1.892)[c]				1.884	16.514 [0.000][a]
S-FF5F Inflation	0.001 (0.262)	0.589 (4.477)[a]	0.117 (1.972)[b]	0.012 (1.917)[c]	0.604 (8.386)[a]	1.042 (15.204)[a]		2.235	457.151 [0.000][a]
S-FF6F Inflation	0.001 (0.264)	0.623 (4.961)[a]	0.104 (1.964)[b]	0.133 (1.845)[c]	0.563 (7.453)[a]	1.079 (14.817)[a]	0.185 (1.811)[c]	2.253	385.846 [0.000][a]

Note: The probability values are presented in brackets, while the T-statistics are enclosed in parentheses. The T-statistics are calculated using Newey-West standard errors. Statistical significance at the 1%, 5%, and 10% levels is denoted by ([a]), ([b]), and ([c]), respectively.

Table 6 presents the comparative performance evaluation of the S-CAPM and alternative Fama-French Factor Models utilizing the inflation rate. The S-FF6F Inflation is the best-performing model among the S-CAPM Inflation, the S-FF3F Inflation, and the S-FF5F Inflation. Thus, it can be clearly observed that these empirical findings support the empirical findings of the S-CAPM and alternative Fama-French Factor Models with RMDZ.

Table 6. The Comparative performance evaluation of models (Inflation)

$R_{it} - Inf_t$	$A\|\alpha_i\|$	GRS	GRS p-value	$A(R^2_{adj.})$
S-CAPM Inflation	0.016	1.382	0.137	0,324
S-FF3F Inflation	0.022	1.133	0.325	0,677
S-FF5F Inflation	0.007	1.092	0.367	0,885
S-FF6F Inflation	0.008	1.080	0.381	0,889

Note: $A|\alpha_i|$ is the average absolute intercept value for a set of regressions. GRS is the F-statistic value of the GRS test. GRS p-value is the probability value for the GRS-F statistic. A(R^2adj.) is the average adjusted R^2.

In summary, this study firstly investigates the validity of S-CAPM and alternative Fama-French Factor Models, which were created using the return mudharabah instead of the risk-free rate as proposed by Faisol, Nidar, and

Herwany (2022), in the BIST Participation All Index. The intercept (α) values of all regression models are statistically equal to zero, and the S-CAPM RMDZ, the S-FF3F RMDZ, the S-FF5F RMDZ, and the S-FF6F RMDZ are valid in BIST Participation All Index. The empirical finding of S-CAPM RMDZ is consistent with Faisol, Nidar, and Herwany (2022). Secondly, this study explores the comparative performance evaluations of the S-CAPM RMDZ, the S-FF3F RMDZ, the S-FF5F RMDZ, and the S-FF6F RMDZ in the BIST Participation All Index. The results indicate that all models are successful in explaining variation in stock returns and the S-FF6F RMDZ explains better the variation in stock returns than the S-CAPM RMDZ, the S-FF3F RMDZ, and the S-FF5F RMDZ in the BIST Participation All Index. Next, in order to check the robustness of empirical findings of the S-CAPM and alternative Fama-French Factor Models with RMDZ, this study uses the S-CAPM and alternative Fama-French Factor Models, which were created using the inflation rate instead of the risk-free rate as proposed by Hanif (2011), in the BIST Participation All Index. The intercept (α) values of all regression models are statistically equal to zero, and the S-CAPM Inflation, the S-FF3F Inflation, the S-FF5F Inflation, the S-FF6F Inflation are valid in the BIST Participation All Index. The empirical finding of S-CAPM Inflation is consistent with Hanif (2011), Dar and Hanif (2012), Sadaf and Andleeb (2014), Effendi (2016), and Rehan, Chhapra, Mithani, and Patoli (2021). In addition, the empirical findings of the S-FF3F Inflation and the S-FF5F Inflation reinforce previous research conducted by Comlekci and Sondemir (2020) and Ozer, Oncu, Ozer, and Comlekci (2021). Then, the results show that all models are successful in explaining variation in stock returns and the S-FF6F Inflation explains better the variation in stock returns than the S-CAPM Inflation, the S-FF3F Inflation, the S-FF5F Inflation in the BIST Participation All Index.

5. Conclusion

The empirical results obtained from the analysis of the S-CAPM and alternative Fama-French Factor Models provide valuable insights into the performance and validity of these models in explaining stock returns in the BIST Participation All Index. Firstly, when using the risk-free rate derived from the return mudharabah, rather than the traditional risk-free rate, the estimation findings indicate statistically significant F-statistic values and the absence of autocorrelation across all models. This suggests that both the S-CAPM and alternative Fama-French Factor Models exhibit robustness and reliability in capturing the relationships between factors and stock returns. Furthermore, the regression intercepts (α) values being statistically equal to

zero and the absence of pricing errors in all regression models provide further evidence of the effectiveness of these models in explaining the variations in stock returns. The positive and statistically significant coefficients (β_1, β_2, β_3, β_4, β_5, β_6) demonstrate the importance of these factors in influencing stock returns within the BIST Participation All Index.

Comparing the performance of different models, the S-FF6F Inflation model emerges as the top-performing model, surpassing the S-CAPM Inflation, S-FF3F Inflation, and S-FF5F Inflation models. This finding highlights the significance of incorporating additional factors, such as size, value, profitability, investment, and momentum, in capturing the complexities of stock returns in the BIST Participation All Index.

Overall, these empirical findings provide support for the applicability and validity of the S-CAPM and alternative Fama-French Factor Models in the context of the BIST Participation All Index. The utilization of alternative risk-free rates and the inclusion of various factors enhance the models' ability to explain the variations in stock returns. These insights contribute to a deeper understanding of the dynamics of the BIST Participation All Index and have implications for investment decision-making and portfolio management strategies.

The results of the study provide important insights for practitioners and investors. Specifically, the study suggests that investors should consider using a multifactor model, such as the S-FF6F model, to explain the returns of the BIST Participation All Index. This is particularly relevant for investors who seek to build diversified portfolios that can effectively capture the risk-return tradeoff in the Turkish equity market.

This study provides several contributions. First, the investors might determine the relationship between expected return and risk using the S-CAPM and alternative Fama-French Factor Models. In particular, investors with Islamic sensitivities might earn more by investing in stocks as well as fixed-income investments, such as Sukuk and mutual funds. In addition, investors might maximize their benefits by including stocks in their portfolios and reduce their risks by diversifying. Investments in the stocks of companies that comply with Islamic rules might also enable companies to meet their financing needs through owner's equity as well as debt. Thus, investments might contribute to the development of companies and the country's economy. Second, it is thought that the results of this study would contribute to Islamic finance since the studies on shari'ah-compliant asset pricing models are very limited in the literature. Third, this study offers an alternative asset pricing model to the S-CAPM.

The findings of this study offer several significant contributions to the field of finance. Firstly, the S-CAPM and alternative Fama-French Factor Models provide valuable insights for investors seeking to understand the relationship between expected returns and risk. These models can assist investors, including those with Islamic sensitivities, in making informed investment decisions. By incorporating stocks, Sukuk, and mutual funds into their portfolios, investors with Islamic preferences may have the opportunity to earn higher returns while also diversifying their risk exposure. Furthermore, the inclusion of shari'ah-compliant investments, such as stocks of companies adhering to Islamic principles, can contribute to both individual and national economic development. Investing in such companies allows them to meet their financing needs through equity and debt, fostering growth and contributing to the overall economy. This study highlights the potential benefits of incorporating Islamic finance principles into investment strategies and provides evidence to support the notion that aligning investments with ethical and religious guidelines can be financially rewarding. Secondly, the scarcity of research on shari'ah-compliant asset pricing models in the existing literature underscores the importance of this study's findings. By exploring and evaluating the performance of these models, this research contributes to the advancement of Islamic finance. The results provide valuable insights for scholars, practitioners, and policymakers interested in understanding the dynamics of shari'ah-compliant asset pricing and its implications for investment decision-making in Islamic finance. Lastly, this study introduces an alternative asset pricing model to the S-CAPM, offering investors an additional framework to evaluate and assess the risk-return tradeoff in their investment decisions. The availability of alternative models enhances the toolkit available to investors and enables them to make more informed choices based on their specific investment preferences, risk appetite, and market conditions.

In conclusion, this study makes significant contributions to the field of finance, particularly in the context of Islamic finance. The findings highlight the importance of considering shari'ah-compliant investments, the potential benefits of diversification, and the availability of alternative asset pricing models. The results provide valuable guidance for investors, contribute to the development of Islamic finance literature, and offer new avenues for future research in the area of asset pricing in Islamic financial markets.

This study focused on a specific index or market. Future studies could consider expanding the sample to include other markets or indices to validate and generalize the findings across different contexts. This would enhance the external validity of the results and provide a more comprehensive understanding of asset pricing models in Islamic finance.

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