Vol. 10, No. 3, 2024, pp. 859-866
DOI: https://doi.org/10.29210/020243901

Contents lists available at Journal IICET

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) ISSN: 2477-8524 (Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jppi

Does inflation provide a more accurate expected return than sharia bonds?

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Article Info

Article history:

Received Jun 27th, 2024
Revised Aug 24th, 2024
Accepted Sept 30th, 2024

Keywords:

Mean average deviation linear regression
Market return
Inflation
Momentum

ABSTRACT

Expected return is an important factor for investors in determining their portfolio strategy. Islamic bonds (sukuk) and inflation are often used as indicators in determining the expected rate of return. However, there is a challenge in determining which instrument is more accurate in describing the expected return. This study aims to test the Carhart Four Factor model with Islamic bonds and inflation as a substitute for Rf. This study uses a quantitative research method using MAD and determines the effect of each research variable using linear regression. The quantitative method was chosen in this study because it is appropriate for measuring and analyzing the relationship between numerical variables objectively and systematically. The results show that sukuk is superior to inflation in terms of expected return accuracy. Although inflation provides accurate results in some portfolios, especially in 2018 and 2021, sukuk consistently shows better accuracy in other years. These findings have significant implications for Islamic finance theory, indicating that sukuk can be a more reliable investment instrument in return planning.

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Introduction

The potential of the Islamic market in Indonesia is huge and ready to be further developed, especially for the Indonesia Stock Exchange (IDX), which seeks to attract Islamic retail investors. Many Indonesian Muslims consider investing in the stock market haram due to the element of usury, involvement in businesses that are prohibited or forbidden according to Islam (such as liquor and tobacco companies), and the perception of stock investment as like gambling. The IDX, in collaboration with the Indonesian Ulema Council (MUI), aims to develop the sharia capital market by selecting sharia-compliant companies for the sharia index to attract devout Muslim investors to the IDX (Safira et al., 2021. The Indonesian Ulema Council (MUI) through various fatwas has stated that Shariah-compliant stock investments and activities on the stock exchange are valid and halal, provided that all transactions comply with Shariah rules.

The fatwa emphasises the importance of avoiding elements of usury, gharar (uncertainty), and business activities that are prohibited in Islam, such as investing in companies engaged in alcohol, tobacco, or gambling (Fajar & Maulidah, 2021). In addition, MUI encourages the use of Shariah indexes as a guide for investors to select stocks that comply with Shariah principles. Thus, MUI plays an important role in providing legitimacy and direction for Muslims to invest in the capital market, provided that Sharia principles are strictly followed,

so as to increase Muslim investors' participation in the stock market without compromising religious values calculation (Qodir & Kurniawan, 2023).

Someone who wants to use the Sharia investors system can use the Islamic asset valuation model (SCAPM), which is an Islamic adaptation of the Capital Asset Pricing Model (CAPM), to calculate the expected return of an Islamic stock or portfolio. The model considers variables such as inflation, zakat, and Islamic bonds as risk-free rates of return, or does not use risk-free rates of return at all in the SCAPM calculation (Hasanah & Maspupah, 2017; Husein & Hasanah, 2017; Quthbi, 2017; Widianingsih, 2019). Studies have compared the accuracy of SCAPM methods using Sharia bonds, zakat, and inflation as risk-free rate variables (Febrianto & Rachman, 2016; Subekti et al., 2022). The research by (Febrianto & Rachman, 2016) concluded that SCAPM with inflation and SCAPM with Sharia bonds yield similar results.

Previous research conducted by Carhart, (1997) found that the four-factor model he developed substantially improved average pricing errors compared to the CAPM and three-factor models. However, recent studies replicating sample calculations for the period 1963-1993 conducted by Carhart showed that significant performance persistence did not exist during the period of 1994-2018. Even during the 1963-1993 period, performance persistence weakened in subsequent years. The loss of significant performance persistence is attributed to lower returns on profitable styles, less profitable style slopes, and increased adjusted performance for winning funds in the past (Choi & Zhao, 2020). The research indicating that momentum has no significant effect on determining expected returns from formed portfolios has been found in Indonesia, even though the four-factor model performs better in explaining expected returns from formed portfolios (Gumanti et al., 2017). Similar results were found in research using the Casablanca Stock Exchange as the research object (Tazi et al., 2022).

Research in the Australian Stock Exchange found the same result, that all indices in the Australian Stock Exchange studied did not have significant WML factor loads, further confirming the lack of momentum in the Australian stock market (Costa et al., 2014). However, different findings were obtained in research in Pakistan, which found that portfolio returns are significantly explained by the market, size, book-to-market ratio, momentum, and SRI, while stock returns are not explained by momentum and SRI. This suggests that investors can choose socially responsible investments without sacrificing returns (Ibrahim et al., 2019). In contrast to previous research, the innovation in this study lies in the use of an analytical approach to assess the performance of both investment instruments during different inflationary periods, as well as considering variables that can affect returns. In addition, this study is the first to use the Carhart Four Factor Model adapted to Sharia principles. There has been no research that compares the accuracy between the Sharia model using inflation and sukuk as an appropriate alternative risk-free interest rate (Rf), and no research that examines the influence of each independent variable in the calculation of the Carhart Four Factor Model using the Structural Equation Modeling (SEM) model.

This research highlights the importance of understanding inflation dynamics in an investment context, particularly in increasingly diverse and complex markets. The purpose of this study is to analyse and compare the effect of inflation on the expected returns of Islamic bonds and conventional bonds, and to evaluate whether Islamic bonds can provide more stable and accurate returns in the face of inflation fluctuations. This study also aims to determine the accuracy of the Carhart Four Factor Model by considering inflation and Islamic bonds as a substitute for free risk. The Mean Average Deviation method will be used to calculate the accuracy of each model in the context of individual stocks and portfolios. In addition, this study will analyse the variables in the Carhart Four Factor Model to determine which variables have the most influence on the formation of expected returns on portfolios formed from JII-70 index member stocks, using inflation and Sharia bonds as substitutes for risk-free interest rates.

Method

The data sources for this research come from books on sharia investment, journals and other information relevant to the research. Stock data was obtained using the BEI website tool, monthly price data for the ISSI Index and monthly stock prices for the period 2018 - 2022 from Investing.com, JII-70 constituent data for the period 2018 - 2022 from doktersaham.com, monthly CPI data from BPS.co.id, Sharia Bond data (SBSN IFR0010) from KSEI.co.id, financial report data from Britama.com and Lembarsaham.com. The population in this study is all sharia stocks that are included as members of the JII-70 index for the 2018-2022 period. The research sample was obtained based on the purposive sampling method with the following criteria: 1) Sharia stocks that are consistently included as constituents of JII-70 after being reviewed twice a year during the 2018-2022 period. 2) Stocks listed in the DES based on the DSN decision in January 2017.

This study groups 28 sharia stock issuers into 10 portfolio groups, namely 6 portfolio groups based on market capitalization, and book to market ratio, and 4 portfolio groups based on market capitalization, and momentum. In this study, Mean Absolute Deviation (MAD) and linear regression are used to compare the accuracy of expected returns between inflation and sukuk. MAD is used to measure the level of prediction error of expected returns. In each year analyzed, MAD calculates the absolute difference between actual returns and expected returns (both from sukuk and inflation). A lower MAD value indicates that the model or instrument provides a more accurate return prediction. In this study, MAD is applied to each portfolio as well as to individual stocks to test the extent to which sukuk and inflation provide more accurate predictions.

Meanwhile, linear regression is used to determine the effect of inflation and sukuk on stock or portfolio returns. By entering sukuk and inflation factors as independent variables, linear regression analyzes the relationship between the two with the actual returns that occur in various portfolios or stocks. From the results of this regression, it can be identified which year shows a stronger relationship between returns and inflation or sukuk, as well as how much each variable contributes to total returns. The independent variables in this study are Actual Return, Excess Return, Risk-free Return, Inflation, Market Return, SMB, HML and Momentum. The following is a table of formulas for finding independent variables:

Table 1. Formula for Finding Independent Variables

Independent Variable	Formula
Actual return	$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$
Excess Return	$\text{Excess Return} = R_{i,t} - R_f$
Risk Free Rate	$R_f = \frac{C}{12}$
Return Market	$R_m = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}}$
Inflasi	$LI = \frac{IHK_t - IHK_{t-1}}{IHK_{t-1}}$
SMB	$SMB = \frac{(SL + SM + SH)}{3} - \frac{(BL + BM + BH)}{3}$
HML	$HML = \frac{(SH + BH)}{2} - \frac{(SL + BL)}{2}$
WML	$WML = \frac{(BW + SW)}{2} - \frac{(BL + SL)}{2}$

The dependent variable in this study is the stock's *Expected Return* based on the results of the *Carhart 4 Factor Model calculation.* The stock's Expected Return *results* will be searched for accuracy using *MAD*. *MAD* is carried out twice, namely *the MAD* of each stock during the observation period and *the MAD* of each portfolio during the observation period. The formula for calculating *expected return* and *MAD* is shown in the table below, as follows:

Table 2. Formula for Calculating Expected Return and MAD

Name	Formula
Carhart Four Factor Model	$E(R_i) = \alpha + \beta_m(R_m - R_f) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{WML}WML$
Carhart Four Factor Model	$E(R_i) = \alpha + \beta_m(R_m - I) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{WML}WML$
MAD	$MAD = \frac{\sum_{i=t}^{n}[A_t - F\,t]}{n}$

The Linear Regression *analysis method* is used to determine the level of influence of each variable used in the *Carhart Four Factor Model* calculation model. The *Linear Regression* method is performed on the entire portfolio every year. The applications used in this study were Microsoft Excel, and JASP.

Results and Discussions

Carhart Regression Results Four Factor Individual Stock Model Uses Inflation as a Substitute Variable for Rf

The results of regression analysis using the Carhart model for individual stocks in 2018 to 2021 show significant variation in the relationship between the independent variables and the dependent variable, expected stock returns. In 2018, the R value was 0.406, indicating that 40.6% of the variability in return expectations could be explained by the independent variables, but the low R^2 (16.5%) and negative Adjusted R^2 (-31.2%) indicated

that the model was not able to explain the variance well. The ANOVA table reveals a calculated F of 0.346, smaller than the tabulated F (4.12), indicating an insignificant effect of the independent variables on the dependent variable. Regression coefficient analysis shows that the momentum variable (WML) has a negative and significant effect on expected returns. Meanwhile, in 2019, the R value increased to 0.800 with an R^2 of 64.1%, indicating a significant increase in variance explanation, although there remains a small and insignificant influence of the independent variables. The year 2020 again showed a lower R (0.540) and R^2 (29.1%), with ISSI exerting a significant negative influence. The year 2021 recorded the lowest R value (0.367) with an R^2 of 13.5% and a significant positive influence of company size. Overall, the results show that there are fluctuations in the strength and significance of the influence of the independent variables on expected stock returns over the study period.

Fluctuations in the strength and significance of the influence of the independent variables on expected stock returns can be influenced by various factors, including economic conditions, changes in monetary policy, and market dynamics (Li et al., 2023). For example, in times of recession, economic uncertainty may reduce investor confidence, thereby changing the influence of independent variables such as company performance, dividends, and macroeconomic factors on expected stock returns. Conversely, in stable or rising economic conditions, the influence of these variables tends to be stronger and more significant as investors are more optimistic about growth prospects (Alawiyah & Setyaningsih, 2021). In addition, fluctuations can also occur due to changes in the life cycle of the industry or company. For example, a booming technology industry may show a stronger influence of independent variables such as product innovation and technology adoption, compared to a mature industry (Aldrin et al., 2021). In other words, as a company enters a growth phase, the variables that influence expected stock returns will undergo significant changes. This suggests that the relevance and significance of independent variables may vary depending on the life cycle phase and industry context (Hartati, 2021).

Finally, external factors such as market news, government regulations, and changes in investor sentiment can also cause fluctuations in the influence of the independent variables. When investors react to certain news or events, they may change their expectations of stock returns significantly (Maulida & Sari, 2023). For example, a favourable fiscal policy announcement may boost investor confidence and strengthen the relationship between the independent variable and stock return expectations. Thus, understanding these fluctuations is important for investors and analysts in making more informed investment decisions (Jalari & Anwar., 2023). Thus, the Carhart Model regression results for individual stocks by implementing inflation as a surrogate variable for risk-free return (Rf) show a significant relationship between the factors affecting stock returns. The model incorporates four main factors: excess market return, firm size, book-to-market value, and momentum. Using inflation in the analysis, the regression results show that inflation has an effect on expected returns, where the higher the inflation rate, the greater the risk investors face. This indicates that the inflation factor needs to be taken into account in the assessment of stock risks and returns, providing a more comprehensive understanding of stock market behaviour in a fluctuating economic context.

Carhart Four Factor Regression Results of Individual Stock Model Using Sukuk for the 2018 – 2022

The results of Carhart's four-factor regression analysis on individual stock models using sukuk for the period 2018 to 2022 show significant variations in the influence of the independent variable on the dependent variable in each year. In 2018, an R value of 0.410 reflected a moderate correlation of 41% between the independent and dependent variables, but the R^2 only explained 16.8% of the variance, with a negative Adjusted R^2 value of -30.8%, indicating that the model was ineffective. The ANOVA table strengthens this finding with a value of $F = 0.352$ and $p = 0.835$, indicating that the independent variables have no significant effect. From the coefficient analysis, only the momentum variable (WML) shows a significant negative influence on expected stock returns. In 2019, the model performance improved with $R = 0.826$, $R^2 = 68.2\%$, and Adjusted $R^2 = 50\%$, with ANOVA showing values of $F = 0.645$ and $p = 0.648$ which were also not significant. The ISSI variable (Indonesian Sharia Stock Index) shows a significant positive influence. In 2020, similar results were found with fixed R and R^2 values, but the ISSI variable remained the determining factor with a significant positive influence. The year 2021 shows a decrease in model performance with $R = 0.269$ and $R^2 = 7.2\%$, where the company size variable (SMB) has a significant negative influence, while momentum shows a small and insignificant influence.

Overall, the regression results show that the influence of independent variables on expected returns varies significantly from year to year, reflecting complex market dynamics as well as the challenges in applying effective regression models for prediction in the context of sukuk investment. The influence of independent variables on expected investment returns, particularly in the sukuk context, varies significantly from year to year due to complex market dynamics. Changes in economic conditions, such as interest rates, inflation, and macroeconomic stability, cause fluctuations in the performance of various assets, including sukuk (Rohmah et al., 2024). For example, when inflation increases, the value of bonds and sukuk can be negatively affected due to a decrease in purchasing power and an increase in interest rates which reduces the attractiveness of fixed

income based instruments. Apart from economic factors, government policy and central bank monetary policy also have a big influence on expected returns on sukuk (Nugrahini et al., 2024).

Constantly changing market dynamics challenge the accuracy of regression models used to predict sukuk returns. In some years, independent factors such as size, value, and momentum may have a stronger or weaker influence, depending on market sentiment and economic conditions. For example, in years of high volatility, market risk factors may be more dominant in influencing returns, while in stable market conditions, other variables such as size and value may be more influential. In addition, changes in investor preferences for sharia-based instruments or the issuance of new sukuk also add to variations in the influence of the independent variables (Momani., 2020). Effective application of regression models to predict expected returns in sukuk is challenging due to this uncertainty. Four-factor models such as Carhart's, which are commonly used in share-based assets, may not fully capture the unique nature of sukuk that are subject to sharia principles (Benali et al., 2023). In addition, external factors such as geopolitical uncertainty or commodity price fluctuations can complicate the dynamics of sukuk returns. Therefore, regression approaches need to consider additional elements specific to sukuk, as well as periodically update model assumptions to capture changes in the ongoing economic and market environment (Ghorbanidolatabadi & Ashl., 2021).

Thus, the regression results from the Carhart model involving four factors for the analysis of individual shares using sukuk during the 2018-2022 period show that the four factors of market excess return, company size, book value to market, and momentum contribute significantly to the returns generated by sukuk . In this analysis, market factors show a strong positive relationship, indicating that overall market movements influence the performance of sukuk. In addition, company size and book-to-market value ratio exert varying impacts, while momentum also shows a significant influence, illustrating that past performance trends are likely to continue in the future. These results indicate that even though sukuk are sharia instruments, fundamental and technical factors remain relevant in determining investment returns.

Results of Carhart Regression Four Factor Portfolio Model Using Inflation

The results of regression analysis using the Carhart Four Factor Portfolio Model from 2018 to 2021 show the development of the relationship between the independent variable and the dependent variable regarding expected returns. For 2018, the R, R^2, and Adjusted R^2 values are 0.441, 0.194, and -0.451 respectively, which indicates that the independent variable is only able to explain 19.4% of the variance of the dependent variable, with an insignificant effect based on the ANOVA results. shows calculated $F = 0.301$ and $p = 0.866$. In 2019, although there was a slight increase with $R = 0.477$ and $R^2 = 0.227$, the Adjusted R^2 value remained negative (-0.391), also reflecting an insignificant influence on the dependent variable. However, the momentum variable shows a significant positive influence. 2020 showed better results, with $R = 0.819$ and $R^2 = 0.670$, but even though there is a higher correlation, the influence of the independent variable on the dependent variable is still not significant. 2021 shows significant progress, with $R = 0.914$ and $R^2 = 0.835$, where the company size variable has a significant negative influence. In all these analyses, there is recognition that there are other independent variables that may be more influential but are not included in the model.

In the analysis using the four-factor Carhart Model regression, with inflation as a surrogate variable for the risk-free rate (Rf), the results show a significant difference in the effect of inflation on expected returns. Inflation, as a macroeconomic indicator, can affect investors' purchasing power and overall asset value, thereby strengthening its influence on returns (Azam & Naveed., 2022). In this model, inflation tends to provide a broader picture of systematic risk, especially in a volatile economic environment, as has often been the case in recent years. However, even though inflation has a real influence, the results are not always more accurate in predicting returns compared to sharia-based instruments such as sukuk bonds (Khan & Fahim., 2021). The effect of inflation on returns often varies depending on economic and market conditions. When inflation increases, investors' purchasing power decreases, which can cause a decline in asset values, including sukuk. However, Islamic bonds such as sukuk are usually better protected from inflation fluctuations because they are based on real assets and have more stable returns than conventional bonds. Additionally, sukuk tend to provide more consistent returns because they are tied to projects or physical assets that have long-term stability. This makes sukuk-based return predictions often more accurate in a stable economic environment, compared to inflation which can be influenced by many external factors (Robin & Svensson., 2023).

From a regression results perspective, inflation as a surrogate variable for Rf can help in understanding systematic risk in the broader market, but Islamic bonds such as sukuk, with their sharia-compliant nature, offer better protection against macroeconomic volatility. Using inflation may provide a clearer picture of macroeconomic risks, but sukuk, with their relatively stable returns, often provide returns that are more in line with Islamic investors' expectations. Because sukuk are not completely affected by direct inflation, results can be more consistent, especially in periods of high economic uncertainty (Carl & Elvin., 2023). Thus, the regression results of the four-factor Carhart portfolio model using inflation as a surrogate variable for the risk-

free rate of return (Rf) show how inflation affects the returns of a portfolio consisting of various assets. In this analysis, the Carhart model which includes market factors, company size (SMB), value (HML), and momentum (WML) succeeded in identifying portfolio sensitivity to inflation fluctuations. The regression results show that inflation has a significant impact on portfolio returns, where increasing inflation can reduce purchasing power and affect expected returns. Additionally, these findings highlight the importance of considering inflation risk in portfolio management, providing investors with insight into how inflation can interact with other risk factors to influence overall investment performance.

Results of the Carhart Four-Factor Regression Portfolio Model Using Sukuk for the Period 2018 – 2022

The results of Carhart's four-factor regression portfolio model using sukuk for the period 2018-2022 show variations in the influence of the independent variables on the dependent variable. In 2018, the model showed an R value of 0.818, indicating a strong correlation between the independent and dependent variables, although the Adjusted R2 value was only 0.403, indicating a limited explanation of the variance in the dependent variable. The low F value (2.520) and insignificant p value (0.169) indicate the small influence of the independent variables. Momentum (WML) was identified as having a significant influence on expected returns, with a coefficient of 13.463. In contrast, in 2019, although R = 0.445, the Adjusted R2 value was negative (-0.444) signalling that the model did not explain the variance well, with momentum remaining a significant albeit lower variable (1.715). The year 2020 shows a significant increase with R2 reaching 0.861 and F count 7.735, indicating a large and significant effect of the independent variables, with firm size having a significant negative effect. In 2021, although R reached 0.890, the influence of the variables remained insignificant (F count 4.77), indicating complexity in the influence of the variables. Overall, these results indicate that momentum is the variable that consistently exerts a significant influence on expected returns among the years analysed, while other variables show variations in influence and significance.

Momentum is a variable that consistently exerts a significant influence on expected returns in the various years analyzed, indicating that previous price trends have an important role in determining future returns. This shows that investors tend to follow ongoing market movements, causing asset prices, including sukuk, to continue to move in the direction of the previous trend (Kuo & Huang., 2022). The consistency of this momentum effect can be attributed to investors' psychological tendency to follow trends and anticipate positive returns from assets that have performed well in the past (Jaravel., 2021). While momentum provides a stable influence, other variables, such as size, value, and market risk, show fluctuations in their influence and significance on expected returns. For example, in some years, the size factor can have a significant influence when small companies with small sukuk issuance experience increased investor interest. However, in other periods, these variables may not be as influential due to different economic conditions or changes in investor preferences for large companies. This reflects that the influence of independent variables other than momentum is very dependent on the specific market conditions in a particular year (Gafurdjan, 2024).

Variations in the influence of these variables reflect the complexity of financial market dynamics, especially in sukuk investment. External factors such as inflation, monetary policy, or global market volatility can affect asset returns differently from year to year (Katmas & Indarningsih., 2022). However, momentum remains a relatively reliable factor in predicting returns because price trends tend to reflect market sentiment that continues over a certain period of time, both in the stock market and in sharia instruments such as sukuk (Bassar et al., 2021). Thus, the results of Carhart's four-factor regression portfolio model applied to sukuk over the period 2018-2022 show how risk factors such as market exposure, firm size (SMB), value (HML), and momentum (WML) affect sukuk returns. These regressions indicate that sukuk have different sensitivities to these factors compared to conventional stocks, reflecting the unique characteristics of Islamic instruments. In addition, the analysis also reveals the influence of inflation and interest rates on sukuk returns, which is important for investors in considering sukuk as an investment alternative. Thus, these regression results provide valuable insights for fund managers and investors in making more informed and strategic decisions regarding the use of sukuk in their portfolios.

Conclusions

The results show that sukuk is superior to inflation in terms of expected return accuracy. Although inflation provides accurate results in some portfolios, especially in 2018 and 2021, sukuk consistently shows better accuracy in other years. This finding has significant implications for Islamic finance theory, indicating that sukuk can be a more reliable investment instrument in return planning. In practice, this provides insight for Islamic investors to focus more attention on sukuk as a more stable alternative compared to inflation. However, the authors also acknowledge the limitations of this study, including methodological and data limitations that may affect the results. As a suggestion for future research, it is important to consider the use of broader methodologies and more comprehensive data to produce more robust findings. Furthermore, although this finding shows the

superiority of sukuk in the context studied, it should be noted that generalization to other contexts should be done with caution, considering local factors that may affect the results. Thus, the conclusion of this study not only highlights the importance of sukuk in a sharia investment portfolio, but also opens up opportunities for further research that can strengthen the understanding of the dynamics of sharia finance in a broader context.

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