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CAN ZAKAT AND PURIFICATION BE EMPLOYED IN PORTFOLIO MODELLING?

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ABSTRACT

The Capital Asset Pricing Model (CAPM), which has interest rates in its specification, can be deemed non-Shariah compliant. Therefore, the sukuk rate has been proposed to replace these rates in CAPM. This study analyses portfolio modelling by involving two essential elements in Islamic principles, namely zakat and purification. The concept of purification has been applied in the Shariah stock selection process in Indonesia, while at the same time, zakat has been widely socialised in stock investment. The study highlights two models that consider the concept of zakat reduction and the purification factors for portfolios in the Indonesian stock market. According to the robustness tests conducted, the proposed Shariah-compliant asset pricing model developed in this study is valid. Zakat reduction and purification factor integration in mathematical models can be applied in portfolio modelling.

Keywords: Zakat, Purification, Shariah-CAPM, Portfolio.
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I. INTRODUCTION

1.1. Background

The 1980s marked rapid progress and development of Islamic finance globally, while in Indonesia it began to thrive with the emergence of Islamic mutual funds in 1997 (Abdalloh, 2020). The Islamic capital market in various countries is run by adapting the conventional market to Islamic principles. With a Muslim majority population, the Indonesian Government has begun to realise the importance of providing assets under Islamic principles. Therefore, the Indonesian Ulema Council (DSN-MUI) synergises with the Financial Services Authority (OJK) in regulating activities in the Indonesian capital market. MUI has issued several fatwas to regulate investment products. The application of Shariah principles in the capital market follows the rules issued by the OJK based on the DSN-MUI fatwa. The JII 30 was issued one year after the establishment of the Dow Jones Islamic Market Index (DJIM) in 1999. Therefore, from 2000 Muslim investors in Indonesia have had numerous Islamic stock options from which to choose from the Jakarta Islamic Index (JII 30) (Subekti, Abdurakhman, & Rosadi, 2020).

The basic Islamic principles emphasised in the Shariah economy are unity, balance, freedom and responsibility (El Ashker & Wilson, 2006). In other words, Muslims are required to avoid several prohibitions in Islam, namely usury (interest rates), *gharar* (lack of information disclosure), *qimar* (gambling) and *maysir* (games of chance involving fraud). Based on these principles, many researchers and practitioners have developed Islamic economics and finance. Apart from these four prohibitions, Islam has one fundamental principle, which is the obligation to pay zakat. Zakat has been an essential topic addressed by many researchers, both in terms of its role and application. It is closely related to the attempt to cleanse property and the soul.

It is also known as purification or cleansing against income obtained from illicit activities. Zakat is explicitly referred to in the Holy Quran, particularly in At-Taubah: 103, Al-Baqarah: 267, An-Nur: 56 and Adz-Zaariyat: 19. In these verses, Allah asserts that zakat is useful for cleansing and purifying people to foster their peace of mind. Paying zakat is one of the ways to obtain mercy from Allah. In addition, the Quran also states that zakat represents the right for the poor to benefit from the common wealth; it is intended to help the poor and alleviate economic inequality. It also reflects the fairness of Islamic principles concerning fellow human beings. Wealth that has met the requirements of *nisab* and *haul* should be given to the poor. *Nisab* is the minimum amount that a Muslim must have before being obliged to give zakat, while *haul* refers to the possession of the asset for one year. The studies of zakat gained from investment profits can be developed into Shariah modelling. Stock investment can be considered as trading; therefore, the profit gained from an investment can be categorised into the type of zakat maal from trading (Pusat Kajian Strategis BAZNAS, 2019).

In fact, to be categorized into Shariah-compliant stock, the stock has to pass the screening stage to ensure that the underlying company's income is not derived from non-halal and dubious source of income.

Numerous studies have addressed the role of zakat in the community. However, there has been a lack of attention to real practice, especially in the Shariah-compliant stock market. On this basis, this study examines the application

of Islamic principles, especially the concepts of zakat and purification, in order to develop a portfolio model consisting of Shariah-compliant stocks. A modified Mean-Variance (MV) model with zakat and purification was proposed by Hazny, Hasim, & Yusof (2012). The adaptation of CAPM into Shariah principles by applying zakat and purification as a Shariah-Compliant Capital Asset Pricing Model (SCAPM) was proposed by Derbali, El Khaldi, & Jouini (2017) and Hazny et al. (2017). Then, that SCAPM has been applied and compared the result to the traditional CAPM in Bursa Malaysia. In contrast, the integration of CAPM with Shariah principles and its implementation in the Indonesian stock market has not included zakat reduction and purification (Subekti et al., 2020). This study therefore aims to make a contribution by investigating and implementing the proposed Shariah-compliant asset pricing model including zakat and purification to build a portfolio of Shariah-compliant stocks in Indonesia.

1.2. Objective

The research aims to investigate the CAPM adapted to Islamic principles. In particular, it examines the application of zakat and purification in portfolio modelling in the Indonesian stock market. Therefore, the study is expected to contribute to the empirical literature on portfolio modelling based on Shariah principles for Shariah-compliant stocks. In addition, the findings will support Islamic economic and financial development, especially in Indonesia.

The literature review in section 2 covers previous studies on the fundamental theories, such as zakat and purification, the mean-variance model and CAPM, Shariah investment in Indonesia. Section 3 presents the data, model development, and research method. Section 4 elaborates the results and analysis, while the paper closes in Section 5 with the conclusion and recommendations.

II. LITERATURE REVIEW

2.1. Background Theory

2.1.1. Zakat and Purification

Economic and Shariah finance is inseparable from several Arabic terms, including *riba* (a risk-free interest rate), *gharar* (uncertainty), *maysir* (gambling) and any activity that is prohibited in Islam. The other essential term is zakat, one of the five pillars of Islam. In principle, this aims to cleanse and purify human assets and souls. Hence, every Muslim must adhere to the obligation of zakat since it is applicable to everyone who is able. Islam requires two kinds of zakat, namely zakat *fitrah* and zakat *maal*. Zakat *fitrah* is paid in the last days of Ramadan, while zakat *maal* is applied to possessed wealth over a one year term. Investments are included in the category of wealth; zakat from stock investments and other assets falls into the zakat *maal* category. According to Qaradawi (1999), wealth refers to traditional and modern assets. Traditional ones include agricultural products, gold, jewellery, cash, and livestock. In contrast, modern assets include associated income, salaries, and securities. Shihatah & Ghuddah (2004) explain the rules for calculating zakat from the various forms of assets, including real estate investments, shares, bonds and investment deposits.

In the Shariah-compliant stock market area, the term 'purification' refers to the process of cleaning a company's income from non-halal income. The idea of purification in selecting Shariah stocks can differ between countries, with each using different associated terms and conditions (Hanafi, 2011). Based on the Shariah board in the Indonesian stock market, the DSN-MUI has issued the rules for selecting Shariah assets. One of the rules is that the company that underlies the stock is not allowed to have a ratio of the non-permissible income to revenue of more than 10% (Hanafi, 2011). Zakat and purification are treated as separate entities in developing the SCAPM, although zakat is a subset of purification. The purification factor of each asset can be defined as the ratio of halal income to total income (Hazny et al., 2012). In Indonesia, annual and quarterly information on financial statements from all companies is provided on the OJK website, which can be used as a reference to view the purification of individual asset returns.

2.1.2. Mean-Variance Optimization

MV and CAPM help managers to optimise their portfolio diversification (Lee, Cheng, & Chong, 2016). However, MV has some disadvantages, including the tendency to produce extremely diversified results. In addition, the MV model is also said to be sensitive because of the input parameters used. Various kinds of optimal robust portfolio methods have been developed (Supandi, Rosadi, & Abdurakhman, 2017; Yin, Perchet, & Soupé, 2021). However, the MV model is still used as a reference in the framework of development and modification for optimal portfolio modelling.

Investors can adjust their main goal by minimising portfolio risk or maximising portfolio return. The classical model of mean-variance is expressed as follows (Supandi et al., 2017):

$$max\ w^t\mu - \frac{\delta}{2}w^t\Sigma w \text{ subject to } e^t w = 1 \text{ and } w \geq 0. \quad (1)$$

The model can be expressed as a minimum-variance form. The goal function of a portfolio is to minimise the risk at a certain level of portfolio return.

$$min\ \frac{\delta}{2}w^t\Sigma w \text{ subject to } w^t\mu \geq R^*,\ e^t w = 1 \text{ and } w \geq 0. \quad (2)$$

Short-selling activity is also permitted by ignoring the constraint of $w \geq 0$ in the model. This indicates that the asset can generate negative weight, in other words, investors can borrow the shares from a broker and sell them theoretically (Deng, 2018). A profit is made if the asset price decreases in the following period. Investors can buy the cheaper asset and give it back to the owner.

In the MV model, μ and Σ are unknown, and thus the sample mean vector ($\hat{\mu}$) and covariance matrix ($\hat{\Sigma}$) are usually used as the estimators (Lai, Xing, & Chen, 2011). Many studies have investigated the use of both estimators obtained from historical data because both are considered suboptimal. Therefore, there are various approaches to obtain estimators μ and Σ. Investors believe that market and asset return are correlated. This notion describes the relationship in the capital asset price model with the expected return expressed as follows:

$$E(R_i) = R_f + \beta_i\big(E(R_m) - R_f\big) \tag{3}$$

where $E(R_i)$ is expected rate of asset return -I; R_f is a risk-free return issued by the Central Bank; β_i is beta from asset return; and $E(R_m)$ is the expected return of the market portfolio. The target return can be set as the investor's preference in MV optimisation.

Under the CAPM assumption, investment in risky assets is expected to outweigh the return in non-risky ones. The assumptions on CAPM are related to investors. First, they can buy or sell all their assets at competitive market prices (without transaction costs) or borrow and lend assets at a risk-free rate. Investors may then hold only efficient portfolios of traded assets which yield the maximum expected return for a given level of risk. Finally, investors have the same (homogeneous) expectations regarding the expected returns, risk and correlations of assets (Brandimarte, 2018).

The Shariah frameworks in the compliant asset and CAPM assumptions (Hazny et al., 2017) are summarised in Table 1. Generally, two assumptions require consideration in portfolio modelling if adjusted to Shariah-compliant stocks; that is, assumptions 5 and 6 in Table 1.

Table 1.
CAPM Assumptions and Shariah Principles

No.	CAPM	Shariah Principles
1.	No transaction fees (in order to reduce the complexity of the model)	Not contradictory
2.	No tax	Tax is unknown in Islam, but there is the provision of *zakat*
3.	Assets can be traded	Not contradictory
4.	The basic decision is mean and variance	Not contradictory because the assumption of every return have a risk associated with an investment
5.	Short-sales are allowed	Contrary to Islamic principles because it leads to speculation
6.	Borrowing or lending is unlimited at a risk-free rate	Contrary to Islamic principles; some also propose using the sukuk rate in place of risk-free return
7.	Homogeneity of expectations	Not contradictory
8.	No one investor affects the asset price	Not contradictory

The short-sales assumption in Table 1 can be overcome by providing additional constraints to ensure that each asset allocation is positive, $w_i \geq 0$. At the same time, various efforts to overcome risk-free interest rate components have been discussed in research related to Shariah principles in CAPM (Ashker, 1987; Hakim, Hamid, & Meera, 2016; Hanif, Iqbal, & Shah, 2016; Shaikh, 2009; Tomkins & Karim, 1987). In this study, the sukuk rate is assumed to be a safe asset in the Shariah principles widely believed by many Muslim investors and used to substitute a risk-free rate interest rate in CAPM. In line with the discussion about premium risk made by

Mehra and Prescott (1985), the substitution of the risk-free rate remains a puzzle. Many influential factors have led to different results in studies of the US market. The effort to use alternative substitutions for risk-free rates identical to Treasure bill remains an area of discussion amongst researchers.

2.1. Islamic Investment in Indonesia

Indonesia is a Muslim majority country. The Islamic religion is based on five pillars: witnessing that there is no God but One and that the Prophet Muhammad is His messenger; saying the prescribed prayers; paying the prescribed charity, zakat; fasting during the month of Ramadhan; and pilgrimage for whoever can afford it.

Zakat is one of the important elements in economic activities. It is divided into two types: zakat *fitrah* and zakat *maal*. In Indonesia, the provision of Zakat is formally regulated by the Indonesian Zakat Center (BAZNAZ) (Hudaefi, Saoqi, Farchatunnisa, & Junari, 2020).

Besides the five main principles, Islam also has principles related to worship and *muamalat* (dealings). Economic activity is related to *muamalat*, as written in the *fiqh muamalat*, which stipulates that all transaction activities are based on Islamic rules drawn from the Quran and the Sunnah (Widityani, Faturohman, Rahadi, & Yulianti, 2020). However, the economic activity of stock market trading did not exist in the early spread of Islam. The economic activity in the Islamic capital market is a duplication model of the current capital market concept by adding Islamic principles (Abdalloh, 2020).

The Shariah capital market has seen rapid growth since JII70 and Indonesian Shariah Stock Index (ISSI), which has certainly given good hope to the Shariah economy and finance. Therefore, investment in the Shariah-compliant stock market has also begun to increase. The historical development of the Shariah capital market in Indonesia can be divided into two stages: the beginning of the market in 1997, marked by Shariah mutual funds; and the inauguration of the ISSI in 2011 (Abdalloh, 2020).

Recently, there has been a significant growth in Shariah investment assets in Indonesia. According to an OJK report, there was an increase in the contribution of various sukuk, Shariah mutual funds, and market cap ISSI from 2015 to 2019 (Lestari, Ginanjar, & Warokka, 2021). Likewise, the number of Shariah investors in Indonesia in 2019 had increased almost three-fold from that of 2017, totalling 68,599. In addition, the occurrence of the global financial crisis in 2008 was an important moment, since the effectiveness of Shariah frameworks was applied to the economy and banking. Studies on the advantages of Islam in overcoming the economic crisis show that Islamic principles are highly likely to serve as a solution for developing a better economic and financial order (Dridi & Hasan, 2011; Luik & Fatoni, 2018).

2.2. Previous Studies

According to Hazny et al. (2012), the assumptions in the MV method are not very different from Shariah principles. In line with Islamic principles, the MV model

can be used to find optimal portfolios considered zakat and purification. Hazny et al. (2012) assumed in the modified MV that the return calculation considers each asset's reduction of zakat and purification. At the same time, the purification factor is also defined as the ratio of non-halal income to total income. The results show that the efficient frontier of sharia and conventional portfolio are sufficiently close. In other word, the reduction of zakat and purification has had almost no impact on the depiction of efficient frontier of both portfolios. In addition, the lower bound (minimum variance portfolio) and upper bound (efficient frontier of an Islamic portfolio) are both lower than conventional ones.

Several models of Shariah-compliant asset pricing have been applied for the Indonesian market. A developed CAPM with adjustments to Islamic principles is expected to serve as an alternative for Muslim investors. In principle, compliance overcomes the problem of using an interest rate in the model. One of the proposed models introduced zakat as the risk-free return component in CAPM (Ashker, 1987). Various substitutions for risk-free rates are inflation (Hanif, 2011; Hanif et al., 2016; Sadaf & Andleeb, 2014); National Gross Domestic Product (NGDP) (Shaikh, 2009); and sukuk return rates (Hakim et al., 2016). Various model of modified CAPM have been implemented in the Indonesian stock market (Subekti et al., 2020). The return rate of sukuk is considered more suitable for substituting SCAPM because sukuk is a safe and productive investment for Muslims. However, it is necessary to emphasize the obligation to pay zakat of sukuk profit as one of the Shariah investment products for Muslim investors. Since the concept of zakat reduction has not been integrated into the formulation of those various SCAPM.

Husein & Hasanah (2017) suggest using Bank Indonesia Certificates Shariah (SBIS) instead of inflation rates because of the CAPM standard assumption. The sukuk rate as a risk-free substitute can result in a higher expected return than four others SCAPM (Subekti et al., 2020). The SCAPM with zakat and purification developed by Derbali et al. (2017) and Hazny et al. (2017). However, the concept of reducing zakat and purification simultaneously in the Indonesian stock market remains understudied.

Therefore, on the basis of the data presented in Table 1, it is necessary to treat zakat as an obligation in the model, since Shariah requires the purification of the underlying asset from non-halal income. This paper proposes a model that integrates zakat and purification and is applied in the description of the model, including the concepts of zakat and purification rate.

III. DATA AND METHODOLOGY

3.1. Data

This empirical study focused on liquid Shariah-compliant stocks in Indonesia with reference to JII70 indices. The data were obtained from wwwk.yahoofinance.com and covered the period June 2009 to December 2021. The Covid-19 pandemic has globally affected all markets, including the stock markets in Indonesia. When many reported deaths were attributed to COVID-19 in the first quarter, the trend was decreasing drastically. This downward trend adversely affected almost all investments. Therefore, the data are split into two subperiods: first, from June 2009 to June 2019 (10 years), the period before the crisis; and second from June

2009 to December 2021, excluding data from January 2020 to May 2020 as the first quarter. The crisis period because of the sharp decline as an intervention due to the Covid-19 pandemic. The beginning of the second quarter of 2020 is assumed to be the period after the sharp decline, but this neglects the fact that the pandemic has been ongoing up to the time of writing. The selected assets were eleven stocks that were consistently listed on JII70 in both periods. All mean returns were around 1% for the stocks, namely ADRO, ASRI, CTRA, INCO, INDF, INTP, LSIP, SMRA, TLKM, UNTR, and WIKA. Statistics description, normality and stationary are presented in Table 2.

Table 2.
Summary of All Assets in a Portfolio

Stock	Company	Mean	Std. dev	JB test (P.val)	ADF (P.val)
ADRO	Adaro Energy Tbk.	0.00717	0.10988	0.05041	0.04332
ASRI	Alam Sutera Realty Tbk.	0.01286	0.11950	0.44578	0.01000
CTRA	Ciputra Development Tbk.	0.01873	0.12907	0.25124	0.01000
INCO	Vale Indonesia Tbk.	0.00958	0.14234	0.09985	0.01000
INDF	Indofood Sukses Makmur Tbk.	0.01445	0.07379	0.07003	0.01000
INTP	Indocement Tunggal Prakarsa Tbk.	0.01287	0.09271	0.42948	0.01000
LSIP	PP London Sumatra Indonesia Tbk.	0.00906	0.12057	0.09317	0.01000
SMRA	Summarecon Agung Tbk.	0.02171	0.12829	0.78275	0.01000
TLKM	Telekomunikasi Indonesia (Persero) Tbk.	0.00954	0.05984	0.09086	0.01000
UNTR	United Tractors Tbk.	0.00970	0.08310	0.13535	0.01000
WIKA	Wijaya Karya (Persero) Tbk.	0.02191	0.12144	0.31326	0.01000

Table 2 provides information about monthly returns. First, the expected return range was 0.7% to 2.1%, and the risk was around 5.9% to 14%. The data show a fairly higher volatility of assets in the portfolio than the expected return. Second, the Jarque Bera results for the normality test show that all assets were normally distributed at 5%. Finally, the ADF test result are shown in column 6. The null hypothesis with a unit root test was rejected at α=5%, and all the return series were indicated as stationary.

3.2. Model Development

The study assumes that a portfolio containing Shariah-compliant stocks has met Islamic principles, such as the selection of assets, which are derived from the underlying halal company's activities and income. However, this is often neglected by many large-scale companies, which seek various ways to invest their funds, including investments based on interest and other financial activities related to *riba.* Therefore, it is necessary to consider the purification concept in selecting Shariah-compliant assets. For long-term investment, a portfolio is considered in terms of one year of possession (*haul*) and based on the *nishab* requirement. Therefore, this paper assumes that investors need to consider paying zakat as part of their investment.

The study highlights several models that refer to the concept of zakat reduction and purification factors by presenting the empirical results of two development models related to Shariah principles in asset allocation. The first model is MV with zakat and purification adjustments, with the assumption that there should be no short-selling (Hazny et al., 2012). The second model is a new concept, proposed as SCAPM with zakat and purification factors (Derbali et al., 2017; Hazny et al., 2017).

Model 1. Modified MV-ZP (Hazny et al., 2012)

$$max\ w^t\mu * -\frac{\delta}{2}w^t\Sigma * w \text{ subject to } e^t w = 1 \text{ and } w \geq 0. \tag{4}$$

where $\mu^*=(1-z)(1-\delta_i)\ E(R_i)$ dan $\Sigma^*=(1-z)^2\ (1-\delta_i)(1-\delta_j)\ \sigma_{ij}$

The new formula for expected portfolio return with Shariah-compliant stocks is defined as:

$$E(R_{ps}) = \sum_{i=1}^{n} w_i(1-z)(1-\delta_i)\ E(R_i) \tag{5}$$

where z = Zakat rate; and δ_i = purification of asset-i. The variance of portfolio return is then defined as:

$$\begin{aligned} &Var(R_{ps}) \\ &= \sum_{i=1}^{n} w_i^2(1-z)^2(1-\delta_i)^2\sigma_i^2 \\ &+ \sum_{i=1}^{n}\sum_{j\neq i}^{n} w_i w_j(1-z)^2(1-\delta_i)(1-\delta_j)\sigma_{ij} \end{aligned} \tag{6}$$

Model 2. MV under SCAPM-ZP

A Shariah version of CAPM shows the relationship between expected return and beta by considering zakat and the purification factor. The detailed explanation of this new SCAPM is derived from Derbali et al. (2017) and Hazny et al. (2017).

$$E(R_i) = \frac{R_s}{1-\delta_i} + \beta_i\left[\left(E(R_M) - \frac{R_s}{1-\delta_M}\right)\right] \tag{7}$$

The calculation of the purification factor of each asset can be made from the ratio of non halal to total revenue, while it is difficult to determine market purification (δ_M)Eq. 7. By assuming the capital market line and a modified Sharpe ratio of market portfolio to zakat and purification, market purification is defined in the following formula (Derbali et al., 2017; Hazny et al., 2017):

$$\delta_M = 1 - \frac{\theta\sigma_M + (1-z)R_s}{(1-z)E(R_M)} \tag{8}$$

By adapting the characteristic line of CAPM as a regression model, the new SCAPM that considers zakat and purification can be expressed as follows:

$$R_{i,t}^{*} = \beta_i \left[\left(E(R_M) - \frac{R_s}{1 - \delta_M} \right) \right] + \varepsilon \quad (9)$$

On this basis, we can rewrite the MV model under the SCAPM version with additional constraints $\sum_{i=1}^{n} w_i = 1$ and $w_i \geq 0$.

3.3. Method

To implement model 1, the mean and variance are adjusted with zakat and purification. The purification of each asset is defined as the ratio of non-halal income to total income. According to DSN MUI, the upper limit for the ratio of non-halal to total income is less than 10%. The annual financial reports of each company can be accessed at https://www.idx.co.id.

It is also demonstrated by model 2 that sukuk is a safe asset for investors based on the halal guarantee by DSN-MUI. Therefore, the sukuk rate is used to substitute a risk-free rate. Based on contract types, there are four types of sukuk in Indonesia, namely *Sukuk Ijarah*, *Sukuk Mudharobah*, *Sukuk Musyarakah* and *Sukuk Istishna*. Based on types of government sukuk, there are *Sukuk Tabungan* (ST) and *Sukuk Ritail* (SR). Retail sukuk is managed based on Shariah principles. A reward is gained from the profit of the investment activities. The sukuk rate significantly increased year on year between 2014 and 2019. In terms of the perspective of liquidity risk, sukuk is mostly liquid during the period after issuance, but it can have lower liquidity if it has a lower rank. Credit rating of sukuk has downgraded or it has been sold by an infrequent issuer (Krichene, 2013).

To describe the impact of zakat and purification on portfolio modelling containing Shariah-compliant stocks, portfolio performance is demonstrated through the Sharpe ratio from MV-ZP and MV under SCAPM-ZP. A robustness test was also conducted for SCAPM-ZP.

IV. RESULTS AND ANALYSIS

4.1. Empirical Results

The summary of the expected returns of MV-ZP and SCAPM-ZP and the portfolio risk are presented for two subperiods (June 2009 to June 2019 and June 2009 to December 2021).

4.1.1. MV and MV-ZP

Table 3 shows the results of mean and variance adjusted to the assumption of a reduction in zakat and purification. The reduction also causes the calculation of the covariance matrix to change.

Table 3.
Expected Return and Risk of MV and MV-ZP

		ADRO	ASRI	CTRA	INCO	INDF	INTP	LSIP	SMRA	TLKM	UNTR	WIKA
Period 1												
MV	E(r)	0.0071	0.0129	0.0187	0.0096	0.0145	0.0129	0.0091	0.0217	0.0095	0.0071	0.0129
	var	0.1098	0.1195	0.1291	0.1423	0.0738	0.0927	0.1206	0.1283	0.0598	0.1098	0.1195
MVZP	E(r)	0.0069	0.0124	0.0124	0.0092	0.0139	0.0122	0.0086	0.0211	0.0092	0.0093	0.0213
	Var	0.0113	0.0133	0.0148	0.0190	0.0050	0.0077	0.0133	0.0155	0.0034	0.0064	0.0140
Period 2												
MV	E(r)	0.0125	0.0159	0.0208	0.0127	0.0135	0.0117	0.0125	0.0238	0.0104	0.0118	0.0205
	Var	0.0132	0.0167	0.0165	0.0043	0.0019	0.0092	0.0142	0.0162	0.0039	0.0078	0.0154
MVZP	E(r)	0.0121	0.0153	0.0197	0.0123	0.0131	0.0111	0.0120	0.0231	0.0101	0.0114	0.0200
	Var	0.0123	0.0156	0.0146	1.8199	0.0049	0.0083	0.0130	0.0153	0.0036	0.0073	0.0147

4.1.2. CAPM and SCAPM-ZP

Table 4 shows the estimated beta and return CAPM for data before and after the pandemic crisis. Similar SCAPM-ZP results is obtained for both periods.

Table 4.
Alpha and Beta of CAPM and SCAPM -ZP

Stock	Period 1				Period 2			
	CAPM		SCAPM-ZP		CAPM		SCAPM-ZP	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
ADRO	-0.0022	0.9199	-0.0029	0.9154	0.0017	0.9162	0.0016	0.9111
	(0.811)	(0.000)	(0.756)	(0.000)	(0.848)	(0.000)	(0.864)	(0.000)
ASRI	-0.0045	1.6964	-0.0002	1.7052	-0.0011	1.9241	-0.0002	1.9285
	(0.612)	(0.000)	(0.980)	(0.000)	(0.895)	(0.000)	(0.983)	(0.000)
CTRA	0.0003	1.7899	0.0051	1.8011	0.0042	1.8633	0.0049	1.8731
	(0.971)	(0.000)	(0.591)	(0.000)	(0.631)	(0.000)	(0.573)	(0.000)
INCO	-0.0022	1.1484	-0.0014	1.1573	0.0000	1.2412	0.0001	1.2450
	(0.858)	(0.000)	(0.908)	(0.000)	(0.999)	(0.000)	(0.989)	(0.000)
INDF	0.0033	1.0844	0.0038	1.0796	0.0025	0.9690	0.0023	0.9668
	(0.542)	(0.000)	(0.479)	(0.000)	(0.631)	(0.000)	(0.651)	(0.000)
INTP	0.0007	1.1810	0.0017	1.1763	-0.0008	1.1965	-0.0008	1.1943
	(0.918)	(0.000)	(0.812)	(0.000)	(0.913)	(0.000)	(0.913)	(0.000)
LSIP	0.0020	0.6866	-0.0002	0.6810	0.0022	0.8552	0.0018	0.8508
	(0.852)	(0.008)	(0.987)	(0.009)	(0.822)	(0.008)	(0.849)	(0.009)
SMRA	-0.0009	2.2080	0.0068	2.2112	0.0052	2.1627	0.0065	2.1680
	(0.910)	(0.000)	(0.412)	(0.000)	(0.502)	(0.000)	(0.401)	(0.000)
TLKM	0.0035	0.5827	0.0008	0.5811	0.0012	0.6720	0.0007	0.6717
	(0.482)	(0.000)	(0.877)	(0.000)	(0.797)	(0.000)	(0.881)	(0.000)
UNTR	-0.0007	1.0159	-0.0007	1.0112	0.0013	0.5459	0.0006	0.5456
	(0.913)	(0.000)	(0.910)	(0.000)	(0.818)	(0.000)	(0.912)	(0.000)
WIKA	0.0051	1.6303	0.0091	1.6445	0.0047	1.7273	0.0005	1.7354
	(0.581)	(0.000)	(0.317)	(0.000)	(0.586)	(0.000)	(0.525)	(0.000)

Source: Author's calculation (p-values in parantheses)

The fact that the hypothesis test for alpha is analogous to CAPM indicates the validity of the SCAPM-ZP model. Table 5 shows the calculation of the expected return of each model, with that of SCAPM-ZP is slightly below that of CAPM.

Table 5.
Expected Return of CAPM and SCAPM-ZP

		ADRO	ASRI	CTRA	INCO	INDF	INTP	LSIP	SMRA	TLKM	UNTR	WIKA
Period 1												
CAPM	E(r)	0.005	0.008	0.009	0.006	0.005	0.006	0.003	0.011	0.003	0.005	0.008
SCAPM	E(r)	0.003	0.006	0.007	0.004	0.004	0.004	0.003	0.008	0.002	0.004	0.006
Period 2												
CAPM	E(r)	0.005	0.012	0.011	0.007	0.006	0.007	0.005	0.013	0.004	0.003	0.010
SCAPM	E(r)	0.004	0.009	0.009	0.006	0.004	0.006	0.004	0.010	0.003	0.002	0.008

4.2. Robustness Test

The attempt to modify CAPM through the process of consideration of zakat and purification and the prohibition of short-sales and usury are included in SCAPM-ZP. Therefore, an additional robustness test was conducted for SCAPM-ZP. According to Hazny et al. (2017), Fama-MacBeth regression can be used to investigate the validity of the CAPM model. The second-pass regression results are presented in Table 6. T-statistics were used to test if the coefficients were significantly different to zero.

Table 6.
Second-Pass Regression

	Coefficient	Std. error	t-statistic	p-value
λ_0	-0.00025	0.000448	-0.54740	0.59015
λ_1	0.00432	0.000327	13.25343	2.3E-11

According to Table 6, the intercept has a p-value of 0.59015, so it can be concluded that it is not statistically different from zero. The CAPM hypothesis states that the intercept should be statistically negligible. The p-value of the t-statistic for λ_1 is very small, suggesting that the coefficient is significantly different to zero. Therefore, this result shows that the modified CAPM involving zakat and purification as SCAPM-ZP is valid. This is in line with Hazny et al. (2017), who show the SCAPM is valid when tested using data from Bursa Malaysia across the sample period.

4.3. Analysis

Based on Tables 3 and 5, the proportion of each asset was then calculated to determine the portfolio return and risk. Portfolio performance is represented by the ratio of the expected return to its portfolio risk; the performance is shown in Table 7. The results reveal that the application of zakat and purification incorporated with portfolio optimisation can achieve a higher performance than the conventional portfolio.

Table 7.
The Comparison of Portfolio Performance

	MV	MV-ZP	MV-CAPM	MV-SCAPM
SR- 1	5.862	6.086	4.286	4.434
SR- 2	5.064	5.262	4.282	4.437

The performance index of the Sharpe ratio for all portfolios in different periods is shown in Table 7. The Sharpe ratio of Shariah version is higher than the classical method for mean-variance model and CAPM. The result shows that the reduction of zakat and purification can be applied in the mathematical modelling. Therefore, the Shariah model for portfolio modelling can consider zakat and purification at the same time.

V. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

This study has demonstrated the application of two Shariah versions in portfolio modelling. It has presented the portfolio performance of the MV method with the modification of zakat, purification and SCAPM. A set of Shariah-compliant stocks defines a Shariah portfolio. Muslim investors clearly need to consider the application of Shariah principles in the overall investment process. First, Investors have been facilitated by DSN-MUI to choose assets through the Islamic market. The assets can be picked up from ISSI. The study applied two models on Shariah-compliant stock from JII70, as a liquid Shariah stocks. Second, Muslim investors need to follow the important rule of no short-selling activity for the proportion of assets in their portfolio. This means that the weight must be positive. Third, the importance of zakat in investment will encourage Muslim investors to use the modelling that considers the zakat component as a way of reminding them of the obligation to pay zakat from investment profits.

Integrating zakat and purification in a mathematical model to comply with the conventional CAPM can be considered as a new perspective in the Islamic CAPM. Both Shariah versions in asset allocation before the pandemic crisis show higher results than the second period based on expected return and its Sharpe ratio. These findings are in line with the mathematical models proposed by Hazny et al. (2017) and Derbali et al. (2017) for the development of a Shariah SCAPM, and thus it can be considered as an alternative model. However, Muslim investors can freely decide which model to use in their investments.

5.2. Recommendations

A limitation of this study is that the SCAPM-ZP is merely considered as an adaptation of static CAPM that only contains one factor. On this basis, the model could be developed into multi-factors. Since implementation with real data often encounters non-normal data case problems such as arbitrage pricing theory (APT) in future research.

Furthermore, this study could be developed further with additional tests to check the robustness of the model. Further research could also develop the discussion on the option for sukuk. This study contributes to the literature and studies of Islamic finance, especially with regard to stock portfolios related to the obligation of zakat and prudence in calculating profit.

The findings suggest that involving Shariah principles such as zakat and purification could be considered for Muslim investors. Higher portfolio performance could attract more participants in Islamic finance and investment.

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