Modified capital asset pricing model (CAPM) into sharia framework

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Abstract. This study is to expose the sharia concept in the Islamic market, especially on the practice of the equilibrium model or the Capital Asset Pricing Model (CAPM). Islamic index and sharia market are introduced to answer the Islamic investment. However, we cannot apart from the interest rate, which is related to ‘riba’ and prohibited in Islam religion. Many references proposed the Islamic theory into the CAPM, so the model has been modified and adjusted to deliver the new solution on sharia investment. We provide a general illustration to explain how the sharia concept in CAPM as an equilibrium model and its implementation in Jakarta Islamic Index (JII). The result shows that the range of return is various, while the risk both beta and standard deviation have remained steady. The result shows that the Sharia version with the Sukuk rate performs better than the others from the expected return.

1. Introduction

The Capital Asset Pricing Model (CAPM) emerged from several developments and authors. As a prediction tool for estimating return assets, CAPM started with the concept of two separation funds. One investment is lying on the free risk asset, and the other one is taking the risky asset. CAPM requires the market information and the interest rate in the formula.

The formula of CAPM is built from the two main reasons that are the assumption of efficiency in the market portfolio and the beta as a risk premium on a risky asset. The CAPM used the relationship between a return and a risk. According to [1] we can express the famous formula of CAPM as

\[ E(r_i) = r_f + b_i(E(r_M) - r_f) \]

where \( E(r_i) \) is \( r_f \) is a risk-free rate, \( b_i \) is an estimated beta, and \( E(r_M) \) is an expected market return.

Even though the CAPM is popular as a fundamental in the equilibrium model, it has many lack in practicing because of the assumption and the limitation as a single factor model. For that reason, many authors try to develop and adjust the CAPM with the real condition. The existence of interest rate indicated in the borrowing and lending funds with its risk. Indeed, during the instability situation, it will lead to the collapse or increasing the risk. This phenomenon delivers to the sharia concept as the solution to handle the problem in the financial system.

In line with the development of Islamic investment, which is becoming a trend nowadays, most people are starting to turn to the sharia system. Many research proposed how Islamic finance is more reliable than conventional. This perspective could be affected by the proof of thinking that Islamic banking gained a positive result in three aspects, such as profitability, efficiency, and liquidity [2].
Indeed, the research [3] reports that even in the crisis condition, Islamic banking is more survive than conventional banking. Moreover, Islamic Banking (IB) was more favorable than the conventional bank (CB) based on the result of research [4] during 2007-2010.

One of the significant reasons is in Islam religion, any transaction involving riba is prohibited. Thus, the big question is how the investment can be stated as a sharia path, particularly in the financial sector. While in Indonesia, the sharia investment was introduced firstly in 1997, which comes from reksa dana shariah. Then in 2000, the Jakarta Islamic Index (JII) emerged to facilitate the investors who want to invest funds in sharia. In practicing sharia investment, there are similarities between the sharia market and the conventional one. The difference is that the effect and mechanism of trading do not violate the sharia principle.

Hence, the benefit that we obtain in the use of sharia concepts in investment will lead people to consider and aware of the Islamic system. It is not only a positive effect on the banking system, but the question of the Islamic system is also addressed in the financial market. How to apply this particular system in the stock market, and can we achieve the investment goal through sharia investment.

Because of the vast concept in this Islamic investment topic, such as Islamic banking, concept on trading, or financial market and behavior so this study is only limited to the CAPM as an asset pricing model in the stock market. We will discuss how to synchronize the modeling of a CAPM, which is still compliant with sharia investment in the equilibrium perspective. Then we will apply the concept into real data.

The Jakarta Islamic Index (JII) is the first sharia stocks index introduced on July 3th, 2000, which involved 30 most liquid stocks from the Indonesian market. The review is regularly done twice a year. Then, this index is followed by Indeks Saham Syariah Indonesia (ISSI) emerged in 2011 and continued with JII 70 in 2018. Those indices are a representative from all the stock collection which are categorized can be chosen for sharia investment.

2. Sharia concept on equilibrium model

The concept of interest rate in Islamic finance can be investigated from many references; following many articles that propose the sharia concept for determining the substitute of the interest rate in the CAPM, we order those models in this study. The first model in the sharia concept is by simplifying the deletion of the risk-free rate, which is proposed by Tomkins and Karim [5]. This proposed model is the simplest sharia version rather than the following sharia CAPM. Because the beyond of the construction of the Tomkins model ignored the concept of an interest rate and it only depended on the market risk so the model can be rewritten as:

\[ E(r_f) = b_iE(r_M) \]  

(2)

The following sharia model for CAPM was proposed by El-Ashker, who replace the interest rate with zakat in Islamic finance [5]. It is difficult to understand the reason for the zakat component could be the replacement item. However, the zakat is an important reason that could be considered for every Muslim, including all the investor who has a profit from their activity. This argument is then called a valuable reason for Islamic investors will be interested in investment [6]. From the rule of zakat as 2.5%, we can calculate that the expected return as a minimum rate for the investor is 2.56%.

\[ R_Z = 2.5\% \]

\[ r_z = \frac{R_Z}{1 - R_Z} = \frac{2.5\%}{1 - 2.5\%} = 2.56\% \]

The modified CAPM into sharia perspective based on El Ashker can be expressed as:

\[ E(r_I) = 0.0256 + b_i(E(r_M) - 0.0256) \]  

(3)

Another concept in adjusting CAPM with replacing the free-risk rate was proposed by Hanif [5] that used the inflation index. The inflation describes the risky situation in one country. Hence it is a risk that will be considered by the investor. Moreover, this perspective is supported by the theory of the existence of a positive relationship between inflation and nominal interest rate, which is reported by Asghapur [7]. Instead of deleting the free risk, then the model allows the inflation index as a substituted component. In other words, when the expected return of CAPM is higher than the interest rate means the investment return that can tackle the inflation rate.
\[ E(r_i) = r_{\text{Inflation}} + b_i(E(r_M) - r_{\text{Inflation}}) \]

The inflation proxy as a representative for interest rate can be referred to as Consumer Price Index (CPI), wholesale price index (WPI), or basket of selected commodities or selected currency [5]. The application of sharia concept with inflation, such as Hanif [5], selected CPI as the preferred inflation index. The result was that the Sharia Compliant Asset Pricing Model (SCAPM) is slightly better than CAPM.

Based on [8], the alternative for substituting a risk-free rate is the rate of Nominal Gross Domestic Product (NGDP), which represented the average growth in the value of consumption in society. If consumption rises, GDP will rise. More precisely, if consumption falls, then, GDP also falls. In the financial concept, if a company generates sales in the financial reporting period, GDP is the gross sales generated by the country’s population. The formula for modified CAPM is

\[ E(r_i) = r_{\text{NGDP}} + b_i(E(r_M) - r_{\text{NGDP}}) \]

Another perspective in replacement of risk-free rate in Islamic finance is beyond the reason that CAPM is built with US Treasuries as a proxy. Hence, Sukuk from Islamic Developing Bank (IsDB) could be a new proxy in sharia investment even there is no risk-free rate in reality. The study of the use of Sukuk in replacement of risk-free rate from [9] while as a sharia investment, this is also reported by Mustofa [10].

The next question is, what the difference of the Sukuk rate with the interest rate. According to [9], the structure of Sukuk is design to avoid a specific religious prohibition, called riba. In the traditional structure of a bond, the meaning of a loan is the issuer pays the interest to the bondholder. Sukuk could be the investment on several various types of assets, especially in the investment that apart from a forbidden component of ribā and in non-halal business.

\[ E(r_i) = r_{\text{Sukuk}} + b_i(E(r_M) - r_{\text{Sukuk}}) \]

We provide a summary explanation in the following table to give a summary of the modified CAPM into the sharia framework.

| CAPM | SCAPM |
|------|-------|
| \( E(r_i) = r_f + b_i(E(r_M) - r_f) \) | SCAPM -1: Deleting \( r_f \) so model CAPM is called a zero risk-free rate. \( E(r_i) = b_iE(r_M) \) |
| \( r_f \): risk-free rate | SCAPM -2 \( r_f \) is replaced by zakat component, based on El Ashker (1987) from Hanif [5] \( E(r_i) = r_{\text{Zakat}} + b_i(E(r_M) - r_{\text{Zakat}}) \) where \( r_{\text{Zakat}} = 2.56\% \) |
| \( r_M \): market return | SCAPM -3 \( r_f \) is replaced by inflation index proposed by Hanif [5] \( E(r_i) = r_{\text{Inflation}} + b_i(E(r_M) - r_{\text{Inflation}}) \) |
| \( r_i \): asset return -i | SCAPM -4: \( r_f \) can be replaced by the Nominal Gross Domestic Product (NGDP) growth rate [8] \( E(r_i) = r_{\text{NGDP}} + b_i(E(r_M) - r_{\text{NGDP}}) \) |
| | SCAPM -5: \( r_f \) can be replaced by the Sukuk rate [9] \( E(r_i) = r_{\text{Sukuk}} + b_i(E(r_M) - r_{\text{Sukuk}}) \) |
To sum up, the options for solving the riba problem as an interest rate from CAPM in the sharia environment are deleting or replacing it with another term. There are four types of risk-free replacement rates, namely (1) Zakat factor, (2) The inflation factor (3) NGDP, and (4) Sukuk rate.

3. Implementation

In order to find the component that eligible in SCAPM as the modified CAPM in the Islamic financial system, we investigate five types of SCAPM in the study case for the Indonesian market. We only discuss the empirical research to focus on applying and modifying an interest rate, \( r_f \), in the CAPM.

In Indonesia, we have Indeks Harga Saham Gabungan (IHSG), and it is denoted by JKSE as a proxy index to represent the market stock. Also, many proxies to represent a part of a smaller group such as KOMPAS100, Pefindo, LQ45, and JII, which can be used by investor preferences. There are twenty-four indexes in the Indonesian market, and those proxy indexes are a benchmark to represent the performance of individual assets against a trend as generally in the marketplace.

In this study, we prefer to use JII 70 assets as an index that describes the sharia investment. The data collected are the close price from January 2014 until September 2019. We select only 48 assets that remain stable in JII 70 and due to limited data availability. To apply the CAPM and SCAPM, we need to consider the information such as a risk-free rate, the inflation rate, zakat component, GDP rate, and Sukuk rate. The riskless rate monthly from BI rate, the inflation rate is around 3.28%, data GDP Indonesia is 5.067%, and Sukuk Sharia SR011 with a yield at 8.05% p.a. which is issued on 28 March 2019.

For the initial equilibrium with CAPM standard, we use IHSG with the symbol ^JKSE as a proxy for the market return. The result of the top ten assets with high beta shown in the Table. 2. We also compare for the use of JII proxy as a shariah market with the symbol ^JKII in constructing the CAPM standard. Then we graph the expected return with each beta in Fig. 2 for all assets.

**Table 2.** The top ten beta from CAPM with IHSG and JII as a market return.

| Asset | Beta (CAPM-JKSE) | Asset | Beta (CAPM-JKII) |
|-------|------------------|-------|------------------|
| INDY  | 2.664            | JPFA  | 2.415            |
| JPFA  | 2.439            | INDY  | 2.256            |
| CTRA  | 2.095            | SMRA  | 1.896            |
| SMRA  | 2.079            | CTRA  | 1.819            |
| ERAA  | 2.045            | BRPT  | 1.773            |
| ADHI  | 1.998            | ADHI  | 1.588            |
| ASRI  | 1.865            | ASRI  | 1.581            |
| BRPT  | 1.753            | HRUM  | 1.577            |
| PTBA  | 1.732            | ERAA  | 1.555            |
| WIKA  | 1.721            | PTBA  | 1.481            |

Table 2 presents the collection of the top ten assets, which has higher beta based on the market JKSE and sharia market JKII. Even though the order of assets and the selected assets is not similar, there is no significant difference in the estimated beta between each asset in the two markets.
4. Result and Discussion

For simplifying, we did not provide all calculations from five version SCAPM in Table 1 with 48 stocks from JII, but we present the result with visualization using the R program. The following graphs are the result of all shariah models with JII proxy as a market return to ensure that the proxy used is from the sharia investment. It is supported by the range of the CAPM risk with JII is lower than IHSG while both have the same range of expected return based on Figure 2. However, the expected market return JII is lower than IHSG because JII is a subset of IHSG.

The graphs of all versions of SCAPM for 48 assets from JII 70 in Indonesia are performed in the following graphs, with the risk is measured from its standard deviation.

Figure 1. The relationship between beta and its return with CAPM.

Figure 2. SCAPM without a risk-free rate.

Figure 3. SCAPM with zakat as a substitute.

Figure 4. SCAPM with inflation as a substitute.
Figure 5. SCAPM with GDP as a substitute.  
Figure 6. SCAPM with the Sukuk rate.

Figure 2 to 6 represents the expected return gained from four models that perform a similar pattern. Meanwhile, the expected return of SCAPM from a model with the Sukuk rate (SCAPM 5) is higher than the others. It is proportional to the minimum of expected return is obtained from SCAPM 5. If we compare the expected return from all versions, the Sukuk rate is better to be a substitute for the risk-free rate in CAPM to adjust in sharia perspective.

5. Conclusion

This research focused on how the modified model for shariah in adjusting CAPM as an equilibrium model, particularly on the use of the risk-free rate. We show the illustration Shari‘a CAPM in five versions with the implementation in the Indonesian Market. The expected return of Shari‘a CAPM with the Sukuk rate places a higher position than the four others SCAPM. However, the significant test for comparing all sharia models has not been provided. Due to this limitation, we will continue as a future study to find the accurate sharia model in equilibrium perspective with Islamic principles.

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