Yes, Beta was Invalid During Covid-19: Evidence from Islamic Stock Index Indonesia

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Abstract. The COVID-19 pandemic has raised the assumption that the market has systematic risk or negative beta so that the formation of an asset portfolio will not be effective in dealing with the risk of loss. However, the rapid recovery of some stock markets in several countries as the outbreak escalates has put this assumption into question. Therefore, this study aims to test the validity of beta in explaining stock returns during the outbreak period, which is empirically tested on Islamic stocks in Indonesia. The research was conducted since the first period of the discovery of Covid19 patients in Indonesia, namely on March 3, 2020 to March 3, 2022 by using a two-step regression method which showed invalid beta results during the covid-19 period, so that the formation of returns in the market was influenced by other factors not described in the model.

Keywords: beta · CAPM · two-step regression

1 Introduction

The CAPM model is a model that is considered to be able to explain the relationship between risk and return on risky assets in an equilibrium condition, which is a condition where the price of the formed asset has explained all the information contained in the market, and there is no more hidden information among market participants symmetrical. The CAPM model was first developed by Sharpe [1] which is the development of the single index model by Markowitz (1950) which states that the risk that is relevant in explaining market returns is systematic risk or beta [2].

However, several empirical studies prove the invalidity of the CAPM theory in the relationship between beta and return, among others those conducted by Lakonishok [3], Jansen, et al. [4], and Lai and Stohs [5] whose relationship argues that beta and return are ineffective, therefore the CAPM theory is considered irrelevant. In contrast, the examiners conducted by Estrada (2002), Levy (2010), Xu & Zhao, (2012), found the effectiveness of CAPM [6, 7].

Furthermore, on the one hand, the existence of the COVID-19 pandemic turned out to have a wide impact on the stock market in Indonesia. The increase in the spread of COVID-19, which causes limited flows of money and goods, causes a decline in the performance of all sectors of the economy which results in losses, a decline in market performance throughout the world, including Indonesia.

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The COVID-19 pandemic is considered an adverse or negative systematic (beta) risk for all markets and worldwide. Therefore, making a portfolio in any way is considered to have no effect on investor returns.

However, the rapid recovery of several stock markets in several countries that do not follow the trend of COVID-19 sufferers in their country causes this assumption to be considered irrelevant. For example, in Indonesia, the market rebounded in early April 2020 and even peaked at the end of December 2020. At the same time, the number of COVID-19 sufferers in Indonesia has a high trend at these times. This phenomenon makes financial practitioners question the validity of systematic risk in influencing the return movement.

Based on this phenomenon, this study aims to examine the effectiveness of the CAPM which explains the relationship between beta and return, especially for stocks in the Jakarta Islamic Index (JII) during the COVID-19 pandemic.

2 Literature Review

A. *CAPM Model*

One of the tools that can be used to measure the relationship between the level of return of a stock that is influenced by beta as a systematic risk is the theory of CAPM (Capital Asset Pricing Model) developed by Sharpe (1964) and Lautner (1965) [1]. This theory is developed from portfolio theory [2] which introduces systematic risk and unsystematic risk. In its development, the risk that is considered relevant is systematic risk (β) because unsystematic risk can be eliminated by diversifying. This systematic risk is then used in the CAPM theory. The CAPM theory assumes that investors are rational, so that every investment made in risky assets will take into account the level of systematic risk in the stock and the value of the return on risk-free investments. An investor will require that the return on investment must be greater than the risk-free risk (Rf) plus the beta sensitivity to the premium return, which is the value of the difference between the market return and the risk-free rate of return. Mathematically the CAPM theoretical model can be written as follows:

$$E(Ri) = Rf + \beta(E(Rm) - Rf) + e \tag{1}$$

where:

E (Ri): Stock or portfolio return expectations

Rf: risk free rate

(Rm) – Rf): Premium Return Expectations

Petengill, Sundaran, and Mathur (1995) argue that one of the weaknesses of the CAPM equation is the assumption that the expected return (E(Ri)) or risk-return trade-off value must always be positive, causing the expected return premium value (E(Rm) – Rf) must also always be positive or in other words the expected market return value (E(Rm) must be greater than the risk free rate (Rf), and the beta value (β) must also always be positive [8].

The error in the assumption of the CAPM equation lies in that if investors realize that the market return value must always be greater than the risk free rate, then no investor will want to invest in risk-free assets. In addition, a portfolio with a high beta requires high return expectations and vice versa, therefore investors must also be aware that sometimes a low beta can have a high return, otherwise no investor will want to invest in assets with a high beta low.

Since realized return is used in the calculation, where the value can be positive or negative compared to the risk-free rate, the CAPM equation requires modification, where the expected return must take into account the mean of the distribution of all possible returns so that its value can bedisplayed over several periods. Furthermore, to reach the tested implications, this modified equation can be used to testthe differences of the return distribution using severaldifferent betas. The form of the CAPM equation modified by Petinggil, Sundharam and Mathur (1990) is as follows [8]:

$$(Ri - Rf) = \beta(Rm - Rf) + e \quad (2)$$

This equation estimates the beta risk (β) for each portfolio using realized returns for both the portfolio and the market. The assumption used is that beta in each estimation period is a proxy for beta in each testing period.

B. *Previous Research*

Researchers have examined the relationship between risk and return. Shen (2018) examines the conditional relationship between beta and return on the US stock market using the Russell 1000, Russell 2000, and Russell 3000 index data for the period 2 October 2000 to 24 June 2014 with 3582 total observations [9]. Empirical results show that when excess market return is neglected, beta is found to be an insignificant risk factor. However, during the period of positive excess market return, a significant positive relationship was found between beta and return. And during the period when excess market return is negative, a significant negative relationship is found between beta and return.

Sandoval and Seins (2004) analyzed the relationship between portfolio beta and return on unconditional and conditional cross section CAPM on the stock markets of Argentina, Chile, Brazil, and Mexico [10]. This study also adds other risk factors: size, book to market ratio, and momentum as control variables. The results show that conditional CAPM is the dominant approach in measuring the risk-return relationship, even after controlling for risk factors different from beta. However, a statistically significant asymmetry was found in the beta risk premium between up and down markets.

Research conducted by Azher (2016) shows that there is an unconditional linear relationship between beta and return which is consistent with previous research [11]. And when the sample used is monthly return data on up and down markets, the results obtained are significant positive for up market, and significant negative for down market.

Lam (2001) examines the relationship between risk and return using the conditional method when there is negative data on ex-post excess market return in the Hong Kong stock market [12]. The data used is daily data from 132 stocks for the period January 2, 1980 to December 31, 1995. The results show that the estimated value of the risk premium in the up market and down market is not much different from the expected risk premium. However, the estimates of the up market and down market risk premiums are asymmetric, with the down market premium being larger than the up market.

Based on the theory of CAPM model and previous research, the hypothesis proposed in the research is: beta has a significant influence in the formation of Islamic stock returns in Indonesia during the covid-19 period.

3 Research Method

A. *Data and Sample*

The data employed in this study are secondary data, in the form of daily data from stock returns, market returns, and risk free rates. Stock return is the return of the stocks contained in the Jakarta Islamic Index (JII), Market return uses the JII return index, the risk free rate reference is used by the BI rate and the BI 7-Day Repo Rate, Research period 3 March 2020–3 March 2022. The sources of data acquisition are obtained from www.id.investing.com.

The study the Islamic stock index in Indonesia (JKII) which is consistent during the research period 3 March 2020–3 March 2022 and totals 19 companies, as shown in the Table 1.

Table 1 describes the number of companies that are members of the JII index at the beginning of the research period, namely March 3, 2022, totaling 30 companies. Furthermore, in the research period, March 3, 2020–March 3, 2022, there were several companies that were included and excluded from the JII index. Companies that enter after the March 3, 2020 period are not included in the research sample, while companies that leave during the research period, which are 11 companies, are a deduction from the number of companies at the beginning of the period. Thus, the number of companies that are consistently in the JII index during the study period are 19 companies.

The linear regression model used in this study is shown in equation, namely:

$$(Ri - Rf) = \beta(Rm - Rf) + e$$

The form of linear regression is simple linear regression, so that there is only 1 dependent variable and 1 independent variable, so the operational variables are (Table 2).

B. *Method*

The method employed in this study is two-step regression method (Fama-Macbath regression), which is a model that estimates the beta value by regressing the time series to the stock returns in the optimum portfolio, and then the beta value obtained

Table 1. SAMPLE CRITERION

Criterion	**Total**
Number of shares incorporated in JII, January 2017 Period 30	30
Number of shares issued fro JII, during the Period 3 March 2020–3 March 2022 -11	-11
Shares listed in JII consistently until March 3, 2022	19

Table 2. VARIABLE OPERATION

Variables	Formula	Description
Dependent Variable	Ri – Rf	Excess Return of individual shares by considering the value of the risk free rate
Independent Variable	Rm – Rf	Return premium by considering the value of the risk free rate

is re-regressed by cross section to measure beta validity. The stages carried out in the research are:

- The formation of the optimum portfolio, which is carried out using a single index model [1], a method that produces a combination of expected return and portfolio risk, from the stocks contained in the research sample.
- Calculate the beta value, which is the slope of the portfolio stock return to the JKSE market index.
- Calculating the validity of the beta obtained in the previous stage, namely by performing a cross section regression of the early stage beta which was used as an independent variable, with the value of excess return on the risk free rate as the dependent variable.

  The formation of the optimum portfolio is carried out using a single index model, with the following stages:
- Calculating daily returns from stocks that are the research sample by:

$$Ri = \frac{Pt - (Pt - 1)}{Pt - 1} \times 100\% \tag{3}$$

  where:
  Pt: Daily closing share price at time t
  Pt − 1: Daily closing stock price at time t − 1
- Calculate daily market return (Rm) from JCI, by:

$$Rm = \frac{Pm - (Pm - 1)}{Pmt - 1} \times 100\% \tag{4}$$

  Where:
  Pmt = closing price at t
  Pmt − 1 = closing price at t − 1
- Calculate the expected return value of each stock and market. The expected return of each stock equation is:

$$E(Ri) = \frac{\sum_{t-1}^{n} Rit}{n} \tag{5}$$

  where:
  E(Ri): expected return of share i
  Rit: stock return of share I

n: observation
while the expected market return is calculated by the equation:

$$E(Rm) = \frac{\sum_{t-1}^{n} Rmt}{n} \tag{6}$$

- Calculate the beta and alpha values of each stock. Beta and alpha values are calculated using the slope and intercept of stock returns to market returns using Ms. Excel.
- Calculating the value of the market return variance.
  The variance of market return is a measurement of risk to market return and expected market return. The market return variance can be calculated by the equation:

$$\sigma m^2 \frac{\sum_{i=1}^{n} (Rm - E(Rm))^2}{n-1} \tag{7}$$

- Calculating the Excess Return to Beta (ERB) value
  Excess Return to Beta (ERB) is a measurement of excess return relative to one unit of risk that cannot be diversified or beta. In this calculation, the excess return used is the excess return which has taken into account each variation of the mudharabah return, so the general ERB equation is:

$$ERBi = \frac{E(Ri) - (Rmd \pm SD)Z}{\beta i} \tag{8}$$

  Where:
  ERBi: Excess Return to Beta stock i
  E (Ri): expected return based on single index model
  (Rmd SD) Z): return mudharabah with a standard deviation of subject to zakat.
  i: Beta stock i
- Determining the cut-off point (C*) and forming the optimum portfolio
  The cut-off point value determines the limiting point of the lowest ERB value when a security meets the criteria for inclusion in the portfolio. To determine the cut off value, the value of Ci is first sought, namely the value of the ERB limit owned by each of the sought securities with the following equation:

$$Ci = \frac{\sigma_m^2 \sum_{j=1}^{i} \frac{[E(R_j) - R_{BR}]\beta_i}{\sigma_{ej}^2}}{1 + \sigma_M^2 \sum_{j=1}^{i} \frac{\beta_i^2}{\sigma_{ei}^2}} \tag{9}$$

  After determining the value of Ci, the cut-off point (C*) is the maximum value of Ci. Furthermore, to determine which stocks are included in the optimum portfolio, the ERB value is compared with the C* value. Stocks with an ERB value above C* are included in the optimum portfolio category.

C. *Hypothesis Testing*

The hypothesis is examined by performing a partial significance test (t-test) of the regression cross section equation on beta validity testing, with a 95% confidence level, with the following criteria:

H10: if the t-value is positive and the significance value is less than 5%, then the hypothesis is accepted

H11: If the t value is not positive and or the significant value is more than 5%, the hypothesis is rejected.

4 Result

A. *Optimum Portfolio*

The formation of the optimum portfolio is carried out with a single index model for 19 companies in JII that pass the sample criteria, with the stages as described by the research method as follows:

- Calculating daily stock returns and market returns of 19 sample companies and the JCI.
- Calculating the expected return value of each stock
- Calculate the beta and alpha values of each stock which is the slope and intercept between stock returns and market returns. Calculating the value of the market return variance and the return of each stock. Calculating the market return variance
- Calculating the value of excess return to beta (ERB) of each stock.
- Determine stocks that are included in the optimal portfolio.

  Calculation of determining stocks that are included in the optimal portfolio, by first finding the value of C* as a benchmark for the ERB of the sample stocks included in the portfolio. Stocks with an ERB value of more than C* indicate that the stock is included in the optimal portfolio. The magnitude of the value of C* can be calculated by Eq. (9), with the results can be seen in Table 3 by following the steps in Eq. (9). Summary of the C* value and which stocks are included in the optimal portfolio and sorted from the largest to the smallest ERB value can be seen in Table 4.

B. *Hypothesis Testing*

1) *Calculation of Optimal Portfolio Stock Beta*

   The first stage in testing the hypothesis is to find the beta value of the optimal portfolio stock. Based on Table 3 and Table 4 which contain the beta values of all sample stocks and stocks classified as optimum portfolios, the optimal portfolio stock beta values can be seen in Table 5.

2) *Beta Significance Test*

After obtaining the beta value of the optimal portfolio stock, the next step is to perform a significant test of the beta value, with the following steps:

- Develop a linear regression model with optimal stock beta as the independent variable (X), and the value of excess return (Ri – Rf) of the optimal portfolio stock as the dependent variable (Y). The value of the variables X and Y of each optimal stock can be seen from the Table 6.

Table 3. BETA, ALPHA, VARIANCE AND ERB VALUE OF THE MARKET AND EACH STOCK

No.	EMITEN	Beta	Alpha	Varians	ERB
1	IHSG (market)			0,000177	
2	UNVR	0,942081	-0,001600	0,000542	-0,001213
3	WIKA	-0,097732	0,001997	0,001465	-0,018760
4	UNIR	1,264144	0,000541	0,000858	0,000942
5	TPIA	0,648051	0,000405	0,000623	0,001059
6	TLKM	1,190484	0,000010	0,000542	0,000517
7	PTBA	1,334133	0,000420	0,000848	0,000833
8	PGAS	-0,043107	0,000301	0,001093	-0,003930
9	MNCN	1,114312	-0,001090	0,000848	-0,000476
10	KLBF	0,877304	0,000381	0,000626	0,000912
11	JPFA	1,114312	-0,000154	0,001018	0,000414
12	INTP	1,411862	-0,001155	0,000959	-0,000251
13	INDF	1,016452	-0,000515	0,000496	-0,000013
14	INCO	1,511798	0,001162	0,001101	0,001294
15	ICBP	1,312415	-0,000815	0,000380	-0,000512
16	EXCL	1,511798	-0,000228	0,000989	0,000376
17	CPIN	1,312415	-0,000357	0,000788	0,000245
18	BRPT	1,710695	-0,000325	0,001625	0,000346
19	ANTM	1,787429	0,002522	0,001628	0,001949
20	ADRO	0,339108	0,001429	0,001034	0,006354

Table 7 shows the descriptive statistic of the variables. The average value of the Y variable is 0.0014 with a standard deviation of 0.00097. Variable X has a mean of 1.152 with a standard deviation of 0.453.

- Perform a cross section regression test on the data contained in Table 4. The test is carried out using a partial significance test (t-test) with 95% confidence level criteria ($\alpha = 5\%$). The results of the calculation of the significance test and the explainitary power (R-squared) value can be seen in Table 8.

Based on the significant test results and the explanitary power value in Table 8, it is known that the level of significance between the independent variable and the dependent variable (prob t-statistic) is 0.4020. This means that the relationship between risk (beta) and return (excess return) is not significant, which indicates that the CAPM model is not valid in conditions of the Covid-19 pandemic. This insignificant relationship is strengthened by the value of explainitary power (R-squared (R 2) of 0.1020 or 10.20% which implies a very weak correlation between risk and return.

Table 4. OPTIMUM PORTFOLIO DETERMINATION

EMITEN	ERB	c•	Result
ADRO	0.0064	0.0004	OPTIMAL
ANTM	0.0019	0.0004	OPTIMAL
INCO	0.0013	0.0004	OPTIMAL
TPIA	0.0011	0.0004	OPTIMAL
UNTR	0.0009	0.0004	OPTIMAL
KLH	0.0009	0.0004	U lIMAL
PTBA	0.0008	0.0004	OPTIMAL
TLKM	0.0005	0.0004	OPTIMAL
JPFA	0.0004	0.0004	OPTIMAL
EXCL	0.0004	0.0004	-
BRPT	0.0003	0.0004	-
CPIN	0.0002	0.0004	-
INDF	0.0000	0.0004	-
INTP	-0.0003	0.0004	-
MNCN	-0.0005	0.0004	-
ICBP	-0.0005	0.0004	-
UNVR	-0.0012	0.0004	-
PGAS	-0.0039	0.0004	-
WI KA	-0.0188	0.0004	-

Table 5. OPTIMAL PORTFOLIO BETA VALUE

Company	Beta
ADRO	0,33910797
ANTM	1,7874292
INCO	1,51602608
TPIA	0,64805129
UNTR	1,26414408
KLBF	0,87730405
PTBA	1,3341331
TLKM	1,19048422
JPFA	1,41186227

Table 6. VALUE OF EXCESS RETURN AND BETA OF OPTIMAL PORTFOLIO SHARES

EMITEN	**Excess Return**	**Beta**
	(Y)	***(X)***
ADRO	0.00215461	0,33910797
ANTM	0,00348331	1,7874292
INCO	0,00196166	1,51602608
TPIA	0,00068606	0,64805129
UNTR	0,00119065	1,26414408
KLBf	0,00079968	0,87730405
PTBA	0,00111141	1,3341331
TLKM	0,00061554	1,19048422
JPf A	0,00058391	1,41186227

Table 7. DESCRIPTIVE STATISTICS

	Mean	**Std. Deviation**	**N**
Y	.00139778	000966667	9
X	1.152025889	.452943096	9

Table 8. Beta Significance Test Results on Return

Dependent variable: Y				
Method: Least Squares				
Sample: 1 9				
Included observations: 9				
Variable	**Coeficient**	**Std, Error**	**t-Statistic**	**Prob.**
C	0,000612	0,000941	0,649906	0,5365
X	0,000683	0,000766	0,892973	0,4020
R-squared	0,102080	Mean dependent var		0,001399
Adjusted R-Squared	-0,026194	S.D. dependent var		0,000968
S.E. of regression	0,000981	Akalike info criterion		-10,82270
Sum squared resid	6.84E.06	Schwarz criterion		-10,77887
Log likelihood	50,70215	Hannan-Quinn criter.		-10,91728
F-statistic	0,795793	Durbin-Watson staf		0,383118
Prob(F-statistic)	0,401977			

Based on the results of the calculation of the significant value and explainitary power as shown in Table 8, the results show that the relationship between risk and return is not significant with a very weak correlation value, therefore the hypothesis which states "There is a significant relationship between risk and return under conditions the COVID-19 pandemic on the Islamic stock index in Indonesia", is not accepted.

C. *Discussion*

Based on the results of the calculation of the significance test and the coefficient of determination, as well as testing the hypothesis, it is known that:

- Beta as a risk variable has a positive value that is not significant to the excess return of its shares which indicates the relationship between risk and return is not significant, thus the CAPM model is not valid in the conditions of the Covid-19 pandemic on Islamic stocks in Indonesia. The influence of the Covid-19 pandemic that affects the global economy thereby increasing the risk and volatility of stocks is no beta risk cannot be predicted with validity, causing the CAPM model to be invalid.
- The results of testing the coefficient of determination (R 2) related to the relationship between risk and return obtained the results of 0.1020. This indicates that the risk beta affects the formation of returns only by 10% or very weak, so it can be concluded that beta cannot be used to explain stock portfolio returns, and thus strengthens the conclusion that the CAPM model is invalid in the Covid-19 pandemic conditions on Islamic stocks in Indonesia.

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