EMPIRICAL TESTING OF FAMA-FRENCH ASSET PRICING FIVE - FACTOR MODEL IN INDONESIA STOCK EXCHANGE DURING THE COVID-19 PANDEMIC PERIOD

Okta Martua Sitanggang*, Eko Rizkianto
Faculty of Economics and Business, University of Indonesia, Indonesia

Abstract

The volatility of the Indonesian Stock Exchange Composite (JKSE) increased significantly during the Covid-19 pandemic period. In this period, return predictability and price volatility in the stock index experienced a single structural break. There is concern among investors and academics that the asset pricing model that has been empirically accepted so far is unable to explain the return or excess return of an asset or investment during the Covid-19 pandemic period. This research empirically tests the significance of Fama – French Five Factor Model. The significance of factors consist of size (market capitalization), profitability, value (book-to-market), investment, and market risk premium (Rm-Rf) factors explain the excess return of stock portfolios on the Indonesian Stock Exchange during the Covid-19 pandemic period. Existing studies show that the Covid-19 pandemic has affected investor sentiment, causing investors to panic and be pessimistic about their investments. In addition, there were deviations from the efficient market hypothesis during several pandemic periods in several countries so that stock prices did not fully reflect the available information. After testing, it was found that the factors size (market capitalization), profitability, value (book-to-market), investment, and market risk premium (Rm-Rf) did not have a significant influence on the excess return of stock portfolios on the Indonesia Stock Exchange during the period Covid-19 pandemic.

Keywords: *asset pricing; structural break; Fama-French*

1. INTRODUCTION

The Covid-19 pandemic is a very dynamic episode with various virus mutations and followed by various market reactions. Investor panic occurred after the emergence of various mutations of the Covid-19 virus, such as Delta in mid-2021, then Omicron at the end of 2021 to early 2022, as a result investor withdrew their investments on the stock exchange after witnessing an increase in the transmission of Covid-19 cases and deaths. So, in 2020 and 2021, volatility in the Indonesian stock market reached a record high.

Rossi (2020) found that previous pandemics such as Bird Flu, SARS, Swine Flu, Ebola, and MERS significantly increased the volatility in the equity market, but Covid-19 had the strongest impact on the stock market. Comparing Covid-19 with the Great Influenza Pandemic (Spanish Flu) from 1918 to 1920 in 48 countries, it can be concluded that the impacst of the Covid-19 pandemic was much greater on Gross Domestic Product (GDP), consumption, and the stock market than the previous pandemic.

Salisu (2020) predicts stock returns using fear sentiment. They compiled a global fear index (GFI) based on cases and deaths due to Covid-19. They find that GFI is an effective predictor of stock returns in OECD and BRICS countries during the pandemic. An increase in the fear index causes a decrease in returns.

*Coressponding author. *Email address:* okta.martua@ui.ac.id

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Apart from that, Baek (2020) also conducted research on the impact of Covid-19 on stock market volatility and trading volume. They found that there was an increase in total risk and idiosyncratic risk due to deaths caused by Covid-19 on the stock market in the United States, while systematic risk experienced an increase while changes in systematic risk vary across industry. This research shows that there has been a change in stock systematic risk (β) after the Covid-19 pandemic. Apart from systematic risk (β), the influence of other factors on stock returns also changes.

Ramelli (2020) examined stock returns in the United States before the pandemic and during the Covid-19 pandemic. They found that there were changes in the coefficients of profitability, book-to-market and market capitalization factors in influencing stock returns. The changes in the influence of the factors are in line with the results of research by Hong et al. (2021). He found that the return predictability and volatility of the S&P 500 and DJIA index experienced a single structural break. A single structural break is a sudden change in the parameters of a regression model, which can cause significant forecasting errors so that the existing model is unreliable. Structural breaks can occur in extreme conditions such as the Covid-19 pandemic (Cheng et al., 2022).

Based on these studies, it is found that stock in the New York Stock Exchange (NYSE) changes in stock beta (β) and single structural breaks during the Covid-19 period. In other words, an asset pricing model that is able to predict returns of stock portfolio and excess returns of stock portfolio in the pre-pandemic, may not be able to predict stock portfolio returns or stock portfolio excess returns during the period of Covid-19 pandemic. Likewise, an asset pricing model that has low performance in predicting returns of stock portfolio and excess returns of stock portfolio during the pre-pandemic period, might be able to predict stock portfolio returns and stock portfolio excess returns during the Covid-19 pandemic period.

During a financial crisis, such as during the Covid-19 pandemic, investors have a risk aversion investment strategy or a flight toward safe-haven asset classes investment strategy (V. Coudert & Gex, 2008b). So according to Singh (2020), investors are paying more attention to company fundamentals in an effort to avoid the risk of falling stock prices during periods of economic slowdown.

Investors pay attention to the company fundamentals related to the internal conditions or management of a company. Even though various studies indicate that investors pay more attention to company fundamentals when investing in stocks during the financial crisis, research regarding fundamental factors that influence stock portfolio returns on the Indonesian stock exchange during the Covid-19 period is still limited. Research on asset pricing models with company fundamental factors is mostly performed on stock exchanges in developed countries. The Fama-French Five Factor asset pricing model uses many fundamental company factors.

2. LITERATURE STUDY

The Efficient Market Hypothesis, introduced by Bachelier (1900), suggests that all information about an asset is reflected in the asset price so that it is impossible to obtain abnormal returns. Consequently, positive alpha cannot be generated neither fundamental analysis nor technical analysis. However, Grossman and Stiglitz (1980) argue that because obtaining information is expensive, investors are compensated for their efforts to gather information and discover “mispriced” assets, this information cannot be reflected in prices. This paradox is called the "Grossman Stiglitz Paradox" (Grossman, 1980 in Dimitrios, 2020).

Covid-19 is a cause of market inefficiency (Hong et al., 2021). When the economy is in bad condition, news and information will cause polarization of opinion which creates differences in investor behavior, some investors are over-reactive to news and information while some

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investors are under-reactive (Cujean & Hasler, 2017). Covid-19 creates better investment opportunities for investors with volatility timing abilities, especially those who have more liquidity than the general public (Hong et al., 2021).

According to Frensidy (2022), although it has more or less the same impact on global finance, the crisis caused by Covid-19 is different from the previous global financial crisis in 2007–2008. During the Covid-19 crisis, the JKSE continued to decline for almost three weeks, while in 1998 and 2008 there were not many lower auto rejects (ARBs) compared to 2020, where the four banks with the largest capitalization (BBCA, BBRI, BMRI and BBNI) experienced ARBs. There is no bid volume at the same time. The Covid-19 crisis has had a broad impact, affecting almost all sectors.

Covid-19 has become a symbol of risks and concerns that are triggering anxiety among investors. However, apart from volatility and panic, stock price movements are still based on expectations of economic conditions (Ramelli & Wagner, 2020). In this way the public can learn about the nature of the challenges faced in these difficult times. The stock price reaction shows that various actions, including fiscal policy interventions, have the effect of avoiding further negative conditions due to the Covid-19 pandemic (Ramelli & Wagner, 2020).

On the other hand, Engelhardt et al., (2021) argues that the amount of market volatility in reaction to Covid-19 differs between countries, depending on public trust, where volatility is lower in high trust countries. Trust in fellow citizens and in the Government are equally important factors.

In the Covid-19 period, return predictability and price volatility in the S&P 500 and DJIA stock indexes experienced a single structural break (Hong et al., 2021). A structural break is a significant change in the parameters of a regression model that happen in a sudden, which can cause a huge projection error so that the model becomes unreliable. When structural break testing is performed, it is assumed that the existing model (null hypothesis) is correct unless they find evidence to the contrary, it can then be concluded that the discrepancy in the results of a model is caused by a structural break (Hyndman, 2014).

Still in the context of the crisis period, Neves et al., (2021), found that the performance of value stocks and growth stocks was different in each different period of the global financial crisis. In six countries, value stocks outperform growth stocks in the period before the subprime crisis, and during the subprime crisis this condition continued to occur in three countries. Meanwhile, changes occurred after the crisis period. It was also found that investor sentiment has a strong significance on stock value returns and growth stock returns.

The first important asset pricing model currently used as the basis for financial theory is the Capital Asset Pricing Model (CAPM) created by Sharpe (1964). CAPM is a single factor model, where the only price factor is the market risk premium. This indicates that there is a positive relationship between a stock's beta and the stock's expected return. CAPM helps calculate investment risk and potential return on investment. Empirically, CAPM fails to explain abnormal stock returns, but is still used as a method for assessing the cost of capital and as a portfolio performance evaluation technique. Criticism of the CAPM is usually caused by the simplicity of the model and the linear relationship between systematic risk and the expected return of a stock. Ross (1976) proposed an alternative, The Arbitrage Pricing Theory (APT), through a multi-factor asset pricing model, showing that there is a linear relationship between the expected return of a stock and a number of macroeconomic variables.

Fama and French (1993), tested the CAPM which then produced a new model known as the three-factor model. This model includes two additional market factors that can explain stock excess returns, namely the market capitalization size factor and the company's book-to-

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market (B/M) ratio. Fama and French found that the three-factor model is a good model for predicting portfolio excess returns.

Daniel and Titman (1997) criticized Fama and French (1993) research and suggested the Characteristics Model. Fama and French show that cross-sectional variations in excess returns can only be explained by size and value factors. Daniel and Titman (1997) found that more characteristics of factor loadings determine excess returns. Their results also show that stock values move because of investors' sensitivity to similar factors and not because of unique factors. The 3-factor model explains the value premium better than Daniel and Titman's characteristic model, in their 68-year period and there is no evidence to contradict the fact that value loadings determine expected returns. Fama and French believe that the evidence from Daniel and Titman (1997) in favour of the characteristics model is due to the short sample period. If they omitted the period examined by Daniel and Titman (1997), the regression intercept could barely approach the zero intercept.

Carhart (1997) extended Fama and French's (1993) three-factor model to a four-factor model including a momentum factor, in addition to size, value and market factors. It appears that Carhart's model explains more variation in average stock returns than Fama and French's (1993) original three-factor model. Blackburn and Cakici (2017) focused on conducting research on momentum factors and examining returns in various capital markets in developed countries. This then resulted in the discovery that returns were significant using a long strategy for long-term losers and short positions for short-term winners. These results were valid for the entire sample period and most markets.

Griffin (2002) examines different versions of Fama and French's three-factor model in an international data set. He found that no model truly captured variations in average returns. However, he found that research on the three-factor Fama–French model using domestic data produced better performance than the three-factor version of the Fama–French model using international stock market data. In its dataset, Griffin has data on 23 international markets divided into four regions, North America, Asia Pacific, Europe and Japan. Griffin conducted integrated asset pricing model research in these four regions.

Novy-Marx (2013) identified profitability factors. They found that stocks of companies with high profitability generated significantly higher returns than stocks of companies with high profitability. In research performed by Watanabe et al., (2013) examines whether the value effect in international stock markets is consistent with results in the United States and evaluates possible economic causes of value factors. They found that the value effect existed in international stock markets and that there were large differences in this effect across the countries they studied. The value effect has a stronger impact in markets that have more efficient information.

After successfully create a five-factor model, which explains size, B/M, profitability, and investment patterns, Fama and French (2017) tried the model internationally and they found that stock returns averaged three of the four regions they used (America North, Europe and Asia Pacific) increases as the B/M ratio and profitability increase. They also found the expected negative relationship between returns and investment. In Japan, the correlation between average investment returns is weak but the relationship between average returns and book-to-market ratio is strong.

In China, this model has also been tested. Journal entitled the five-factor asset pricing model, short-term reversal, and ownership structure – the case of China by Lin Chen et al. (2022). The sample period is from January 2004 to December 2017. The results of the study found that the Fama and French Five-Factor Model overall better explains excess returns than the Fama and French Three-Factor Model.

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In India, similar research was also conducted by Singh, Singh, and Prakash in 2021 with the title Testing Factor Models in An Emerging Market: Evidence from India with the conclusion that the five-factor model has better power to explain stock returns than the three-factor model.

Fama and French (2015) tested the five-factor model internationally in four regions, namely the United States, Asia Pacific, Europe and Japan in the period July 1990 to September 2014. They found that the average equity return in North America, Asia Pacific, and Europe as profitability and book-to-market increase are negatively correlated with investment. Meanwhile, for the Japanese case, the relationship between average returns and market equity ratios is strong in all size groups, but the relationship between average returns and profitability or investment is weaker.

Meanwhile, Sutrisno and Ekaputra (2016) tested the performance of the five-factor Fama - French model on the Indonesia Stock Exchange during the period 2000 to 2015. It was found that the Five-Factor Model had a better ability to explain the excess returns of stock portfolios on the Indonesia Stock Exchange than the three-factor model. However, in this study, investment and profitability factors had a weak influence on portfolio excess returns.

From existing research, there are variations in the significance of the influence of independent variables in different geographic regions and this is proven in Fama and French (2017) where the model has different performance from one region to another (Dimitrios, 2020).

3. RESEARCH METHODOLOGY

The object of this research is the stock portfolio on the Indonesian Stock Exchange (IDX) during the Covid-19 pandemic period starting from the first quarter of 2020 to the fourth quarter of 2022. The portfolio used in this research comes from stocks listed on the Indonesian Stock Exchange (IDX) during the study period. The financial data used in this research is in Rupiah. The data used is panel secondary data taken via Thomson Reuters DataStream. This research uses the entire population of stock listed on the IDX for the period first quarter 2020 – fourth quarter 2022.

In terms of data collection criteria, this research follows Fama and French (2015). The criteria are: (1) do not include financial stocks, (2) the stock must have data on operating profit, book-to-market and fixed assets; and (3) does not include stocks with negative equity. Based on these criteria, the stocks that fulfil those criteria are around 667, stock data for each period is updated every quarter.

This empirical research examines whether the Fama - French Five Factor Model can explain the excess return of stock portfolios using large spreads on size, value, profitability and investment. The large spread referred to is that the independent variable is divided into three groups based on its size, with the value from group three is deducted by the value from group one. For example, SMB is arranged based on market cap, where the return from stocks with the smallest capitalization (group three) is deducted by the return from stocks with the biggest capitalization (group one).

This research aims to find out the factors that have a significant influence on the excess return of stock portfolios using the Fama - French Five Factor Model.

Ordinary Least Squares (OLS) method is used in this study to assess the statistical significance of each Rm-Rf, SMB, HML, RMW, and CMA factor individually. This research also tested the average adjusted R^2 in the model to test the significance of the model in explaining variations in stock portfolio returns on the Indonesian stock exchange during the Covid-19 pandemic. An asset pricing model with a larger average adjusted R^2 value indicates that the model is better. The equations tested are as follows:

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$$R_{it} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + r_p RMW_t + c_p CMA_t + e_{pt}$$

Dependent Variable, Left Hand Side

The dependent variable in this study is the excess return (Rit-Rft), which is calculated by subtracting the risk-free return from the return on the security or portfolio. Rit is the Indonesian Stock Exchange Composite (JKSE) closing price at the end of each quarter (Rit), and Rft is the BI-7 Day Reverse Repo Rate (BI7DRR).

Following the research conducted by Fama and French (2015), the dependent factors in this model are sorted using 5 x 5 portfolio sorting, which generates 25 dependent variables. There are three sets of dependent variables:

1. Excess return of 25 stock portfolios arranged based on Size - B/M
2. Excess return of 25 stock portfolios arranged based on Size – OP
3. Excess return of 25 stock portfolios arranged based on Size - Inv.

The 25 portfolios arranged based on Size - B/M are as follows:

The market capitalization size breakpoints are the 1st, 2nd, 3rd, 4th, and 5th quantiles of the aggregate market capitalization of all stocks that were researched. For the book-to-market (B/M), operating profitability (OP), and investment (Inv) factors, use the 1st, 2nd, 3rd, 4th, and 5th quantiles of the aggregate value of each factor. To build the dependent factor, the excess return variable from period t is used. The book-to-market ratio, operating profitability, and investment values use data of the previous period (t-1).

Independent Variable, Right Hand Side

The independent variables are Market Factor (Rm – Rf), Size Factor (SMB), Value Factor (HML), Profitability Factor (RMW), and Investment Factor (CMA). Following research conducted by Fama and French (2015), the arrangement of independent factors uses 2 x 3 portfolio sorting. A more detailed explanation for each independent variable, as follows:

1. The stock data is grouped by period, then in each period it is sorted into two market capitalization size categories, and into three categories for each book-to-market equity (B/M), operating profitability (OP), and investment (Inv).
2. The breakpoint for market capitalization size is the median of the aggregate market capitalization of stocks in one period, while the breakpoints for B/M, OP, and Inv are the 30th and 70th percentiles. Stocks with large market capitalization are stocks that are above the median IDX capitalization value in a period, while small stocks are below the median stock.
3. To build independent factors, the Rm-Rf, market capitalization, book-to-market ratio, operating profitability, and investment values use data at the end of period t-1, with the following explanation:
    a. Rm-Rf is the IDX return in one quarter minus the BI-7 Day Reverse Repo Rate (BI7DRR) for one quarter which is expressed in Rf. The data is at the end of the previous period (t-1)
    b. SMB is a size proxy using market capitalization data for a stock at the end of the previous period (t-1).
    c. HML is a proxy for company value relative to the amount of capital invested using book to market data for a stock at the end of the previous period (t-1). The book-to-market ratio can be used as an indicator of whether a company is undervalued or overvalued.
    d. RMW is a proxy for company profitability calculated using $\frac{Operating\ Profit}{Book\ Value\ of\ Equity}$ at the end of the previous period (t-1)

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e. CMA is a proxy for the company's investment factors. The data used is the quarterly increase in total assets, namely the growth in total assets at the end of the previous period (t-1) divided by total assets at the end of the two previous periods (t-2).

The summary of the formula for the independent variables can be seen in table 1 below:

Table 1
Construction of Size, B/M, Profitability, and Investment Factors

Portfolio Type	Breakpoint	Factors and components
Arrangement of 2x3 portfolio based on	Size: Median of IHSG	$SMB_{B/M}$ = (SH + SN + SL)/3 - (BH + BN + BL)/3
Size and B/M		SMB_{OP} = (SR + SN + SW)/3 - (BR + BN + BW)/3
Size and OP		SMB_{Inv} = (SC + SN + SA)/3 - (BC + BN + BA)/3
Size and Inv		SMB = (SMBB/M + SMBOP + SMBInv)/3
	B/M: 30th and 70th percentile IHSG	HML = (SH + BH)/2 - (SL + BL)/2 = [(SH - SL) + (BH - BL)]/2
	OP: 30th and 70th percentile IHSG	RMW = (SR + BR)/2 - (SW + BW)/2 = [(SR - SW) + (BR - BW)]/2
	Inv: 30th and 70th percentile IHSG	CMA = (SC + BC)/2 - (SA + BA)/2 = [(SC - SA) + (BC - BA)]/2

Source: Results Processed by Researchers (2023)

Before testing the model, autocorrelation is examined by using the Durbin-Watson test and Multi Collinearity Test using the Correlation Matrix. Durbin Watson values for 75 portfolios are in the range of 1.32 and 3.07, indicating there is no autocorrelation in the data, in the correlation matrix, the all correlation between factors is <= 0.8 which indicates there is no autocorrelation. The correlation between RMW and HML is -0,808, which is still in the threshold for the autocorrelation. Heteroscedasticity testing is also performed, to test whether heteroscedasticity conditions exist or not, the Breusch-Pagan Test. Based on the test results above, it can be seen that almost all portfolios have a Probability Chi Square > 0.05, which indicates that there is no indication of heteroscedasticity problems.

4. RESULT AND DISCUSSION

Descriptive Statistics

Table 2 Panel A provides information on the average return for each factor. The average monthly market return is 0.02%. On a monthly basis, the average excess return of the size factor (SMB) was 0.63%, implying an average premium of 0.63% for buying small-cap stocks over large-cap stocks. Meanwhile the average monthly excess return of the book-to-market ratio (HML) factor is 1.23%, implying an average premium of 1.23% for buying large book-to-market stocks over stocks with small book-to-market. Meanwhile, the average monthly return on the profitability factor (RMW) is 1.82%, meaning an average premium of 1.82% for buying stocks of companies with strong profitability rather than stocks of companies with weak profitability. Meanwhile, the average excess return from investment factors (CMA) is -2.62%, indicating that stocks of companies with aggressive investment produce a higher rate of return of 2.26% than stocks of companies with conservative investment.

This finding is in line with the findings of Sutrisno and Ekaputra (2016) where all factors produce positive monthly averages except the investment factor (CMA), where investing in

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stocks of companies that are conservative in investing produces lower returns than investing in companies that are aggressive in investing.

Table 2
Summary Statistics for Monthly Excess Return Factor 2x3

Panel A: Mean, standard deviation, and t-statistics for monthly returns

	2x3 Factors				
	Rm-Rf	**SMB**	**HML**	**RMW**	**CMA**
Mean	0,02%	0,63%	1,23%	1,82%	-2,62%
Std dev	4,74%	3,16%	3,57%	3,58%	4,59%
t-Statistic	-1,01	-0,53	0,13	0,75	-3,52

Panel B: Small and Large Factor Components (2x3)

	2X3 Factors								
	HML S	**HML B**	**HML S-B**	**RMW S**	**RMW B**	**RMW S-B**	**CMA S**	**CMA B**	**CMA S-B**
Mean	1,14%	1,32%	-0,18%	1,27%	-2,37%	3,64%	-2,12%	-3,11%	0,99%
Std dev	4,11%	5,36%	6,36%	4,09%	5,50%	7,16%	4,71%	7,55%	8,61%
t-Statistic	0,04	0,19	-1,00	0,16	-2,96	1,79	-3,01	-2,88	-0,07

Panel C: Correlation between different factors

	2 x 3 Factor				
	SMB	**HML**	**RMW**	**CMA**	**Rm-Rf**
SMB	1,000				
HML	-0,159	1,000			
RMW	-0,162	0,145	1,000		
CMA	0,107	-0,260	-0,808	1,000	
Rm-Rf	-0,043	-0,030	-0,003	0,026	1,000

Source: Results Processed by Researchers (2023)

Panel B divides the small and large components of the 2 x 3 factor. The value premium between large capitalization stocks (HMLB) and small capitalization stocks (HMLS) tends to be the same. Meanwhile, the profitability premium is lower for large cap stocks (RMWB) -2.37% compared to (RMWS) 1.27% for small cap stocks. Lower investments result in better returns on small caps (CMAS)= -2.12% compared. (CMAB) = -3.11 on large stocks. This RMW pattern is the same as the research results of Sveronis (2020). Meanwhile, the investment premium is negative for both large capitalization stocks and small capitalization stocks. This indicates that the excess return on the portfolio of stocks of companies that invest aggressively is higher than the excess return on the stock portfolio of companies that invest conservatively. The t-statistic for HMLS and HMLB is positive. Meanwhile, RMWS is positive and RMWB is negative, indicating a reversal in the directionality of the effect. Meanwhile, CMAS and CMAB are negative, meaning they have a negative directionality of the effect with the average stock return.

Panel C shows the correlations between the independent variables. There is a positive correlation between RMW and HML, between CMA and SMB, and between Rm-Rf and CMA. Meanwhile there is a negative correlation between SMB and HML, SMB and RMW, SMB with Rm-Rf, HML with CMA, HML with Rm-Rf, RMW with CMA, and RMW with Rm-Rf.

The average monthly portfolio excess return pattern of the 25 Size-B/M, 25 Size-OP, and 25 Size-Inv portfolios can be seen in table 3. The excess return in table 3 is the dependent variable in the Fama - French Five Factor Model. In Panel A stock portfolio is arranged based on size (market capitalization) and value (book-to-market). Vertically from small, 2, 3, 4, big is the order of portfolios with the smallest market capitalization to the largest. Meanwhile, horizontally, low, 2, 3, 4, high is the portfolio from lowest to highest book-to-market. In Panel B, stock portfolio is arranged based on size (market capitalization) and profitability (operating profit). Vertically from small, 2, 3, 4, big is the order of portfolios with the smallest market capitalization to the largest. Meanwhile horizontally, weak, 2, 3, 4, robust is the order of portfolios with the lowest to the highest operating profit. In Panel C, a stock portfolio is arranged based on size (market capitalization) and investment. Vertically from small, 2, 3, 4, big is the order of portfolios with the smallest market capitalization to the largest. Meanwhile horizontally, conservative, 2, 3, 4, aggressive of portfolios with lowest to highest investment. Table 4 displays the average monthly excess return (36 observations) for 25 stock portfolios compiled based on Size-B/M, 25 stock portfolios compiled based on Size-OP, and 25 stock portfolios compiled based on 25 Size-Inv from January 2020 until December 2022.

Table 3
Average Monthly Return for Each Portfolio

Panel A: Size-B/M portfolio					
	Low	**2**	**3**	**4**	**High**
Small	0,008	0,058	0,031	0,030	0,020
2	-0,005	0,000	0,021	0,022	0,022
3	0,000	0,018	0,017	0,023	0,020
4	0,002	0,014	0,004	0,019	0,022
Big	0,007	0,001	0,016	0,021	0,004
Panel B: Size-OP portfolio					
	Weak	**2**	**3**	**4**	**Robust**
Small	0,014	0,019	0,019	0,026	0,055
2	0,006	0,003	0,018	0,017	0,037
3	-0,003	0,006	0,008	0,025	0,036
4	0,008	-0,002	0,007	0,003	0,025
Big	-0,030	-0,001	0,003	0,010	0,025
Panel C: Size-Inv portfolio					
	Conservative	**2**	**3**	**4**	**Aggressive**
Small	0,029	0,026	0,039	0,018	0,027
2	0,025	0,006	0,016	-0,003	0,013
3	0,021	0,008	0,013	0,018	0,024
4	0,022	0,008	-0,001	-0,002	0,016
Big	0,009	0,030	0,006	-0,001	0,006

Source: Results Processed by Researchers (2023)

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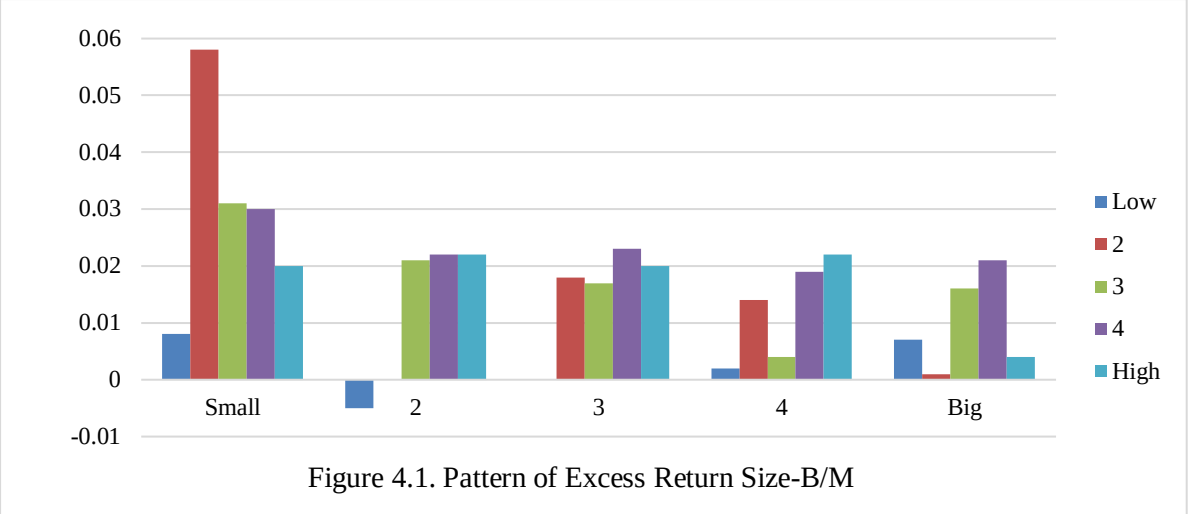

Figure 4.1. Pattern of Excess Return Size-B/M

Figure 4.2. Pattern of Excess Return Size-OP

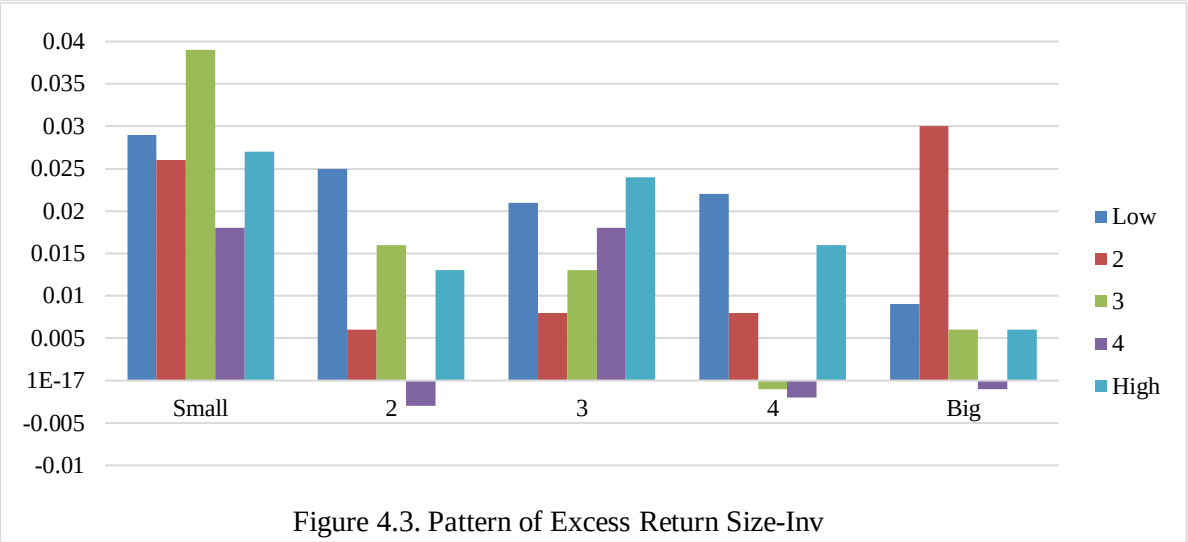

Figure 4.3. Pattern of Excess Return Size-Inv

Panel A shows 25 stock portfolios arranged based on Size-B/M, the stocks in this group have an excess return pattern that decreases as the size of market capitalization increases, while the excess return pattern cannot be observed as Book-to-Market increases (B/M), in the top two quantiles of market capitalization, excess returns increase as Book-to-Market increases while in the first quartile there is no observable pattern. Both market capitalization and book-to-market size patterns are unclear in Panel A. A visualization of the excess return pattern in

Panel A can be seen in Graph 4.1. An unclear pattern was also found by Dimitrios (2020) by examining stocks in 19 countries from 1990 to 1990. 2019.

Panel B shows 25 portfolios arranged based on Size-OP, stocks in this group have excess returns which decrease as the size of market capitalization increases. Meanwhile excess return increases along with the increase in operating profit (OP). At the smallest market capitalization quantile, excess return increases from 0.014 to 0.055, and at the largest market capitalization quantile, excess return increases from 0.030 to 0.025 as OP increases. Visualization of the excess return pattern in Panel B can be seen in Graph 4.2. The findings in this research are also in line with Sutrisno and Ekaputra (2016) and Dimitrios (2020). In each size quantile, portfolios with high operating profitability show higher excess returns than portfolios with low operating profitability.

Meanwhile, for the 25 portfolios arranged based on Size-Inv in panel C, the stocks in this group have an excess return pattern that cannot be observed related to the size of market capitalization and increase in investment (Inv). Visualization of the excess return pattern in Panel C can be seen in Graph 4.3. The findings in this research are also in line with Sutrisno and Ekaputra (2016), for 25 portfolios arranged based on Size-Inv, the average excess return for low-capitalization and high-capitalization stocks does not appear to have a clearly captured pattern.

Model Performance Summary

The five-factor model is formulated in an equation as follows:

$$R_{it} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + r_p RMW_t + c_p CMA_t + e_{pt}$$

The regression results table below is divided into two parts, on the left are coefficients of the independent variables indicated by the letters a, s, h, r, c, and b. Meanwhile on the right is the t-statistic of the coefficients in the left side.

This study used a confidence level of 90%, with the t-statistic =>|1.697| produces significant regression results. In the table on the right that shows the t-statistic, it is labelled black to indicate a portfolio that is statistically significant.

Table 4
Regression for 25 Portfolios based on Size-B/M

BM	Low	2	3	4	High
			a		
Small	0,02	0,02	0,04	0,02	0,02
2	-0,03	-0,01	0,01	0,01	0,01
3	0,01	0,03	0,01	0,01	0,01
4	0,00	0,01	0,00	0,01	0,01
Big	0,00	-0,01	0,01	0,01	-0,02
			s		
Small	0,16	3,37	0,02	0,50	0,11
2	0,93	0,47	0,58	0,21	0,80
3	0,18	0,30	0,06	0,01	0,04
4	-0,22	-0,13	-0,05	-0,53	-0,46
Big	-0,43	-0,31	-0,63	-0,35	0,31

BM	Low	2	3	4	High
			t (a)		
Small	-0,86	0,49	2,25	1,34	2,18
2	-0,98	-1,27	0,98	1,26	1,07
3	0,58	1,83	1,12	1,53	0,93
4	0,18	0,96	0,34	0,78	0,72
Big	0,63	-0,56	0,72	0,44	-0,95
			t (s)		
Small	0,23	3,18	0,04	1,11	0,56
2	1,35	1,83	2,30	0,99	3,27
3	0,36	0,74	0,21	0,03	0,23
4	-1,10	-0,35	-0,22	-1,83	-1,45
Big	-2,46	-1,17	-1,97	-1,01	0,61

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	h				
Small	0,11	1,10	-0,38	0,26	0,25
2	0,14	0,54	0,23	0,50	0,65
3	-0,58	0,57	0,39	0,60	0,93
4	0,30	-0,03	0,57	0,73	1,49
Big	-0,15	0,59	0,61	1,39	0,91

	t (h)				
Small	-0,18	1,14	-0,81	0,63	1,45
2	0,23	2,34	1,00	2,58	2,96
3	-1,27	1,53	1,58	2,80	5,21
4	1,64	-0,08	2,92	2,75	5,19
Big	-0,91	2,48	2,10	4,47	1,97

	r				
Small	-1,14	0,44	-1,29	-1,18	0,30
2	-0,63	0,30	-0,67	0,13	0,13
3	-0,56	-0,32	-0,18	0,09	-0,20
4	0,20	-0,60	-0,12	-0,77	-0,05
Big	0,33	0,35	-0,16	0,12	-1,10

	t (r)				
Small	-1,08	0,28	-1,67	-1,76	1,04
2	-0,62	0,80	-1,78	0,40	0,37
3	-0,76	-0,53	-0,43	0,25	-0,70
4	0,66	-1,05	-0,38	-1,77	-0,11
Big	1,25	0,91	-0,34	0,24	-1,45

	c				
Small	-0,13	0,18	-0,58	-0,84	0,18
2	-0,93	0,11	-0,67	-0,06	0,11
3	-0,21	0,48	-0,15	-0,02	-0,19
4	0,21	-0,48	0,12	-0,72	0,03
Big	-0,04	0,19	-0,27	0,07	-1,10

	t (c)				
Small	-0,16	0,14	-0,95	-1,59	0,79
2	-1,15	0,37	-2,24	-0,24	0,39
3	-0,36	1,00	-0,48	-0,06	-0,82
4	0,89	-1,06	0,46	-2,09	0,07
Big	-0,19	0,62	-0,71	0,17	-1,84

	b				
Small	0,21	1,37	0,16	0,36	0,13
2	0,04	-0,08	0,08	0,00	0,00
3	-0,52	0,29	0,18	-0,12	-0,12
4	-0,11	0,07	-0,02	-0,02	-0,02
Big	0,08	0,08	-0,46	-0,30	-0,30

	t (b)				
Small	0,45	1,99	0,48	1,22	1,03
2	0,08	-0,46	0,47	-0,03	1,35
3	-1,59	1,11	1,01	-0,78	0,37
4	-0,87	0,26	-0,12	-0,12	-0,02
Big	0,67	0,49	-2,22	-1,33	1,29

adj R square: 0,1520874

Source: Results Processed by Researchers (2023)

In each sub table there are 5 x 5 rows and columns which show the regression results for each portfolio. Where for each row the first is the regression result from the smallest size stock portfolio and the fifth row is the regression result from the largest size stock portfolio. Meanwhile, the leftmost column of each sub table is the regression result of the stock portfolio with the lowest book-to-market and the rightmost column is the regression result of the stock portfolio with the highest book-to-market.

Table 5
Regression Results for 25 Portfolios based on Size-OP

OP	Weak	2	3	4	Rob
			a		
Small	0,01	0,01	0,02	0,02	0,04
2	0,01	0,00	0,00	0,01	0,01
3	0,00	0,02	0,00	0,01	0,02
4	0,01	0,00	0,00	0,00	0,01
Big	-0,04	0,00	0,00	0,01	0,01
			s		
Small	0,47	0,46	-0,35	0,37	1,35
2	0,09	0,36	1,19	0,24	0,71
3	0,25	-0,11	0,02	0,57	0,08
4	-0,29	-0,06	-0,26	-0,40	-0,19
Big	0,14	-0,15	-0,24	-0,13	-1,41
			h		
Small	0,14	0,18	0,43	0,05	0,35
2	0,21	0,37	0,36	0,25	1,00
3	0,61	0,21	0,80	0,55	0,53
4	0,55	0,66	0,73	0,55	0,56
Big	0,22	0,38	0,85	0,08	0,22
			r		
Small	-0,56	-1,14	0,16	0,00	-0,03
2	-0,34	-0,47	-0,43	-0,21	0,79
3	-0,22	-0,27	-0,40	0,12	0,03
4	0,02	-0,23	-0,78	0,30	-0,29
Big	0,06	-1,47	-0,32	-0,20	0,53
			c		
Small	-0,28	-0,77	0,38	0,04	-0,28
2	-0,14	-0,34	-0,47	-0,31	0,16
3	0,34	0,25	-0,26	-0,05	-0,22
4	0,15	0,03	-0,51	0,22	-0,46
Big	-0,30	-0,74	-0,18	-0,20	-0,38
			b		
Small	0,03	0,07	0,38	0,09	0,89
2	0,11	0,06	0,42	-0,02	-0,02
3	-0,03	0,45	0,01	0,02	0,02
4	-0,39	0,19	0,26	-0,08	-0,08
Big	0,38	0,08	-0,15	-0,22	-0,22

OP	Weak	2	3	4	Rob
			t (a)		
Small	-1,07	1,50	1,74	2,18	1,95
2	0,58	-0,51	0,13	0,92	0,64
3	0,08	1,39	-0,15	1,04	1,94
4	0,55	-0,49	0,01	-0,06	1,24
Big	-2,79	0,20	-0,40	0,81	1,00
			t (s)		
Small	1,54	1,79	-1,32	1,25	2,77
2	0,38	1,55	3,13	0,94	1,83
3	1,01	-0,35	0,08	2,00	0,28
4	-0,96	-0,26	-0,72	-2,29	-0,74
Big	0,34	-0,43	-0,82	-0,46	-4,48
			t (h)		
Small	-0,50	0,76	1,48	0,18	0,80
2	0,92	1,77	1,05	1,07	2,84
3	2,74	0,78	3,92	2,12	1,87
4	2,02	3,07	2,18	3,41	2,37
Big	0,58	1,19	3,13	0,32	0,78
			t (r)		
Small	-1,23	-2,96	0,37	0,01	-0,04
2	-0,92	-1,37	-0,76	-0,55	1,36
3	-0,60	-0,61	-1,20	0,28	0,07
4	0,04	-0,66	-1,44	1,13	-0,76
Big	0,10	-2,79	-0,74	-0,50	1,13
			t (c)		
Small	-0,77	-2,53	1,08	0,11	-0,48
2	-0,47	-1,25	-1,04	-1,02	0,34
3	1,18	0,70	-0,98	-0,13	-0,60
4	0,41	0,11	-1,18	1,04	-1,50
Big	-0,61	-1,76	-0,50	-0,62	-1,03
			t (b)		
Small	0,14	0,39	1,82	0,45	2,82
2	0,69	0,41	1,72	-0,12	0,40
3	-0,17	2,29	0,09	0,09	-0,34
4	-2,03	1,20	1,07	-0,70	0,84
Big	1,44	0,35	-0,77	-1,24	1,58

adj R square 0,14722

Source: Results Processed by Researchers (2023)

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Table 6
Regression Results for 25 Portfolios based on Size-Inv

Inv	Cons	2	3	4	Aggr	Inv	Cons	2	3	4	Aggr
		a						t (a)			
Small	0,02	0,03	0,01	0,03	0,02	Small	-1,79	2,02	0,59	1,55	2,05
2	0,00	-0,01	0,01	-0,01	0,00	2	0,30	-0,50	0,75	-1,06	0,18
3	0,01	0,00	0,01	0,01	0,02	3	1,10	0,67	0,90	0,94	1,84
4	0,01	0,01	-0,01	0,00	0,01	4	1,51	0,62	-0,75	-0,26	0,89
Big	0,00	0,03	0,00	0,00	0,00	Big	-0,40	2,27	0,25	-0,26	0,26
		s						t (s)			
Small	0,45	0,36	1,87	0,18	0,10	Small	1,27	0,88	3,52	0,39	0,32
2	0,86	0,32	0,27	-0,05	0,59	2	2,69	1,01	0,82	-0,23	2,85
3	-0,05	0,33	-0,33	0,38	0,11	3	-0,16	2,04	-1,26	1,27	0,38
4	-0,25	-0,16	-0,26	-0,34	-0,27	4	-1,08	-0,50	-1,16	-1,47	-0,96
Big	-0,48	-0,46	-0,14	-0,53	-0,35	Big	-2,51	-1,16	-0,58	-1,46	-1,31
		h						t (h)			
Small	0,27	0,73	0,57	-0,50	0,04	Small	-0,84	1,96	1,19	-1,16	0,13
2	0,68	0,44	0,33	0,50	0,50	2	2,34	1,55	1,10	2,58	2,63
3	0,56	0,48	0,18	0,54	0,68	3	2,20	3,29	0,76	1,99	2,48
4	0,71	0,42	0,14	0,28	0,77	4	3,37	1,46	0,69	1,34	2,98
Big	0,58	-0,32	0,12	0,22	0,47	Big	3,36	-0,88	0,54	0,69	1,93
		r						t (r)			
Small	-0,51	0,32	-0,14	1,58	-0,93	Small	-0,97	0,52	-0,18	2,24	-2,02
2	-0,24	-0,42	0,05	0,34	0,17	2	-0,49	-0,89	0,11	1,07	0,57
3	-0,10	0,07	-0,51	0,37	-0,17	3	-0,24	0,28	-1,31	0,85	-0,37
4	-0,02	-0,14	-0,02	-0,32	-0,70	4	-0,04	-0,31	-0,06	-0,95	-1,64
Big	0,05	0,45	0,17	-0,17	-0,12	Big	0,17	0,75	0,46	-0,32	-0,31
		c						t (c)			
Small	-0,32	0,86	-0,39	1,25	-0,73	Small	-0,76	1,77	-0,62	2,24	-2,00
2	-0,44	-0,46	-0,01	0,23	0,06	2	-1,18	-1,25	-0,03	0,94	0,23
3	-0,19	0,20	-0,50	0,33	0,12	3	-0,59	1,05	-1,63	0,95	0,34
4	-0,06	0,04	-0,22	-0,20	-0,43	4	-0,21	0,11	-0,83	-0,74	-1,28
Big	-0,26	0,20	-0,02	-0,23	-0,09	Big	-1,16	0,44	-0,07	-0,53	-0,30
		b						t (b)			
Small	0,43	0,10	0,62	0,08	0,24	Small	1,86	0,39	1,81	0,27	1,18
2	0,15	0,32	0,11	-0,03	-0,03	2	0,71	1,56	0,54	-0,24	0,19
3	0,00	-0,06	-0,06	0,02	0,02	3	0,02	-0,58	-0,34	0,08	0,74
4	0,04	0,28	0,20	0,10	0,10	4	0,28	1,35	1,39	0,70	0,30
Big	0,10	-0,07	-0,42	-0,18	-0,18	Big	0,83	-0,28	-2,61	-0,75	0,40

adj R square 0,112996121

Source: Results Processed by Researchers (2023)

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Regression results for 25 portfolios compiled based on Size-BM show that there are three significant intercepts in the Fama-French five-factor asset pricing model. The size factor (SMB) has 7 coefficients which show significant values at the 90% confidence level. But there is no observable pattern for the SMB coefficients. In the HML factor there are 12 coefficients that show significant values. The HML coefficient has a positive correlation with increasing the portfolio's book-to-market ratio. The HML coefficient is statistically significant for portfolios with larger stocks sizes and those with high profitability. There are 3 significant RMW coefficients and 3 significant CMA coefficients. Based on observations in table 4, no pattern can be found for the RMW and CMA coefficients. Thus, it can be concluded that the RMW and CMA factors have minimal influence on the excess return of stock portfolios on the Indonesia Stock Exchange. The market risk premium factor (Rmt – Rft) has 2 coefficients that show significant values. The average adjusted R2 of the 25 Size-B/M portfolios is 0.1521.

The regression results for 25 portfolios arranged based on Size-OP in Table 5 show that 5 of the 25 portfolios have significant intercepts at the 90% confidence level. The size factor (SMB) has 7 significant coefficients. No explanatory pattern can be observed for the SMB coefficients. There are 12 significant coefficients of the book-to-market capitalization (HML) factor. The HML coefficient does not have an insignificant influence pattern on portfolios according to size and profitability. Meanwhile, there are only 2 significant RMW coefficients and 2 significant CMA coefficients. From these results, no pattern can be found for the RMW and CMA coefficients. Thus, it can be concluded that the RMW and CMA factors have minimal influence on the excess return of stock portfolios on the Indonesia Stock Exchange. The market risk premium factor (Rmt – Rft) has 5 coefficients with significant values. The average adjusted R2 for the 25 Size-OP portfolios is 0.14722.

Three of the 25 portfolios arranged based on Size-Inv in table 6 have significant intercepts at the 90% confidence level. Meanwhile, 5 of the 25 portfolios arranged based on size factors (SMB) were categorized as statistically significant. The SMB coefficient decreases with size (market capitalization). The HML factor has 12 coefficients which are categorized as significant at the 90% confidence level. Observing the pattern of significant HML coefficients shows that there is no clear pattern. Meanwhile, RMW only has 2 significant coefficients, and CMA only has 3 significant coefficients. The influence of the RMW and CMA factors on the excess return of stock portfolios on the Indonesia Stock Exchange is weak. The market risk premium factor (Rmt – Rft) has k

The table below (Table 8) shows a detailed summary of statistically significant the independent variables in predicting excess returns.

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Table 8. Summary of Comparison of Significant Coefficients of Independent Variables

The number of coefficients that are statistically significant (90%) t-value=>|1.697|				
Independent Variable	This research Examining all shares on the Indonesian Stock Exchange during the Covid-19 pandemic period (2020-2022)	Sutrisno and Ekaputra (2016) Examining all shares on the Indonesian Stock Exchange in the 2009-2016 period	Fama and French (2015) Examining stocks on the NYSE, AMEX, and NASDAQ for the period July 1963 – December 2013	Dimitrios (2020) 22 developed countries except the US in the period November 1990 to December 2019
SMB (Size-BM)	7	13	n/a	n/a
SMB (Size -OP)	7	17	n/a	n/a
SMB (Size -Inv)	5	14	n/a	n/a
HML (Size -BM)	12	12	23	23
HML (Size -OP)	12	13	20	17
HML (Size -Inv)	12	14	21	21
RMW (Size - BM)	3	7	23	9
RMW (Size -OP)	2	7	24	20
RMW (Size -Inv)	2	6	20	9
CMA (Size -BM)	3	3	24	20
CMA (Size -OP)	2	4	18	7
CMA (Size -Inv)	3	8	25	20
Mean Adj R^2 (Size -BM)	0,1521	0,2613	n/a	n/a
Mean Adj R^2 (Size -OP)	0,1472	0,2543	n/a	n/a
Mean adj R^2 (Size -Inv)	0,1130	0,2736	n/a	n/a

Source: Results Processed by Researchers (2023)

5. CONCLUSION

The results of descriptive statistics conclude that the average excess return of stock portfolios on the Indonesia Stock Exchange increases in conjunction with the increase in operating profit and the excess return decreases with the increase in market capitalization size. This is in line with the findings of Fama and French (2015), that stocks with small capitalization produce higher returns compared to stocks with large capitalization. Meanwhile, in this research, the pattern of book-to-market and investment variables cannot yet be observed.

Simultaneously, the independent variables of the Fama and French Five Factor Models have a weak influence on the excess returns of stock portfolios on the Indonesian Stock Exchange during the Covid-19 period.

The five factors Market (Rm-Rf), Market capitalization (SMB), Book to Market (HML), Profitability (RMW), and Investment have a decreasing influence on the conditions of the COVID-19 pandemic compared to the normal year period 2009-2016. This can be seen from the mean adj R2 which decreased from 0.2613 to 0.1521 on 25 Size-BM portfolios; Adj

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R2 decreased from 0.2543 to 0.1472 on 25 Size-OP portfolios. Meanwhile, adj R2 decreased from 0.2736 to 0.1130 on 25 Size-Inv portfolios. According to Chin (1998) R Squared >0.33 is considered weak. So the five factors in the Fama French model have a weak influence on excess returns both before the pandemic and during the pandemic.

Based on the t - test performed in this research, the Book to Market (HML) factor has a greater influence than other variables. However, there is no pattern that can be observed between Book to Market and 25 stock portfolios arranged based on Size-BM, Size, OP, and Size-Inv.

It is recommended that further research perform empirical testing of excess return calculations using the Fama - French Six Factor Model considering that the momentum factor has the potential to have an influence in crisis periods such as the Covid-19 pandemic. In addition, it is recommended to test excess returns using 2x2 portfolio sorting in the Fama - French Six Factor Model test.

For investors, this research finds a pattern that on the Indonesian Stock Exchange the average excess return of stock portfolios increases with the increase in operating profit and the average excess return decreases with the increase in market capitalization size. So, investors are advised to invest in stocks with the highest operating profitability with the lowest market capitalization size to obtain higher returns. In this research, it was found that these two criteria had the highest portfolio excess returns compared to other portfolios.

The Fama – French Five Factor Model has a weak ability to explain the excess returns of stock portfolios on the Indonesia Stock Exchange during the Covid-19 pandemic period. So, in situations with similar characteristics this model can be used in the following eight portfolios:

1. Portfolio with the second largest size and second highest book-to-market
2. Portfolio with the largest size and highest book-to-market
3. Two portfolios with the smallest size and the strongest operating profit. The portfolio with the second smallest size and the strongest operating profit.
4. Four portfolios, namely the portfolio with the smallest size with the most aggressive investment quantile, the second most aggressive investment quantile, the third most aggressive investment quantile, the fourth most aggressive investment quantile.

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