

# THE LINKING OF THE FAMA FRENCH FIVE FACTOR AND ENVIRONMENTAL PERFORMANCE ON MARKET VALUE

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Received 15.04.2024. | Sent to review 28.04.2024. | Accepted 30.08.2024.

Original article



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**JEL Classification:** F65, G38, L25

**Doi:** 10.2478/eoik-2024-0020

**UDK:** 005.336.4:658.14/.17

## ABSTRACT

The pharmaceutical industries are crucial for the nation's health and economy; therefore, their performance must be maintained. When they obtain the more successful performance indicators that can sway investors to raise their confidence as well as market value. This study aims to examine the effect of the Fama-French five factors and environmental performance on share returns. This was conducted on pharmaceutical industries listed on the Indonesia Stock Exchange, and all data was obtained from annual-quarterly reports in the period 2017–2023. A total of 196 panel data observations have been conducted, and the analysis technique has employed quantitative approaches, notably autoregressive distributed lag analysis, of time series data. The results showed that market risk premium (MRP), firm size (SMB), profitability (RMW), and environment performance (EP) have a significant impact on share returns (SR), while firm size (SMB) and book value to equity (CMA) have not been significant statistically. The study is important for a variety of stakeholders, including managers, investors, and policymakers, who are interested in resolving the financial and environmental performance of pharmaceutical companies and preserving market prices by establishing mitigation strategies related to the specific factors. However, this study has limited relevance to the presence of F-F five factors and environmental performance that cannot maximally encourage the disclosure of market value.

**Keywords:** *financial performance, environmental, market risk, firm size, book value, profitability, market value*

## 1. INTRODUCTION

In recent years, especially since COVID 19, the Indonesian pharmaceutical industry has grown rapidly as one of the most promising industries among the key sectors of the nation's health. This effort can make a huge contribution to the well-being of social welfare and include companies in terms of revenue and profit generation to boost financial performance. The achievement of that pharmaceutical industry is such that all environments have a fleet of their field force operating at various levels of hierarchy due to the scale of the business of medicines and their market value. However, since 2022, the performance of these companies has decreased due to competition, notably lots of imports. Several big companies, like KLBF, SIDO, and KAEP, were recorded to have declined significantly by 15.55%, 25.83%, and 27.65%. (Dermawan, R., & Wahyu, 2024). This phenomenon encourages the author to conduct research on the factors

that influence the market's performance.

Understanding the relationship between financial and environmental performance, including share price and return, is important in addressing and promoting sustainability in business practices. Companies that prioritize financial and environmental performance may be motivated to disclose as a means of demonstrating their commitment to their environmental responsibilities. This disclosure can enhance their reputation, attract socially responsible investors, and mitigate potential risks associated with environmental regulations. A company with better financial and environmental performance may have the resources and capabilities to invest in sustainable businesses, leading to a rise in market value.

To evaluate the companies' performance based on pre-established the F-F five indicator and environmental factors relating to share price establishments are intended to be investigated, which will be useful for managers, equity investors, and researchers. The F-F five factor model is a development of the F-F three factor model by adding two indicators, namely profitability and investment. (Fama, E., F., and French, K., R., 2015). These factors, which include market risk, firm size, book-to-market equity, profitability, and investment, are commonly used to analyze portfolio financial performance, but in pharmacy firms, this is a new topic, especially if environmental disclosure is added, which is thought to influence. Hence, the relationship between the F-F five factor and environmental disclosure with share prices and returns is interesting to examine. Further, environmental disclosure has become increasingly important in assessing the impact of businesses and can influence their company image and market valuation.

Some companies have a compelling connection between the implementation of management systems and a host of environmental and financial advantages (Lyulyov and Oleksii, 2023). There is some previous research conducted, as in Kubota, K., and Takahera, H. (2018), which implies that beta has a significant effect on stock returns and has been used as an indicator of returns in the CAPM. Dominic, H., and Yung, L., W. (2021) found that all of the beta model parameters are insignificant. Isthiaq, M. et al., (2019) mention that firm size does not have a significant influence on stock returns. According to Li Linfeng and Suwei, E. (2022) and Ragab, N. S. et al. (2020), the value of a company has a significant effect on stock returns. The study by Sun Yi (2021) reveals that profitability has no effect on returns. Furthermore, a study by Kubota, K., and Takahera, H. (2017) concluded that investment has no influence on stock returns. However, these studies are used by different companies as research objects with various results and provide a comprehensive understanding of the factors influencing environmental performance, but further research is needed to specifically examine the impact of the F-F five factor model.

Considering the above issues, the topic of determinants of the F-F five factor and environmental performance on market share returns is necessary to be studied. This study can be summarized as follows: Recently, the literature on the analysis of the joint causal impact among the relationship factors has been limited, and from a theoretical perspective, it will expand the current literature comprehensively. This study employed the autoregressive distributed lag (ARDL) test method as a dynamic test method in econometrics. The ARDL test model is a combination of auto-regressive (AR) and distributed lag (DL) models. The advantage of using the ARDL test model is that the stationary of the data can be different. In estimating the ARDL model in this study, independent variables were used, namely market risk MRP, SMB, HML, RMW, CMA, EP, and SR. To analyze the long-term series data, the Johansen cointegration and vector autoregressive models were used.

This study focuses on the consequences of meeting expectations and requires a measure of information realization, particularly in the realm of financial and environmental performance issues and market price dynamics. Hence, it offers valuable insights for corporate organizations

in Indonesia by examining the model of these variables that should be taken into account when analyzing the determinants of stock price fluctuations, which provides inspiration for firms to formulate a mitigation strategy and improve the company's performance.

Based on the previous elucidation, this paper attempts to contribute by investigating the relationship between F-F five factors, environmental disclosure, and share market prices of pharmacy firms. The robustness analysis is prepared by discussing the relationship between these factors and exploring the effect in the model, as well as focusing on the consequences of meeting the relationship among these expectations of the evidence of the investigation results. Thus, it will mainly answer the following questions: Does F-F five factors and environmental performance affect the share prices and returns of Indonesia's pharmacy firms?

The rest of this paper is as follows: In Section 2 will describe the literature review and propose research hypotheses. Section 3 explains the research method and data sources. Section 4 gives the empirical results. Section 5 presents and discusses the main results. Finally, Section 6 will be prepared to conclude.

## 2. LITERATURE REVIEWS

The formation of theories defining nature resulted in the establishment of flexible pricing models, which are widely applied in capital markets (Laubscher and Eugene, 2001). The analysis of sustainable financial practices highlights the crucial interaction between financial management and environmental preservation (Sayan, S. et al., 2023). Prospect theory and the role of behavioral finance that describe investment decisions in imperfect capital markets are presented to the perfect market efficiency (Hodnett, K. 2012). The capital market theory contains some of the most interesting applications of probability and optimization theory (Merton, R. 1991). The role of the financial market, was designed by economists and investors aimed at identifying patterns in average stock returns (Chikwira, C., Jahed M., 2023). One of the roles of accounting is to provide information on business performance, either through financial accounting indicators or otherwise. (Boaventura et al., 2012). The results of the company's financial performance assessment can be used as a guideline to follow (Yuniningsih et al., 2018). The environmental performance index is a tool that ranks the sustainability of states worldwide with the help of different indicators and ecosystem vitality (Singh, A.N., and Shenu Sharma, 2023). For determining the environmental performance of industrial systems from a life cycle perspective, the calculation method of environmental analysis can also be employed (Burhan et al., 2018). Then, signaling theory provides the opportunity to integrate and interact with symbolic communication and social benefits. It explains job market behavior and helps explain financial performance information for principles and managers (Reutzel, C., R., 2007).

### 2. 1. FAMA FRENCH FIVE FACTORS.

The Fama French three-factor model, which includes market risk premium, size, and equity value, has been expanded to the Fama French five factor model, which adds profitability and investment factors (Thangaiyarkarasi, N., and Vanitha, S., 2021). This expansion has been supported by empirical evidence, providing a better explanation for market prices or stock returns. Although the adjusted F-F five factors captured more returns than the F-F three factors, there was only a slight improvement in the predicting power of the model (Nsibande et al., 2023). The significance of the additional factors, suggests that the three-factor model may still be sufficient for explaining stock returns (Griffin, C., and Lemon, M. 2002). That applicability was determined to be more successful than other traditional asset pricing models in explaining stock returns (Tzu Lun, H., 2019). The usefulness of that is to predict the excess return of stocks (Wijaya, L.I. et al., 2018). Hence, this model includes factors of market risk premium, size, book-

to-market equity, profitability, and investment.

## 2. 2. SHARE RETURNS

As is known, the importance of financial and environmental performance is related to the return on shares. The F-F five-factor model has a higher explanatory power in describing the stock returns of the portfolios formed (Altinay, A.T. et al., 2023). In particular, the size and book-to-market ratio, have been found to have a significant effect on stock returns (Bambang, S., and Moch Irsyad., 2011). This model has been found to have limited explanatory power in emerging markets. Additionally, the variables of profitability and investment are not always explanatory for manufacturing companies, therefore, the asset pricing model failed to explain the returns. Scholtens, B., and Focko, V. D. G. (2014) indicate the influence of environmental on stock market returns, with a positive effect in most industries. These factors have been shown to contain more information for future stock returns than traditional financial variables (Panopoulou et al., 2014). The underlying concept of financial capital circulation is based on achieving the most attractive rates of return for its investors. (Mike, D. 2013).

## 2. 3. ENVIRONMENT PERFORMANCE

The Environmental Performance Index provides a data-driven summary of the state of sustainability around the world. In general, the measurable outcome of an environmental management system is related to the aspect of performance (Alqudah, M.N.K., and Yusof 2024). The existence of legitimacy theory requires all companies to participate in preserving the environment by disclosing related issues. Environmental performance is a result obtained from the measurement of the management system's controls on environmental aspects based on assessments and policies. As a response to the weakness of the command and control program to support the agenda of economic development and sustainability in the environment, in 1995, the Government of Indonesia launched PROPER as a program for pollution control, evaluation, and rating (Sofik, H. 2018). The basic idea of PROPER is to use public disclosure of firms' environmental indicators as a substitute for enforcement (Gracia, J.H. et al. 2009).

## 2. 4. HYPOTHESIS DEVELOPMENT

### 2. 4. 1. EFFECT OF MARKET RISK PREMIUM ON SHARE RETURNS.

The market risk premium, as estimated by De Beer, J. (2008), has been found to vary over time and is influenced by factors such as interest rates and risk proxies. Todorov, V. (2007) explores this variation, identifying a significant increase in investors' willingness to pay for protection against jumps in the market. The market risk premium shows the demand by investors to assume average stock risk. This can be measured by the extent to which the stock tends to move up or down following the market (Handayani, Farlian, and Ardian 2019). Beta equal to 1 explains that there is a relationship: if market returns move up and down, securities or portfolio returns also move as much as the following market returns (Hartono, J. 2014). For the risk premium, find that down streams is closely related to supply-side risks (Branger et al. 2023). If the market rewards firms for meeting expectations, it will be reflected in a share market risk premium (Kasznik and McNichols 2002)

Some previous studies have been conducted. (Kassimatis, 2011) found that stocks with low downside risk in bear markets and high upside potential in bull markets demand a premium. This is supported by Madsen, J., and Ratbek, D. (2012), who showed that the equity risk premium and required share returns are closely related. However, the calculation of the market risk premium can be challenging due to the instability of betas and volatilities. (Zhao, Y., 2009), further explored the relationship between stock market returns and volatility, finding that the mar-

ket risk premium is influenced by various market state variables. Thus, the following hypothesis is proposed:

*Hypothesis 1.: Market risk has a significant effect on share returns.*

#### 2. 4. 2. EFFECT OF FIRM SIZE ON SHARE RETURNS.

Market capitalization, or size, is a key indicator of a company's value, influenced by various factors. (Irina et al., 2023) emphasize the importance of effective management and strategic goals in determining market capitalization in the various sectors. (Reinganums, M. 2009) highlights the significance of market capitalization in portfolio management, suggesting that flexibility in capitalization exposure can enhance returns that also move up and down as much as following market returns (Hartono, J. 2014). The market capitalization can be obtained from the calculation of stock prices multiplied by the number of shares issued in that year (Art 21 Racmawati 2021 n.d.). The size of F-F research is measured using market capitalization, which can be obtained from the calculation of stock prices multiplied by the number of shares issued in a certain year. (Chandra, T. 2015). Thus, this capitalization shows the size of the company. In the theory of size effects, small-value stocks with small capitalization have an average historical return that is higher than the market portfolio. In addition, small stocks with high market risk, tend to provide a high return (Merton, R, 2014).

Firm size can be seen as a crucial component of capital structure due to its ability to serve as an indicator of a company's sustainability, and it also justifies the size impact on probability and market value (Diantimala et al., 2021). A study demonstrates that firm size influences market share performance favorably in developed countries that have established strong financial or economic systems (Siagian, P. 2023). Further, a diagnostic examination revealed that panel data violated that among financial variables, firm size has a significant negative impact on the market price of equity shares (Art 14 Plus FF Kumar 2023 n.d.). The study by Helia, S. et al. (2020) found a negative effect, with smaller firms outperforming larger ones. Leledakis, G.N., et al. (2004) support the inverse relationship between small, highly leveraged companies. Based on the above arguments, the author proposes the second hypothesis as follows:

*Hypothesis 2.: Firm size has a significant effect on share return.*

#### 2. 4. 3. EFFECT OF BOOK-TO-MARKET EQUITY ON SHARE RETURNS.

The book-to-market equity ratio as a key factor in stock performance has been extensively studied. In the asset pricing literature, this ratio is an important proxy for systematic risk in estimating risk-adjusted returns, and as a measure of systematic risk (Art 10 plus FF Cheng Ho Kung 2022 n.d.). While the market value shows the product of the number of shares outstanding with the close price of each company. The book value per share shows the net assets owned by the shareholders. Where net assets are equal to total shareholders' equity (Art 19 Hartono 2014 n.d.). Griffin, C.M., and Michael. (2022) explored this relationship, noting that the difference in returns between high and low book-to-market securities is particularly significant in firms with high distress risk.

Bali et al. (2009) found a strong correlation between this ratio and stock returns, attributing it to unobserved risk factors and market leverage. The diagnostic testing revealed that price to book value and book value per share have a significant positive impact on market price shares (Kumar, P. et al., 2023). Research revealed that all the financial variables, among others book value, have a positive and significant impact on the market price of shares. (Yadaf, S., 2023). The results of the valuation ratios, namely market-to-book value and enterprise value multiple, exhibit a positive and significant relationship with the share prices. However, a study by (Laurens and Mulyani 2022) justifies that price-to-book value has no impact on stock returns. According to

this concept, the following hypothesis is:

*Hypothesis 3.: Book-to-market equity has a significant effect on share returns.*

#### **2. 4. 4. EFFECT OF PROFITABILITY ON SHARE RETURNS.**

Profitability is a key measure of a company's success and efficiency (Muhamad, N., 2011). For the industrial sector, profitability is crucial for survival and growth, and is often assessed using performance indicators such as interest spread and return on assets (Almaskati, N., 2022). Profitability describes the level of profit of companies whose measurements use the ratio of return on equity (ROE), namely by comparing net profit before tax with shareholder equity. It is influenced by various factors, including liquidity, efficiency, and firm size (Geovanni, A., and Chandra, K.S., 2019). (Art 62 FF five n.d.) use operating profit in defining profitability measures. When evaluating the potential impact on profits to optimize favorable results (Lyulyov et al. 2023).

In this context, numerous studies have been conducted. A study by Wardhani, R.S. et al. (2019) shows that some proxies of profitability, like ROI, ROE, EPS, and DER, partially did not affect stock returns. By using regression models, it was found that profitability and earning per-share has a significant effect on the share market price (Art 15 FF Sarita Yadaf, (2023) n.d.). Likewise, based on the results of the panel data regression model. it indicates that, beside economic value added, profitability and EPS have negative impact on share prices. (Art 16 FF Bachtiar usman, (2019) n.d.). Regarding the above explanation, the next hypothesis, is prepared:

*Hypothesis 4.: Profitability has a significant effect on share returns.*

#### **2. 4. 5. EFFECT OF INVESTMENT ON SHARE RETURNS**

Investment, as defined by Kort, P. M., and Pawlina (2004), involves incurring an immediate cost with the expectation of future rewards. This concept is further explored by (Fitriasuri and Simanjuntak, 2022) who identify factors influencing investment intentions, including the capital market, investment, and the benefits of investing in equities. The company's investment is measured based on the growth rate of total assets from the fiscal year. (Sudyatno et al., 2011). Conservative minus aggressive is the differentiation every month between the average return on two portfolios with conservative investment and the average return on two portfolios with aggressive investment (Bambang, S. et al., 2016).

The previous studies have been conducted. Asset investment plays a special role in cross-sectional asset pricing, and these variables themselves are associated with significant return premiums (Timothy Clue and Jin Karen Xu., 2022). When firms plan to expand their business through investment, they should focus on investing in assets related to their core business as a priority (Than, V.H., 2021). Although firms that increase investments tend to have high past returns and often issue equity, the relationship indicates a negative abnormality in long-term return reversals and equity issue anomalies. (Sheridan, T. et al., 2009). The most important thing is to develop and earn money commensurate with their objectives. They need to make the investment prudently to gain a profit and raise the market price. (Al-Hmerawee and Slim, 2024). Hence, the researcher makes the related hypothesis as follows:

*Hypothesis 5.: Investment has a significant effect on share returns.*

#### **2. 4. 6. EFFECT OF ENVIRONMENTAL PERFORMANCE ON SHARE RETURNS**

To encourage the adoption of harnessing the environmental and financial advantages, the government can implement a multifaceted policy approach (Lyulyov et al. 2023).

Companies that have good environmental performance goals will focus on disclosing carbon

emissions or will focus on voluntary disclosure. The environmental performance index must be related to and based on the effectiveness of the PROPER program in detail (Isthiaq et al., 2019). The quality of environmental reporting has also been linked to factors like the environmental audit committee and corporate governance (Moalla, M. et al., 2020). To explain the environmental performance of countries, democracy and social policy have a significant contribution. (Almeida, T., and Isabel, M., 2016).

Research on the relationship between environmental performance and share returns yields mixed results. The studies by Budiarto, R. (2020), and Reinganum, M. (2009) both find a positive impact of return on share equity. However, Misy, M. (2019) did not find a significant relationship. These conflicting findings suggest that the impact of environmental performance on share returns may be influenced by other factors, such as industry- or company-specific characteristics. Based on the above explanation, the last hypothesis in this study is as follows:

*Hypothesis 6.: Environmental has a significant effect on share returns.*

### 3. RESEARCH METHODS

This research is classified as basic research that was conducted specifically on pharmaceutical industries listed on the Indonesia Stock Exchange. The highlight of the methodological considerations related to analyzing the impact of the F-F five factors model and environmental performance (EP) on share return. Hence, this study includes discussions about data sources, measurements, and examination methods of the relationship between these factors. The type of data used is quantitative data involving time series and cross-section, also called panel data. It was obtained from pharmaceutical companies listed on IDX for the years 2017 to 2023, quarterly. The purpose of this research is to analyze the determination of F-F five factors, i.e., beta coefficient as a measure of market risk (MRP), firm size (SMB), book-to market value (HML), profitability (RMW), and investment (CMA), including EP as the independent variables and share return as the dependent variable. In the F-F five factor model, profitability and investment were added, as formulated below (Fama, E., F., and French, K., R. 2015).

Variables of MRP, SMB, HML, RMW, and CMA were obtained by constructing portfolios from sample data.

Table 1. Formulation of a portfolio by:

$$R_p + R_{fr} = \alpha + b(RM - R_f) + bSMB + bHML + bRMW + bCMA + e \quad (1)$$

Where:

$R_p$	: Return on portfolio.
$R_{fr}$	: Return free risk.
$\alpha$	: Constanta.
RPM	: Market Risk Premium, or $RM - R_f$ . (Excess return on the market portfolio - market risk).
SMB	: Size premium (Small Minus Big).
HML	: Value premium (High Minus Low).
CMA	: Conservative Minus Aggressive.
$b$	: Coefficient regression factor.
$\epsilon$	: Error term.

Table1: Operational definition of research variables

Variables	Definition	Formula
Share Return	Share returns are obtained from the difference between stock returns and the average risk-free rate	SR = ASR – RF Share Return = Average Share Return– Risk Free Rate.
Market Risk Premium (MRP)	MRP is the return spread between the capitalization-weighted stock market and cash	MRP = RM - Rf Beta = Return of Market – Risk Free
Firm size (Small Minus Big/SMB)	SMB is the return spread of small minus large stocks (i.e. the size effect)	$SMB = \frac{SMB \frac{B}{M} + SMB \frac{O}{P} + SMBINV}{3}$
Value (High Minus Low/HML)	HML is the return spread of cheap minus expensive stocks (i.e. the value effect)	$HML = \frac{(SH + BH) - (SL + BL)}{2}$
Profitability (Robust Minus Weak/RMW)	RMW is the return spread of the most profitable firms minus the least profitable	$RMW = \frac{(SR + BR) - (SW + BW)}{2}$
Investment (Conservative Minus Aggressive/CMA)	CMA is the return spread of firms that invest conservatively minus aggressively	$CMA = \frac{(SC + BC) - (SA + BA)}{2}$
Environmental Performance	Environmental performance is called as the Program for Pollution Control, Evaluation and Rating (PROPER)	Gold is excellent : 5 Green is good : 4 Blue is adequate : 3 Red is poor : 2 Black is very poor : 1

Sources: prepared by author

Based on that objective, this is a causal research type because it was conducted to examine the effect of exogenous and endogenous variables, both partially and simultaneously.

The auto-regressive distributed lag (ARDL) test method is a dynamic test method in econometrics. The ARDL test model is a combination of auto regressive (AR) and distributed lag (DL) models. The advantage of using the ARDL test model is that the stationarity of the data can be different, but there is no data that is stationary at the second difference. In estimating the ARDL model in this study, independent variables were used, namely RPM, SMB, HML, RMW, CMA, and EP, as well as SR as dependent. Furthermore, this study employed Johansen cointegration and vector autoregressive models to analyze the long-term series data, specifically focusing on the volatility of the share return.

Based on equation 1, the equation for the ARDL model can be expressed for each variable in the following manner:

$$\Delta SR = \alpha_0 + \sum_{i=1}^n \beta_1 \Delta \ln MRPt_{-i} + \sum_{i=1}^n \beta_2 \Delta \ln SMBt_{-i} + \sum_{i=1}^n \beta_3 \Delta \ln HMLt_{-i} + \sum_{i=1}^n \beta_4 \Delta \ln RMWt_{-i} + \delta_1 \Delta \ln RMPt_{-i} + \delta_2 \ln RPMt_{-i} + \delta_3 \ln RMPt_{-i} + \delta_4 \ln RMPt_{-i} + \delta_4 \ln RMWt_{-1} + \epsilon_t$$

The hypothesis of the bound test can be expressed as:

**H0:**  $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$

**H1:**  $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0$

The significant effect of each independent variable on the dependent variable individually will



be examined with a probability rate less than 5%, with degrees of freedom (n-k-1), where n is the number of observations, and k: number of independent variables.

The hypothesis tests are carried out using the following formula:

$$t - count = \beta n / S\beta n$$

Where:

- T : The following function t with degrees of freedom (df)
- Bn : Coefficient of regression of each variable
- Sβn : Standard error of each variable.

## 4. RESULTS

The outcomes of this study that derived from the previous research method performed will elucidate in this section subsequently.

### 4. 1. DESCRIPTIVE STATISTIC OF RESEARCH VARIABLES

Table 2: Descriptive statistic of research variables

Out put	SR	RM	SMB	HML	RMW	CMA	EP
Mean	0.03187	-0.051904	0.041625	0.214779	0.335742	0.088642	2.263533
Median	0.039550	-0.0465	0.067350	0.191800	0.315600	0.066100	2.362150
Maximum	0.089300	0.050600	0.117000	0.483200	0.578200	0.295100	2.714300
Minimum	-0.5883	-0.2309	-0.4916	0.150600	0.225700	0.035200	1.714200
Std. Dev.	0.0297	0.04829	0.017731	0.076775	0.077080	0.059155	0.442408
Skewness	-4.420758	-0.736051	-4.082735	2.498136	1.207910	2.073272	-0.242215
Kurtosis	21.08290	3.368463	19.11803	8.633118	5.051707	7.358424	1.303134

Sources: eviews output

The above Table 2 shows the outcomes of each research variable conducted, where the share return (SR) variable has a lower limit or minimum value of -0.5883; the upper limit or maximum value stands at 0.0893 (8.93%); and the average value is 0.03187 (3.28%). The environmental performance (EP) factor has a minimum value of 1.7142, a maximum value of 2.7143, and an average value of 2.2635, accompanied by a standard deviation of 0.4424. Similar methods can be conducted for each variable to describe these measurements. All the data indicate that the mean values are greater than the standard deviation. These conclusions conclude that, within the scope of this study, these variables did not exhibit a significant level of variation.

### 4. 2. STABILITY TEST

To examine data stationarity in ARDL analysis, the augmented dicky fueller (ADF) can be used. This test indicates the existence of a unit root as a null hypothesis. Based on the output of stationarity analysis at the data level using the ADF Test, it shows the following results:

Table 3: Test unit root - 1<sup>st</sup> difference

Method	Statistic	Prob.**
ADF - Fisher Chi-square	107.575	0.0000
ADF - Choi Z-stat	-5.76468	0.0000

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi - square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(UNTITLED)

Series	Prob.	Lag	Max Lag	Obs
D(SR)	1.0000	3	6	24
D(RMRF)	0.0013	2	6	24
D(SMB)	0.0302	0	6	24
D(HML)	0.0001	0	6	24
D(RMW)	0.0000	0	6	24
D(CMA)	0.0000	1	6	24
D(EP)	0.0008	0	6	24

Sources: eviews output

Table 3 indicates that, those P-values are less than 0.05, for all variables are stationary in the first difference data, the ARDL analysis can be continued.

### 4. 3. COINTEGRATION TEST

The next step is the cointegration – or Johansen test to know the suitable model criteria used.

Table 4: Unrestricted Cointegration Rank Test

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.956516	68.97801	46.23142	0.0000
At most 1 *	0.939645	61.76536	40.07757	0.0501
At most 2 *	0.871201	45.08897	33.87687	0.0816
At most 3	0.476347	14.23239	27.58434	0.8063
At most 4	0.363253	9.930422	21.13162	0.7512
At most 5	0.186533	4.541897	14.26460	0.7982
At most 6	0.012250	0.271170	3.841466	0.6025
Max-eigenvalue test indicates 3 cointegrating eqn. (s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Sources: eviews output

Regarding the results of the Johansen-test or cointegration analysis in Table 4, the p values are greater than 0.05; hence, it is concluded that no cointegration occurs, and these results indicate that the model meets the criteria.

Furthermore, to ascertain the stability of the cointegration correlation among variables, the stability test employed two models, namely cumulative recursive residual sum (CUSUM) with a critical limit of 5% (Janjua et al., 2014). This result demonstrates statistical significance and exhibits stability, or the outcomes of cointegration exhibit a considerable level of stability (see Figure 1).

Figure 2: The cumulative recursive sum.

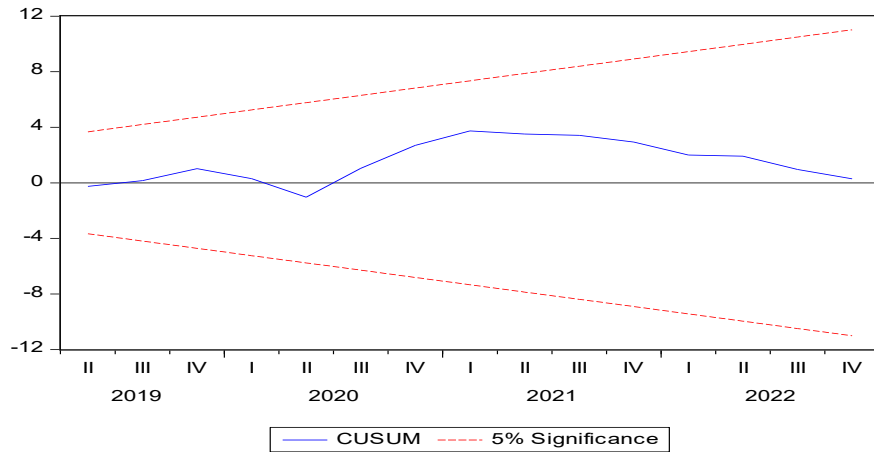
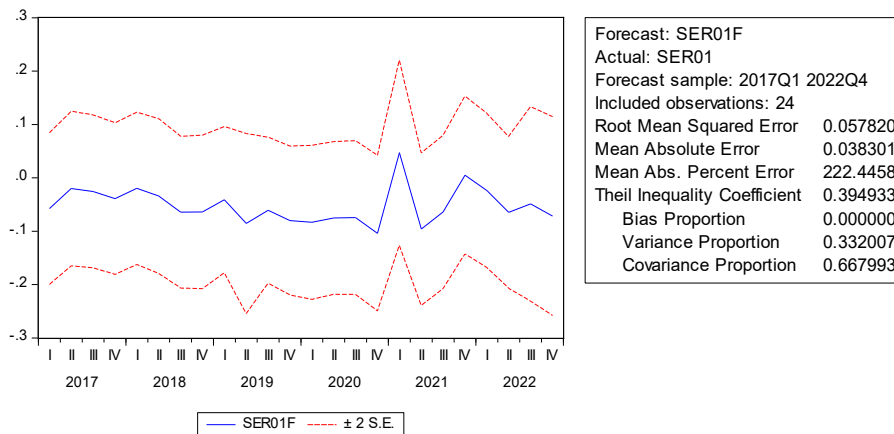


Figure 3: The forecast based on ARDL



As seen in the output diagram above, the blue line is between the red line, namely the upper and lower limits of the degree of error of 5%, so that the prediction or forecasting model is stable.

#### 4. 4. DIAGNOSTIC TEST

Regarding Table 5, the diagnostic tests revealed that the residuals exhibit a serial normal distribution as determined by the Jarque-Bera test, the Breusch-Godfrey serial correlation LM test, the conditional heteroscedasticity test (Breusch-Pagan-Godfrey), and respectively. This implies that the model possesses validity and may be employed for policy suggestions without necessitating any modifications.

Table 5. The result of diagnostic tests

Tests	Prob.	F-Stat.
Jarque-Bera test (Normality test)	0.7788	0.4999
Breusch-Godfrey Serial Correlation LM Test:	0.9533	0.4079
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.4632	0.8259

Sources: eviews output

#### 4. 5. HYPOTHESIS TEST RESULTS

Table 6: ARDL-ECM long-run estimates

Dependent Variable: RS

Sample: 2017Q1 - 2022Q4

Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.281907	0.043797	3.019001	0.1902
MRP	-0.810191	0.071086	2.390208	0.0152
SMB	1.189190	0.893538	3.163077	0.0024
HML	0.130019	0.132930	-1.029011	0.2916
RMW	3.278273	0.029882	-9.312402	0.0000
CMA	-0.891101	0.059930	-1.302929	0.1208
EP	0.509393	0.099030	2.870119	0.0209
R-squared	0.874739			
Adjusted R-squared	0.860976			
F – Statistic (Prob.)	0.000000			

Sources: eviews output

The results from the long-term ARDL model, as presented in Table 5, indicate the presence of a significant and positive relationship between the market risk premium (MRP), capital value (SMB), profitability (RMW), environmental performance (EP), and the share return (SR). The estimated coefficient values are 0.8101, 1.1891, 3.2782, and 0.5093, with p-values of 0.0152, 0.0024, 0.000, and 0.0209, suggesting that this relationship is statistically significant at the 5 percent level of significance. The adjusted R-squared of 0.8609 (86.09%) implies that holding all factors can determine SR, while the remaining 0.1391 (13.91%) is determined by the other factors that were not conducted in this study. However, it was found that there is no long-term relationship between the HML, CMA, and SR, where the values of the coefficient obtained are 0.1300 and -0.8911, with p-values of 0.2916 and 0.1208.

#### 4. 6. LINIER REGRESSION EQUATIONS.

A linear regression equation was employed to find the coefficient values of each independent variable. This equation is applied to determine how independent variables affect RS.

Referring to Table 6, the regression equations are as follows:

$$SR = 5.2819 - 0.8101MRP + 1.1891SMB + 0.1300HML + 3.2782 RMW - 0.8911CMA + 0.5094EP$$

Interpretation:

The findings from linear regression revealed a long-term relationship between independent variables and the dependent variable over an extended period. The constant coefficient value of 5.2819 indicates a positive association between overall independent variables and share return. For example, the relationship between MRP and SR implies that, holding all other factors constant, a 1% alteration in MRP will increase the SR over time, namely by 0.8101. Similar ways can be conducted for other factors for the same reason with a positive effect. However, the other result shows a negative relation in CMA; the coefficient was not judged to be statistically significant at the 5% level. The most influential variable was found in profitability (RMW) to share return variable.

## 5. DISCUSSION

### 5. 1. MARKET RISK PREMIUM AND SHARE RETURNS

This study found that MRP has a negative and significant effect on SR. Hence, the result follows the expectation of the hypothesis, where MRP has a significant effect on SR. The relationship between two variables is mutually influencing each other, including in chemical manufacturing. The risk premium that is proxied by MRP in the market portfolio will affect the company's share return, which is detrimental, as increasing market risk serves as a systemic risk indication for investors, leading them to divert their investments away from capital market risk. The increase in the riskiness of the capital market could explain the velocity of share values. This result is strongly in line with research by [Madsen, J., and Ratbek, D. \(2012\)](#), who showed that the equity risk premium and required share returns are closely related and that the expected return on the stock market in excess of the risk-free rate has a significant impact on share returns. Also, [Yoggan, Z. \(2008\)](#) explored the relationship between stock market returns and volatility, finding that the market risk premium influences various market states.

### 5. 2. FIRM SIZE AND SHARE RETURNS

This linking of firm size (SMB) and share returns is legitimate, positive, and significant, which indicates a significant level at 5%. and follows the expectation of the hypothesis. This confirmed the impact of firm size on share return, reversed when considering the market, and observed chemical companies generating significant returns. Market efficiency states that the relationship between a company characteristic, namely size (market capitalization value), and returns leads to higher market performance. The size, as seen from the market capitalization value, is a considerable factor that is always used by investors in making decisions to invest, although it is not the sole determining factor. Thus, the larger firms tend to yield higher returns, even though they have a higher risk impact. Regarding this result, it is known that the size variable can encourage companies to disclose their market value. However, it is important to note that these findings are specific to the Indonesian context and may not be generalizable to other sectors. This result is supported by research by [Diantimala, Y., et al. \(2021\)](#) that justifies how company size affects probability and market value. Likewise, [Siagian, P. \(2023\)](#), demonstrates that firm size influences the share return. Further, a diagnostic examination revealed that firm size has a significant impact on the market price of equity shares ([Kumar, P. et al, 2023](#); [Helia, S. et al., 2020](#)).

### 5. 3. BOOK-TO-MARKET EQUITY AND SHARE RETURNS

The study reveals that book value to market equity, as measured by HML, has no significant relationship with share return. So, the result does not follow the expectations of the hypothesis. The HML variable doesn't tend to respond to the company's share price and return, including for pharmacy firms. Despite changes in book-to-market equity value, it is not possible to predict share market price velocity, and this variable is not an important factor in determining share returns. When the market value is higher than the book value and vice versa, investors do not respond, which discourages them from buying it. This study is not in accordance with [Bali et al. \(2009\)](#) and [Kumar, P. et al. \(2023\)](#), who found a strong correlation or significant relationship between this ratio and stock returns. Similarly to the results of [Yadaf, S. \(2023\)](#), which revealed the book value has a positive and significant impact on the share market price. However, it is not in line with [Laurens and Mulyani \(2022\)](#), who conclude the price-to-book value has no impact on stock returns.

#### 5. 4. PROFITABILITY AND SHARE RETURNS

This result findings that profitability (RMW) has a positive and significant relationship with share return, and the results follow the expectation of hypothesis, and the impact implies the inverse relationship between the two variables. The profitability measures of return on equity (ROE) are obtained by dividing net income by the book value of equity. When the profitability is higher, share market prices tend to increase, and conversely, when the profitability rate is low, share prices tend to decrease. Furthermore, if that factor is elevated, investors exhibit a greater inclination to allocate their funds into share investments in the capital market, rendering investments in shares comparatively more attractive and consequently leading to a rise in portfolio returns, which is quite important in the manufacturing industry, including the pharmacy industry. This result is supported by [Laurens and Mulyani \(2022\)](#), who conclude there is a significant relationship between the two variables. But, it is not in line with the finding of ([Wardhani, R.S. et al., 2019](#)) that state profitability did not affect stock returns partially.

#### 5. 5. INVESTMENT AND SHARE RETURNS

The study reveals that the investment variable (CMA) that used the formation of portfolios based on size of investment, where CMA is the divergence between the average return on conservative investment and aggressive investment, has no a valuable relationship with share returns. So, the result does not follow the expectations of the hypothesis. As mentioned, the level of a company is measured based on the growth rate of total assets in a certain fiscal year. Consequentially, investors tend not to sell their shares and allocate their funds towards alternative investments, such as savings accounts or time deposits. The transition towards alternative investment will not prompt investors to divest their shares; thereby, it is not leading to a decline or rise in share prices and returns, although to earn more money, one needs to make the investment prudently to gain profit and raise the market price. This finding is not in accordance with [Sheridan, T., et al. \(2009\)](#). Although the increase in investments tends to have high past returns, the relationship indicates a negative abnormality in long-term returns. Similarly, the study by [Timothy Clue \(2022\)](#) mentions that asset investment plays a special role in cross-sectional asset pricing, although, these variables themselves are associated with significant return premiums.

#### 5. 6. ENVIRONMENTAL PERFORMANCE WITH SHARE RETURNS.

The last examinee found that environmental performance (EP) has a positive and legitimate effect on SR. The result complies with the expectation of the hypothesis, where EP has a significant effect on SR. Although EP is not a part of the F-F five factors, this study asserts that investors are concerned about environmental management. Therefore, an increase in EP that is measured by PROPER will affect their perception of decisions considerably. This study observed that firms with EP can boost market prices significantly and mitigate positive market shares. Even though the effect of that performance is a complex and multifaceted issue, it suggests a comprehensive analysis of the risk relationship in the carbon future market to enhance market efficiency and mitigate that potential impact. This result supports ([Budiarjo, R. 2020](#); [Reinganums, M. 2009](#)), which concludes the significant relationship between environmental performance and share return yields. However, it is not in line with [Msy, M. \(2019\)](#), who found a significant relationship.

### 6. CONCLUSSION

The results of this study show that the market risk premium (MRP), firm size variable (SMB), profitability (RMW), and environmental performance have a significant effect on share returns, which can encourage companies to disclose and raise those returns. If the firm size increases,

it is notable that the result is specific to a specific context but cannot be generalizable to other sectors. The financial performance in the F-F five factor variable tends to respond to the movement of share prices and returns, particularly with high disclosure and high-profile industries involving pharmacy. Then, profitability explored the considerable correlation; with this gain, these policies can manage and, in some cases, increase profit. Based on that conclusion, investors can pay attention to the variables that have a large enough influence to ensure the stability of the share market price. Similarly, the other variables, namely companies' size, have a statistically significant effect on share returns. This finding implies that it is crucial for the management to continually manage that size in order to enhance the stability and value of market share. As known, the relationship between environmental performance and stock return is mutually influencing each other, including for chemical manufacturing, and could explain the velocity of share values. Referring to the positive coefficient value, this impact was reciprocal when considering the market as a whole and was observed with chemical companies.

As is known, this study is specific because it uses the F-F factor model as a proxy for financial performance to analyze the impact on share price and return, as well as other performance related to environmental factors. The study reveals practical consequences arising from the impacts of these variables on share returns. The available evidence indicates that there is a discernible relationship, particularly in response to upward movements between these factors.

The findings of this study are derived from a dataset and the research method used. Subsequently, some limitations of this study can be highlighted. First, this is subjectivity at the stage of assessing content analysis to determine the share market price return by the F-F five factors and environment performance, which only involves the limited number of pharmacy companies with the number of years. Nevertheless, this research does not provide an in-depth analysis of the time span and conditions needed for the optimum relationship between these factors to appear. Secondly, the issue of performance indicator asymmetry is also linked to the F-F five factors, and only one of the environmental factors was investigated. Hence, the implications can be considered for the company's management in the formulation and as a form of voluntary information about the other financial and environmental performances, which have an effect on the company's market value and maintain sustainability to create the positive image shareholders need in making investment decisions. This study strongly suggests that future research should add and enhance the number and various company sectors, such as mining, infrastructure, and other miscellaneous industries, as well as expand the time period to obtain a more representative sample and better results. However, to enhance scholarly investigations and public awareness to understand the stock market, thereby fostering a literacy of financial performance by employing the F-Five factor model and environmental performance to increase participation in stock investment assessment, there is a compulsion. Additionally, investor and security analysis should enhance the ability to forecast share market prices and therefore generate financial gains.

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