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Effect of *leverage*, *firm size*, and profitability on systematic risk and its implications on share price

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Abstract
Purpose: Palm oil plantations are among Indonesia's leading commodities that significantly contribute to the national economy. The fluctuation of stock prices in this subsector has attracted researchers' attention to understand the factors influencing it, including leverage, Firm Size, profitability, and systematic risk. This study aims to analyze the impact of leverage, Firm Size, profitability, and systematic risk on the stock prices of palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) during the period 2013-2023.
Research Methodology: This study utilizes panel data and applies three main regression models, namely the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), to evaluate the impact of the independent variables on stock prices.
Results: The findings indicate that leverage, Firm Size, profitability, and systematic risk do not have a significant impact on stock prices. Specifically, leverage does not have a significant effect on systematic risk or stock prices, Firm Size does not have a significant effect on systematic risk and stock prices, and profitability does not significantly affect systematic risk and stock prices. Systematic risk does not have a significant effect on stock price. There is no significant evidence that systematic risk mediates the impact of leverage, Firm Size, or profitability on stock prices.
Limitations: This study is limited to palm oil plantation subsector companies listed on the IDX and the period between 2013 and 2023. External factors, such as macroeconomic conditions, government policies, and environmental factors that might be more significant, have not been deeply analyzed.
Contributions: This study contributes to the literature by showing that internal variables such as leverage, Firm Size, and profitability do not always significantly affect stock prices in the context of the palm oil plantation sub-sector in Indonesia.
Keywords: *Leverage, Firm Size, Profitability, Systematic Risk, Stock Prices, Panel Data*
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1. Introduction

Stock prices are indicators of a company's success and are greatly influenced by investors' demand and supply. Stock prices that tend to be stable will make investors more interested because the level of risk is lower, and the goal of investors is to invest or seek profit. If stock prices are unstable, investors will not have the confidence to invest. In Indonesia, the prices of all companies in the stock market are still unstable.

Stock price volatility can be used to measure a stock (Hashemijoo, Mahdavi Ardekani, & Younesi, 2012) Stocks that experience volatility, the price can change at any time and are difficult to predict. Many investors prefer stocks that are easy to predict and have minimal risks. The higher the volatility, the greater the level of uncertainty to obtain a return. Therefore, investors need information to invest in their shares. This is in accordance with signal theory, which states that companies should provide signals to users of financial statements (JAMA'AN, 2008). According to ANASTASSIA and Firnanti (2014), the importance of information regarding dividend policy, asset growth, company size, book value per share, profit volatility, and debt to assets (Financial Leverage) determines stock price volatility.

According to Tandelilin (2010), the factors that influence price movements are highly dependent on the company's profit prospects, and these profits depend on macroeconomic conditions such as gross domestic product, unemployment rate, inflation, interest rate, and the Rupiah exchange rate against the US dollar. According to Alwi (2008), marketing is an internal factor that can influence stock prices. Price is an aspect of the marketing mix (Kotler & Keller, 2016). Fahmi (2014) states that one of the factors that influences stock prices is systematic risk. Volatile stock prices can cause systematic risk; the higher the volatility of stock prices, the higher is the systematic risk, and vice versa.

Macro factors that influence the movement or volatility of stock prices, such as Sunariyah (2013), can cause stock risks known as systematic risk. Systematic risk is related to changes in the market as a whole. These market changes affect the variability in an investment's returns. According to a study by Beaver et al. ((Hartono, 2010), internal fundamental factors influence systematic risk, such as dividend payout, asset growth, leverage, liquidity, asset size, earnings variability, and accounting beta. Logue and Merville (1972) and Januardi and Arfianto (2017) stated that profitability is one of the factors that influences systematic risk. Pramana (2011) states that product price variability is a business risk factor. From the theoretical description above, it can be concluded that there is a relationship between stock price movements and systematic risk, and the factors that influence stock prices and systematic risk.

Al-Qaisi (2011) found that profitability had a negative effect on systematic risk. However, Werastuti and Estiyanti (2018) find that profitability has a significant positive effect on the stock beta. Kustini and Pratiwi (2011) and Indra (2005) found that profitability had no significant effect on systematic risk. Previous research related to leverage on stock prices (Septyadi and Bwarleling (2020) found that leverage has no effect on a company's Stock Price Volatility, which differs from the results of Rosyida, Firmansyah, and Wicaksono (2020), who found that leverage has a positive effect on stock price volatility.

Previous studies have yielded inconsistent findings. Therefore, in addition to looking for significant causal factors that influence systematic risk and stock prices in the palm oil plantation sub-sector, further testing is needed to determine the consistency of the findings.

1.1 Problem Formulation

Based on the research gap phenomena, it is necessary to conduct further research by asking the following three research questions:

1. How does leverage influence systematic risk in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
2. How does Firm Size influence systematic risk in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
3. How does profitability influence systematic risk in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
4. How does leverage influence stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
5. How does Firm Size influence stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?

6. How does profitability affect stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
7. How does systematic risk affect stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
8. How do Leverage, Firm Size and Profitability mediated by Systematic Risk affect stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?

1.2 Research Objectives

Based on the formulation of the problem above, the research objective was obtained, namely, to find and analyze:

1. The effect of leverage on systematic risk in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the 2013-2022 Period?
2. The Effect of Firm Size on Systematic Risk in Palm Oil Plantation Sub-sector Companies Listed on the Indonesia Stock Exchange (IDX) for the 2013-2022 Period?
3. The effect of profitability on systematic risk in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the 2013-2022 Period?
4. The Effect of Leverage on Stock Prices in Palm Oil Plantation Sub-sector Companies Listed on the Indonesia Stock Exchange (IDX) for the 2013-2022 Period?
5. The Effect of Firm Size on Stock Prices in Palm Oil Plantation Sub-sector Companies Listed on the Indonesia Stock Exchange (IDX) for the 2013-2022 Period?
6. The effect of profitability on stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
7. The effect of systematic risk on stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?
8. The effect of Leverage, Firm Size and Profitability mediated by Systematic Risk on stock prices in palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2022?

2. Literature Review

2.1 Agency Theory

Agency theory, first introduced by Jensen and Meckling (1976), highlights the differences in interests between principals and agents. (Uffiah & Kadarningsih, 2021) In the context of a company, principals are usually shareholders who have an interest in maximizing the value of the company, while agents are top management consisting of the board of commissioners and directors who are tasked with running the company's operations and making strategic decisions. These differences in interests can affect various aspects of company performance including stock performance.

According to Supriyono (2018), the concept of agency theory is a contractual relationship between the principal and agent, where the principal gives the agent authority to make decisions aimed at achieving the principal's interests. The agent is fully responsible for ensuring that the goals set by the principal can be achieved; in return, the agent receives compensation from the principal. In the context of company performance, the achievement of goals set by the principal is often measured through performance indicators, such as profitability, revenue growth, and operational efficiency. Good company performance creates value for shareholders, which in turn can be reflected in the positive stock performance in the capital market.

2.2 Firm Size

According to Murni (2015), company size is a scale used to classify the size of a company through its total assets, net sales, and market capitalization. Patriadjati (2017) states that company size is a scale in which the size of a company can be classified based on its total assets or total sales. Companies with large sizes will find it very easy to access the capital market, and their flexibility and ability to obtain funds are higher than those of companies with small sizes (Selpiana and Badjra 2018).

Bambang (2001) defines Company Size asBambang (2001) the size of the company, as seen from the value of equity, sales value, or asset value. According to Agnes (2010), company size is a determinant of the financial structure. Based on this definition, it can be seen that company size is a scale that determines the size of the company which can be seen from the value of Equity, sales value, number of employees and total asset value which are context variables that measure the demands of organizational services or products.

Firm Size is the size of a company based on its market capitalization. Company size was measured using the natural logarithm of a company's total assets. The logarithmic form is used because, in general, the value of a company's assets is very large; thus, it standardizes the value with other variables by natural logarithmizing the total assets (Sugiarto, 2011). Company size (Firm Size) describes the size of a company as indicated by total assets, sales volume, average sales level, and average total assets. Large-scale companies find it easier to obtain loans than small companies.

2.3 Profitability

Profitability is a company's ability to generate profits during a certain period. Profitability is measured by Return on Equity (ROE). Profitability measures the effectiveness of management reflected in the return on investment through company activities; in other words, it measures the company's overall performance and efficiency in managing liabilities and capital (Sugiono, 2008). According to Munawir (2013), profitability or rentability is a company's ability to generate profit during a certain period. According to Sartono (2011), profitability is a company's ability to earn profits in relation to sales, total assets, and equity. Based on the opinion above, it can be concluded that profitability is to measure the effectiveness of management based on the results of returns generated from sales volume, total assets and equity. In addition, the profitability ratio can be used to measure a company's ability to earn profits during a certain period.

2.4 Systematic Market Risk

Market risk is the risk used in this study. Market risk is the risk faced by security caused by market factors such as political and economic factors (Tandelilin, 2010). According to Zubir (2011), market risk is caused by the volatility of an investment's return as a result of fluctuations in transactions in the market as a whole. Market risk is caused by events that are comprehensive in nature and affect market activities in general, such as war, recession, changes in economic structure, and changes in consumer tastes. According to Bodie, Kane, and Marcus (2018), if the source of risk affects the entire company, portfolio diversification does not help reduce risk.

Risk is always inherent in every investment and is borne by investors. According to Tandelilin (2010), the relationship between risk and expected return from an investment is unidirectional and linear. A high level of risk reflects a high level of expected return. Risk can also be interpreted as a form of uncertainty about a situation that will occur sometime in the future, with decisions taken based on various considerations at this time (Fahmi, 2014). A similar understanding of risk was also conveyed by Tandelilin (2010), namely, that risk is the possibility of a difference between the actual return received and the expected return.

2.5 Stock Price

Stock price volatility is the understanding of the price of a stock that experiences ups and downs. Stock price volatility is a benchmark for determining stock risks (Ullah et al. 2015). A company can experience stock price volatility if stock prices fluctuate. Stocks can be said to be volatile if the changes are quite large and significant (Theresia & Arilyn, 2015). According to Hartono (2010), stock price is the price of a stock that occurs on the stock exchange at a certain time determined by market players and by the demand and supply of the shares concerned in the capital market. The stock price refers to the value of the stock. Shareholders receive returns on their capital in the form of dividends and capital gains.

Meanwhile, according to Darmadji and Fakhruddin (2011), the stock price is the price that occurs on the stock exchange at a certain time. Stock prices can change up or down in a very fast time. Stock prices can change in minutes and can even change in seconds. This is possible because of the demand and supply between stock buyers and sellers. According to Zubir (2011) in (Gultom, Purba, Zepria, & Sinaga, 2019), stock prices reflect good company management to create and utilize business prospects to obtain profits and fulfill their responsibilities to owners, employees, society, and government (stakeholders).

2.6 Framework of Thought

The framework of this study aims to show that Leverage, Firm Size, Profitability influence systematic risk and its implications for stock prices.

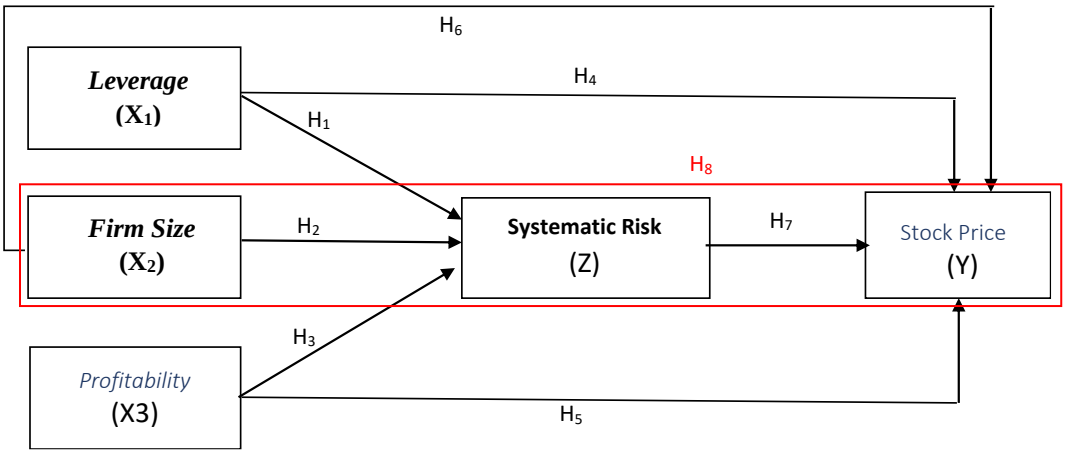

Figure 1. Framework of Thought

2.7 Research Hypothesis

H_1 : Leverage affects systematic risk

Leverage, which refers to a company's use of borrowed funds to finance operations, can have a significant impact on systematic risk. High leverage increases interest expenses and payment obligations, which in turn increases the volatility of the company's earnings and cash flows. This increased volatility makes the company more vulnerable to changes in market conditions, such as interest rate fluctuations and economic recession. In this context, companies with high leverage levels must manage the additional risks arising from large debt obligations.

Zhang et al. (2019) find that companies with high debt ratios tend to have higher stock betas, reflecting increased systematic risk. Higher stock betas indicate greater sensitivity to overall market movements, implying that companies with high leverage are more likely to experience larger stock price fluctuations in response to market changes.

H_2 : Firm Size affects systematic risk

Firm size is often measured by the total assets or sales of the company. Large companies tend to have more resources and higher operational stability than small companies. These additional resources allow large companies to be more effective in diversifying both operationally and geographically, thereby reducing the systematic risks they face. This diversification helps large companies manage the the risks associated with earnings volatility and market uncertainty, because they are less dependent on one product line or one particular market.

Chen & Chen (2018) show that large companies have better ability to manage operational and financial risks, which reduces volatility and systematic risk. Large companies also have better access to capital markets, allowing them to obtain financing at lower and more stable costs. Additionallyy, large companies tend to have a better reputation with investors and creditors, which can provide a competitive advantage in accessing financial resources.

H_3 : Profitability affects systematic risk

Profitability refers to a company's ability to generate profit from its business operations. More profitable companies tend to have lower systematic risk because they have a better capacity to absorb losses and greater financial flexibility. A high profitability level indicates that a company has a solid and efficient business model that can generate stable and sustainable income. This provides the company with a financial cushion that can be used to mitigate economic uncertainty and market volatility, thereby reducing the systematic risk faced by the company.

Kim et al. (2020) showed that companies with high profitability levels have lower systematic risk. High profitability allows companies to build financial reserves and invest in initiatives that enhance long-term competitiveness. Additionally, profitable companies have a greater ability to attract and retain talented human resources, invest in innovation, and expand their market share.

H_4: Leverage affects stock prices

High leverage can increase the risk of bankruptcy of the company, which in turn can lower the stock price as investors become more cautious and demand higher returns to cover greater risk. High leverage levels are often seen as a sign of a company's inability to generate sufficient internal cash flow to finance its operations, raising concerns about its long-term sustainability. Under this condition, investors tend to demand a higher risk premium, resulting in a decrease in the company's stock price.

Huang and Ritter (2021) showed that high leverage is often associated with increased bankruptcy risk, which ultimately lowers stock prices. The market tends to punish companies with high debt ratios because this increases the uncertainty of future cash flows. In addition, high leverage can send a negative signal to the market about a company's inability to generate sufficient internal cash flow, which can reduce demand for the company's shares and lower stock prices. In the long run, companies with high leverage may face higher capital costs and decreased competitiveness owing to heavy debt burdens.

H_5 : Firm Size affects stock prices

Company size is often associated with stability and the ability to generate consistent profit. Large companies tend to have higher financial stability and the ability to generate consistent profits, which can increase investor confidence and demand for company shares. A large company size allows companies to have better access to capital markets and obtain financing at a lower cost, which, in turn, can increase stock prices.

Fama and French (2019) show that large companies tend to have more stable stock prices and are often valued higher by investors because of their operational stability and ability to generate consistent profits. Investors tend to consider large companies safer investments because they have more resources for weather economic and market uncertainties. Additionally, large companies often have a better reputation in the market, which can increase the liquidity of their shares and attract more investors. All of these factors contribute to the increase in the stock prices of large companies compared to small companies.

H_6 : Profitability affects stock prices

High profitability indicates good performance and the company's ability to provide returns to shareholders. More profitable companies tend to be valued more highly by the market because of their ability to generate consistent profits and provide greater returns to investors. High profitability also indicates good operational efficiency and positive growth prospects, all of which contribute to high stock prices.

Greene (2000) showed that high profitability is an indicator of good company performance and is often associated with higher stock prices. Investors tend to value companies that are able to generate stable

and sustainable profits because this indicates the sustainability of the company's business model. In addition, profitable companies have a greater capacity to invest in new growth opportunities and innovation, which can improve their future prospects and attract more investors. All of these factors contribute to the increase in the stock prices of more profitable companies.

H_7 : Systematic risk affects stock prices

Systematic risk is a market risk that cannot be diversified and is influenced by macroeconomic factors such as changes in interest rates, inflation, and global economic conditions. High systematic risk can reduce stock prices because investors tend to avoid high-risk stocks and expect higher returns to offset the risk. High levels of systematic risk can reflect greater uncertainty about a company's future prospects, which can reduce the demand for shares and lower stock prices.

Campbell et al. (2018) show that systematic risk negatively affects stock prices. Companies with high systematic risk tend to have lower stock prices, because investors demand a higher risk premium to compensate for the additional risk they face. In addition, high systematic risk can create greater stock price volatility, which can discourage investors from investing in a company's shares.

H_8 : Systematic risk mediates the influence of Leverage, Firm Size, and Profitability variables on Stock Prices

This hypothesis states that systematic risk mediates the relationship between leverage, firm size, and profitability and stock prices. Leverage, firm size, and profitability affect systematic risk, which, in turn, affects stock prices. For example, a high leverage can increase systematic risk, which lowers stock prices. Similarly, large firms with good diversification and high profitability can reduce systematic risk, which increases stock prices.

Berkman et al. (2020) showed that systematic risk can act as a mediator in the relationship between leverage, firm size, and profitability and stock prices. This study shows that these variables affect systematic risk, which, in turn, affects a company's stock price. For example, high leverage can increase systematic risk by increasing the volatility of a company's earnings and cash flows, which lowers stock prices. Conversely, large firms with good diversification and high profitability can reduce systematic risk by increasing their financial and operational stability, which then increases their stock prices. Systematic risk acts as a mechanism through which these variables affect stock prices, indicating the importance of managing systematic risk to increase the value of a company in the eyes of investors.

3. Research Methodology

3.1 Type of Research

This research is causal because one or more variables affects other variables (Sekaran, 2016). Causal research uses a quantitative approach that focuses on sorting, distinguishing, and comparing the influence of independent variables on the dependent variables. The data used in this study are panel data, which is a form of time-series data sourced from secondary data, namely financial reports and annual reports of each company's publication according to the research period.

3.2 Operational Variables

Table 2. Operational Variables

Variables	Definition	Indicator	Scale
Dependent Variable			
Stock price volatility (Y)	Company value can be assessed by market capitalization (share price multiplied by the number of shares outstanding).	$PVOL = \sqrt{\sum \frac{\left\{\frac{Hi-Li}{(\frac{Hi+Li}{2})}\right\}^2}{12}}$	Ratio
Independent Variables			

Variables	Definition	Indicator	Scale
Leverage (X_1)	Measuring how much debt is used in company spending.	$Debt\ to\ Equity\ Ratio = \frac{Total\ Debt}{Total\ Equity}$	Ratio
Firm Size (X_2)	Company size is a benchmark for a company's operational performance to show how well the company's management operates the company.	$Size = Natural\ Logarithm\ (Ln)\ Total\ Assets$	Nominal
Profitability (X_3)	shows the company's ability to generate profits during a certain period.	$Return\ on\ Equity = \frac{net\ profit\ after\ tax}{Total\ Equity} \times 100$	Ratio
Moderation Variables			
Systematic Risk (Z)	describes the sensitivity of a stock's return to movements or changes that occur in market returns.	$\mathcal{B}i = \frac{\propto iM}{\propto^2 M}$	Index units

3.3 Population and Sample

3.3.1 Population

The population in this study is Palm Oil Plantation Sub-Sector companies listed on the Indonesia Stock Exchange (IDX) for the period 2013-2023. The population of Palm Oil Plantation companies listed on the IDX comprises of 35 companies. Sampling was performed using the purposive sampling technique, which is a sample collection technique that applies certain considerations or criteria. The criteria set in this study were as follows:

1. Companies listed on the Indonesia Stock Exchange in the palm oil plantation subsector.
2. Companies that publish audited annual financial reports from 2013-2023 to.

Based on the established criteria, all data were selected so that the number of companies used as samples in this study was 10 (ten) companies, which are presented in Table 3.

Table 3. List of Research Objects

No	Company Name	Issuer Code	IPO date
1	PT. Astra Agro Lestari Tbk	AALI	December 9, 1997
2	PT. Eagle High Plantations Tbk	BWPT	October 27, 2009
3	PT. Gozco Plantations Tbk	GZCO	May 15, 2008
4	PT. Perusahaan Perkebunan London Sumatra Indonesia Tbk	LSIP	July 5, 1996
5	PT. Pinago Utama Tbk	PNGO	December 24, 1997
6	PT. Sampoerna Agro Tbk	SGRO	June 18, 2007
7	PT. Salim Ivomas Pratama Tbk	SIMP	June 9, 2011
8	PT. Sinar Mas Agro Resources And Technology Tbk	SMART	November 20, 1992
9	PT. Tunas Baru Lampung Tbk	TBLA	February 14, 2000
10	PT. Bakrie Sumatera Plantations Tbk	UNSP	March 6, 1990

Source: data has been processed

3.4 Data Analysis and Hypothesis Testing Techniques

The data analysis technique used in this study is a quantitative analysis that tests the relationship between variables using panel data regression analysis. By using the Eviews 13 software tool.

3.4.1 Descriptive Statistical Analysis
Descriptive statistical analysis provides a description of the data, which can be seen from the average value (mean), standard deviation, and maximum and minimum values. This descriptive statistical analysis provides descriptive data from the dependent variable Tax Avoidance and the independent variables Profitability, Sales Growth and Financial Distress.

3.4.2 Panel Data Regression Analysis
Panel data are a combination of cross-sectional and time series data. Panel data regression analysis is a regression analysis based on panel data to observe the relationship between one dependent variable and one or more independent variables. The estimation of an economic model is required to determine the actual condition of something being observed.

The estimation model used in this study is as follows:
$Y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3_{it}} + \beta_4 X_{4_{it}} + \varepsilon_{it}$
Information:
Y_{it} = Tax evasion
β_0 = Constants
$\beta_{1,}\beta_2, \beta_3, \beta_4$ = Independent variable coefficient
$X_{1_{it}}$ = Profitability
$X_{2_{it}}$ = Sales Growth
$X_{3_{it}}$ = *Financial distress*
ε_{it} = *Error term*

1. Common Effect Model (CEM)
By combining time series data and cross-sectional data without looking at the differences between time and individuals, the regression equation model is
$Y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3_{it}} + \varepsilon_{it}$

2. Fixed Effect Model (FEM)
This model also assumes that the slope remains constant across firms and time. The approach used in this model uses the least squares dummy variable (LSDV) method. The Least Squares Dummy Variable (LSDV) is an Ordinary Least Squares (OLS) regression using dummy variables, where the intercept is assumed to differ across firm units. This dummy variable is useful in describing the effects of investment firms. The Fixed effect model with the Least Square Dummy Variable (LSDV) technique can be written as follows: can be written as follows:
$Y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3_{it}} + \beta_4 X_{4_{it}} + \cdots + \beta_n d_{n_{it}} + \varepsilon_{it}$

3. Random Effect Model (REM)
This random-effect estimation approach uses disturbance variables (error terms). These disturbance variables may be connected between times and between companies. The writing of constants in the random effects model is no longer fixed but random, so it can be written using the following equation:
$Y_{it} = \beta_0 + \beta_1 X_{1_{it}} + \beta_2 X_{2_{it}} + \beta_3 X_{3_{it}} + \varepsilon_{it} + \mu_i$

3.5 Model Selection
Of the three models that have been estimated, the most appropriate one for the research objectives will be selected. Three tests can be used as tools in selecting a panel data regression model (CEM, FEM, or REM) based on the characteristics of the data owned: F *Test* (*Chow Test*), *Hausman Test, and Langrangge Multiplier* (*LM*) *test*.

1. Chow Test
The Chow test is used to choose between the Common Effect method and the Fixed Effect method, with the following decision-making provisions: The hypothesis in the Chow Test in the research is as follows:

a. If the Chi-square probability was <0.05, then the fixed effect was selected.
b. If the Chi-square probability was > 0.05, then the Common Effect was selected.

From the test results, it was determined that the Common Effect model was used, and there was no need to carry out the Hausman Test. However, if the results of the Chow Test determine the fixed effect model to be used, then it is necessary to carry out a further test, namely, the Hausman Test, to determine the fixed effect or random effect model to be used.

2. Hausman test

The Hausman test is used to determine whether the random effects method or the fixed effects method is appropriate, with the following decision-making provisions:
H_0: Random effect method
H_1: Fixed effect method

If the Chi-square probability is <0.05, then H_0 is rejected, or the method used is the fixed effect method. On the other hand, if the chi-square probability is > 0.05, then H_0 is accepted or the method used is the Random Effect method.

3. Langrange Multiplier (LM) Test

The LM test was used to select a random or common effect model. This test can also be called a significant random effect test developed by Bruesch-Pagan (1980). The Bruesch-Pagan LM test is based on the residual value of the common effects method. The following hypotheses were proposed:
H_0: Random effect method
H_1: Common effect method

If the probability of Chi-square is < 0.05, then H_0 is rejected or it can be said that the method used is the common effect method. If the probability of chi-square ≥ 0.05, then H_0 is accepted, or it can be said that the method used is the random effect method.

3.6 Hypothesis Testing

The t-test was used to test whether each independent variable (independent) individually or partially had a significant influence on the dependent variable (dependent) at a significance level of 0.05 (5%) by assuming that the independent variable had a constant value. The steps that must be taken with the t-test are by testing, namely: Hypothesis:
a. H_0:$\beta_i = 0$, meaning that each independent variable has no significant influence on the dependent variable.
b. H_0:$\beta_i \neq 0$, meaning that each independent variable has a significant influence on the dependent variable.

Testing Criteria:
a. If the probability > α 5% or t count ≤ t table, the independent variable is not significant or has no influence on the dependent variable (H_0 accepted, H_a rejected).
b. If the probability is <α 5% or t count > t table, then the independent variable is significant or has an influence on the dependent variable (H_0 rejected, H_a accepted).

4. Results and Discussions

4.1 Description of Research Object

This study used a sample of 12 companies. The names of the companies selected as research objects are as follows:

Table 4. Company Name Data

No	Code	Company name
1	AALI	Astra Agro Lestari Tbk

No	Code	Company name
2	TBLA	Tunas Baru Lampung Tbk
3	SMAR	Sinar Mas Agro Resources and Technology Tbk
4	LSIP	PP London Sumatra Indonesia Tbk
5	SGRO	Sampoerna Agro Tbk
6	DSNG	Dharma Satya Nusantara Tbk
7	ANJT	Austindo Nusantara Jaya Tbk
8	SIMP	Salim Ivomas Pratama Tbk
9	UNSP	Salim Ivomas Pratama Tbk
10	BWPT	Eagle High Plantations Tbk
11	GZCO	Gozco Plantations Tbk
12	JAWA	Jaya Agra Wattie Tbk

4.2 Descriptive Statistics

Tabel statistik deskriptif untuk penelitian ini memberikan gambaran awal tentang karakteristik data untuk variabel *Leverage* (X_1), *Firm Size* (X_2), *profitabilitas* (X_3), harga saham (Y) dan risiko sistematis (Z) pada perusahaan sub sektor perkebunan kelapa sawit yang terdaftar di Bursa Efek Indonesia selama periode 2013-2023. Berikut merupakan hasil statistik deskriptif menggunakan *E-Views versi 13*.

Table 5. Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
Leverage (X_1)	1.345.758	1.105.000	2.932.000	-4.596.000	5.416.879
Firm Size (X_2)	1.620.781	1.600.000	1.757.000	1.448.151	0.787428
Profitability(X_3)	0.029318	0.050000	5.170.000	-2.550.000	0.576277
Stock price (Y)	0.365530	0.310000	2.390.000	0.000000	0.283372
Systematic Risk (Z)	0.648638	0.666120	1.198.750	-9.603.958	1.762.801

Table 5 presents the descriptive statistics of the variables used in this study, namely leverage (X1), Firm Size (X2), profitability (X3), Stock Price (Y), and Systematic Risk (Z). Descriptive statistics provide an overview of the characteristics of the data, including the mean, median, maximum, and minimum values, and standard deviation.

4.3 Selection of Panel Data Regression Model

4.3.1 Common Effect Model (CEM)

In the common effects model, it is assumed that there is no difference in the intercept and slope values in the regression results, either based on differences between individuals or between times. The parameter estimation method in the common effects model uses the ordinary least squares (OLS) method. The results of the panel data regression with the Common Effect Model are presented in the following table:

Table 6. Results of Panel Data Regression of Common Effect Model

Dependent variable: Y
Method: Panel Least Squares
Date: 08/02/24 Time: 14:00

Sample: 2013 2023
Periods included: 11
Cross-sections included: 12
Total panel (balanced) observations: 132

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	*1.183185*	*0.534495*	*2.213650*	*0.0286*
X1	*-0.009541*	*0.012715*	*-0.750425*	*0.4544*
X2	*-0.049677*	*0.033332*	*-1.490368*	*0.1386*
X3	*-0.023079*	*0.121504*	*-0.189948*	*0.8497*
Z	*0.001568*	*0.014158*	*0.110717*	*0.9120*
R-squared	*0.037278*	*Mean dependent var*		*0.365530*
Adjusted R-squared	*0.006956*	*S.D. dependent var*		*0.283372*
S.E. of regression	*0.282385*	*Akaike info criterion*		*0.346050*
Sum squared resid	*10.12713*	*Schwarz criterion*		*0.455247*
Log likelihood	*-17.83932*	*Hannan-Quinn criter.*		*0.390423*
F-statistic	*1.229404*	*Durbin-Watson stat*		*1.247212*
Prob(F-statistic)	*0.301697*			

Based on Table 6, the regression results using the Common Effect Model (CEM). The constant coefficient (C) is 1.183185, with a t-statistic of 2.213650 and a probability value of 0.0286, which shows that this constant is statistically significant at the 5% significance level. This shows that when all independent variables are zero, the average dependent variable is 1.183185.

So these results show that the variables leverage, company size, profitability, and systematic risk do not have a significant influence on the stock prices of palm oil plantation sub-sector companies listed on the Indonesia Stock Exchange during the 2013-2023 period, but there are other factors that may have a greater influence on the stock prices of palm oil plantation sub-sector companies.

4.3.2 Fixed Effect Model (FEM)
The panel data regression estimation method on the Fixed Effect Model uses the dummy variable addition technique or the Least Square Dummy Variable (LSDV). The results of the panel data regression with the fixed-effects model are presented in the following table:

Table 7. Panel Data Regression Results Fixed Effect Model
Dependent variable: Y
Method: Panel Least Squares
Date: 08/02/24 Time: 14:15
Sample: 2013 2023
Periods included: 11
Cross-sections included: 12
Total panel (balanced) observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.077249	1.147126	-0.067341	0.9464
X1	-0.012406	0.014408	-0.861015	0.3910
X2	0.028137	0.070982	0.396398	0.6925
X3	0.022829	0.134845	0.169301	0.8659
Z	0.004264	0.014412	0.295868	0.7679
Effects Specification				

Cross-section fixed (dummy variables)

R-squared	0.191738	Mean dependent var	0.365530
Adjusted R-squared	0.087221	S.D. dependent var	0.283372
S.E. of regression	0.270732	Akaike info criterion	0.337839
Sum squared resid	8.502323	Schwarz criterion	0.687269
Log likelihood	-6.297359	Hannan-Quinn criter.	0.479831
F-statistic	1.834519	Durbin-Watson stat	1.352166
Prob(F-statistic)	0.037647		

Based on Table 7, the regression results were obtained using the fixed effects model (FEM). The constant coefficient (C) is -0.077249, with a t-statistic of -0.067341 and a probability value of 0.9464, indicating that this constant is not statistically significant. This shows that when all independent variables are zero, the average dependent variable is not significantly different from zero.

4.3.3 Random Effect Model (REM)

The random effects model is accommodated through an error. The panel data regression estimation method in the random effects model uses the generalized least squares (GLS) method. The following is the output of the panel data regression with the random-effects model:

Table 8. Results of Panel Data Regression Random Effect Model

Dependent variable: Y
Method: Panel EGLS (Cross-section random effects)
Date: 08/02/24 Time: 14:19
Sample: 2013 2023
Periods included: 11
Cross-sections included: 12
Total panel (balanced) observations: 132
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.129196	0.582556	1.938347	0.0548
X1	-0.009953	0.012728	-0.781981	0.4357
X2	-0.046343	0.036249	-1.278471	0.2034
X3	-0.010743	0.121043	-0.088752	0.9294
Z	0.001802	0.013777	0.130802	0.8961

Effects Specification	S.D.	Rho
Cross-section random	0.053649	0.0378
Idiosyncratic random	0.270732	0.9622

Weighted Statistics

R-squared	0.040052	Mean dependent var	0.305464
Adjusted R-squared	0.009817	S.D. dependent var	0.277670
S.E. of regression	0.276304	Sum squared resid	9.695686
F-statistic	1.324705	Durbin-Watson stat	1.273992
Prob(F-statistic)	0.264326		

Unweighted Statistics

R-squared	0.036048	Mean dependent var	0.365530
Sum squared resid	10.14007	Durbin-Watson stat	1.218160

Based on Table 8, the regression results are obtained using the random effects model (REM). The constant coefficient (C) is 1.129196, with a t-statistic of 1.938347 and a probability value of 0.0548, indicating that this constant is almost statistically significant at the 5% significance level. This shows that when all independent variables are zero, the average dependent variable is 1.129196.

4.4 Panel Data Regression Model Selection Method

To select the most appropriate model to use in managing panel data, several tests can be carried out: the Chow Test (Common Effect vs. Fixed Effect), Hausman Test (Fixed Effect vs. Random Effect), and Lagrange Multiplier Test (Random Effect vs. Common Effect).

4.4.1 Chow Test

To determine which model is better in panel data testing, it can be done by adding dummy variables so that it can be seen that the intercepts are different and can be tested with the Chow Test. This test is used to determine whether the panel data regression technique with the fixed effects method is better than the panel data model regression without dummy variables (common effects model). The calculation results of the Chow Test are listed in the following table:

Table 9. Chow Test Results

Redundant Fixed effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.015249	(11,116)	0.0328
Cross-section Chi-square	23.083925	11	0.0172

Table 9 shows that the Probability Cross-section Chi-square value is 0,0172 < 0,05 thus rejecting H_0 with the hypothesis:
H_0 : *Common Effect Model*
H_1 : *Fixed Effect Model*

Thus, it can be concluded that the fixed effects model is more appropriate than the common effects model.

4.4.2 Hausman Test

The Hausman Test aims to compare the fixed- and random-effects models. The results of this test are used to determine whether the panel data regression technique with the Generalized Least Square method (Random Effect Model) is better than panel data regression with the Least Square Dummy Variable method (Fixed Effect Model). The calculation results of the Hausman Test are listed in the following table:

Table 10. Hausman Test Results

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	9.281444	4	0.0544

Based on Table 10, it can be seen that the value of the random Cross-section Probability is 0.0544, which means it is significant with a significance level of 95% (α = 5%) and uses the chi-square

distribution. Therefore, the decision taken in this Hausman Test is to accept H_0 (*P-value* > 0,05) with the following hypothesis.
H_0 : *Random Effect Model*
H_1 : *Fixed Effect Model*

Based on the results of the Hausman Test, it can be concluded that the random effects model is more appropriate than the fixed effects model.

4.4.3 Langrange Multiplier Test
The LM Test aims to select the random effects model or common effects model. This test was based on the residual value of the common effects model method. The results of the Lagrange multiplier test are presented in the following table:

Table 10. Results of the Lagrange Multiplier Test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis Cross-section	Time	Both
Breusch-Pagan	1.728225 (0.1886)	0.274807 (0.6001)	2.003032 (0.1570)

Based on Table 10, it can be seen that if the value of the Breusch-Pagan cross section ≥ 0,05, then H_0 is accepted, with the following hypothesis:
H_0 : *Common Effect Model*
H_1 : *Random Effect Model*

Based on the results of the Lagrange multiplier test, Common Effect Model vs. Random Effect Model above, the Breusch-Pagan cross section value is 0.1886 ≥ 0.05, so the H0 hypothesis is accepted, which means that the Common Effect Model (CEM) is more appropriate than the Random Effect Model (REM).

4.5 Hypothesis Testing
Hypothesis testing was conducted to examine the effect of Leverage, Firm Size, and profitability on systematic risk (Z) and stock prices (Y). The results of the hypothesis tests are presented in the following table.

Table 11. Hypothesis Test Results of the Effect of Leverage, Firm Size, and Profitability on Systematic Risk (Z)

Hypothesis	**Variable**	***Coefficient***	**Std. *Error***	***t-Statistic***	***Prob.***	**Conclusion**
H_1	*Leverage* (X_1)	-0.006969	0.079375	-0.087800	0.9302	Not Significant
H_2	*Firm Size* (X_2)	0.193339	0.207388	0.932261	0.3530	Not Significant
H_3	Profitability (X_3)	-0.494707	0.757287	-0.653262	0.5148	Not Significant

Based on Table 11, the results of the hypothesis test on the influence of Leverage, Firm Size, and profitability on systematic risk are:

1. H_1 = Leverage (X_1) does not have a significant effect on systematic risk (Z), as indicated by a P-value of 0.9302, which is far above 0.05.
2. H_2 = Firm Size (X_2) also does not have a significant effect on systematic risk (Z), with a P-value of 0.3530.
3. H_3 = Profitability (X_3) does not have a significant effect on systematic risk (Z), with a p-value of 0.5148.

Table 12. Results of Hypothesis Testing of the Effect of Leverage, Firm Size, Profitability, and Systematic Risk on Stock Prices (Y)

Hypothesis	**Variable**	***Coefficient***	**Std. *Error***	***t-Statistic***	***Prob.***	**Conclusion**
H_4	*Leverage* (X_1)	-0.009541	0.012715	-0.750425	0.4544	Not Significant
H_5	*Firm Size* (X_2)	-0.049677	0.033332	-1.490.368	0.1386	Not Significant
H_6	Profitability (X_3)	-0.023079	0.121504	-0.189948	0.8497	Not Significant
H_7	Systematic Risk (Z)	0.001568	0.014158	0.110717	0.9120	Not Significant

Based on Table 12, the results of the hypothesis test on the influence of Leverage, Firm Size, profitability, and systematic risk on stock prices are:

1. H_4 = Leverage (X_1) does not have a significant effect on stock prices (Y), with a p-value of 0.4544.
2. H_5 = Firm Size (X_2) does not have a significant effect on stock prices (Y), with a P-value of 0.1386.
3. H_6 = Profitability (X_3) does not have a significant effect on stock prices (Y), with a p-value of 0.8497.
4. H_7 = Systematic Risk (Z) does not have a significant influence on stock prices (Y), with a p-value of 0.9120.

Table 13. Results of Hypothesis Testing of the Effect of Leverage, Firm Size, and Profitability on Stock Prices Mediated by Systematic Risk (Z)

Hypothesis	**Connection**	**Conclusion**
H8	*Leverage* (X_1) → Systematic Risk (Z)	Not Significant
	Firm Size (X_2) → Systematic Risk (Z)	Not Significant
	Profitability (X_3) → Systematic Risk (Z)	Not Significant
	Systematic Risk (Z) → Stock price (Y)	Not Significant
	Leverage (X_1) → Stock price (Y)	Not Significant
	Firm Size (X_2) → Stock price (Y)	Not Significant
	Profitability (X_3) → Stock price (Y)	Not Significant

Based on Table 13, the results of the hypothesis test on the influence of Leverage, Firm Size, profitability, and systematic risk on stock prices are:

1. Leverage (X_1) → Systematic Risk (Z): There is no significant effect of leverage on systematic risk.
2. Firm Size (X_2) → Systematic Risk (Z): Company size has no significant effect on systematic risk.
3. Profitability (X_3) → Systematic Risk (Z): Profitability has no significant effect on systematic risk.
4. Systematic Risk (Z) → Stock Price (Y): Systematic risk does not have a significant effect on stock prices.
5. Leverage (X_1) → Stock Price (Y): There is no significant effect of leverage on stock price.
6. Firm Size (X_2) → Stock Price (Y): Company size has no significant effect on stock prices.
7. Profitability (X_3) → Stock Price (Y): Profitability has no significant effect on stock prices.

5. Conclusion

5.1 Conclusion

This study focuses on the analysis of the influence of leverage, company size (Firm Size), profitability, and systematic risk on the stock prices of palm oil plantation subsector companies listed on the Indonesia Stock Exchange (IDX) during the period 2013-2023. Based on the results of panel data analysis conducted using the Common Effect Model (CEM), it was found that the variables leverage, company size, profitability, and systematic risk did not have a significant effect on stock prices.

First, Leverage does not significantly affect systematic risk or stock prices. This result shows that although leverage can increase a company's financial risk, in the context of palm oil plantation subsector companies, other factors such as commodity price fluctuations and government policies seem to be more dominant in influencing systematic risk and stock prices. This is in accordance with modern financial theory, which states that the financial risk caused by leverage can be minimized by portfolio diversification and effective risk management.

Second, company size has no significant effect on systematic risk or stock price. This shows that company size is not a major determinant in determining the level of systematic risk or stock prices in this sector. Although larger companies are often considered more stable and less risky because of better diversification, the results of this study indicate that in the palm oil plantation subsector, industry-specific factors such as dependence on palm oil prices and weather conditions may have a greater impact.

Third, profitability does not significantly affect systematic risk or stock price. Although in theory more profitable companies should have lower risk and higher stock prices, in the palm oil plantation sub-sector, profitability does not appear to be a major factor affecting systematic risk or stock prices. This may be due to the high volatility of commodity prices and regulatory uncertainty, which affects the long-term prospects of this industry.

Fourth, systematic risk does not significantly affect stock prices. Systematic or market risk usually affects the entire market or a particular sector and cannot be eliminated through diversification. However, in the palm oil plantation sub-sector, these results indicate that systematic risk is not a major consideration for investors, perhaps because they focus more on company- or industry-specific fundamental factors.

Fifth, there is no significant evidence that systematic risk mediates the effects of leverage, firm size, or profitability on stock prices. This suggests that other factors may be more important in determining the stock prices in this sector. Factors such as macroeconomic conditions, government policies, and environmental factors may have more significant effects and require further research. Thus, this study shows that factors such as leverage, company size, profitability, and systematic risk only explain a small part of the variation in the stock prices of companies in the palm oil plantation sub-sector. These results indicate that other factors may be more influential in determining the stock prices in this sector. Further research is needed to explore these factors and improve stock price prediction models in the palm oil plantation sector. This study provides important insights for investors, companies, and policymakers to understand the broader dynamics of stock price determination in this sector and the importance of considering external and industry factors in decision-making.

5.2 Suggestions

Based on these conclusions that have been outlined, several suggestions for future research and practice are as follows:

1. Expansion of Research Variables
   The expansion of research variables by including external factors such as palm oil commodity prices, regulatory policies, and weather conditions can provide a more comprehensive understanding of the factors that influence stock prices in this sector.
2. Different Methodological Approaches

3. The use of different methodological approaches, such as dynamic models or nonlinear analysis, may provide deeper insights into the relationships between the variables studied.
4. Improving Risk Management
   Companies in the palm oil plantation subsector need to improve risk management, especially in relation to commodity price fluctuations and environmental conditions. This can be achieved through diversification strategies, the use of futures contracts, and investments in agricultural technology that is more resilient to climate change.
5. Investor Decision Making
   Investors need to pay attention to company- and industry-specific fundamental factors in making investment decisions in the palm oil plantation sub-sector. Focusing on the long-term profitability and sustainability of a company's operations can be important considerations.
6. Government Policy
   The government must provide stable and sustainable policy support for the palm oil plantation sector, including regulations that support sustainable practices and environmental risk management. This can increase investors' confidence and encourage growth in this sector.

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