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Palm Oil Industry Dynamics: Assessing P/B Ratios of Indonesian Palm Oil Companies through Palm Tree Profile, Average FFB Yield, and Palm Oil Extraction Rate

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Abstract

The primary objective of this paper is to explore the impact of palm tree profile (age), Fresh Fruit Bunch (FFB) yield, and Oil Extraction Rate (OER) on the Price-to-book (P/B) ratio of Indonesian palm oil companies listed on the Indonesia Stock Exchange (IDX) with return on equity (ROE) as a mediating variable. This study is important because it explores the variables that affect business valuations in a vital industry that employs more than 16 million people and generates huge export earnings, significantly supporting the Indonesian economy. Multiple linear regression is used in a quantitative analysis of secondary data gathered from the financial statements and annual reports of 15 palm oil enterprises from 2013 to 2023. The results show a strong positive relationship between OER and FFB yield with the P/B ratio, indicating that increased operational productivity and efficiency raise firm values. Specifically, the regression analysis revealed that each percentage point increase in OER is associated with a 0.1546 increase in the P/B ratio ($p < 0.001$), and each unit increase in FFB yield contributes to a 0.1013 increase in the P/B ratio ($p < 0.001$). On the other hand, the P/B ratio is negatively impacted by palm tree age, suggesting that older palms are less productive, with a coefficient of -0.1035 ($p < 0.001$). The relationship between productivity ratio and valuation was also shown to be influenced by Return on Equity (ROE), which was identified as a mediating variable. The findings suggest that enhancing internal factors, such as plantation management and mill efficiency, can improve company valuation. It is recommended for future research to use larger sample sizes and longer observation periods to confirm these findings and explore additional variables.

Keywords: Palm Tree Profile, FFB Yield, Oil Extraction Rate, Price to Book Ratio, Return on Equity

1. Introduction

Palm oil industry is one of the industries present on the Indonesia Stock Exchange. With a total of 26 palm oil companies listed on the Indonesia Stock Exchange in 2023, the oil palm industry plays a significant role in the Indonesian economy, employing approximately 16.2 million workers and contributing to export values amounting to 29.66 billion US dollars, accounting for around 10.2 percent of Indonesia's total export value [1].

The primary factor behind the significant contribution of the palm oil industry is the drastic increase in the price of palm oil itself. The price surged from $525 USD per metric ton in 2019 to a peak of $1,975 USD per metric ton in 2022 [2]. This remarkable rise resulted in the highest export values in a decade, and it is anticipated that export levels will continue to grow in the future. On the flip side, the industry faces some negative environmental and social issues, such as deforestation, biodiversity loss, and disputes over land rights, which have raised concerns about the sustainability of palm oil production.

In response, palm oil companies will remain competitive in maximizing their profits while conducting ESG practices to promote sustainable production. Especially, companies that are listed on the Indonesia Stock Exchange will continue to strive to enhance the attractiveness of their stocks to gain investor trust and confidence. Companies' attractiveness will be assessed by investors to determine investment choices through various valuation methods. Companies with

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premium valuations will have an advantage as they can raise more capital through the sale of company shares, enabling them to expand their business by expanding palm oil plantations and developing more efficient palm oil mills. The phenomenon addressed in this study is the fluctuating level of price appreciation by investors over time due to various factors. As a result, the valuation of palm oil companies, especially the Price to Book value (P/B) ratio, in the capital market, fluctuates highly and is subject to change. In early 2022, the P/B ratios of some palm oil companies were notably high, with an average P/B ratio exceeding 1.25x. However, the P/B ratio for these companies declined ever since to below 1.0x until 2024.

The level of price appreciation by investors is influenced by the effectiveness and efficiency of companies in generating profits in the present and future. A key ratio of such effectiveness is the Return on Equity (ROE), which measures a company's profitability by revealing how much profit a company generates with the money shareholders have invested. However, In this specific industry, Palm oil companies' effectiveness could be further broken down into the productivity ratios such as the Palm Tree Profile, Average Fresh Fruit Bunch (FFB) Yield, and Oil Extraction Rate (OER) of the palm oil companies.

Many prior studies have explored factors that influence P/B ratio. A study conducted by Henviani and Sanjaya examined factors influencing P/B of 54 non-financial companies listed on the Indonesia Stock Exchange from 2016-2018, employing multiple regression analysis. Among the variables tested, only Return on Asset (coefficient: 35.670) and Debt to Equity ratio (coefficient: 0.976) showed significant positive influence on firm value, while other factors including institutional ownership, liquidity, dividend policy, company size, audit committee, and managerial ownership demonstrated no significant impact [3]. Research specific to the palm oil industry was carried out by Elfian et al. The study analyzed seven Indonesian palm oil companies from 2015-2021 using Economic Value Added (EVA) analysis, focusing on factors like company profits, Rupiah exchange rate, interest rates, and CPO prices. The research revealed that only company profits (coefficient: 0.623%) and Rupiah exchange rate (coefficient: 0.065%) significantly influenced EVA, with these factors explaining 61.5% of financial performance variation [4].

Similarly, Amin et al. study, using ARDL methodology, analyzed the relationship between financial development (Financial depth (agricultural credit), Access to financial services (bank branches), Efficiency (bank lending-deposit spread), Financial stability (bank credit-to-deposit)) and Malaysia's palm oil industry from 1981-2017, revealing that financial depth had the most significant impact, where a 1% increase in private sector credit led to a 0.11% increase in palm oil production, and a 1% increase in stock trade resulted in a 0.06% production increase, while other financial indicators showed no significant effect. The study concluded that stock market development was more important than credit market development for the palm oil sector's growth, implying that policymakers should emphasize frameworks that improve financial system development to encourage sustainable agricultural production [5].

However, the study highlighted that financial accessibility, efficiency, and stability did not exert a significant effect on palm oil industry productivity. Therefore, there is a gap in the existing research landscape, as studies similar to this topic, examining the impact of productivity ratios of palm oil companies on the P/B ratio, have not been conducted. This research gap is what became the novelty and attracted our interest in carrying out this research. This research explores the impact of palm tree profile, average FFB yield, and Oil Extraction Rate on the Price-to-Book ratios of palm oil companies in Indonesia. It seeks to determine whether these factors significantly influence the P/B ratio and examines if company performance mediates the effects of palm tree profile, average FFB yield, and OER on the P/B ratio.

2. Literature Review and Hypothesis Development

2.1. Literature Review

In this research, we combined two theories. The first theory is the Efficient Market Hypothesis. According to Fama, all information that can be known publicly is reflected in stock prices [6]. The Efficient Market Hypothesis (EMH) suggests that stock prices efficiently incorporate available information. In its weakest form, this means past prices and volumes are already reflected, making technical analysis ineffective. A semi-strong EMH adds that all public information, including financial reports and economic data, is factored in, rendering both technical and fundamental

analysis futile for consistent outperformance. The strongest form posits that even private, insider information is reflected in prices, making it impossible to consistently beat the market regardless of knowledge [7].

The second theory is Signaling Theory. According to Michael Spence, individuals and organizations communicate information to other parties to influence perceptions and behavior [8]. Information about their abilities, qualities and intentions is used to provide signals to parties who have not received the information. Companies can send signals to investors through various aspects of their financial management. The financial structure model suggests the debt-to-equity ratio can signal future performance, with more equity indicating confidence. The corporate investment model sees investment decisions, particularly unique or substantial ones, as a sign of belief in prospects. Similarly, the debt maturity model interprets long-term debt as a signal of confidence, while short-term debt suggests financial strain. Finally, the dividend-based model suggests stable and increasing dividends signal a company's belief in its ability to generate future cash flows and commitment to sharing profits with investors [9].

The combination of EMH and Signaling Theory is critical to our research because it allows us to investigate how efficiently the market integrates signals issued by companies into stock prices. This is especially important for determining whether the signals that corporations broadcast through their financial decisions are accurately represented in their market valuation, in accordance with EMH principles.

2.2. Effects of Palm tree profile on Price to Book value ratio

Plant age is important because it will reflect the productivity prospects of the company's oil palm plants based on the age classification of the plants they have. Palm trees can be divided into three age categories: young age (1-8 years) with productivity starting from the age of 4 years and tree height of 2-4 meters, prime age (9-18 years) which has good productivity with tree height of 4-8 meters, and old age (18 years and above) where productivity decreases and even stops when reaching the age of 25 years with tree height reaching 8-12 meters, making it difficult for farmers to harvest fresh fruit bunches [10]. Companies with prime plant age will have better productivity and this will lead to an increase in sales quantity which will lead to an increase in net profit. this concept aligns with the signaling theory and the Efficient Market Hypothesis, suggesting that informed investors are likely to value companies with optimal plant age profiles more favorably, reflected in a higher P/B ratio. Palm oil companies' disclosure of plant age sends an important signal to the market, increasing transparency and potentially impacting market valuation.

Further supporting the significance of plant age, J. Zhao et al. Emphasizes replanting oil palms at 25 years and implementing yield improvements are essential strategies to stabilize and potentially increase palm oil production in Riau, Indonesia [11]. Specific research regarding the relationship between palm tree profile and Price to Book value of palm oil companies is still rarely carried out so that no research in a similar field can be found. So, from the support of logic and theory a hypothesis can be formulated as follows:

H1: Palm tree profile has a significant influence on Price to Book value for palm oil companies.

2.3. Effects of Average FFB Yield on Price to Book value ratio

The average FFB yield per hectare is a key metric in palm oil production, influenced by factors such as tree age, seed quality, and soil conditions [12]. Which reflects the competency of plantation management, both in terms of fertilizer selection, superior seeds, and also good water management. The average FFB yield per year in Indonesia is approximately 18 tons per hectare [13]. The higher this yield, the greater the company's sales volume, which can lead to an increase in net profit. Consequently, companies with higher yields are often able to distribute dividends with a large payout ratio, thereby providing a substantial dividend yield.

According to signaling theory and the Efficient Market Hypothesis, the market values companies with higher operational efficiencies and financial returns more favorably, as reflected in a higher P/B ratio. This suggests that companies demonstrating superior FFB yields are likely to be awarded higher market multiples due to perceived better long-term profitability and risk management.

According to Amin et al. [5], Long-term performance in the palm oil business is positively impacted by the financial market, even if the financial institutions only have a long-term effect. In the meanwhile, the industry's productivity is not significantly impacted by financial accessibility, efficiency, or stability. It suggests that the expansion of the equity

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market will have a greater impact on the palm oil business than the development of the credit market. Despite the recognized importance of FFB yield on company performance, specific research regarding the relationship between FFB yield and Price to Book value of palm oil companies is still rarely carried out so that no research in a similar field can be found. So, from the support of logic and theory a hypothesis can be formulated as follows:

H2: Average FFB Yield has a significant influence on Price to Book value for palm oil companies.

2.4. Effects of Oil Extraction Rate on Price to Book value ratio

Oil Extraction rate refers to the quantity of palm oil that can be produced by a palm oil mill after processing fresh fruit bunches, where well-ripe FFB will have a high oil extraction percentage in the range of 20% [14]. Factors influencing the Oil Extraction Rate such as leftover fruit pieces in the plantation resulting to yield reduction, debris such as wood, leaves, and stones in the raw material can also reduce oil yield [15]. Lastly, oil losses at the mill can further decrease the overall oil extraction rate. In other words, it reflects the level of productivity performance of the company's factories, where companies with high OER reflect efficient and effective factory management, leading to increased operational margins and will increase net profit, so the company can distribute dividends with a payout ratio which is large and provides a large dividend yield.

According to signaling theory and the Efficient Market Hypothesis, companies demonstrating high OER are likely to be more valued by the market, receiving a higher P/B ratio due to perceived better efficiency and profitability. A study on Malaysia's oil palm industry reveals that fluctuations in the Oil Extraction Rate (OER) from 18.48% to 19.87% between 1980 and 2002 led to significant economic impacts, including a RM 1.15 billion loss in 1999 [16]. Specific research regarding the relationship between OER and Price to Book value of palm oil companies is still rarely carried out so that no research in a similar field can be found. So, from the support of logic and theory a hypothesis

H3: Oil Extraction Rate has a significant influence on Price to Book value for palm oil companies.

2.5. Effects of Company performance on Price to Book value ratio

One of the most important things that investors look at when choosing an investment is a company's potential to turn a profit. The ability of a business to turn a profit can also be predicted using profitability. One financial metric that can be used to assess profitability is ROE. ROE is a measure of a company's ability to generate net income for shareholders and assesses profitability from the viewpoint of shareholders [17]. A company's profitability and appeal to investors both increase with its ROE. The ROE of a business dictate whether or not it will distribute dividends to its owners. A company that is successfully controlling costs and accepting investment opportunities is one that has a high ROE. According to signal theory and Efficient market hypothesis, a company with a higher Return on Equity will also send a signal to investors to invest in it because it has more potential profits. Thus, deserve a more premium valuation and will increase the Price to Book value ratio multiple

Previous study concluded that increased R&D spending significantly enhances the value of palm oil companies in Indonesia, with firm size moderating this relationship, and factors like current ratio, debt to assets ratio, and return on assets influencing company value, except for total assets turnover [18]. A study conducted on LQ45 companies also concluded that ROE has a significant positive effect to Price to Book value [19]. So, from the support of previous research and theory, a hypothesis can be formulated as follows:

H4a: Company performance is able to mediate effect of palm tree profile on Price to Book value for oil palm companies.

H4b: Company performance is able to mediate effect of average FFB Yield on Price to Book value for oil palm companies.

H4c: Company performance is able to mediate effect of Oil Extraction Rate Price to Book value for oil palm companies.

3. Methodology

3.1. Material and Method

This research is a quantitative analysis utilizing secondary data sources, including Price to Book value ratios, Financial Statements, and Annual Reports obtained from www.idx.co.id and Bloomberg. The focus of this study is on palm oil

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companies listed on the IDX between 2013 and 2023. We have open data, the data of this research can be downloaded in this link Open Data Research.xlsx. The selection of the sample was strategically carried out based on purposeful sampling technique. This purposeful sampling strategy is used because it is appropriate for quantitative research, which does not include generalizations. Ultimately, 15 companies were selected that fulfilled these requirements, resulting in a total sample size of 117 for the study period.

Criteria used in purposive sampling in this research included selecting palm oil companies with a book closing date of December 31 and those that provided comprehensive data on palm tree profile, FFB production volume, planted area, and CPO production volume from 2013 to 2023. Additionally, only industrial sector companies that consistently disclosed annual reports during this period and were not delisted from 2013 to 2023 were considered. This ensured the reliability and relevance of the data for analyzing the impact on P/B ratios.

Multiple linear regression analysis is carried out using Stata. The classical assumption tests, which comprise the heteroscedasticity, autocorrelation, multicollinearity, and normality tests, will be conducted before going to the multiple linear regression analysis. The partial significance test, simultaneous significance test, and coefficient of determination test are all included in multiple linear regression analysis with these following equations:

$$\text{P/B ratio} = \alpha + \beta 1 \times \text{Palm tree profile} + \beta 2 \times \text{Average FFB Yield} + \beta 3 \times \text{OER} + \epsilon \quad (1)$$

$$\text{ROE} = \alpha + \beta 1 \times \text{Palm tree profile} + \beta 2 \times \text{Average FFB Yield} + \beta 3 \times \text{OER} + \epsilon \quad (2)$$

$$\text{P/B ratio} = \alpha + \beta 1 \times \text{Palm tree profile} + \beta 2 \times \text{Average FFB Yield} + \beta 3 \times \text{OER} + \beta 4 \times \text{ROE} + \epsilon \quad (3)$$

3.2.Operating Variable

In this study, several key variables were analyzed to understand their impact on P/B ratio, which serves as the dependent variable. The P/B ratio, a method of relative valuation methods that focuses on the company's Book value as the main key in assessing share prices [20], calculated as the market price per share divided by the book value per share.

Among the independent variables, the palm tree profile represents the age of oil palm trees within a plantation, which influences production results and the quality of the oil palm fruit produced. Oil palm productivity usually increases as the tree ages, reaching a peak at a certain age before starting to decline [21].

Another independent variable, the average FFB yield, measures the average number of FFB produced by one palm tree in one year. Calculating the average FFB yield provides an overview of the productivity of oil palm plantations and can be used to evaluate production efficiency [22]. This yield is calculated by dividing the total FFB produced by the planted area.

The oil extraction rate, also an independent variable, indicates the percentage of palm oil that is successfully extracted from the fresh fruit produced. An important parameter in assessing the efficiency of palm oil processing factories, calculated as the total CPO production divided by the total FFB processed [23].

Additionally, ROE is used as a mediating variable, where ROE is a measure of profitability to determine how efficient the company is utilizing its equities to make profits, calculated by dividing net income by shareholder's equity [24].

4. Results and Discussion

The initial data analysis conducted in this study was descriptive statistical analysis. This study uses Stata for descriptive statistical analysis, taking into account the minimum, maximum, mean, standard deviation values, skewness, and kurtosis. The results of this analysis are detailed in table 1.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Deviaton	Min	Max	Skewness	Kurtosis
PBV	117	1.58	1.15	0.34	6.12	1.79	6.16
AGE	117	12.74	3.48	4.40	20.60	-0.21	2.74
FFBYield	117	18.03	4.37	7.60	27.00	-0.47	2.31

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OER	117	21.51	2.44	12.62	24.85	-2.01	6.97
ROE	117	10.03	12.57	-69.25	33.23	-2.40	16.09

The sample companies' average P/B ratio was 1.58x with skewness of 1.7902 indicates a right-skewed distribution, implying that the majority of companies have lower P/B ratios, and kurtosis of 6.1551 indicates a leptokurtic distribution with significant outliers. PT Sawit Sumbermas Sarana Tbk (SSMS) got the most premium valuation in 2015 which was traded at 6.12x P/B and 5.69x P/B in 2023. The premium valuation is achieved because of their remarkable financial performance, which is positively rewarded by the market, shown by their robust 29.26 ROE in 2023 and 20.7% revenue growth per annum since 2015. In contrast, the lowest P/B ratio was contributed by PT Salim Ivomas Pratama Tbk (SIMP) in their 2023 financial year which is owned by Salim group, one of the conglomerate groups in Indonesia. SIMP performed very poorly in 2023 where their revenue dropped 38.5% year-on-year thus also dragged down their ROE from 7.1% in 2022 to 4.3% in 2023.

Whereas the average palm tree profile (age) was roughly 12.7 years old, with the palm tree profile of 20.6 years old owned by PT. Sinar Mas Agro Resources and Technology Tbk (SMAR). Indicating that their plantations have passed their prime productivity age of 9-18 years old [10] and replantation is needed soon to replace old trees thus optimizing the company's productivity. The average FFB yield of 18 tons per hectare suggests that palm oil companies in Indonesia have an advance plantation management in compared to other countries like Malaysia with the average FFB yield of 16.2 ton per hectare [25]. PT Sawit Sumbermas Sarana Tbk (SSMS) once again show remarkable achievement in 2022 with the highest FFB yield of 27 ton per hectare which was attributed to i. Prime plantation age of 13.7 years old ii. superior seeds quality and iii. excellent plantation management competency.

Most of the palm oil mills were also well managed with an average OER of 21.5%, kurtosis of 6.9726, suggesting the presence of outliers or extreme values, and skewness of -2.0079, indicating that most companies have higher extraction rates. PT Palma Serasih Tbk (PSGO) and PT Dharma Satya Nusantara Tbk are the 2 companies standing on the pinnacle with oil extraction rate greater than 24%, showing their excellence oil mills operation. In overall, there is no multicollinearity in the data according to the correlation analysis.

4.1. Classic Assumption Test

The subsequent phase in the analysis is multiple linear regression analysis. In multiple linear regression analysis, a classic assumption test is employed to ensure that the regression model is not biased, where the test will validate the integrity of the data and confirm the regression results are reliable and can be interpreted with confidence. The classic assumption test used in this study comprises of four tests: normality, multicollinearity, autocorrelation, and heteroscedasticity.

4.2. Normality Test

In this study, the normality test was performed using the Shapiro-Wilk test using Stata Graph's normal probability plot. A variable is considered to pass the normality test if the prob > z value in the Shapiro-Wilk test exceeds 0.05 and the points in the normal probability plot are clustered around the normal line. The Shapiro-Wilk test is shown in table 2, and the normal probability plot is presented in figure 1.

Table 2. Shapiro Wilk W Test for Normal Data

Variable	Obs	W	V	z	Prob>z
PBV	117	0.80	18.47	6.53	0.00
AGE	117	0.99	1.18	0.38	0.35
FFBYield	117	0.95	4.35	3.29	0.00
OER	117	0.78	21.23	6.84	0.00
ROE	117	0.82	16.79	6.31	0.00

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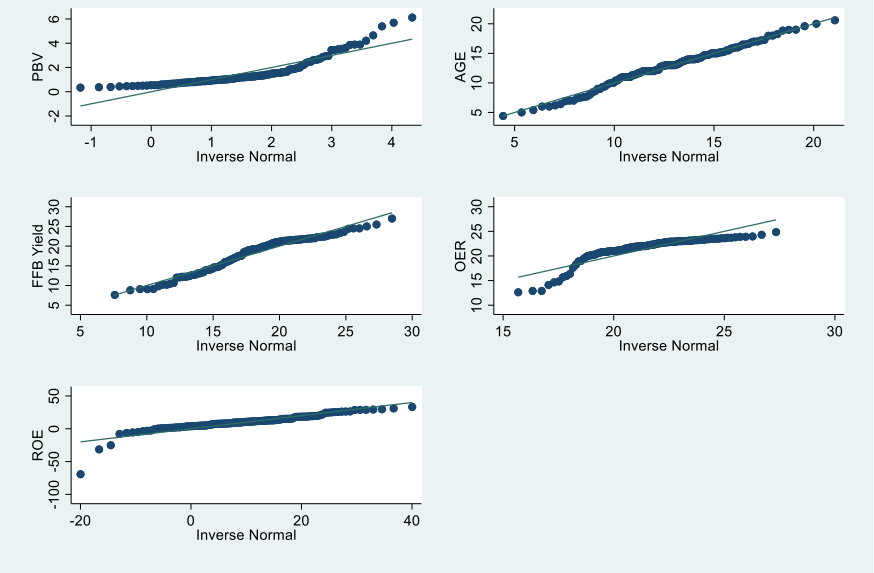

Figure 1. Normal Probability Plot

Based from data presented in table 2, we can conclude that Palm tree profile (AGE) is the only one that have a normal distribution, as seen by their Shapiro-Wilk test results (p-value > 0.05). The P/B ratio, Average FFB Yield, OER and ROE do not have a normal distribution because their p-values are significantly less than 0.05, supported by the deviations observed in figure 2.

4.3. Multicollinearity Test

The next assumption test used was a multicollinearity test to explain the correlation between independent variables in the regression model. The criterion utilized are to pay attention to Variance Inflation Factors (VIF) for independent variables with values less than 10. The VIF values for each variable are presented in table 3 below.

Table 3. Multicollinearity Test

Variable	Variance Inflation Factors
AGE	1.32
FFBYield	1.04
OER	1.36

Based on these results, we can conclude that all independent variables in this study model passed the multicollinearity test, since their VIF values were less than 10.

4.4. Autocorrelation and Heteroskedasticity Test

The next assumption test is autocorrelation, which seeks to identify the relationship between data from various observations in the regression model. The number of samples for this study was 117, with four variables studied: three independent variables, one dependent variable. The Durbin-Watson d-statistic reported is 2.167454 (table 4), which mean there is no significant autocorrelation in the residuals of this regression model. Typically, a Durbin-Watson statistic value near 2 suggests no autocorrelation, while values substantially less than 2 suggest positive autocorrelation, and values toward 4 indicate negative autocorrelation.

Table 4. Autocorrelation and Heteroskedasticity Test

Breusch-Pagan		Durbin-Watson	
Chi^2	34.88	d-statistic	2.17
Prob > Chi^2	0.00		

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The Breusch-Pagan/Cook-Weisberg test indicated significant heteroskedasticity (chi-square = 34.88, $p < 0.01$), suggesting non-constant variance in the error terms. To address this, we employed robust regression techniques, which adjust standard errors to provide reliable estimations despite the presence of heteroskedasticity. This method enhances the validity of our regression analysis, ensuring that our conclusions remain robust against such violations of classical OLS assumptions.

4.5. Hypothesis Testing

In order to address the formulation of the research topic, hypothesis testing was done in this study. The simultaneous test (F test), individual significance test (t test), and coefficient of determination test (R^2) make up the hypothesis test that is conducted. The regression analysis conducted to test the hypotheses concerning the effects of Palm tree Age, FFB yield, and OER on the P/B ratio of palm oil companies is detailed in table 5.

Table 5. Multiple Regression Analysis

PBV	Coefficient	Std. Error	t-value	p-value
Age***	-0.10	0.25	-4.17	0.00
FFBYield***	0.10	0.21	4.67	0.00
OER***	0.16	0.27	5.71	0.00
_cons	-2.25	0.94	-2.40	0.02

*** p<.01, ** p<.05, * p<.1

The model's R-squared is 0.3852, indicating a significant overall fit where 38.52% of the variability in the dependent variable (P/B ratio) can be explained by the independent variables (Age, FFB Yield, and OER). The remaining 61.48% of the variability is due to other factors not included in this model. These could be variables such as weather factors or annual precipitation, palm oil price, market conditions, or political stability, which were not discussed in this study. OER and FFB yield have a significant positive impact with a coefficient of 0.1546 and 0.1013 respectively. This suggests that a 1% increase in oil extraction rate leads to a 0.1546 increase in P/B ratio multiple and a 1 ton/ha increase in FFB Yield results in a increase in P/B ratio by approximately 0.1013 units. Meanwhile, we discover that Palm tree profile has a significant negative impact with -0.1035 coefficient, meaning that for every 1-year increase in palm tree profile, P/B ratio decreases by 0.1035 units. Overall, the model indicates that palm tree profile negatively impacts P/B ratio, while FFB yield and OER positively contribute to P/B ratio, with all variables showing strong statistical significance ($p < 0.01$), thus confirming our hypothesis.

A thorough mediation analysis was carried out in order to better understand the relationships between business performance, particularly ROE, and its mediating impacts on various factors affecting the P/B ratio in oil palm enterprises. Table 6.1 and table 6.2 provide a thorough presentation of the analysis's findings, which examine the connections between age, FFB Yield, OER, and their effect on the P/B ratio through ROE.

Table 6.1. Mediation Analysis

ROE	Coefficient	Std. Error	t-value	p-value
Age	0.19	0.25	0.76	0.45
FFBYield***	1.35	0.39	3.50	0.00
OER***	1.14	0.30	3.80	0.00
_cons	-41.41	12.32	-3.36	0.00

*** p<.01, ** p<.05, * p<.1

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Table 6.2. Mediation Analysis

PBV	Coefficient	Std. Error	t-value	p-value
Age***	-0.11	0.02	-4.47	0.00
FFBYield ***	0.08	0.02	3.76	0.00
OER***	0.14	0.03	5.19	0.00
ROE*	0.02	0.01	1.81	0.07
_cons	-1.56	0.89	-1.75	0.08

*** p<.01, ** p<.05, * p<.1

The models' R-squared are 0.227 and 0.4108 respectively, indicating a significant overall fit. The hypothesis of ROE mediates the effect of palm tree age on P/B ratio is rejected because, with the p-value of 0.451, Age does not significantly affect ROE. On the other hand, the hypotheses that ROE mediates the effects of FFB Yield and OER on PBV are accepted. FFB yield and OER significantly impacted ROE, which then marginally affects PBV ($p < 0.01$), and FFB yield and OER coefficient decrease from 0.1013 to 0.0786 and from 0.1546 to 0.1354 respectively when ROE is included in the model, meaning that ROE partially mediates the relationship between FFB yield and OER to P/B ratio. These results highlight that company performance plays an important role in how FFB Yield and OER impact the financial valuation, emphasizing the importance of managing yield and resource extraction efficiently to increase market value for palm oil companies.

5. Conclusion

This research offers insight into palm oil industry in Indonesia, with high contributions to employment and export revenues. According to our study, palm tree profile, FFB yield, and OER is one of the key determinants of palm oil company's valuation in Indonesia. Where we identify a negative correlation between the age of oil palm trees and the P/B ratio, indicating younger palm trees may experience higher valuations due to the anticipated prime productivity. We also find a positive correlation between higher average FFB yield and Oil Extraction rate with P/B value ratio, reflecting investor confidence in the company's capability to sustain high productivity and profitability margins through efficient plantation and oil mills management.

The study also confirms the mediating role of firm performance proxied by ROE in the relationship between productivity ratios and the P/B value ratio. The ability of a company to properly manage its operations, thereby achieving higher ROE, is significantly bound to affect its capital market valuation. These findings are therefore in line with the Efficient Market Hypothesis and the Signaling Theory, where market participants make intelligent investment decisions through available information about the company performance and productivity. The findings of this study therefore agree with those of past studies in the industry, all adding to a greater understanding of what drives investor valuations in the palm oil business.

However, palm oil industries are also influenced through many external factors such as the weather in terms of annual precipitation, palm oil price changes, and government regulations. As a result, Palm oil companies need to focus on maximizing their internal performance through proficient plantations and oil mills management. Companies are encouraged to manage their plantations in terms of fertilizer selection, superior seeds, and good water management have demonstrated its benefits.

We accept that the current study has several limitations, including a small sample size, and a short observation period. To get a more definitive conclusion, more research and improvement of palm oil metrics are needed. Future studies should look at extending the sample size and observation duration and assessing the palm oil variable using various proxies such as Palm oil price changes, annual precipitation, Trade policies, and political stability.

6. Declarations

6.1. Author Contributions

Conceptualization: N.D.H., B.L.H., A.S.L.L., and H.S.; Methodology: B.L.H.; Software: N.D.H.; Validation: N.D.H., A.S.L.L., and H.S.; Formal Analysis: N.D.H., A.S.L.L., and H.S.; Investigation: N.D.H.; Resources: A.S.L.L.; Data Curation: A.S.L.L.; Writing Original Draft Preparation: N.D.H., A.S.L.L., dan H.S.; Writing Review and Editing: A.S.L.L., N.D.H., and H.S.; Visualization: N.D.H.; All authors have read and agreed to the published version of the manuscript.

6.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6.4. Institutional Review Board Statement

Not applicable.

6.5. Informed Consent Statement

Not applicable.

6.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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