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DETERMINANTS OF PROFITABILITY AND DEA EFFICIENCY ANALYSIS OF INDONESIA'S CIGARETTE INDUSTRY

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ABSTRACT:

Despite high smoking rates and large household spending on cigarettes, the cigarette sales volume in Indonesia has gradually declined. Due to challenging years in the cigarette industry, this research aims to analyze the determinants of profitability and efficiency of cigarette companies in Indonesia from 2019 to 2023. The study uses data from quarterly financial reports of four companies listed on the IDX. In panel data regression analysis, the independent variables include the current ratio (CR), asset turnover (TATO), and debt-to-equity ratio (DER), while the dependent variable is return on assets (ROA). The selected model is the Fixed Effect Model (FEM). The findings reveal that CR and DER significantly negatively influence return on assets, whereas TATO has a significant positive influence on ROA. All the independent variables collectively have a significant influence on the ROA of cigarette companies. Among these variables, DER has the most significant influence on profitability. These variables explain 51.90% of the variation in ROA. Separately, the average technical efficiency score of cigarette companies in Indonesia from 2019 to 2023 is 69.0%. Simple regression analysis shows that the average technical efficiency score is positive and significantly influences ROA. This variable explains 47.68% of the variation in ROA. Overall, these variables in this research explain 99.76% of the variation in ROA. In conclusion, cigarette companies should prioritize using their assets effectively and carefully manage debt levels to attract investors and maintain stable returns even during market fluctuations.

Keywords: *Profitability, Efficiency, Cigarette Companies*

1. Introduction

The prevalence of smoking in Indonesia is alarming, as the country stands as one of the world's largest tobacco producers and has the third highest number of smokers globally after China and India, with 62 million adult smokers (The Tobacco Atlas, 2019). In Indonesia, the industry is divided into machine-made cigarettes, including clove and white cigarettes, and hand-made cigarettes. Local communities usually provide the raw materials used in tobacco production for their livelihoods. Farmers, laborers working in tobacco companies, and governments depend on it as a source of income (Purwanto & Sari, 2021). Furthermore, from an economic point of view, many Indonesian households spend more money on cigarettes than on nutritious foods (Ahmad, 2020).

Despite high smoking rates and large household spending on cigarettes, the sales volume of cigarettes in Indonesia has gradually declined. This decline reached its peak during the lockdowns in 2020. The

lockdowns disrupted supply chains, limited access to retail outlets, and reduced consumer spending due to economic uncertainty. By 2021, sales began to recover slowly as stores reopened and discretionary spending increased. However, ongoing economic pressures, the lasting effects of the pandemic, tax hikes, and rising inflation pose potential threats to industry.

Tax hikes have made cigarettes more expensive, which could reduce consumption, particularly among price-sensitive consumers. Furthermore, the trend of downtrading, where consumers switch to cheaper tobacco alternatives like fine-cut tobacco or illicit products, has further worsened the situation. Due to challenging years in the cigarette industry that have led to a significant volume decline in the recent past, the industry is currently recovering from the previous impact of COVID-19 and adapting to new excise tax rates.

As shown in Figure 1, HMSP and GGRM, both key players in their industry, saw their ROA decline sharply from 27% and 14% in 2019 to only 12% and 3% by 2022, despite a minor rebound in 2023. On the other hand, WIIM and ITIC showed more resilience as WIIM's ROA grew from 2% in 2019 to 19% by 2023. Likewise, ITIC's also went up from -2% to 5%. These unpredictable fluctuations highlight the need to understand how companies internally manage their operations and asset utilization to generate profit. Therefore, this research aims to analyze the determinants of profitability and efficiency of cigarette companies in Indonesia from 2019 to 2023.

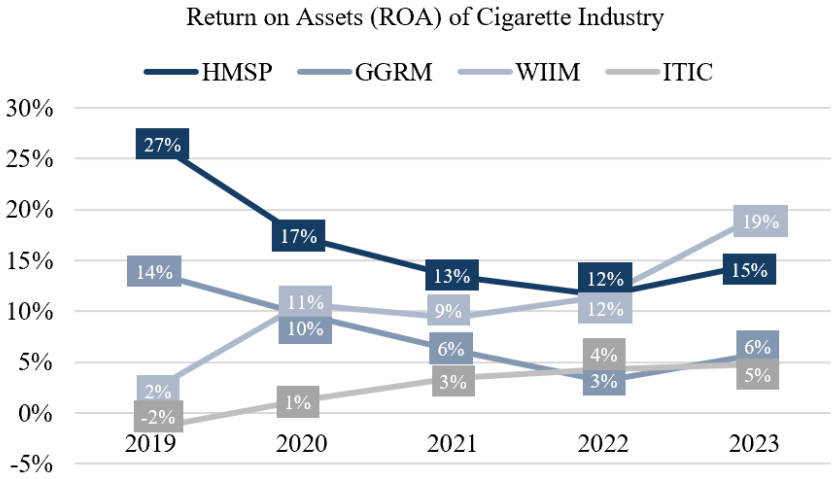

Figure 1. Return on Assets of Cigarette Companies in Indonesia
(Source: Annual Report, 2019-2023)

2. Literature Review

Financial ratio analysis uses financial data and other information to assess a company's financial performance. Although these ratios are based on financial statements, their interpretation should consider company-specific occurrences as well as a larger economic cycle. Based on the data, financial ratios are classified into profitability, liquidity, activity, and leverage ratios (Clayman et al., 2012).

1. Profitability

Profitability is defined as the company's capacity to make a profit from its resources (Ittelson, 2009). Profitability has two key components: margins (the portion of sales not consumed by costs) and turnover (how efficiently capital is used) (Wild et al., 2007). The return on assets (ROA) compares net profit to total assets and represents the profitability of a company's assets. This ratio evaluates management's effectiveness in using the company's assets to produce profit (Clayman et al., 2012). The higher the return, the more productive and efficient the management uses economic resources (Setiawan & Yumeng, 2021). The return on assets (ROA) formula is as follows:

$$Return\ on\ Assets = \frac{Net\ Income}{Total\ Assets}$$

2. Liquidity

Liquidity refers to a company's capacity to satisfy short-term obligations with quickly convertible assets into cash (Clayman et al., 2012). These easily convertible assets, known as liquid assets, are listed as current assets on financial statements, including cash, accounts receivable, and inventory. Current assets are often used to meet short-term obligations known as current liabilities, such as accounts payable, wages due, and accrued liabilities. Working capital is the gap between the company's current assets and liabilities.

Generally, higher liquidity ratios indicate a better ability to meet immediate obligations (Moridu et al., 2023). A high current ratio, measured by comparing current assets to current liabilities, indicates that businesses can easily pay their short-term liabilities. However, if a company has more assets than is required, it may overinvest in low- or non-earning assets, failing to put its assets to the best possible use. The current ratio represents the ratio of current assets to current liabilities. This ratio measures the ability to cover its current obligations with current assets. The formula of the current ratio is as follows:

$$Current\ Ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

3. Activity

Activity refers to how effectively a company utilizes its asset investments (Clayman et al., 2012). Activity ratios assess the benefits generated by individual assets, such as inventory or accounts receivable, or evaluate the benefits produced by all company assets together. Turnover ratios indicate how frequently the company effectively utilizes its assets to generate value in a given period. Assets turnover measures how efficiently a company uses its assets to generate sales (Clayman et al., 2012). This ratio indicates the sales generated from the company's total assets. The formula of the assets turnover is as follows:

$$Assets\ Turnover = \frac{Net\ Sales}{Average\ Total\ Assets}$$

4. Leverage

The company may fund its activities with equity, debt, or a combination of both. Debt financing carries risk because it requires the company to repay borrowed funds with interest (Fadlilah et al., 2018). Leverage ratios measure a company's debt to its total assets or equity capital. Debt can be measured in many ways. Short-term debt consists of liabilities due within a year or a portion of longer-term obligations that mature within a year. Meanwhile, long-term debt refers to obligations with a maturity of more than a year, such as interest-bearing bonds or deferred income taxes.

Based on the book value of both funding sources, the debt-to-equity ratio shows how equity a company must finance its assets (Clayman et al., 2012). The formula for the debt-to-equity ratio is as follows:

$$Debt\ to\ Equity\ Ratio = \frac{Total\ Debt}{Total\ Shareholder's\ Equity}$$

5. Efficiency

Efficiency compares output and input, or the amount produced from a given input. A company is considered efficient if it can achieve the same output with fewer input units than other companies or produce more output with the same inputs (Zhu, 2008). According to Puspitasari (2011), in production planning, Pareto efficiency requirements control productive efficiency, which has two components:

1. Technical Efficiency
   Technical efficiency measures a company's ability to maximize output with available inputs by showing how effectively the company uses economic resources to produce a specific output (Setiawan & Tjiasaka, 2016).
2. Allocative Efficiency
   Allocative efficiency measures how well a company chooses the optimal combination of inputs in production processes based on the relative pricesof these production resources.

Data Envelopment Analysis (DEA) is used to assess the efficiency level of an organization or economic activity unit (EAU). In DEA, the relative efficiency of an EAU is defined as the ratio of its weighted total outputs to its weighted total inputs.

This research contains dependent and independent variables. The dependent variable is profitability, which is represented by return on assets. Meanwhile, the independent variables include liquidity (current ratio), activity (asset turnover), and leverage (debt-to-equity ratio).

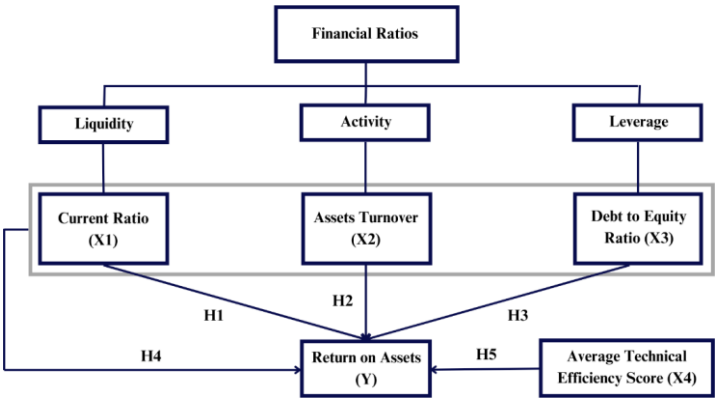

Figure 2. Theoretical Framework
(Source: Adjusted by Researcher, 2024)

The technical efficiency analysis contains input and output. The inputs consist of total assets, total liabilities, total equity, and total employees, while the outputs include net sales and gross profit.

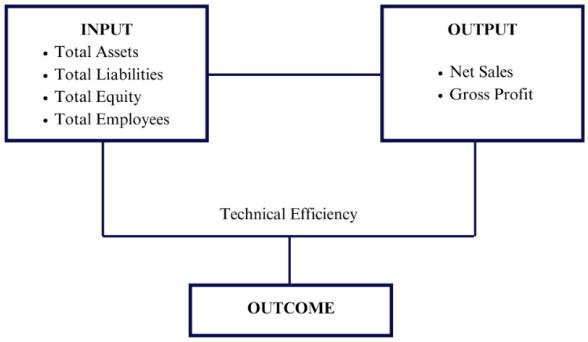

Figure 3. Technical Efficiency Framework
(Source: Adjusted by Researchers, 2024)

1. **The Influence of Current Ratio on Return on Assets**
   The current ratio is a liquidity measure that shows how well a company can meet short-term obligations. A higher current ratio can reduce the risk that a company will fail to meet its obligations (Afriyanti, 2011). However, an extremely high current ratio means that too many current assets are idle, which is detrimental for the company, as these assets could be used to produce higher profits but are left unused, thereby reducing the company's profitability. According to Wahyuni et al. (2018) and Afriyanti (2011), the current ratio (CR) has a significant negative influence on the return on assets (ROA). As a result, the research hypothesis can be formulated as follows:

   H_{01}: The current ratio (CR) significantly negatively influences on the return on assets (ROA) of cigarette companies in Indonesia.

2. **The Influence of Assets Turnover on Return on Assets**
   Asset turnover is a ratio that compares the total assets used with the revenue generated over a specific period. If the trend shows an increasing pattern over several periods, it indicates more efficient use of assets (Afriyanti, 2011). Hence, using fewer assets reduces the cost of capital and increases profitability (Simatupang, 2012). According to Gamara et al. (2022), Darminto and Fuadati (2020), Wahyuni et al. (2018), Siallagan and Ukhriyawati (2016), Utama and Muid (2014), and Afriyanti (2011), the assets turnover (TATO) has a significant positive influence on ROA. As a result, the research hypothesis can be formulated as follows:

   H_{02}: The assets turnover (TATO) has a significant positive influence on the return on assets (ROA) of the cigarette companies in Indonesia.

3. **The Influence of Debt-to-Equity Ratio on Return on Assets**
   Based on the book value of funding sources, the debt- to-equity ratio shows the amount of debt a company uses to finance its assets. Profitable companies generally borrow less, while less profitable companies tend to have higher debt due to insufficient internal funds (Afriyanti, 2011). The company has a greater proportion of debt than equity due to its high debt- to-equity ratio (DER). As a result, the company pays high interest costs, which impacts its profitability.

   According to Wulandari and Yulita (2023) and Utama and Muid (2014), the debt-to-equity ratio (DER) has a significant negative influence on the return on assets (ROA). As a result, the research hypothesis can be formulated as follows:

   H_{03}: The debt-to-equity ratio (DER) has a significant negative influence on the return on assets (ROA) of the cigarette companies in Indonesia.

4. **The Influence of Current Ratio, Assets Turnover, and Debt-to-Equity Ratio on Return on Assets**

According to Gamara et al. (2022), Darminto and Fuadati (2020), Wahyuni et al. (2018), and Siallagan and Ukhriyawati (2016), the current ratio, assets turnover, and debt-to-equity ratio simultaneously have a significant influence on the return on assets (ROA). As a result, the research hypothesis can be formulated as follows:

H_{04}: The current ratio (CR), assets turnover (TATO), and debt-to-equity ratio (DER) simultaneously significantly influence on the return on assets (ROA) of cigarette companies in Indonesia.

5. **The Influence of Average Technical Efficiency Score on Return on Assets**

Efficiency compares output and input, or the amount produced from a given input. A company is considered efficient if it can achieve the same output with fewer input units than other companies or produce more output with the same units, thereby increasing profitability (Zhu, 2008). According to R. Supriyadi (2009), the average technical efficiency score (ATES) has a significant positive influence on the return on assets (ROA). As a result, the research hypothesis can be formulated as follows:

H_{05}: The average technical efficiency score (ATES) has a significant positive influence on the return on assets (ROA) of the cigarette companies in Indonesia.

3. Research Methodology

According to Sugiyono (2019), "population" refers to a group of individuals or objects having specified characteristics and traits as described by the researcher. This research's population consists of five cigarette companies listed on the Indonesia Stock Exchange (IDX).

Table 1. Population of Cigarette Companies

No.	Code	Name
1	HMSP	PT H. M. Sampoerna Tbk
2	GGRM	PT Gudang Garam Tbk
3	WIIM	PT Wismilak Inti Makmur Tbk
4	ITIC	PT Indonesian Tobacco Tbk
5	RMBA	PT Bentoel International Investama Tbk

Source: Indonesia Stock Exchange, 2024

The sample is a small subset of the population chosen through specific procedures to represent the entire population (Somantri, 2006). An effective sampling method should accurately reflect the characteristics of the population. In this research, a non-probability method of sampling is used. Non-probability sampling does not give each population member an equal chance of being picked as a sample (Creswell, 2012).

The researcher will use purposive sampling, which is purposeful selection based on specified criteria. The sample criteria include:

1. Cigarette companies listed on the Indonesia Stock Exchange are publicly traded.
2. Cigarette companies with total assets exceeding IDR 500 billion.
3. Cigarette companies that have published financial statements on the Indonesia Stock Exchange from 2019 to 2023.
4. Cigarette companies that have never been suspended or delisted by the Indonesia Stock Exchange.

Based on these criteria, four out of five companies met the requirements. The analysis covers data from 2019 to 2023, with 80 observations selected for analysis.

Table 2. Sample Proportion

No.	Code	Name	Year	Period	Total
1	HMSP	PT H. M. Sampoerna Tbk	2019 - 2023	Quarterly	20
2	GGRM	PT Gudang Garam Tbk	2019 - 2023	Quarterly	20
3	WIIM	PT Wismilak Inti Makmur Tbk	2019 - 2023	Quarterly	20
4	ITIC	PT Indonesian Tobacco Tbk	2019 - 2023	Quarterly	20
		Total			80

Source: Adjusted by Researchers, 2024

Data collection methods are typically categorized into two main types: primary and secondary. Secondary sources refer to information from published sources that have been previously collected by others for different purposes but can be reused in research (Taherdoost, 2021). The researcher utilized secondary data from financial reports of the cigarette companies (HMSP, GGRM, WIIM, and ITIC). The dataset includes quarterly financial reports sourced from IDN Financials from 2019 to 2023.

Quantitative research typically measures variables objectively and is hypothesis-driven; it begins with clearly stated research questions or hypotheses, which are then tested through data collection and analysis (Dorenzo & Joel Moss, 2006). This research uses a quantitative method, and the analysis methods include panel data regression, as well as a separate analysis of the companies' average technical efficiency scores using Data Envelopment Analysis (DEA), and their influence on return on assets through simple regression analysis. The data is processed using Eviews 12 software for panel data regression and simple regression analysis. Meanwhile, MaxDEA 12 Lite software is used to assess the average technical efficiency of cigarette companies. Regression testing will be performed after the data meets all classical assumption tests, including normality, heteroscedasticity, autocorrelation, and multicollinearity tests. Here are the regression equations in this study:

$$ROA_{it} = \alpha + \beta_1 CR_{it} + \beta_2 DER_{it} + \beta_3 TATO_{it} + \epsilon_{it}$$

$$ROA = \alpha + \beta ATES + \epsilon$$

Where:

ROA : Return on Assets
CR : Current Ratio
DER : Debt-to-Equity Ratio
TATO : Assets Turnover
ATES : Average Technical Efficiency Score

4. Result and Discussion

Descriptive Statistics

Descriptive analysis involves using simple quantitative measures to calculate the mean, median, maximum, minimum, and standard deviation of the independent variables in this research. The dataset includes 80 observations from four companies in Indonesia's cigarette industry from 2019 to 2023.

Table 3. Descriptive Statistics of Independent and Dependent Variables

	ROA	CR	TATO	DER	ATES
Mean	0.0248	2.2525	0.2609	0.5431	0.6860
Median	0.0200	2.1100	0.2300	0.5050	0.7700
Maximum	0.0800	4.6200	0.6600	0.9900	1.0000
Minimum	-0.0200	0.2700	0.0000	0.2600	0.1500
Std. Deviation	0.0197	1.0760	0.2017	0.1821	0.2711
Observations Data	80	80	80	80	80

Source: Proceed Data by EViews 12

Since the standard deviation of all the independent variables is below the mean, this would imply that the values in the dataset are relatively close to the mean. In other words, the data points are clustered closely around the mean, indicating less variability or dispersion in the dataset.

Classical Assumption Test

1. Normality Test

As shown in Figure 4, the Jarque-Bera probability value is 0.293536, greater than 0.05. This implies that the data is normally distributed and meets the criteria.

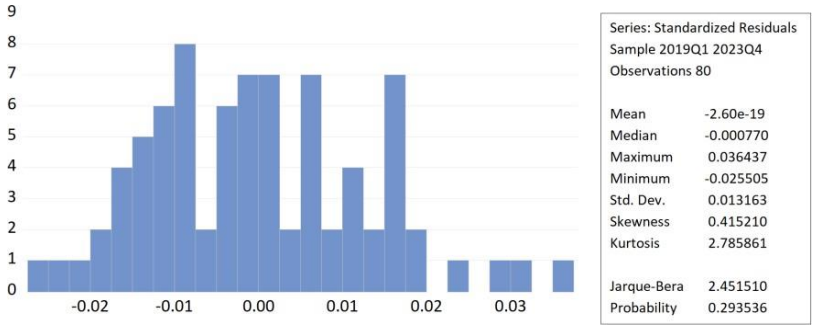

Figure 4. Normality Test
(Source: Proceed Data by EViews 12)

2. Heteroscedasticity Test

As shown in Figure 5, the probability values of CR are 0.2875, TATO 0.0770, and DER 0.2988, all greater than 0.05, which implies that the data have no heteroscedasticity.

Dependent Variable: ABS_RES
Method: Panel Least Squares
Date: 05/19/24 Time: 15:26
Sample: 2019Q1 2023Q4
Periods included: 20
Cross-sections included: 4
Total panel (balanced) observations: 80

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012756	0.013674	0.932862	0.3540
CR	-0.003024	0.002823	-1.071355	0.2875
TATO	0.042063	0.023449	1.793818	0.0770
DER	-0.011588	0.011074	-1.046406	0.2988

Figure 5. Heteroscedasticity Test
(Source: Proceed Data by EViews 12)

3. **Autocorrelation Test**
As shown in Figure 6, the Durbin-Watson (D-W) statistic is 0.9904, greater than -2 and less than 2, implying no autocorrelation.

Weighted Statistics	
Durbin-Watson (D-W) Statistic	0.9904

Figure 6. Autocorrelation Test
(Source: Proceed Data by EViews 12)

4. **Multicollinearity Test**
As shown in Table 4.6, the highest value is between CR and DER, 0.7073, which is less than 0.80. This implies that the data has no multicollinearity between the independent variables.

	CR	TATO	DER
CR	1.0000	-0.1212	-0.7074
TATO	-0.1212	1.0000	0.3794
DER	-0.7074	0.3794	1.0000

Figure 7. Multicollinearity Test
(Source: Proceed Data by EViews 12)

Panel Data Regression (Estimation Model)

1. **Chow Test**
As shown in Figure 8, the Chow Test has a probability value of 0.0000. If the p-value < 0.05, H_0 is rejected and H_a is accepted, the Fixed Effect Model (FEM) is chosen.

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

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.110163	(3,73)	0.0000
Cross-section Chi-square	30.087410	3	0.0000

Figure 8. Chow Test
(Source: Proceed Data by EViews 12)

2. **Hausman Test**
As shown in Figure 9, the Hausman Test has a probability value of 0.0000. If the p-value < 0.05, H_0 is rejected, and H_a is accepted, the Fixed Effect Model (FEM) is still the chosen model.

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	33.330489	3	0.0000

Figure 9. Hausman Test
(Source: Proceed Data by EViews 12)

Panel Data Regression Analysis

Based on the Chow Test and the Hausman Test results, the fixed-effect model is the most suitable model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.057240	0.024907	2.298105	0.0244
CR	-0.012651	0.005142	-2.460349	0.0162
TATO	0.116000	0.042711	2.715893	0.0082
DER	-0.063071	0.020171	-3.126810	0.0025

Figure 10. Panel Data Regression Analysis
(Source: Proceed Data by EViews 12)

As shown in Figure 10, the independent and dependent variables will be formulated as follows:

$$\mathbf{Y = 0.0572 - 0.0127CR + 0.1160TATO - 0.0631DER}$$

Weighted Statistics	
F-statistic	15.20723
Prob. (F-statistic)	0.000000

Figure 11. F-Test
(Source: Proceed Data by EViews 12)

Weighted Statistics	
R-squared	0.555538
Adjusted R-squared	0.519007

Figure 12. Coefficient of Determination (R^2)
(Source: Proceed Data by EViews 12)

1. **The Influence of Current Ratio on Profitability**

   As shown in Figure 10, the current ratio (CR) has a significant negative influence on the return on assets (ROA) of the cigarette companies in Indonesia, with a regression coefficient of -0.012651 and a p-value of 0.0162, which is less than 0.05 (0.0162 < 0.05). This means that for each one-point increase in the current ratio (CR), the return on assets (ROA) decreases by 0.012651, assuming other independent variables remain constant. With a p-value < 0.05, then H_{01} is accepted.

   A high current ratio (CR) indicates that too many current assets are idle, which is not beneficial for the company as these assets could be used to generate higher profits but are left unused. Optimal management of current assets should balance liquidity and profitability.

   These findings align with the research by Wahyuni et al. (2018) and Afriyanti (2011), which also found that the current ratio (CR) has a significant negative influence on the return on assets (ROA). Otherwise, Siallagan and Ukhriyawati (2016) found that the current ratio (CR) has a significant positive influence on the return on assets (ROA).

2. **The Influence of Assets Turnover (TATO) on Profitability**

   As shown in Figure 10, the assets turnover (TATO) has a significant positive influence on the return on assets (ROA) of the cigarette companies in Indonesia, with a regression coefficient of 0.116000 and a p-value of 0.0082, which is less than 0.05 (0.0082 < 0.05).

This means that for each one-point increase in the assets turnover (TATO), the return on assets (ROA) increases by 0.116000, assuming other independent variables remain constant. With a p-value < 0.05, then H_{02} is accepted.

If a company generates the same sales with fewer assets, it indicates greater efficiency as it requires a lower level of investment. The more effectively a company uses its assets, the fewer assets it needs. Thus, using fewer assets reduces the cost of capital and increases profitability (Simatupang, 2012). This suggests that any increase in the assets turnover (TATO) will enhance the profitability of cigarette companies. A higher assets turnover (TATO) implies better management of the company's total assets, leading to increased net sales and higher profits.

These findings align with the research by Darminto and Fuadati (2020) and Siallagan and Ukhriyawati (2016), which also found that the assets turnover (TATO) has a significant positive influence on the return on assets (ROA).

3. The Influence of Debt-to-Equity Ratio (DER) on Profitability

As shown in Figure 10, the debt-to-equity ratio (DER) has a significant negative influence on the return on assets (ROA) of the cigarette companies in Indonesia, with a regression coefficient of -0.063071 and a p-value of 0.0025, which is less than 0.05 (0.0025 < 0.05). This means that for each one-point increase in the debt-to-equity ratio (DER), the return on assets (ROA) decreases by 0.063071, assuming other independent variables remain constant. With a p-value < 0.05, then H_{03} is accepted.

According to Roberto Ang (1997), it is suggested that a higher debt-to-equity ratio (DER) affects the company's profit (return on assets). A larger ratio implies less equity to secure its debt, thus increasing the company's risk. Meanwhile, a lower debt-to-equity ratio indicates better performance and higher returns. From this research, a high debt-to-equity ratio (DER) indicates a larger proportion of debt compared to equity; as a result, the company is paying relatively high interest expenses, which reduces its profitability.

These findings align with the research by Wulandari and Yulita (2023) and Utama and Muid (2014), which also found that the debt-to-equity ratio (DER) has a significant negative influence on the return on assets (ROA). Otherwise, Darminto and Fuadati (2020) found that the debt-to-equity ratio (DER) has a significant positive influence on the return on assets (ROA).

4. The Influence of Current Ratio (CR), Assets Turnover (TATO), Debt-to-Equity Ratio (DER) on Profitability

As shown in Figure 11, the probability of the F-statistic is 0.0000, which is less than 0.05 (0.0000 < 0.05). This means all the independent variables, including the current ratio (CR), asset turnover (TATO), and debt-to-equity ratio (DER), simultaneously have a significant influence on the return on assets (ROA) of the cigarette companies in Indonesia. With a p-value < 0.05, then H_{04} is accepted. Meanwhile, Figure 12 demonstrates that the current ratio (CR), assets turnover (TATO), and debt-to-equity ratio (DER) simultaneously have a 51.90% significant influence on the return on assets (ROA) of cigarette companies. The remaining 48.0993% is attributed to other variables not tested.

These findings align with the research by Darminto and Fuadati (2020) and Siallagan and Ukhriyawati (2016), which also found that the current ratio (CR), asset turnover (TATO), and debt-to-equity ratio (DER) simultaneously significantly influence on the return on assets (ROA).

5. The Most Significant Influence Variable on Profitability in Cigarette Companies

As shown in Figure 10, the most significant influence variable in cigarette companies is the debt-to-equity ratio (DER). This indicates a strong negative relationship between the debt-to-equity ratio (DER) and return on assets (ROA). As the proportion of debt-to-equity increases, the return on assets (ROA) decreases due to interest payments reducing net profit.

Data Envelopment Analysis

As shown in Figure 13, the average technical efficiency of the cigarette industry in Indonesia during the 2019–2023 period is 69.0%, indicating there is still 31.0% room to achieve full efficiency. HMSP is the most efficient company, with the highest average technical efficiency score of 0.91 and an efficiency score of 1.00 for six consecutive quarters. This means HMSP used 91.0% of its inputs to produce maximum outputs. Following HMSP, WIIM ranks second with an average technical efficiency score of 0.84 due to its good performance over the past few years. GGRM holds third place with an average technical efficiency score of 0.74 and a maximum score of 0.90 in Q4 of 2023, indicating improvement in the last quarter. On the other hand, the least efficient company over the past five years is ITIC, with an average technical efficiency score of 0.25 and a minimum score of 0.15 at its Initial Public Offering (IPO) in 2019.

Year/Quarter	Cigarette Companies				Average	Max.	Min.
	HMSP	GGRM	WIIM	ITIC			
2019Q1	0.82	0.77	0.64	0.21	0.61	0.82	0.21
2019Q2	1.00	0.67	0.76	0.23	0.67	1.00	0.23
2019Q3	0.96	0.69	0.82	0.15	0.66	0.96	0.15
2019Q4	1.00	0.71	0.94	0.26	0.73	1.00	0.26
2020Q1	0.87	0.69	0.71	0.24	0.62	0.87	0.24
2020Q2	0.80	0.65	0.79	0.30	0.64	0.80	0.30
2020Q3	0.84	0.79	0.89	0.37	0.72	0.89	0.37
2020Q4	0.82	0.84	0.93	0.18	0.69	0.93	0.18
2021Q1	0.96	0.81	0.99	0.24	0.75	0.99	0.24
2021Q2	0.85	0.88	0.71	0.27	0.68	0.88	0.27
2021Q3	0.83	0.73	0.80	0.38	0.68	0.83	0.38
2021Q4	0.86	0.71	0.77	0.23	0.64	0.86	0.23
2022Q1	0.83	0.68	0.94	0.22	0.67	0.94	0.22
2022Q2	1.00	0.76	0.94	0.23	0.73	1.00	0.23
2022Q3	1.00	0.76	0.76	0.32	0.71	1.00	0.32
2022Q4	0.89	0.69	0.85	0.21	0.66	0.89	0.21
2023Q1	0.92	0.75	0.87	0.20	0.69	0.92	0.20
2023Q2	1.00	0.67	0.94	0.24	0.71	1.00	0.24
2023Q3	1.00	0.66	0.97	0.26	0.72	1.00	0.26
2023Q4	0.94	0.90	0.85	0.27	0.74	0.94	0.27
Average	0.91	0.74	0.84	0.25	**0.69**	0.93	0.25
Max.	1.00	0.90	0.99	0.38	0.75		
Min.	0.80	0.65	0.64	0.15	0.61		

Figure 13. Average Technical Efficiency Score of the Cigarette Industry
(Source: Proceed Data by EViews 12)

Simple Regression Analysis

Dependent Variable: ROA
Method: Panel Least Squares
Date: 06/29/24 Time: 04:47
Sample: 2019Q1 2023Q4
Periods included: 20
Cross-sections included: 4
Total panel (balanced) observations: 80

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.017355	0.014534	-1.194092	0.2362
ATES	0.061378	0.021058	2.914630	0.0047

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	0.013828	R-squared	0.503253
Mean dependent var	0.024750	Adjusted R-squared	0.476760
S.D. dependent var	0.019744	S.E. of regression	0.014282
Akaike info criterion	-5.599228	Sum squared resid	0.015297
Schwarz criterion	-5.450351	Log likelihood	228.9691
Hannan-Quinn criter.	-5.539539	F-statistic	18.99560
Durbin-Watson stat	0.800496	Prob(F-statistic)	0.000000

Figure 14. Simple Regression Analysis
(Source: Proceed Data by EViews 12)

As shown in Figure 14, the independent and dependent variables will be formulated as follows:

$$\mathbf{Y = -0.0173 + 0.0613ES}$$

The average technical efficiency score (ATES) has a positive significant influence on the return on assets (ROA) of cigarette companies in Indonesia, with a regression coefficient of 0.061378 and a p-value of 0.0047, which is less than 0.05 (0.0047 < 0.05). With a p-value < 0.05, then *H*05 is accepted. The variable has a 47.6760% significant influence on cigarette companies' return on assets (ROA). This indicates that as companies optimize the utilization and management of their resources, they are more likely to achieve increased profitability.

These findings align with the research by R. Supriyadi (2009), which also found that the average technical efficiency score (ATES) has a positive significant influence on the return on assets (ROA) of cigarette companies in Indonesia.

5. Conclusion and implications

1. Based on panel data regression analysis, the partial influence of each independent variable on the dependent variable is summarized as follows:
   a. Current ratio significantly negatively influences the return on assets (ROA). This suggests that having too many idle current assets is detrimental, as these assets could be utilized to generate higher profits but are left unused, thereby reducing the company's profitability.
   b. Asset turnover (TATO) has a significant positive influence on return on assets (ROA). This suggests that efficient asset use reduces the cost of capital and increases profitability.
   c. The debt-to-equity Ratio (DER) has a significant negative influence on the return on assets (ROA). A higher proportion of debt than equity leads to higher interest expenses and reduces the company's profitability.
2. Among all the independent variables examined in this research, the most significant variable that influenced the return on assets (ROA) of the cigarette companies from 2019 to 2023 is the debt-to-equity ratio (DER), with a t-statistic of -3.126810 and a p-value of 0.0025. Therefore, investors should carefully consider how companies manage their debt levels to mitigate the negative impact of a high debt-to-equity ratio on profitability.
3. The average technical efficiency score of the cigarette industry from 2019 to 2023 is 69.0%. This means Indonesian cigarette companies, on average, use only 69.0% of their resources to achieve maximum output. During this period, PT HM Sampoerna Tbk (HMSP) stood out as the most efficient company, scoring an average of 0.91 or 91.0%. In contrast, ITIC was the least efficient company over the past five years, scoring an average technical efficiency of 0.25 or 25.0%. This means ITIC should reevaluate its resource utilization and process management, as inefficiencies could stem from outdated production techniques, inadequate use of technology, or suboptimal management practices.
4. Based on simple regression analysis, the average technical efficiency score (ATES) positively influences cigarette companies' return on assets (ROA) in Indonesia. This indicates that as companies optimize the utilization and management of their resources, they are more likely to achieve increased profitability.
5. In panel data regression analysis, the variables explain 51.90% of the variation in return on assets. Meanwhile, the average technical efficiency score as an independent variable in simple regression analysis explains 47.68% of the variation in return on assets. In conclusion, these variables in this research explain 99.76% of the variation in return on assets. For future recommendations, cigarette companies should prioritize the effective use of their assets and manage debt levels carefully, as investors will consider companies with strong growth potential and solid management to ensure consistent returns even during market fluctuations.

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