

Impact of Capital Structure on Firm Value with Profitability as Mediator: Indonesian Coal Companies Study

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Abstract

Over the past six years, global economic volatility shaped by geopolitical complexities has significantly impacted the coal sector, marked by fluctuating prices influenced by events such as the Ukraine crisis and the COVID-19 pandemic. This study focuses on Indonesian coal companies, examining the relationship between capital structure (DER), firm performance (ROA), and firm value (PBV). Through empirical analysis of 15 listed companies from 2018 to 2023, utilizing Hayes' Process Macro Model 4, the research finds that higher Debt to Equity Ratios (DER) negatively affect Return on Assets (ROA), indicating reduced efficiency in asset utilization. However, DER positively correlates with Price to Book Value (PBV), implying investor optimism regarding future earnings and asset worth. The study underscores the nuanced interplay between financial metrics in shaping corporate value within Indonesia's coal sector, offering insights for strategic financial management amid market uncertainties.

Keywords: *capital structure, profitability, firm value, mediation, coal company*

BACKGROUND

In the last six years, the global economy has experienced significant volatility, primarily influenced by intricate geopolitical elements. During these transitions, the coal sector has assumed a pivotal role, primarily due to a notable upsurge in prices. Geopolitical tensions, exemplified by the Ukraine crisis and turmoil in the Middle East, have brought about a sense of unpredictability and insecurity in worldwide markets, affecting coal prices through supply chain disturbances and the inclusion of geopolitical risk premiums. Furthermore, the obstacles have become even more complex due to the sudden emergence of the COVID-19 pandemic, causing chaos in supply chains, reducing consumer needs, and impacting the workforce in areas where coal mining takes place. For instance, the International Energy Agency (IEA) reported a 4% global decrease in coal demand in 2020 as a result of the pandemic's impact on industrial operations and energy usage ("Global Energy Review 2021," IEA). In Indonesia, the pandemic has emphasized the importance of resilient infrastructure and adaptable regulatory frameworks to support the coal sector in the face of unforeseen disruptions. These diverse influences underscore the necessity for a nuanced comprehension of coal

market dynamics, incorporating geopolitical developments and public health emergencies into strategic decision-making and policy formulation processes.

The coal mining industry holds a pivotal position within Indonesia's economic landscape, serving as a cornerstone for the nation's energy requirements and overall development trajectory. With coal being one of Indonesia's flagship commodities, the abundant coal resources and reserves underscore its significance in powering the country's growth trajectory. As outlined by the Geological Agency's comprehensive report on Indonesia's Coal and Geothermal Resources and Reserves, the vast coal resources totaling 99,193.11 million tons and reserves amounting to 35,054.07 million tons, provide a substantial foundation for sustained production and economic prosperity. This abundance positions Indonesia as a key player in the global coal market, capable of meeting both domestic energy demands and international export requirements.

Empirical research on coal companies, particularly focusing on the Debt to Equity Ratio (DER), Return on Assets (ROA), and Price to Book Value (PBV), reveals several significant insights. The Debt to Equity Ratio (DER) has a complex relationship with Return on Assets (ROA) and Price to Book Value (PBV) in coal mining companies listed on the Indonesia Stock Exchange. Research indicates that DER generally has a negative impact on ROA, suggesting that higher leverage can reduce the efficiency of asset utilization in generating profits (Radiman, 2018). Capital structure is crucial for business value, but profitability does not mediate this relationship (Akhmadi et al., 2023). This negative relationship is also supported by findings that show DER has no significant effect on stock returns, which indirectly affects ROA (Sinaga Isma Khairani & Astini Rina, 2021). However, the impact of DER on PBV is less straightforward. While some studies suggest that DER has no significant influence on PBV, they also indicate a positive direction, implying that higher leverage might not necessarily devalue the company's book value (Radiman, 2018). On the other hand, ROA itself, while positively correlated with stock prices, does not always significantly impact PBV directly (Rahayu, 2021). This is further complicated by findings that show ROA has no significant effect on stock returns, which could indirectly influence PBV (Sinaga Isma Khairani & Astini Rina, 2021). Additionally, other factors such as the Current Ratio and Earning Per Share (EPS) also play roles in determining stock prices and returns, which in turn affect PBV (Cahyani & Hendra, 2022). Therefore, while DER negatively impacts ROA, its direct effect on PBV is not significant, and ROA's influence on PBV is also not straightforward, indicating that multiple financial metrics must be considered to fully understand these relationships in coal mining companies.

In light of the intricate nature and divergent outcomes present in the current body of literature, the primary objective of this study is to investigate the mediating influence that exists between leverage and corporate value, utilizing firm performance as the mediating factor. The fundamental inquiries that steer this research endeavor are:

1. How does the Debt to Equity Ratio (DER) affect the Price to Book Value (PBV) in Indonesian coal companies?

2. Does the Return on Assets (ROA) mediate the relationship between the Debt to Equity Ratio (DER) and the Price to Book Value (PBV) in Indonesian coal companies?

The research will yield a comprehensive insight into the interaction among capital structure, firm performance, and firm value, particularly focusing on financial executives in the coal industry, especially in emerging markets like Indonesia. An examination will be conducted on the mediation effect of firm performance between capital structure and firm value within Indonesian coal companies. Furthermore, the study aims to identify the specific conditions under which leveraging can either enhance or diminish firm value. Consequently, this research provides significant implications for financial management within Indonesia's coal sector, given the prominence of coal as a key commodity in the country.

METHODOLOGY

Sample Selection

The population of this study includes all coal-producing sub-sector companies listed on the Indonesia Stock Exchange (IDX), totaling 22 companies. The sample consists of 15 companies over a 6-year period from 2018 to 2023, as 7 companies did not meet the criteria, resulting in 90 observational data points. The data collection techniques used are literature research and documentation research to obtain references related to relevant theories and previous studies. Additionally, these techniques are used to obtain secondary data related to the Debt to Equity Ratio, Return on Assets, and Price to Book Value, which were obtained from the Annual Reports of each company and data from www.stockbit.com, and were subsequently processed further.

Data Analysis Method

The methodology employed in this research utilizes the Hayes Process Macro Model 4 approach. Hayes' Macro Process Model 4 serves as a statistical instrument utilized in mediation analysis, enabling researchers to explore whether the impact of an independent variable (X) on a dependent variable (Y) is channeled through a mediator variable (M). This particular model constitutes a component of the PROCESS macro, devised by Andrew F. Hayes, and is incorporated into statistical software such as SPSS and SAS. Within the context of this investigation, the principal objective of Model 4 lies in evaluating the mediation effect. Mediation occurs when the relationship between the independent variable (DER) and the dependent variable (PBV) is partially explained by a third variable (ROA) known as the mediator.

The Hayes Process Macro utilizes bootstrapping. In the bootstrap method, there is no need to assume a specific distribution of data or the distribution of limits for test statistics. Bootstrap is a statistical technique that eliminates the need for making specific distributional assumptions, consequently improving its adaptability and resilience when constructing confidence intervals and testing hypotheses. This approach also circumvents issues associated with violating classical assumptions, thereby supporting

its application for inferring indirect effects in mediation analysis. In mediation analysis, bootstrapping is used to generate an empirically derived representation of the sampling distribution of the indirect effect, and this empirical representation is used for the construction of a confidence interval for $\tau_{a\tau b}$. Unlike the normal theory approach, no assumption is made about the shape of the sampling distribution of ab . Bootstrap confidence intervals better respect the irregularity of the sampling distribution of ab and, as a result, yield inferences that are more likely to be accurate than when the normal theory approach is used. When used to test a hypothesis, the result is a test with higher power (Hayes, 2013).

Research Variables and Operational Descriptions

Firm Value (Dependent Variable)

The Price-to-Book Value (PBV) is a crucial metric that serves as a reflection of firm value by encompassing diverse aspects of a company's financial well-being and market sentiment. Essentially, the PBV assesses the market's appraisal of a company's stock in comparison to its book value, offering valuable perspectives on the amount investors are prepared to invest for every dollar of net assets. Research indicates that the PBV is influenced by anticipatory information that the market price reflects, which is not always present in the model value, thus highlighting the market's ability to foresee changes in performance (Branch et al., 2014).

$$PBV = \frac{\text{Market Price per Share}}{\text{Book Value per Share}}$$

Capital Structure (Independent Variable)

DER is a measure of a company's financial leverage, calculated by dividing its total liabilities by its shareholder equity. Research indicates that DER significantly impacts corporate performance metrics such as Return on Equity (ROE) and Return on Assets (ROA). For instance, a study on mining companies listed on the Indonesia Stock Exchange found that DER, along with the Debt to Assets Ratio (DAR), significantly affects both ROE and ROA, although DAR showed a more pronounced effect when considered individually (Fauzan & Mukaram, 2018).

$$PBV = \frac{\text{Total Liabilities}}{\text{Shareholder's Equity}}$$

Firm Performance (Mediating Variable)

The Return on Assets (ROA) is a crucial metric used to evaluate the effectiveness of a company in generating profits from its assets. It serves as a gauge of a company's profitability relative to its total assets. It exemplifies the effectiveness of management in utilizing its assets to yield earnings. An elevated ROA typically signifies enhanced financial performance, implying that the company is more proficient in generating profits from its asset investments. For instance, research indicates that ROA directly influences stock returns, demonstrating that higher profitability, as measured by ROA, leads to better stock performance (Rosyada, 2023). Additionally, ROA has a significant positive

influence on firm value, both directly and indirectly, suggesting that companies with higher ROA are perceived as more valuable in the market (Cahya & Riwoe, 2018)

$$ROA = \frac{Net\ Income}{Total\ Asset}$$

Where:

X = Debt to Equity Ratio (DER)

M = Return on Asset (ROA)

Y = Price to Book Value (PBV)

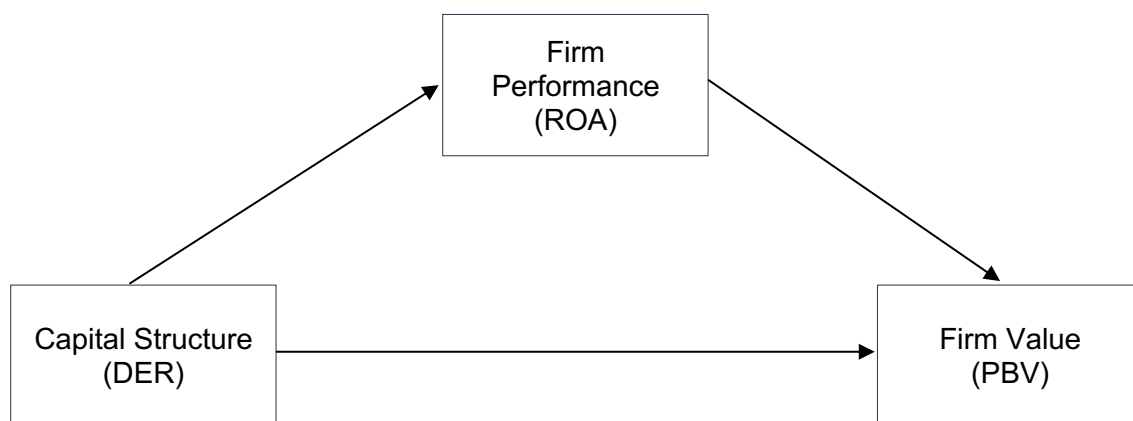


Figure 1. Conceptual Framework

RESULTS AND DISCUSSIONS

Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Debt to Equity Ratio	90	.097	34.056	1.95147	4.683119
Return on Asset	90	-.098	.616	.13611	.153137
Price to Book Value	90	-2.360	11.810	1.63256	1.827869
Valid N (listwise)	90				

Table. 1 Descriptive Statistics.

The following descriptive statistics offer a comprehensive summary of the variables analyzed in this study, based on 90 observations from Indonesian coal mining companies listed on the Indonesia Stock Exchange between 2018 and 2023. These statistics include measures such as the mean, standard deviation, minimum, and maximum values, providing insights into the distribution and characteristics of each variable. (a) Debt to

Equity Ratio: This ratio, with a mean of 1.951 and a standard deviation of 4.683, ranges from 0.097 to 34.056. The wide range and high standard deviation suggest significant variability in how companies finance their operations through debt and equity structures. (b) Return on Asset: With a mean of 0.136 and a standard deviation of 0.153, ranging from -0.098 to 0.616, this metric shows varying levels of profitability achieved from assets across the dataset. The positive mean indicates that, on average, companies generate a modest return on their assets, though with some variability in performance. (c) Price to Book Value: This ratio averages at 1.633 with a standard deviation of 1.828, spanning from -2.360 to 11.810. It reflects diverse market valuations relative to book values, indicating that some companies may be valued at a premium or discount compared to their book values.

Model : 4
Y : PBV
X : DER
M : ROA

Sample
Size: 90

Outcome Variable = ROA

Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.3291	0.1083	0.0211	10.6858	1.0000	88.0000	0.0015
Model	coeff	se	t	p	LLCI	ULCI	
Constant	0.1571	0.0166	9.4525	0.0000	0.1241	0.1901	
DER	-0.0108	0.0033	-3.2689	0.0015	-0.0173	-0.0042	

Table 2. Hayes Process Macro Model 4 Result (Outcome variabel: ROA)

Based on Table 2 above, The model summary indicates that the independent variables (particularly DER) account for approximately 10.83% of the variance in ROA, as indicated by the R-squared value. The model's F-test (F-value = 10.6858, $p = 0.0015$) indicates that the overall regression model is statistically significant, suggesting that the independent variable (DER) does significantly predict ROA in this sample. The model suggests that there is a significant negative relationship between the Debt-to-Equity Ratio (DER) and Return on Assets (ROA) (DER coefficient = -0,0108 and p -value 0,0015 < 0,05). Specifically, as the DER increases, ROA tends to decrease.

Outcome Variable = PBV

Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.5738	0.3293	2.2924	21.3568	2.0000	87.0000	0.0000
	coeff	se	t	p	LLCI	ULCI	
Constant	0.4471	0.2457	1.8202	0.0722	-0.0411	0.9354	
DER	0.1918	0.0363	5.2855	0.0000	0.1197	0.2640	
ROA	5.9590	1.1098	5.3693	0.0000	3.7531	8.1649	

Table 3. Hayes Process Macro Model 4 Result (Outcome variabel: PBV)

Based on Table 3 above, the model summary indicates that the independent variables (DER and ROA) collectively explain approximately 32.93% of the variance in PBV, as indicated by the R-squared value. The F-test (F-value = 21.3568, $p < 0.0001$) suggests that the overall regression model is statistically significant, meaning that at least one of the independent variables significantly predicts PBV in this sample and the combined influence of DER and ROA on PBV is significant and unlikely to be due to random chance.

The model suggests that both the Debt-to-Equity Ratio (DER) and Return on Assets (ROA) are significant predictors of Price-to-Book Value (PBV) for Indonesian coal companies. This conclusion is drawn based on the statistically significant coefficients and p-values ($p < 0.0001$) associated with both DER and ROA in the regression model.

The impact of DER on PBV can be explained as follows: For every unit increase in the Debt-to-Equity Ratio (DER), the PBV is expected to increase by 0.1918 units. The t-value of 5.2855 indicates that this relationship is statistically significant ($p < 0.0001$), suggesting that higher levels of DER tend to lead to higher PBV ratios.

Then, the impact of ROA on PBV is for every unit increase in Return on Assets (ROA), the PBV is expected to increase by 5.9590 units. The t-value of 5.3693 also shows this relationship to be statistically significant ($p < 0.0001$). Importantly, the standardized coefficient (0.4992) indicates that ROA has a slightly larger standardized effect on PBV compared to DER (0.4915), suggesting that improvements in ROA may have a slightly stronger impact on PBV compared to changes in DER.

Outcome

Variable = PBV		TOTAL EFFECT MODEL					
Model Summary	R	R-sq	MSE	F	df1	df2	p
	0.3272	0.1070	3.0174	10.5487	1.0000	88.0000	0.0016
Model	coeff	se	t	p	LLCI	ULCI	
Constant	1.3834	0.1985	6.9681	0.0000	0.9888	1.7779	
DER	0.1277	0.0393	3.2479	0.0016	0.0496	0.2058	

Table 4. Hayes Process Macro Model 4 Result (Total Effect Model, Outcome variabel: PBV)

The model summary indicates that The independent variable (DER) explains approximately 10.70% of the variance in PBV, as indicated by the R-squared value. The F-test (F-value = 10.5487, $p = 0.0016$) suggests that the overall regression model is statistically significant, indicating that DER significantly predicts PBV in this sample. The intercept (constant = 1.3834, standard error = 0.1985, $t = 6.9681$, $p < 0.0001$) represents the estimated PBV when the independent variable (DER) is zero. It's statistically significant, indicating that even without debt (DER = 0), PBV is significantly different from zero. For every unit increase in the Debt-to-Equity Ratio (DER), PBV is expected to increase by 0.1277 units, holding other variables constant. The standardized coefficient indicates that DER has a moderate positive effect on PBV. A one standard deviation increase in DER results in a 0.3272 standard deviation increase in PBV.

The Total Effect Model confirms that the Debt-to-Equity Ratio (DER) significantly predicts the Price-to-Book Value (PBV) of Indonesian coal companies. A higher DER is positively associated with a higher PBV. This suggests that investors may view companies with higher debt relative to equity as potentially having higher future earnings or asset values, which increases their PBV. The statistically significant p-value (0.0016) indicates that the observed relationship between DER and PBV is unlikely to be due to random chance. Instead, it suggests a reliable association between these variables in the context of Indonesian coal companies.

TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y							
	coeff	se	t	p	LLCI	ULCI	c_cs
Total Effect of X on Y	0.1277	0.0393	3.2479	0.0016	0.0496	0.2058	0.3272
	coeff	se	t	p	LLCI	ULCI	c'_cs
Direct Effect of X on Y	0.1918	0.0363	5.2855	0.0000	0.1197	0.2640	0.4915
	Effect	BootSE			BootLLCI	BootULCI	
Indirect Effect(s) of X on Y	-0.0641	0.0287			-0.1531	-0.0380	

Table 5. Hayes Process Macro Model 4 Result (Total, Direct, & Indirect Effect X on Y)

Total Effect DER on PBV reflected the total effect of the Debt-to-Equity Ratio (DER) on Price-to-Book Value (PBV) is 0.1277. This means that for every unit increase in DER, PBV is expected to increase by approximately 0.1277 units. The statistically significant p-value ($p = 0.0016$) indicates that this effect is unlikely to be due to random chance. The completely standardized coefficient ($c_cs = 0.3272$) suggests that DER has a moderate positive effect on PBV when expressed in standard deviation units.

The Direct Effect of DER on PBV reflected that the direct effect of DER on PBV is 0.1918. This indicates that when considering only the direct relationship between DER and PBV (without the mediating effect of ROA), PBV is expected to increase by 0.1918 units for every unit increase in DER. The direct effect is statistically significant ($p < 0.0001$), reinforcing the robustness of this relationship.

The indirect effect of DER on PBV through Return on Assets (ROA) is -0.0641. This means that DER indirectly decreases PBV by 0.0641 units through its negative impact on ROA. The bootstrapped 95% confidence interval (-0.1531, -0.0380) suggests that this indirect effect is statistically significant and likely robust. The completely standardized coefficient ($c_cs = -0.1643$) indicates the magnitude of this indirect effect in standard deviation units.

In summary, The total effect of DER on PBV (0.1277) includes both the direct effect (0.1918) and the indirect effect through ROA (-0.0641). Direct Effect: DER directly increases PBV, indicating a positive influence on market valuation. Indirect Effect: The

indirect effect through ROA partially offsets the direct effect, suggesting that higher DER might negatively impact PBV indirectly by reducing ROA.

Discussions

Based on the findings from the study on Indonesian coal producer companies between 2018 and 2023, several conclusions can be drawn:

Capital Structure Implications:

The Debt-to-Equity Ratio (DER) significantly predicts both Return on Assets (ROA) and Price-to-Book Value (PBV). A higher DER tends to correlate with lower ROA, indicating potential financial risk and decreased profitability due to increased leverage. Conversely, a higher DER is associated with higher PBV, suggesting that investors perceive companies with higher debt relative to equity as having greater future earnings potential or asset values. This aligns with the signaling hypothesis in capital structure theory, where firms use their financing choices to signal their financial health and growth prospects. This is supported by findings that DER significantly affects firm value, as evidenced by a study showing that DER had a significant effect on PBV in consumer goods sector companies (Irnawati et al., 2022).

Agency Costs and Financial Performance:

The negative relationship between DER and ROA supports the notion of agency costs, where higher debt levels may lead to managerial behavior focused on short-term gains or risky projects at the expense of long-term shareholder value. This highlights the importance of monitoring and governance mechanisms to mitigate agency conflicts. The study emphasizes the importance of debt in positively affecting company value through monitoring mechanisms and creditor discipline (Ichwanudin et al., 2023).

Pecking Order Theory Insights:

The findings generally align with pecking order theory, which suggests that firms prefer internal financing (retained earnings) over external financing (debt and equity) due to lower information asymmetry and transaction costs. The moderate positive effect of DER on PBV indicates that while debt financing can enhance market valuation, it also introduces financial risk and potential constraints on future growth. This aligns with the pecking order theory, as firms with higher profitability, liquidity, and firm size tend to have a significant impact on their capital structure decisions, favoring internal funds first (Sumartik, 2023).

Market Valuation Dynamics:

The significant influence of both DER and ROA on PBV underscores their combined impact on how investors value Indonesian coal companies. Improvements in ROA have a slightly stronger standardized effect on PBV compared to changes in DER, highlighting the importance of profitability in driving market perceptions and valuations. The moderate positive effect of debt-to-equity ratio (DER) on price-to-book value (PBV)

suggests that while debt financing can enhance market valuation, it also introduces financial risk and potential constraints on future growth, as firms must balance the benefits of leverage with the associated risks and costs (Fikasari & Bernawati, 2021)

Statistical Significance and Robustness:

The statistical tests (F-tests, t-tests, and p-values) confirm the robustness of the relationships observed in the regression models. The findings suggest reliable associations between DER, ROA, and PBV in the context of Indonesian coal companies, indicating that these relationships are unlikely to be due to random chance.

In summary, mediation by ROA is categorized as partial due to its illustration of several crucial elements in the association between DER (Debt-to-Equity Ratio) and PBV (Price-to-Book Value). The direct impact of DER on PBV continues to hold statistical significance (0.1918), signifying a robust direct influence. Nevertheless, with the inclusion of ROA in the model, the overall impact of DER on PBV (0.1277) diminishes in comparison to its direct impact, implying a noteworthy decrease in this direct influence. Furthermore, the indirect impact of DER on PBV through ROA (-0.0641) indicates that ROA partially clarifies how DER impacts PBV, despite its negative direction.

CONCLUSION

The study on Indonesian coal producers companies (2018-2023) reveals insights into capital structure and financial performance. Higher Debt-to-Equity Ratios (DER) correlate with lower Return on Assets (ROA), suggesting managerial risk-taking and reduced profitability. Prudent debt management is crucial in volatile sectors like mining to mitigate financial risks. Conversely, DER shows a positive correlation with Price-to-Book Value (PBV), indicating investor perception of higher future earnings and asset value. Hence, ROA functions as a partial mediator by shedding light on some aspects of the connection between DER and PBV, while the direct effect of DER remains prominent, highlighting the intricate interplay between these variables. Limitations include industry specificity and a constrained timeframe, limiting generalizability. Future research should explore corporate governance's role and external influences on capital structure decisions can optimize financing strategies in emerging markets, enhancing understanding of financial policies' impact on firm performance.

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