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# Cash Flow Volatility and Capital Structure in The Indonesia Mining Sector: The Moderating Role of Fixed Assets Listed on The Indonesian Stock Exchange 2018-2023

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**Abstract**
This study aims to analyze the effect of cash flow volatility on capital structure and to examine the moderating role of fixed assets in the mining sector companies listed on the Indonesia Stock Exchange (IDX) during the 2018–2023 period. The study employs a quantitative approach using secondary data obtained from the annual financial statements of mining companies. The population consists of all mining firms listed on the IDX, while purposive sampling is applied to select companies that meet specific criteria, resulting in a sample of 57 firms observed over five years. Capital structure is used as the dependent variable, while cash flow volatility serves as the independent variable. Data analysis is conducted using panel data regression with the Fixed Effect Model (FEM) through EViews 12 software. The results indicate that cash flow volatility has a positive and significant effect on capital structure. However, fixed assets exhibit a negative but insignificant moderating effect on the relationship between cash flow volatility and capital structure. These findings suggest that higher fluctuations in operating cash flows increase firms' reliance on debt financing. Therefore, effective cash flow management and optimal utilization of fixed assets are essential to maintaining a healthy capital structure.

## 1. Introduction

The mining sector is one of the key pillars of Indonesia's economy as it contributes significantly to state revenues and employment. However, this sector is characterized by high risks due to fluctuating commodity prices and regulatory uncertainty. One of the factors influencing the financial performance of mining companies is capital structure. Nguyen et al. (2021) define capital structure as the mix of debt and equity used to finance a company's investments. Determining the appropriate capital structure is crucial, as it affects the cost of capital and the company's flexibility in managing risk. Mining companies, which are highly capital-intensive, generally rely on substantial levels of debt to finance major investments such as exploration, heavy equipment procurement, and infrastructure development. Therefore, firms in this sector tend to adopt capital structures with high debt burdens to meet their financing needs. Brigham & Houston (2012) explain that firms with large investment requirements, such as those in the mining industry, tend to use higher levels of debt to finance long-term projects. However, they also emphasize that the use of debt must be aligned with the company's ability to manage cash flow, which often fluctuates.

In theory, cash flow volatility can disrupt a company's financial stability and its ability to invest and grow (Martinez et al., 2023). Thus, high cash flow volatility can influence a company's decisions regarding funding sources. The Pecking Order Theory suggests that uncertainty arising from fluctuating cash flows may lead companies to avoid debt, opting instead for equity financing. Although equity tends to have a higher cost, firms prefer it as a strategy to maintain liquidity and avoid bankruptcy risk. One factor that may moderate the relationship between cash flow volatility and capital structure is fixed assets. Denis & McKeon (2018) point out that changes in fixed-asset investments have recently influenced corporate strategies and revenue patterns. With strong fixed assets, mining companies can reduce their financing risk, strengthen their bargaining position when obtaining debt, and consequently shape their chosen capital structure. Fixed assets can serve as collateral for securing debt financing, potentially reducing the negative impact of cash flow volatility on capital structure.

Preliminary data from PT Adaro Energy Indonesia Tbk and PT Baramulti Suksessarana Tbk reveal a discrepancy between theory and empirical reality. This difference indicates a significant gap between conceptual theory and real-world conditions, requiring deeper analysis to understand the factors that may influence this inconsistency. Such analysis is essential to help companies navigate fluctuating cash flows and make critical capital structure decisions. Based on the observed phenomena and empirical findings, this study aims to analyze the effect of cash flow volatility on capital structure and examine the moderating role of fixed assets in mining companies listed on the Indonesia Stock Exchange (IDX) during the 2018–2023 period. This research is expected to enrich the academic literature on the relationship between cash flow volatility and capital structure in the mining sector, particularly in Indonesia. It may also provide practical insights for companies in formulating more effective financial strategies, enabling them to better plan long-term projects and allocate resources efficiently.

### Literature Review

### 1) Pecking Order Theory

The Pecking Order Theory introduced by Myers (1984) explains that firms follow a hierarchical preference when selecting financing sources, starting with internal financing (retained earnings), followed by debt, and lastly the issuance of new equity. Internal financing is preferred because it does not incur issuance costs and involves lower risk for management (Myers & Majluf, 1984). In relation to cash flow volatility, the theory provides a relevant framework for understanding capital structure decisions. Fazzari et al. (1988) argue that when firms experience fluctuating cash flows and unstable liquidity, they rely more heavily on internal funds. Cash flow uncertainty discourages the use of debt due to the heightened risk of default under volatile conditions. Supporting this view, Naser et al. (2024) note that while cash flow volatility does not directly influence the cost of capital, it affects a firm's ability to secure external financing, prompting firms to choose the safest available funding sources when liquidity is constrained.

**2) Trade-Off Theory**

The Trade-Off Theory posits that firms determine their optimal capital structure by balancing the benefits of using debt, such as tax shields, against the costs of bankruptcy and financial distress (Kraus & Litzenberger, 1973). Scott (1977) explains that increasing debt can enhance firm value, but only up to a point where the costs of financial distress begin to rise significantly. In relation to cash flow volatility, the theory suggests that firms with stable cash flows are more willing to use debt because they can enjoy tax benefits without facing a high risk of default. Conversely, firms experiencing high cash flow volatility tend to reduce their debt proportion to avoid increasing bankruptcy costs. However, the Trade-Off Theory also highlights that firms with substantial fixed assets may still utilize debt, as these assets can be used as collateral to reduce creditor risk.

**3) Capital Structure**

Capital structure refers to the composition of a firm's long-term financing through debt and equity (Horne & Wachowicz, 2008). This structure reflects the right-hand side of the balance sheet and indicates how firms fund operational and investment activities (Zani et al., 2014). Excessive debt usage increases financial risk, as firms must meet interest and principal obligations (Myers, 1984). Although Modigliani and Miller (1958) assert that capital structure does not affect firm value in a perfect market, empirical conditions demonstrate that financing choices influence the cost of capital in imperfect markets. The Debt to Equity Ratio (DER) is one of the most widely used indicators of capital structure because total debt and equity values are readily observable in financial statements (Titman, 1998). The DER formula is expressed as:

$$\text{Debt to Equity Ratio} = \frac{Total\ Debt}{Total\ Equity}$$

**4) Cash Flow Volatility**

Cash flow volatility reflects the degree of fluctuation in operating cash flows over time and is a key indicator of financial stability. High volatility may hinder a firm's ability to meet short-term obligations and manage financing needs (Graham & Harvey, 2001). External factors such as economic conditions, regulatory environments, and managerial decisions can further influence cash flow volatility (Njuguna et al., 2022). Keefe and Nguyen (2023) identify cash flow volatility as an important determinant of capital structure, while Yuan and Motohashi (2014) emphasize that cash flows serve as a measure of a firm's ability to fulfill daily financial commitments and reflect its intrinsic value. Firms with high cash flow volatility often face instability in generating cash, increasing their dependence on external financing—particularly debt—when internal funds are insufficient. This condition aligns with the Pecking Order Theory, which states that firms prioritize internal financing before seeking external sources. Cash flow volatility is commonly measured as:

$$\text{CFV} = \frac{\sigma(CFO)t}{Total\ aktiva\ t}$$

**5) Fixed Assets**

Fixed assets are long-term tangible assets used in business operations, such as buildings, machinery, and equipment (Warren et al., 2008). These assets are initially recorded at acquisition cost and subsequently measured using either the cost model or revaluation model depending on the firm's accounting policy (Choi & Meek, 2017). Fixed assets play a strategic role in determining capital structure because they can serve as collateral for debt financing, thereby reducing creditor risk (Li & Islam, 2019). Firms with a larger proportion of fixed assets generally possess greater capacity to secure debt, strengthening their bargaining position in financing decisions.

## 2. Method

This study employs three categories of variables: the dependent variable, the independent variable, and the moderating variable. The dependent variable is Capital Structure, while the independent variable is Cash Flow Volatility, and Fixed Assets serve as the moderating variable. The research focuses on mining sector companies in Indonesia listed on the Indonesia Stock Exchange (IDX) during the 2018–2023 period.

The population of this study consists of 91 mining companies listed on the IDX from 2018 to 2023. A purposive sampling technique was applied to select firms that met the research criteria. The sample criteria are as follows:
1) Mining companies listed on the Indonesia Stock Exchange during the 2018–2023 period.
2) Companies that consistently publish financial reports for five consecutive years within the study period.
3) Companies that issue annual reports dated 31 December for the years 2018–2023.
4) Companies with extreme values (outliers) in their financial data during the observation period.

This research uses secondary data, including annual reports, financial statements, and other relevant corporate documents obtained from the official IDX website (www.idx.co.id). All data used are derived from publicly available electronic reports issued by mining sector companies. The study employs the documentation method to collect data. Financial statements and annual reports of all mining companies listed on the IDX for the 2018–2023 period serve as the primary sources of information.

The analytical method used in this study is moderated regression analysis (MRA), applying a quantitative statistical approach. Data processing is conducted using Eviews 12 software. The analysis includes classical assumption testing and hypothesis testing to ensure the accuracy and reliability of the model. This general model is then adapted into the specific regression model for this study:

$$CS = \alpha + \beta_1 CFV_{(i,t)} + \beta_2 (CFV \times FA)_{(i,t)} + e_{(i,t)}$$

The moderated regression model incorporating the interaction term is specified as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 M + \beta_3 (X_1 \times M) + e$$

Hypothesis testing in this study was carried out using the F-test and t-test with a significance level of 5%. Decisions were made based on the significance value, where a value < 0.05 indicates that the alternative hypothesis (H1) is accepted and the null hypothesis (H0) is rejected, while a value > 0.05 indicates that H1 is rejected and H0 is accepted. The F-test is used to assess the simultaneous effect of the independent variables on the dependent variable. If the test results show a significance value < 0.05, the independent variables are considered to have a significant joint effect; conversely, if the value is > 0.05, no significant simultaneous effect is present. Meanwhile, the t-test is used to evaluate the partial effect of each independent variable on the dependent variable. If the significance value is < 0.05, the independent variable is proven to have a significant partial effect; however, if the value is > 0.05, the variable is considered to have no significant partial effect on the dependent variable.

## 3. Result and Discussion

### 3.1. Descriptive Statistics

**Table 1. Descriptive Statistic**

|  | CFV | CS | FA | LNM | INTR |
|---|---|---|---|---|---|
| Mean | 0.133084 | 1.445381 | 2529835. | 21.15828 | 2.875398 |
| Median | 0.092100 | 0.977386 | 745984.0 | 26.41715 | 1.785536 |
| Maximum | 4.569247 | 57.15968 | 41097112 | 31.34696 | 65.84137 |
| Minimum | -0.355948 | -39.33333 | 1.000000 | 7.070724 | -5.402747 |
| Std. Dev. | 0.327018 | 5.529318 | 5692839. | 7.986908 | 5.334797 |
| Observations | 285 | 285 | 285 | 285 | 285 |

Descriptive statistics were employed to provide an overall overview of the dataset, including the number of observations, maximum and minimum values, median, mean, standard deviation, skewness, and kurtosis for each variable. The results indicate that the Cash Flow Volatility (X) variable has an average value of 0.133, with a range from –0.355 to 4.569, and a standard deviation of 0.327, which exceeds its mean, suggesting substantial variability in cash flow fluctuations among firms. The Capital Structure (Y) variable also exhibits considerable dispersion, with a mean of 1.445, a minimum value of –39.333, and a maximum value of 57.159. Its standard deviation of 5.529 is notably higher than the mean, indicating a high degree of variability in firms' capital structure decisions. Similarly, the Fixed Assets (M) variable shows a mean value of 2,529.0, with values ranging from 1.000 to 41,097.0, and a standard deviation of 5,692.0, which again exceeds its mean. This suggests that the distribution of fixed asset ownership across firms is highly dispersed, reflecting differences in asset intensity within the mining sector.

### 3.2. Model Selectoin

**Tabel 2. The Chow Test**

| Redundant Fixed Effects Tests | | | |
|---|---|---|---|
| Test cross-section fixed effects | | | |
| Effects Test | Statistic | d.f. | Prob. |
| Cross-section F | 8.016368 | (56,225) | 0.0000 |
| Cross-section Chi-square | 312.646710 | 56 | 0.0000 |

**Tabel 3. The Hausman Test**

| Correlated Random Effects - Hausman Test | | | |
|---|---|---|---|
| Test cross-section random effects | | | |
| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
| Cross-section random | 0.000000 | 3 | 1.0000 |

Based on the results of the Chow Test conducted using EViews 12, the significance values of both the F-test and Chi-square were 0.0000 (< 0.05), indicating that the null hypothesis is rejected and the Fixed Effect Model (FEM) is more appropriate than the Common Effect Model (CEM). Subsequently, the Hausman Test was performed, as the Chow Test yielded a significant result. The Hausman Test shows that the Prob. Cross-section Random value is 1.000 (> 0.05), meaning that the null hypothesis is accepted and the Random Effect Model (REM) is considered more suitable than FEM. However, given that the R-squared value in the REM is relatively low, the researcher opted to use the FEM because it provides a higher R-squared value, thus offering a more accurate interpretation of the relationships among variables in accordance with the characteristics of the data.

### 3.3. Assumption Test

The classical assumption tests in this study include multicollinearity, heteroskedasticity, and autocorrelation tests. The results of the multicollinearity test indicate that the Variance Inflation Factor (VIF) values for Cash Flow Volatility and Fixed Assets are both 1.000528, which is below the threshold of 10, confirming that the model is free from multicollinearity issues. Furthermore, the heteroskedasticity test shows a probability value of Obs*R-squared of 1.251648 (> 0.05), indicating that the model does not suffer from heteroskedasticity. However, the autocorrelation test results reveal a Durbin–Watson value of 1.216187, which falls within the range of 0 < DW < DL, suggesting the presence of positive autocorrelation in the regression model used in this study.

### 3.4. Discussion

The findings indicate that cash flow volatility has a significant and positive effect on the capital structure of mining companies in Indonesia. This suggests that higher fluctuations in cash flows lead firms to increase their reliance on debt financing. These results align with Harris & Roark (2019) and are consistent with the Pecking Order Theory, which predicts that firms with unstable internal funds tend to limit debt usage. In the context of the mining industry, this behavior is likely driven by the presence of substantial sunk costs associated with exploration activities, heavy machinery, and

infrastructure development, which require continuous and long-term funding regardless of short-term cash flow conditions. Mining projects cannot be easily postponed or scaled down once initiated, forcing firms to secure external financing to sustain operations during periods of cash flow volatility. Consequently, debt financing becomes a practical necessity rather than a discretionary choice, particularly in capital-intensive and commodity-dependent sectors.

Despite theoretical expectations that cash flow volatility does not directly affect the cost of capital (Naser et al., 2024), in practice, firms rely on debt secured by assets to meet operational and investment needs, especially in capital-intensive and commodity-dependent sectors. Regarding the moderating role of fixed assets, the analysis shows a negative but statistically insignificant effect on the relationship between cash flow volatility and capital structure. While theoretically, substantial fixed assets could mitigate the impact of cash flow fluctuations by providing collateral for debt, the results suggest that in practice, asset size alone does not guarantee improved access to financing. Creditors appear to emphasize the firm's ability to generate stable future cash flows over the mere quantity of fixed assets, particularly when asset liquidity is low or highly specific (Harris & Roark, 2019). Overall, the study highlights that mining firms must enhance cash flow management and strategic financing decisions to reduce reliance on debt, as volatility in cash flows remains a critical determinant of capital structure, while fixed assets alone are insufficient as a moderating factor. These findings provide practical insights for corporate financial planning in capital-intensive and volatile industries.

## 4. Conclusion

This study examines the effect of cash flow volatility on capital structure, with fixed assets as a moderating variable, in mining companies listed on the Indonesia Stock Exchange during 2018–2023. The results indicate that cash flow volatility has a significant and positive impact on capital structure. This finding suggests that companies with higher fluctuations in operational cash flows tend to rely more on debt financing, highlighting cash flow volatility as a key determinant in funding decisions. Conversely, fixed assets as a moderating variable exhibit a negative but statistically insignificant effect on the relationship between cash flow volatility and capital structure. This implies that, although substantial fixed assets may theoretically reduce the impact of cash flow fluctuations by providing collateral, in practice, their influence is not sufficient to alter financing decisions in the mining sector significantly.

Based on these findings, several practical and research implications can be drawn. Mining companies should enhance cash flow management and implement careful financial planning to control debt levels and reduce financial risks. Efficient utilization of fixed assets as collateral can strengthen long-term financial stability and increase creditor confidence, even though their moderating effect was not significant. Investors and financial institutions are encouraged to consider cash flow volatility as a key risk indicator when assessing creditworthiness or investment opportunities, as high volatility signals increased funding risk. For future research, incorporating additional variables such as profitability, liquidity, and firm size, or examining different industry sectors, could provide a deeper understanding of the determinants of capital structure in Indonesian mining companies.

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