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# Financial Determinants of Tax Aggressiveness and the Moderating Role of Market Reaction: Evidence from Indonesia's Energy Sector

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**Abstract:** *This study examines the financial determinants of tax aggressiveness and the moderating role of market reaction among energy companies listed on the Indonesia Stock Exchange during 2020–2023. Drawing on agency and political cost theories, it investigates the effects of capital intensity, leverage, profitability, and liquidity on tax aggressiveness, with market reaction (Tobin's Q) as a moderating variable. Panel data from 46 firms (182 firm-year observations) were analysed using quantile regression at Q25, Q50, and Q75. The results show that liquidity consistently reduces tax aggressiveness, whereas capital intensity is significant only among the most aggressive firms. Leverage and profitability have no significant effect. Market reaction moderates the relationships between leverage, liquidity, and tax aggressiveness at the lower and median quantiles, but these effects disappear at the highest quantile. The findings reveal heterogeneous patterns of tax aggressiveness and suggest that market mechanisms alone are insufficient to constrain tax aggressiveness in capital-intensive firms.*
**Abstrak :** *Penelitian ini menganalisis determinan keuangan agresivitas pajak serta peran moderasi reaksi pasar pada perusahaan sektor energi yang terdaftar di Bursa Efek Indonesia periode 2020–2023. Berlandaskan teori agensi dan teori biaya politik, penelitian ini menguji pengaruh intensitas modal, leverage, profitabilitas, dan likuiditas terhadap agresivitas pajak serta peran reaksi pasar (Tobin's Q) sebagai variabel moderasi. Data panel dari 46 perusahaan (182 observasi firm-year) dianalisis menggunakan regresi kuantil pada Q25, Q50, dan Q75. Hasil penelitian menunjukkan bahwa likuiditas secara konsisten menurunkan agresivitas pajak, sedangkan intensitas modal hanya berpengaruh pada perusahaan dengan tingkat agresivitas tertinggi. Leverage dan profitabilitas tidak berpengaruh signifikan. Reaksi pasar memoderasi hubungan leverage dan likuiditas dengan agresivitas pajak pada kuantil bawah dan median, tetapi efek tersebut menghilang pada kuantil tertinggi. Temuan ini menunjukkan adanya heterogenitas perilaku agresivitas pajak serta mengindikasikan bahwa mekanisme pasar belum memadai untuk membatasi agresivitas pajak pada perusahaan padat modal.*

**Keywords :** *Tax Aggressiveness; Market Reaction; Quantile Regression; Energy Companies*

## INTRODUCTION

Tax revenue is central to public finance in developing economies. In Indonesia, it accounts for approximately 78 percent of national revenue, making tax compliance essential for financing infrastructure and development (Directorate General of Taxes, 2023). Despite improvements in tax collection, revenue growth has slowed, partly because corporate tax aggressiveness remains pervasive, ranging from legitimate tax planning to legally and ethically questionable practices (Frank et al., 2009; Hanlon & Heitzman, 2010).

The OECD estimates that aggressive tax planning reduces government revenue by USD 100–240 billion annually (OECD, 2015). Capital-intensive firms are particularly prone to such practices because their complex asset structures and financing arrangements provide greater opportunities to reduce taxable income (Duhoon & Singh, 2023; Hossain et al., 2024). This issue is especially relevant in Indonesia's energy sector, which contributes more than 12 percent of GDP and is characterised by substantial fixed-asset investment and complex financing (Matanari & Hutagalung, 2024).

Previous studies identify capital intensity, leverage, profitability, and liquidity as important determinants of tax aggressiveness decisions (Rama Soumokil & Budi Yanti, 2024). However, limited attention has been given to whether market reaction influences these relationships. Measured by Tobin's Q, market reaction reflects investors' assessments of firm value and governance quality (Desai et al., 2005; Hasan et al., 2021; Lim et al., 2024). Agency theory suggests that investor scrutiny constrains managerial opportunism (Hanlon & Heitzman, 2010), while political cost theory argues that firms in high-profile industries face reputational pressures that discourage aggressive tax behaviour (Watts & JL Zimmerman, 1978). Empirical evidence on this moderating role, particularly in Asian emerging markets, remains limited (Dyah Permatasari et al., 2021).

Using panel data from 46 energy companies listed on the Indonesia Stock Exchange during 2020–2023, this study examines the effects of financial characteristics on tax aggressiveness and the moderating role of market reaction through quantile regression. By capturing heterogeneity across the tax aggressiveness distribution, the study extends agency and political cost theories while providing practical insights for investors, managers, and regulators in capital-intensive industries.

**Theoretical Underpinnings**

Agency theory explains that the separation of ownership and control creates conflicts of interest arising from information asymmetry (Salehi et al., 2024; Wongsinhirun et al., 2024). In the context of taxation, managers may exploit this informational advantage by adopting tax strategies that maximise after-tax cash flows or reported earnings, potentially at the expense of shareholders (Armstrong et al., 2015; Hasan et al., 2021; Salehi et al., 2024). Market reaction, proxied by Tobin's Q, may mitigate such behaviour because investor scrutiny serves as an external governance mechanism that constrains managerial opportunism (Cho et al., 2024; Marheni et al., 2025).

Political cost theory argues that large and visible firms face greater scrutiny from regulators, policymakers, and the public, making aggressive tax practices more costly in terms of reputation and political exposure (Bahtiar & Wenten, 2024; Compagnie & Torsin, 2025; Fan & Chen, 2023). These perspectives suggest that corporate tax aggressiveness is jointly influenced by internal financial characteristics and external market responses.

**Financial Determinants of Tax Aggressiveness**

Prior studies identify capital intensity, leverage, profitability, and liquidity as key determinants of tax aggressiveness. Capital intensity provides opportunities to reduce taxable income through depreciation allowances, while leverage generates tax savings through interest deductibility (Hendayana et al., 2024; Hossain et al., 2024). Evidence regarding profitability and liquidity is less conclusive. Higher profitability may encourage tax planning by increasing tax burdens, but it may also discourage aggressive behaviour because of greater regulatory and public scrutiny (Compagnie & Torsin, 2025; Hossain et al., 2024; Soumokil & Yanti, 2024). Likewise, liquidity may either facilitate sophisticated tax planning or reduce incentives for aggressive tax behaviour by easing financial pressure (Dyah Permatasari et al., 2021; Junaidi & Hidayat, 2025). Table 1 summarises the definitions, measurement proxies, and supporting literature for each variable.

Table 1. Financial Determinants of Tax Aggressiveness

| Variable | Definition | Proxy | Key References |
|---|---|---|---|
| Capital Intensity (X1) | Proportion of fixed assets relative to total assets | Fixed Asset / Total Asset | Bahtiar & Wenten (2024) |
| Leverage (X2) | Debt financing relative to total assets | Total Debt / Total Assets | Hossain et al. (2024); Hendayana et al. (2024) |
| Profitability (X3) | Firm’s capacity to generate earnings | ROA | Soumokil & Yanti (2024); Tamia (2021) |
| Liquidity (X4) | Ability to meet short-term obligations | Current Ratio | Permatasari (2023); Junaidi & Hidayat (2025) |

*Source: Compiled by authors based on literature review*

**Market Reaction as a Moderator**

Market reaction, measured by Tobin's Q, reflects investors' assessments of firm value and governance quality. Positive market sentiment may reinforce the effects of financial decisions, whereas negative sentiment may discourage aggressive tax behaviour by increasing reputational concerns (Hanlon & Heitzman, 2010). Although prior empirical work indicates that market-based valuation, proxied by Tobin's Q, may condition the relationship between firms' financial characteristics and tax aggressiveness (Dyah Permatasari et al., 2021; Guedrib & Marouani, 2023; Junaidi & Hidayat, 2025),systematic evidence on this moderating role remains scarce, particularly in the context of emerging Asian markets.

**Hypotheses Development**

Based on agency theory and prior empirical evidence, capital intensity is expected to increase tax aggressiveness because firms with larger fixed-asset bases can benefit more from depreciation

allowances (Bahtiar & Wenten, 2024; Hendayana et al., 2024). Likewise, leverage is expected to increase tax aggressiveness through the tax-deductibility of interest payments (Bahtiar & Wenten, 2024; Duhoon & Singh, 2023; Hendayana et al., 2024; Hossain et al., 2024). Although previous findings on profitability are mixed, this study predicts a positive relationship based on the argument that higher profits increase incentives to minimise tax liabilities (Bahtiar & Wenten, 2024; Hendayana et al., 2024; Hossain et al., 2024). In contrast, liquidity is hypothesised to negatively affect tax aggressiveness because firms with stronger financial flexibility face lower pressure to minimise tax payments (Duhoon & Singh, 2023; Dyah Permatasari et al., 2021; Junaidi & Hidayat, 2025).

Market reaction is further expected to moderate these relationships by strengthening or weakening the influence of firms' financial characteristics on tax aggressiveness. Accordingly, the following hypotheses are proposed:

H1: Capital intensity positively affects tax aggressiveness.

H2: Leverage positively affects tax aggressiveness.

H3: Profitability positively affects tax aggressiveness.

H4: Liquidity negatively affects tax aggressiveness.

H5: Market reaction positively moderates the effect of capital intensity on tax aggressiveness.

H6: Market reaction moderates the effect of leverage on tax aggressiveness.

H7: Market reaction moderates the effect of profitability on tax aggressiveness.

H8: Market reaction positively moderates the effect of liquidity on tax aggressiveness.

These hypotheses are integrated into the conceptual framework presented in Figure 1, which illustrates the proposed relationships between financial characteristics, market reaction, and tax aggressiveness.

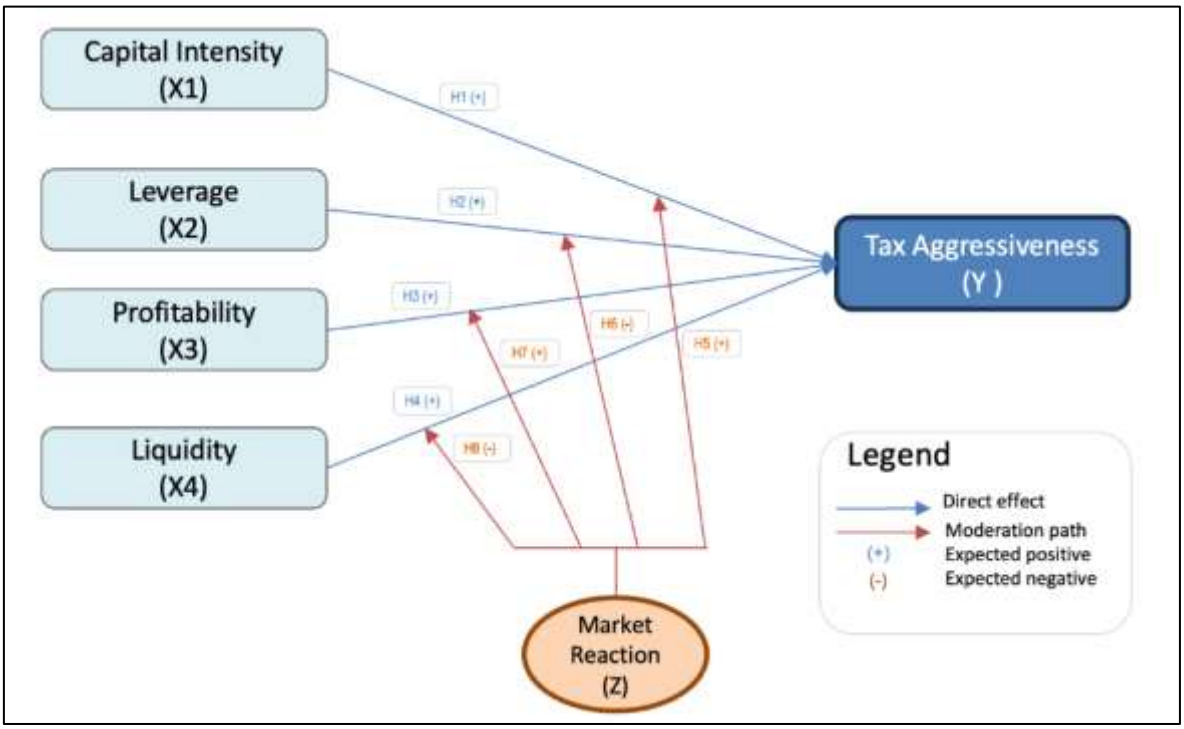


Figure 1. Conceptual Framework
Source: Developed by author

## METHOD

The study examines energy companies listed on the Indonesia Stock Exchange (IDX) during 2020–2023. Purposive sampling was employed, resulting in an initial sample of 188 firm-year observations from 46 firms. After excluding extreme outliers (1−ETR < −3 and Tobin's Q > 10), the final sample comprised 182 firm-year observations. Sample firms were required to have complete financial data, remain continuously listed throughout the observation period, and experience no major structural changes, such as mergers or significant capital restructuring. Financial and market data were collected from audited annual reports and the IDX website.

Table 2 summarises the operational definitions, measurement proxies, and supporting references for all variables. Tax aggressiveness (Y) is measured using 1−ETR, where higher values indicate greater tax aggressiveness (Dyreng et al., 2008; Frank et al., 2009; Lanis & Richardson, 2011). Capital intensity (X1) is measured by the ratio of fixed assets to total assets, leverage (X2) by total debt to total assets, profitability (X3) by return on assets (ROA), and liquidity (X4) by the current ratio. Market reaction (Z) is proxied by Tobin's Q, calculated as the market value of equity plus the book value of debt divided by total assets.

Table 2. Variable Definitions and Measurement

| Variable | Role | Proxy | Definition | Key References |
|---|---|---|---|---|
| Tax Aggressiveness (Y) | Dependent | 1−ETR | Tax expense / Pre-tax income; lower values indicate higher aggressiveness | Lanis & Richardson (2011) |
| Capital Intensity (X1) | Independent | Fixed Asset / Total Assets | Proportion of fixed assets to total assets; reflects depreciation tax shield | Lanis & Richardson (2011) |
| Leverage (X2) | Independent | Total Debt / Total Assets | Debt financing relative to total assets; captures interest tax shield | Hossain et al. (2024); Kurniasih & Sari (2013) |
| Profitability (X3) | Independent | ROA | Net profit before tax / Total assets; capacity and incentive for tax minimisation | Graham et al. (2014); Soumokil & Yanti (2024) |
| Liquidity (X4) | Independent | Current Ratio | Current assets / Current liabilities; financial flexibility | Hossain et al. (2024); Permatasari (2023) |
| Market Reaction (Z) | Moderator | Tobin's Q | Market value of equity + book value of debt / Total assets; investor sentiment | Guedrib & Marouani (2023); Sasmita et al. (2025) |

*Source: Compiled by authors based on literature review*

**Analytical Method**

The study employs quantile regression (QR) as the primary analytical method (Koenker & Bassett, 1978). Compared with ordinary least squares (OLS), QR is more robust to outliers and enables estimation of variable effects across different levels of tax aggressiveness. The models are estimated at the 25th, 50th, and 75th quantiles, representing firms with low, moderate, and high tax aggressiveness, respectively. The estimated model is expressed as:

$$Q\tau(TA) = \alpha\tau + \beta\tau_1 CI + \beta\tau_2 LEV + \beta\tau_3 PROF + \beta\tau_4 LIQ + \beta\tau_5 MR + interaction\ terms + \varepsilon$$

where TA denotes tax aggressiveness (1−ETR). Standard errors were estimated using 1,000 bootstrap replications, while model fit was assessed using pseudo-$R^2$ (Koenker & Machado, 1999). OLS estimates are reported as benchmark comparisons. All analyses were conducted using Python with the *statsmodels* library (Seabold & Perktold, 2010).

**Data Analysis Procedure**

The analysis was conducted in four stages. First, descriptive statistics were used to summarise the characteristics of the data. Second, correlation analysis and variance inflation factors (VIF) were examined to assess multicollinearity. Third, quantile regression was employed to estimate the direct effects of financial characteristics on tax aggressiveness. Finally, interaction terms between each

financial variable and Tobin's Q were introduced to test the moderating role of market reaction. The findings were subsequently interpreted using Agency Theory and Political Cost Theory.

## RESULTS AND DISCUSSION

Table 3 presents the descriptive statistics for 182 firm-year observations from 46 Indonesian energy companies during 2020–2023. Tax aggressiveness (1−ETR) has a mean of 0.694 (SD = 0.375), indicating a moderate level of tax aggressiveness across the sample. Capital intensity averages 0.445 (SD = 0.290), leverage 0.545 (SD = 0.428), profitability (ROA) 0.044 (SD = 0.333), and liquidity 2.465 (SD = 3.961), suggesting considerable variation in firms' financial conditions. Market reaction, measured by Tobin's Q, records a mean of 0.931 (SD = 0.874), reflecting the relatively modest market valuation of Indonesian energy firms during the observation period.

Table 3. Descriptive Statistics

| Variable | Mean | Std. Dev. | Min | Max | Observations |
|---|---|---|---|---|---|
| Tax Aggressiveness (Y) | 0.694 | 0.375 | −0.988 | 1.365 | 182 |
| Capital Intensity (X1) | 0.445 | 0.290 | 0.000 | 1.576 | 182 |
| Leverage (X2) | 0.545 | 0.428 | 0.021 | 3.490 | 182 |
| Profitability (X3) | 0.044 | 0.333 | −2.957 | 0.796 | 182 |
| Liquidity (X4) | 2.465 | 3.961 | 0.035 | 34.993 | 182 |
| Market Reaction (Z) | 0.931 | 0.874 | 0.030 | 5.585 | 182 |

*Source: data analysis*

Table 4 reports the OLS and quantile regression estimates. The OLS model explains 21.0% of the variation in tax aggressiveness ($R^2 = 0.210$), while the quantile models produce pseudo-$R^2$ values of 0.156 (Q25), 0.110 (Q50), and 0.088 (Q75). The results reveal substantial heterogeneity across the tax aggressiveness distribution. Capital intensity is positively associated with tax aggressiveness only at Q75 ($\beta = 0.180$, $p = 0.033$), whereas leverage is positive but not statistically significant at any quantile. Profitability exhibits a marginal negative effect only at Q25 ($\beta = -0.256$, $p = 0.092$). In contrast, liquidity consistently shows a significant negative effect across all quantiles (all $p < 0.001$), while market reaction has no significant direct effect on tax aggressiveness.

Table 4. Quantile Regression Results and Hypothesis Testing

| Path | Q25 β | Q50 β | Q75 β | OLS β | p-value | Decision |
|---|---|---|---|---|---|---|
| X1 → Y (H1) | −0.021 | +0.045 | +0.180* | +0.224** | 0.033 (Q75) | Partially supported |
| X2 → Y (H2) | +0.116 | +0.042 | −0.018 | +0.123* | 0.125 (Q25) | Not supported |

| Path | Q25 β | Q50 β | Q75 β | OLS β | p-value | Decision |
|---|---|---|---|---|---|---|
| X3 → Y (H3) | −0.256† | −0.089 | +0.026 | +0.026* | 0.092 (Q25) | Not supported |
| X4 → Y (H4) | −0.067*** | −0.062*** | −0.031*** | −0.723*** | <0.001 (all τ) | Not supported (direction reversed) |
| Z → Y | — | — | — | −0.040 | 0.503 | Not significant |
| Z×X1 → Y (H5) | n.s. | n.s. | n.s. | — | — | Not supported |
| Z×X2 → Y (H6) | −0.338** | −0.181* | n.s. | — | 0.002; 0.015 | Partially supported |
| Z×X3 → Y (H7) | n.s. | n.s. | n.s. | — | — | Not supported |
| Z×X4 → Y (H8) | +0.018* | +0.015** | n.s. | — | 0.016; 0.004 | Partially supported |

Note: *p<0.05; **p<0.01; ***p<0.001; †p<0.10. Significance based on 1,000 bootstrap replications. n.s. = not significant. OLS estimates serve as benchmark only.
Source: data analysis

The moderating effects of market reaction also vary across quantiles. Tobin's Q significantly moderates the relationship between leverage and tax aggressiveness at Q25 and Q50, while it also moderates the relationship between liquidity and tax aggressiveness at the same quantiles. However, neither moderating effect remains significant at Q75, indicating that market reaction exerts greater influence among firms with low-to-moderate tax aggressiveness than among the most aggressive firms.

To complement the regression results, Figure 2 illustrates the estimated quantile coefficients and their confidence intervals across the tax aggressiveness distribution. The figure highlights the heterogeneous effects of the explanatory variables across quantiles and demonstrates patterns that cannot be fully captured by the OLS estimates alone.

The findings demonstrate that the determinants of tax aggressiveness differ across the distribution, confirming the value of quantile regression in capturing heterogeneous corporate tax behaviour. Capital intensity is positively associated with tax aggressiveness only at the upper quantile, partially supporting H1 and aligning with agency theory. Indonesian energy companies rely heavily on depreciable fixed assets, including extraction facilities, processing plants, and power infrastructure, making depreciation an important mechanism for reducing taxable income under Indonesian tax regulations. The post-pandemic increase in capital expenditure further strengthened this opportunity, particularly among firms already exhibiting high levels of tax aggressiveness. This finding is consistent with prior empirical evidence demonstrating that capital intensity positively influences tax aggressiveness through depreciation-based mechanisms, particularly among firms with higher levels of tax aggressive behaviour (Bahtiar & Wenten, 2024; Duhoon & Singh, 2023; Hendayana et al., 2024).

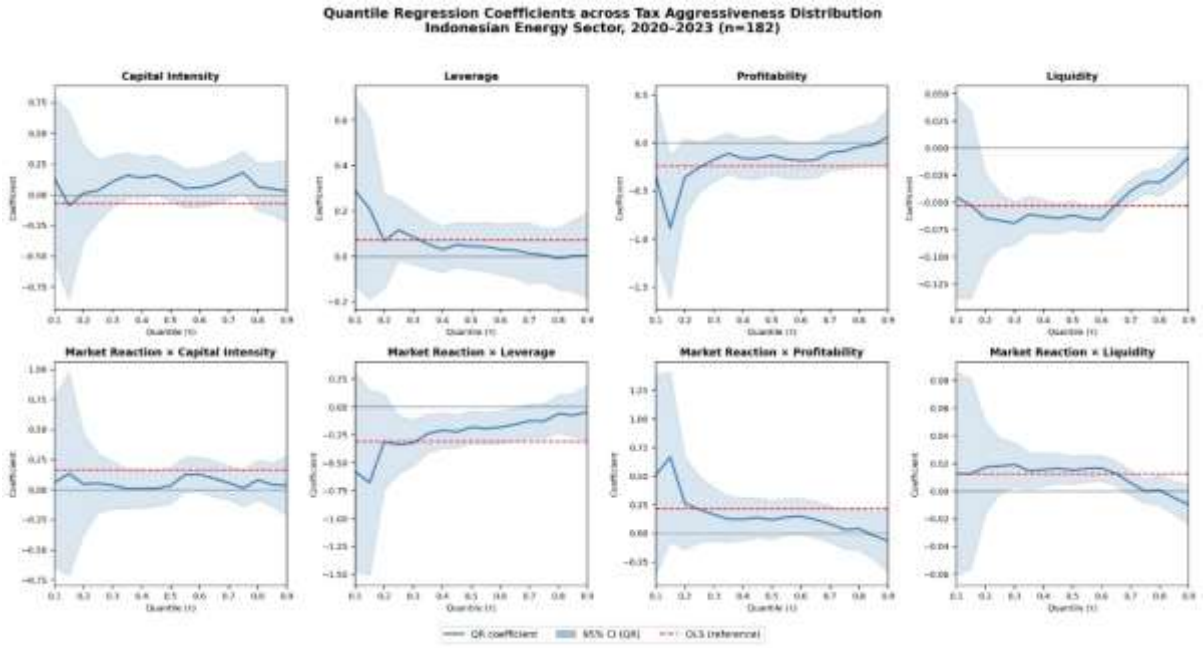


Figure 2. Quantile Regression Coefficients across the Tax Aggressiveness Distribution. Note: Blue line = QR coefficient; shaded area = 95% confidence interval; red dashed line = OLS reference. Indonesian energy sector, 2020–2023 (n = 182).

Leverage shows a positive but statistically insignificant effect, providing limited support for H2. Although interest deductibility theoretically encourages debt-financed tax planning, creditor monitoring and financing constraints may discourage more aggressive practices, particularly in the capital-intensive energy industry (Jin, 2021). In contrast, profitability exhibits a marginal negative effect only at the lower quantile, contradicting H3 but supporting political cost theory. More profitable firms may avoid aggressive tax strategies because greater public visibility increases reputational and regulatory pressures (Compagnie & Torsin, 2025; Graham et al., 2014). This interpretation is also consistent with (Matanari & Hutagalung, 2024), who report an insignificant profitability effect among Indonesian energy firms, and with Tamia Widjaya (2021)and Soumokil & Yanti (2024), who argue that firms operating in regulated industries tend to prioritise legitimacy over incremental tax savings.

Liquidity emerges as the most robust determinant of tax aggressiveness, exhibiting a significant negative effect across all quantiles. However, its influence gradually weakens toward the upper quantiles, indicating that financial flexibility constrains tax aggressiveness more effectively among firms with low and moderate levels of aggressiveness than among highly aggressive firms. Rather than encouraging more sophisticated tax planning, the findings suggest that firms with stronger liquidity face less pressure to reduce tax payments aggressively, whereas firms experiencing tighter liquidity may have

greater incentives to preserve cash through tax minimisation. This result highlights liquidity as an important stabilising factor in corporate tax behaviour within Indonesia's energy sector.

The moderating role of market reaction is more selective. Tobin's Q significantly moderates the relationships between leverage, liquidity, and tax aggressiveness at the lower and median quantiles but becomes insignificant at the upper quantile. These findings indicate that market discipline is effective only among firms with relatively moderate tax aggressiveness, whereas highly aggressive firms appear less responsive to external governance mechanisms. This pattern supports the agency perspective that investor monitoring can constrain managerial opportunism (Arora & Gill, 2022; Hanlon & Heitzman, 2010), although its effectiveness weakens once firms become deeply engaged in aggressive tax strategies.

The findings should also be viewed within the institutional context of Indonesia's energy sector during 2020–2023. The post-pandemic recovery, commodity price boom, and growing investment in energy infrastructure increased both capital expenditure and financial flexibility, while regulatory reforms accelerated sectoral transformation. These conditions likely shaped the observed relationships between capital intensity, liquidity, and tax aggressiveness. Overall, the study extends agency theory and political cost theory by demonstrating that the effects of financial characteristics and market reaction vary across the distribution of tax aggressiveness. The findings further suggest that market-based governance alone is insufficient to constrain the most aggressive firms, highlighting the continuing importance of targeted regulatory oversight in capital-intensive industries.

## CONCLUSION

This study examined the financial determinants of tax aggressiveness and the moderating role of market reaction among Indonesian energy companies during 2020–2023 using quantile regression. The findings reveal substantial heterogeneity across the tax aggressiveness distribution that conventional OLS models would not capture. Liquidity consistently reduces tax aggressiveness across all quantiles, whereas capital intensity influences only the most aggressive firms and leverage only the least aggressive firms. Profitability shows only a weak negative effect. Although market reaction (Tobin's Q) has no direct impact on tax aggressiveness, it moderates the relationships between leverage, liquidity, and tax aggressiveness at the lower and median quantiles, but not among the most aggressive firms. These findings indicate that corporate tax behaviour is jointly shaped by internal financial characteristics and external market signals, while the effectiveness of market-based governance diminishes at higher levels of tax aggressiveness.

The study extends agency theory and political cost theory by demonstrating that the influence of market discipline varies across the distribution of tax aggressiveness rather than operating uniformly

across firms. It also highlights the importance of industry-specific institutional conditions, suggesting that general models of tax aggressiveness may not fully explain corporate behaviour in capital-intensive sectors. Practically, the findings provide useful signals for investors in assessing tax aggressiveness risk, encourage managers to consider the governance implications of financial and tax-planning decisions, and suggest that regulators should complement market discipline with stronger disclosure requirements and targeted oversight for highly aggressive firms. This study is limited by its focus on Indonesian energy companies over a four-year period and by the use of the 1−ETR proxy, which may not fully distinguish tax avoidance from temporary book-tax differences. Future research could extend this analysis to other industries and emerging economies, incorporate governance-related moderators such as board independence, institutional ownership, or ESG disclosure, and examine how evolving transparency regulations and the low-carbon transition reshape corporate tax aggressiveness over time.

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