



Jurnal Riset Akuntansi dan Keuangan

Journal homepage: <https://ejournal.upi.edu/index.php/JRAK/>



CSR as Moderator of Profitability's Impact on Tax Avoidance

Sandy Gusti Setyaji¹

Faculty of Economics and Business, Universitas Airlangga, Indonesia

*Correspondence: E-mail: sandy.gusti.setyaji-2025@feb.unair.ac.id

ABSTRACT	INFO ARTIKEL
This study investigates the effect of profitability (ROA) on tax avoidance (ETR) and the moderating role of corporate social responsibility (CSR), using 714 firm-year observations from 238 non-financial firms listed on the Indonesia Stock Exchange during 2022–2024. Employing Moderated Regression Analysis within a panel-data framework, the results reveal that profitability significantly increases tax avoidance, while CSR strengthens this relationship as a pure moderator. Firms appear to use CSR both to enhance reputation and to mitigate risks linked to tax-avoidance practices. Theoretically, the study extends agency and risk management perspectives by showing how CSR shifts from a reputational signal to an active moderator of tax behavior. Practically, the findings highlight the need for regulators, auditors, and investors to scrutinize high-CSR, high-profitability firms more closely and to align CSR-disclosure standards with tax-transparency requirements in Indonesia.	Article History: <i>Submitted/Received 09 June 2026</i> <i>First Revised 18 June 2026</i> <i>Accepted 03 July 2026</i> <i>First Available online 17 July 2026</i> <i>Publication Date 25 August 2026</i> Keyword: <i>Agency Theory; Corporate Social Responsibility; Profitability; Tax Avoidance.</i>
© 2026 Kantor Jurnal dan Publikasi UPI	

1. INTRODUCTION

Tax avoidance (TA) is a strategy firms use to minimize expenses and optimize profit. Firms that engage in TA reduce the taxes they pay in order to increase business profit (Muhmad et al., 2020a); (Muhmad et al., 2020b). By engaging in TA, firms can reduce their tax liabilities, freeing up more cash to distribute to shareholders or to reinvest in operations (Rui, 2019).

At the national level, indications of tax avoidance are reflected in Indonesia's persistently low tax ratio. In 2025, Indonesia's tax ratio stood at only 9.31% of a total GDP of Rp23,821.1 trillion, with tax revenue of Rp2,217.9 trillion. Although GDP grew by 7.5%, tax revenue declined by 0.6%, causing the tax ratio to fall from 10.08% in 2024 (Wildan, 2026).

This phenomenon cannot be separated from corporate decisions to engage in tax avoidance. Under agency theory, the conflict of interest between principals and agents arising from information asymmetry encourages managers to pursue TA for personal benefit at the expense of firm owners' interests (Jensen & Meckling, 1976); (Boubaker et al., 2022).

Profitability measures a firm's financial condition, reflecting its ability to generate revenue and manage expenses (Luchko et al., 2024). The higher a firm's profitability, the greater the tax obligation it must bear (Cerdeira & Larrain, 2010), which in turn encourages firms to seek ways to minimize tax through TA strategies (Zhang et al., 2022). The relationship between profitability and TA has been widely studied, yet findings remain inconsistent: some studies report a positive relationship (Hossain et al., 2024), others a negative one (Shubita, 2024), and others find no significant relationship at all (Mulyati et al., 2019).

This inconsistency suggests the presence of an intervening factor. One candidate is corporate social responsibility (CSR). CSR can reduce taxable income while simultaneously serving as a risk-management and image-building tool (Mao, 2019); (Araújo et al., 2024). CSR is also related to profitability, which in turn affects TA (Withisuphakorn, 2018). However, the role of CSR as a moderator of the profitability–TA relationship remains under-researched, particularly in the Indonesian context.

This study offers two main contributions. Theoretically, it extends agency theory and risk management theory by clarifying the boundary condition under which CSR moves from a reputation-signaling activity into an active moderator that changes the strength of the profitability–TA relationship; in doing so it responds directly to the inconsistent profitability–TA findings noted above by identifying CSR as one source of that inconsistency, and it adds to the accounting literature on how non-financial (sustainability) disclosure interacts with core financial reporting outcomes such as the effective tax rate. Practically, the study gives regulators, auditors, and financial-statement users an empirical basis for treating a high-CSR, high-profitability profile as a signal that warrants closer scrutiny of a firm's effective tax position, and it informs policy discussions on aligning CSR-disclosure standards with tax-transparency requirements in Indonesia.

Based on this background, this study aims to examine the effect of profitability on tax avoidance among non-financial companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period, and to examine the moderating role of CSR in that relationship.

Hypothesis Development

Under agency theory (Jensen & Meckling, 1976), managers may use TA opportunistically to maximize firm profitability. The higher a firm's profitability, the stronger management's

incentive to pursue aggressive TA strategies (Shin & Woo, 2017); (Hossain et al., 2024). Mulya et al. (2024) similarly found that highly profitable firms tend to adopt more aggressive tax planning. Based on this reasoning, the first hypothesis is formulated as:

H1: Profitability (P) has a positive effect on Tax Avoidance (TA).

In its relationship with TA, CSR can function as either a substitute for or a complement to tax payment (Timbate, 2023). Karlinah et al. (2025) show that CSR strengthens the relationship between financial variables and TA. Firms also use CSR as an insurance mechanism to preserve their reputation even while engaging in TA activities (Wulandari & Fanani, 2024). Under risk management theory (Ajupov et al., 2019), firms use CSR to mitigate risks associated with decisions that could damage their public image. Accordingly, the second hypothesis is:

H2: CSR moderates the relationship between Profitability (P) and Tax Avoidance (TA).

2. METHODOLOGY

This study focuses on non-financial companies listed on the IDX between 2022 and 2024. Financial firms were excluded from the sample because of their distinct financial structure. Data were obtained from the OSIRIS database, annual reports, and sustainability reports. Data were analyzed using EViews, testing the Common Effect Model, Fixed Effect Model, and Random Effect Model. The regression models used are:

$$ETR = \alpha_1 + \beta_1 ROA + \varepsilon \dots\dots\dots (1)$$

$$ETR = \alpha_1 + \beta_1 ROA + \beta_2 CSR + \varepsilon \dots\dots\dots (2)$$

$$ETR = \alpha_1 + \beta_1 ROA + \beta_2 CSR + \beta_3 ROA \times CSR + \varepsilon \dots\dots\dots (3)$$

The proxies used in this study are ROA as a proxy for profitability (P), ETR as a proxy for tax avoidance (TA), and Global Reporting Initiative (GRI) disclosures as a proxy for CSR. Sampling was conducted using the purposive sampling method. Variable measurement is presented in Table 1 and sample details in Table 2.

Table 1. Variable Measurement

Variable	Measurement	Source
Tax Avoidance	ETR = Income Tax / Pre-tax Income	(Abdelfattah & Aboud, 2020); (Richardson et al., 2016)
Profitability	ROA = Net Profit / Total Assets	(Yusuf et al., 2025)
CSR	Global Reporting Initiative (GRI) disclosures	(Harymawan et al., 2021)

Source: Researcher (2026)

Table 2. Purposive Sampling

Description	Number of Firms
Non-financial OSIRIS companies (2022–2024)	283
ETR outside the 0–1 range (excluded)	45
Final sample	238
Total observations (3 years)	714

Source: Researcher (2026)

In addition, the type of CSR moderation was analyzed following the classification of Sharma et al. (1981), which distinguishes between a Predictor Moderator, Homologizer Moderator, Quasi Moderator, and Pure Moderator, as presented in Table 3.

Table 3. Moderation Classification

	Independent Model: Significant	Independent Model: Not Significant
Moderator Model: Not Significant	Predictor Moderator	Homologizer Moderator
Moderator Model: Significant	Quasi Moderator	Pure Moderator

Source: Sharma et al. (1981)

3. RESULT AND DISCUSSION

Descriptive Statistics

Before testing the hypotheses, the researcher conducted a descriptive analysis covering the mean, median, maximum, minimum, standard deviation, skewness, and kurtosis. Results are presented in Table 4.

Table 4. Descriptive Statistics

Description	ETR	ROA	CSR	ROA×CSR
Mean	0.222	0.086	0.672	0.058
Median	0.220	0.064	0.650	0.041
Maximum	0.942	0.602	0.970	0.584
Minimum	0.001	0.0001	0.357	0.0001
Std. Deviation	0.115	0.082	0.151	0.0684

Description	ETR	ROA	CSR	ROA×CSR
Skewness	1.338	2.586	0.583	3.938
Kurtosis	8.735	12.628	2.294	24.280

Source: Researcher's data processing (2026)

The mean ETR of 0.222 is below Indonesia's statutory corporate income tax rate of 22%, a first indication that, on average, sample firms report an effective tax burden consistent with some degree of tax avoidance. The pronounced positive skewness and high kurtosis in ROA and, especially, the ROA×CSR interaction term reflect the non-normal distribution typical of financial-ratio data pooled across heterogeneous industries; this distributional profile is consistent with the choice of a panel Fixed Effect estimator, which does not require the classical normality assumption, over a pooled OLS specification.

Regression Model Selection

A model-selection test was conducted because panel-data regression requires identifying the most appropriate estimation model. Consistent with Kristin & Yandari (2025), panel data do not require classical assumption testing. The Chow test was used to compare the Common Effect Model and Fixed Effect Model, while the Hausman test was used to compare the Fixed Effect Model and Random Effect Model. Results are presented in Table 5.

Table 5. Model Selection Test

	Chow Test	Hausman Test
Model 1	0.000	0.010
Model 2	0.000	0.048
Model 3	0.000	0.037

Source: Researcher's data processing (2026)

As shown in Table 5, all models have a Chow-test probability below 0.05, so the Fixed Effect Model is selected. The Hausman test also yields a probability below 0.05 for all three models, confirming the Fixed Effect Model as the estimation model used in the subsequent analysis.

Hypothesis Testing

Hypothesis testing was performed using Moderated Regression Analysis (MRA). Results are presented in Table 6.

Table 6. Hypothesis Testing Results (MRA)

	Model 1	Model 2	Model 3
c	0.261 (37.925)	0.266 (4.125)	0.315 (4.548)

	Model 1	Model 2	Model 3
ROA	-0.449 (-6.112)*	-0.451 (-5.994)*	-0.949 (-3.489)*
CSR	–	-0.008 (-0.089)	-0.080 (-0.802)
ROA×CSR	–	–	0.726 (1.905)**
R ²	0.741	0.741	0.743

Source: Researcher's data processing (2026). Note: * significant at the 0.05 level; ** significant at the 0.10 level; figures in parentheses are t-statistics.

The Effect of Profitability on Tax Avoidance (H1)

As shown in Table 6, ROA has a negative and significant effect on ETR, with a coefficient of -0.449. Because ETR is inversely related to TA, this result indicates that ROA has a positive effect on TA, so H1 is supported. This finding is consistent with Lahrari & Sahbani (2025) and Lucut Capras et al. (2024), who likewise found a positive effect of ROA on TA.

This positive effect indicates that the higher a firm's ROA, the greater its involvement in TA. Firms with high profitability have sufficient resources to implement aggressive TA strategies (Karlinah et al., 2024). Consistent with agency theory, opportunistic managers exploit gaps in tax policy to maximize profit while shifting the fiscal burden away from the firm and onto the state (Davis et al., 2016).

The Moderating Role of CSR (H2)

In Model 2, CSR has no significant effect as an independent variable (coefficient -0.008). In Model 3, however, the ROA×CSR interaction term is significant, with a coefficient of 0.726, indicating that CSR strengthens the positive effect of ROA on TA; H2 is therefore supported.

Because CSR is not significant as an independent variable (Model 2) but is significant as a moderating variable (Model 3), CSR is classified as a Pure Moderator following Sharma et al. (1981). This finding is consistent with Alsaadi (2020) and Wulandari & Fanani (2024), who found that CSR is used as an insurance mechanism. Firms that actively engage in CSR build a positive image among stakeholders, which gives them greater latitude to pursue aggressive TA strategies without a correspondingly large reputational cost. This finding supports risk management theory, in that firms use CSR as a risk-mitigation strategy that accompanies TA activity.

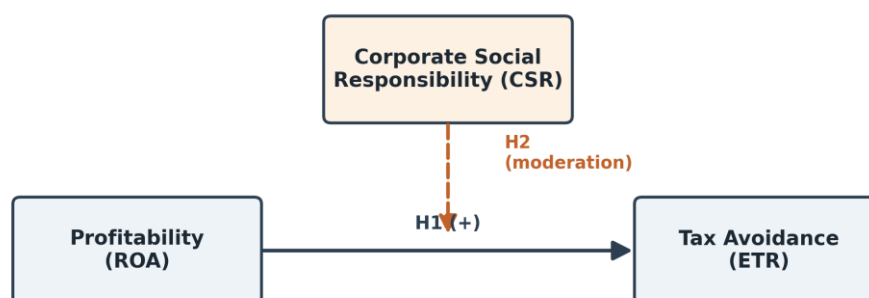
Theoretical Synthesis and Implications for Accounting Science

Read together, the two hypothesis tests describe a coherent mechanism rather than two isolated effects. Agency theory explains why profitable firms have both the incentive and the capacity to pursue Tax Avoidance which resulting from information asymmetry that let opportunistic managers convert tax savings into private or short-term shareholder benefit (Jensen & Meckling, 1976). Another theory apart from Agency Theory, Risk management theory explains why that behavior is not constrained by reputational cost when CSR is high: CSR functions as an insurance-like buffer that firms draw down precisely when their Tax Avoidance exposure is greatest (Ajupov et al., 2019); (Chatterjee et al., 2012). The Pure

Moderator classification is the empirical signature of this buffering role. CSR, as the moderating variable, does not independently move ETR, but it changes how strongly ROA moves ETR, which is exactly what an insurance mechanism, rather than a direct tax-planning lever, would be expected to do.

This synthesis also helps reconcile the inconsistent relationship between profitability and Tax Avoidance findings noted in the Introduction (Hossain et al., 2024); (Shubita, 2024); (Mulyati et al., 2019): a positive, negative, or null profitability effect may partly reflect unmeasured variation in firms' CSR intensity across samples and institutional settings, rather than a genuinely unstable underlying relationship. For accounting science more broadly, the result speaks to the growing integration of financial and non-financial reporting. It suggests that sustainability disclosure and core financial-statement outcomes such as the effective tax rate should not be assessed as independent reporting streams: a firm's CSR narrative can condition how its profitability translates into tax outcomes, which is directly relevant to assurance practice on integrated and sustainability reports, to standard-setters considering closer alignment between ESG and disclosure frameworks (e.g., GRI, IFRS S1/S2) and tax-transparency disclosure, and to tax authorities and capital-market regulators evaluating whether high-CSR firms merit closer scrutiny of their effective tax positions rather than a presumption of good corporate citizenship. Figure 1 summarizes the conceptual relationship examined in this study.

Figure 1. Conceptual Model of Profitability, Tax Avoidance, and the Moderating Role of CSR



Source: Researcher (2026)

4. CONCLUSSION

This study set out to examine the effect of profitability, proxied by ROA, on tax avoidance, proxied by ETR, and the moderating role of CSR in that relationship among non-financial companies listed on the IDX during 2022–2024, based on 714 observations. Profitability is found to have a positive and significant effect on tax avoidance, indicating that firms with higher profitability have a greater incentive to pursue aggressive tax-avoidance strategies, consistent with an agency-theory account in which opportunistic managers exploit profitable positions to minimize tax obligations. CSR, in turn, is shown to act as a Pure Moderator that strengthens the positive effect of profitability on tax avoidance rather than as a direct, independent driver of the effective tax rate; firms appear to use CSR as an image-building and risk-management device as an insurance mechanism, in the language of risk management theory that allows them to pursue tax avoidance while containing the reputational cost of doing so. Taken together, these findings extend agency theory and risk management theory by clarifying the conditions under which CSR shifts from a reputational signal into an active

moderator of tax behavior, and they help explain why prior studies have reported inconsistent findings from profitability and tax avoidance relationships, since that inconsistency may partly reflect unmeasured variation in firms' CSR intensity. For accounting science and practice, the results support closer scrutiny of high-CSR, high-profitability firms' effective tax positions by auditors, tax authorities, and capital-market regulators, and they point toward closer alignment between CSR-disclosure standards and tax-transparency requirements. This study is limited by its focus on non-financial firms only; future research is encouraged to include financial-sector firms to obtain a more comprehensive picture of corporate tax behavior in Indonesia, and policymakers are encouraged to strengthen corporate financial-oversight regulation to curb aggressive tax avoidance while encouraging firms to align their CSR activities with responsible tax strategy.

5. REFERENCES

- Abdelfattah, T., & Aboud, A. (2020). Tax avoidance, corporate governance, and corporate social responsibility: The case of the Egyptian capital market. *Journal of International Accounting, Auditing and Taxation*, 38. <https://doi.org/10.1016/j.intaccaudtax.2020.100304>
- Ajupov, A., Sherstobitova, A., Syrotiuk, S., & Karataev, A. (2019). The risk-management theory in modern economic conditions. *E3S Web of Conferences*, 110, 1. <https://doi.org/10.1051/e3sconf/2019>
- Alsaadi, A. (2020). Financial-tax reporting conformity, tax avoidance and corporate social responsibility. *Journal of Financial Reporting and Accounting*, 18(3), 639–659. <https://doi.org/10.1108/JFRA-10-2019-0133>
- Araújo, L., Ravara Cruz, S., Lima Santos, L., & Cardoso, L. (2024). Mapping Corporate Tax Planning and Corporate Social Responsibility: A Hybrid Method of Category Analysis. In *Journal of Risk and Financial Management* (Vol. 17, Number 8). Multidisciplinary Digital Publishing Institute (MDPI). <https://doi.org/10.3390/jrfm17080333>
- Boubaker, S., Derouiche, I., & Nguyen, H. (2022). Voluntary disclosure, tax avoidance and family firms. *Journal of Management and Governance*, 26(1), 129–158. <https://doi.org/10.1007/s10997-021-09601-w>
- Cerda, R. A., & Larrain, F. (2010). Corporate taxes and the demand for labor and capital in developing countries. *Small Business Economics*, 34(2), 187–201. <https://doi.org/10.1007/s11187-008-9113-2>
- Chatterjee, A., Ying, L., & Vishwanath, S. (2012). Revenue and Reputation: A Stochastic Control Approach to Profit Maximization. *Annual Allerton Conference Allerton House*, 15, 617.
- Davis, A. K., Guenther, D. A., Krull, L. K., & Williams, B. M. (2016). Do Socially Responsible Firms Pay More Taxes? Do Socially Responsible Firms Pay More Taxes? Do Socially Responsible Firms Pay More Taxes? *Accounting Review*, 91(1), 47–68.
- Harymawan, I., Putra, F. K. G., Fianto, B. A., & Wan Ismail, W. A. (2021). Financially distressed firms: Environmental, social, and governance reporting in indonesia. *Sustainability (Switzerland)*, 13(18). <https://doi.org/10.3390/su131810156>

- Hossain, M. S., Ali, M. S., Islam, M. Z., Ling, C. C., & Fung, C. Y. (2024). Nexus between profitability, firm size and leverage and tax avoidance: evidence from an emerging economy. *Asian Review of Accounting*, 32(5), 759–780. <https://doi.org/10.1108/ARA-08-2023-0238>
- Jensen, M. C., & Meckling, W. H. (1976). THEORY OF THE FIRM: MANAGERIAL BEHAVIOR, AGENCY COSTS AND OWNERSHIP STRUCTURE. In *Journal of Financial Economics* (Vol. 3). Q North-Holland Publishing Company.
- Karlinah, Lady, Meutia, Hanifah, I. A., & Ismawati, I. (2024). How does Financial Performance Moderate the Effect of Corporate Governance Mechanisms on Tax Avoidance? *Quality - Access to Success*, 25(201), 292–302. <https://doi.org/10.47750/QAS/25.201.32>
- Karlinah, Lady, Meutia, M., Hanifah, I. A., & Ismawati, I. (2025). HOW IS CORPORATE SOCIAL RESPONSIBILITY A MODERATING VARIABLE IN TAX AVOIDANCE? A BUSINESS STRATEGY CONTEXT. *Corporate Governance and Sustainability Review*, 9(1), 115–125. <https://doi.org/10.22495/cgsrv9i1p10>
- Kristin, D., & Yandari, A. D. (2025). Intellectual Capital, Leverage, Competitive Advantage, Earnings Management Terhadap Implementasi Adopsi IFRS 9 di Perbankan. *Reviu Akuntansi Dan Bisnis Indonesia*, 9(3), 452–467. <https://doi.org/10.18196/rabin.v9i3.27694>
- Lahrari, K., & Sahbani, S. (2025). TAX AVOIDANCE AND FINANCIAL PERFORMANCE OF NON-FINANCIAL QUOTED COMPANIES: EMPIRICAL EVIDENCE FROM MOROCCO. *Financial and Credit Activity: Problems of Theory and Practice*, 3(62), 95–107. <https://doi.org/10.55643/fcaptp.3.62.2025.4742>
- Luchko, M., Szmitka, S., Dziubanovska, N., & Vovk, I. (2024). Comparative analysis of business profitability in Ukraine and Poland. *Direccion y Organizacion*, (84), 45–52. <https://doi.org/10.37610/84.681>
- Lucut Capras, I., Achim, M. V., & Mara, E. R. (2024). Is tax avoidance one of the purposes of financial data manipulation? The case of Romania. *Journal of Risk Finance*, 25(4), 588–601. <https://doi.org/10.1108/JRF-11-2023-0273>
- Mao, C. W. (2019). Effect of corporate social responsibility on corporate tax avoidance: evidence from a matching approach. *Quality and Quantity*, 53(1), 49–67. <https://doi.org/10.1007/s11135-018-0722-9>
- Muhmad, S. N., Haat, M. H. C., Taha, R., Rashid, N., & Muhmad, S. N. (2020a). The effects of financial motives towards corporate tax avoidance: evidence from public listed companies in Malaysia. *Journal of Advanced Research in Dynamical and Control Systems*, 12(1), 161–166.
- Muhmad, S. N., Haat, M. H. C., Taha, R., Rashid, N., & Muhmad, S. N. (2020b). The influence of the financial indicators towards the changes of the corporate tax avoidance. *Journal of Advanced Research in Dynamical and Control Systems*, 12(1), 167–171.

- Mulya, A. S., Sandy, R. M., & Janti, K. M. (2024). THE ROLE OF INDONESIAN BUSINESS OWNERS IN AGGRESSIVE TAX PLANNING. *Revista de Gestao Social e Ambiental*, 18(6). <https://doi.org/10.24857/rgsa.v18n6-087>
- Mulyati, Y., Subing, H. J. T., Fathonah, A. N., & Prameela, A. (2019). Effect of profitability, leverage and company size on tax avoidance. *International Journal of Innovation, Creativity and Change*, 6(8), 26–35.
- Richardson, G., Taylor, G., & Lanis, R. (2016). Women on the board of directors and corporate tax aggressiveness in Australia An empirical analysis. *Accounting Research Journal*, 29(3), 313–331. <https://doi.org/10.1108/ARJ-09-2014-0079>
- Rui, J. (2019). Effect of Corporate Tax Avoidance on the Investment-cash Flow Sensitivity. *Journal of Physics: Conference Series*, 1237(2). <https://doi.org/10.1088/1742-6596/1237/2/022050>
- Sharma, S., Durand, R. M., & Gur-Arie, O. (1981). Identification and Analysis of Moderator Variables. In *Source: Journal of Marketing Research* (Vol. 18, Number 3).
- Shin, H.-J., & Woo, Y.-S. (2017). The effect of tax avoidance on cost of debt capital: Evidence from Korea 1. *Journal of Business Management*, 48(4), 83–89.
- Shubita, M. F. (2024). The relationship between sales growth, profitability, and tax avoidance. *Innovative Marketing*, 20(1), 113–121. [https://doi.org/10.21511/im.20\(1\).2024.10](https://doi.org/10.21511/im.20(1).2024.10)
- Timbate, L. (2023). CSR and corporate taxes: Substitutes or complements? *BRQ Business Research Quarterly*, 26(4), 327–346. <https://doi.org/10.1177/23409444211002218>
- Wildan, M. (2026). *Tax Ratio 2025 Hanya Sebesar 9,31% dari PDB*. DDTC News. <https://news.ddtc.co.id/berita/nasional/1817160/tax-ratio-2025-hanya-sebesar-931-dari-pdb>
- Withisuphakorn, P. (2018). Relationship between CSR and financial performance: The first comparative study on listed companies in Thailand and the USA. *International Journal of Economic Policy in Emerging Economies*, 11(4), 367–377.
- Wulandari, A., & Fanani, Z. (2024). Corporate Social Responsibility (CSR) and Tax Avoidance (TA) in Indonesia : Moderated Audit Committee Characteristics. *Accounting Analysis Journal*, 13(2), 106–117. <https://doi.org/10.15294/aaj.v13i2.2586>
- Yusuf, M., Ismail, T., Taqi, M., & Soleha, N. (2025). AUDIT DELAY IN THE AGENCY CONTEXT: PROFITABILITY, CORPORATE SOCIAL RESPONSIBILITY, INTELLECTUAL CAPITAL, AND TAX AVOIDANCE. *Financial and Credit Activity: Problems of Theory and Practice*, 4(63), 93–105. <https://doi.org/10.55643/fcaptp.4.63.2025.4812>
- Zhang, L., Zhang, Z., Zhang, P., & Wang, X. (2022). Defend or remain quiet? Tax avoidance and the textual characteristics of the MD&A in annual reports. *International Review of Economics and Finance*, 79, 193–204. <https://doi.org/10.1016/j.iref.2021.12.016>