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TAX RISK AND CREDIT RATING: A MACHINE LEARNING APPROACH TO PREDICTING CREDITWORTHINESS

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ABSTRAK

Peringkat kredit adalah penilaian kemampuan perusahaan untuk membayar utang, kemampuan untuk membayar kembali utang, dan kemungkinan gagal bayar. Semakin besar risiko perusahaan, termasuk risiko pajak, semakin rendah peringkat kreditnya. Penelitian ini bertujuan untuk mengeksplorasi apakah risiko pajak dapat memengaruhi peringkat kredit perusahaan tersebut. Populasi dalam penelitian ini adalah perusahaan yang terdaftar di PT Pemeringkat Kredit Indonesia (PEFINDO) dan Bursa Efek Indonesia (BEI) tahun 2020-2022. Studi ini mengumpulkan 185 sampel menggunakan *purposive sampling*. Hasil penelitian menunjukkan bahwa risiko pajak berpengaruh negatif dan signifikan terhadap peringkat kredit. Hal ini mengindikasikan bahwa tingginya risiko pajak dapat menurunkan peringkat kredit perusahaan. Hasil ini juga mengindikasikan bahwa semakin tingginya risiko pajak dapat mengurangi kelayakan kredit perusahaan. Berdasarkan temuan tersebut, penelitian ini dapat membantu kreditur dalam penilaian kelayakan kredit perusahaan. Bagi tax regulator, peringkat kredit dapat dijadikan dasar untuk melakukan audit pajak bagi wajib pajak yang berisiko.

Kata Kunci: risiko pajak, peringkat kredit, kelayakan kredit

ABSTRACT

A credit rating evaluates a company's likelihood of default, creditworthiness, and ability to repay debt. The greater the company's risk, including tax risk, the lower its credit rating. This research explores whether tax risk can affect a company's credit rating. The population in this study are companies listed on PT Pemeringkat Kredit Indonesia (PEFINDO) and the Indonesian Stock Exchange in 2020-2022. This research used purposive sampling and collected 185 samples. According to the study, tax risk adversely and considerably impacts credit ratings. This suggests that a company's credit rating may be lowered by significant tax risk. These findings suggest that increased tax risk may lower a company's creditworthiness. This study can help creditors assess companies' creditworthiness based on these findings. For tax regulators, credit ratings can be used as a basis for conducting tax audits for taxpayers at risk.

Keywords: tax risk; credit rating, creditworthiness

1. Introduction

Tax can be defined as the most important instrument in collecting state revenue to support various government activities and programs. Therefore, tax is a mandatory and compulsory contribution for every individual/body paid to the country. In this case, taxpayers who meet subjective or objective criteria must fulfil tax obligations. However,

this contrasts with taxpayers who assume that taxes are the largest expense for several companies (Kovermann, 2018). Taxes imposed on taxpayers are subjective, that is, imposed based on the income or earnings received. If a company earns a large income, the tax imposed on the company will be of great value. Then, if a company's income is low, the imposition of tax on the company will be undervalued.

Tax is not only an obligation that every intensity business must fulfil but also its influence in making strategic decisions (Rossa et al., 2024). Tax risks become an integral part of strategy finance for a company and impact health finance for the company. The company is often faced with changes in fiscal policy, which can influence current cash and the company's capital structure. Tax risk is a condition where there is inconsistency in a company's tax position due to the company's inability to maintain performance financially for the long term (Dewi & Ardiyanto, 2020). Tax risk can cause uncertainty. This is because tax risk generally occurs. After all, companies carry out tax avoidance actions for a long time. Uncertainty is a consequence of the potential imposition of sanctions on tax administration, for which tax evasion is a factor.

The legal provisions are regulated in Law Number 28 of 2007. Article 38 arranges the criminal tax act, which happens as a consequence of negligence, whereas the criminal act, which is intentionally done, is regulated in Articles 39 and 39A. Regarding tax evasion cases, criminal penalties may include fines, jail time, or the loss of specific rights, such as business licenses or the disclosure of court rulings that impact the company's image. Interest sanctions when underpayment occurs are also set at a minimum of 0.40% to a maximum of 2.24% based on Minister of Finance Decree Number 8/KMK.10/2024.

Financial institutions, such as banks, use credit ratings to determine the level of risk of providing a loan or investment in a company. Companies with high credit ratings tend to get access to funding sources at low costs. In contrast, companies with low credit ratings tend to have higher borrowing costs and difficulty getting funding loans. A credit rating assesses creditworthiness, debt repayment ability, and probability of default.

One important aspect in evaluating a company's creditworthiness is assessing company risk, including tax risk. Tax risk is information that can be used as a basis for creditors to provide credit to a company. The greater the tax risk a company has, the more the creditors will provide a high rate of return (in the form of interest) to the company. This research suspects that corporate tax risk can be used as "machine learning" to detect a company's credit rating in the future. Continuous tax avoidance can create tax risks because these activities often make companies vulnerable to legal violations. Although tax avoidance activities are legal under certain provisions, if carried out continuously in the long term, they can become an interesting concern for the tax authorities (Fadillah & Rachmawati, 2024). In general, creditors tend to provide more lenient loan terms to companies with good credit ratings. Meanwhile, creditors will set stricter terms or offer higher interest rates to companies with poor credit ratings.

Research examining the influence of tax risk on credit ratings is still very limited. As a stand-in for the cost of debt, several earlier studies continued to examine the impact of tax aggression on credit ratings (Pramesti & Rachmawati, 2021; Rachmawati et al., 2023). Additionally, several previous research only looked at how tax avoidance affected the cost of debt (Sánchez-Ballesta & Yagüe, 2023; Shevlin et al., 2020; Hadiwibowo et al., 2024),

financial performance of businesses (Sabrina & Muharam, 2015), audit quality (Suwardi & Saragih, 2023), and capital structure (Tjondro, 2007). Meanwhile, other research also focuses on examining factors that influence tax risk. Fadillah and Rachmawati (2024) tested the influence of company characteristics on company risk. So, this study aims to fill the knowledge gap by conducting an empirical study on the effect of tax risk on credit ratings. By analysing data on finance and credit ratings from several companies, this study will identify the relationship between tax risk and credit ratings. The findings of this study are expected to improve understanding of tax risks affecting lenders' risk perceptions towards companies, thereby contributing to the development of more effective tax strategies and better risk management.

This research contributes to the development of science, especially regarding the influence of tax risk on company credit ratings. Similar research is still very limited. Based on the results, it is hoped that tax risk can become "machine learning" to help creditors detect a company's creditworthiness.

2. Theoretical Framework and Hypothesis Development

Theory agency can be applied to understanding how to manage risk tax by the manager as an agent for the owner company. Theory agency highlights the possibility of a conflict of interest between the manager and the owner (Jensen & Meckling, 1976). In context, risk tax managers may be incentivised to take greater risks, depending on the impact of bonuses or incentives that will be obtained. Therefore, understanding the conflict of interest between the principal and agent and implementing system incentives and mechanisms for appropriate control is key to minimising associated risks with risk tax.

According to agency theory, management and creditors may have agency issues (Jensen & Meckling, 1976). Moreover, aggressive tax reporting can boost a company's worth by reducing taxes. Aggressive tax reporting poses a greater risk to creditors than the potential savings on taxes (Hasan et al., 2014). As residual claimants, stockholders may benefit from the tax savings, but creditors, who are fixed claimants, may not (Hasan et al., 2014). According to Jensen and Meckling (1976), corporate risks are foreseen in debt covenants and debt capital expenses imposed on the company because creditors do not have direct control over company management's actions.

Tax risk is interpreted differently among various sciences (Nesbitt et al., 2017). The difference in translating the concept of tax risk is that taxation issues encompass various aspects of science, namely accounting, finance, economics, and law (Hanlon & Heitzman, 2010). Because of that, several researchers have their own definition of tax risk. Nesbitt et al. (2017) define risk tax as a variation from the results of tax avoidance actions. Nesbitt et al. (2017) view that various tax avoidance actions that are done by management in a frame to avoid tax own risk are seen as how big the action is and how much the tax authorities can know it. Drake et al. (2017) also take the same approach with Nesbitt et al. (2017). Concerning understanding the field, Drake et al. (2017) stated that considering tax avoidance can provide tax savings, so risk tax differs from the results expected from the tax savings.

One of the studies that discusses tax risk is conducted by Guenther et al. (2017) on whether tax avoidance is related to company risk. This study proves that the higher the tax

risk, the higher the cost of debt for the company, so it can be interpreted that if a company owns cost debt, it will, in a way, significantly matter the effect on the company's credit rating, because of the increasing financial risk and the company's lack of ability to meet debt obligations. This can cause a decrease in the company's credit rating.

Further research was conducted by Kovermann (2018) on tax avoidance, tax risk, and debt costs in a bank-dominated economy. This study found that creditors understand that companies with high tax risks are riskier or debtors. Tax risk has a significant impact on a company's credit rating. In this context, tax risk includes the complexity of tax rules, potential impact change regulation tax, and practice avoidance tax. Companies exposed to higher tax risks tend to exhibit lower credit ratings. Tax risks can substantially affect current cash, profit, and ability to fulfil financial obligations and pay debts on time. By the explanation above, the hypothesis proposed in this study is: that tax risk has a negative effect on credit rating**.**

3. Research Method

This study manages and analyses data using quantitative research techniques. This study's population and sample are companies registered with PEFINDO and the Indonesia Stock Exchange (IDX) from 2020 to 2022. PEFINDO is Indonesia's first independent credit rating agency, and its reliability has been tested. PEFINDO's role is to analyse the probability of default on a company or debt instrument in Indonesia. Not all companies listed on the IDX have a credit rating at PEFINDO. Sampling in this study used the purposive sampling method, which is a sampling technique considering certain characteristics. Characteristics that set in taking samples on this study are: 1) Company registered in PEFINDO and Exchange Effect Indonesia year 2020-2022; 2) Exclude a company that has no own bond rating; 3) Exclude a company that is currently experiencing a loss in the research period; and 4) Exclude a company in the banking industry because it has been arranged specially in tax. The data used in this study are secondary in the form of audited company financial reports for 2020-2022 on the PEFINDO website and the Indonesia Stock Exchange (www.idx.co.id) and also other secondary data obtained from collecting articles, journals, previous research, and supporting books. Sample selection is shown in Table 1.

Table 1. Sample Selection

Criteria	Amount
Companies that registered on PEFINDO and IDX	172
Companies that set up special tax	(73)
Companies that experience loss in the research period	(36)
Companies that were used in the study	63
Total	189
Exclude outlier data	(4)
Total observations	185

This study uses an ordered logistic model because the dependent variable is ordinal. The following is a model used to measure credit ratings:

$$Prob\ (RATING)_{it+1} = \frac{1}{1+e^{-z}}$$

$$z = \alpha_0 + \alpha_1 TAX\_RISK_{it} + \alpha_2 SIZE_{it} + \alpha_3 LEVERAGE_{it} + \alpha_4 CFO_{it} + e_{it}$$

Where:

RATINGit+1	= Credit rating, an ordinal variable, with a score of 4 for AAA to a score of 0 for BBB and below for company i in year t+1
TAX_RISKit	= Tax risk for the company i in year t
SIZEit	= Size for the company i in year t
LEVERAGEit	= Leverage for the company i in year t
CFOit	= Cash flow from operating for the company i in year t
εit	= error term

Based on this model, tax risk becomes a "tool" or "machine learning" to predict a company's future credit rating. Table 2 shows the variables' measurements in detail.

Table 2. The Measurement of Variables

Variable	Measurement
RATINGit+1	The study's independent variable is PEFINDO's credit rating (Pramesti & Rachmawati, 2021). RATINGit+1 is an ordinal variable with a score of 4 for AAA to a score of 0 for BBB and below for company i in year t+1.
TAX_RISKit	The dependent variable in this study is tax risk. This study measures risk on a volatility/uncertainty basis (Hamilton & Stekelberg, 2017). In line with Saragih & Ali (2021), this study uses the standard deviation of total Book-Tax Differences (BTD) divided by total assets for three years (from t-1 to t+1).
SIZEit	Firm size, which is determined by the natural logarithm of total assets, is the first control variable (Rachmawati et al., 2023). Large companies generally have good solvency and compliance with debt covenants, which can reduce their debt capital costs (Hasan et al., 2014).
LEVERAGEit	Leverage, the second control variable, is calculated by dividing total debt by total assets. (Rachmawati et al., 2023). Several previous studies stated that corporate debt positively correlates with the cost of debt capital (Rachmawati et al., 2023; Jiang, 2008).
CFOit	Operating cash flow, the last control variable, is calculated by dividing it by total assets. (Rachmawati et al., 2023). Several studies have shown that controlling cash flow from company operations is one of the variables influencing the cost of debt capital (Jiang, 2008; Lim, 2011; Rachmawati et al., 2023). The greater the cash flow from a company's operations, the lower the cost of debt capital because the risk creditors face is lower.

4. Results and Discussion

Descriptive statistics are shown in Table 3. The first variable that is shown is credit rating (RATING). It can be seen that in Table 3, the company registered with PEFINDO with the highest credit rating is given a score of 4, which has a ranking of AAA as much as nine from 185 sample companies; score 3, which has a rating of AA as much as 42 from 185 sample companies; score 2, which owns an A rating of 95 out of 185 company samples; score 1, which has a BBB rating of 24 company samples; and score 0, which has a BBB rating or below of 15 company samples. Percentage of sample companies that have a rating credit AAA as big as 5%, credit rating A A as big as 23%, credit rating A as big as 51%, credit rating BBB as big as 13%, and the rest with credit rating BBB down as big as 8%.

The mean of the TAX_RISK variable is 0.0135, which means that the volatility of the Book Tax Difference in the sample companies in this study is high, so a high tax risk is indicated. The mean of the SIZE variable is 30.0119, which means that the company size in this study is relatively large. The LEVERAGE variable has a mean of 1.1147 with a median value of 0.9149, indicating that the company's debt in the sample companies in this study is relatively large. The mean of the CFO variable is 0.0939 with a median value of 0.0841, indicating that the operational cash flow of the companies in the sample companies in this study is relatively large.

Table 3. Descriptive Statistics

Variable	N	Mean	Median	Std.Dev	Minimum	Maximum
TAX_RISK_{it}	185	0.0135	0.0099	0.0142	0.0004	0.1145
$SIZE_{it}$	185	30.0119	29.8751	1.5547	24.4925	33.6552
$LEVERAGE_{it}$	185	1.1147	0.9149	0.7266	0.0006	3.3546
CFO_{it}	185	0.0939	0.0841	0.0966	0.2284	0.5203

Variable	Score 4		Score 3		Score 2		Score 1		Score 0	
	Obs	%	Obs	%	Obs	%	Obs	%	Obs	%
$RATING_{it}$	9	5%	42	23%	95	51%	24	13%	15	8%

Table 4 presents the results of the Pearson correlation analysis between tax risk and credit rating. The correlation coefficient is -0.1810, indicating a negative relationship between the two variables. This suggests that as tax risk increases, a corporation’s credit rating tends to decrease. In other words, companies with higher tax risk are more likely to receive lower credit ratings, reflecting potential concerns about financial stability or governance. This finding is consistent with the initial hypothesis and aligns with previous research indicating that elevated tax risk may adversely affect a firm’s perceived creditworthiness.

Table 4. Results Pearson Correlation Test

	$RATING_{it}$	TAX_RISK_{it}	$SIZE_{it}$	$LEVERAGE_{it}$	CFO_{it}
$RATING_{it}$	1.0000				
TAX_RISK_{it}	-0.1810	1.0000			
$SIZE_{it}$	0.3989	-0.2695	1.0000		
$LEVERAGE_{it}$	-0.0667	-0.2282	0.0939	1.0000	
CFO_{it}	0.2404	0.2146	0.0947	-0.1023	1.0000

Before testing the hypothesis, this research performed classical assumption tests, including multicollinearity and heteroscedasticity tests. Based on the test results, it is known that there is no multicollinearity problem in this research. This also aligns with the correlation test results between dependent variables, which do not exceed 0.8. The test results also show no heteroscedasticity problem in this research.

Table 5 presents the results of the hypothesis testing. The probability value (Prob > chi2) is 0.0021, which is less than the significance level α = 0.01. This indicates that tax risk, company size, leverage, and operating cash flow simultaneously have a statistically significant effect on the credit rating variable. The model's goodness of fit is indicated by the pseudo-R squared value of 0.1616, or 16.16%. Since the dependent variable is nominal or ordinal, the pseudo-R squared is used instead of the traditional R squared to assess model fit when employing a likelihood function. This means that 16.16% of the variation in credit ratings can be explained by the combined influence of tax risk, company size, leverage, and operating cash flow, while the remaining 83.84% is attributed to other factors not included in this study.

Table 5. Results *Ordered* Testing *Logistic Regression*

RATING	Predicted sign	Coefficient	z	P>[z]
TAX RISKit	(-)	-13.4987	- 2.98	0.068*
SIZEit	(+/-)	0.2759	5.36	0.004***
LEVERAGEit	(-)	-0.4488	- 4.32	0.078*
CFOit	(+)	1.2073	1.60	0.211
Cons		-6.0938	- 4.04	0.022**
LR chi2			16.83	
Prob. > Chi2			0.0021	
Pseudo-R square			0.1616	

Notes: *, **, and *** show their significance levels at 10%, 5%, and 1%, respectively, with confidence levels of 90%, 95%, and 99%.

We can see from the results in Table 5 that the tax risk variable has a negative and significant effect, with a 90% confidence level on the credit rating variable. It is proven that the value of (P>[z]) of the tax risk variable is 0.068, so it can be interpreted that the value of (P>[z]) < from α (0.10) means that H1 in the hypothesis in this study is proven. The impact of tax risk on a company's credit rating is substantial. The intricacy of tax laws, the possible effects of modifications to tax laws, and tax evasion are all considered forms of tax risk in this context. Because tax risk has a significant impact on cash flow and net income, businesses that are more susceptible to it typically have lower credit ratings. Additionally, debt payments are made on schedule, and financial commitments are fulfilled (Kovermann, 2018). The hypothesis's findings demonstrate that credit ratings are negatively impacted by tax risk. This implies that a corporation with a significant tax risk would typically have a low credit rating.

Table 5 indicates that the company size control variable has a positive and significant effect, with a 99% confidence level on the credit rating. It is proven that the value of (P>[z]) of the size company is 0.004. So that it can be interpreted that mark at (P>[z]) < of α (0.01). What was found showed that company size positively influences credit ratings. It was stated that company size positively influences credit ratings, which means that the higher the company size, the higher its credit rating. It will tend to be high because the bigger the company, the more sufficient resources it has to meet its financial obligations. Therefore, large companies tend to have better credit ratings.

Table 5 also shows that the leverage variable has a negative and significant effect, with a 90% confidence level on the credit rating variable. This is proven by the resulting value at (P>[z]) leverage of 0.0775 so that it can be interpreted that the value at (P>[z]) < from α (0.10). What was found showed that leverage has a negative effect on credit ratings. It is stated that leverage has a negative effect on credit ratings. This means that high leverage means that the credit rating of the company will tend to be low because it can be said that leverage is the ratio of debt to total assets, or in this study, equity so that it reflects how much the company relies on debt to finance its operations. When a company has high leverage, it can be interpreted that it has a large proportion of debt compared to equity. It can increase the company's financial risk because high debt obligations can reduce the ability of the company to fulfil other financial obligations. Therefore, companies with high leverage tend to have low credit ratings because they are considered to have a higher risk of default.

It can be seen in Table 5 that the cash flow from operating has a positive effect and is not significantly influential to variable credit rating. This is proven by the value generated at (P>[z]) cash flow from operating is 0.211. So that it can be interpreted that mark on (P>[z]) > from α (0.10). What was found showed that cash flow from operating did not significantly affect credit ratings. It was stated that cash flow from operating does not influence credit rating. This means that the cash flow from operating does not significantly influence credit rating companies. Although the CFO is the main indicator determining how well a company generates revenue from operational activities, the CFO does not influence credit ratings. Still, they are influenced by other indicators outside of the CFO.

According to agency theory, management and creditors may have agency issues (Jensen & Meckling, 1976). Moreover, aggressive tax reporting can boost a company's

worth by reducing taxes. Aggressive tax reporting poses a greater risk to creditors than the potential savings on taxes (Hasan et al., 2014). As residual claimants, stockholders may benefit from the tax savings, but creditors, who are fixed claimants, may not (Hasan et al., 2014). According to Jensen and Meckling (1976), corporate risks are foreseen in debt covenants and debt capital expenses imposed on the company because creditors do not have direct control over company management's actions.

Tax risk is a consequence of various factors, including complex tax regulations, uncertainty about changes in tax policy, and the use of complex tax avoidance strategies. These factors create uncertainty regarding future tax burdens and potential disputes that can affect a company's finances (Guenther et al., 2017). Tax risk can directly impact a company's cash flow and net income. Changes in tax regulations or disclosure of tax issues can result in costs, additions, or income subtractions. Which significantly reduces the company's ability to pay debts or finance future investments.

Tax risk significantly influences a company's credit rating. This risk includes factors such as the complexity of tax regulations, the potential impact of changes in tax laws, and tax avoidance practices. Companies exposed to higher tax risk tend to have lower credit ratings because tax risk can substantially affect cash flow and net income, which are critical for meeting financial obligations and making timely debt payments (Kovermann, 2018). The hypothesis testing results indicate that tax risk has a negative effect on credit ratings. This implies that companies with higher tax risk are more likely to receive lower credit ratings.

A company's credit rating is typically low if it has a high tax risk since it is viewed as having a higher risk. Economic risk, the unpredictability of tax laws, and imprecise information processing are the main sources of tax risk. Uncertainty law tax is uncertainty about the proper application of tax laws due to changing regulations, while inaccurate information processing is an accounting system error and managerial (Dewi & Ardiyanto, 2020). Ultimately, risky companies (including tax risks) can obtain loans from creditors but at a high cost of debt (Francis et al., 2005; Pramesti & Rachmawati, 2021; Rachmawati et al., 2023). Axelton (2022) found that comprehensive tax-related risk disclosures reduce the impact of tax risk on the cost of debt. Firms with more transparent tax disclosures tend to have lower loan spreads, even after controlling for past level of tax risk and avoidance. Tax-related risk disclosures enhance management credibility and reassure lenders by reducing perceived uncertainty.

5. Conclusion, Implications, and Limitations

The purpose of the research that has been carried out is to determine and test the effect of tax risk on credit ratings. By taking companies that have been registered with PEFINDO and BEI for the period 2020-2022 as samples. The result shows that tax risk has a negative effect on credit rating, which means that when the level of tax risk is high, it can influence a company's credit rating, so the higher the tax risk on a company, the lower the credit rating tends to be. In this case, if the company has a high tax risk, the company is assessed to own risk, which is more so that the credit rating in the company tends to be low. This will also cause the company to get loans with high debt interest costs.

Based on the results of this study, the Directorate General of Taxes should focus more on carrying out inspections on the tax risk, which has a low credit rating because the risk tax company reflected on the credit rating published by PEFINDO. The findings of this study can provide additional insights. It will also become a reference, which is important for researchers regarding the impact of tax risk on credit ratings. For companies, the results show that tax risk will be reflected in the company's credit rating. Thus, companies must be careful when managing their taxes. Tax risk can be used as "machine learning" to determine creditors' creditworthiness.

The limitation of this study is the method of credit assessment. Various credit rating agencies may use different approaches in assessing and providing credit ratings, which may involve varying criteria, methodologies, and models. For example, Moody's, S&P, and Fitch. Each may have its way of evaluating a company's financial health and credit risk, such as financial ratio assessment, cash flow analysis, and consideration of macroeconomic factors. Based on the limitations above, this research, which has been described previously, suggests that further researchers should use rating agencies other than PEFINDO to see the differences in methodology and research results.

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