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The Influence of Air Pollution on Accounting Conservatism (Empirical Study of Manufacturing Companies in Indonesia)

Muhammad Ali Ma'sum, Sunarto, Pancawati Hardiningsih

Fakultas Ekonomika dan Bisnis, Universitas Stikubank
Jl Kendeng No 5 Bendan Duwur Kec. Gajahmungkur, Kota Semarang, 50233, Indonesia

ABSTRACT

Air pollution is an important factor that influences stakeholders' risk perceptions, including those of investors and managers. Managers tend to adopt more conservative accounting policies due to the perceived risks associated with increasing air pollution. This study aims to examine whether companies implement more conservative accounting policies as a response to the risks posed by rising air pollution. Furthermore, this study investigates whether conservative accounting policies as a response to air pollution risks are more pronounced in companies facing high financial constraints. Using a sample of manufacturing companies in Indonesia and air quality index (IKU) data issued by the Ministry of Environment, analyzed through panel data regression, the study finds that companies adopt conservative accounting policies as a response to the risks of increasing air pollution. However, such conservative accounting policies are not found to be more pronounced in companies under high financial constraints. This study contributes to the literature by being the first in Indonesia to directly explore the relationship between air pollution and accounting conservatism.

Keywords: *air pollution; accounting conservatism; financial constraints.*

INTRODUCTION

The deteriorating air quality in Indonesia has garnered significant attention from various stakeholders. According to data from the IQAir website on Wednesday, August 23, 2023, at 2:12 PM WIB, Jakarta's air quality reached 170 AQI (Air Quality Index). Jakarta has repeatedly ranked as the city with the worst air pollution in Southeast Asia. Below is the AQI data for the capital cities in Southeast Asia.

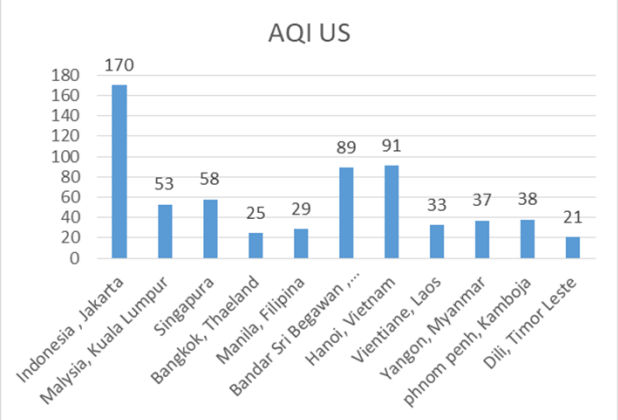

Figure 1 Air Pollution Levels in Southeast Asian Cities in 2023
Source: https://www.iqair.com

✉ *Corresponding author:* **Muhammad Ali Ma'sum:** E-mail: ma'sum@edu.unisbank.ac.id

The data shows that Jakarta, the capital of Indonesia, has become the city with the worst air pollution in Southeast Asia and even the world. According to medical professionals, the deteriorating air quality has serious implications for health. Meanwhile, psychologists explain that air pollution has a detrimental psychological impact on individuals living in polluted environments. In the field of economics, economists report that air pollution has harmful effects on companies and the economy as a whole (Jung et al., 2016)..

The following literature has documented the adverse effects of air pollution on company operations. Tan et al. (2022) and Tan et al. (2021) found that air pollution increases debt costs. Air pollution also negatively affects the issuance of new shares, causing underpricing during IPOs due to the more pessimistic mood and cognition of investors (Han et al., 2022; Wang et al., 2023). Similarly, Dong et al. (2021) found that air pollution induces biases in institutional investors exposed to pollution, making them more pessimistic when making offers. Tan et al. (2021) also explained that suppliers reduce trade credit for companies located in areas with poor air quality. These findings are consistent with the notion that companies adjust their business strategies to compensate for the risks associated with air pollution exposure.

This study aims to examine the impact of air pollution on corporate accounting conservatism. Ghoul et al. (2021) argue that executives assess the environmental risks in the areas where their companies operate before making key accounting policies. The theoretical framework of this study is based on the operational risks faced by companies due to air pollution. Dong et al. (2021) report that analysts at companies experiencing severe air pollution predict lower earnings. Therefore, air pollution increases the perception of operational risks for companies. Specifically, this study uses the accounting conservatism model developed by Khan and Watts (2009) and Basu (1996). In general, accounting conservatism refers to a condition where negative changes are reflected more quickly than positive changes. Based on this theoretical framework, the study hypothesizes that companies located in cities with high levels of air pollution exhibit higher levels of accounting conservatism.

The only study that examines the effects of air pollution on accounting conservatism policies is a study in China by Wu et al. (2022), which provides evidence of a positive impact of air pollution on accounting conservatism. However, a limitation of the Wu et al. (2022) study is its use of cross-sectional AQI (Air Quality Index) data, which is less capable of capturing changes in air pollution levels from year to year. Therefore, this study aims to build upon the research by Wu et al. (2022) by using panel data over a 9-year period to address the limitations of their study. This study is conducted with a sample of manufacturing companies in Indonesia and air quality index data from the Ministry of Environment. Indonesia provides a good background for this study for several reasons. First, the generally high levels of air pollution.

This study makes several contributions to the literature. It is the first study in Indonesia to directly explore the relationship between air pollution and accounting conservatism. Previous studies have explored the impact of air pollution on corporate practices and asset pricing (Han et al., 2022; B. Liu et al., 2021; Zhang et al., 2021), as well as the impact of air pollution on factors influencing accounting conservatism (C. Hu & Jiang, 2019; J. Hu et al., 2020; Li et al., 2020). This study addresses the limitations of the Wu et al. (2022) study, which only used cross-sectional data, by utilizing 9-year panel data to examine changes in air pollution levels over time.

Air Pollution and Accounting Conservatism

Several studies have shown a relationship between CSR and accounting conservatism levels. Pan and Zhao (2022) found that corporate social responsibility (CSR) reporting obligations significantly

reduce accounting conservatism levels. This study suggests that CSR reporting reduces information asymmetry related to environmental, social, and governance (ESG) factors, thereby reducing the need to compensate for environmental risks. In contrast, Cho, Kang, Lee, and Park (2020) found that companies adopting conservative reporting practices tend to refrain from implementing CSR disclosures.

Similar to CSR, air pollution is an important factor influencing the risk perception of stakeholders, including investors and managers. First, several studies show the impact of air pollution on individuals as well as the business or investment environment. Oltra and Sala (2016) found that attention to air quality levels and beliefs about control increase concern and information-seeking behavior among individuals living in high-pollution areas. Similarly, Huang and Yang (2019) used an environmental documentary to raise awareness about air quality issues and found that individuals sought more information and took more mitigative actions after watching the documentary. A similar impact is observed in the business environment. For instance, Giudici et al. (2018) examined stock returns around air pollution warnings and found that air pollution warnings significantly increased stock returns (both positive and negative), indicating that air pollution warnings raise market uncertainty and investor risk perception, both short-term and long-term. Therefore, this study argues that air pollution is a determinant factor in the risk perception of business stakeholders, including investors and managers.

The literature suggests that managerial risk perception is a key determinant of accounting conservatism and reporting strategies. Hsieh et al. (2019) found that more aggressive businesses increase management's risk perception, leading to higher conservatism. Y. Liu (2021) and C. Hu & Jiang (2019) found a relationship between managerial risk perception and accounting conservatism. Krishnan (2007) found increased conservatism in Arthur Andersen clients who switched to Big 4 firms after the 2002 audit crisis, clearly showing that various types of risks, including litigation and reputational risks, can lead to more cautious behavior.

The theoretical argument of this study is consistent with the idea that managerial risk perception is a fundamental determinant of accounting conservatism in corporate financial reporting policies. Investors demand more transparency due to increased operational risks (Anctil, Dickhaut, Kanodia, & Shapiro, 2004). To meet this demand for additional transparency, companies use increasingly conservative accounting to accurately represent the company's financial situation. Conservative accounting strategies minimize the negative impact of increased risk on investor satisfaction and stock prices. Given the established relationship between air pollution and various corporate risk responses, as well as the strong link between operational risk and accounting conservatism, this study argues that severe air pollution leads to increased levels of accounting conservatism. Therefore, the first hypothesis proposed in this study is as follows:

H_1: Companies located in areas with higher levels of air pollution show higher levels of accounting conservatism.

Air Pollution, Accounting Conservatism and Financial Constraints

Environmental conditions caused by air pollution can increase managers' risk perceptions and the literature shows that managers' risk perceptions are a determining factor in accounting conservatism and reporting strategies. Hsieh et al., (2019) documented that more aggressive businesses increase management's risk perceptions and lead to increased conservatism. Y. Liu, (2021) and C. Hu & Jiang, (2019) found a relationship between managerial risk perceptions and accounting conservatism. Krishnan (2007) found increased conservatism in Arthur Anderson's clients who switched to the Big 4 after the 2002 audit crisis, clearly showing that various types of risks including litigation and reputation risks can lead to more cautious behavior. This more cautious behavior is manifested in the form of more conservative accounting policies.

A company in financial distress shows a higher level of operational and financial risk for investors and creditors. The company is at risk of indirect impacts from bankruptcy, including loss of potential customers, reduced customer retention and damage to brand reputation. Managers of companies experiencing financial constraints will tend to adopt conservative accounting policies. As research by Donovan, Frankel, and Martin (2015) which describes a positive relationship between accounting conservatism before default and the level of recovery for creditors after default. Furthermore, Liang Liu (2024) documented that managers tend to adopt conservative reporting policies to restore reputation due to financial reporting failures. However, the study by Biddle et al. (2022) shows a negative relationship between accounting conservatism and bankruptcy risk. The influence of environmental conditions caused by air pollution on conservative accounting policies will be stronger when the company is in a state of financial constraints because the risks faced by the company will be greater. Therefore, the second hypothesis proposed in this study is as follows:

H_2: The influence of air pollution levels on the level of accounting conservatism will be more prominent in companies that experience financial constraints.

METHODS, DATA AND ANALYSIS

This study uses a sample of manufacturing companies listed on the Indonesia Stock Exchange from 2014 to 2022. This study was conducted in Indonesia because of the high level of air pollution in Indonesia. Manufacturing companies are interesting to be used as samples in this study because manufacturing companies in Indonesia have a large contribution to air pollution. Sampling was carried out using a purposive sampling method with the criteria of being listed on the Indonesia Stock Exchange from 2014 to 2022, publishing an annual report from 31 December 2014 to 31 December 2022 and having complete data according to research needs. The data used in this research is secondary data (financial data) obtained from company annual reports obtained from the OSIRIS database, the website www.idx.co.id and IKU data (air quality index) which is released every year by the Ministry of the Environment.

The data used in this research is secondary data obtained from the OSIRIS database, the website www.idx.co.id and the IKU (air quality index) report from the Ministry of Environment.

Operational Definition of Variables

Accounting conservatism is defined as **the tendency to require a higher degree of verification for recognizing good news as gains than bad news as losses in financial statements.** This means that conservatism reflects an asymmetry in the recognition of economic events, where potential losses are recognized more promptly than potential gains Givoly and Hayn, 2000). Accounting conservatism in this study is measured using CONSER_NOA (eg Givoly and Hayn 2000; Krisnan and Visvanathan 2008) which is measured by non-operating accruals divided by average total assets (average for the three years ending this year) which then multiplied by -1.

$$\text{CONACC} = \frac{(NIO + DEP - CFO)X(-1)}{TA}$$

Information:

CONACC: Earning conservatism based on accrual items; NIO: Operating profit of current year; DEP: Depreciation of fixed assets of current year; CFO: Net amount cash flow from operating activities of current year; TA: Book value of closing total assets.

The level of air pollution is measured using the IKU (air quality index) which is reported annually by the Ministry of Environment. The Air Quality Index (IKU) represents the air quality as a composite measure of air quality parameters in a specific area at a given time (Ministry of Environment Regulation No. 27 of 2021). A higher IKU value indicates better air quality.

$$\text{IKU} = 100 - \left(\frac{50}{0{,}9}\,(I_{EU} - 0{,}1)\right)$$

$$I_{EU} = \frac{\text{Index } NO_2 + \text{Index } SO_2}{2}$$

$$\text{Index } NO_2 = \frac{\text{Average } NO_2}{Quality\ Standar\ I_{EU}}$$

$$\text{Index } SO_2 = \frac{\text{Average } SO_2}{Quality\ Standar\ I_{EU}} \quad (3)$$

The IKU value ranges from 0 to 100. The higher the IKU value, the better the air quality, and vice versa. According to Ministry of Environment Regulation No. 27 of 2021 on the Air Quality Index, the IKU categories are as follows:

Table 1. Air Quality Index Category

No	Category	Range
1	Very Good	90 ≤ x < 100
2	Good	70 ≤ x < 90
3	Moderate	50 ≤ x < 70
4	Poor	25 ≤ x < 50
5	Very Poor	0 ≤ x < 25

Sources: Ministry of Environment Regulation No. 27 of 2021

In categorizing companies that experience financial constraints and unconstraints, this research uses Basic earning power, this ratio shows the ability to generate profits from company assets which is useful for comparing companies that have different levels of financial leverage (Brigham and Houston, 2011). In this research Basic Earning Power will be compared with investment credit interest rates in the same period.

$$\text{Basic earning power} = \frac{EBIT}{TA}$$

Information:

Basic Earning Power: The Ability To Generate Profits; EBIT: Profit Before Interest And Taxes; TA: Total Assets

If the value of the company's basic earning power ratio is greater than the investment credit interest rate, then the company is classified as financially unconstrained. However, if the value of the company's basic earning power is smaller than the investment credit interest rate, then the company is classified as financially constrained. Companies that are included in the financial constraints and unconstraints categories will be assessed using dummy variables. A value of 1 for financially constrained companies and vice versa.

To avoid problems related to neglected variables, several control variables were included including ROA, Leverage and Size (Ryan, 2006; Khan and Watts, 2009). Leverage ratio (LEV) is calculated by dividing the book value of debt by the book value of equity.

$$\text{LEV} = \frac{Book\ Value\ of\ Debt}{Book\ Value\ of\ Equity}$$

Firm size (SIZE) is calculated by the natural logarithm of the market value of equity
Firm size = log market value of equity

To make it easier to understand, the definitions and formulas of the variables are:

Table 2. Operational Definition of Variables

No	Variables	Definition	Measurement of Variable
1	Accounting conservatism (CONSER_NOA)	Accounting conservatism is defined **as** the tendency to require a higher degree of verification for recognizing good news as gains than bad news as losses in financial statements. This means that conservatism reflects an asymmetry in the recognition of economic events, where potential losses are recognized more promptly than potential gains Givoly and Hayn, 2000)	$\text{CONACC} = \frac{(NIO + DEP - CFO)X(-1)}{TA}$
2	Air Pollution (IKU)	The Air Quality Index (IKU) represents the air quality as a composite measure of air quality parameters in a specific area at a given time (Ministry of Environment Regulation No. 27 of 2021)	$\text{IKU} = 100 - (\frac{50}{0,9}(I_{EU} - 0,1))$ $I_{EU} = \frac{Indeks\ NO_2 + Indeks\ SO_2}{2}$ $\text{Index } NO_2 = \frac{\text{Average } NO_2}{Quality\ Standar\ I_{EU}}$ $\text{Index } SO_2 = \frac{\text{Average } SO_2}{Quality\ Standar\ I_{EU}}$
3	Financial Constraints	This research uses Basic earning power, this ratio shows the ability to generate profits from company assets which is useful for comparing companies that have different levels of financial leverage (Brigham and Houston, 2011).	$\text{Basic earning power} = \frac{EBIT}{TA}$
4	Control Variables (ROA, Leverage, Size)	To avoid problems related to neglected variables, several control variables were included including ROA, Leverage and Size (Ryan, 2006; Khan and Watts, 2009).	$\text{ROA} = \frac{net\ income}{Total\ Asset}$ $\text{LEV} = \frac{Book\ Value\ of\ Debt}{Book\ Value\ of\ Equity}$ $\text{LEV} = \frac{Book\ Value\ of\ Debt}{Book\ Value\ of\ Equity}$

This study is analyzed using a panel data regression model through four stages. The first stage is model estimation. Widarjono (2017, 355) explains that there are three common methods used to estimate regression models with panel data: Common Effect, Fixed Effect, and Random Effect. The Common Effect Model is the most basic approach in panel data modeling, as it simply combines time series and cross-sectional data. In this model, neither the time dimension nor individual differences are considered, assuming that the behavior of company data remains consistent over different time periods. This method can utilize the Ordinary Least Squares (OLS) approach or the least squares technique to estimate the panel data model.

The Fixed Effect Model assumes that variations between individuals can be captured through differences in intercepts. In the Fixed Effects model, panel data estimation is carried out using the dummy variable technique to represent the intercept differences among companies. These variations in intercepts may arise from factors such as work culture, managerial style, and incentives. However, the slope is assumed to be the same across all companies. This estimation technique is also known as the Least Squares Dummy Variable (LSDV) method. The Random Effect Model estimates panel data where disturbances across time and individuals may be correlated. In the Random Effect model, intercept differences are accounted for through error terms specific to each company. One advantage of using the Random Effect model is its ability to address heteroskedasticity issues. This model is also referred to as the Error Component Model (ECM) or employs the Generalized Least Squares (GLS) approach.

The second stage is the selection of the panel data regression model (estimation technique). Widarjono (2017, 362) explains that there are three tests used to determine the most appropriate technique for estimating panel data regression. First, the Chow test (F-test) is used to choose between the common effect model or the fixed effect model. Second, the Hausman test is used to decide between the fixed effect or random effect model. Third, the Lagrange Multiplier (LM) test is used to choose between the common effect model or the random effect model. The third stage is the testing of classical assumptions. Both the common effect and fixed effect models use the ordinary least squares (OLS) approach in their estimation techniques, so the classical assumption tests applied include normality, multicollinearity, and heteroskedasticity. To detect whether the residuals are normally distributed, the Shapiro-Wilk test is used (Widarjono 2017, 49). This study uses the Pearson product-moment correlation test to detect multicollinearity issues in the model. The Breusch-Pagan test is used to detect heteroskedasticity problems. The fourth stage is hypothesis testing. To test hypotheses 1 and 2, this study uses the regression equation model specification as follows.

$$CONSER_{i,t} = \beta_0 + \beta_1 IKU_{i,t-1} + \beta_2 Financial\ Constraint_{i,t-1} + \beta_2 \beta_1 IKU_* \beta_3 Financial\ Constraint_{i,t-1} + \sum_{k=3} \beta_k CONTROL_{it} + Firm + Year + \varepsilon_{it} \text{ (model)}$$

RESULT AND DISCUSSION

Descriptive statistics of the selected sample are presented below.

Table 3. Descriptive statistics of selected samples

Var.	Obs.	Min	Max	mean	Std. Dev.
Conser	1,386	-0.67054	0.7591238	-0.036958	0.0932072
IKU	1,386	41.51	96.2	67.87618	13.5288
Financial Constraints	1,386	0	1	0.7878788	0.4089578
ROA	1,386	-0.7291	0.921	0.029768	0.0991251
Leverage	1,386	-0.5711	0.9998	0.5254537	0.2466273
Size	1,386	15.84998	26.74743	21.5724	1.661878

The number of observations in this study is 1,386 observations from 154 companies from 2014 to 2022. The data shows that the average IKU is 67.87618 with a standard deviation of 13.5288. The IKU range ranges from 0 to 100. The higher the IKU, the better the air quality. The average IKU value of 67.87618 can be said to be less than good. This means that the average air quality index in Indonesia is not good. The average level of accounting conservatism of sample companies is -0.36958 with a standard deviation of 0.0931072. The average financial constraints of sample companies measured by basic earning power is 0.7878788 with a standard deviation of 0.4089578. This means that the average level of financial constraints of companies in Indonesia is low because of their high profit-generating ability.

To select the most appropriate panel data regression model, the Chow test results show a Chi-Sq value of 1.47 with a probability of 0.0004. The fixed effect mode is more appropriate than the common effect model. The Hausman test results have a Chi-Sq value. 9.5 with a probability of 0.1471. So the random effect model is better than the fixed effect model. The LM test results have a Chi-Sq value. 10.69 with probability 0.0005. So the best model for estimating the model is the random effect model.

Table 4. Descriptive statistics of selected samples

Var.	Coef.	Error Standar	P value
Cons.	-0.1514174	0.1345179	0.261
IKU	-0.1424965	0.0004256	0.041
Financial Constraints	-0.0152444	0.0316002	0.630
Financial Constraint*IKU	0.0004021	0.0004443	0.366
ROA	-0.3326473	0.0379173	0.000
Leverage	0.0883049	0.0186059	0.000
Size	0.0025464	0.0065138	0.696

The regression equation can be seen as follows.

Conser = -0.1514174 - 0.1424965*IKU + -0.0152444*Financial Constraints + 0.0004021*Financial Constraints*IKU -0.3326473*ROA + 0.0883049*Leverage + 0.0025464*Size

Information:

Conser is the level of conservatism of company accounting; IKU is the air quality index of a region where the company is domiciled; ROA is the level of company profitability; Leverage is the company's leverage; Size is the size of the company.

Based on the results of panel data regression testing, the coefficient value of the air quality index (IKU) is -0.1424965 at a significant level of 0.041. This means that by using a sample of manufacturing companies in Indonesia, the first hypothesis (H1) is supported. This shows that in the context of companies in Indonesia, companies located in locations with higher levels of air pollution have more conservative accounting policies. This finding is in line with the study conducted by Wu et al. (2022), which provides evidence of the positive effect of air pollution on accounting conservatism. The results of this study are also consistent with the opinion that air pollution is an important factor influencing the risk perception of stakeholders including investors and managers (Oltra & Sala, 2016); (Huang & Yang, 2019) and (Giudici et al., 2018). So that investors will demand transparency with more information. In line with the argument Anctil, Dickhaut, Kanodia, & Shapiro, (2004) that investors will ask for more information due to increased operational risk caused by increased air pollution. To meet these investor demands, managers will use more conservative accounting. This is because more conservative accounting will be able to accurately represent the company's financial situation. A conservative accounting strategy is chosen in environmental situations with high levels of pollution because it is seen as being able to minimize the negative impact of increased risk on investor satisfaction and stock prices.

The results of the first hypothesis test of this study are consistent with the argument that managerial risk perception is a fundamental determinant of accounting conservatism in corporate financial reporting policies (Hsieh et al., 2019; Y. Liu, 2021; C. Hu & Jiang, 2019; and Krishnan, 2007). The worse the environmental conditions caused by air pollution, the higher the risk perception by managers, both the risk of increasing debt costs (Tan et al., 2022) and Tan et al., 2021), the risk of underpricing when issuing new shares due to the mood and cognition of investors who tend to be more pessimistic (Han et al., 2022; Wang et al., 2023) and the risk of causing bias in institutional investors exposed to air pollution, namely being more pessimistic in submitting bids (Dong et al., 2021), and the risk of decreasing trade credit by suppliers (Tan et al., 2021). The company will change its financial reporting strategy to be more conservative to compensate for these risks.

Based on the results of panel data regression testing, the interaction coefficient value of IKU and Financial Constraints is 0.0004021 at a significance level of 0.366. This means that in the context of companies in Indonesia, the second hypothesis (H2) is not supported. This shows that by using a sample of companies in Indonesia, the effect of air pollution levels on accounting conservatism does not appear to be more prominent in companies experiencing financial constraints. The results of this study are inconsistent with the argument that companies experiencing financial constraints will tend to adopt conservative accounting policies as in the research of Donovan, Frankel, and Martin (2015) which describes a positive relationship between accounting conservatism before default and the level of recovery for creditors after default and the results of the study by Liang Liu (2024) which documents that managers tend to adopt conservative reporting policies to restore their reputation due to financial reporting failures.

The results of the second hypothesis test of this study are consistent with the results of other studies, namely by Biddle et al. (2022) which shows a negative relationship between accounting conservatism and bankruptcy risk. This is likely because managers consider that conservative accounting policies in environmental situations with high levels of pollution are not appropriate for companies experiencing financial distress. Conservative accounting policies tend to disclose understated financial statements. In conditions where the company is experiencing financial distress, this will give a bad signal to external parties, especially creditors. And this creates new risks for the company.

CONCLUSIONS AND SUGGESTION

This study examines the influence of air pollution on company accounting conservatism policies and examines the influence of financial constraints in moderating this relationship. Based on a sample of manufacturing companies in Indonesia from 2014 to 2022 and using the air quality index (IKU) reported by the Ministry of the Environment to measure the level of air pollution, the following conclusions were obtained. First, companies located in areas with high levels of air pollution show conservative accounting policies. Second, the influence of air pollution levels on accounting conservatism is not proven to be more prominent in companies experiencing financial constraints. The results of this study can serve as a consideration for company leaders and standard setters that a conservative accounting approach is still relevant as a basis for developing accounting standards, especially in environments with high levels of air pollution.

This study has several contributions. First, it is the first study in Indonesia to directly explore the relationship between air pollution and accounting conservatism. Second, this study overcomes the weakness of the air quality index (AQI) measurement used in Wu et al.'s (2022) study which is less

able to capture changes in air pollution levels from year to year because AQI data is only available in cross sections. This study overcomes this weakness with air quality index data from the Ministry of Environment in the form of panel data. Third, this study uses panel data with a fairly long time span, namely 9 years.

However, this study also has several limitations. First, this study does not use air pollution level data at the city level but at the provincial level so it cannot show the variation in pollution levels of companies located in different cities in the same province. Provincial level data is used because air pollution level data at the city level is not yet available in Indonesia. Second, this study uses the company's domicile to capture the effect of air pollution on the company, even though the effect may be more pronounced at the company's place of operation than at the domicile (center). Third, this study only uses one measurement of accounting conservatism. Suggestions for further research are as follows. First, further research can use air pollution level data at the city level if the data is available. Second, further research can use the company's place of operation to capture the effect of air pollution on the company. Third, use various alternative measurements of accounting conservatism, either conditional or unconditional conservatism, to be more robust. Fourth, future research could use AQAir data, which measures air pollution levels from satellite imagery based on air concentration levels, with measurements taken progressively over a one-year period.

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