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Analysis of the Volatility and Asymmetric Stocks Information in the Energy Sector on the Indonesia Stock Exchange 2021-2024

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ABSTRACT

This study examines the relationship between market uncertainty and asymmetric information in the Indonesian energy sector from 2021 to 2024, utilizing the World Uncertainty Index (WUI) as a measure of global economic and political uncertainty. The research is motivated by heightened uncertainty caused by major global events such as the COVID-19 pandemic and the Russia–Ukraine conflict, both of which have introduced significant volatility into the market. This research uniquely focuses on the Indonesian energy sector—an underexplored area in global finance—and employs the World Uncertainty Index (WUI) to link global uncertainties with the performance of Indonesia's developing energy market. Employing a regression model, the study investigates the causal relationship between stock market volatility and asymmetric information using panel data from 62 energy companies listed on the Indonesia Stock Exchange. The findings reveal that increased volatility negatively affects market efficiency, indicating that uncertainty and information asymmetry hinder the market's ability to fully reflect available information. The study highlights the significant influence of market uncertainty and asymmetric information on stock market volatility and efficiency in Indonesia's energy sector, offering valuable insights for enhancing investment strategies and policy formulation in an increasingly volatile global environment. These findings contribute both theoretically and practically to understanding market dynamics in emerging economies and provide actionable recommendations for investors, regulators, and energy-sector stakeholders navigating uncertainty-driven market conditions.

KEYWORDS *Market Uncertainty, Asymmetric Information, Stock Market Volatility, Indonesian Energy Market, World Uncertainty index*

INTRODUCTION

Energy has become a significant and irreplaceable resource in modern industrialization, playing a crucial role in economic growth and influencing all

aspects of production and human life (Alfeus et al., 2025; Bhattacharya & Daouk, 2015; Chen et al., 2021; Cheteni, 2016). Developing countries, particularly those in Southeast Asia, face unique challenges in energy market volatility due to their dependence on energy imports, vulnerability to global price shocks, and developing financial market infrastructure (Zhang et al., 2024; Sadorsky, 2012). Indonesia, as the largest economy in Southeast Asia and a member of the G20, faces particularly complex energy market dynamics characterized by high price volatility, regulatory transitions, and increasing financialization of energy commodities (Reboredo et al., 2020; Kumar et al., 2019).

The country's energy sector exhibits heightened sensitivity to global uncertainties, including geopolitical tensions, commodity price fluctuations, and macroeconomic policy changes, all of which collectively contribute to substantial market volatility (Aloui et al., 2018; Mensi et al., 2021). Furthermore, Indonesia's position as both an energy producer and consumer creates unique market dynamics where domestic energy policies intersect with international market forces, amplifying volatility transmission mechanisms (Arouri et al., 2011; Balcilar et al., 2020). In the context of a modern economy, energy supports the acceleration of urbanization and industrialization—both key drivers of economic growth. Additionally, energy possesses financial and commercial attributes, meaning it can be traded as a commodity in the financial market (Li et al., 2022; Liu et al., 2022; Modjo et al., 2024). Energy is considered to have value that can be traded, invested in, and managed like other financial assets (Xie et al., 2024).

The financialization of the energy market has driven an increase in the number of institutional investors participating in this market. Energy-related assets have become an important component of fund managers' portfolios and a vital strategic investment for many investors worldwide (Robiyanto, 2021; Ugurlu et al., 2014). According to extensive studies, further expanded by Xie (2024), the global energy market faces the persistent challenge of volatility, which often triggers systemic risk (Diebold & Yilmaz, 2015; Ivanitskiy & Tatyannikov, 2018; Just et al., 2025; Khalfaoui et al., 2022). Volatility among energy companies worldwide is interconnected and influences risk transmission in the energy stock market at the company, national, and regional levels.

The relationship between uncertainty in Indonesia and energy stock price volatility requires careful examination within the context of the nation's specific market characteristics. Indonesia's energy market exhibits unique features, including regulatory uncertainties related to energy subsidy reforms, the transition toward renewable energy, and the dual role of state-owned enterprises in the sector (Sugiawan & Managi, 2016; Burke & Kurniawati, 2018). Previous studies have established that policy uncertainty, measured through economic policy uncertainty

(EPU) indices, significantly affects stock market volatility in emerging markets (Baker et al., 2016; Phan et al., 2018).

In the Indonesian context, uncertainty stemming from government policy changes—particularly those concerning fuel subsidies and energy pricing mechanisms—creates additional layers of volatility beyond global market factors (Yusuf & Resosudarmo, 2015; Gunningham, 2013). Furthermore, the asymmetric information problem in Indonesia's energy sector is compounded by relatively lower market transparency compared to developed economies, limited analyst coverage of smaller energy firms, and the prevalence of family-controlled business structures that may restrict information flow to minority shareholders (Hamzah, 2020). These factors collectively necessitate a more nuanced understanding of how uncertainty translates into stock price volatility in the Indonesian energy sector, accounting for both global uncertainty indices and Indonesia-specific institutional conditions.

The Volatility Spillover Index is used to measure the extent of risk transmission within the energy system, with Oil Price Volatility (OVX) serving as the primary variable to assess the impact of oil price uncertainty on volatility spillovers in the energy market. OVX is selected as the main variable because oil, as one of the most important energy sources, plays a central role in the global energy market. Additionally, several prior studies have employed OVX to quantify energy market uncertainty. A key finding in the study is the high degree of interconnectedness among global energy companies, as reflected in the static spillover index of 75.91%. Extreme events, such as the 2008 financial crisis and COVID-19, significantly amplified volatility spillovers, particularly in North America and Europe. In these regions, energy companies act as major risk transmitters, while Asian companies are more susceptible to such spillover effects. Market volatility not only affects the performance of energy companies but also induces instability in financial markets, negatively impacting investor sentiment (Xie et al., 2024).

The stock performance of energy companies is influenced by both external and internal factors that can directly affect market volatility and information efficiency. Market efficiency refers to the market's ability to quickly and accurately reflect information through stock prices. An efficient market processes all relevant information fairly and promptly, enabling investors to make informed decisions. Conversely, an inefficient market can create opportunities for insider trading or suboptimal investment decisions (Frijns et al., 2023). However, volatility, which frequently leads to systemic risk, remains a persistent problem for the global energy market. Equity Market Uncertainty is directly linked to the quality of information. Stock market uncertainty has a direct relationship with the quality of information,

which ultimately affects stock prices and leads to informational inefficiency (Frijns et al., 2023).

Research on Equity Market Uncertainty (EMUNC) and Informational Efficiency has been widely conducted, particularly in the U.S. and China, along with studies on Volatility Connectedness in the energy sector. However, in Indonesia, limited research exists on EMUNC and Volatility Connectedness in the energy sector, even though such studies could substantially benefit companies, investors, and policymakers in making decisions and designing risk management strategies. The energy sector contributes significantly to economic growth in Indonesia. According to the Handbook of Energy and Economic Statistics of Indonesia 2023, final energy consumption rose by 6.29% to reach 1,220 million BOE, marking the highest increase in the past six years, consistent with the rise in the primary energy supply for 2023. The industrial sector had the highest energy demand at 45.60%, followed by transportation at 36.74%, households at 12.35%, commercial use at 4.44%, and other sectors at 0.87%. The number of shareholders in Indonesia's energy sector during 2021–2023 averaged 371,829 or 8.5% of total stock investors on the Indonesia Stock Exchange. The volume of stock trading in this sector during the same period averaged nearly 2.5 million. Meanwhile, as of December 31, 2023, 62 energy sector companies were actively listed on the exchange.

This study analyzes the relationship between stock market volatility and the connection between market uncertainty and asymmetric information on energy sector stock prices on the Indonesia Stock Exchange from 2021 to 2024. It employs the World Uncertainty Index (WUI) by Ahir, H., N. Bloom, and D. Furceri (2022) as a global measure of economic and political uncertainty. The study covers the 2021–2024 period, coinciding with the global economy's recovery from the COVID-19 pandemic, which affected nearly every industry, including the energy sector.

The primary aim of this research is threefold: first, to examine the relationship between market volatility and asymmetric information in Indonesia's energy sector; second, to assess the impact of global uncertainty (measured through WUI) on stock market efficiency; and third, to analyze the interconnectedness of volatility among energy companies during a period of heightened global uncertainty. This study offers several significant contributions. Theoretically, it extends the literature on market efficiency and information asymmetry by providing empirical evidence from an emerging market context, specifically addressing research gaps in Southeast Asian energy markets. The application of the World Uncertainty Index (WUI) to the Indonesian energy sector represents a novel approach in linking global uncertainty measures with localized market dynamics in developing economies.

Practically, the findings provide valuable insights for multiple stakeholders: (1) investors can better understand risk–return trade-offs in the Indonesian energy sector under varying uncertainty conditions, enabling more informed portfolio allocation decisions; (2) policymakers and regulators can apply evidence on market efficiency and information asymmetry to design more effective regulatory frameworks that enhance market transparency and investor protection; (3) energy company executives can develop stronger risk management strategies by understanding the mechanisms through which global uncertainties affect their stock valuations; and (4) financial analysts and market participants can refine forecasting models by incorporating uncertainty measures and volatility connectedness indicators. Furthermore, this study's focus on the 2021–2024 period—encompassing the post-COVID recovery and the Russia–Ukraine conflict—offers timely evidence on how energy markets respond to successive global shocks, providing lessons applicable to future crisis management and market resilience building.

RESEARCH METHOD

This study employs a quantitative research approach using panel data regression analysis to examine the causal relationships between stock market volatility, asymmetric information, and market uncertainty in the Indonesian energy sector. The research was conducted on the Indonesia Stock Exchange (IDX), focusing specifically on energy sector companies listed during the period 2021-2024. The population of this study comprises all energy companies listed on the Indonesia Stock Exchange, which totaled 83 companies as of December 2024.

Using purposive sampling technique, the sample was refined to include only companies meeting specific criteria: (1) continuous listing on the IDX throughout the 2021-2024 period without delisting or suspension; (2) availability of complete financial reports and trading data for all quarters within the study period; and (3) minimum trading activity threshold to ensure meaningful volatility measurements. Based on these criteria, 62 energy companies were selected for analysis, representing 74.7% of the total energy sector population on the IDX. Data collection was conducted through multiple sources and techniques.

Primary data sources include: (1) daily stock price data, trading volume, and shareholder information obtained from the Indonesia Stock Exchange database and Bloomberg Terminal; (2) insider trading data collected from IDX regulatory filings and company disclosures as mandated by Otoritas Jasa Keuangan (OJK); and (3) the World Uncertainty Index (WUI) for Indonesia obtained from the International Monetary Fund database. Secondary data sources comprise company financial

statements, annual reports, and market research reports from the Indonesian Energy Ministry and sector associations.

Data analysis techniques involve several stages: (1) descriptive statistical analysis to characterize the distribution and central tendencies of research variables; (2) correlation analysis using Pearson's correlation matrix to assess multicollinearity among independent variables; (3) panel data regression analysis with fixed effects or random effects models (determined through Hausman test) to examine the relationships specified in the research models; (4) diagnostic tests including normality tests, heteroscedasticity tests, and autocorrelation tests to ensure regression assumptions are met; and (5) robustness checks using alternative model specifications. The analytical software employed includes EViews 12 for econometric analysis and Stata 17 for robustness checks and supplementary analyses.

This study focuses on analyzing the causal relationship between stock market volatility and asymmetric information in the energy sector of BRICS countries from 2021 to 2023. The regression model as follows:

Regression Model for Stock Market Volatility

Volatility it = α + β1Priceit + β2Volumeit + β3Stockholdersit + β4InsiderTradingit + β5EPUit + β6 VolatilityConnectedness it +ϵ it

Regression Model Efficiency Stock Information

Information Efficiency it = α + β1Priceit + β2Volumeit + β3Stockholdersit + β4EPUit + β5VolatilityConnectedness it +ϵ it

This model observes the changes in variables within energy companies (i) at each specific time period (t). Where volatility is the stock price volatility of energy company i at time t; Priceit = the stock price of energy company i at time t; Volumeit = the trading volume of energy company i's stock at time t, Stockholderit = the number of shareholders of energy company i at time t; Insider Tradingit = the insider trading activity in the stock of energy company i at time t; EMHit = the market efficiency indicator based on the EMH test, EPUit= market uncertainty using the "World Uncertainty Index" (WUI); Volatility Connectednessit= the interconnectedness and mutual influence of stock volatilities among energy companies; α = the constant in the model; $\beta 1, \beta 2, \ldots.., \beta 5$ = regression coefficients that show the relationship between volatility and each independent variable; ϵit = error term, representing other factors not included in the model that may influence volatility

Data (Overview of the Research Object)

The study utilizes a sample of energy companies listed in Indonesia. The list of these companies was obtained through the use of the S&P 500 data generator. In Indonesia, only 62 out of 83 energy companies will be included in the sample for

further analysis, as they have complete financial reports and are listed on the Indonesia Stock Exchange for the years 2021 to 2024.

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Based on the data analysis using Eviews, the descriptive statistics results are presented, which provide a simple overview of the independent variables tested in this study. The descriptive analysis of the independent variables examined is shown in Table 1 below:

Table 1. Descriptive Statistical

No	Variables	Mean	Std Dev	Min	Max
1	Volatility	0.37737	0.143	0.13	0.63
2	Price	1.7308	0.204	1.39	2.08
3	Volume*)	124.5	71.73	1	248
4	Stockholders*)	124.5	71.73	1	248
5	EMH	0.09064	0.04	0.03	0.16
6	Insider Trading	0.45205	0.144	0.19	0.68
7	Volcon	1.25116	0.342	0.69	1.83

The results of the descriptive statistical analysis above indicate that the mean values of the measurement variables range from 0.09 to 1.73, while the standard deviations range from 0.04 to 71.73. The highest volatility value is 0.63, identified as coming from the CUAN issuer, while the lowest value is 0.13, identified as coming from the BYAN issuer. The wide range in volatility (0.13 to 0.63) suggests that different issuers experience varying levels of market fluctuations, which could be further examined in terms of how market volatility affects investor decisions and stock prices.

The highest price value is 2.08, identified as coming from the ITMG issuer, while the lowest value is 1.39, identified as coming from the ENRG issuer. The wide range in volatility (0.13 to 0.63) suggests that different issuers experience varying levels of market fluctuations, which could be further examined in terms of how market volatility affects investor decisions and stock prices. The highest volume value is 248, identified as coming from the ADRO issuer, while the lowest value is 1, identified as coming from the ITMG issuer. The volume range (1 to 248) implies differences in liquidity across issuers, which may have implications for stock price movement and market efficiency.

The highest stockholders value is 248, identified as coming from the CUAN issuer, while the lowest value is 1, identified as coming from the ITMG issuer. The varying stockholder values (1 to 248) point to differing levels of shareholder involvement, potentially influencing corporate governance and stock performance.

The highest EMH value is 0.16, identified as coming from the CUAN issuer, while the lowest value is 0.03, identified as coming from the ITMG issuer. The EMH range (0.03 to 0.16) indicates that some stocks may be more informationally efficient than others, offering a potential area for investigating market efficiency and its relation to stock performance.

The highest insider trading value is 0.68, identified as coming from the BYAN issuer, while the lowest value is 0.19, identified as coming from the DOID issuer. The differences in insider trading (0.19 to 0.68) suggest varying levels of insider activity, which could impact market perceptions and stock prices. The highest volatility connectedness value is 1983, identified as coming from the CUAN issuer, while the lowest value is 0.69, identified as coming from the HRUM issuer. The extreme variation in volatility connectedness (0.69 to 1983) points to the differing impact of global or external market factors on individual issuers, suggesting that interconnectedness between markets and sectors could be further explored.

Correlation Analysis

Pearson's Correlation Matrix shows the strength of the relationship between the independent variables in a study. According to Nachrowi (2006), a correlation coefficient close to 0.8 or -0.8, or exactly at such a value, indicates the presence of multicollinearity between the independent variables. As seen in Table 2, the results do not indicate a strong relationship between the independent variables, suggesting that there is no multicollinearity issue in the research model. Below is the Pearson's correlation matrix for the first research model:

Table 2. Pearson's Correlation Matrix – Model 1

	PRICE	VOLUME	STOCKH	EMH	VOLCON
PRICE	1				
VOLUME	0.0081	1			
STOCKH	0.0372	0.3456	1		
EMH	0.0911	0.0232	0.0802	1	
VOLCON	0.1298	0.0021	0.8373	0.2767	1

From the output of the Pearson's correlation matrix in the second research model, the highest correlation occurs between the Volcon and STOCKH variables, with a correlation coefficient of 0.8373. However, overall, the first research model does not show a strong relationship between the variables. Table 3 presents the output of the Pearson's correlation matrix for the second research model.

Table 3. Pearson's Correlation Matrix – Model 2

	PRICE	VOLUME	STOCKH	IT	VOLCON
PRICE	1				
VOLUME	0.0273	1			
STOCKH	0.1938	0.3093	1		
IT	0.0002	0.3721	0.4664	1	
VOLCON	0.1783	0.4482	0.1635	0.2322	1

From the output of the Pearson's correlation matrix in the second research model, the highest correlation occurs between the VOLUME and EMH variables, with a correlation coefficient of 0.5763. However, overall, the second research model does not show a strong relationship between the variables.

Data Distribution Analysis of Variables

Based on the data distribution analysis, it was found that the variable EMH shows a considerable range, indicating the presence of a biased variable that causes the data distribution to fluctuate significantly. This contributes to the Volatility, which also becomes more dispersed. The analysis reveals a linear relationship between Volatility and EMH, where an increase in the dispersion of Volatility corresponds with an increase in the dispersion of EMH. EMH has the most widely separated range, which aligns with the distribution of the research variables as depicted in Figure 1. Meanwhile, when examining Volatility, the variable is fairly divided into two parts. The values below the median are further split into two groups: one close to the line and the other farther from the central line. This indicates that the accumulation of the dependent variable shows considerable variation in relation to Volatility.

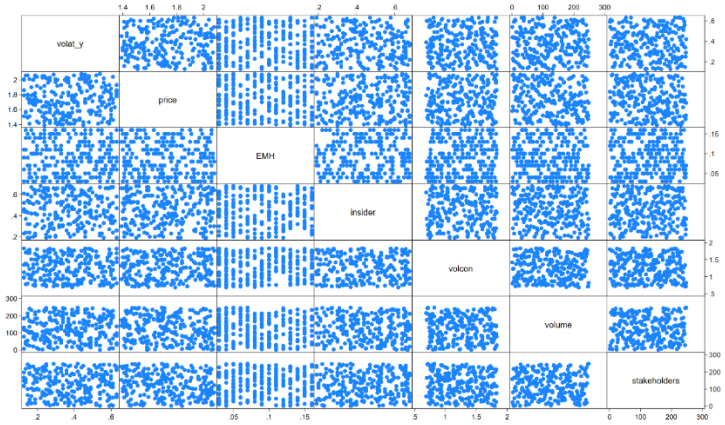

Figure 1. Distribution of Research Variable Characteristics
Source: Processed by the Author (2025)

Analysis of Regression Model for Stock Market Volatility

Based on the coefficient of determination, the R-squared value is 0.9083, which means that the dependent variable can be explained by the independent

variables quite well, with 90.83% of the variance being explained, while the remaining 9.17% is influenced by other variables. Meanwhile, the Prob > F value, which is greater than 0.05, indicates that the null hypothesis can be accepted, suggesting that the independent variables in the model are able to explain the changes in the dependent variable and that the independent variables have a significant influence on the dependent variable. A summary of these values is presented in Table 4. below.

Table 4. Regression Analysis of Volatility

Variables	Coefficient	Std. Dev	t	P > |t|
Price	0.001	0.003	0.08	0.004
Volume	0.004	0	0.87*)	0.002
Stockholders	0.028	0	0.03	0
EMH	0.006	0.048	26.3**)	0
IT	0.062	0.155	2.25*)	0.7
Volcon	0.004	0.006	-0.58*)	0.81

**) sig α = 5%, **) sig α = 10%*

Based on the t-statistic value, the result obtained is 4.18, while in Table 4.7, the EMH variable has a t-value greater than 2.02, specifically the EMH variable with a t-value of 17.36. According to the t-test, the EMH variable does not have an influence. However, when considering the F-statistic, the model can be accepted overall. This is because the calculated F-statistic is greater than the F-table value, with the real value of 1.87 > 1.79. Based on the graph for each variable, the dispersion of the Volatility variable with respect to the dependent variable is as follows:

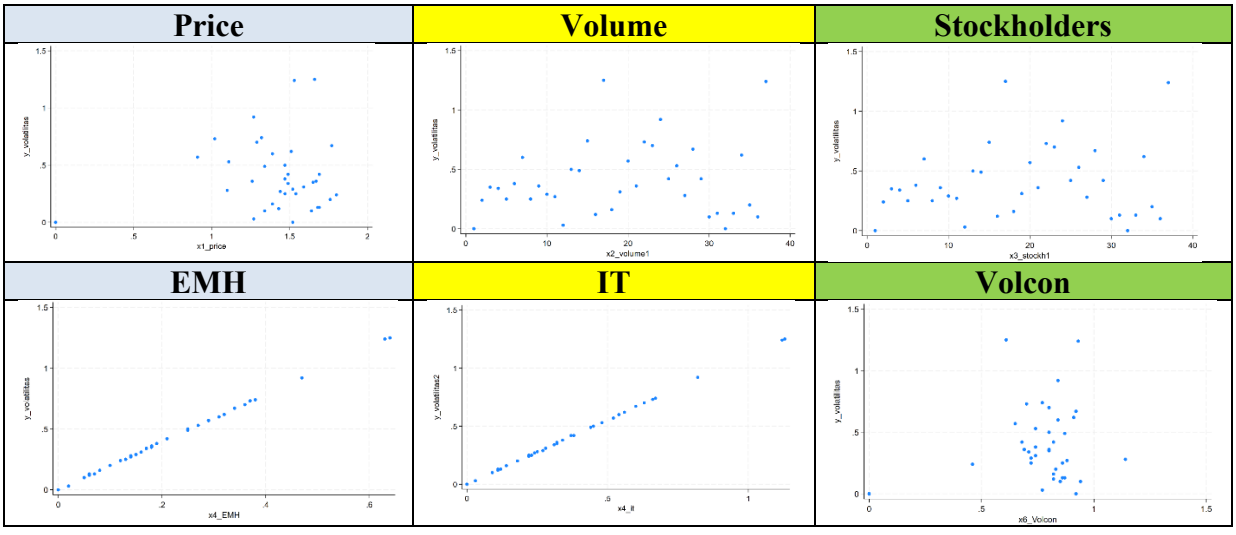

Figure 2. Volatility Model - Comparison
Source: Processed by the Author (2025)

Based on the distribution data of Volatility against the dependent variables as described in Figure 2, it is observed that the widest dispersion occurs between Volatility and Volume and Stockholders. This is due to the varying values of Volume and Stockholders across energy companies in Indonesia, with a wide range of data and interquartile differences. However, there is also linear dispersion observed, such as between Volatility and EMH and Insider Trading (IT). This is because the majority of the data for these variables show only small differences.

Regression Analysis of the Stock Asymmetric Information Model

Based on the coefficient of determination, the R-squared value is 0.9084, which means that the independent variables can explain the dependent variable well, accounting for 90.84% of the variance. The remaining 9.16% is explained by other variables not included in the model. Furthermore, the Prob > F value, which is greater than 0.05, indicates that the null hypothesis can be accepted. This suggests that the independent variables in the model are capable of explaining the changes in the dependent variable, and that the independent variables can indeed influence the dependent variable. A summary of these values is shown in Table 5 below.

Table 5. Stock Asymmetry Regression Analysis

Variable	Coefficient	Std. Err	t	P > |t|
Price	0	0	-0.03*	0.003
Volume	0	0.000*	0.37*	0.004
Stockholders	0	0	0.00*	0
Insider Trading	1.327	0	7.23**	0
EMH	0.283	0.283	1.29*	0.091
Volcon	0.007	0.002	0.21*	0.224

**) sig α = 5%, **) sig α = 10%*

Based on the t-statistic value, the result obtained is 2.02, while in Table 5, the EMH variable shows a value greater than 2.02, specifically the Insider Trading variable with a t-value of 417.23. According to the t-value calculation, this indicates that the Insider Trading variable does not have a significant effect on the dependent variable. However, when evaluated based on the F-statistic, the model as a whole is acceptable. This is because the calculated F-value (Fcounted) is greater than the critical F-value (Ftable), with a real value of 2.34 > 1.95.

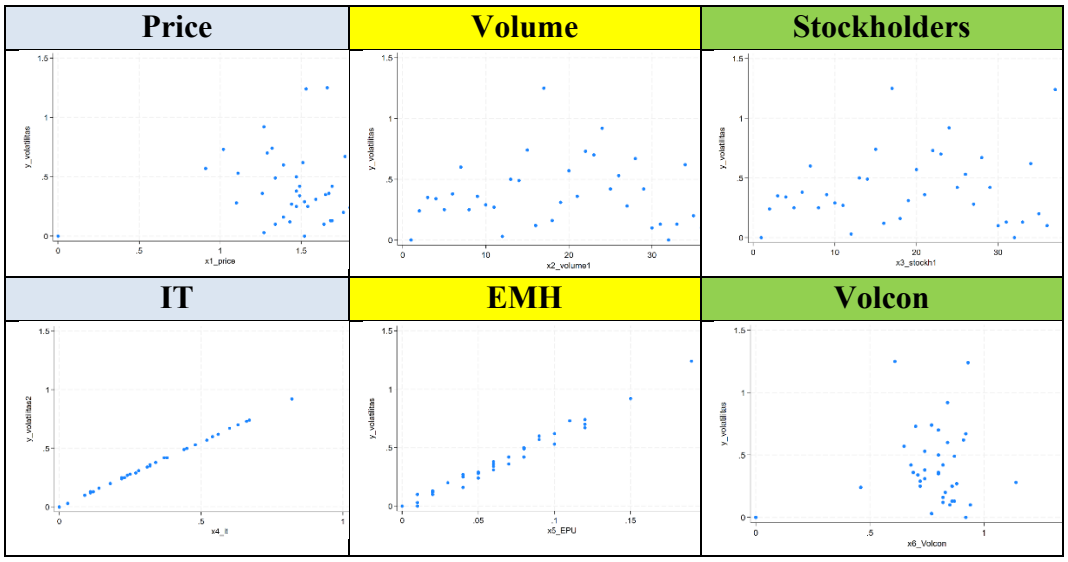

Figure 3. Volatility Model 2 – Comparison
Source: Processed by the Author (2025)

Based on the distribution data of Volatility in Model 2 against the dependent variables, as described in Figure 3, it can be observed that the most widely spread dispersion occurs between Volatility and the variables Volume and Stockholders. This is caused by the varying values of volume and stockholders across energy companies in Indonesia, with a wide range between data points and across quartiles. However, there is also a linear dispersion, such as the relationship between Volatility and Insider Trading and EMH. This is due to the fact that the majority of the data points in these variables have small differences in their values.

CONCLUSION

The analysis of 62 energy companies revealed that PT Resource Alam Indonesia Tbk experienced the highest volatility rate (0.4) among 25 firms, while the lowest volatility was observed in PT Medco Energi Internasional Tbk, and Indonesia's overall volatility averaged 0.37 across all firms. Consistent with the Efficient Market Hypothesis (EMH), most companies exhibited similar efficiency levels around 0.06, with PT Raharja Energi Cepu Tbk recording the highest EMH rate (0.0677) and PT Golden Energy Mines Tbk the lowest (0.063). Regarding Volatility Connectedness, Indonesia displayed the highest level (0.736), whereas PT Petrindo Jaya Kreasi Tbk had the lowest (0.701) across its 10 energy companies. These findings indicate that despite differences in firm characteristics, volatility, efficiency, and connectedness remain relatively uniform across the sector. Future research should extend the analysis to include the impact of macroeconomic and

geopolitical factors on volatility transmission and market efficiency within Indonesia's energy sector.

REFERENCES

Ahir, H., Bloom, N., & Furceri, D. (2022). The world uncertainty index. In *Stanford Institute for Economic Policy Research Working Paper*. https://www.policyuncertainty.com/wui_quarterly.html

Alfeus, M., Harvey, J., & Maphatsoe, P. (2025). Improving realised volatility forecast for emerging markets. *Journal of Economics and Finance*, *49*(1), 299–342. https://doi.org/10.1007/s12197-024-09685-6

Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, *131*(4), 1593–1636. https://doi.org/10.1093/qje/qjw024

Bhattacharya, U., & Daouk, H. (2015). Insider trading and the valuation of international strategic alliances in emerging stock markets. *Journal of International Business Studies*, *38*(1), 134–157. https://doi.org/10.1057/palgrave.jibs.8400322

Chen, X., Huang, S., & Wang, Y. (2021). Institutional ownership and insider trading profitability: Evidence from an emerging market. *Pacific-Basin Finance Journal*, *70*. https://doi.org/10.1016/j.pacfin.2021.101231

Cheteni, P. (2016). Stock market volatility using GARCH models: Evidence from South Africa and China stock markets. *Journal of Economics and Behavioral Studies*, *8*(6), 237–245. https://doi.org/10.22610/jebs.v8i6.1493

Diebold, F. X., & Yilmaz, K. (2015). Trans-Atlantic equity volatility connectedness: US and European financial institutions, 2004–2014. *Journal of Financial Econometrics*, *14*(1), 81–127. https://doi.org/10.1093/jjfinec/nbv021

Frijns, B., Indriawan, I., Tourani-Rad, A., & Zhang, H. (2023). The effect of equity market uncertainty on informational efficiency: Cross-sectional evidence. *Global Finance Journal*, *57*. https://doi.org/10.1016/j.gfj.2023.100826

Hamzah, A. (2020). Market efficiency and global issues: A case of Indonesia. *Investment Management and Financial Innovations*, *19*(4), 95–104. https://doi.org/10.21511/imfi.19(4).2022.08

Ivanitskiy, V., & Tatyannikov, V. (2018). Information asymmetry in financial markets: Challenges and threats. *Economy of Region*, *1*(4), 1156–1167. https://doi.org/10.17059/2018-4-16

Just, M., Kliber, A., & Echaust, K. (2025). Return connectedness between energy commodities and stock markets: New evidence from 31 energy sector companies in Europe. *International Review of Financial Analysis*, *95*. https://doi.org/10.1016/j.irfa.2024.103358

Khalfaoui, R., Mefteh-Wali, S., Viviani, J. L., Ben Jabeur, S., Abedin, M. Z., & Lucey, B. (2022). How do climate risk and clean energy spillovers, and uncertainty affect US stock markets? *Technological Forecasting and Social Change*, *185*. https://doi.org/10.1016/j.techfore.2022.122083

Kumar, P., & Katoch, D. R. (2025). Interconnected markets: How energy, green finance, and APEC equities drive global volatility. *International Journal of Accounting and Economics Studies*, *12*(3), 140–153. https://doi.org/10.14419/j89zk395

Li, K., Hu, M., & Wang, Y. (2022). Asymmetric information and inside management trading in the Chinese market. *Journal of Corporate Finance*, *62*. https://doi.org/10.1016/j.jcorpfin.2022.101844

Liu, X., Zhang, L., & Wang, H. (2022). Uncertainty index and stock volatility prediction: Evidence from international markets. *Financial Innovation*, *8*(1), 1–28. https://doi.org/10.1186/s40854-022-00373-5

Modjo, M. I., Sergi, B. S., Wongkar, N., & Suhariono, K. L. (2024). Manipulation and financial market misconduct in Indonesia. *Asia-Pacific Journal of Management Research and Innovation*, *20*(3), 245–268. https://doi.org/10.1177/23220979241256233

Robiyanto, R. (2021). Determinant of Indonesian stock market's volatility during COVID-19 pandemic. *Jurnal Keuangan Dan Perbankan*, *25*(1), 1–20. https://doi.org/10.26905/jkdp.v25i1.4980

Ugurlu, E., Thalassinos, E., & Muratoglu, Y. (2014). Modeling volatility in the stock markets using GARCH models: European emerging economies and Turkey. *Procedia Economics and Finance*, *14*, 485–492. https://doi.org/10.1016/S2212-5671(14)00735-7

Xie, Q., Luo, C., Cong, X., & Wang, X. (2024). Volatility connectedness and its determinants of global energy stock markets. *Economic Systems*, *48*(3). https://doi.org/10.1016/j.ecosys.2024.101139

Zhang, J., Xiang, Y., Zou, Y., & Guo, S. (2024). Volatility forecasting of Chinese energy market: Which uncertainty have better performance? *Energy Economics*, *132*. https://doi.org/10.1016/j.eneco.2024.107456