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The Effect of Macroeconomic Variables and Global Stock Index on Mining Sector Stock Index in Indonesia

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Abstract: The capital market plays a crucial role in the global economy, particularly within Indonesia's industrial sector. This study sought to examine the influence of macroeconomic indicators and international stock indices on the domestic mining sector stock index. The Autoregressive Distributed Lag (ARDL) approach was employed to analyse secondary data collected as monthly time series spanning January 2010 to December 2021. The ARDL estimation of first differences revealed that inflation, exchange rates, crude oil prices, and the US stock index (S&P 500) significantly impacted the Jakarta Islamic Index (JII). Conversely, inflation, the Thai mining sector stock index (SET), the Philippine mining sector stock index (PHS), and the S&P 500 exerted significant effects on the Indonesia Stock Exchange (IDX) mining sector index. In summary, the JII and IDX models were predominantly influenced by macroeconomic indicators and international stock indices, respectively.

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Introduction

In numerous countries, the mining sector is recognised as a key driver of economic growth. An enabling environment coupled with modern mining regulations can attract private sector investments in production and exploration, fostering employment creation, export revenues, and enhanced tax collections in rural areas (World Bank, 2013). Mining plays a pivotal role in advancing infrastructure by supporting the development and expansion of critical facilities such as electricity, transportation, and communication networks. In Indonesia, the sector significantly contributes to the national economy, accounting for approximately 5% of the gross domestic product (GDP) in 2018 (Statista, 2023). According to the Trade Commissioner Service (2022), mining is also a major source of export revenue for Indonesia, with coal alone constituting 14% of the country's total exports. Furthermore, the sector supports job creation and employment opportunities. Effective governance and the adoption of responsible mining practices in low- and middle-income countries can lead to substantial poverty alleviation and broader improvements in social welfare (S&P Global, 2022).

The mining sector forms an integral part of the industrial sector within the context of the national economy. The performance of this sector can directly influence the stock index, as its contributions to the broader economy often impact investor sentiment. Arman & Suade (2022) observed that the industrial sector's performance significantly affects stock index performance, highlighting its role as a vital economic component. To analyse the relationship between stocks, industries, and the economy, the weighted average index of the Indonesian stock market is often correlated with indices of various industrial stock types (Yang & Itan, 2021). For instance, a downturn in the mining sector can reduce demand for building materials, thereby affecting the construction sector. Such interdependencies underscore the connections between industrial sectors and the Miscellaneous Industry Sector stock index (Gupta & Kumar, 2019; Sharabati, Noor, & Saymeh, 2013). Furthermore, Indonesian mining stocks are regarded as promising investment opportunities, supported by the country's substantial mineral reserves, which make significant contributions to its economy (Ghosh, 2023).

The global financial crises of 1998 and 2008 significantly impacted the national economy, prompting extensive research into factors that foster stable economic development and sustained growth. These crises directly influenced the Indonesian economy, as evidenced by fluctuations in the stock market. Economic progress is closely linked to capital market activities, which play a pivotal role in facilitating capital formation and supporting economic growth (Antono, Jaharadak, & Khatibi, 2019). Beik & Fatmawati (2014) similarly highlighted the capital market as a critical component of the global economy, particularly in Indonesia. As a developing nation, Indonesia utilises its capital market as a platform for fundraising, an alternative investment avenue through stock sales and bond issuance, and a barometer of macroeconomic stability. The capital market also serves as a mechanism for assessing the health of companies within the country. Consequently, it acts as a vital driver of economic growth by enabling investment opportunities (Nuryasman & Permatasari, 2016).

According to the mining index recorded on the IDX, the sector experienced a substantial decline in stock prices over four consecutive years beginning in 2013. This decline was primarily influenced by several factors and certain internal determinants (Antono et al., 2019). These findings indicate that the mining sector continues to face numerous challenges shaped by diverse factors. These include the downturn in global commodity prices, which has led to a decrease in the valuation of mining issuers and subsequent impacts on the stock index. Additionally, regulatory instability, negative market perceptions, economic uncertainty, environmental concerns, and fluctuations in corporate stock prices further exacerbate these issues (Antono et al., 2019).

While commodity price variations and the USD/IDR exchange rate affected stock returns in Indonesia's mining sector, Putra & Robiyanto (2019) found that gold positively affected PTBA, INCO, TINS, and KKGI. Silver negatively affected RUIS and positively affected HRUM, while crude oil prices positively affected PTBA and HRUM. However, the exchange rate hurt CTHH, ANTM, DOLD, HRUM, ELSA, KKGI, and ITMG returns. Moreover, Endri & Nugraha (2019) examined how return on assets, debt-to-equity ratio, dividend payout ratio, world oil prices, and currency rates affect stock values. Elfiswandi et al. (2020) examined how fundamental analysis, energy usage, and macroeconomic factors affected IDX-listed energy and mining businesses' stock returns between 2014 and 2018. Return on equity, debt-to-equity ratio, interest rate, energy consumption, currency rate, earnings per share, and inflation significantly affected stock returns, whereas the current ratio did not. In addition to this, Muzindutsi et al. (2022) evaluated JSE mining index subsector response to financial, political, and economic risk variables. The short- and long-run results showed that distinct JSE mining index subsectors reacted differently to nation risk shocks, indicating that investors diversify their portfolios against sector risk components. Capital market investors can learn from this research.

Literature Review

Several studies have demonstrated that stock prices are influenced by a range of factors, with inflation being the most widely examined variable (Al-Shubiri, 2010; Büyüksalvarci, 2010; Divianto, 2013; Gunu & Idris, 2009; Khumalo, 2013; Mahmood et al., 2014; Talla, 2013). Following inflation, exchange rates and interest rates are also key factors affecting stock prices, ranking second and third, respectively (Altin, 2014; Büyüksalvarci, 2010; Khumalo, 2013; Kutty, 2010; Talla, 2013). Inflation tends to have a negative impact on stock prices, as established theory suggests that rising inflation reduces capital gains, leading to lower profits for investors. On the corporate side, higher inflation can decrease income levels, increasing the risk associated with investment and ultimately reducing demand for stocks. As companies' profitability declines, securities in the capital market become less attractive to investors (Dornbusch, Fischer, & dan Richard, 2008).

The exchange rate has a positive influence on stock prices, and according to established theory, changes in macroeconomic variables have distinct effects on stock prices. This suggests that when one stock is positively influenced, others may experience negative effects. For instance, a sudden depreciation or decline in the rupiah against the USD typically negatively impacts stock prices, as import-dependent companies face higher costs and reduced profits. Conversely, export-oriented companies

may benefit from such depreciation. However, a weakening of the rupiah against the USD is often interpreted by investors as an indication of unfavorable economic prospects. This depreciation can be driven by weak fundamental economic factors, resulting in a stronger USD and declining stock prices, thereby increasing risks for investors in the stock market.

Interest rates have a negative impact on stock prices, and according to established theory, interest rates play a crucial role as a macroeconomic variable influencing stock prices. Changes in interest rates can create challenges for investors and affect company profits, resulting in fluctuations in stock prices. This study found that lower interest rates generally lead to higher stock prices due to the substantial transfer of funds to the stock market (Mankiw, 2000).

Study Method

Data Type and Source

This study utilised monthly time series data for the period from January 2010 to December 2021 as secondary data, which was sourced from various platforms such as Yahoo Finance, the Central Statistics Agency (BPS), and the Central Bank of Indonesia (BI). The estimation process involved formulating and specifying appropriate models. Two models were used to examine the impact of macroeconomic variables and the international stock index on the IDX stock index, including both the IDX mining sector index and the Jakarta Islamic Index (JII). The modeling procedure was carried out as follows:

Model 1 JII (ARDL First Difference):

$$LN_JII_t = \alpha + \sum_{i=1}^p \beta_1 LN_M2_{t-i} + \sum_{i=1}^p \beta_2 INF_{t-i} + \sum_{i=1}^p \beta_3 LN_EX_{t-i} + \sum_{i=1}^p \beta_4 LN_COP_{t-i} + \sum_{i=1}^p \beta_5 LN_IPI_{t-i} + \sum_{i=1}^p \beta_6 LN_SET_{t-i} + \sum_{i=1}^p \beta_7 LN_PHS_{t-i} + \sum_{i=1}^p \beta_8 LN_SP500_{t-i} + \varepsilon_t$$

Model 2 IDX (ARDL First Difference):

$$LN_IDX_t = \alpha + \sum_{i=1}^p \beta_1 LN_M2_{t-i} + \sum_{i=1}^p \beta_2 INF_{t-i} + \sum_{i=1}^p \beta_3 LN_EX_{t-i} + \sum_{i=1}^p \beta_4 LN_COP_{t-i} + \sum_{i=1}^p \beta_5 LN_IPI_{t-i} + \sum_{i=1}^p \beta_6 LN_SET_{t-i} + \sum_{i=1}^p \beta_7 LN_PHS_{t-i} + \sum_{i=1}^p \beta_8 LN_SP500_{t-i} + \varepsilon_t$$

Table 1 presents a list of the variables employed in this study, along with their corresponding descriptions.

Table 1: List of Variables.

No.	Variables	Description	Unit
1	LN_JII	Jakarta Islamic Index (Indonesia)	Natural Logarithm (LN)
2	LN_IDX	The IDX Mining Sectoral Index (Indonesia)	Natural Logarithm (LN)
3	LN_M2	Money in Circulation	Natural Logarithm (LN)
4	INF	Inflation	Percent (%)
5	LN_EX	Rupiah to USD Exchange Rate	Natural Logarithm (LN)
6	LN_COP	Crude Palm Oil Price	Natural Logarithm (LN)
7	LN_IPI	Industrial Production Index	Natural Logarithm (LN)
8	LN_SET	SET Mining Sectoral Index (Thailand)	Natural Logarithm (LN)
9	LN_PHS	PHS Mining Sectoral Index (Philippines)	Natural Logarithm (LN)
10	LN_SP500	S&P 500 Stock Index (US)	Natural Logarithm (LN)

Method

The ARDL methodology, an econometric method developed by Shin & Pesaran (1999) to investigate long-term relationships and carry out cointegration tests among time series variables, was used for estimation in this work. This approach uses Bound Testing for Cointegration to compare F-statistics with key values from the F-table. The ARDL model permits variables to be integrated at different orders, in contrast to conventional cointegration tests that demand that variables be integrated at the same order (I(1) or first difference). The ARDL model is estimated first, and then the Error Correction Model (ECM) if cointegration is discovered. After determining the proper ARDL order, the ARDL model is identified and estimated using Ordinary Least Squares (OLS) (Pesaran, Shin, & Smith, 2001). When the required econometric requirements are satisfied, OLS is employed to ensure that the estimations are objective and consistent, as long as problems like heteroscedasticity, functional misspecification, multicollinearity, and autocorrelation are not present.

Results and Analysis

Stationarity Test Results

In order to determine whether a unit root existed among all variables at both the level and first difference, data stationarity was first evaluated using the Augmented Dickey-Fuller (ADF)

test. The data is regarded as stationary at the designated level if the ADF statistic value is less than the MacKinnon Critical Value. Additionally, if the ADF probability value is below the significance level, stationarity can be verified. Table 2 displays the outcomes of these examinations. The unit root test was performed at the first difference level after the test showed that the inflation (INF) variable was stationary at the level. The findings demonstrated that there was no unit root in the data since all variables examined for unit roots at the first difference level using the ADF test were stationary.

Table 2: Stationarity Test.

Variables	ADF Value	
	Level	1st Difference
LN_JII	1.034048	-11.32755
LN_IDX	-0.451187	-7.946922
LN_M2	3.754030	-11.36489
INF	-1.647832	-10.59563
LN_EX	-0.252294	-8.703402
LN_COP	-0.308015	-7.773195
LN_IPI	6.405041	-12.78234
LN_SET	0.748560	-7.197941
LN_PHS	-0.264659	-8.503419
LN_SP500	3.402442	-8.815802
MacKinnon critical values:	1% level	-2.585405
	5% level	-1.943662
	10% level	-1.614866

Notes: Bold Signifies that the Data is Stationary at 1%, 5%, and 10% Real Level.

Cointegration Test

Cointegration in the ARDL model is assessed using the Bound Testing for Cointegration method. If the F-statistic is below the lower bound, no cointegration is present; if above the upper bound, cointegration is confirmed. If it falls between the bounds, the result is inconclusive. The test showed that both models' F-statistics were below the critical value (2.62 at the 1% level), indicating no long-term cointegration. Therefore, both models were estimated using the short-term ARDL approach with the first difference method.

Table 3: ARDL Bound Test Results.

Model	F-Statistic	Decision
Model 1 (JII)	2.254311***	Not Cointegrated
Model 2 (IDX)	2.451293***	Not Cointegrated
Significance	Lower Bound	Upper Bound
10%	1.85	2.85
5%	2.11	3.15
1%	2.62	3.77

Note: ***, **), and *) are cointegrated at the 1 %, 5 %, and 10 % real level, respectively.

Optimum Lag Test

The optimum lag test was conducted by selecting the lag interval that minimized the Schwarz Bayesian Criterion (SC) value. The results indicated that the optimal lag length varied for each model.

Table 4: ARDL Optimum Lag Test Results.

Model	Optimum Lag
Model 1 (JII)	1, 0, 4, 0, 0, 0, 0, 0
Model 2 (IDX)	1, 0, 0, 0, 0, 0, 0, 0

Note: Schwarz Bayesian Criterion (SC) test results

Stability and Autocorrelation Test Results

The stability test was conducted using recursive estimation through the cumulative sum (CUSUM) plot, which indicated the stability of the variable coefficients in the model. The CUSUM plot results for both models showed that the variables remained stable throughout the study period. Additionally, the autocorrelation test, using the LM test, revealed that the p-value of obs*R-squared was above the 5% significance level (0.05), suggesting that there were no autocorrelation issues in any of the ARDL models estimated.

Table 5: Autocorrelation Results.

Breusch-Godfrey Serial Correlation LM Test (JII Model)			
F-Statistics	0.313123	Prob. F(2,99)	0.7319
Obs*R-Squared	0.722885	Prob. Chi-Square(2)	0.6967
Breusch-Godfrey Serial Correlation LM Test (IDX Model)			
F-Statistic	0.311534	Prob. F(2,106)	0.7330
Obs*R-Squared	0.689550	Prob. Chi-Square(2)	0.7084

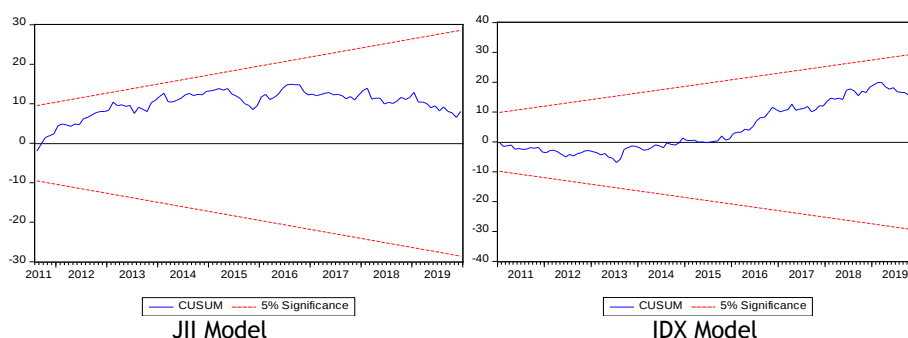


Figure 1: CUSUM Results.

Model Estimation Results

Based on the results of the Bound Testing for Cointegration, both the JII and IDX models did not exhibit cointegration in the long run. Therefore, the estimation

was conducted using the ARDL first difference approach. This estimation focused solely on determining the short-term impact of the independent variables on the dependent variable, as the study models were not cointegrated.

Table 6: ARDL First Difference Short-Term Estimation Results.

Variables	Coefficient	
	Model 1 (JII)	Model 2 (JCI)
D(LN_JII(-1))	-0.178397**	
D(LN_IDX(-1))		0.097603
D(LN_M2)	0.016243	-0.025567
D(INF)	-0.006158	-0.013225*
D(INF(-1))	-0.009728	
D(INF(-2))	-0.005552	
D(INF(-3))	0.015379	
D(INF(-4))	-0.018659**	
D(LN_EX)	-1.070541***	-0.058386
D(LN_COP)	-0.095608*	0.101509
D(LN_IPI)	0.091086	0.076043
D(LN_SET)	0.045771	0.406452***
D(LN_PHS)	0.070731	0.247642***
D(LN_SP500)	0.304870**	0.377629**
C	0.000747	-0.007480

Note: ***, **), and *) are significant at 1%, 5%, and 10% real level, respectively.

The ARDL first difference estimation for the JII model identified five significant variables. LN_JII at the first lag had a negative impact (-0.178), INF at the fourth lag also negatively impacted (-0.018). LN_EX, LN_COP, and LN_SP500 significantly affected the model with coefficients of -1.07, -0.0956, and 0.3, respectively. For the IDX model, four variables were significant: INF (-0.01), LN_SET (0.406), LN_PHS (0.247), and LN_SP500 (0.377). INF had a negative effect, while LN_SET and LN_PHS had positive effects, and LN_SP500 was positively significant at the 5% level.

Results

The ARDL first difference estimation results showed that exchange rate, inflation, crude oil prices, and S&P 500 significantly influenced the JII. This aligns with studies by Mashudi, Ibrahim, & Ilahi (2020), who found a strong effect of inflation, the Industrial Production Index, and exchange rate on JII, and Yahya (2020), who reported similar findings for inflation, BI interest rate, and exchange rate. Ridlo, Yudianto, & Rohmah (2021) also noted the significant impact of the exchange rate, moderated by inflation, on stock prices and the relationship between JII and Islamic mutual fund growth. Inflation and exchange rate fluctuations are key macroeconomic factors affecting JII, guiding investor decisions (Husnah, Nugraha, & Rizal, 2022). Currency depreciation can make Indonesian stocks more appealing to foreign investors, while inflation may prompt capital withdrawal, impacting the stock index (Kultsum, Hakim, & Pasaribu, 2021; Ridlo et al., 2021).

Several key factors explain the influence of the S&P 500 and crude oil prices on the JII. Degiannakis, Filis, & Arora (2018) highlighted the interdependence between the S&P 500 and WTI crude oil prices. Vijn & Wang (2022) argued that the S&P 500, as a leading global stock index, reflects the performance of major US companies, and fluctuations in this index can influence global market sentiment, including in Indonesia, thereby affecting the JII. Choi & Hong (2020) noted that changes in crude oil prices can impact financial markets due to their relationship with stock indices. This is further supported by Antonio et al. (2021), who found that shifts in global crude oil prices significantly influence JII movements, as oil prices are seen as a key driver of economic prosperity. Fluctuations in oil prices affect the operations of various industries, thereby impacting the stock market. Husnah et al. (2022) explained that crude oil prices influence investor behaviour, market expectations, and the JII, with rising oil prices often associated with economic growth, which in turn affects the stock market.

Inflation, SET, PHS, and the S&P 500 significantly influence the IDX index. These findings are consistent with Antono et al. (2019), who noted that inflation has a considerable impact on the stock prices of mining companies listed on the IDX. Inflation is believed to lower the valuation of mining developers' equities, creating pressure on companies due to rising costs, which ultimately affects financial performance and the broader mining sector index. An increase in inflation may lead to a decline in stock prices, thereby impacting the general mining sector index. While inflation-driven commodity price increases may promote short-term growth in asset valuations, prolonged inflation coupled with weak demand can lead to a downward trend in market values as costs rise.

The relationship between SET, PHS, S&P 500, and the IDX index is influenced by various factors. The mining sector is particularly sensitive to global economic trends, and the

S&P 500, representing the US stock market, often reflects the overall economic health of the US (Vijn & Wang, 2022). Economic conditions in major countries can influence commodity prices and mining stocks globally, including in Thailand, the Philippines, and Indonesia. This is supported by Imron, Rosdiana, & Hendryadi (2020), whose findings correlate with the current study, highlighting the significant negative effect of the S&P 500 on stock indices in sectors such as agriculture and chemicals, as well as its positive impact on the mining sector, property, consumer goods, infrastructure, trade, and finance. Mining stocks are highly sensitive to commodity prices, and thus, global commodity trends can affect the SET, PHS, and S&P 500, ultimately influencing the profitability and stock performance of local companies. For instance, a significant increase in the demand or price of metals like gold, copper, and nickel could positively affect mining companies worldwide.

Investor sentiment and risk appetite are key factors in stock index performance, with the S&P 500 often serving as a benchmark for global risk sentiment. Changes in risk perception and market conditions can influence fund flows across different markets, including in Southeast Asia. During a global economic downturn, investors may reduce their exposure to riskier assets, such as mining stocks, which can impact the IDX index. The mining sector, which often attracts foreign investment, is sensitive to economic conditions and policies in countries like the US, Thailand, and the Philippines, which can, in turn, affect investor decisions and capital flows. A shift in FDI patterns can have a significant impact on the mining sector index in these countries, including Indonesia. Furthermore, the global financial market is highly interconnected, with developments in one market often having a substantial effect on others. For instance, a global economic crisis or significant financial event can undermine investor confidence worldwide, thereby influencing mining sector indices across various regions.

The results indicate that macroeconomic indicators strongly influence the JII model, while the international stock index has a more significant impact on the IDX model. Venkatamuni Reddy, Nayak, & Nagendra (2019) noted that factors in the international stock index, even if not directly related to individual companies, can affect stock prices and investor behavior. For instance, an improving economy can stimulate industrial growth, positively impacting the stock market. Conversely, a global economic crisis can lead to a decline in stock indices worldwide, including in Indonesia. Investors often diversify their portfolios across countries and industries, so significant changes in international stock indices may prompt adjustments in investment strategies, affecting the IDX index across various sectors. This behavior is driven by factors such as risk appetite, return expectations, and market sentiment (Ervina et al., 2022). Stock market indices reflect the overall health and performance of economies, and any substantial changes in these indices tend to influence sentiment and market dynamics (Arman & Suade, 2022; Min, Shin, & Taltavull de La Paz, 2022). Consequently, the IDX index in various sectors is more heavily influenced by the international stock index due to the interconnectedness of the global economy, investor behavior, and macroeconomic factors.

Conclusion

In conclusion, this study examined the influence of macroeconomic indicators and the international stock

index on domestic stock indices through the JII and IDX models. The analysis revealed that both models did not exhibit long-term cointegration, thus only short-term estimations were obtained. The ARDL first-difference results demonstrated the significant impact of inflation, exchange rate, crude oil prices, and the S&P 500 on the JII, while inflation, SET, PHS, and the S&P 500 influenced the IDX index. These findings highlighted that macroeconomic indicators primarily controlled the JII model, while the international stock index significantly impacted the IDX model. The government should implement policies tailored to the distinct characteristics of each model. For the JII, emphasis should be placed on macroeconomic stability, such as managing inflation and ensuring exchange rate stability. For the IDX index, policies should focus on tracking and responding to fluctuations in the international stock market, including promoting investment diversification and closely monitoring the international stock index. Such policies would help strengthen the resilience of both models against economic and global market volatility.

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