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# DO MACROECONOMICS AND COMMODITIES PREDICT STOCK MARKET? AN EVIDENCE FROM GARCH MODEL

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***Abstract***

*The stock market is a leading indicator and barometer of a nation's economics and is influenced by a wide of factors, including global commodity prices and macroeconomic conditions. This research examines the effect of foreign exchange, as a proxy of macroeconomics and tin price as a proxy of commodities on the stock market, uses daily data from the beginning of January 2020 to the end of December 2023, and applies the Generalized Auto Regression Conditional Heterokedasticity (GARCH) method, based on the flow-oriented model and the sectoral linkages theory. The findings show that foreign exchange has a negative significant effect on the stock market, while commodities have a positive and significant effect on the stock*

***Keywords:*** *stock market, foreign exchange, commodities, GARCH*

## Introduction

The price of commodities was a concern for industrialists, economists, and researchers (Peng et al., 2014). The Global EV Outlook 2023 reported there were more than 26 million electric cars on the road in 2022, and more than 2.3 million electric cars were sold in the first quarter of 2023. Currently, numerous automakers are attempting to create an electric car that runs on batteries. The Global EV Outlook 2023 reported battery demand is set to increase significantly by 2030, and need more than 50 gigafactories to meet that demand too. Tin metal is required for those batteries as a component. Tin metal is essential to both construction and electronics. One of the world's largest tin mining nations is Indonesia. The top five nations in the world by volume of tin mining are Bolivia, Peru, Indonesia, Myanmar, and China. Indonesia will produce 71.000 tons of tin in 2021 and 74.000 tons in 2022. According to icdx.co.id, Indonesia produces around 19.5% of the world's TIN. Indonesia is the second largest tin producer in the world with 84,000 metric tons tin produced every year. On the other hand, tin metal could be used for raw material of electronic, chemical, automotive products, etc. Therefore, the tin price has impact on revenue and profit of those companies, and in the end, it has impact on stock market.

Zhu et al. (2021) found that non-ferrous metal prices have a favorable influence on stock indexes in China. In their study, Wen et al. (2021) investigated the correlation between commodities and the stock market. Their findings revealed a clear association between the two. Similarly, Peng et al. (2014) demonstrated a substantial correlation between the volatility of copper and aluminum and the return of the stock market. Kumar et al. (2023) found no statistically significant correlation between the price of gold and the performance of the stock market. Gorton & Rouwenhorst (2006) demonstrated a negative correlation between commodity futures and the stock market. Woode et al. (2024) discovered that metal

commodities exert a detrimental influence on the stock market in the context of the COVID-19 pandemic and a drop in the metal market.

One of the consequential effects of the stock market is foreign exchange (Adiputri & Robiyanto, 2021; Danila et al., 2023; Du & Hu, 2012; He et al., 2023; Yunita & Robiyanto, 2018). Indonesia experienced a financial crisis in 1997–1998. The stock market dropped, and foreign exchange increased. The increase in foreign exchange caused the price of numerous products, including those that are daily necessities, to skyrocket. The result was hyperinflation. Due to the inability of the public to purchase necessities, many businesses were unable to sell their goods, suffered losses, and eventually went bankrupt. The circumstances caused the stock market to plummet.

Foreign exchange and the stock market are two significant components of the financial system. They are connecting to another component, such as real investment, consumption, GDP, and other macroeconomic performance (He et al., 2023). In a study conducted by He et al. (2023), it was shown that foreign exchange had a considerable negative impact on the Turkish stock market. Robiyanto et al. (2019) investigated the influence of foreign exchange on the stock market. The researchers discovered that the USD/IDR currency pair, which serves as a representative of foreign exchange, has a strong negative influence on the stock market. Danila et al. (2023) discovered a negative association between currency and the stock market. Patra & Poshakwale (2006) conducted a study on the Greek stock market and various economic factors, including foreign exchange. Their findings indicated that there was no association between foreign exchange and the stock market. Xie et al. (2020) investigated the relationship between foreign exchange and the stock market. There was no observed association between the foreign currency market and the stock market, according to their analysis. In their study, Diamandis & Drakos (2011) found a large and beneficial influence of foreign exchange on the stock market.

The dollar index, which is used to calculate the value of the US dollar, is a geometric average of the six major currencies. The Euro (57.6%), the Swedish Krona (4.2%), the Swiss Franc (3.6%), the British Pound Sterling (11.9%), the Swedish Krona (13.6%), and the Canadian Dollar (Canada) are the six major currencies. It was established by the US Federal Reserve in 1973 to provide bilateral trade with an average US dollar value. The dollar index is currently traded on the futures market under the symbol DXY (www.ice.com; Jalbert, 2013). A robust dollar is indicated by a strong value, and vice versa. Beginning in March 1973, this index had a value of 100 (Jalbert, 2013).

LQ45 and IDX30 were two of the stock indices developed based on market segmentation (Jalbert, 2013). For traders or investors who wish to trade or invest in liquid transaction stocks, the Indonesia Stock Exchanges regulation established LQ45. This allows them to purchase and sell those stocks without worrying that there will be no buyers or sellers who are against them. For investors seeking strong liquidity, large capitalization market value, and high-performing stocks, the

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Indonesia Stock Exchange established IDX30 (idx.co.id). Therefore, LQ45 and IDX30 will be the significant stock indices on the Indonesia Stock Exchange.

Launched on April 23, 2012, with a base value of 100, the Indonesia Stock Exchange Index 30 (IDX30) is one of the Indonesia stock exchange indexes that includes 30 of the top stocks in the Indonesian stock market. The IDX30 stock index evaluates a company's performance based on three factors: high market value, high liquidity, and strong performance. These companies will be chosen based on a variety of factors, including financial performance, free-float market capitalization, transaction volume, value, and others (idx.co.id). The infrastructure and financial sectors make up the majority of IDX30. The top 5 components are GoTo Gojek Tokopedia, Tbk, Bank Central Asia, Tbk, Bank Rakyat Indonesia (Persero), Tbk, Telkom Indonesia (Persero), Tbk, and Bank Mandiri (Persero), Tbk.

Figure 1. Fluctuation of LQ45

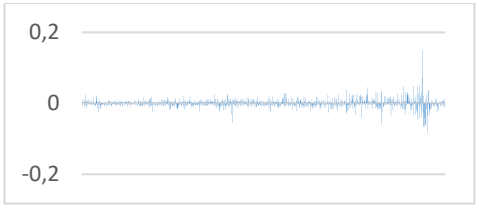



Figure 2. Fluctuation of IDX30

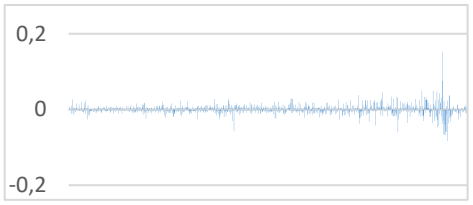



Figure 3. Fluctuation of DXY

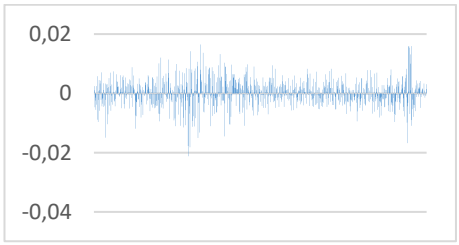
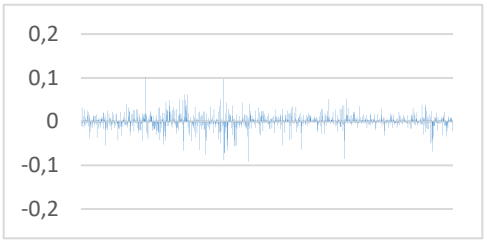



Figure 4. Fluctuation of TIN




Source: investing.com, processed

At least 70% of the capitalization and transaction value of the Indonesia Stock Exchange's 45 most liquid companies—which are listed on the IDX—are included in the LQ45 Index, which measures their performance. A stock that is included in the LQ45 index needs to be in strong financial standing, have room to grow, and see a lot of trading activity. Every six months, those stocks will be assessed; if any of them don't meet the set standards, they'll be replaced in the following stock selection cycle (idx.co.id)., LQ45 made its debut in February 1997.

The sectoral linkages theory states that the production of a sector would be an input of the other sector and the output of one sector becomes an input for a different sector. For instance, the production of metal tin from the tin-producing company would be an input for other companies, such as an electronic or automotive company. Therefore, the tin price would affect the revenue and profit of their company and its stock price. On the other side, the flow-oriented model states that the changes in foreign exchange has an impact on the stock market, hence there is an interconnected between foreign exchange and stock market.

This study aims to investigate the relationship between changes in TIN, a proxy for commodities on LQ45 and IDX30, and changes in DXY, a proxy for foreign currencies. Thus, the queries are: Is there a relationship between changes in foreign exchange and the stock market? and does the stock market correlate with commodities? This research will help stock investors and traders become more conscious of their portfolios.

The paper is segmented into the subsequent sections. Section 2 comprises the literature review and developed hypotheses. Section 3 presents the research methods. Section 4 highlights the findings and discussion. Section 5 shows the conclusion, limitations, and suggestions for future research.

**Literature Review and Hypotheses**

The stock market will be impacted by fluctuations in foreign exchange. Foreign exchange depreciation boosts exports, which benefits the exporter financially. As a result, it will be a good indication for investors to purchase that stock and raise its price. Theoretically, foreign exchange has an effect on a company's cash flow volatility, particularly on its foreign exchange debt (Du & Hu, 2012). Nonetheless, the stock market benefits from foreign exchange (Robiyanto et al., 2019).

Khan et al. (2021) investigated the relationship between the return on the Shanghai stock market and the prices of oil, gold, and currency rates., Khan et al (2021) used monthly time series data from the Shanghai Stock Exchange from January 2000 to December 2018. The outcome showed that exchange rates have a detrimental effect on stock returns. They advised investors to take exchange rate fluctuations into account.

He et al. (2023) investigated the causal association between the Turkish Stock Market Index (XU100) and foreign exchange rates (USD/TRY and EUR/TRY) in Turkey. They investigated the short- and long-term association between foreign exchange and the stock market using a monthly data set spanning from April 2000 to March 2019. Their empirical findings showed a negative connection between the stock market and foreign exchange, although there are differences in the co-movement strength and causality in the temporal and frequency domains. There is a larger association during times of financial crisis. However, Du and Hu (2012) discovered that there is no association between foreign exchange and the stock return cross-section or time series. They used information from 34 nations, including the United Kingdom, Austria, Australia, Canada, China, the Euro Area, Germany, Hong Kong, Japan, Korea, and New Zealand. They employed research using daily data from January 1973 to December 2010. In their investigation into the effect of foreign exchange on the Indonesia Stock Market (IDX), Danila et al. (2023) discovered that foreign exchange does have an effect on IDX. They used daily data from January 2, 2014, to November 5, 2019, for the Indonesia Stock Index (JCI) and USD/IDR. Glosten-Jagannathan-Runkle Generalized Auto-Regression Conditional Heteroskedasticity (GJR-GARCH) was the method they employed. According to their research, foreign exchange

significantly and negatively affects JCI. The weakening of the Indonesian Rupiah in relation to the US dollar puts a strain on state budgets and slows economic growth. As a result, the stock price will decline. According to Adiputri and Robiyanto (2021), the Dollar Index (DXY) was able to outperform the Indonesia Stock Market (IDX). They discovered that DXY positively affects LQ45, one of the Indonesian Stock Market's indexes. They employed the Generalized Auto Regression Conditional Heteroskedasticity (GARCH). The data was separated into two time periods: January to December 2019 prior to the COVID-19 epidemic, and January to December 2020 during the pandemic.

Tin may be a crucial component in things like electric car batteries, container lining, coating materials for electrical equipment, etc. In solder, around half of the tin is consumed. The demand for tin will rise in proportion to economic development or stability. Due to tin's significant role in upscale electronics, the demand for tin will decline as a result of the economic downturn's impact on that market. The product symbol for tin metal traded on the London Metal Exchange (LME) is SN. Numerous researchers have established a link between the stock index and commodity prices (Wadud et al., 2023). According to Bruno et al. (2017), the association increased during the Great Recession but decreased following it and the financial crisis. According to Civcir and Akkoç (2021), the price of commodities like gold and oil has a big impact on the stock market. Civcir and Akkoç (2021) contended that there is a relationship between the price of gold and oil and the stock market in Turkey, particularly in the sectors of banking, industry, technology, and services. They estimated the effect of oil and gold prices on the stock market using the SVAR-cDCC-GARCH approach. They utilized the daily prices of the Borsa Istanbul Stock Market, Brent oil, and gold from January 1, 2009, to December 31, 2017. The outcome is a favorable association between the price of gold and oil and the financial, industrial, and service sectors. The price of gold and oil has a negative relationship with the technology industry.

Zhu et al. (2021) investigated how non-ferrous metal prices affected the stock market. They used the Chicago Board of Exchange (CBOE) Volatility Index (VIX) as a stand-in for stock market uncertainty and the London Metal Exchange base metal index (LME index) as a proxy for non-ferrous metal pricing. They investigated the impact of non-ferrous metal prices on the stock market using quantile regression (QREQ). As a result, the stock market benefits from non-ferrous metal pricing. Furthermore, Peng et al. (2014) examined whether the volatility of metal prices can be used to predict stock market returns in China. They used monthly data from January 2004 to December 2011. The results show that copper can predict stock market returns better than aluminum.

Engle (1982) introduced Autoregressive Conditional Heteroscedasticity (ARCH) for examining time series data. Several years later, Bollerslev (1986) developed it and introduced Generalized Autoregressive Conditional Heteroscedasticity (GARCH). The GARCH model allows conditional variance to be dependent on its previous lags. GARCH transforms the autoregressive process from The ARCH model into an Auto Regressive Moving Average (ARMA) process by adding a moving average process (Gherghina et al., 2021). This paper uses

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GARCH (1.1) foe examining the spillover impact of DXY and TIN on Indonesia stock market.

The theory that explains the spillover impact of the exchange rate on the stock market is the flow-oriented model. The former was introduced by Dornbusch and Fischer (Dornbusch & Fischer, 1980). The flow-oriented emphasizes that the changes in foreign exchange have an impact on domestic or foreign goods, which consequently changes the competitiveness of the company, especially companies who export their product or import raw materials for their product, hence it will affect the company's revenue and/or cost of goods sold and its share price (Nusair & Olson, 2022; Yunanto & Medyawati, 2021; Živkov et al., 2023). Therefore, there is an interconnection between foreign exchange and the stock market, based on the flow-oriented model. The portfolio-balanced approach states that increasing demand for domestic stock affects increasing demand for domestic currency, and vice versa. Therefore, there is interconnection between foreign currency and stock market (Živkov et al., 2023).

The sectoral linkages theory, who was proposed by Albert O. Hirschman states the key concept of linkages (Hirschman, 1959). They are backward linkages, which that emphasize the production of a sector increases demand for input from other sectors, and forward linkages, which that emphasize the output of one sector becomes an input for other sectors. For instance, the growth in the production of electric cars increases the demand for batteries, and the production of tin being used in the production of batteries. Therefore, the tin price has an impact on the cost of goods sold of batteries and electric cars, hence it has an impact on its stock price (Peng et al., 2014).

According to the prior studies and based on theory, the following hypotheses can be made in light of the explanation:

H1: The volatility of the US Dollar Index (DXY) impacted on the volatility of LQ45 from January 2020 to December 2023

H2: The volatility of the US Dollar Index (DXY) impacted the volatility of IDX30 from January 2020 to December 2023.

H3: The volatility of TIN affected the volatility of LQ45 from January 2020 to December 2023

H4: The volatility of TIN affected the volatility of IDX30 from January 2020 to December 2023

**Research Methods**

The JCI Index LQ45, IDX30, US Dollar Index (DXY), and TIN daily fluctuations from January 2020 to December 2023 are the data used in this research. The source of that information was www.investing.com. There are 952 data series in the final dataset. The daily changes of LQ45, IDX30, DXY, and TIN are the variables in this article, and they are computed using:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

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Notes:

$R_t$ = changes of variables

$P_t$ = the price of variables in t period

$P_{t-1}$ = the price of variables in t-1 period

The stationary test is the first method used to look at the relationship between the US Dollar Index and the stock index. Time series data require a stationary test because they contain root or non-stationary data, which can lead to false or questionable regression results. Therefore, doing a stationary test is necessary. This study conducted a stationary test using the Augmented Dickey-Fuller (ADF) test (Robiyanto et al., 2019).

This research investigates the spillover effect of DXY and TIN on JCI Index LQ45 and IDX30's volatility using GARCH (Generalized Auto Regression Conditional Heteroskedasticity). Numerous researchers have discovered that this approach best explains time series data (Jalbert, 2013). Heteroskedasticity or non-constant residual variance could be resolved using the GARCH approach. It is necessary to test the stationary variables before estimating using the Garch technique. To determine if such variables are stationary, one option is to apply the Augmented Dickey-Fuller (ADF) test (Setiawan et al., 2021). This study's model is found in Yunita and Robiyanto (2018):

$$R_t = \alpha + \beta_t (X) + \varepsilon_t \quad (2)$$

$$\varepsilon_t = \Phi\varepsilon_{t-1} + \ldots + \Phi\varepsilon_{t-n} + \dot{\eta}_t \sim N(0,1) \quad (3)$$

$$\dot{\eta}_t = \sigma\varepsilon_t \quad (4)$$

$$\sigma\varepsilon_t = \alpha 0 + \alpha_1\dot{\eta}_{t-1} + \ldots + \alpha_n\dot{\eta}_{t-n} + \beta_1\sigma\varepsilon_{t-1} + \ldots + \beta_n\sigma\varepsilon_{t-n} \quad (5)$$

Notes:

$R_t$ = return of Y variables (LQ45 and IDX30)

$\alpha$ = constant

$\beta$ = slopes (DXY or TIN)

$\varepsilon_t$ = error term

The symbol $\varepsilon t$ can represent a discrete-time stochastic process with real values that is identical and independently distributed N(0,1) and are not affected by historical data. The entire knowledge set during time t is represented by X (Bollerslev, 1986; Yunita & Robiyanto, 2018).

**Findings and Discussion**

The descriptive statistics for the variables LQ45, IDX30, DXY, and TIN from January 2020 to December 2023 are shown in Table

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Table 1. Descriptive Statistic of Selected Variables

| | LQ45_CHANGE | IDX30_CHANGE | DXY_CHANGE | TIN_CHANGE |
|---|---|---|---|---|
| Mean | 1.72E-05 | -4.19E-05 | 6.40E-05 | 0.000480 |
| Median | 5.00E-05 | 5.00E-05 | 0.000000 | 0.001600 |
| Maximum | 0.149200 | 0.152900 | 0.016500 | 0.101200 |
| Minimum | -0.082600 | -0.082800 | -0.021200 | -0.091400 |
| Std. Dev. | 0.014127 | 0.014343 | 0.004557 | 0.019085 |
| Skewness | 0.706624 | 0.776897 | -0.148750 | -0.513601 |
| Kurtosis | 20.34782 | 20.64619 | 4.761761 | 7.161295 |
| Jarque-Bera | 12016.79 | 12447.49 | 126.6282 | 728.7369 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| Sum | 0.016400 | -0.039900 | 0.060900 | 0.457400 |
| Sum Sq. Dev. | 0.189794 | 0.195628 | 0.019749 | 0.346374 |
| Observations | 952 | 952 | 952 | 952 |

Source: the data processed using Eviews (2024)

The description of the variables LQ45, IDX30, DXY, and TIN are described in Table 1. The minimum and maximum of LQ45 are -0.0826 (or -8.26%) and 0.1492 (14.92%), with a corresponding change in the standard deviation of 0.014127. The figure of 14.92% happened on March 26, 2020, or at the start of COVID-19. The minimum and maximum of IDX30 variables are -0.0828 (or -8.28%) and 0.1529 (or 15.29%), with a standard deviation of 0.014343. The value of 15.29% happened on March 26, 2020, or at the start of COVID-19. The standard deviation of DXY is 0.004557 and the minimum and maximum are -0.0212, or -2.12%, to 0.0165, or 1.65%. The minimum and maximum of variable TIN are -0.091400, or -9.14%, and 0.101200, or 10.12% and the standard deviation of variable TIN is 0.019085. The total number of observations is 952 data.

Table 2. Correlation

| Correlation | LQ45 | IDX30 | DXY | TIN |
|---|---|---|---|---|
| LQ45 | 1.000000 | 0.997661 | 0.011348 | 0.145869 |
| IDX30 | 0.997661 | 1.000000 | 0.013598 | 0.143801 |
| DXY | 0.011348 | 0.013598 | 1.000000 | 0.022959 |
| TIN | 0.145869 | 0.143801 | 0.022959 | 1.000000 |

Source: the data processed using Eviews (2024)

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The maximum correlation was discovered between LQ45 and TIN (0.145869), while the lowest correlation was obtained between LQ45 and DXY (0.011348). There is no perfect correlation between any variables. Table 2 shows that TIN has a greater spillover impact on the Indonesian stock market (LQ45 and IDX30) compared to DXY. Indonesia might do this because to its substantial untapped tin reserves, which ranked as the fourth highest in the world in 2019 (internationaltin.org). The quantity of TIN sold will have an impact on GDP, thereby resulting in a favorable effect on the stock market.

Table 3. Unit Root Test

| Variable | t-Statistic | Probability | Result |
|---|---|---|---|
| LQ45 | -16.42708 | 0.0000 | Stationary |
| IDX30 | -16.40345 | 0.0000 | Stationary |
| DXY | -28.34875 | 0.0000 | Stationary |
| TIN | -29.41457 | 0.0000 | Stationary |

Source: the data processed using Eviews (2024)

Table 3 shows the Augmented Dickey-Fuller (ADF) test to describe the unit root test of the variables LQ45, IDX30, DXY, and TIN. The LQ45, IDX30, DXY, and TIN test results are significant in 1%. GARCH might be used to examine the stationary data of LQ45, IDX30, DXY, and TIN.

Table 4. GARCH Test Result

| Variables | | Coef. | Probability | RESID(-1)^2 | GARCH(-1) |
|---|---|---|---|---|---|
| Y | X | | | | |
| LQ45 | DXY | -0.176356 | 0.0068* | 0.0000 | 0.0000 |
| LQ45 | TIN | 0.045878 | 0.0012* | 0.0000 | 0.0000 |
| IDX30 | DXY | -0.171234 | 0.0090* | 0.0000 | 0.0000 |
| IDX30 | TIN | 0.10807 | 0.0228** | 0.0000 | 0.0000 |

Note: * and ** are significant at 0.01 and 0.05 levels of significance, respectively
Source: the data processed using Eviews (2024)

The spillover effect of DXY on LQ45 was described in Table 4. Due to the value of probability is smaller than 0.01, hence the spillover effect of DXY on LQ45 is significant at 1%. It suggests that from January 2020 to December 2023, there was a spillover effect of DXY on LQ45; thus, H1 could not be dismissed. The negative sign at the coefficient denotes an inverse relationship between LQ45 and DXY. It implies that if DXY changes less, LQ45 will change more, and vice versa. The coefficient result shows that for every 1% increase in DXY changing, the changing of LQ45 will decrease by 0.00176356, or 0.176356%. The LQ45 prediction error is influenced by the residuals from the prior period, as indicated by the RESID(-1)^2 probability value of 0.0000. The residual variable from the prior period has an impact on the LQ45 prediction error, as indicated by the GARCH probability value of 0.000. In contrast to Adiputri & Robiyanto (2021), this conclusion is corroborated by Khan et al. (2021), He et al. (2023), and Danila et al.

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(2023). According to Adiputri and Robiyanto's (2021) analysis, LQ45 and USD/IDR have a favorable association with DXY in 2020.

The spillover effect of DXY on IDX30 was described in Table 4. The spillover effect of DXY on IDX30 was 1%, as evidenced by a probability value less than 0.01. It suggests that from January 2020 to December 2023, there was a spillover effect of DXY on IDX30; thus, H2 was not rejected. The negative sign at the coefficient denotes an inverse correlation between DXY and IDX30. It implies that if DXY changes less, IDX30 will change more, and vice versa. The coefficient value shows that for every 1% rise in DXY changing, the changing of IDX30 will reduce by 0.00171234, or 0.176356%. The probability value of 0.0000 for RESID (-1)^2 indicates that the IDX30 prediction error is influenced by the residuals from the preceding period. The residual variant from the prior period has an impact on the IDX30 prediction error, as indicated by the GARCH probability value of 0.000. In contrast to Adiputri and Robiyanto (2021), this conclusion is corroborated by Khan et al. (2021), He et al. (2023), and Danila et al. (2023). According to research done in 2021 by Adiputri & Robiyanto, there is a favorable association between the DXY in 2020 and the JCI index LQ45.

The spillover effect of TIN on LQ45 is displayed in Table 4. The spillover effect of TIN on LQ45 is statistically significant due to a probability value smaller than 0.01. As a result, H3 is not rejected because it showed the was a spillover effect of TIN on LQ45 from January 2020 to December 2023. The fact that the coefficient has no sign minus suggests that TIN and LQ45 have a positive association. This indicates that if TIN changes, LQ45 changes as well, and vice versa. For every 1% rise in TIN, the coefficient value suggests that LQ45 will increase by 0.00045878 or 0.045878%. The LQ45 prediction error is influenced by the residuals from the prior period, as indicated by the RESID(-1)^2 probability value of 0.0000. The residual variable from the prior period has an impact on the LQ45 prediction error, as indicated by the GARCH probability value of 0.000. Zhu et al. (2021), looked at how non-ferrous metal prices affected the stock market, and Peng et al (2014), which found there was a significant correlation between metal prices and the stock market, corroborating this finding.

The association between IDX30 and TIN is displayed in Table 3. IDX30 and TIN exhibit a substantial association at 1%, as indicated by a probability value of less than 0.01. It suggests that there was a link between TIN and IDX30 from January 2020 to December 2023, which is why H4 was not rejected. The fact that the coefficient has no sign of minus suggests that IDX30 and TIN have a positive association. It implies that if the TIN increases, IDX30 will as well, and vice versa. According to the coefficient's value, for every 1% increase in TIN, IDX30 will rise by 0.00108070, or 0.10807%. The probability value of 0.0000 for RESID(-1)^2 indicates that the IDX30 prediction error is influenced by the residuals from the preceding period. The residual variant from the prior period has an impact on the IDX30 prediction error, as indicated by the GARCH probability value of 0.000. Zhu et al. (2021), who looked at how non-ferrous metal prices affected the stock market, and Peng et al (2014), that found there was a significant correlation between metal price and stock market, corroborated this finding.

## Conclusion

It has been demonstrated that DXY changes estimate LQ45 and IDX30's volatility. During times of difficulty, the COVID-19 era, there is a stronger spillover effect between the foreign currency market and the stock market (He et al., 2023). When the US Dollar Index rises, the value of the Indonesian Rupiah relative to the US Dollar will also rise. The exporting company will make more money than the importing company. Businesses with international debt, particularly those denominated in US dollars, have to get ready or increase their payments in order to fulfill their commitment. The stock price will decline as a result of higher costs and lower profits.

It has been demonstrated that TIN changes estimate LQ45 and IDX30's volatility. The mining business will sell its TIN reserve at a higher price as a result of the rising price. Their stock price will rise as a result of their increased earnings. Another explanation is that the metal price has an impact on macroeconomics, including industrial production, unemployment, the exchange rate, GDP, and other things; hence, it will relate to the stock market. The fluctuation of foreign exchange, particularly that of DXY, and metal prices, such as TIN, should be taken into consideration by investors, stock traders, and investment managers as it will affect their portfolio. The main constraint of this article is its exclusive dependence on data from the years 2020 to 2023, with only one proxy for foreign exchange and commodities, therefore the next paper will examine the relationship between stock market volatility in the BRICS countries and non-ferrous metals, including aluminum, copper, and nickel.

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