



Analysis of the Causality Relationship Between World-Tin Prices, Tin Stock Prices, Tin Ore Production, and Exchange Rates in Indonesia

Rahayu Zakiah¹, Muhammad Faisal Akbar^{2*}, and Eka Fitriyanti³

^{1,2,3} Faculty of Economics and Business, Universitas Bangka Belitung, Bangka Belitung Province 33172, Indonesia

*faisal-akbar@ubb.ac.id.com

Abstract. Indonesia has abundant natural resources. Tin is widely used in the world as weapons, fire-resistant clothing, electronics, and aviation components are some of the main items made from tin. World demand for tin is estimated to reach 360,000 tons per year and continues to increase along with advances in industrial technology and human lifestyle. World tin prices are influenced by a number of variables, including changes in tin stock prices, tin production, fluctuations in international currency exchange rates, as well as supply and demand dynamics. This research aims to analyze the relationship between World Tin Prices, Tin Stock Prices, and Exchange Rates in Indonesia. This type of research is a type of quantitative research. The data source in this research uses secondary data obtained from the London Metal Exchange (LME), Indonesia Stock Exchange (IDX), World Bureau of Metal Statistics (WBMS), and Ministry of Trade Statistics. The data used are data on World Tin Prices, Tin Stock Prices, Tin Ore Production, and exchange rates in the form of monthly time series for the period January 2018 to December 2023. The results of the research show that there is a one-way relationship between tin production and the exchange rate. In the long-term relationship between world tin prices, tin stock prices, tin production and exchange rates, there is cointegration or balance.

Keywords: World Tin Price, Tin Stock Price, Tin Ore Production, Exchange Rate.

1 Introduction

Indonesia has abundant natural resources. According to the Geological Agency of the Ministry of Energy and Mineral Resources (ESDM). Natural resources are ecosystems that play a role in meeting human needs. Available resources can be used on the earth's surface that have been preserved and utilized to meet human needs forever [1].

Renewable and non-renewable natural resources are abundant in Indonesia and can be utilized in the country's economy. This can be seen in regions such as Kalimantan, Sumatra, and Papua which are rich in natural resources. However, some regions, such as Bangka Belitung Province, only have one main type of natural resource, tin [2].

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Meanwhile, tin production in Indonesia reached 84,000 metric tons in 2014, indicating that the country is one of the largest tin producers in the world, accounting for about 30% of global tin production. Indonesia is the second largest tin producer in the world and the first largest producer is the People's Republic of China (PRC), with a production of 110,000 metric tons. Bangka Belitung Islands Province is known as one of Indonesia's tin producers. In addition to agriculture, tin mining is also a major industry in the economic structure of the people in Indonesia, especially the Province of Bangka Belitung Islands [3].

The unique quality of tin from Bangka Belitung Islands Province is white tin (stannum) which is marketed under the Banka Tin brand and is said to be the highest quality available worldwide. The 19th century colonial era was the beginning of the tin mining business which was then supervised by the Indonesian government. Independence with the State-Owned Enterprise PT Timah. PT Timah was established in 1976 with the aim of advancing the tin business. It was authorized to mine 331,580 hectares on land and 184,400 hectares at sea [4].

Tin is widely used in the world as a material for weapons, fireproof clothing, electronics, and aviation components are some of the main items made from tin ore. Tin can also be used as a coating on light metal structures, canned goods, steel goods, aluminum products, and welded metal parts. Given its many benefits, tin is one of the materials needed by the world. At the end of 2023, tin commodities for June-August began to experience price increases until October 9, 2023, the price of tin commodities had reached US\$25,000 per ton, based on trading activity monitored by Westmetall. Tin goods trading has decreased by 0.75% on an annual basis (year on year) and by 0.79% [5].

The world demand for tin is estimated at 360,000 tons per year and continues to increase as industrial technology and human lifestyles progress. White tin is a material used to coat metals. In addition, tin can improve material performance, stop corrosion, and enhance the appearance of other metals [6]. Then According to by Kettle et al. [7] argues that due to a lack of supply and a decrease in global tin supply, tin prices are expected to increase in the next three to four months, with an estimated range of USD 30,000 to USD 35,000 or more per ton.

Indonesia as the third largest tin supplier in the world, certainly feels the impact of the decline in world tin value. PT Timah Tbk as Indonesia's main company engaged in the tin sector, feels the impact of the decline in the world's tin value. The decline in the value of tin on the London Metal Exchange (LME) tin exchange makes the national tin price also decreased. According to the latest data from the London Metal Exchange (LME) due to the high demand for tin by many countries, as well as the need to produce goods that use tin raw materials and the rapid advancement of technology, the price of tin in the world is expected to continue to increase until April 2024, reaching US\$32,825 per ton [8]. This refers to the data in the figure 1.

Figure 1 shows that the average world tin price fluctuates where the world tin price from 2018 - 2020 the average price of tin has decreased while, in 2021 the average world tin price has increased very high, then in 2022 - 2023 the average world tin price has decreased again. The price of tin has increased considerably from USD

17,158.70/matrix ton (Mton) to USD 32,678.16/Mton. The relationship between commodity prices and stocks can also be explained in commodity financialization which is an intermarket relationship between commodities, stock markets and bond markets [9]. The movement of the average price of tin stocks in Indonesia in 2018-2023 can be seen in Figure 2.

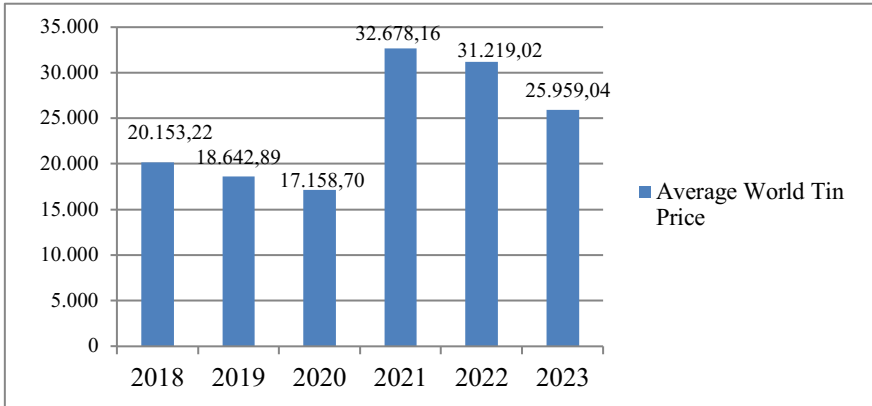


Fig. 1. Average World Tin Price 2018-2023

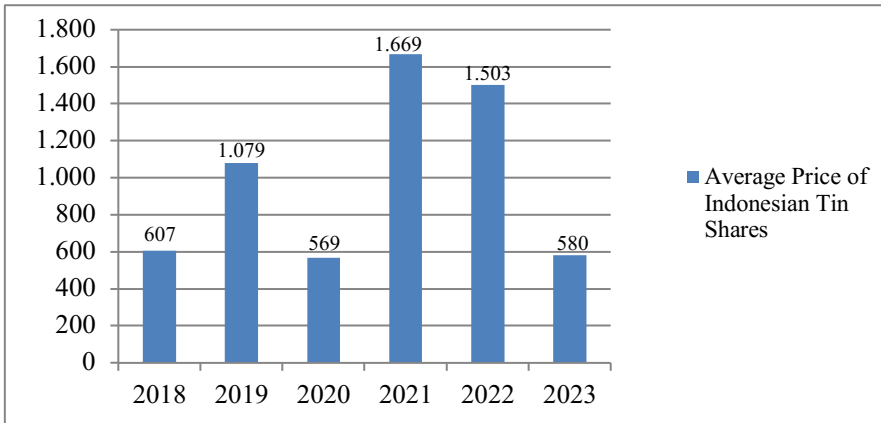


Fig. 2. Average Price of Indonesian Tin Shares 2018-2023

Based on Figure 2 the average price of tin stocks from 2018-2023 has fluctuated. The highest average occurred in 2021 amounting to Rp1,669 and the lowest average occurred in 2020 amounting to Rp569. During 2020-2021 there was a significant increase of IDR 1,100, while in 2022-2023 there was a decrease of IDR 923. This shows a different intermarket relationship. The intermarket relationship between the commodity market and the stock market can occur due to the financialization of the commodity market [10]. Tin processing production in Indonesia in the industrial sector has recently experienced a slowdown in growth, so that the growth of the national economy is felt

to be starting to decline. One way to obtain revenue from tin processing production can be measured by how much tin production is produced. The growth of tin ore production in Indonesia in 2018-2023 can be seen in Figure 3 below:

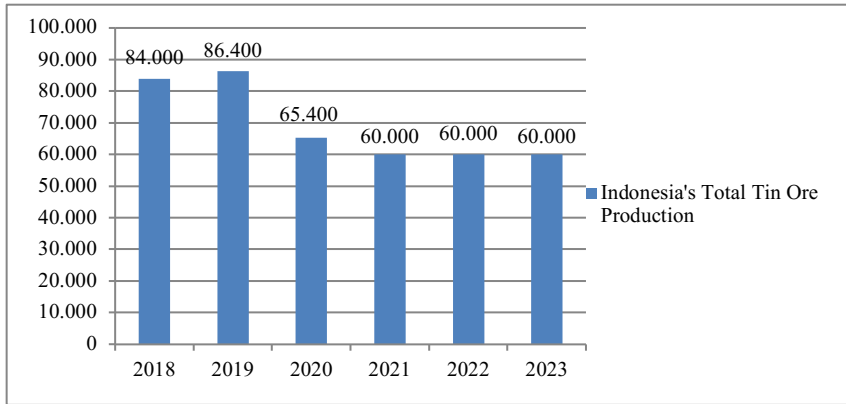


Fig. 3. Indonesia's Total Tin Ore Production 2018-2023 Source: World Bureau of Metal Statistics (WBMS), 2024

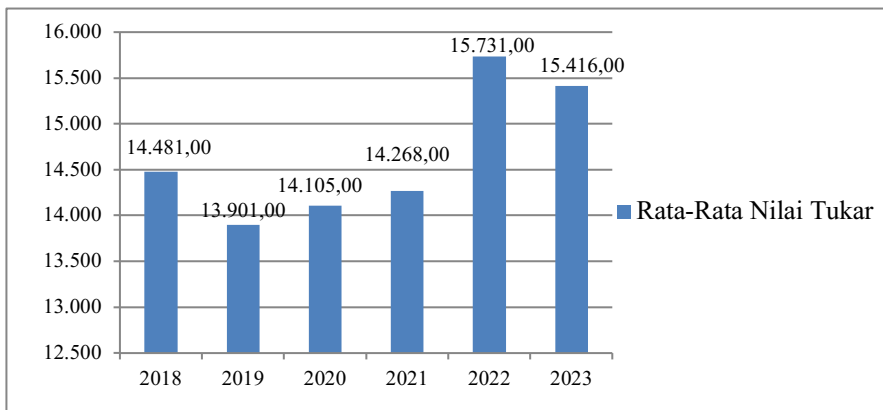


Fig. 4. Average Exchange Rate of Indonesia in 2018-2023

Based on Figure 3, the data obtained from the World Bureau of Metal Statistics (WBMS), shows that the growth of tin ore production in Indonesia from 2018-2023 has fluctuated. The highest total tin ore production occurred in 2019, which amounted to 86,400 while the lowest total tin ore production occurred in 2021-2023 with a total of 60,000. One of the factors for the decline in tin ore production is due to the rise of illegal tin ore miners. In addition, due to the decline in sales volume, the decline in the average selling price of tin, and the slow recovery of the global and domestic economy. So, the weak demand for tin due to high LME inventories has resulted in a decline in Indonesia's tin exports since 2022 until now. It can be seen in Figure 4 the average

condition of the exchange rate based on statistical data from the Ministry of Trade (Kemendag) from 2018-2023.

Based on Figure 4, it illustrates that the data on the average foreign exchange rate against the rupiah from 2018 to 2023 that occurred in Indonesia fluctuated. The highest average exchange rate occurred in 2022 at IDR 15,731 per US dollar and the lowest average exchange rate occurred in 2019 at IDR 13,901 per US dollar. Apart from being seen in terms of exchange rates, the production of goods to be exported is also seen from the superior potential of a country so that it can be taken into consideration and make decisions that domestic needs are sufficient.

2 Research Methods

2.1 Model Feasibility Test

The model feasibility test is carried out before continuing the next test, in the VECM method the model feasibility test that can be seen is probability. If the majority of probability values > 0.05 then the conclusion is that some lag optimums fail to reject H_0 , meaning that there is no autocorrelation of the residuals in the model or it can be interpreted that it has fulfilled the total feasibility study.

2.2 Granger Causality Test

The granger causality test is a test to measure the strength of the relationship between two or more variables. In other words, it questions the causal problem between these variables. The purpose of causality testing is to determine whether the model of the variables used has a backward relationship. The following is a granger causality equation model:

$$Y_{it} = \sum a Y_{it-i} + \sum \beta_j X_{it-j} + \varepsilon_{1t}; X \rightarrow Y \text{ if } \beta_j > 0 \quad (1)$$

$$X_{it} = \sum \lambda Y_{it-i} + \sum \gamma_j X_{it-j} + \varepsilon_{2t}; Y \rightarrow X \text{ if } \gamma_j > 0 \quad (2)$$

Where:

Y : The dependent variable

X : Free variable

s_1, s_2 : Error of term

3 Results and Discussions

3.1 Model Feasibility Test Results

The feasibility test of the model in this study is seen in the probability value, if the majority of the probability value is > 0.05 then the log optimum can be said to have met the feasibility of the model.

Table 1. Model Feasibility Test Results

Lags	Q-Stat	Prob*	Adj Q-Stat	Prob*	Df
1	2.637100	NA*	2.676460	NA*	NA*
2	16.76952	NA*	17.23713	NA*	NA*
3	23.04011	0.7310	23.79713	0.6922	28
4	33.77363	0.8677	35.20150	0.8255	44
5	43.87917	0.9414	46.10907	0.9065	60
6	51.61867	0.9855	54.59756	0.9697	76
7	67.58604	0.9738	72.39724	0.9348	92
8	83.24319	0.9631	90.14201	0.8931	108
9	97.44835	0.9625	106.5141	0.8696	124
10	107.6979	0.9804	118.5308	0.9057	140
11	120.4107	0.9844	133.6970	0.9015	156
12	137.5407	0.9751	154.4977	0.8268	172
13	179.7029	0.6554	206.6254	0.1674	188
14	185.4749	0.8194	213.8939	0.3033	204
15	212.3002	0.6329	248.3113	0.0922	220
16	218.9554	0.7804	257.0142	0.1659	236
17	223.4828	0.9018	263.0507	0.3033	252
18	231.5136	0.9479	273.9726	0.3879	268
19	234.8721	0.9848	278.6335	0.5787	284
20	249.0683	0.9855	298.7447	0.5096	300

The results of the model feasibility test in Table 1 found that the majority of the probability value is > 0.05 , so it is stated that this log optimum result carried out in the previous test has fulfilled the feasibility of the model.

3.2 Granger Causality Test Results

The granger causality test is used to see the direction of the relationship between a variable and another variable. This test is needed to observe whether or not there is a reciprocal relationship between variables. The presence or absence of a relationship is seen from the probability value of each causality test which is then compared to the alpha value of 0.05. If the probability value is less than 0.05, then the variable has a reciprocal relationship with other variables.

Table 2. Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob
HTD does not Granger Cause HST	70	0.23778	0.7891
HST does not Granger Cause HTD		0.23056	0.7947
NT does not Granger Cause HST	70	1.68949	0.1926
HST does not Granger Cause NT		34.4731	6.E-11
PBT does not Granger Cause HST	70	0.76281	0.4705
HST does not Granger Cause PBT		1198.26	5.E-52
NT does not Granger Cause HTD	70	0.37795	0.6868

Null Hypothesis:	Obs	F-Statistic	Prob
HTD does not Granger Cause NT		0.52139	0.5962
PBT does not Granger Cause HTD	70	1.99909	0.1437
HTD does not Granger Cause PBT		0.02986	0.9706
PBT does not Granger Cause NT	70	2.58969	0.0828
NT does not Granger Cause PBT		9.07734	0.000

Based on the results of Table 2, it is found that the world tin price does not affect the price of tin stocks in Indonesia with a probability value of 0.7891, conversely the price of tin stocks Indonesia does not affect the world tin price with a probability value of 0.7947. Then, the exchange rate does not affect the price of tin stocks in Indonesia with a probability value of 0.1926, otherwise the price of Indonesian tin stocks does not affect the exchange rate with a probability value of 6.E-11.

Based on these results, tin ore production does not affect the price of tin stocks in Indonesia with a probability value of 0.4705, otherwise the price of Indonesian tin stocks does not affect tin ore production with a probability value of 5.E-52. Then, the exchange rate does not affect the world tin price in Indonesia with a probability value of 0.6868, conversely, the world tin price in Indonesia does not affect the exchange rate with a probability value of 0.5962. Based on these results, tin ore production does not affect the world tin price in Indonesia with a probability value of 0.1437, conversely, the world tin price of Indonesia does not affect tin ore production with a probability value of 0.9706. Then, tin ore production does not affect the exchange rate in Indonesia with a probability value of 0.0828, but the Indonesian exchange rate affects tin ore production with a probability value of 0.0000.

4 Conclusions

Based on the results of data analysis and discussion, then it can be concluded:

1. The Causality Relationship between World Tin Price, Tin Stock Price, Tin Ore Production, and Exchange Rate as follows:
 - There is no causal relationship between the global Tin Price and the Tin Stock Price in Indonesia.
 - There is no causal relationship between Tin Ore Production and World Tin Prices in Indonesia.
 - There is no causal relationship between Exchange Rate and World Tin Price in Indonesia.
 - There is no causal relationship between Exchange Rate and Tin Stock Price in Indonesia.
 - There is no causal relationship between Tin Ore Production and Tin Stock Price in Indonesia.
2. There is a one-way causal relationship between Tin Ore Production and Exchange Rate in Indonesia

3. There is a long-term equilibrium relationship on the World Tin Price in Indonesia. This long-term relationship of the World Tin Price in Indonesia is supported by the Tin Stock Price
4. Impulse Response Function analysis shows that there is a fluctuating response although the movement is slowing down in the long run between the world tin price and the exchange rate in Indonesia while the world tin price gives a positive response to the exchange rate.
5. Variance Decomposition analysis shows that world tin prices have a greater contribution to tin stock prices than the contribution of tin stock prices to world tin prices.

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