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International Journal of Energy Economics and Policy <ijeep@econjournals.com>   02 March 2021 pukul 02.21
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The Effect of World Oil Prices, Gold Prices and Other Energy Prices on the Indonesian Mining Sector With Exchange Rate of Indonesian Rupiah as the Moderating Effect

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ABSTRACT

The purpose of this research was to anlyze the effect of world oil prices, gold prices, and rupiah exchange rates against the dollar toward mining sector stock returns with the rupiah exchange rate as a moderating variable. The mining sector was the sector that ranks third sector driving the growth of the IHSG in 2017. Used monthly stock price return, monthly world oil price, monthly gold prices, and monthly rupiah exchange rate against the dollar, this research was analysis with a sample of 48 months from 2015 to 2018 from IDX, This research method is Moderated Regression Analysis (MRA)
The results showed that there was a significant influence between oil prices, gold prices and the rupiah exchange rate on mining sector stock returns. With the MRA test, it was concluded that the rupiah exchange rate could not moderate the influence between world oil prices and gold prices on the mining sector stock returns

Keywords: Oil Price, Gold Price, Exchange Rate, Mining Sector Stock Returns, and MRA
JEL Classifications: Q41, Q47.

1. INTRODUCTION

The capital market is currently one of the most popular investment tools besides land, gold, and real estate. The capital market is also a high-risk investment compared to other investment tools. Considering that can't be separated the capital market from a country's economic condition, if the financial situation is good, it will increase the issuer's share price as a whole and vice versa (Jannah and Ady, 2017). The Indonesian stock market's statue is sawing from the Integrated Stock Price Index (IHSG) trend. Many companies from various industries are include in the index, one of which is the mining industry, which will be discussing in this study.

A study conducted by the Indonesian Policy Brief (2014) found that Indonesia is the largest mining producer. Indonesia is the second-largest tin producer globally, the fourth largest copper mine globally, the fifth-largest nickel mine globally, and the largest gold and coal. Eighth in the world, Indonesia has become an essential country in the world mining industry. The stock index's development in the mining

sector can be showed by fluctuations in shares traded on the stock exchange. This unstable price change usually is caused by factors, such as internal factors (company performance) (Ady, Salim, and Susanto 2010) and external factors, which are variables in this study, such as price—world oil, world gold prices, and the rupiah exchange rate against the United States dollar, including market anomalies (Nuroniyah, Ady, and Sugiyanto 2018).

Many studies explain the factors that influence the mining industry stock price, which affect the results (returns) obtained. Research conducted by Movahedizadeh et al. (2014); Cong et al. (2008) show that world oil prices have a positive effect on stock returns, but Kuwornu (2012) do not show that oil prices have a negative impact effect on returns on mining stocks. Research conducted by Dwiati & Ambarwati (2017) shows that gold prices positively impact the IHSG but cannot moderate the Indonesian rupiah exchange rate.

Previous research has yielded inconsistent results, or research gaps arise due to

inconsistent results due to the research industry, different testing tools, and the year's timing and economic conditions. Also, considering that mining companies are most sensitive to changes in exchange rates, several studies have been conducted on the rupiah exchange rate as a moderating variable. Therefore, various factors are using in this study, namely macroeconomic factors (exchange rates) and commodity prices (oil prices and world gold prices). The time of this research is 2015-2018.

This study aimed to determine the effect of mining commodity prices (world oil and gold) and macroeconomics (exchange rates) on the Indonesian mining industry's stock returns.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS FORMULATION

2.1 Stock Return
Expect for future investment investors. Return is also one of the reasons investors invest. Return, according to Hartono (2010), is the result obtained from an investment.

There are two main elements of total stock returns, namely: capital gains and dividends. Capital gain is obtaining by investors from the difference between the buying price and the selling price. That means this if the buy price is less than the selling price, it means that the investor has received capital gains, and vice versa, which is called a capital loss. Meanwhile, dividends are the results obtained by investors by owning company shares and can be collected in cash (cash dividends) and percentages (stock dividends) Hartono (2010). In this study, the return studied is the mining industry's return.

2.2 The Influence of World Oil Prices on the Mining Sector Stock Return
The oil price used in this study is WTI (West Texas Intermediate), which is the standard oil price sold at most in the world. Because this type of crude oil has high quality (light sweet) and has a shallow sulfur content, this type of oil is also suitable for energy fuel needs, and crude oil is needed to carry out economic activity. That happens because capital market investors think that the increase in world crude oil prices is a sign of increasing demand, which indicates an improving global economy (Widjanarko et

al. 2020). An increase followed the rise in world oil demand for mining commodities. On the other hand, the decline in mining commodity prices reflects the weakening global economic recovery. If the price of crude oil increases, expectations of an improvement in mining companies' performance will also increase, and automatically their share prices will rise again, followed by the rise in *returns* stock in the mining sector.

Research conducted by Movahedizadeh et al. (2014) also shows the positively affect World Oil Prices on returns Tehran stock. That is because the rising oil price will also increase the cost of other mining commodities, increasing the profit of mining companies, and providing an increase in the return of shares in the mining sector. Likewise, the research results of Degiannakis et al. (2017) and Akinlo (2014) found that oil price fluctuations have a significant positive impact on stock market fluctuations. So that the hypothesis can the hypothesis formulated:
H1: World oil prices have a positive effect on stock returns in the mining sector

2.3 The Effect of Gold Prices on the Mining Sector Stock Return
Gold is also included in an investment instrument, commonly referred to as a haven because it is liquid and has a low level of risk, and prices rarely decline. In their research, Yunita et al. (2018) found that the rising gold price will increase the stock price index so that the *return* obtained will also increase. The demand for gold is so high that the price continues to rise, mainly since many mining companies process pure gold for jewelry. The pricing of gold tends to correlate with the share price of the mining sector directly. Also, mining companies can increase their profits from selling gold to people who invest in gold for speculation. Also, Putra & Robiyanto (2019) research results show that gold prices significantly affect stock returns in the mining sector. Hlupo (2017) also indicates a short-term, unidirectional relationship between gold prices and mining industry stock prices.

The gold price data used in this study is the change in monthly prices obtained from the website goldpricenetwork.com which is the standard price worldwide, and the pricing of

gold in this study uses troy ounces (31.103 grams) and uses the pricing in dollars. So can formulate hypothesis:

H2: The gold price has a positive effect on stock returns in the mining sector.

2.4 The Effect of Rupiah Exchange Rate on the Return of Mining Sector Shares

The exchange rate is a means of payment with funding or international economic trade transactions using foreign currencies. In the free market, the exchange rate is determining by the number of requests and supplies for a country's currency. Still, the most traded currency in the United States dollar is the hard currency (Widjanarko et al., 2020). The Indonesian government also has many policies regarding exchange rates to maintain economic stability, including fiscal and monetary policies that impact the selling, buying, and middle rates. Exchange rates also affect companies that carry out export-import activities and affect their finances and share value in the capital market. When the exchange rate rises and the domestic currency depreciates, companies with liabilities (debt) in dollars will record a small profit on their financial statements and may experience losses so that their share price in the capital market also falls. Therefore, in working on a project, a project risk assessment is needed before the project is funded to see the feasibility of the project being an investment (Sulastri et al. 2019), especially projects related to the environment such as mining that should pass an EIA assessment, which sometimes requires capital in the short term or unplanned long term (Ady et al. 2020). The exchange rate data used in this study is the selling rate taken from the site www.bi.go.id 2020. Also, Apituley (2018) found that the relationship between the rupiah exchange rate and the JCI shows a positive relationship. This result indicates that the higher the rupiah exchange rate will increase the JCI. So the hypothesis is formulated:

H3: The rupiah exchange rate had a negative impact effect on stock returns in the mining sector.

2.5 The Effect of the Rupiah Exchange Rate as a Moderating Variable of the Relationship between Oil and Gold Prices on the Mining Sector Stock Return

Exchange rate as a means of payment and fixing oil and gold price, where the oil price in barrels and gold is trying, oz always uses dollars to determine the price. So the exchange rate had an impact effect on the price of oil and gold.

Research conducted by Arfaoui & Rejeb (2017) shows that many factors, including exchange rates, can compile oil prices. And research conducted by Mochammad Yusuf Wicaksono (2016) and Zagaglia & Marzo (2010) shows that the exchange rate has a positive effect on the gold price.

Research conducted by Mashayekhi et al. (2013) shows that the price of gold is affected by many factors, including the exchange rate.

Based on the explanation and research results above, it can conclude that the hypothesis:

H4: The rupiah exchange rate moderates the impact of oil prices on stock returns in the mining sector.

H5: The rupiah exchange rate moderates the effect of gold prices on the mining sector stock returns.

3. CONCEPTUAL FRAMEWORK

Figure I: Conceptual Framework of the Effect of Oil Prices, Gold Prices on Stock Returns in the Mining Sector with the Exchange Rate as a Moderating Variable
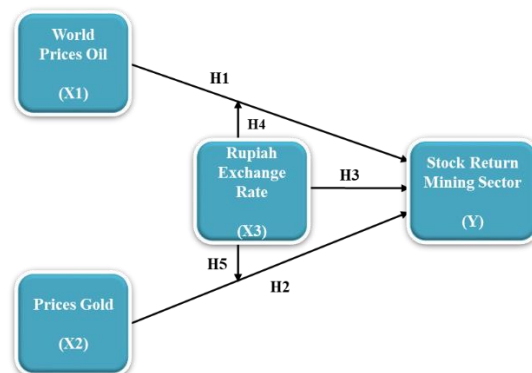
4. METHODS OF THE STUDY

This research is a quantitative study. Used secondary data, namely, data are a take on from various research sources such as data on the closing of world oil prices every month taken from the Energy Information Administration website, the pricing of gold every month from www.goldpricenetwork.com and the selling rate every month from the official website of Bank Indonesia namely www.bi.go.id 2020. This research period is from 2015 to 2018, and for the mining sector, stock returns can be from the obtained IDX Monthly Statistic. So that is getting as many as 48 research samples.

5. DATA ANALYSIS TECHNIQUE

This study's data analysis technique uses Moderated Regression Analysis (MRA), a particular application in multiple linear regression. The regression equation contains interaction or multiplication elements between two or more independent variables Ghozali, (2013). MRA is used to determine whether moderation will strengthen or weaken the relationship between the independent and dependent variables. The classical assumption test is using to qualify for the use of multiple linear regression models. Some of the classical assumptions used include normality test, multicollinearity test, and heteroscedasticity test. Analysis The coefficient of determination (adjusted R^2) To measure how far the model can explain variations in the dependent variable.

The research model used is:

$$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \varepsilon…(1)$$
(Ghozali 2005)

$$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X1*X3 + \beta5X2*X3 \varepsilon........(2)$$ (Ghozali 2005)

Keterangan:

Y   = Return of Mining Sector Stock

X1   = World Oil Price

X2   = Gold Price

X3   = Rupiah Exchange Rate

a   = Ratio Constant

ε   = Standard Error

b_1, b_2, b_3 = Coefficient of Independent Variables

6. RESULTS AND DISCUSSION

Descriptive Analysis

Table I: Descriptive Statistics

	Mean	Std. Deviation	N
Return Saham	1,0048	7,24552	48
Oil Prices	51,9138	10,03313	48
Gold Prices	1231,88	73,087	48
Exchange Rate	13646,96	551,717	48

Source: Secondary Data, The author (2019)

Of the results, the descriptive analysis above the mining sector's stock return can be obtained from the closing price of the mining sector shares every month during the research, and the average is 1.0048.

Normality Test Results

Table II: One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		48
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	6,37386326
Most Extreme Differences	Absolute	,078
	Positive	,078
	Negative	-,076
Kolmogorov-Smirnov Z		,539
Asymp. Sig. (2-tailed)		,933
a. Test distribution is Normal.		

Table 2, the results of the normality Kolmogorov-Smirnov test on the variable Oil Price, Exchange Rate, Gold Price show that the Asymp.Sig. (2-tailed) value> 0.05, which is equal to 0.933. That shows that HO is accepted, and overall the variables are normally distributed.

7. HYPOTHESIS TEST RESULTS

7.1 Test Results Hypothesis 1

Hypothesis 1 was testing using regression model 1. The test results are as follows:

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Oil Prices	-,331	,120	-,459	-2,761	,008

Source: Secondary Data, The author (2019)

The first hypothesis test showed that the value oil price of -2.761 with a significance value of t (sig-t) of 0.008 (p > 0.05). That means that oil prices have an impact negatively significant effect on Stock Returns. That shows that the first hypothesis is rejected, where when the world oil price increases by 1 unit, the mining sector stock return will decrease by -2,761 units.

7.2 Test Results Hypothesis 2

Hypothesis 2 was testing using a regression model 1. The test results are as follows:

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Gold Prices	48,847	15,062	,493	3,243	,002

Source: Secondary Data, The author

The second hypothesis testing indicates that value Gold Prices of 3.243 with a significance value of t (sig-t) of 0.002 (p> 0.05). That means that the price of gold has a significant positive effect on Stock Return. That shows that the second hypothesis is accepted, where when the price of gold increases by 1 unit, the return of the mining sector shares will increase by 3.243 units.

7.3 Test Results Hypothesis 3

Hypothesis 3 was testing using regression model 1. The results of the test are as follows:

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Exchange Rate	,004	,002	,268	1,635	,109

Source: Secondary Data, The author

The third hypothesis testing shows that the exchange rate variable has a value $_{calculated}$ of 1.635 with a significance value of t (sig-t) of 0.109. That means the exchange rate has no significant positive effect on stock returns, from the calculation results rejecting H3.

7.4 Test Results Hypothesis 4&5

Tested hypotheses 4 & 5 use regression model 2. The results of these tests are as follows:

Coefficients*					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
X1*X3	,000	,000	-4,002	-,951	,347
X2*X3	3,239E0	,000	4,787	,793	,432
a. Dependent Variable: Stock Return					

Source: Secondary Data, The author

This study indicates that the exchange rate as a moderating variable cannot moderate the variables of world oil prices and gold prices on stock returns. That is because the results of the t-test show a low level of influence (no effect) and a significance level of> 0.05%.

8. DISCUSSION

Based on research and tests conducted can be concluded that:

8.1 World oil prices have an impact negative a significant effect on stock returns in the mining sector.

The world oil price that tends to rise will result in a decrease in profits generated by mining companies because there will be an increase in operating costs within the company, resulting in reduced yields. As a result, the stock market immediately responded negatively. Quoting IDX trade data in 2018, the mining sector was a sector that experienced a very sharp decline because, in October, the world oil price rose to 70.75 dollars/barrel, so that the mining sector recorded a weakening of up to 1.79%. That can happen because coal companies with 23 coal companies dominate the mining sector's driving force. In contrast, only seven companies in the oil and gas sector cause a decrease in returns earned in this sector.

This study's results are consistent with findings Kuwornu (2012), which state that world oil prices negatively impact stock returns in the mining sector. Then, Kelikume & Muritala (2019) show that oil prices negatively impact African stock markets.

However, this study is not in line with the results of research conducted by Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014), and Putra & Robiyanto (2019) who say that world oil prices have a positive effect on stock returns in the mining sector. Also, Basher et al. (2012) show a positive impact on oil prices on emerging market share prices and the US dollar.

8.2 The price of gold has a significant positive effect on stock returns in the mining sector.

According to researchers, this is because the price of gold, which has increased, will increase mining companies' income because there is a lot of demand for gold, making mining companies record profits on their financial statements (Jannah & Ady, 2017). In 2018 ANTM shares rose 37% and MDKA 4.5%, and Jresources 30%. They are causing a positive sentiment on the stock exchange so that mining stocks also rose in price as a study of gaining profits and a positive opinion from the stock exchange. The return generated by this sector also increased.

The results of this study are following (Dwiati & Ambarwati, 2017); (Putra & Robiyanto, 2019) who say that gold prices have a positive effect on stock returns in the mining sector in Indonesia. Also, Apituley (2018) found that the relationship between the rupiah exchange rate and the JCI shows a positive relationship. This result indicates that the higher the rupiah exchange rate will increase the JCI.

However, this study is not in line with the research results conducted by Arfaoui & Rejeb (2017) that the gold price can use by many factors, including oil prices, dollar exchange rates, and the capital market. And not in line with Hutapea et al. (2014) and Utama & Puryandani (2020), which show that the price of gold has no significant effect on the return of the JCI.

8.3 The exchange rate has a positive and insignificant effect on stock returns in the mining sector.

According to the research results, the exchange rate affects the mining sector's stock returns because the mining sector is also susceptible to changes in the exchange rate, making the exchange rate affect the sector's stock returns. That is evident by the weakening of the rupiah in 2017-2018 to reach IDR 15,000 / USD. However, in 2017, this sector's stock returns received many positive results coming 24.97% in December 2017 and 9.82% in June 2018. Because when the rupiah depreciates, it will benefit mining companies as an increase. If converted into rupiah, an increase in mining prices will make the company's contract value increase in the long run.

The results of this study are consistent with the findings of Hutapea et al. (2014) found that the exchange rate has a significant effect on the JCI. And according to Sujit & Kumar (2011), changes significantly influence the exchange rate in other variables (gold prices, stock prices, exchange rates, and oil prices).

However, this study is not in line with the results of research conducted by Putra & Robiyanto (2019) found that the exchange rate has a significant negative effect on mining companies. And it is also not in line with Hendrawan & Dzakiri (2014) dan D. A. A. Putra (2016), who found that the dollar exchange rate does not affect the volume of stock returns.

8.4 The exchange rate cannot moderate the relationship between gold prices and oil prices on stock returns in the mining sector.

According to the research results, it is founding that the exchange rate variable as moderation cannot moderate other independent variables on the dependent variable. That is due to the negative relationship between gold and the exchange rate, where when the US dollar weakens, the use will divert its funds to gold as a hedge and the price of gold by many factors, namely: inflation, financial crises, and the demand for gold in the market. This has an impact on share prices, because investors do not have financial literacy (Ady & Hidayat 2019). Likewise, with world oil, if it increases, it will cause an increase in the exchange rate of the dollar against the rupiah so that it will weaken the exchange rate. That will make investors afraid due to the worsening *current account deficit current account* or the balance due to the increasing oil price.

This study's results are in line with Arfaoui & Rejeb (2017) show that oil pricing comes from many factors, one of which is the *exchange rate*. Zagaglia & Marzo (2010); Adaramola (2012); Mochammad Yusuf Wicaksono (2016); Rahmanto et al. (2016), and Zarei et al. (2019) show that the exchange rate has a positive impact effect on gold prices and stock returns. Also, Mashayekhi et al. (2013) show that the pricing of gold is affected by the exchange rate. And Sadorsky (2000) also states that the exchange rate affects oil prices.

However, this study's results are not following the findings of Dwiati & Ambarwati (2017) and Suriani et al. (2015), which states that the rupiah exchange rate is unable to moderate the relationship between the gold price and the JCI. Then Khan (2019) also noted that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange.

9. LIMITATIONS AND FURTHER RESEARCH SUGGESTIONS

The limitation of this research is that this research uses all macroeconomic variables. It would be nice if further research uses internal company variables such as financial performance and other factors considering the test result, adjusted R Square low, which is only 17.3%. The addition of the research period is also because this research period is only four years (2015-2018). Investors who want to invest should look at the movement of oil prices because only seven mining companies are to export oil on the IDX. The rest is importing oil as their energy raw material so that more stocks in this sector are corrected. Conversely, suppose investors want to invest, preferably when the price of gold rises because of rising commodity pricing. In that case, mining companies will record profits and get a positive response from the stock market.

8. CONCLUSIONS

a. World oil prices have an impact negative a significant effect on stock returns in the mining sector.
b. The price of gold has a significant positive effect on stock returns in the mining sector.
c. The exchange rate has a positive and insignificant effect on stock returns in the mining sector.
d. The exchange rate cannot moderate the relationship between gold prices and oil prices on stock returns in the mining sector.

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Dear Sri Utami Ady,

We have reached a decision regarding your submission to International Journal of Energy Economics and Policy (IJEEP) "THE EFFECT OF WORLD OIL PRICES, GOLD PRICES, AND OTHER ENERGY PRICES ON THE INDONESIAN MINING SECTOR WITH EXCHANGE RATE OF INDONESIAN RUPIAH AS THE MODERATING EFFECT".

Our decision is: Revisions Required

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Title and abstract of the Study: Appropriate. Introduction: This section needs some revision to highlight the importance of the study Literature Review: Literature review is not in appropriate shape. Needs focus and brevity Methodology: Needs pruning and should be specific rather than general, all parameters must be included. Author must apply some measure of difference or association test on gathered data. Frequency graphs and charts are not sufficient and may be removed. Only results of inferential tests should be reported here. Results may be compared with earlier studies where possible. Conclusion and Recommendation: Some concrete conclusion and recommendations should be written in the light of study outcomes. References: The reference and running text citations must be rechecked as per journal format.
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THE EFFECT OF WORLD OIL PRICES, GOLD PRICES, AND OTHER ENERGY PRICES ON THE INDONESIAN MINING SECTOR WITH EXCHANGE RATE OF INDONESIAN RUPIAH AS THE MODERATING EFFECT

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Abstract

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, Augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.
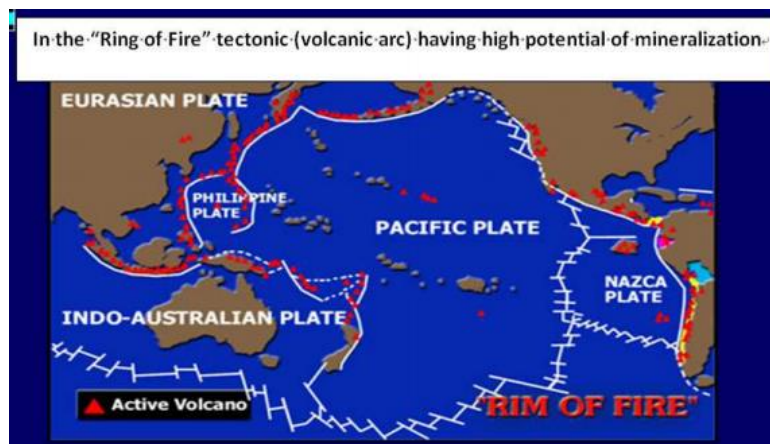
1. Introduction

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

Figure 1: Pacific Ring of Fire
Source: Soelistijo et al. (2015)

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane & Prasad, 1991; Le & Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:

- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector.
- To analyze the moderating effects of the Indonesian Rupiah*'s exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector.
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. Literature Review

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H1: Oil price change has a positive effect on the stock return of the mining sector.
H2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le & Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo & Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg & Harris, 1995).

In addition to the above information, a study conducted by Yousefi & Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi & Wirjanto (2004) can also be supported by Putra

& Robiyanto (2019). discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries, such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H4: Exchange rate moderates the relationship between oil prices and the mining sector.

H5: Exchange rate moderates the relationship between gold prices and the mining sector.

H6: Exchange rate moderates the relationship between gas prices and the mining sector.

3. Theoretical Framework

Arbitrage Pricing Theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Robiyanto, Wahyudi & Pangestuti, 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that gold price is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy. Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the

exchange rate can be interpreted. Concerning this, it has been stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. Methods

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices, gold prices, and other energy prices on the Indonesian mining industry. The analysis in this study is carried out with the help of E-views. The study conducted by Gerrard and Johnson (2015) argued that there is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 EX_t + \varepsilon_t$$

The above equation denotes the study's regression model in which IND refers to the Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 Ex_t + \beta_5 (GP * Ex)_t + \beta_6 (OP * Ex)_t + \beta_7 (GS * Ex)_t + \varepsilon_t$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. Results

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from $ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	-28.034	0.000
Oil Returns	-23.892	0.000
Gold Returns	-35.008	0.000
Gasoline Returns	-32.112	0.000
FX Returns	-21.557	0.000
FXxOI	-7.265	0.000
FXxGI	-20.920	0.000
FXxGSL	-26.953	0.000

deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline

returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

Table 1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	-0.0632	0.0623
Oil Returns	980	0.0004	0.0335	-0.2822	0.3196
Gold Returns	982	0.0002	0.0155	-0.0777	0.0782
Gasoline Returns	982	0.0002	0.0227	-0.2023	0.1349
FX Returns	982	0.0001	0.0041	-0.0278	0.0447

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis and Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

Table 2 Augmented Dickey-Fuller (ADF)

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	–28.034	0.000
Oil Returns	–23.892	0.000
Gold Returns	–35.008	0.000
Gasoline Returns	–32.112	0.000
FX Returns	–21.557	0.000
FXxOI	–7.265	0.000
FXxGI	–20.920	0.000
FXxGSL	–26.953	0.000

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that

there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the p-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the p-value is 0.517, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed p-value was 0.298, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the p-value was 0.00, which is below the threshold of 0.05. Similarly, the association among the variables was also significant for the equation of gasoline returns. The p-value was determined to be 0.00, which is also below the threshold of 0.05. Moreover, the association among the variables was significant for FX returns as the computed p-value was 0.002, which is below the threshold of 0.005.

Table 3 Vector Autoregression Equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 4 Vector Autoregression (IDX Returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	-0.0134	0.04038	-0.33	0.74
Oil Returns				
L1.	-0.0003	0.01762	-0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	-0.0493	0.03739	-1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	-4E-05	0.00056	-0.08	0.94

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and gasoline prices with Indonesian stock exchange return of mining companies. It is because all the p-values are above the threshold of 0.05, depicting no significant effect.

Table 5 Vector Autoregression (Moderation of FX Returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	-0.011	0.040	-0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				

L1.	0.017	0.035	0.49	0.626
L2.	-0.061	0.038	-1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	-0.045	0.160	-0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	-6.571	3.786	-1.74	0.083
L2.	-2.677	3.983	-0.67	0.502
FXxGI				
L1.	-4.896	9.035	-0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	-11.722	6.414	-1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	-0.05	0.959

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 6 Granger Causality (IDX Returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

Table 7 Granger Causality (Moderating Effect of FX Returns)

Equation	Excluded	chi2	df	Prob>chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

5.5 Hypothesis Assessment and Discussion

Table 8 Summary of Hypothesis

S.NO	Proposition	Results
H_1	Oil price change has a significant effect on the stock return of the mining sector.	Rejected
H_2	Gas price change has a significant effect on the stock return of the mining sector.	Rejected
H_3	Gold price change has a significant effect on the stock return of the mining sector.	Rejected
H_4	The exchange rate moderates the relationship between oil prices and the mining sector.	Rejected

H5	The exchange rate moderates the relationship between gold prices and the mining sector.	Rejected
H6	The exchange rate moderates the relationship between gas prices and the mining sector.	Rejected

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1 Oil Price has a Significant Effect on the Stock Return of Mining Sector.

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla & Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume & Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra & Robiyanto (2019) and Antonoa et al. (2019) which demonstrates that there is a significant influence of world oil and gas prices on stock return in short and long-term. Then Boyer & Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2 Gas Price has a Significant Effect on the Stock Return of Mining Sector.

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad & Bashir (2015); Saudi et al. (2018); Antonoa et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer & Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3 Gold Price has a Significant Effect on the Stock Return of Mining Sector.

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR) of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur & Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama & Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui & Rejeb (2017); Dwiati & Ambarwati (2017), and Putra & Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4 Exchange Rate Moderates the Relationship between Oil Prices of Mining Sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman & Siddiqui (2019) that there is no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic & Zarafat (2013); Hartley & Medlock (2014); Arfaoui & Rejeb (2017); Beckmann et al. (2017) and Antonoa et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra & Robiyanto (2019); Wasserfallen (1990); Hali J. Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5 Exchange Rate Moderates the Relationship between Gold Prices of Mining Sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini & Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi & Wirjanto (2004); Zagaglia & Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6 Exchange Rate Moderates the Relationship between Gas Prices of Mining Sector

It can be proven from table 8 above that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.

It also contradicts the findings of Hartley & Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Hali J. Edison (1991); Putra & Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on the stock exchange is mostly influenced by psychological factors (Ady, 2015; 2018; Ady et al., 2013; Ady & Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy,

and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. Conclusion

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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Dear Sri Utami Ady,

There are some corrections from the reviewer regarding your submission to International Journal of Energy Economics and Policy (IJEEP) "THE EFFECT OF WORLD OIL PRICES, GOLD PRICES, AND OTHER ENERGY PRICES ON THE INDONESIAN MINING SECTOR WITH EXCHANGE RATE OF INDONESIAN RUPIAH AS THE MODERATING EFFECT".

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Reviewers Feedback:

Methodology and analysis are more sharpened. Novelty is more sharpened with a global scope. Conclusions are more in line with the results. Please proofread before resubmission

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THE EFFECT OF WORLD OIL PRICES, GOLD PRICES, AND OTHER ENERGY PRICES ON THE INDONESIAN MINING SECTOR WITH EXCHANGE RATE OF INDONESIAN RUPIAH AS THE MODERATING EFFECT

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Abstract

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, Augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.
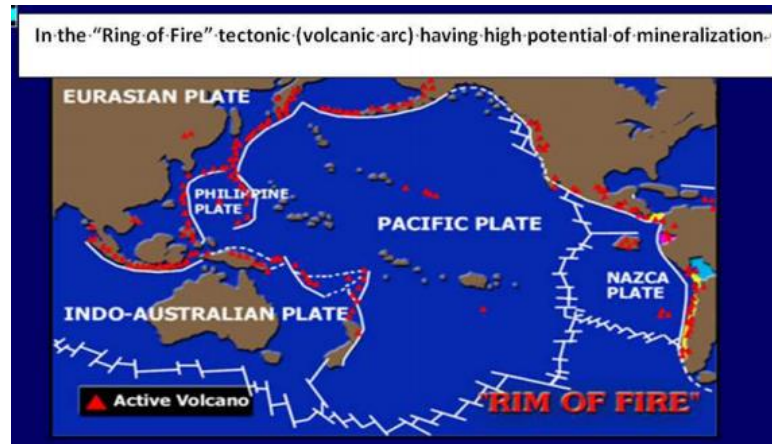
1. Introduction

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

Figure 1: Pacific Ring of Fire
Source: Soelistijo et al. (2015)

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane & Prasad, 1991; Le & Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

In addition to the above information, there are few studies wherein these minerals' relationship has been looked at in sectorial shares. To the best of our knowledge, no study has considered the exchange rate's moderating effects in this context. Therefore, these gaps are intended to be overcome in the present study. The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:

- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector.
- To analyze the moderating effects of the Indonesian Rupiah*'s exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector.
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. Literature Review

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H1: Oil price change has a positive effect on the stock return of the mining sector.
H2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le & Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo & Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg & Harris, 1995).

In addition to the above information, a study conducted by Yousefi & Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in

which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi & Wirjanto (2004) can also be supported by Putra & Robiyanto (2019). discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries, such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H4: Exchange rate moderates the relationship between oil prices and the mining sector.

H5: Exchange rate moderates the relationship between gold prices and the mining sector.

H6: Exchange rate moderates the relationship between gas prices and the mining sector.

3. Theoretical Framework

Arbitrage Pricing Theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Robiyanto, Wahyudi & Pangestuti, 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that gold price is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy.

Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the exchange rate can be interpreted. Concerning this, it has been stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. Methods

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices, gold prices, and other energy prices on the Indonesian mining industry. The deductive approach has been utilized in this study, as the hypothesis has been tested (Razzaqi, Bilquees, and Shahbaz, 2011). It is because an already existing theory has been tested in the context of the Indonesian mining industry. The data collection method is secondary as time series data for world oil prices, gold prices, and other energy prices. The Indonesian mining index considered for the past six years, i.e., 2015 to 2020, of daily frequency. The analysis in this study is carried out with the help of E-views. The study conducted by Gerrard and Johnson (2015) argued that there is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 EX_t + \varepsilon_t$$

The above equation denotes the study's regression model in which IND refers to the

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	-28.034	0.000
Oil Returns	-23.892	0.000
Gold Returns	-35.008	0.000
Gasoline Returns	-32.112	0.000
FX Returns	-21.557	0.000
FXxOI	-7.265	0.000
FXxGI	-20.920	0.000
FXxGSL	-26.953	0.000

Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 Ex_t + \beta_5 (GP * Ex)_t + \beta_6 (OP * Ex)_t + \beta_7 (GS * Ex)_t + \varepsilon_t$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. Results

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia

are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from $ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

Table 1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	-0.0632	0.0623
Oil Returns	980	0.0004	0.0335	-0.2822	0.3196
Gold Returns	982	0.0002	0.0155	-0.0777	0.0782
Gasoline Returns	982	0.0002	0.0227	-0.2023	0.1349
FX Returns	982	0.0001	0.0041	-0.0278	0.0447

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis and Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

Table 2 Augmented Dickey-Fuller (ADF)

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	–28.034	0.000
Oil Returns	–23.892	0.000
Gold Returns	–35.008	0.000
Gasoline Returns	–32.112	0.000
FX Returns	–21.557	0.000
FXxOI	–7.265	0.000
FXxGI	–20.920	0.000
FXxGSL	–26.953	0.000

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the p-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the p-value is 0.517, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed p-value was 0.298, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the p-value was 0.00, which is below the threshold of 0.05. Similarly, the association among the variables was also significant for the equation of gasoline returns. The p-value was determined to be 0.00, which is also below the threshold of 0.05. Moreover, the association among the variables was significant for FX returns as the computed p-value was 0.002, which is below the threshold of 0.005.

Table 3 Vector Autoregression Equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 4 Vector Autoregression (IDX Returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	-0.0134	0.04038	-0.33	0.74
Oil Returns				
L1.	-0.0003	0.01762	-0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	-0.0493	0.03739	-1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	-4E-05	0.00056	-0.08	0.94

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and

gasoline prices with Indonesian stock exchange return of mining companies. It is because all the p-values are above the threshold of 0.05, depicting no significant effect.

returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 5 Vector Autoregression (Moderation of FX Returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	-0.011	0.040	-0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				
L1.	0.017	0.035	0.49	0.626
L2.	-0.061	0.038	-1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	-0.045	0.160	-0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	-6.571	3.786	-1.74	0.083
L2.	-2.677	3.983	-0.67	0.502
FXxGI				
L1.	-4.896	9.035	-0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	-11.722	6.414	-1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	-0.05	0.959

Table 6 Granger Causality (IDX Returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

Table 7 Granger Causality (Moderating Effect of FX Returns)

Equation	Excluded	chi2	df	Prob>chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil

5.5 Hypothesis Assessment and Discussion

Table 8 Summary of Hypothesis

S.NO	Proposition	Results
H_1	Oil price change has a significant effect on the stock return of the mining sector.	Rejected
H_2	Gas price change has a significant effect on the stock return of the mining sector.	Rejected
H_3	Gold price change has a significant effect on the stock return of the mining sector.	Rejected
H_4	The exchange rate moderates the relationship between oil prices and the mining sector.	Rejected
H_5	The exchange rate moderates the relationship between gold prices and the mining sector.	Rejected
H_6	The exchange rate moderates the relationship between gas prices and the mining sector.	Rejected

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1 Oil Price has a Significant Effect on the Stock Return of Mining Sector.

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla & Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume & Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra & Robiyanto (2019) and Antonoa et al. (2019) which demonstrates that there is a significant influence of world oil and gas prices on stock return in short and long-term. Then Boyer & Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2 Gas Price has a Significant Effect on the Stock Return of Mining Sector.

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad & Bashir (2015); Saudi et al. (2018); Antonoa et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer & Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3 Gold Price has a Significant Effect on the Stock Return of Mining Sector.

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR) of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur & Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama &

Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui & Rejeb (2017); Dwiati & Ambarwati (2017), and Putra & Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4 Exchange Rate Moderates the Relationship between Oil Prices of Mining Sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman & Siddiqui (2019) that there is no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic & Zarafat (2013); Hartley & Medlock (2014); Arfaoui & Rejeb (2017); Beckmann et al. (2017) and Antonoa et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra & Robiyanto (2019); Wasserfallen (1990); Hali J. Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5 Exchange Rate Moderates the Relationship between Gold Prices of Mining Sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be

needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini & Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi & Wirjanto (2004); Zagaglia & Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6 Exchange Rate Moderates the Relationship between Gas Prices of Mining Sector

It can be proven from table 8 above that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.

It also contradicts the findings of Hartley & Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Hali J. Edison (1991); Putra & Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on the stock exchange is mostly influenced by psychological factors (Ady, 2015;

2018; Ady et al., 2013; Ady & Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy, and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. Conclusion

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of

oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

This study has focused on determining the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating effect of exchange rate on the Indonesian Rupiah. In this manner, the impact of all independent variables has been considered in the Indonesian mining sector. Therefore, it is suggested for future researchers also to investigate other sectors of the country, which are also influenced by oil prices, gold prices, and different energy prices. On the other hand, the Indonesian Rupiah's moderating effect has been considered in this study, which also restricts this study's scope. Therefore, it is also suggested for future researchers to investigate the moderating effect of other economic measures.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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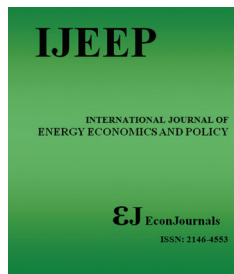Kepada: International Journal of Energy Economics and Policy <ijeep@econjournals.com>

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The Effect of World Oil Prices, Gold Prices, and Other Energy Prices on the Indonesian Mining Sector with Exchange Rate of Indonesian Rupiah as the Moderating Effect

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ABSTRACT

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.

Keywords: Exchange Rate, Oil Price, Gold Price, Gasoline Price, Indonesian Mining Sector Stock Returns
JEL Classifications: Q41, Q47

1. INTRODUCTION

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity

of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy

resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane and Prasad, 1991; Le and Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

In addition to the above information, there are few studies wherein these minerals' relationship has been looked at in sectorial shares. To the best of our knowledge, no study has considered the exchange rate's moderating effects in this context. Therefore, these gaps are intended to be overcome in the present study. The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:
- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To analyze the moderating effects of the Indonesian Rupiah's *exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. LITERATURE REVIEW

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas

exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H_1: Oil price change has a positive effect on the stock return of the mining sector.

H_2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le and Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo and Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H_3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg and Harris, 1995).

In addition to the above information, a study conducted by Yousefi and Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi and Wirjanto (2004) can also be supported by Putra and Robiyanto (2019) discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries,

such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H$_4$: Exchange rate moderates the relationship between oil prices and the mining sector.

H$_5$: Exchange rate moderates the relationship between gold prices and the mining sector.

H$_6$: Exchange rate moderates the relationship between gas prices and the mining sector.

3. THEORETICAL FRAMEWORK

Arbitrage pricing theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Wahyudi et al., 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that inflation is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy. Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the exchange rate can be interpreted. Concerning this, it has been stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. METHODS

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices, gold prices, and other energy prices on the Indonesian mining industry. The deductive approach has been utilized in this study, as the hypothesis has been tested (Razzaqi et al., 2011). It is because an already existing theory has been tested in the context of the Indonesian mining industry. The data collection method is secondary as time series data for world oil prices, gold prices, and other energy prices. The Indonesian mining index considered for the past 6 years, i.e., 2015 to 2020, of daily frequency. The analysis in this study is carried out with the help of E-views. The study conducted by Gerrard and Johnson (2015) argued that there is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, EX_t + \varepsilon_t \qquad (1)$$

The above equation denotes the study's regression model in which IND refers to the Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, Ex_t + \beta_5\, (GP*Ex)_t + \beta_6\, (OP*Ex)_t + \beta_7\, (GS*Ex)_t + \varepsilon_t \qquad (2)$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. RESULTS

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from \$ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	−0.0632	0.0623
Oil Returns	980	0.0004	0.0335	−0.2822	0.3196
Gold Returns	982	0.0002	0.0155	−0.0777	0.0782
Gasoline Re~s	982	0.0002	0.0227	−0.2023	0.1349
FX Returns	982	0.0001	0.0041	−0.0278	0.0447

gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis and Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the P-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the P = 0.517, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed P = 0.298, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the P = 0.00, which is below the threshold of 0.05. Similarly, the association among the variables was also significant for the equation of gasoline returns. The P-value was determined to be 0.00, which is also below the threshold of 0.00. Moreover,

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	−28.034	0.000
Oil Returns	−23.892	0.000
Gold Returns	−35.008	0.000
Gasoline Returns	−32.112	0.000
FX Returns	−21.557	0.000
FXxOI	−7.265	0.000
FXxGI	−20.920	0.000
FXxGSL	−26.953	0.000

Table 3: Vector autoregression equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

the association among the variables was significant for FX returns as the computed P = 0.002, which is below the threshold of 0.002.

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and gasoline prices with Indonesian stock exchange return of mining companies. It is because all the p-values are above the threshold of 0.05, depicting no significant effect.

Table 4: Vector autoregression (IDX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	−0.0134	0.04038	−0.33	0.74
Oil Returns				
L1.	−0.0003	0.01762	−0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	−0.0493	0.03739	−1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	−4E−05	0.00056	−0.08	0.94

Table 5: Vector autoregression (moderation of FX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	−0.011	0.040	−0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				
L1.	0.017	0.035	0.49	0.626
L2.	−0.061	0.038	−1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	−0.045	0.160	−0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	−6.571	3.786	−1.74	0.083
L2.	−2.677	3.983	−0.67	0.502
FXxGI				
L1.	−4.896	9.035	−0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	−11.722	6.414	−1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	−0.05	0.959

AQ1

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

5.5. Hypothesis Assessment and Discussion

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1. Oil price has a significant effect on the stock return of mining sector

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla and Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume and Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra and Robiyanto (2019) and Antono et al. (2019) which demonstrates that there is a significant influence of world oil and

gas prices on stock return in short and long-term. Then Boyer and Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2. Gas price has a significant effect on the stock return of mining sector

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad and Bashir (2015); Saudi et al. (2018); Antono et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer and Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3. Gold price has a significant effect on the stock return of mining sector

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR). Of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur and Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama and Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui and Rejeb (2017); Dwiati and Ambarwati (2017), and Putra and Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4. Exchange rate moderates the relationship between oil prices of mining sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman and Siddiqui (2019) that there is

Table 6: Granger causality (IDX returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7: Granger causality (moderating effect of FX returns)

Equation	Excluded	Chi2	df	Prob> chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic and Zarafat (2013); Hartley and Medlock (2014); Arfaoui and Rejeb (2017); Beckmann et al. (2017) dan Antono et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra and Robiyanto (2019); Wasserfallen (1990); Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5. Exchange rate moderates the relationship between gold prices of mining sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini and Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi and Wirjanto (2004); Zagaglia and Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6. Exchange rate moderates the relationship between gas prices of mining sector

It can be proven from Table 8 that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.
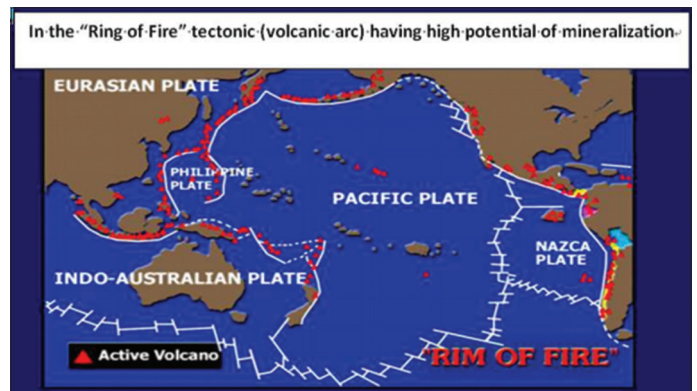
It also contradicts the findings of Hartley and Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Edison (1991); Putra and Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on

Table 8: Summary of hypothesis

S. No	Proposition	Results
H$_1$	Oil price change has a significant effect on the stock return of the mining sector	Rejected
H$_2$	Gas price change has a significant effect on the stock return of the mining sector	Rejected
H$_3$	Gold price change has a significant effect on the stock return of the mining sector	Rejected
H$_4$	The exchange rate moderates the relationship between oil prices and the mining sector	Rejected
H$_5$	The exchange rate moderates the relationship between gold prices and the mining sector	Rejected
H$_6$	The exchange rate moderates the relationship between gas prices and the mining sector	Rejected

Figure 1: Pacific ring of fire

Source: Soelistijo et al. (2015)

the stock exchange is mostly influenced by psychological factors (Ady, 2015, 2018; Ady et al., 2013; Ady and Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy, and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. CONCLUSION

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating

influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

This study has focused on determining the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating effect of exchange rate on the Indonesian Rupiah. In this manner, the impact of all independent variables has been considered in the Indonesian mining sector. Therefore, it is suggested for future researchers also to investigate other sectors of the country, which are also influenced by oil prices, gold prices, and different energy prices. On the other hand, the Indonesian Rupiah's moderating effect has been considered in this study, which also restricts this study's scope. Therefore, it is also suggested for future researchers to investigate the moderating effect of other economic measures.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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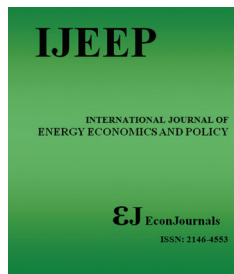
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The Effect of World Oil Prices, Gold Prices, and Other Energy Prices on the Indonesian Mining Sector with Exchange Rate of Indonesian Rupiah as the Moderating Effect

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ABSTRACT

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.

Keywords: Exchange Rate, Oil Price, Gold Price, Gasoline Price, Indonesian Mining Sector Stock Returns
JEL Classifications: Q41, Q47

1. INTRODUCTION

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy

resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane and Prasad, 1991; Le and Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

In addition to the above information, there are few studies wherein these minerals' relationship has been looked at in sectorial shares. To the best of our knowledge, no study has considered the exchange rate's moderating effects in this context. Therefore, these gaps are intended to be overcome in the present study. The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:
- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To analyze the moderating effects of the Indonesian Rupiah's *exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. LITERATURE REVIEW

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas

exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H_1: Oil price change has a positive effect on the stock return of the mining sector.

H_2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le and Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo and Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H_3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg and Harris, 1995).

In addition to the above information, a study conducted by Yousefi and Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi and Wirjanto (2004) can also be supported by Putra and Robiyanto (2019) discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries,

such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H$_4$: Exchange rate moderates the relationship between oil prices and the mining sector.

H$_5$: Exchange rate moderates the relationship between gold prices and the mining sector.

H$_6$: Exchange rate moderates the relationship between gas prices and the mining sector.

3. THEORETICAL FRAMEWORK

Arbitrage pricing theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Wahyudi et al., 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that inflation is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy. Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the exchange rate can be interpreted. Concerning this, it has been stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. METHODS

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices, gold prices, and other energy prices on the Indonesian mining industry. The deductive approach has been utilized in this study, as the hypothesis has been tested (Razzaqi et al., 2011). It is because an already existing theory has been tested in the context of the Indonesian mining industry. The data collection method is secondary as time series data for world oil prices, gold prices, and other energy prices. The Indonesian mining index considered for the past 6 years, i.e., 2015 to 2020, of daily frequency. The analysis in this study is carried out with the help of E-views. The study conducted by Gerrard and Johnson (2015) argued that there is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, EX_t + \varepsilon_t \qquad (1)$$

The above equation denotes the study's regression model in which IND refers to the Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, Ex_t + \beta_5\, (GP*Ex)_t + \beta_6\, (OP*Ex)_t + \beta_7\, (GS*Ex)_t + \varepsilon_t \qquad (2)$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. RESULTS

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from \$ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	−0.0632	0.0623
Oil Returns	980	0.0004	0.0335	−0.2822	0.3196
Gold Returns	982	0.0002	0.0155	−0.0777	0.0782
Gasoline Re~s	982	0.0002	0.0227	−0.2023	0.1349
FX Returns	982	0.0001	0.0041	−0.0278	0.0447

gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis and Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the P-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the P = 0.517, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed P = 0.298, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the P = 0.00, which is below the threshold of 0.05. Similarly, the association among the variables was also significant for the equation of gasoline returns. The P-value was determined to be 0.00, which is also below the threshold of 0.00. Moreover,

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	−28.034	0.000
Oil Returns	−23.892	0.000
Gold Returns	−35.008	0.000
Gasoline Returns	−32.112	0.000
FX Returns	−21.557	0.000
FXxOI	−7.265	0.000
FXxGI	−20.920	0.000
FXxGSL	−26.953	0.000

Table 3: Vector autoregression equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

the association among the variables was significant for FX returns as the computed P = 0.002, which is below the threshold of 0.002.

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and gasoline prices with Indonesian stock exchange return of mining companies. It is because all the p-values are above the threshold of 0.05, depicting no significant effect.

Table 4: Vector autoregression (IDX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	−0.0134	0.04038	−0.33	0.74
Oil Returns				
L1.	−0.0003	0.01762	−0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	−0.0493	0.03739	−1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	−4E−05	0.00056	−0.08	0.94

Table 5: Vector autoregression (moderation of FX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	−0.011	0.040	−0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				
L1.	0.017	0.035	0.49	0.626
L2.	−0.061	0.038	−1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	−0.045	0.160	−0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	−6.571	3.786	−1.74	0.083
L2.	−2.677	3.983	−0.67	0.502
FXxGI				
L1.	−4.896	9.035	−0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	−11.722	6.414	−1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	−0.05	0.959

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

5.5. Hypothesis Assessment and Discussion

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1. Oil price has a significant effect on the stock return of mining sector

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla and Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume and Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra and Robiyanto (2019) and Antono et al. (2019) which demonstrates that there is a significant influence of world oil and

Table 6: Granger causality (IDX returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7: Granger causality (moderating effect of FX returns)

Equation	Excluded	Chi2	df	Prob> chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

gas prices on stock return in short and long-term. Then Boyer and Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2. Gas price has a significant effect on the stock return of mining sector

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad and Bashir (2015); Saudi et al. (2018); Antono et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer and Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3. Gold price has a significant effect on the stock return of mining sector

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR). Of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur and Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama and Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui and Rejeb (2017); Dwiati and Ambarwati (2017), and Putra and Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4. Exchange rate moderates the relationship between oil prices of mining sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman and Siddiqui (2019) that there is

no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic and Zarafat (2013); Hartley and Medlock (2014); Arfaoui and Rejeb (2017); Beckmann et al. (2017) dan Antono et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra and Robiyanto (2019); Wasserfallen (1990); Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5. Exchange rate moderates the relationship between gold prices of mining sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini and Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi and Wirjanto (2004); Zagaglia and Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6. Exchange rate moderates the relationship between gas prices of mining sector

It can be proven from Table 8 that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.
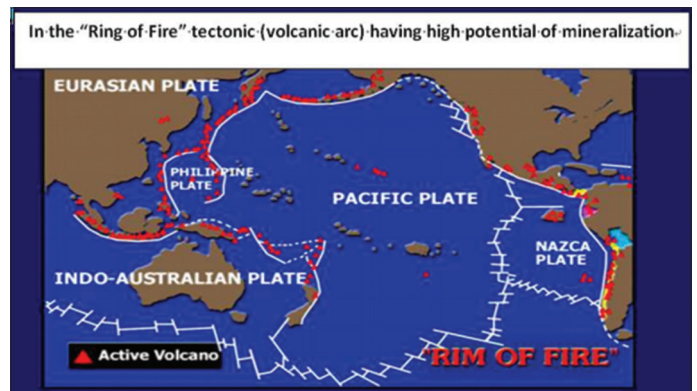
It also contradicts the findings of Hartley and Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Edison (1991); Putra and Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on

Table 8: Summary of hypothesis

S. No	Proposition	Results
H₁	Oil price change has a significant effect on the stock return of the mining sector	Rejected
H₂	Gas price change has a significant effect on the stock return of the mining sector	Rejected
H₃	Gold price change has a significant effect on the stock return of the mining sector	Rejected
H₄	The exchange rate moderates the relationship between oil prices and the mining sector	Rejected
H₅	The exchange rate moderates the relationship between gold prices and the mining sector	Rejected
H₆	The exchange rate moderates the relationship between gas prices and the mining sector	Rejected

Figure 1: Pacific ring of fire

Source: Soelistijo et al. (2015)

the stock exchange is mostly influenced by psychological factors (Ady, 2015, 2018; Ady et al., 2013; Ady and Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy, and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. CONCLUSION

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating

influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

This study has focused on determining the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating effect of exchange rate on the Indonesian Rupiah. In this manner, the impact of all independent variables has been considered in the Indonesian mining sector. Therefore, it is suggested for future researchers also to investigate other sectors of the country, which are also influenced by oil prices, gold prices, and different energy prices. On the other hand, the Indonesian Rupiah's moderating effect has been considered in this study, which also restricts this study's scope. Therefore, it is also suggested for future researchers to investigate the moderating effect of other economic measures.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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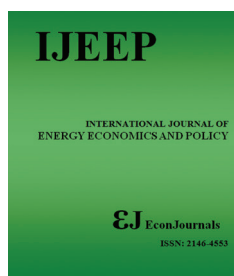
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The Effect of World Oil Prices, Gold Prices, and Other Energy Prices on the Indonesian Mining Sector with Exchange Rate of Indonesian Rupiah as the Moderating Effect

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ABSTRACT

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.

Keywords: Exchange Rate, Oil Price, Gold Price, Gasoline Price, Indonesian Mining Sector Stock Returns
JEL Classifications: Q41, Q47

1. INTRODUCTION

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country that can we see on Figure 1. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity

of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy

resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane and Prasad, 1991; Le and Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

In addition to the above information, there are few studies wherein these minerals' relationship has been looked at in sectorial shares. To the best of our knowledge, no study has considered the exchange rate's moderating effects in this context. Therefore, these gaps are intended to be overcome in the present study. The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:

- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To analyze the moderating effects of the Indonesian Rupiah's *exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. LITERATURE REVIEW

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas

exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H_1: Oil price change has a positive effect on the stock return of the mining sector.

H_2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le and Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo and Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H_3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg and Harris, 1995).

In addition to the above information, a study conducted by Yousefi and Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi and Wirjanto (2004) can also be supported by Putra and Robiyanto (2019) discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries,

such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H_4: Exchange rate moderates the relationship between oil prices and the mining sector.

H_5: Exchange rate moderates the relationship between gold prices and the mining sector.

H_6: Exchange rate moderates the relationship between gas prices and the mining sector.

3. THEORETICAL FRAMEWORK

Arbitrage pricing theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Wahyudi et al., 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that gold price is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy. Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the exchange rate can be interpreted. Concerning this, it has been **AQ1** stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. METHODS

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices,

gold prices, and other energy prices on the Indonesian mining industry. The deductive approach has been utilized in this study, as the hypothesis has been tested (Razzaqi et al., 2011). It is **AQ1** because an already existing theory has been tested in the context of the Indonesian mining industry. The data collection method is secondary as time series data for world oil prices, gold prices, and other energy prices. The Indonesian mining index considered for the past 6 years, i.e., 2015 to 2020, of daily frequency. The analysis in this study is carried out with the help of E-views. The study conducted by Gerrard and Johnson (2015) argued that there **AQ1** is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, EX_t + \varepsilon_t \qquad (1)$$

The above equation denotes the study's regression model in which IND refers to the Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1\, GP_t + \beta_2\, OP_t + \beta_3\, GS_t + \beta_4\, Ex_t + \beta_5\, (GP*Ex)_t + \beta_6\, (OP*Ex)_t + \beta_7\, (GS*Ex)_t + \varepsilon_t \qquad (2)$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. RESULTS

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from $ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	−0.0632	0.0623
Oil Returns	980	0.0004	0.0335	−0.2822	0.3196
Gold Returns	982	0.0002	0.0155	−0.0777	0.0782
Gasoline Returns	982	0.0002	0.0227	−0.2023	0.1349
FX Returns	982	0.0001	0.0041	−0.0278	0.0447

gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis and Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the P-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the P = 0.517, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed P = 0.298, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the P = 0.00, which is below the threshold of 0.05. Similarly, the association among the variables was also significant for the equation of gasoline returns. The P-value was determined to be 0.00, which is also below the threshold of 0.05. Moreover,

the association among the variables was significant for FX returns as the computed P = 0.002, which is below the threshold of 0.005.

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and gasoline prices with Indonesian stock exchange return of mining companies. It is because all the p-values are above the threshold of 0.05, depicting no significant effect.

Table 4: Vector autoregression (IDX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	−0.0134	0.04038	−0.33	0.74
Oil Returns				
L1.	−0.0003	0.01762	−0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	−0.0493	0.03739	−1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	−4E−05	0.00056	−0.08	0.94

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	−28.034	0.000
Oil Returns	−23.892	0.000
Gold Returns	−35.008	0.000
Gasoline Returns	−32.112	0.000
FX Returns	−21.557	0.000
FXxOI	−7.265	0.000
FXxGI	−20.920	0.000
FXxGSL	−26.953	0.000

Table 3: Vector autoregression equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

Table 5: Vector autoregression (moderation of FX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	−0.011	0.040	−0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				
L1.	0.017	0.035	0.49	0.626
L2.	−0.061	0.038	−1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	−0.045	0.160	−0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	−6.571	3.786	−1.74	0.083
L2.	−2.677	3.983	−0.67	0.502
FXxGI				
L1.	−4.896	9.035	−0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	−11.722	6.414	−1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	−0.05	0.959

AQ1

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

5.5. Hypothesis Assessment and Discussion

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1. Oil price has a significant effect on the stock return of mining sector

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla and Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume and Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al. (2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra and Robiyanto (2019) and Antono et al. (2019) which demonstrates that there is a significant influence of world oil and gas prices on stock return in short and long-term. Then Boyer and Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2. Gas price has a significant effect on the stock return of mining sector

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad and Bashir (2015); Saudi et al. (2018); Antono et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer and Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3. Gold price has a significant effect on the stock return of mining sector

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR) of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur and Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama and Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui and Rejeb (2017); Dwiati and Ambarwati (2017), and Putra and Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4. Exchange rate moderates the relationship between oil prices of mining sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman and Siddiqui (2019) that there is

Table 6: Granger causality (IDX returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7: Granger causality (moderating effect of FX returns)

Equation	Excluded	Chi2	df	Prob> chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic and Zarafat (2013); Hartley and Medlock (2014); Arfaoui and Rejeb (2017); Beckmann et al. (2017) and Antono et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra and Robiyanto (2019); Wasserfallen (1990); Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5. Exchange rate moderates the relationship between gold prices of mining sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini and Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi and Wirjanto (2004); Zagaglia and Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6. Exchange rate moderates the relationship between gas prices of mining sector

It can be proven from Table 8 that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.
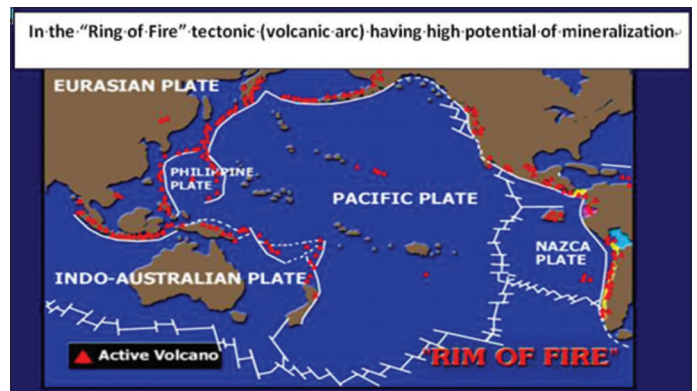
It also contradicts the findings of Hartley and Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Edison (1991); Putra and Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Even Indonesia is considered one of those developing countries that have rich mineral resources, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country that can we see on figure 1, the result

Table 8: Summary of hypothesis

S. No	Proposition	Results
H_1	Oil price change has a significant effect on the stock return of the mining sector	Rejected
H_2	Gas price change has a significant effect on the stock return of the mining sector	Rejected
H_3	Gold price change has a significant effect on the stock return of the mining sector	Rejected
H_4	The exchange rate moderates the relationship between oil prices and the mining sector	Rejected
H_5	The exchange rate moderates the relationship between gold prices and the mining sector	Rejected
H_6	The exchange rate moderates the relationship between gas prices and the mining sector	Rejected

Figure 1: Pacific ring of fire

Source: Soelistijo et al. (2015)

of this research show there are no relationship beetwen gas prises and the mining sector stock prices.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on the stock exchange is mostly influenced by psychological factors (Ady, 2015; 2018; Ady et al., 2013; Ady and Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy, and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. CONCLUSION

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive

contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

This study has focused on determining the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating effect of exchange rate on the Indonesian Rupiah. In this manner, the impact of all independent variables has been considered in the Indonesian mining sector. Therefore, it is suggested for future researchers also to investigate other sectors of the country, which are also influenced by oil prices, gold prices, and different energy prices. On the other hand, the Indonesian Rupiah's moderating effect has been considered in this study, which also restricts this study's scope. Therefore, it is also suggested for future researchers to investigate the moderating effect of other economic measures.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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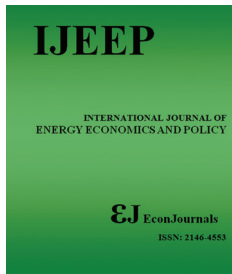stock returns. Review of Middle East Economics and Finance, 7(1), 32-51.

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The Effect of World Oil Prices, Gold Prices, and Other Energy Prices on the Indonesian Mining Sector with Exchange Rate of Indonesian Rupiah as the Moderating Effect

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ABSTRACT

The paper aimed to determine the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah. This study is quantitative in which the data gathered from Investing.com from 2016 to 2020. The variables considered in the survey include exchange rate, Indonesian stock returns of mining companies, gold prices, oil prices, and gasoline prices. Concerning the analysis, the vector autoregression, augmented Dickey-Fuller (ADF), and adopt the granger causality test. The results of this study identified no effect of oil price, gasoline price, and gold price on the Indonesian stock exchange of mining companies. On the other hand, there is no moderation of foreign exchange of Indonesian Rupiah among the relationship of oil price, gasoline price, and gold price with stock returns of Indonesian mining companies. This study's results are restricted to the Indonesian context, and the data considered from 2016 to 2019.

Keywords: Exchange Rate, Oil Price, Gold Price, Gasoline Price, Indonesian Mining Sector Stock Returns
JEL Classifications: Q41, Q47

1. INTRODUCTION

Indonesia is considered one of those developing countries that have rich mineral resources. Many mineral resources can be found in the country, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of fire, located in the country that can we see on figure 1. Indonesia's gross domestic product, mineral, and energy commodities have always contributed (Soelistijo et al., 2015). The trade of mineral commodities' primary intent is to gain from the exchange of minerals to encourage economic growth through Balance of Trade (BOT). It is undeniable that in determining Indonesia's energy needs, the mining sector plays a considerable role. It has analyzed that in Indonesia's GDP, 6% to 12% contribution to its mining sector.

However, due to an increase in energy consumption triggered by rapid industrial growth; therefore, from the production capacity

of the Indonesian mining sector, the use of energy derived from petroleum cannot be met (Nawaz et al., 2020). Thus, to fulfil this, the government must import 20% to 30% from abroad. It has been analyzed that changes in world oil and gold prices reach the zenith point, which profoundly affects Indonesia's mining sector (Handri et al., 2019). For a long time, mineral trade markets have been volatile. There has been a fluctuation in the trend of mineral commodity prices, and recently due to costs of the commodity increasing within only several years, it has changed astronomically.

Consistent with the above information, the price fluctuation in gold prices, oil prices, and other energy prices, such as gas, strongly influences Indonesia's mining sector and, eventually, its economic development. The exchange rate plays a considerable role in the relationship between change in gold prices, oil prices, other energy resources prices, and Indonesia's mineral sector (Smith, 2001). The reason is that the trade of gold, oil, and other energy

resources is made through the dollar. In other words, the world oil, gold prices, and different energy prices are dominated in US dollars (Beckmann et al., 2017; Othman et al., 2020). Therefore, when there is an increase in the US dollar costs, these minerals' prices also increase. This relation can also be understood. If there is a decrease in the Indonesian Rupiah against the international currency, such as the dollar, there will be a higher cost borne by Indonesia on importing mineral resources.

Thus, based on the above context, the study is intended to assess the effects of world oil prices, gold prices, and other energy, such as gas, on Indonesia's mineral sector. In this direct relationship, the exchange rate's moderating effects are also considered (Wahyudi et al., 2017). This study will be very significant and have a considerable contribution to this field. The reason is that the effect of world oil prices, golds prices, and other energy, such as gas, has been assessed in a minimal number of studies, for instance (Keane and Prasad, 1991; Le and Chang, 2012; Lin et al., 2008). Moreover, there is excellent scarce in studies investigating this relationship between the mineral sector of Indonesia. Furthermore, previous research has significantly varied from different methods, such as autoregression, non-linear vector, and time series (Handri et al., 2019). Besides this, from changes in oil and gold prices in exporting countries, developed countries, and developing countries, research objectives also vary.

In addition to the above information, there are few studies wherein these minerals' relationship has been looked at in sectorial shares. To the best of our knowledge, no study has considered the exchange rate's moderating effects in this context. Therefore, these gaps are intended to be overcome in the present study. The main research question of the study is designed as:

What are the effects of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating influence of the exchange rate of the Indonesian Rupiah?

Based on the research question, the objective of the study is designed as:

- To assess world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To analyze the moderating effects of the Indonesian Rupiah's *exchange rate* in the relationship between world oil prices, gold prices, and other energy prices on the Indonesian mining sector
- To provide a recommendation to maintain the prices of gold, oil, and other energy resources in Indonesia's mineral sector.

2. LITERATURE REVIEW

The world crude oil prices and other energy such as gas are directly affected by the increasing demand for oil and gas and the emergence of newly industrialized nations. A country's economy is directly affected by oil and gas prices associated with economic activity. As per the study of Wahyudi et al. (2017), there are variations in increased oil and gas prices on the economy in general and the capital market. It has been analyzed that the displacement of welfare from oil and gas importing countries to oil and gas

exporting countries is illustrated by the rising prices of oil and gas (Chien et al., 2021; Sadiq et al., 2020; Degiannakis et al., 2017). Therefore, on the acceptance and welfare of the community, this will have an impact. Besides, a study conducted by Rahmanto et al. (2016) infers that a country's economy is also affected by it. Furthermore, a study put forward by Basher et al. (2012) demonstrates that on world oil and gas prices on stock return in short and long-term, there is a positive influence. Hence, based on the above description, the following hypothesis can be created:

H_1: Oil price change has a positive effect on the stock return of the mining sector.

H_2: Gas price change has a positive effect on the stock return of the mining sector.

The effects of gold prices on the mining stock return have been analyzed in various studies. A study put forward by Le and Chang (2012) reveals that between the recovery of the mining sector and the prices of gold, there is a significant favorable influence. Likewise, it has been argued in the study conducted by Nangolo and Musingwini (2011) that between gold and stock return, there is a positive relationship. The previous two studies' findings can also be validated by the survey results conducted by Gilmore et al. (2009). It has been indicated that with the price of gold, there is a significant favorable influence among French stock exchanges. Additionally, the study conducted by Smith (2001) also found a meaningful relationship between the prices of gold with the Malaysian Stock Exchange. The before the presented argument is sufficient to hypothesize that:

H_3: Gold price change has a positive effect on the stock return of the mining sector.

Concerning the impact of exchange rates on prices of oil, gold, and other energy resources, such as gas, evidence obtained from previous research infer that the US dollars dominate causality from exchange rate to the process of gold, oil, and natural gas. Another study conducted by Beckmann et al. (2017) demonstrates an appreciation of the US dollar increases oil, gas, and gold prices measured in terms of the domestic currency. As a result, the demand for these minerals decreases outside the countries where the dollar is not the official currency, such as Indonesia, where Indonesia Rupiah is used. It reduces the demand for these minerals in the country and affects the mineral industry's production (Akram, 2009; Blomberg and Harris, 1995).

In addition to the above information, a study conducted by Yousefi and Wirjanto (2004) opines that the price strategy is crucial to cope with the exchange rate. It will help to adjust oil prices. From these findings, it can be understood that the authors have recommended the use of price strategy because it has been insinuated that fluctuation in the exchange rate has a direct impact on the world oil prices, gold price, and gas. Coudert et al. (2008) conducted a study in which they have echoed that from the rise in oil and gas prices due to the US dollar appreciation, if production or drilling activity increases in the mining sector, there will be a positive supply response may stem. The findings of Yousefi and Wirjanto (2004) can also be supported by Putra and Robiyanto (2019) discovery. It has been analyzed that to adjust the prices of oil supply as a response, oil, and gas exporting countries,

such as Indonesia, should also adjust oil supply as a response to the exchange rate. Based on the collected evidence, it can be hypothesized that:

H_4: Exchange rate moderates the relationship between oil prices and the mining sector.

H_5: Exchange rate moderates the relationship between gold prices and the mining sector.

H_6: Exchange rate moderates the relationship between gas prices and the mining sector.

3. THEORETICAL FRAMEWORK

Arbitrage pricing theory (APT) can be used in this study. Ross (1976) introduced this theory, which is generally considered a pricing model for security through which the relationship between price determinations in the CAPM is generalized. It has been inferred by Huberman and Wang (2005) that APT is one period model wherein it is believed by investors that the factor structure is consistent with the matters related to the stochastic level of profit. In determining the prices of assets, there are necessary implications held by the formulation of APT. APT has stated that the profit level of investment is influenced by one or several explanatory variables. However, what influences the level of profit is not displayed correctly by APT (Wahyudi et al., 2017).

The price of gold is high as it is rare and possesses corrosion resistance properties (Wahyudi et al., 2017). Gold is considered a risk-free investment. Apriyanti (2011) also supports this statement and opines that investors' wealth will remain intact by investing in gold. One of the essential advantages of gold for Indonesia's wealth sector is that gold price is not affected by inflation, and no price determination is involved. When it comes to oil and gas, they are often considered as the head of the commodity. An increase in the prices of oil and gas can decrease the return of the mining sector. Therefore, for all industries, world oil and gas have become the primary sources of energy. Rising oil prices will add to the country's welfare as the income of the local community increases. The exchange rate plays an imperative role in the relationship between gold, oil, and gas prices. To obtain one currency unit in another country, the amount of domestic money is needed, and the exchange rate can be interpreted. Concerning this, it has been stated by Tsen (2011) that in the world of investment, buying, and the system of selling internationally, the exchange rate has a crucial role to play. Therefore, it can be deduced that in the relationship between the prices of gold, oil and gas, and the Indonesian mineral sector, there is a crucial role play by the exchange rate, and APT theory can be employed here in the relationship between price determinations.

4. METHODS

This research paper includes the study's quantitative design to assess the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector and the moderating effect of the exchange rate of the Indonesian Rupiah. Data for measuring the effect is in numeric form and required statistical analysis for providing the evidence concerning the effect of oil prices, gold prices, and other energy prices on the Indonesian mining industry. The deductive approach has been utilized in this study, as the hypothesis has been tested (Razzaqi et al., 2011), and Shahbaz, 2011). It is because an already existing theory has been tested in the context of the Indonesian mining industry. The data collection method is secondary as time series data for world oil prices, gold prices, and other energy prices. The Indonesian mining index considered for the past 6 years, i.e., 2015 to 2020, of daily frequency. The analysis in this study is carried out with the help of E-views. The study conducted by (Gerrard & Johnson, 2015) argued that there is the presence of unit root in the macroeconomic data because of the random trends. Therefore, the researchers need to test the data stationary while implementing the ADF test. After the unit root test, the regression is determined along with Indonesia's exchange rate's mediating effect. The regression equation is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 EX_t + \varepsilon_t \qquad (1)$$

The above equation denotes the study's regression model in which IND refers to the Indonesian mining index. On the other hand, α refers to the constant, while OP is the world's oil prices over the period. In addition to this, GP refers to gold prices, while GS denotes gasoline prices over the years. Moreover, the EX is the exchange rate of Indonesian Rupiah, and ε is the error term. Furthermore, the equation for moderating effect is as follows:

$$IND_t = \alpha + \beta_1 GP_t + \beta_2 OP_t + \beta_3 GS_t + \beta_4 Ex_t + \beta_5 (GP*Ex)_t + \beta_6 (OP*Ex)_t + \beta_7 (GS*Ex)_t + \varepsilon_t \qquad (2)$$

The above equation shows the moderating effect of the Indonesian Rupiah's exchange rate in the regression equation model. In this manner, the moderating influence of the Indonesian rupiah's exchange rate is tested with gold prices, oil prices, and gasoline prices to determine the effect over the Indonesian mining industry index.

5. RESULTS

5.1. Descriptive Statistics

Table 1 depicts the descriptive statistics of the variables which have been considered in this study. In this manner, it determines with the help of Table 1 that the mean value for IDX returns is 0.0002, which shows that the average stock returns of mining companies in Indonesia are 0.0002. On the other hand, the standard deviation for IDX returns is determined to be 0.0134, which shows that the IDX return will deviate from $ 0.0134. The mean value for oil returns is 0.0004, which depicts that the average for oil returns is 0.0004%, while the standard deviation for oil returns was computed to be 0.0335, which shows that the oil return will deviate

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
IDX Returns	982	0.0002	0.0134	−0.0632	0.0623
Oil Returns	980	0.0004	0.0335	−0.2822	0.3196
Gold Returns	982	0.0002	0.0155	−0.0777	0.0782
Gasoline Returns	982	0.0002	0.0227	−0.2023	0.1349
FX Returns	982	0.0001	0.0041	−0.0278	0.0447

from 0.0335%. Concerning the gold returns, the mean value was 0.0002, which shows that the average gold return was 0.0002%. The standard deviation was computed to be 0.0155, depicting that the gold returns will deviate from 0.0155%. Moreover, the mean value for gasoline returns was determined to be 0.0002, which shows that the average gasoline returns were 0.0002%, having a standard deviation of 0.0227, predicting that the gasoline returns will deviate from 0.0227%. Lastly, the mean value for foreign exchange returns was 0.0001, showing that the Indonesian rupiah's average foreign exchange returns were 0.0001%, having a standard deviation of 0.0041. It implies that the foreign exchange returns will deviate from 0.0041%.

5.2. Augmented Dickey-Fuller (ADF)

The unit root testing is considered essential for forecasting the values based on previous patterns. As per the study conducted by Paparoditis & Politis (2018), future values' assessment is challenging based on historical values while using conventional inferential statistics. In this manner, the Augmented Dickey-Fuller (ADF) has been employed to determine the data's unit root.

The above Table 2 depicts the results of Augmented Dickey-Fuller (ADF) in which the null hypothesis is based upon the assumption that there is a presence of unit root in the data. In this manner, it can be determined from the above Table 2 that there is no unit root presence. In the IDX returns, oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL as the P-values of all the variables are below the threshold of 0.05.

5.3. Vector Autoregression

Table 3 depicts the association among each variable of the study concerning each model equation. It can determine that there is no association among the variables concerning the equation of IDX returns as the $P = 0.517$, which is above the threshold of 0.05. Similarly, there is no association among the variables concerning the equation of oil returns as the computed $P = 0.298$, which is also above the threshold of 0.05. In contrast to this, for the equation of gold returns, the $P = 0.00$, which is below the threshold of 0.05. Similarly, the association among the variables was also significant

Table 2: Augmented Dickey-Fuller

Augmented Dickey-Fuller test statistic	t-Statistic	Prob.*
IDX Returns	−28.034	0.000
Oil Returns	−23.892	0.000
Gold Returns	−35.008	0.000
Gasoline Returns	−32.112	0.000
FX Returns	−21.557	0.000
FXxOI	−7.265	0.000
FXxGI	−20.920	0.000
FXxGSL	−26.953	0.000

Table 3: Vector autoregression equations

Equation	Parms	RMSE	R-sq	chi2	P>chi2
IDX Returns	11	0.013	0.017	9.161	0.517
Oil Returns	11	0.032	0.022	11.809	0.298
Gold Returns	11	0.015	0.129	77.942	0.000
Gasoline Returns	11	0.023	0.075	42.661	0.000
FXReturns	11	0.004	0.051	28.524	0.002

for the equation of gasoline returns. The P-value was determined to be 0.00, which is also below the threshold of 0.05. Moreover, the association among the variables was significant for FX returns as the computed $P = 0.002$, which is below the threshold of 0.005.

Table 4 depicts the vector autoregression concerning the Indonesian stock index returns of mining companies. Based on Table 4, it can determine that there is no effect of oil returns, gasoline returns, gold returns, and FX returns over the Indonesian stock index returns of mining companies.

Table 5 depicts the vector autoregression for the moderating effect of foreign exchange returns. In this manner, it can be determined from the below Table 5 that there is no moderation of FX returns over the relationship of oil prices, gold prices, and gasoline prices with Indonesian stock exchange return of mining companies. It is

Table 4: Vector autoregression (IDX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.06794	0.04119	1.65	0.099
L2.	−0.0134	0.04038	−0.33	0.74
Oil Returns				
L1.	−0.0003	0.01762	−0.02	0.984
L2.	0.01675	0.01696	0.99	0.323
Gold Returns				
L1.	0.01975	0.03539	0.56	0.577
L2.	−0.0493	0.03739	−1.32	0.188
Gasoline Returns				
L1.	0.00537	0.02503	0.21	0.83
L2.	0.0349	0.02621	1.33	0.183
FX Returns				
L1.	0.10426	0.13681	0.76	0.446
L2.	0.0664	0.14527	0.46	0.648
_cons	−4E−05	0.00056	−0.08	0.94

Table 5: Vector autoregression (moderation of FX returns)

	Coef.	Std. Err.	z	P>|z|
IDX Returns				
L1.	0.064	0.041	1.56	0.12
L2.	−0.011	0.040	−0.28	0.782
Oil Returns				
L1.	0.001	0.018	0.03	0.975
L2.	0.019	0.017	1.14	0.254
Gold Returns				
L1.	0.017	0.035	0.49	0.626
L2.	−0.061	0.038	−1.61	0.108
Gasoline Returns				
L1.	0.010	0.025	0.41	0.681
L2.	0.033	0.026	1.26	0.209
FX Returns				
L1.	−0.045	0.160	−0.28	0.778
L2.	0.033	0.160	0.2	0.839
FXxOI				
L1.	−6.571	3.786	−1.74	0.083
L2.	−2.677	3.983	−0.67	0.502
FXxGI				
L1.	−4.896	9.035	−0.54	0.588
L2.	10.575	11.069	0.96	0.339
FXxGSL				
L1.	−11.722	6.414	−1.83	0.068
L2.	0.763	6.853	0.11	0.911
_cons	0.000	0.001	−0.05	0.959

because all the p-values are above the threshold of 0.05, depicting no significant effect.

5.4. Granger Causality Test

Table 6 depicts the Granger causality test in which none of the equation is determined to be significant. In this manner, it determines that oil returns, gold returns, gasoline returns, FX returns, and all the variables granger IDX returns. It is because the p-value of all the equations was determined to be above the threshold of 0.05.

Table 7 depicts the results of Granger causality concerning the moderating effect of FX returns. In this manner, it determines from the below Table 7 that oil returns, gold returns, gasoline returns, FX returns, FXxOI, FXxGI, and FXxGSL granger IDX returns as the p-values are above the threshold of 0.05.

5.5. Hypothesis Assessment and Discussion

The above table depicts the summary of the hypothesis, based on the analysis and results of this study as follows:

5.5.1. Oil price has a significant effect on the stock return of mining sector

The first hypothesis that changes in oil prices significantly affect stock returns in the mining sector is rejected. It can occur because coal companies with 23 coal companies dominate the mining sector's driving force. In comparison, there are only seven companies in the oil and gas sector, which causes changes in oil prices not to affect the mining sector's return of shares.

This result is following Kuwornu (2012); Saudi et al. (2018); Muramalla and Alqahtani (2020) argued that there is no association between the oil price on stock market prices in the mining sector. Then, Kelikume and Muritala (2019) argued that there is have a hostile impact oil prices on African stock markets.

However, it contradicts with the findings of Dawson (2007); Oberndorfer (2009); Basher et al. (2012); Movahedizadeh et al.

Table 6: Granger causality (IDX returns)

Equation	Excluded	chi2	df	Prob>Chi2
IDX Returns	Oil Returns	0.976	2	0.614
IDX Returns	Gold Returns	2.527	2	0.283
IDX Returns	Gasoline Returns	1.774	2	0.412
IDX Returns	FX Returns	0.906	2	0.636
IDX Returns	ALL	6.381	8	0.605

Table 7: Granger causality (moderating effect of FX returns)

Equation	Excluded	Chi2	df	Prob> chi2
IDX Returns	Oil Returns	1.303	2	0.521
IDX Returns	Gold Returns	3.319	2	0.19
IDX Returns	Gasoline Returns	1.613	2	0.446
IDX Returns	FX Returns	0.103	2	0.95
IDX Returns	FXxOI	3.538	2	0.17
IDX Returns	FXxGI	1.224	2	0.542
IDX Returns	FXxGSL	3.340	2	0.188
IDX Returns	ALL	14.300	14	0.428

(2014); Degiannakis et al. (2017); Akinlo (2014); Gupta (2016); Putra and Robiyanto (2019) and Antono et al. (2019) which demonstrates that there is a significant influence of world oil and gas prices on stock return in short and long-term. Then Boyer and Filion (2004) argued that oil prices impact stock markets in the mining sector.

5.5.2. Gas price has a significant effect on the stock return of mining sector

The second hypothesis that changes in gas prices positively affect stock returns in the mining sector is also rejected. It because gas production and exploration are needed to meet demand. The ups and downs of gas price also do not affect the mining sector's return because only one company produces gas (PGAS). As a result, it does not affect returns in the mining sector.

This result is following Oberndorfer (2009); Arshad and Bashir (2015); Saudi et al. (2018); Antono et al. (2019) argued that there is no significant relationship between the oil price on the stock market price in the mining sector. However, it contradicts the findings of Basher et al. (2012); Wahyudi et al. (2017) argued that the impact of gas price changes on stock markets in the mining sector. Then Boyer and Filion (2004); Ghoilpour (2011), and Acaravci et al. (2012) show that gas prices have a significant relationship with mining sector stock returns.

5.5.3. Gold price has a significant effect on the stock return of mining sector

The third hypothesis shows that gold price changes significantly affect the mining industry stock returns rejected. The ups and downs of gold prices do not affect the mining sector's return because only six companies produce gold (ANTM, BRMS, PSAB, MDKA, SQMI, UNTR) of the 23 companies in the mining sector that were the samples of this study. As a result, it does not affect returns in the mining sector.

It aligns with the study of Baur and Lucey (2011); Wang (2012); Agyei-Ampomah et al. (2014); Sheikh et al. (2020) that there is no change in the stock market with the shift in prices of gold. Then Apituley (2018) and Utama and Puryandani (2020) argued that there is no association between the gold price on IHSG. It also contradicts with the findings of Le & Chang (2012); Arfaoui and Rejeb (2017); Dwiati and Ambarwati (2017), and Putra and Robiyanto (2019) reveals that between the return of the mining sector and prices of gold, there is a significant favourable influence.

5.5.4. Exchange rate moderates the relationship between oil prices of mining sector

The fourth hypothesis, which shows that the exchange rate moderates the relationship between oil prices and the mining sector, is rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

This result is under Suriani et al. (2015), which shows that the exchange rate cannot moderate the relationship between the gold

price on IHSG. Khan (2019) also stated that the exchange rate has a significant negative effect on stock returns on the Shenzhen Stock Exchange. Then Usman and Siddiqui (2019) that there is no influence of the exchange rate in the relationship of oil prices and stock prices.

It also contradicts with the findings of Sadorsky (2000); Mashayekhi et al. (2013); Vejzagic and Zarafat (2013); Hartley and Medlock (2014); Arfaoui and Rejeb (2017); Beckmann et al. (2017) and Antono et al. (2019) that the prices of oil measured in terms of the domestic currency is increased by an appreciation of the US dollar. Wahyudi et al. (2017) show that the exchange rate is the center of the relationship between the oil price and mining sector stock returns. Likewise, the results of Putra and Robiyanto (2019); Wasserfallen (1990); Edison (1991) show that the exchange rate has a significant negative effect on stock returns.

5.5.5. Exchange rate moderates the relationship between gold prices of mining sector

The fifth hypothesis is that the exchange rate moderates the relationship between the gold price and the mining sector is also rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates.

Similar results were presented by Ghalayini and Farhat (2020) in which there was no intervention of exchange rates among the relationship between gold prices and stock returns. It also contrasts with the findings of Yousefi and Wirjanto (2004); Zagaglia and Marzo (2010); Adaramola (2012); Rahmanto et al. (2016), and Zarei et al. (2019) that the price strategy is critical to cope with the effects of the exchange rate as it will help to adjust oil prices. Beckmann et al. (2017) that the costs of gold measured in terms of the domestic currency is increased by an appreciation of the US dollar.

5.5.6. Exchange rate moderates the relationship between gas prices of mining sector

It can be proven from Table 8 that the hypothesis that the exchange rate moderates the relationship between gas prices and the mining sector has also been rejected. If the dollar exchange rate increases, more dollars will be needed to pay for oil imports abroad. However, importers can get around this by hedging through forwarding contracts to anticipate changes in exchange rates. This result is by Baatarzorig et al. (2018) determined that there is no moderation of exchange rate among the relationship between gas prices and stock prices.
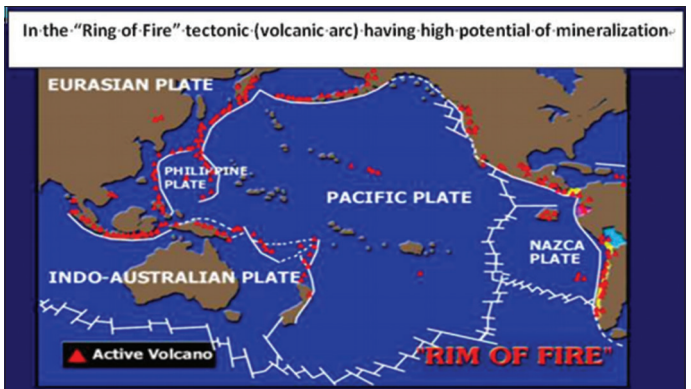
It also contradicts the findings of Hartley and Medlock (2014), which indicates that the exchange rate affects gas prices. Wasserfallen (1990); Edison (1991); Putra and Robiyanto (2019) that to adjust the prices of oil supply as a response, oil and gas exporting countries, such as Indonesia, should also adjust oil supply or process as a response to the exchange rate. Then Beckmann et al. (2017) that the prices of gas measured in terms of the domestic currency are increased by appreciating the US dollar.

Even Indonesia is considered one of those developing countries that have rich mineral resources, such as oil and gas and hard material (stone, coal, and metallic) because, in the Pacific ring of

Table 8: Summary of hypothesis

S. No	Proposition	Results
H₁	Oil price change has a significant effect on the stock return of the mining sector	Rejected
H₂	Gas price change has a significant effect on the stock return of the mining sector	Rejected
H₃	Gold price change has a significant effect on the stock return of the mining sector	Rejected
H₄	The exchange rate moderates the relationship between oil prices and the mining sector	Rejected
H₅	The exchange rate moderates the relationship between gold prices and the mining sector	Rejected
H₆	The exchange rate moderates the relationship between gas prices and the mining sector	Rejected

Figure 1: Pacific ring of fire

Source: Soelistijo et al. (2015)

fire, located in the country that can we see on figure 1, the result of this research show there are no relationship beetwen gas prises and the mining sector stock prices.

Another factor that is considered why the ups and downs of oil prices, gold prices, and gas prices are not determinants for investors to get a return on shares in the mining sector is because trading on the stock exchange is mostly influenced by psychological factors (Ady, 2015; 2018; Ady et al., 2013; Ady and Hidayat, 2019). (Hagstrom, 2010) shows that 60% of investor transactions are based on psychological, and only 40% transact rationally. It means that the increase in share prices in the mining sector is caused by investor optimism for the mining sector in the future. If investors are optimistic, they see that energy from petroleum and coal in the future will get better and develop. Investors believe that energy production and exploration will continue, and energy demand will continue to increase so that mining stocks will increase, thereby increasing returns.

Meanwhile, suppose the investor is pessimistic, for example. In that case, they think that oil and coal energy will not last long and run out because it is replaced with alternative energy, such as solar energy, wind energy, water energy, and so on. It will reduce the purchase of shares in the mining sector so that the mining sector's share price declined and decreasing returns.

6. CONCLUSION

Indonesia has been a country that is considered rich in terms of natural resources. The mining industry of the country has a massive

contribution to the development of the economy. However, external factors like fluctuations in rates cause considerable losses in this industry. Therefore, this study has focused on determining the effect of world oil prices, gold prices, and other energy prices in the Indonesian mining sector stock return with the moderating influence of the exchange rate of the Indonesian Rupiah. For this purpose, the data has been gathered from the secondary sources of information for the oil price, gold price, gasoline price, Indonesian mining sector index, and Indonesian Rupiah exchange rate from 2016 to 2020. The results have been analyzed using descriptive statistics, Augmented Dickey-Fuller (ADF), vector autoregression, and granger causality test. Based on the analysis, it has been determined that there is no significant effect of oil price, gold price, gasoline price over on the Indonesian mining sector stock returns. In addition to this, it has also been determined concerning the moderation of foreign exchange return that there is no moderation of FX returns over the relationship of oil price, gold price, gasoline price with Indonesian stock returns of the mining sector. In this manner, it is suggested that the mining companies in Indonesia provide less emphasis on oil price, gold price, gasoline price, and the foreign exchange rate of the Indonesian Rupiah. Other factors, such as investor psychology, also affect the return of shares in the mining sector.

This study has focused on determining the effect of world oil prices, gold prices, and other energy prices on the Indonesian mining sector with the moderating effect of exchange rate on the Indonesian Rupiah. In this manner, the impact of all independent variables has been considered in the Indonesian mining sector. Therefore, it is suggested for future researchers also to investigate other sectors of the country, which are also influenced by oil prices, gold prices, and different energy prices. On the other hand, the Indonesian Rupiah's moderating effect has been considered in this study, which also restricts this study's scope. Therefore, it is also suggested for future researchers to investigate the moderating effect of other economic measures.

Moreover, the entire industry is restricted to one country, which is Indonesia. In this manner, it is also suggested for future researchers to investigate the change in oil, gold, and other energy prices over different countries' mining industry. Therefore, they will be able to make significant contributions to the existing literature.

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