Oil price, gold price and stock market index: Evidence form ASEAN+3 countries

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Chronicle

Article history

Received 18th Jul 2022
Revised 29th Aug 2022
Accepted 19th Sep 2022

Keywords
Oil Price,
Gold Price,
Stock Market Indexes,
ASEAN+3

JEL classification

Abstract

The interconnection between the oil price and gold price with the stock market index has generated an epic amount of discussion for ages. While a numerous number of prior studies on different economies have drawn mixed findings, empirical findings for the relationship of those three vital economic indicators in ASEAN countries remain limited and open room for further research to call for better macroeconomic policy stances. This inclines our paper to center on exploring the nexus between the world oil price and gold price with the movement of ASEAN+3 countries' stock markets represented by the stock market indexes. To conduct the research, we apply different empirical techniques and models (VECM, ARDL, VAR) on a monthy dataset from January 2010 to December 2021 collected on the cases of ASEAN economies together with three other ASIAN countries including India, Japan, South Korea. The study's findings reveal the long-run relationship between stock market and the oil, gold price in several countries covering Vietnam, Korea, Indonesia, India, and Japan, leaving the rest of the country sample with short-run dynamics between those three macro indicators. Besides, the results also indicate that even though the impacts of oil prices and gold prices on the stock price index of emerging economies are inconsistent, the shocks to oil price in comparison with gold price swings seem to have more impact on the movements of stock market indices.

1. Introduction

Gold is a precious metal that acts as both an industrial commodity and a monetary or investment asset, used for the purpose of hoarding or exchanging. Gold is a liquid, counter-cyclical asset that can help investors accomplish their basic objectives of safety, liquidity, and return by acting as a long-term store of value (Yousef and Shehadeh, 2020). Besides, gold is also known as a leading indicator reflecting the level of inflation, and is always considered as a hedge against inflation, diversifying risks when a financial crisis occurs (Gokmenoglu and Fazlollahi, 2015). When there are fluctuations in the economy, the risk of investing in channels increases, investors will tend to look for gold. Gold is also

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ISSN 2734 - 9853

kept in significant quantities by central banks and international financial organizations for diversification and economic security purposes. Oil price can be considered as an indicator of volatility, because fluctuations in world oil price are influenced by the unexpected changes in supply and demand, leading to fluctuations of the exchange rate of an oil importing economy. Understanding the volatility of crude oil prices is critical because it can affect many sectors of the economy and contribute to economic instability in both exporting and importing countries (Gokmenoglu and Fazlollahi, 2015). In detail, most businesses use oil as an input fuel, therefore as the price of oil swings around the world, it affects firms' input costs, causing performance to fluctuate. This will have a direct impact on company stock indexes (Nguyen, 2016).

Instead of choosing to invest safely in gold and other precious metals, the emergence of the stock market offers diversification in the portfolio investment, which has greater appeal to investors. With a similar amount of money, investors can choose to invest in businesses that perform well, bring higher returns on investment, but also are possibly exposed to higher risks in comparison to traditional investments including gold.

Gold, oil and stock market not only provide investors with different investment channels, but also reflect and simultaneously direct economic activities through their markets' transaction volume and prices. The movements of oil price, gold price and stock price coupled with their interactions serve as important economic indicators for policymakers in regulating the economy. As a result, the relationship between gold price, oil price and stock market has always been a topic of interest to researchers and policymakers.

Previous studies provide mixed findings about the relationship between the oil and gold markets with the stock market. Specifically, Gokmenoglu and Fazlollahi (2015) conducted research on the Interactions of gold, oil, and stock market in the United States, mentioning the long run and short run impact of gold and oil price on S&P 500 stock market price index. The stock markets of the ASEAN-5 countries were found to interact dynamically with their respective significant macroeconomic issues including GNP – Gross National Product, Money Supply, Consumer Price Index and Money Market Rate, according to Wongbangpo and Sharma (2001).

The long-run relationship is confirmed in Gokmenoglu and Fazlollahi (2015) indicated that one percentage increase in oil price would lead to a decrease 18% in stock market in long-run, Alamgir and Amin (2021) found the positive relationship between world oil price and stock market with the evidence from South Asia, Nguyen et al. (2020) shared a similar result, oil price positively affects Vietnam's Stock Market. Whereas short-term interaction is explored in other previous studies including Nguyen (2018) showed that in short-run, gold price produced no effect on Vietnam Stock Market Index, Tursoy (2017) demonstrated that Turkey experienced a negative relationship between gold price and stock price, and positive relationship between crude oil and stock prices.

To be the best knowledge of the authors, there is no prior literature covering the relationship between oil, gold, and stock markets for ASEAN, and even ASEAN+3 markets, especially with the research period covering the emergence of the Covid-19 epidemic. Therefore, with this study, we would like to contribute some novelty to the research field, including: (i) the study, by deploying various appropriate empirical models (VAR – Vector AutoRegression, VECM – Vector Error Correction Model, and ARDL – Auto Regressive Distributed Lag) into scrutinizing the relationship between the two commodities markets with the stock market, provides reliable findings to enrich the research field of finance and economics; (ii) the research model is designed with a combination of important explanatory macro variables with oil and gold prices to bring about the most objective and reliable findings about the relationship between stock markets and the world oil price and gold price.

To successfully achieve those contributions,

the study focuses on shedding lights on following research questions: (i) Do world oil price and gold price have either a short run or long run relationship with the stock market of every single country in ASEAN+3?; (ii) How are these relationships different among countries? Accordingly, the rest of the paper is constructed as following: the literature review focuses on discussing previous studies's findings to highlight the novelty of our paper; the empricial method utilized to address aforementioned research questions is thoroughly presented in the section of methodology and data; Finally, the research results are discussed at the end of this paper.

2. Literature Review

Oil has been the cornerstone of the economy in this modern world (Huang et al., 1995). It provides energy to the power industry, creates heat, generates electricity and extracts fuel for running vehicles and planes. Moreover, it is also essential for the manufacturing of everyday life necessities including plastics, fertilizers, paints, medicines and so on. This demonstrates that oil can be widely used as an indicator to evaluate economic stability since the dependence of production on oil is ineluctable. Higher oil prices implicates higher production cost (Gisser and Goodwin, 1986), entailing the rise in price of products and services, the corollary is that input costs will also go up which then hurt the businesses' financial performance, theoretically causing the firm share's price to fall and eventually a decrease in the stock market index as well. However, this relationship is only right for nations having production activities that depend much on oil-importing. In contrast, the oil-exporting countries definitely bear fruits from selling oil at a higher price, which consequently raises government spending and investing activities, then intensifies the production (Filis et al., 2011). For such countries, the stock market responds positively to the change in the oil price. As for the relationship between gold price and the stock market index, even though gold and the stock market are not directly correlated, throughout history, gold price is observed to surge during market wobbles (Mani, 2019). Whenever there are factors such as high inflation, increase in interest rate, fall in GDP and so on that stagger the economy, the stock market will be more likely to become less attractive for investors. Instead, they would prefer gold investment to secure their money due to its less varying value over the course of time. This somehow explains what happened in the past when a positive change in the gold price indicates a decline in the stock market. In other words, gold and the stock market price normally establish an inverse relationship.

The inter-relationship between commodity markets (gold price and oil price) and financial market (stock market) has become one of the great interests to many researchers for years due to expected possible impact of any variation in those commodities' prices to different market participants and the stability of the economy and financial market, yet the number of studies related to the topic are still limited and the findings have been observed to be mixed across the studies.

Papapetrou (2001) studied the relationship between oil price and stock market in Greece, using the VAR approach, observed that oil prices could be considered as an important factor to explain the movements of stock prices. In detail, real stock returns would decrease because of a positive oil price.

Gokmenoglu and Fazlollahi (2015) found the long- run impact of both of gold and oil price changes on S&P 500 stock market price index, in which, the impact of the gold price is higher in both long- run and short- run. Arouri et al. (2015) also indicated the significant impact between gold prices and China's stock prices, by using the VAR- GARCH model, with the data from 2004 to 2011.

Different from above research, Raza et al. (2016) found interesting relationship between oil and gold markets with the stock market. By looking at the asymmetric influence of gold, oil, and their associated volatilities on developing market stock markets, the authors believed

that gold prices have a positive impact on stock market values in the growing BRIC nations.
As for ASEAN literature, the relationship between macroeconomic fundamentals, gold, oil, and stock market performance has become a hot topic of debate among financial economists (Ouma and Muriu, 2014), particularly in ASEAN countries, where the stock market and economy are growing at the same time, raising an empirical question about these economic phenomena. Several scholars have used a variety of theoretical frameworks to model the influence of gold and oil prices on stock market performance, as well as other macroeconomic issues. The majority of research focuses on the stock market's short-term impact on those economic factors.
Wongbangpo and Sharma (2001) found a negative long-run link between stock prices and interest rates in the Philippines, Singapore, and Thailand, but a positive link in Indonesia and Malaysia. Jamaludin et al. (2017) found that CPI, as a proxy for the inflation rate, has a greater impact on the stock market than the exchange rate in Islamic nations like Singapore, Malaysia, and Indonesia. Hussin et al. (2013) and his colleagues in Malaysia discovered that the FBMES (FTSE Bursa Malaysia Emas Shariah Index) and crude oil prices have a statistically significant association, as the Pearson correlation coefficient's significance and big value imply a strong relationship. Forson and Janrattanagul (2013) discovered that CPI and stock market movements had a negative association. Oil and gold prices have both had a detrimental impact on Thailand's stock markets (Raza et al., 2016). Wahyudi et al. (2017), on the other hand, claims that the oil price has a positive impact on the aggregate stock price index, while the exchange rate has a huge negative impact. Using the Johansen Cointegration test for the period January 2000 to November 2019, Selvan and Raj (2019) stated that there is a long-run link between the gold price and the Bombay stock market index (Sensex) in India. Masih et al. (2011) found a long-run negative link between the stock market and oil price in South Korea. As a result of their findings from our VECM, real stock returns appear to be the primary channel of short-run adjustment to long-run equilibrium, as oil price shocks have two negative effects on firm profitability: it raises production costs for firms, and investors anticipate a decline in profit margins for firms, causing them to make decisions that affect stock market indexes (i.e., selling shares).
Le and Chang (2011) used the limits test to cointegration to study whether the gold price and the Japanese stock price have considerably positive impacts on the Japanese interest rate in Japan, a large oil-consuming and gold-holding country. This means that rising gold and stock prices may assist to create expectations of rising inflation over time, leading to an increase in interest rates in the long run. Nguyen and Vo (2019) found that the price of oil (OP) has a minor effect on the VN-Index, with the regression coefficient being statistically insignificant, and that the price of gold (GP) has little effect on the VN-Index in the short and medium run in Vietnam. Furthermore, long-term inflation as measured by the consumer price index (CPI) has a positive impact on the VN-Index. Furthermore, the results of the VECM model show that the exchange rate has a short-term negative impact on the VN-Index. Besides, the emergence of the unprecedented COVID-19 pandemic, affecting and changing various economies across the globe, has been suspected to distort the relationship between oil, gold and stock market. Most research results in this period show that the long-term relationship between stock markets in Southeast Asian countries and oil prices, gold prices, and other macro variables no longer exists as it was before the global pandemic (Asaad, 2021). Singh et al. (2021) found the negative relationship between the exchange rates, stock market return and the number of COVID- 19 infections in G7 countries.
By contrast, Arisandhi and Robiyanto (2022) studied the relationship only of gold price and currency rates on the stock market in 5 countries: Thailand, Singapore, Malaysia, Philippines and Indonesia, found that exchange rate was produced a positive correlation with stock

price, and be considered as a better investment in compared with gold. Similarly, Prabheesh et al. (2020), Nguyen et al. (2020), Ngo and Vo (2021) share the similar findings as in Arisandhi and Robiyanto (2022). In detail, Prabheesh et al. (2020) used the DCC-GARCH model and also found a positive joint movement between oil price and stock market for one of the major oil-importing Asian economies, Korea, during the COVID19 outbreak from 1 January to 8 June 2020. Nguyen et al. (2020) discovered that the gold price had a negative impact on the Vietnam's stock market index, whereas the oil price has no immediate impact. Ngo and Vo (2021) found that the crude oil and stock markets appeared to be strongly correlated under the Covid-19 outbreak; and that the associations between West Texas Intermediate (WTI) crude oil price and S&P 500, Gold exhibit high coherence, but comovements between S&P 500 and gold markets revealed a weak connectedness. Those results are for explaining the impact of the Covid-19 epidemic to the relationship but are driven from the dataset up to April of 2020 which seems to be early and short research period to adequately observe the impact of the Covid-19 to the interaction of stock market towards shocks on oil and gold prices in examined countries.

Furthermore, regarding that limited number of research covering the Covid-19 impact on the relationship, due to the scarcity of the monthly data for periods after the Covid-19 emergence to produce reliable arguments, most above studies (Nguyen et al., 2020, Ngo & Vo, 2021, Asaad, 2021, Arisandhi & Robiyanto, 2022) included only investigated behavior of stock price, oil price and gold price and ignore other factors as control variables that could potentially have impact on stock market volatility, such as CPI, central bank policy rate, and exchange rate. This shortage could lead to empirical models with omitted variables bias and less-reliable conclusion and encourage our study for not dividing the sample into subsamples to scrutinize the separtate contribution to the interconnection between oil, gold price, and stock market.

In brief, through a review of prior literature both internationally and in ASEAN+3 cases, it can be seen that empirical studies and empirical conclusions on the relationship between the stock market, oil price, gold price, and other macroeconomic variables in ASEAN+3 are very few. Hence, it is necessary to call for further studies to provide reliable findings providing a concrete foundation for producing effective and appropriate policy recommendations in preventing the stock market of ASEAN+3 countries from external shocks driven by international gold and oil markets.

3. Methodology and data

3.1. Methodology

To examine the relationship among variables that hold no clear and direct impact on each other, Vector Autoregression model (VAR) will be an appropriate choice (Ngo et al., 2020). Furthermore, there could be a long term relationship among those variables that could not be detected by VAR which exclusively specializes in short-term dyanmics of variables. Accordingly all possible models are tested with the sample, including Autoregressive distributed lage model (ARDL) and Vector error correction model (VECM) for checking the existence of long-run relationship, and VAR for short-run one.

In particular, the stationary characteristic of the original dataset and its transformation importantly define the appropriate models among ARDL, VECM, and VAR (Ngo et al., 2020). Therefore, initial stage in the regression process is to perform the Augmented Dickey-Fuller Test (ADF) and Phillips-Perron (PP) tests on the entire dataset (all variable series) to see whether there is a unit root process.

If the results of the unit root testing on Y series demonstrate that Y series are stationary at level (I(0)), the basic Ordinary Least Square (OLS) will be used for stationary Y and X series. Cointegration tests will be performed to assess whether the variables X and Y have a long-term relationship if the Y series are unit

root processes (I(1)) at the level but stationary (I(0)) at the initial difference. Depending on the stationary feature of the X series, several tests and models will be applied. If X and Y (both series are I(1)) are non-stationary (I(1) at level, but stationary (I(0)) at the initial difference, the Johansen-Cointegration Test with Error Correction Model (ECM) is used. If the X series are stationary at the same level, the Autoregressive Distributed Lag (ARDL) model will be employed in combination with the Bounds Test. Bounds tests should be used initially to see if two variables are cointegrated. If these two tests reveal a cointegrating vector (a long-run relationship) between two variables, the next step is to use ECM and ARDL to appropriately assess short- and long-run pass-through. The Vector Autoregressive Model (VAR) will be employed instead of ECM and ARDL if neither of these tests finds a cointegrating relationship between two variables.
In addition, if cointegration is observed but the regression findings from the ARDL and ECM models show no meaningful evidence for the projected long-run pass-through, this study will use VAR for variable series. The model specifications' stability and other flaws are checked and detected before being proceeded to stages of result interpretation and discussion. The tests covered in this study include the CUSUM test (stability check), Breusch-Godfrey LM tests (autocorrelation diagnosis), and Breusch-Pagan LM test for heteroskedasticity. Following Ngo et al. (2020), ECM, ARDL, and VAR models are presented below.

Vector Error Correction Model – VECM
The Vector error correction mechanism (VECM) is the next stage in our study process. The speed at which an endogenous variable return to equilibrium following any change in exogenous variables is estimated using an error correction model, which demonstrates how to reconcile the short-run behaviour of a time series economic variable with its long-run behaviour. The VECM is determined using the

$$\Delta y_t = \alpha' \Delta X_t + \sum_{j=1}^{p-1} \beta_j' \Delta Z_{t-j} + \pi_{yy}\, y_{t-1} + \pi_{yX,X} X_{t-1} + \gamma ECT_{t-1}$$

Where y is the estimated coefficient of ECT-1 (the first lag of error correction term-ETC) and ECT are the estimated model's residuals.
The lag order is decided using a set of criteria that includes: LR (Sequential modified LR test statistics); FPE (Final prediction error); AIC (Akaike information criterion); SC (Schwarz information criterion); and HQ (Hannan-Quinn information criterion). The recommended lag order changes depending on the criterion utilized, therefore the lag length that is suggested the most frequently by multiple criteria is chosen for the regressing model.

Autoregressive Distributed Lag – ARDL
A false regression can occur when a nonstationary series is regressed on another nonstationary time series. The purpose of the co-integration test is to see if there is a long-run equilibrium connection between variables that are integrated at least in first difference I. (1). If the time series variables are integrated at separate levels (I(0) and I(1)), the ARDL (autoregressive distributed lag) approach may be used to look for co-integration (Ngo et al., 2020).
The equation for the ARDL modified model is as follows:

$$\Delta y_t = \alpha_0 + \alpha_i \Delta X_t + \sum_{j=1}^{p-1} \beta_j' \Delta Z_{t-j} + \varepsilon_t$$

Where Δ is the difference operator, Yt denotes the dependent variable, Xt denotes the independent variables, Zt denotes the variable lags, Z = f(Xt, Yt), t denotes the trend term, and is the disturbance.
After that, the model's serial correlation and stability should be verified. The null hypothesis for testing co-integration is ϖyy = ϖxx = 0 (no co-integration), which is evaluated using the Wald test and should be rejected in terms of the long-run connection between variables. The presence of a significant F test indicates co-integration.

Vector Autoregressive Model – VAR
The VAR model is estimated as follows (Ngo et al., 2020):

$$\Delta Y_t = A(L)\Delta Y_{t-1} + B(L)\Delta X_{t-1} + u_t$$

where Y denotes endogenous variables and X denotes exogenous variables, A(L) and B(L) denote coefficient matrices, and u denotes a vector of impulses.

In a VAR model, ordering variables play a critical role in the estimation process. The most exogenous variables are generally ordered first, followed by the least exogenous variables. This paper only looks at VAR's variance decompositions (evaluate the contribution of variables in forecast error of one variable) and impulse response functions (trace the impact of one-time shock in one variable on current and future movements of other variables), which provide information on short-run dynamics or immediate interest rate pass-through, in an attempt to investigate the response of stock price to shocks to oil, gold price through a two-stage mechanism.

3.2. Data

Beside key variables representing stock market index, oil price, and gold price, to obtain better fitness of the empirical models, or in other words, to effectively and properly examine the contribution of oil and gold prices on the movement of stock market along with observing how stock market response to changes in the world oil and gold markets, some important economic indicators contributing to the variance of the stock market index are also placed into regression models as control variables. Those variables that are most recommended and used by prior studies include central bank policy rate, exchange rate, consumer price index as presented in the table 1.

In brief, the dataset utilized in this study is a month-end dataset of different macroeconomic variables suggested by various prior literature (Table 1) including central bank policy rate, exchange rate, world oil price, world gold price, consumer price index, and stock price index for the period from January 2010 to December 2021 from four main sources: Inter-

Table 1. Summary Table of the dataset

Variables	Notation	Sample	Frequency	Sources	References
Central Bank Policy Rate	PR	2010M01 –2021M12	Monthly	IMF	Assefa et al. (2017), Papapetrou (2001), Forson and Janrattanagul (2013)
Exchange Rate	ER	2010M01 – 2021M12	Monthly	Investing	Asaad (2021), Ngo and Vo (2021), Singh et al. (2021)
World Oil Price	OP	2010M01 – 2021M12	Monthly	EIA	Gokmenoglu and Fazlollahi (2015), Papapetrou (2001)
World Gold Price	GP	2010M01 – 2021M12	Monthly	Investing	Gokmenoglu and Fazlollahi (2015), Arouri et al. (2015), Arisandhi and Robiyanto (2021)
Consumer Price Index	CPI	2010M01 – 2021M12	Monthly	S&P global	Forson and Janrattanagul (2013)
Stock Price Index	VNI SET PSEI KOSPI IDDOW KLCI SGXL NIKKEI NIFTY 50	2010M01 – 2021M12	Monthly	Investing	Assefa et al. (2017), Gokmenoglu & Fazlollahi (2015), Papapetrou (2001), Arouri et al. (2015), Nguyen et al. (2020), Ngo and Vo (2021), Singh et al. (2021), Forson and Janrattanagul (2013)

Note: VNI (Vietnam); SET (Thailand); PSEI (Philippines); KOSPI (South Korea); IDDOW (Indonesia); KLCI (Malaysia); SGXL (Singapore); NIKKEI (Japan); NIFTY 50 (India)

Table 2. Results of Unit Root Tests

Country	Series	Result	Country	Series	Result	Country	Series	Result
The world market	LNOP	I (1)						
	LNGP	I (1)						
Vietnam	CPI	I (1)	Philippines	CPI	I (0)	Japan	CPI	I (1)
	PR	I (1)		PR	I (1)		PR	I (1)
	LNER	I (0)		LNER	I (1)		LNER	I (1)
	LNSP	I (1)		LNPSEI	I (0)		LNN225	I (1)
Indonesia	CPI	I (1)	Singapore	CPI	I (1)	India	CPI	I (0)
	PR	I (1)		PR	I (1)		PR	I (1)
	LNER	I (1)		LNER	I (1)		LNER	I (1)
	LNIDDOW	I (1)		LNSGXL	I (1)		LNNSEI	I (1)
Malaysia	CPI	I (1)	Thailand	CPI	I (1)	Korea	CPI	I (1)
	PR	I (1)		PR	I (1)		PR	I (1)
	LNER	I (1)		LNER	I (1)		LNER	I (0)
	LNSP	I (0)		LNSET	I (0)		LNKOSPI	I (1)

Note: I (0) denotes for series stationary at level; I (1) denotes for series having unit root for the level series stationary at first difference; "LN" represents logarithm form of original time series

Source: Authors' estimations from Eviews 9

national Monetary Fund (IMF); Investing.com; U.S. Energy Information Administration (EIA) and S&P global. The dataset covers 6 ASEAN countries in research, Malaysia, Indonesia, Vietnam, Thailand, Philippines, Singapore, and other 3 economies - India, Japan, South Korea.

4. Empirical result and discussion

Looking through tables, not all variables are non-stationary at level and stationary at first different. As presented in the methodology part, for variables are integrated at different levels (Y series is I(1) (not-stationary at level but stationary at the first difference series while X series could be I(0) or I(1)), the ARDL model is employed to figure out the long-run relationship. Results of unit-root test from Table 2 suggest that there are a total of 6 countries including Vietnam, Singapore, Korean, India, Japan, Indonesia that ARDL can be applied to explore long-run relationships between stock market and oil, gold markets, which is discussed in below sections.

4.1. Long- run relationship

The long- run relationship, between stock price index with the world oil price, world gold price and other control variables for all these 5 countries, namely Vietnam, Korea, Indonesia, India, and Japan are investigated through using the ARDL model as these variables are integrated at different levels I(0) and I(1). There is a long-run relationship among the variables (Stock Price Index; LNOP; LNGP; PR; LNER; CPI) because the null hypothesis (H0): "no long- run relationship exists" is rejected as the value of F- statistic is 2.843, 9.196, 2.974, 8.344, 4.521, in these countries respectively, which is higher than the value of F-critical 5%.

As can be seen from the table, there are two types of relationships between the stock price index, oil price, and gold price, which are the positive and negative ones. Hence, the two groups of countries will be examined separate-

Table 3. Long-run relationship with ARDL models

Country	ARDL BOUND TEST				LONG RUN RELATIONSHIP		Short run Adjustment Speed (ECT)
	F-statistic	F-critical values			LNOP	LNGP	CointEq(-1)
		10%	5%	1%			
India	8.344	2.080	2.390	3.060	0.120	0.384	-0.614
Indonesia	2.974	2.08	2.39	3.060	0.567	-0.504	-0.085
Japan	4.521	2.080	2.390	3.060	0.107	0.485	-0.214
Korea	9.196	2.080	2.390	3.060	-0.023	0.466	-0.208
Vietnam	2.843	2.080	2.390	3.060	-0.101	-0.816	-0.083

Source: Authors' estimations from Eviews 9

ly according to the nature of the relationship. The first group will be these countries that witness a negative relationship between the variables, namely Vietnam, Korea, and Indonesia. Another will be the ones that demonstrate a positive relationship between these variables, which is India and Japan.

Vietnam is an outstanding country in the first group, which shows a negative relationship between both oil price and gold price on the stock market index. Through results from the long–run ARDL model coefficients, it is clear that a one percent rise in the oil price (LNOP) and gold price (LNGP) would lead to a decrease of approximately 0.101% and a decline of 0.816% in the stock price index in the long run. Since gold is seen as a classic stock market replacement. An increase in the price of gold may encourage investors to withdraw their funds from the stock market, resulting in a drop in the stock index. The findings are consistent with those of Gokmenoglua and Fazlollahia (2015), who discovered a negative link between the stock price index and the gold price. In terms of oil price, it has a direct and indirect impact on stock market volatility. The direct effect is explained by the fact that oil price volatility creates uncertainty in financial markets, which leads to a drop in stock prices. Because of high input costs and difficulty selling output items, the company's real cash flow is reduced as a result of oil price volatility. This then leads to a fall in production output and an increase in the rate of inflation. Then, it could be seen that changes in the economy's macro factors, changes in the firms' performance and future development prospect in turn have an impact on the firms' stock price in particular and the stock market index in general. The price of oil has a negative influence on the stock market. Furthermore, the study indicated that oil price is a risk factor for the stock market by employing the arbitrage business model. In addition, Alamgir and Amin (2021) discovered evidence that high oil prices will raise the economy's production costs, resulting in lower output and a lower projected return on the stock market. In brief, it could be said that the impact of the global gold and oil price on the movement of Vietnam's stock market is relatively weak. The short-term disequilibrium relationship of those three markets is adjusted to the long-run one with the adjustment speed of only 8.3% which is considerably low as well.

The results of Korea and Indonesia also reveal the same pattern. One percentage increase in oil price leads to a decline of 0.023% in the stock price index of Korea. And one percent rise in the gold price in Indonesia leads to a decrease of 0.504% in the stock price index of this country.

For the second group of results, taking India as a representative, the result of the ARDL model reveals a positive relationship between the stock price index, oil price, and gold price. It indicates that a one percent increase in oil price and gold price would lead to a rise of 0.120% and 0.384%, respectively in the stock price

Table 4. Impulse response (10 months)

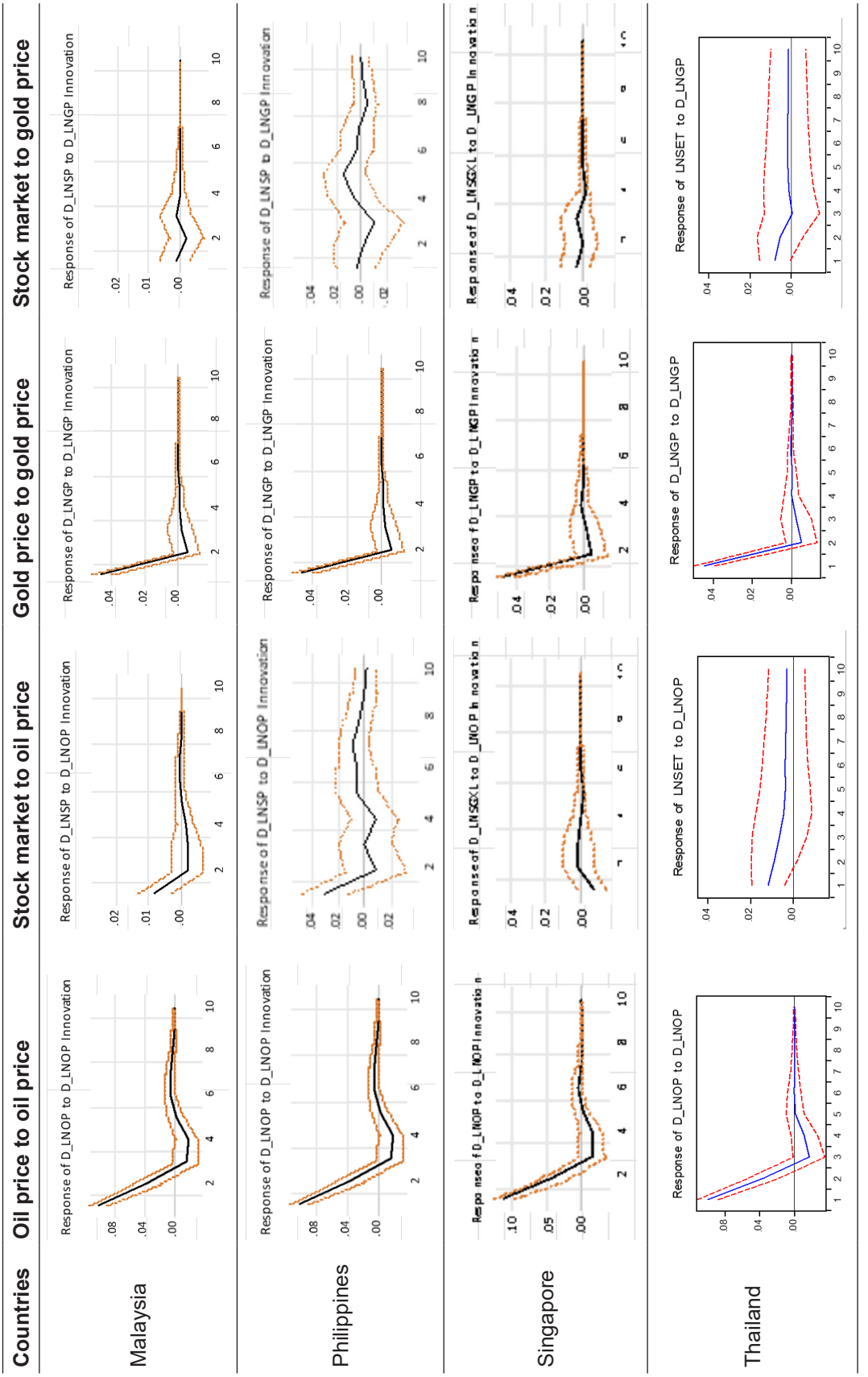

Table 5. Variance Decomposition

Period	Malaysia		Philippines		Singapore		Thailand	
	D_LNOP	D_LNGP	D_LNOP	D_LNGP	D_LNOP	D_LNGP	D_LNOP	D_LNGP
1	7.223	0.184	27.554	0.365	1.938	0.606	6.386	2.851
2	7.896	0.343	25.776	0.325	2.019	0.589	4.994	2.066
3	7.806	0.376	22.279	2.717	2.056	1.050	4.194	1.455
4	8.554	0.820	22.798	3.381	2.048	1.111	3.578	1.172
5	8.366	1.094	21.733	7.303	2.057	1.110	3.182	1.019
6	8.324	1.284	21.992	7.466	2.057	1.112	2.939	0.922
7	9.480	1.267	22.908	7.394	2.057	1.112	2.764	0.856
8	9.392	1.652	22.949	7.599	2.057	1.112	2.630	0.805
9	9.382	1.691	22.919	7.661	2.057	1.112	2.528	0.766
10	9.430	1.688	22.896	7.663	2.057	1.112	2.448	0.735

Notes: The letter "D" in D_LNOP and D_LNGP denotes the first difference of the time series.

Sources: Author's estimations from Eviews 9

index, with the adjustment speed of 61.4%. These findings are in line with those of Nguyen et al. (2020), Nguyen (2018), Raza et al. (2016). Japan's results also showed the same outcome. One percent increase in oil price and gold price leads to a rise of 0.107% and 0.485% in the stock price index of this country.

4.2. Short-run relationship

For models that fail to explore the long-term interaction between stock market and oil, gold markets, the short-run relations are scrutinized and deeply discussed in this section with the support of the VAR models.

Impulse Response

The impulse response is applied to demonstrate the stock market index's response to short-run shocks in oil and gold prices, using logarithms with variables and observations over a period of 10 months (Table 4). During the whole study period, the reaction of stock indexes to changes in oil and gold prices experienced different patterns in different country cases. To be specific, in Singapore, when the oil price increased 0.14% in the first period, the stock price index saw a slight decrease in 0.02%. This can be understandable for the response as mentioned in the theoretical framework, oil price increase directly impacts the input of business, leading to the reduction in profits of oil production and use by enterprises. While Philippines' stock market slightly and negatively reacts to a shock of the oil price, the stock markets of Thailand, Malaysia and Philippines witness a contrasting response in its stock market indexes.

A striking feature to note is that, there is a positive relationship between gold price and stock market indexes, where an increase in gold price also leads to a growth in the stock indexes of all four countries. In detail, for the first month, gold price increased 0.06%, as a response, the stock price increased from the range of 0.002% to 0.01%. This results somewhat contrary to the usual theoretical framework, when the price of gold and stock indexes have an inverse relationship, gold has always been "a safe haven" for investors.

However, from the second month, gold price and stock market returned to their inherent negative relationship, seeing the decline in gold price and the rise of stock indexes in countries such as Thailand, Singapore, in the third month for Malaysia and in the fourth

month for the Philippines.

The variance decomposition shows how much percentage change in stock price is explained by the change in price of world oil and gold price during a 10-month period. The first noticeable feature is that the world oil price, compared with the gold price, takes more responsibility for the variation in the stock price of all four countries, which is quite reasonable. As mentioned in the theoretical framework, oil and stock markets are more strongly correlated. This result is also consistent with some other studies. Nguyen and Vo (2019) indicated that in the short term, oil price moved in the same direction with the VN index while gold price did pose an impact but not significant on the Vietnamese stock market from 2000 to 2018. With the endeavour to study about the nexus between oil, gold and S&P 500 during COVID-19 period, Ngo and Vo (2021) found out that the movement of gold price weakly connected with the alteration of S&P 500. In contrast, this index interacted strongly and positively with crude oil price.

Next noteworthy point is that the oil and gold price's extent of impact differs among countries. Shock to both the world oil price and gold price made the greatest and lowest contribution to the variability of the Philippines and Singapore's stock index, respectively. Specifically, in the first month, world oil price accounts for 27.554% of the volatility in the Philippines' stock price. For the gold price, although its shock only contributes a small percentage, this number grows considerably after 2 years to reach 7.663% in the last month. Meanwhile, the gold and oil market in return has nearly 13 and 7 times lower contribution to Singapore stock price's fluctuation, which are 2.057% and 1.112% in month 10.

The last remarkable point is that most of the contribution of gold and oil price shock to the change in stock price of different nations experience an upward trend over a 10-month period except for the oil price shock for Philippines and Thailand as well as gold price shock for Thailand. All of these adjustments all help come to the final interpretation that the Philippines is the country whose stock price is affected the most by stock price and oil price, in which the impact of oil in the stock market is eclipsed as time passes by, which is the same to Thailand but in terms of both gold and oil price. Meanwhile, Singapore's stock index has the lowest dependence on the movement of oil prices. Eventhough Singapore possesses one of the most developing economies in the region and has deeply integrated into the regional and global financial market, its stock market volatility seems to be explained by it own movements rather than highly affected by world indicators including oil price and gold price as observed in other ASEAN countries. This is understandable since Singapore is the third largest oil trading centre with Singapore Exchange (SGX) offers a range of risk management tools for fuel oil and a wide range of other commodities, allowing both investors and finance managers to position themselves against major swings in commodities prices for both investment and operational purposes. The SGX's existing infrastructure and products has helped investors to have active responses and protections against the shocks of oil price as well as other commodities, reducing the influences of those variables on the investment behavior of investors and the stock market index.

5. Conclusion

With the support of the cointegration test, ARDL and VAR models, the study empirically investigates the influence of oil price, gold price on the stock price index from January 2010 to December 2021 coupled with scrutinizing the reaction of the stock market towards the shocks generated from the global oil and gold markets. The empirical results in Vietnam, Korea, Indonesia, India, and Japan reject the null hypothesis that there is no long-run association between the variables, whether negative or positive, while the results for the remaining countries show no evidence to reject that null hypothesis.

The study's major contribution is to provide empirical evidence for the theoretical premise

that the results of the impacts of oil price and gold price on the stock price index of emerging or oil-exporting nations are inconsistent, which is consistent with Asaad (2021). Furthermore, the research findings reveal an influence with distinct signals of oil price, and gold price on the stock price index in the long term, which is reasonable since oil prices have a critical influence in fostering economic growth and stabilizing inflation. Specifically, because the economy is still very sensitive and largely dependent on oil, a shock in oil prices might have a detrimental impact on the economy's stable development, pushing it into recession or catastrophe. Furthermore, changes in the price of oil not only affect the price of the economy, resulting in cost-push inflation, which destabilizes the economy, raises costs, and has a direct impact on people's lives, but also expands the gap between the affluent and the poor.

Eventhough the research findings show that Vietnam, Indonesia, India, Japan and Korea have observed a weak long-run relationship between oil price nad stock market movements over the studied time period, that relationship should be closely watched and tracked over time. Particularly, the found nexus between two indicators in Vietnam could be resulted from the success of the subsidy fund specializing in stabilizing petrol price over years, which is not a permanent solution for the laddering oil price worldwide any longer. It is recommended that the government should be proactive in making national budget revenue and expenditure plans, appropriate state budget revenue structure, and develop economic development plans with petroleum as input with low prices so that they can take advantage of opportunities from the sharp drop in oil prices. In addition, step by step there are plans to limit the influence of oil prices on the economy such as being more proactive in developing other budget revenue sources from crude oil, reducing the proportion of crude oil in total budget revenue, as well as having reasonable policies to control gasoline prices to help the economy develop sustainably and limit the impact of oil price shocks.

The practice of Singapore in developing exchanges for commodities and providing investors and firms with various tools in hedging against the price shocks of oil and other goods could be a good price to be learnt by other countries. This could help investors and firms in particular and the stock market in general to be less affected by the fluctuations in the international oil and gold markets

When it comes to the gold price, investors may react to changes in the gold price by noting that gold is a very excellent stock substitute since it is more readily available and can be used to hedge against inflation. When the gold price fluctuates, it has the greatest influence on the stock market.

Although the paper establishes the long-term and short-term relationships between stock indexes, oil prices, and gold prices, it still has certain shortcomings that could be addressed by future research. To begin with, using a market representative index will fail to capture the unique effects of the independent variables on individual stocks or industry groupings. Second, research data is scarce, particularly in the post-COVID era, refraining us from developing the reseach model as well as extracting reliable research findings exclusively for the period after the COVID-19 emergence outbreak. This could be a promising research area to be addressed in future studies on the ASEAN economies' cases. And last but not least, COVID-19 indicators, such as confirmed cases or death ratios, might be used as a gauge or proxy for the impact of a pandemic on stock market performance. ■

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