Bulletin of Monetary Economics and Banking

Volume 25 | Number 4 Article 7

1-20-2022

The Effect Of Covid-19 Pandemic On The Risks Of Investments In Indonesia: Evidence From The Egarch Model

Meinisa Fadillah Rahmi
BPS-Statistics Indonesia, Indonesia, meinisa.fadillah@bps.go.id

Nasrudin Nasrudin
Polytechnic of Statistics STIS, Indonesia, nasrudin@stis.ac.id

Recommended Citation
Rahmi, Meinisa Fadillah and Nasrudin, Nasrudin (2022) "The Effect Of Covid-19 Pandemic On The Risks Of Investments In Indonesia: Evidence From The Egarch Model," *Bulletin of Monetary Economics and Banking*: Vol. 25: No. 4, Article 7.
DOI: https://doi.org/10.21098/bemp.v25i4.1758
Available at: https://bulletin.bmeb-bi.org/bmeb/vol25/iss4/7

Bulletin of Monetary Economics and Banking, Vol. 25 No. 4, 2022, pp. 673 - 688
p-ISSN: 1410 8046, e-ISSN: 2460 9196

THE EFFECT OF COVID-19 PANDEMIC ON THE RISKS OF INVESTMENTS IN INDONESIA: EVIDENCE FROM THE EGARCH MODEL

Meinisa Fadillah Rahmi* and Nasrudin**

*Corresponding author. BPS-Statistics Indonesia, Jakarta, Indonesia.
Email: meinisa.fadillah@bps.go.id
** Polytechnic of Statistics STIS, Jakarta, Indonesia. Email: nasrudin@stis.ac.id

ABSTRACT

This study analyzes the effect of the COVID-19 pandemic on the risks of gold, stocks, and the US dollar investments as well as risk comparison among those instruments. An EGARCH model is used to accommodate the asymmetric effect on the risks. To examine the pandemic effect, we use a dummy variable of before and during the pandemic and stringency index which reflects government seriousness about COVID-19 prevention. The results show that risks are higher during the pandemic while government actions reduce risks. Stocks are riskiest instrument and suitable for risk seekers. Gold is least risky and suitable for risk averters.

Keywords: COVID-19 pandemic; Risk; Investment; EGARCH; Stringency.
JEL Classifications: C22; C58; E22; G11.

Article history:
Received : August 10, 2021
Revised : July 31, 2022
Accepted : December 23, 2022
Available Online : January 20, 2023
https://doi.org/10.21098/bemp.v25i4.1758

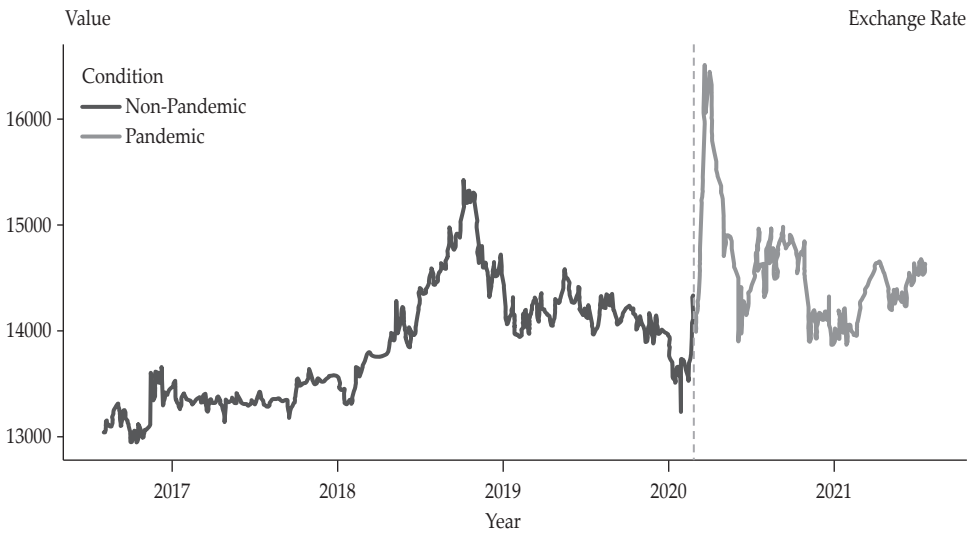
I. INTRODUCTION

The literature on COVID-19 has grown immensely in such a short period of time; for a survey, see Narayan (2021) and Phan and Narayan (2020). The studies on investment risks during the pandemic had been carried out by Adenomon *et al*. (2020), Basistha and Bora (2020), and Onali (2020), and Narayan *et al.* (2022) which examined the pandemic effect on stocks. Meanwhile, Yousef (2020), Lamouchi and Badkook (2020), and Thaker (2022) examined its effect on gold. Then, Benzid and Chebbi (2020) studied its effect on US Dollar exchange rate volatility. An obvious research gap is that none of these studies analyzed those investment instruments at once. Therefore, this study analyzed the risks of gold, stocks, and US Dollar investments at once so that it is possible to compare the characteristics of each of these instruments and provide a guide for investors to better manage assets in their portfolios.

Our hypothesis is that the economic uncertainty caused by the COVID-19 pandemic would make the investment risks higher than before. According to Statistics Indonesia, the Indonesian economy underwent contraction since the second quarter of 2020 (Statistics Indonesia, 2020). The price of gold rose sharply at the start of the pandemic as seen in Figure 1. Meanwhile, Yahoo Finance data showed that Indonesia Composite Index (ICI) decreased sharply and Rupiah also depreciated considerably against US Dollar at the start of the pandemic. This showed that the pandemic caused a shock to financial markets and the movements became more volatile. This shock led to investor panic and increased uncertainty on the financial market so that investors needed a nimble guide to make the investment decision carefully to avoid big losses (Haroon and Rizvi, 2020).

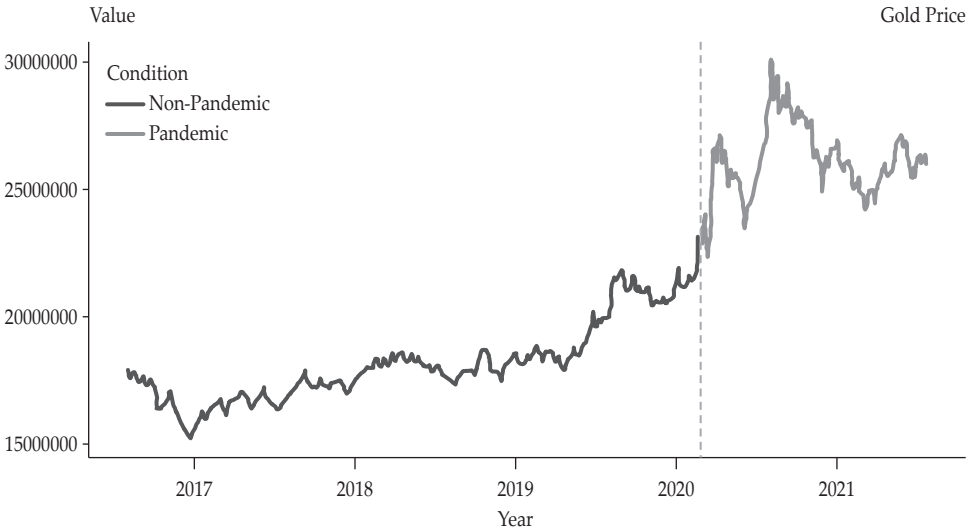
Figure 1.
The Movement of Gold Price, ICI, and Exchange Rate

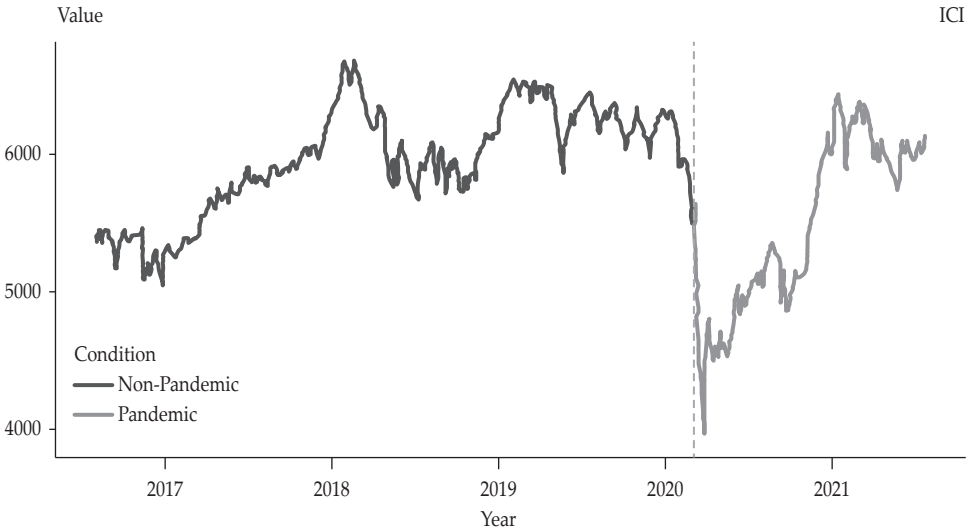
This figure shows the movement of gold price, ICI, and Rupiah exchange rate against US Dollar during the study period. The movements are presented in the line graphs for each of the variables where the blue line describes the pre-pandemic period, while the green line describes the pandemic period.



https://bulletin.bmeb-bi.org/bmeb/vol25/iss4/7
DOI: 10.21098/bemp.v25i4.1758

Figure 1.
The Movement of Gold Price, ICI, and Exchange Rate (Continued)





Volatility is an important indicator for making investment decisions (Sunaryo, 2019). Higher return volatility resulted in a large change in asset value so that the risk became even higher. Lyócsa and Molnár (2020) found that in general, volatility in financial markets reflected the risks faced by investors because it described the uncertainty that investors had. Instruments that have high volatility are suitable for risk seekers, while instruments that have low volatility are suitable for risk averters (Hartono, 2017). Gold, stocks, and foreign exchange, especially US Dollar are the most popular investment instruments because the benefits they provide are comparable, even above inflation (Nuryana, 2014). The recent survey

conducted by Databox in February 2021 resulted that those instruments are still favorites in Indonesia during the pandemic. Hence, in this study, we analyze the return volatility of gold, ICI, and Rupiah exchange rate against US Dollar as a form of risk measurement to examine the effect of the pandemic in terms of risk difference on gold, stocks, and US Dollar investment between before and during the pandemic. We also included the stringency index which reflected government policy strictness on COVID-19 prevention and could affect the return volatility of investment instruments (Acharya *et al*., 2021).

We used Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) to model volatility. This model does not require the fulfillment of non-negative constraints and accommodates the leverage effect because financial data generally has an asymmetric effect between good news and bad news on volatility (Enders, 2014). This model can also add other explanatory variables to the conditional variance equation to assess their impacts on volatility. In this study, we add a dummy variable of COVID-19 pandemic with a value of 1 for the pandemic period (March 2, 2020 to July 23, 2021) and 0 for others (August 2, 2016 to February 28, 2020) and stringency index on the conditional variance equation. We have tested the correlation among the instruments and it showed that the three instruments are uncorrelated to each other so that the analysis should be done independently.

We find that return volatility of gold, ICI, and Rupiah exchange rate against US Dollar is higher during the pandemic than before. It means that the risks of those investment instruments are higher during the pandemic, ceteris paribus. We also find that the stringency index has a negative effect on the risks of those instruments. It meant that government seriousness on COVID-19 prevention reduced the investment risks of those instruments. We also show that stocks are the riskiest instrument, while gold is the least risky.

Our study contributes to the literature that examines the impact of COVID-19 pandemic on risk investments. Adenomon *et al*. (2020) and Onali (2020) finds that the pandemic affects the volatility of stock returns significantly. Adenomon *et al*. (2020) show that the pandemic has a negative effect on the volatility of Nigerian stock returns. A different direction of the effect is found by Onali (2020) who examines the effect of the pandemic on the volatility of US stock returns which the higher the cases of COVID-19, the more volatile stock returns are. On the other hand, Basistha and Bora (2020) find that the pandemic does not significantly affect the volatility of Indian stock returns. Yousef (2020) and Lamouchi and Badkook (2020) test the effect of the pandemic on gold returns. Both studies give the same results which the volatility of gold returns is higher during the pandemic. Benzid and Chebbi (2020) examine the effect of the pandemic on US Dollar exchange rates. The results show that COVID-19 cases in the US have a significant positive impact on the US Dollar exchange rate volatility. Acharya *et al*. (2021) and Ibrahim *et al*. (2020) find that the stringency of government policy on COVID-19 prevention reduced the volatility on the financial market. On contrary, Zaremba *et al*. (2020) show that the stringency of government policy increased the volatility because it might limit the economic activity. These studies still draw inconsistent conclusions. To our best knowledge, there is no such study which examine the pandemic effect on several investment instruments at once so that it is difficult to

compare the characteristics of those instruments. Therefore, our study is the first to study the pandemic effect on risks of three favorite investment instruments, which are stocks, gold, and US Dollar investments at once. This finding is a useful contribution towards investment decision-making. We were able to distinguish investment instruments based on their risks. This study suggests that investors who are risk seekers should choose stocks as their instrument, while investors who are risk averters should choose gold as theirs.

We performed the robustness checks by estimating the EGARCH models for each of the returns based on the best model selection to analyze factors that affected the return volatility. Then, we conducted some diagnostic checks on the estimated models, including white noise and homoskedasticity assumptions. The paper proceeds as follows. In the next section, we detail our data and methodology. Section III presents the results, while Section IV concludes the paper.

II. DATA AND METHODOLOGY

A. Data

This study is a quantitative study using secondary data which is time series. The series is in the form of five-daily data Monday to Friday from August 2, 2016 to July 23, 2021. The variables used in this study are presented in Table 1.

Table 1.
Variables Used in this Study

This table presents all the variables which are used in this study, including variable names, definitions, unit measurements, and sources.

Variable Name	Definition	Unit Measurement	Source
Gold return	Total return of gold	%	Calculated using gold price data which is obtained from www.gold.org
ICI return	Total return of ICI	%	Calculated using ICI data which is obtained from Yahoo Finance
Exchange rate return	Total return of Rupiah exchange rate against US Dollar	%	Calculated using Rupiah exchange rate against US Dollar data which is obtained from Yahoo Finance
COVID-19 dummy	Dummy variable which is 1 for pandemic period which includes March 2, 2020 to July 23, 2021 and 0 for August 1, 2016 to February 28, 2020.	-	-
Stringency index	Government seriousness measurement on COVID-19 prevention, including public place closure, travel control, testing and vaccination policy, etc.	-	www.ourworldindata.org

Gold, ICI, and exchange rate returns are calculated by the total return formula from the price data (Haldar and Sethi, 2021). The formula used can be seen in Equation (1) below.

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

where P_t is the investment price at time *t*, and P_{t-1} is the investment price at time *t-1*. The return used in this study is expressed in %s form, so that it is easier to read. Therefore, the formula above is multiplied by 100%.

B. Methodology

This study used descriptive analysis and the EGARCH model. Descriptive analysis used line charts to describe the movements of gold, ICI, and exchange rate returns during the study period. Besides that, tables were also used to present the summary of the returns. The first step of EGARCH modelling which was done in this study was preparing the variables used. Then, we performed the return data stationarity test using Augmented Dickey-Fuller (ADF) test at the level. If the data was stationary, the ARMA models as the mean models were formed for each of the returns. After that, we selected the best ARMA models and performed model diagnostic tests, which were the Ljung-Box test to check whether the model residual satisfied the white noise process or not and the ARCH-LM test to check homoskedasticity assumption. If the ARCH-LM test was significant, we moved on to ARCH/GARCH models. Next, we tested the asymmetric effect using a cross-correlation between squared standardized residuals and standardized residual lag. If there was an asymmetric effect, EGARCH models were used to model the volatility with COVID-19 pandemic dummy variable and stringency index added as explanatory variables in the conditional variance equation for each of the returns.

The ARMA equation as the mean model is given by Equation (2).

$$Return_t = \delta + \sum_{i=1}^{p} \alpha_i Return_{t-i} + \sum_{j=1}^{q} \mu_j \tau_{t-j} + \tau_t \quad (2)$$

The EGARCH equation as variance equation is given by Equation (3).

$$ln\,\sigma_t^2 = \theta + \sum_{k=1}^{s} \gamma_k \left|\frac{\varepsilon_{t-k}}{\sigma_{t-k}}\right| + \sum_{m=1}^{u} \lambda_m \left(\frac{\varepsilon_{t-m}}{\sigma_{t-m}}\right) + \sum_{l=1}^{r} \emptyset_l\, ln\,\sigma_{t-l}^2 + \beta D_t + \omega I_t \quad (3)$$

Where $Return_t$ is the return value at time *t*, δ is the mean model intercept, α_i is the *i*-th autoregressive component where *i*=1,2,…,*p*, μ_j is the *j*-th moving average component where *j*=1,2,…,*q*, τ_{t-j} is white noise error component at time *t*, σ_t^2 is the conditional error variance of the mean equation at time *t*, $\left|\frac{\varepsilon_{t-k}}{\sigma_{t-k}}\right|$ is the absolute

standardized ε_{t-k} value of mean equation where $k = 1,2,\ldots, s$, $\frac{\varepsilon_{t-m}}{\sigma_{t-m}}$ is the standardized ε_{t-m} value of mean equation where $m = 1,2,\ldots, u$, σ_{t-1}^2 is the conditional error variance of the mean equation at time t-l where $l = 1,2,\ldots, r$, θ is the variance model intercept, γ_k is the coefficient in the k-th ARCH process where $k = 1,2,\ldots, s$, $\emptyset_1$ is the coefficient in the l-th GARCH process where $l = 1,2,\ldots, r$, λ_m is the coefficient in the m-th EGARCH process with $m = 1,2,\ldots, u$ and describe the asymmetric effect, β is the coefficient of COVID-19 pandemic dummy variable, D_t is the dummy variable of COVID-19 pandemic at time t which is 1 for the pandemic period and 0 for the others, ω is the coefficient of stringency index variable, and I_t is stringency index at time t.

The best EGARCH models for each of the returns were selected based on parsimony, goodness of fit, Akaike Information Criterion, and Schwarz Information Criterion. Then, we performed diagnostic tests of EGARCH models and the parameter significance test of the models which had met the requirements. After that, we calculated the return volatility using the estimated conditional variance of the EGARCH models as the risk measurement so that we could compare the investment risks among gold, stocks, and US Dollars.

III. MAIN FINDINGS

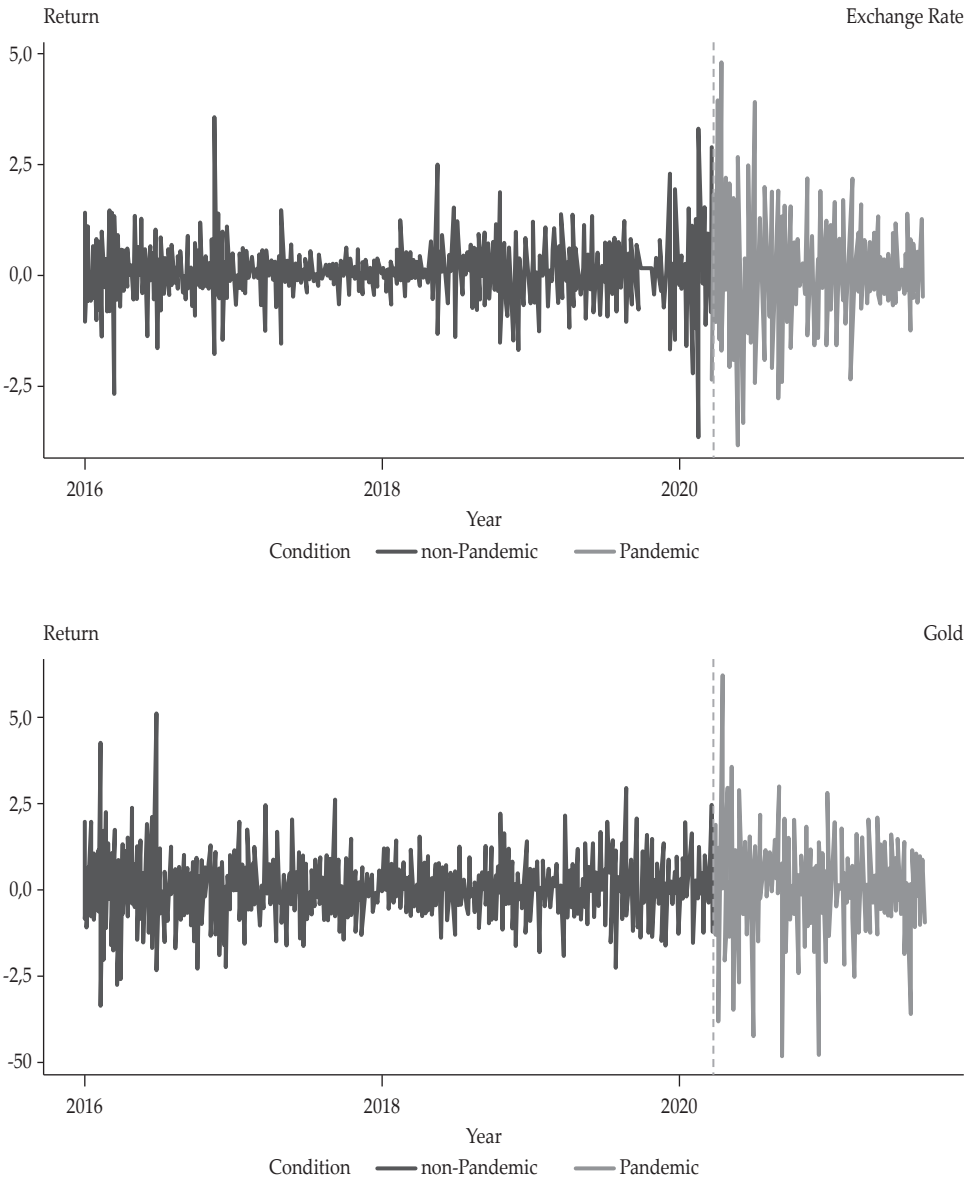
This section comprises three subsections. The first subsection is a preliminary analysis which provides the general description of returns on gold, ICI, and Rupiah exchange rate against US Dollar during the study period. The second subsection is the main result which discusses the pandemic effect on the risks of the three instruments, while the final subsection discusses the robustness checks.

A. Preliminary Analysis

The movements of returns on gold, ICI, and Rupiah exchange rate against US Dollar, both before the COVID-19 pandemic and during the pandemic are shown in Figure 2.

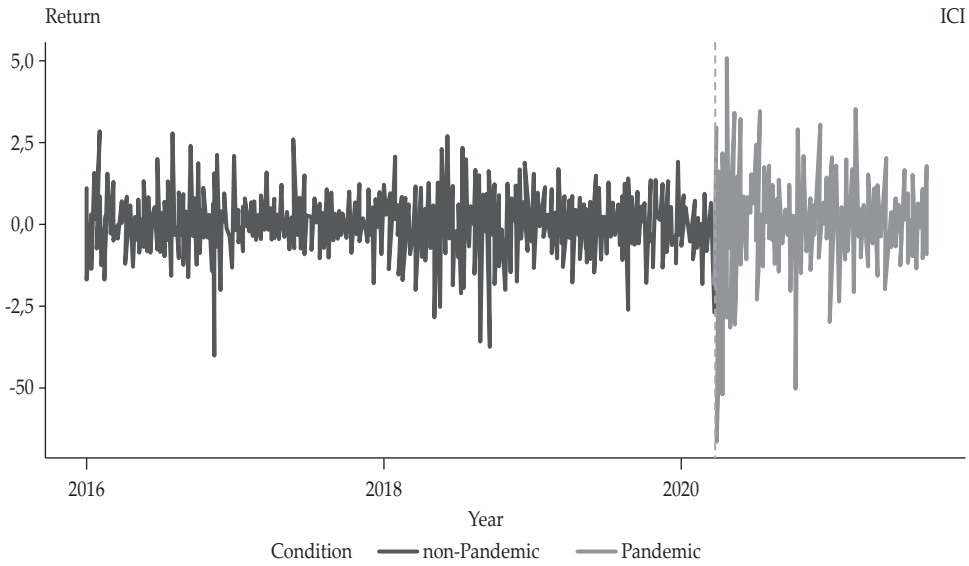
Figure 2.
The Movement of Gold, ICI, and Exchange Rate Returns

This figure shows the movement of returns on gold, ICI, and Rupiah exchange rate against US Dollar during the study period. The return movements are presented in the line graphs for each of the returns where the blue line describes the pre-pandemic period, while the green line describes the pandemic period.



https://bulletin.bmeb-bi.org/bmeb/vol25/iss4/7
DOI: 10.21098/bemp.v25i4.1758

Figure 2.
The Movement of Gold, ICI, and Exchange Rate Returns (Continued)



The returns of gold, ICI, and Rupiah exchange rate against US Dollar from August 2, 2016 to July 23, 2021 experienced quite high fluctuations per day. At the beginning of the pandemic, the fluctuations were much higher than before. Although the fluctuations briefly decreased in May 2020, the returns of the three instruments still fluctuated high after that. This showed that the volatility of returns during the pandemic was higher than before.

Table 2.
The Summary of Gold, ICI, and Exchange Rate Returns

This table presents the summary of returns on gold, ICI, and Rupiah exchange rate against US Dollar during the study period, including mean, median, standard deviation, maximum and minimum value.

Statistics	Exchange Rate			Gold			ICI		
	Overall	Non-Pandemic	Pandemic	Overall	Non-Pandemic	Pandemic	Overall	Non-Pandemic	Pandemic
Mean	0.006	0.005	0.010	0.042	0.042	0.041	0.025	0.020	0.040
Median	0.000	0.000	-0.010	0.002	0.001	0.012	0.064	0.062	0.077
Maximum	4.680	3.430	4.680	6.240	5.150	6.240	5.100	2.850	5.100
Minimum	-3.790	-3.640	-3.790	-4.900	-3.380	-4.900	-6.580	-4.010	-6.580
SD	0.694	0.527	1.040	0.914	0.775	1.240	0.960	0.763	1.390

The statistical summary of returns is shown in Table 2. It showed that the returns had higher maximum values and standard deviation during the pandemic than before. Meanwhile, the minimum values were lower during the pandemic than before. This meant that the range of returns during the pandemic was wider than before the pandemic so that the changes in asset values were also bigger.

B. Main Result

B1. The General Pattern of Return Volatility

The model parameter estimates of each of the returns were presented in Table 3.

Table 3.
The Parameter Estimates of Gold, ICI, and Exchange Rate Return Model

This table reports the parameter estimates of gold, ICI, and exchange rate (Rp/US$) return model, both mean and conditional variance equations. Then, ** denotes statistical significance at the 5% level.

Return	Mean Equation			Conditional Variance Equation		
	Parameter	Coefficient	Standard Error	Parameter	Coefficient	Standard Error
Gold	AR(1)	-0.7954**	0.2469	Intercept	-0.0597**	0.0094
	MA(1)	0.8023**	0.2437	γ	0.0615**	0.0113
				λ	0.0369**	0.0083
				$\emptyset$	0.9827**	0.0042
				dummy	0.1941**	0.0264
				stringency	-0.0028**	0.0004
ICI	ARMA(0,0)			Intercept	-0.2155**	0.0244
				γ	0.2059**	0.0246
				λ	-0.1248**	0.0172
				$\emptyset$	0.9037**	0.0156
				dummy	0.5229**	0.0964
				stringency	-0.0069**	0.0014
Exchange rate	MA(1)	-0.2385**	0.0281	Intercept	-0.2311**	0.0186
				γ	0.2705**	0.0210
				λ	-0.0204	0.0158
				$\emptyset$	0.9696**	0.0048
				dummy	0.1470**	0.0715
				stringency	-0.0021**	0.0011

Based on the results of the parameter significance test, it was found that the return of gold in the current period was influenced by the return of gold and residual in the previous period at a significance level of 5%. The volatility of gold return in the current period was influenced by volatility and residual in the previous period, COVID-19 pandemic, and stringency index. The conditional variance equation also showed the presence of asymmetric effect where bad news had a smaller impact on volatility than good news.

The mean equation of ICI return showed that the return was only affected by the stochastic error process. Because the residual of ICI returns still had heteroscedasticity and asymmetric effect, the residual variance of ICI return was modelled using EGARCH (1,1). It was found that the volatility of ICI return in the

current period was influenced by volatility and residual in the previous period, COVID-19 pandemic, and stringency index. The conditional variance equation also showed that there was an asymmetric effect where bad news had a greater impact on volatility than good news.

The mean equation of exchange rate return showed that the return in the current period was influenced by the residual in the previous period. The conditional variance equation showed that the volatility of exchange rate return in the current period was influenced by volatility and residual in the previous period, COVID-19 pandemic, and stringency index. It also showed that there was no asymmetric effect, meaning that the effect of good news and bad news on volatility was relatively symmetrical. This contradicted the previous test results for the presence of the asymmetric effect using cross-correlation. Different results can be due to sensitivity to data sampling, models, and methods used. However, modelling with Asymmetric GARCH was still considered better than Symmetric GARCH based on the results of asymmetric effect test before.

B2. The Effect of Pandemic on the Risks of Investments

COVID-19 pandemic significantly affected the volatility of gold return at the 5% significance level. The D_t coefficient was positive, meaning that the volatility of gold return was higher during the pandemic than before so that the risk of investing in gold was higher during the pandemic, ceteris paribus. This result is in line with the results of the previous descriptive analysis, Yousef (2020), and Lamouchi and Badkook (2020).

The pandemic also significantly affected the volatility of ICI return. The D_t coefficient was positive, meaning that the ICI return volatility was higher during the pandemic than before so that the risk of investing in stocks was higher during the pandemic, ceteris paribus. This result is in line with the previous descriptive analysis and Onali (2020). However, it is not in line with Adenomon *et al*. (2020) which found that the pandemic had a significant negative effect on stock return volatility, and also not in line with Basistha and Bora (2020) which found that the pandemic did not significantly affect the stock return volatility.

The volatility of exchange rate return was significantly affected by the COVID-19 pandemic. The D_t coefficient was positive, meaning that the volatility of exchange rate return was higher during a pandemic than before so that the risk of US Dollar investment became higher during the pandemic, ceteris paribus. This result is in line with the results of previous descriptive analysis and Benzid and Chebbi (2020).

The stringency index negatively influenced the volatility of the three returns at the 5% significance level. It meant that government seriousness on COVID-19 prevention reduced the investment risks of those instruments. This result is in line with Acharya *et al*. (2021) and Ibrahim *et al*. (2020), but not in line with Zaremba *et al*. (2020).

B3. The Risk Comparison among Gold, Stocks, and US Dollar Investments

The summary of gold, ICI, and exchange rate return volatility was presented in Table 4.

Table 4.
The Summary of Gold, ICI, and Exchange Rate (ER) Return Volatility

This table provides the statistical summary of gold, ICI, and exchange rate (Rp/US$) return volatility, both before and during the COVID-19 pandemic, including mean, standard deviation, coefficient of variation, maximum and minimum value.

Statistics	Before Pandemic			During Pandemic		
	Gold Return Volatility	ICI Return Volatility	ER Return Volatility	Gold Return Volatility	ICI Return Volatility	ER Return Volatility
Mean	0.4752	0.5793	0.2591	1.5353	1.8108	0.9901
Maximum	1.1592	3.1855	2.0713	6.7473	18.8988	5.7068
Minimum	0.2491	0.2098	0.0297	0.5650	0.4154	0.1774
Standard Deviation	0.1409	0.3477	0.2129	1.1973	2.6894	0.8570
Coefficient of Variation	0.2965	0.6002	0.8216	0.7798	1.4852	0.8656

In the pre-pandemic period, ICI return volatility was the highest compared to other investment instruments, either in the average, standard deviation, or range. Based on the standard deviation, range, and coefficient of variation, gold return volatility was the lowest. Thus, in the pre-pandemic period, stock investment had the highest risk, so it is suitable for investors who are risk seekers. While, gold investment had the lowest risk, so it is suitable for investors who are risk averters. US Dollar fell into the medium-risk category, which was between gold and stocks.

During the pandemic, the ICI return volatility was also the highest compared to other instruments. Based on the coefficient of variation, the gold return volatility was the lowest, while the ICI was the highest. Thus, both during the pandemic and before, stock investment still carried the highest risk compared to gold and US Dollar, so it is indeed suitable for risk-seeker investors. Meanwhile, gold and exchange rate return volatility were not much different which both were lower than ICI return volatility. It meant that both gold and US Dollar investment had a lower risk. Therefore, gold investment is indeed suitable for investors who are risk averters both before and during the pandemic.

C. Robustness Checks

Table 5 showed the results of all robustness checks which were done in this study.

Table 5.
Robustness Checks

This table reports the results of all robustness checks, including stationary test using ADF, Ljung-Box of best ARMA models, ARCH-LM test of best ARMA models, asymmetric effect test, Ljung-Box of best EGARCH models, and ARCH-LM test of best EGARCH models for each of the returns.

Return	ADF Test (Level)	Best ARMA Model	Ljung-Box Test of ARMA Model	ARCH-LM Test of ARMA Model	Asymmetric Effect Presence	Best EGARCH Model	Ljung-Box Test of EGARCH Model	ARCH-LM Test of ARMA Model
Gold	Significant at α=5%	ARMA(1,1)	Not significant	Significant at α=5%	Yes	EGARCH(1,1)	Not significant	Not significant
ICI	Significant at α=5%	ARMA(0,0)	Not significant	Significant at α=5%	Yes	EGARCH(1,1)	Not significant	Not significant
Exchange Rate	Significant at α=5%	MA(1)	Not significant	Significant at α=5%	Yes	EGARCH(1,1)	Not significant	Not significant

Based on the ADF test, the returns of gold, ICI, and the exchange rate were stationary, so there was no need for a differencing process. Furthermore, the ARMA model was formed using Box-Jenkins methodology and obtained the best ARMA model for gold return was ARMA(1,1), ARMA(0,0) for ICI return, and MA(1) for exchange rate return. From the ARCH-LM test of ARMA models results which were significant at 5% level, it meant that the residual variance was not constant so that it could proceed to volatility modelling using ARCH/GARCH. Before proceeding to EGARCH modelling, we tested the asymmetric effect using cross-correlation between squared standardized residuals and standardized residual lag of the models. It was found that the correlogram formed exceeded the Bartlett line and the correlation value was not equal to zero, so there was an asymmetric effect on the residuals of the three return models. Therefore, it was suitable to use the EGARCH model.

The conditional variance equations were formed using the EGARCH model based on the mean equations in the form of the best ARMA models that had been obtained. The best EGARCH models were obtained based on the parsimony, the most parameter significance, the largest Log-likelihood value, the largest R-squared, and the smallest AIC and SIC. The best models for the three returns were EGARCH(1,1). A diagnostic test for the best EGARCH models was carried out and resulted that the models had satisfied the white noise and homoskedasticity assumptions.

IV. CONCLUDING REMARKS

The returns of gold, ICI, and Rupiah exchange rate against the US dollar during the study period showed high volatility. The volatility during the COVID-19 pandemic was higher than before, especially during the early days when positive confirmed COVID-19 cases were announced in Indonesia. It was found that the risks of investing in gold, stocks, and US Dollar were higher during the COVID-19 pandemic than before, as indicated by the higher return volatility of gold, ICI, and Rupiah exchange rate against US Dollar during the pandemic. Furthermore, the government policy stringency on COVID-19 prevention reduced the risks of those instruments. Stocks were the riskiest instrument, both during and before the pandemic. Meanwhile, gold was the least risky instrument, both before and during the pandemic. The US Dollar investment is at moderate risk.

Based on those conclusions, suggestions can be given to investors to be more careful in managing their portfolio assets during the pandemic because all investment instruments tend to have a higher risk during the pandemic than before. Investors who are risk seekers should choose stocks as their investment instrument because it is suitable for people who prefer to speculate and are more willing to take high risks. On the contrary, investors who are risk averters should choose gold as their instrument because it is suitable for people who tend to avoid high risks and prioritize safety. Government should continue showing the seriousness in controlling COVID-19 to boost markets' confidence and the pandemic may end soon. This study only examined the effect of the pandemic on the risks of investments in terms of the level effect, so that future research is able to analyze the effect of the pandemic, which is not only seen from the level effect but also the rate effect.

REFERENCES

Acharya, V. V., Liu, Y., & Zhao, Y. (2021). COVID-19 Containment Measures and Expected Stock Volatility: High-Frequency Evidence from Selected Advanced Economies. *International Monetary Fund Working Paper.* WP/21/157.

Adenomon, M. O., Maijamaa, B., & John, D. O. (2020). On the Effects of COVID-19 outbreak on the Nigerian Stock Exchange performance: Evidence from GARCH Models. *MDPI AG*.

Basistha, D., & Bora, D. (2020). The Outbreak of COVID-19 Pandemic and Its Impact on Stock Market Volatility: Evidence from a Worst-affected Economy. *Research Square*.

Benzid, L., & Chebbi, K. (2020). The Impact of COVID-19 on Exchange Rate Volatility: Evidence Through GARCH Model. *SSRN Electronic Journal*.

Enders, W. (2014). *Applied Economic Time Series (Fourth Edition)*. USA: John Wiley & Sons, Inc.

Haldar, A., & Sethi, N. (2021). The News Effect of COVID-19 on Global Financial Market Volatility. *Bulletin of Monetary Economics and Banking,* 24, 33-58.

Haroon, O., & Rizvi, S. A. R. (2020). COVID-19: Media Coverage and Financial Markets Behavior—A Sectoral Inquiry. *Journal of Behavioral and Experimental Finance*, 27, 100343.

Hartono, J. (2017). *Portfolio Theory and Investment Analysis*. Yogyakarta: BPFE-Yogyakarta.

Ibrahim, I., Kamaludin, K., & Sundarasen, S. (2020). COVID-19, Government Response, and Market Volatility: Evidence from the Asia-Pacific Developed and Developing Markets. *Economies MDPI*, 8, 105.

Lamouchi, R. A., & Badkook, R. (2020). Gold Prices Volatility among Major Events and During the Current COVID-19 Outbreak. *Journal of Statistical and Econometric Methods*, 9, 39-52.

Lyócsa, Š., & Molnár, P. (2020). Stock Market Oscillations during The Corona Crash: The Role of Fear and Uncertainty. *Finance Research Letters*, 36, 101707.

Narayan, P. K., (2021) COVID-19 Research Outcomes: An Agenda for Future Research, *Economic Analysis and Policy*, 71. doi: 10.1016/j.eap.2021.06.006

Narayan, P. K., Gong, Q., & Ahmed, H. J. A. (2022). Is There a Pattern in How COVID-19 has Affected Australia's Stock Returns. *Applied Economics Letters*, 29, 179-182. https://doi.org/10.1080/13504851.2020.1861190

Nuryana, F. (2014). Analysis of the Selection of Gold, Foreign Exchange, and Stock Business Investment Instruments. *Journal of Economics and Islamic Banking*, 1, 196.

Onali, E. (2020). COVID-19 and Stock Market Volatility. *SSRN Electronic Journal*.

Phan, D. H. B., & Narayan, P. K. (2020) Country Responses and the Reaction of the Stock Market to COVID-19—A Preliminary Exposition. *Emerging Markets Finance and Trade*, 56, 2138-2150.

Statistics Indonesia. (2020). Official Statistics News *"Gross Domestic Product Economic Growth"*, No. 85/11/Th.XXIII.

Sunaryo, D. (2019). *Invetment and Portfolio Management Textbook*. Serang: Qiara Media.

Thaker, H. M. T. (2022). COVID-19, Mobility, and Stock Markets Performance: Evidence From ASEAN–5. *Asian Economics Letters*, 3. https://doi.org/10.46557/001c.37963

Yousef, I., & Shehadeh, E. (2020). The Impact of COVID-19 on Gold Price Volatility. *International Journal of Economics and Business Administration*, VIII, 353–364.

Zaremba, A., Kizys, R., Aharon, D. Y., & Demir, E. (2020). Infected Markets: Novel Coronavirus, Government Interventions, and Stock Return Volatility around the Globe. *Finance Research Letters,* 35, 101597.