Precious Metals as a Safe Haven for Crude Oil: Focusing on the Impact of the COVID-19 Pandemic

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Abstract

We investigate the impact of the COVID-19 pandemic on precious metals as a safe haven for crude oil. Unlike recent studies that focus on the initial impact of the pandemic, our study compares the safe haven properties of precious metals across the pre- and post-pandemic periods. Also, we extend the post-pandemic sample period to capture the lingering effect of the pandemic as well as its initial impact. We find the asymmetric impact of the pandemic on precious metals as a safe haven for oil. Since the recent market crash caused by the pandemic is intrinsically different from the previous ones triggered by structural vulnerability or defects in financial markets, our study is expected to provide a new insight to policymakers as well as professional investors.

Keywords: COVID-19 Pandemic; Safe Haven; Crude Oil; Precious Metals

JEL Classifications: G01, G10

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1. Introduction

The COVID-19 pandemic has significantly influenced a wide range of industries including the crude oil market. Particularly, in the first flush of the pandemic, the West Texas Intermediate (WTI) oil price dramatically declined to its lowest level because the sharp drop in demand for oil coupled with economic downturn caused oil prices to fall heavily. Considering that oil is an important resource not only for industrial development but also for the purpose of investment, we are motivated to identify and compare safe haven assets for oil by analyzing extreme returns across the pre- and post-pandemic periods. An unexpected extreme event may have a serious impact on the values of oil-related portfolios even though they are diversified because the relationship between oil and an asset in a normal time can be completely different from their relationship in a bad time. Thus, the risk of the portfolios should be properly analyzed and managed under extreme market conditions.

Traditionally, there has been extensive research on the links between crude oil and precious metals because they play a critical role as alternative investment assets in the financial industry. Previous studies largely focus on information flow across oil and precious metal markets. Many of them investigate volatility and return spillovers or the effect of volatility jumps or persistence (Morales and Andreosso-O'Callaghan, 2014; Laua et al., 2017; Mokni, 2018; Shahzad et al., 2019; Yildirim et al., 2020; Umar et al., 2021; Yildirim, 2022; Das et al., 2022) and they show that oil and precious metal markets are connected through risk transmissions although the degree of the connection differs depending on market conditions or investigated periods. Another studies examine causality between oil and precious metals and identify their causal links (Bildirici and Turkmen, 2015; Churchill et al., 2019; Dhifaoui et al., 2022; Miao et al., 2022). Most of these studies confirm that oil and precious metal markets are closely interacted in terms of risk and return.

On the other hand, some studies investigate precious metals as a safe haven for oil during market downturns. Ciner et al. (2013) investigate the dependencies between major asset classes under extreme conditions and argue that while gold is regarded as a safe haven against exchange rates, it does not perform as a safe haven for oil. Liu and Lee (2022) identify the long-run relationship between gold and oil and show that gold is considered as a diversifier for oil on average and also, it can act as a safe haven based on the negative correlation shown after 2020. Dutta et al. (2020) investigate the time-varying relationship between gold and oil using the sample period that reflects the initial impact of the COVID-19 pandemic and find that gold acts as a safe haven for oil. Wen et al. (2022) compare gold and bitcoin as a safe haven for oil during the COVID-19 bear market and report that gold performs as a safe haven for oil. Syuhada et al. (2022) show that gold holds its safe haven property for oil during the COVID-19 outbreak by examining the downside risk of an energy portfolio including oil. Although Huang et al. (2022) find that only gold among precious metals performs as a weak safe haven for oil, their sample period includes the recent Russia-Ukraine war as well as the COVID-19 pandemic and thus, their results reflect the mixed effect of both events.

The main purpose of our study is to examine the impact of the COVID-19 pandemic on the role of precious metals as a safe haven for oil. Unlike recent studies that focus on the initial impact of the COVID-19 pandemic, our study compares four precious metals (gold, silver, platinum, and palladium) by examining their safe haven properties for oil across the pre- and post-pandemic. Also, we extend the post-pandemic sample size to capture the lingering effect of the pandemic as well as its initial impact. To the best of our knowledge, since no study has compared four precious metals' safe haven properties for oil with a focus on the impact of the COVID-19 pandemic, we make a substantial contribution to the literature.

First of all, we find that while gold and silver perform as a safe haven for oil in the pre-pandemic period, their safe haven properties are weakened in the post pandemic. This means that gold and silver tend to have extreme losses more simultaneously with oil in the post-pandemic period. Also, we find that platinum does not perform as a safe haven in the pre-pandemic period whereas it performs as a safe haven in the post-pandemic period. Thus, the role of platinum as a safe haven appears to be strengthened in the post-pandemic period. However, palladium is not regarded as a safe haven at all in both periods. As a result, we confirm the asymmetric impact of the COVID-19 pandemic on precious metals as a safe haven for oil. Our analysis is conducted as follows. First, we compare precious metals as a hedge or diversifier for oil on average before and after the pandemic. Second, for our main task, we examine the impact of the pandemic on precious metals as a safe haven for oil and how their safe haven properties vary across the pre- and post-pandemic periods. The data are described in Section 2. Models and empirical results are demonstrated in Section 3 and Section 4 respectively. Then, we conclude in Section 5.

2. Data

We obtain daily prices for WTI (West Texas Intermediate) oil, gold, silver, platinum, and palladium futures from investing.com. Our full sample covers about four-year period from January 2, 2018 to February 24, 2022. We do not include daily data after the recent Russia-Ukraine war due to its significant impact on the energy sector. While recent studies that focus on the initial impact of the COVID-19 pandemic use a relatively short post-pandemic period, our study extends the post-pandemic period up to February 24, 2022 (just before the recent Russia-Ukraine war) in order to reflect the lingering effect of the pandemic as well as its initial impact. Based on the COVID-19 bear market period proposed by Baek and Jackman (2021), we use February 19, 2020 as a reference point to split the full sample period into two subperiods: Pre-COVID-19 pandemic from January 2, 2018 to February 19, 2020 and Post-COVID-19 pandemic from February 20, 2020 to February 24, 2022.

Table 1 summarizes basic statistics for daily returns on oil, gold, silver, platinum, and palladium. The standard deviations significantly rise in the post-pandemic period, which means that the post-pandemic returns are far more volatile than the pre-pandemic returns. While skewness of each asset is negative and considerably decreases in the post-pandemic period, kurtosis of each asset increases.

Table 1. Summary statistics for daily returns

	WTI Oil	Gold	Silver	Platinum	Palladium
Panel A – Full Sample Period					
Mean	0.00042	0.00037	0.00035	0.00012	0.00080
Standard Deviation	0.03901	0.00959	0.01925	0.01882	0.02321
Skewness	-3.43131	-0.27206	-0.72145	-0.47455	-0.72741
Kurtosis	72.90076	8.74887	10.18881	9.30696	18.22197
Panel B – Pre-COVID-19 Pandemic					
Mean	-0.00024	0.00039	0.00013	0.00015	0.00173
Standard Deviation	0.02034	0.00691	0.01186	0.01227	0.01726
Skewness	0.05378	0.16123	-0.02756	-0.01536	-0.35329
Kurtosis	8.22141	5.41821	5.31574	3.96554	5.98290
Panel C – Post-COVID-19 Pandemic					
Mean	0.00111	0.00036	0.00059	0.00010	-0.00019
Standard Deviation	0.05199	0.01180	0.02481	0.02391	0.02817
Skewness	-3.03397	-0.33372	-0.71539	-0.47395	-0.68805
Kurtosis	47.75368	7.21658	7.36366	7.09551	16.36004

Note: This table shows summary statistics for daily returns on oil, gold, silver, platinum, and palladium. The full sample period is January 2, 2018 to February 24, 2022, the pre-pandemic period is January 2, 2018 to February 19, 2020, and the post-pandemic period is February 20, 2020 to February 24, 2022.

This shows that the return distributions in the post-pandemic period have a longer tail on the left side (more extreme losses) than those in the pre-pandemic period. Thus, we identify the overall impact of the COVID-19 pandemic on oil and precious metal markets.

3. Models

We employ the following econometric model proposed by Baur and Lucey (2010) and Baur and McDermott (2010) to investigate the impact of the COVID-19 pandemic on precious metals as a safe haven for oil. The model is well supported by previous studies and its estimation procedure is relatively parsimonious.

$$y_{i,t} = \mu + \delta r_{wti,t} + \varepsilon_t \tag{1}$$

$$\delta = \beta_0 + \sum_{n=1}^{m} \beta_{qx_n} D_{wti,qx_n} \tag{2}$$

where $y_{i,t}$ is gold, silver, platinum, or palladium return at time t, $r_{wti,t}$ is WTI oil return at time t, and D_{wti,qx_n} is the dummy variable for x_n% quantile of WTI oil return distribution. If WTI oil returns fall into x_n% quantile, the dummy variable is equal to one and zero otherwise. Since the main purpose of our study is to examine the relationship between oil and precious metals under extreme conditions, we use 1% and 2.5% quantiles as threshold levels for their extreme returns. Thus, the sum of β coefficients indicates the overall effect for each quantile. In other words, the sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ indicates the overall effect for the 1% quantile and the sum of β_0 and $\beta_{q2.5\%}$ indicates the overall effect for the 2.5% quantile.

As we see in Figure 1, daily returns on all assets show time-varying volatilities So, the error term in Equation (1) needs to be estimated with a time-varying feature. Also, it is well known that there exists leverage effect between negative and positive shocks on volatilities in financial time series. To incorporate the leverage effect as well as time-varying volatilities, we adopt the Glosten-Jagannathan-Runkle GARCH (GJR-GARCH) process proposed by Glosten et al. (1993) for the error term in Equation (1) where $\varepsilon_t = \sigma_t z_t$ and z_t follows a standard Gaussian distribution.

$$\sigma_t^2 = \alpha + \sum_{i=1}^{k}(\theta_i + \varphi_i I_{t-i(\varepsilon_{t-i}>0)})\, \varepsilon_{t-i}^2 + \sum_{j=1}^{l} \omega_j\, \sigma_{t-j}^2 \qquad (3)$$

where σ_t^2 is the conditional variance and ε_{t-i}^2 is the lagged squared residual. We choose the first order that is most stable and widely used for the GARCH process. I_{t-i} is an indicator function. All coefficients are simultaneously estimated.

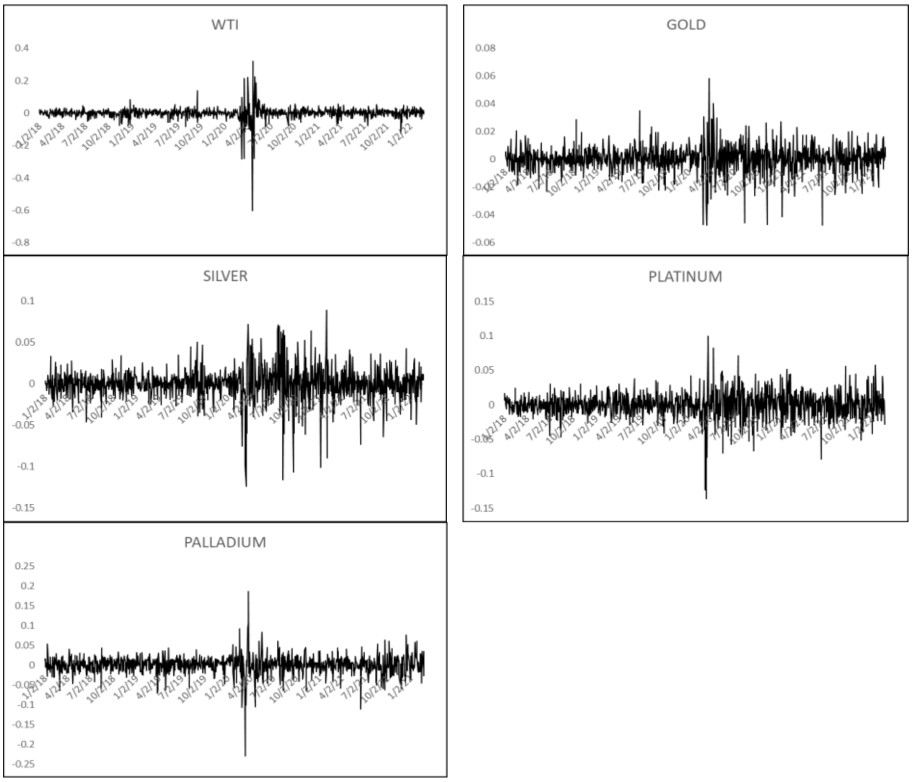

Figure 1. Daily returns

4. Empirical Results and Discussions

4.1. Hedge or Diversifier?

According to Baur and Lucey (2010), while an asset is regarded as a hedge if the asset is negatively correlated or uncorrelated with another asset on average, an asset is regarded as a diversifier if the asset is positively (not perfectly positively) correlated with another asset on average. On the other hand, an asset is regarded as a safe haven if the asset is negatively correlated or uncorrelated with another asset in a bad time. Figure 2 shows scatter plots for pairs of WTI oil and each precious metal. If their scatter plots approximately present a negative (positive) slope, then, the metal serves as a hedge (diversifier) on average. Roughly speaking, all of them appear to have positive slopes rather than negative slopes on average in both pre-pandemic and post-pandemic periods. This implies that four precious metals would serve as a diversifier for oil on average in both periods. In fact, this is confirmed by β_0 shown in Table 2, Table 3, and Table 4.

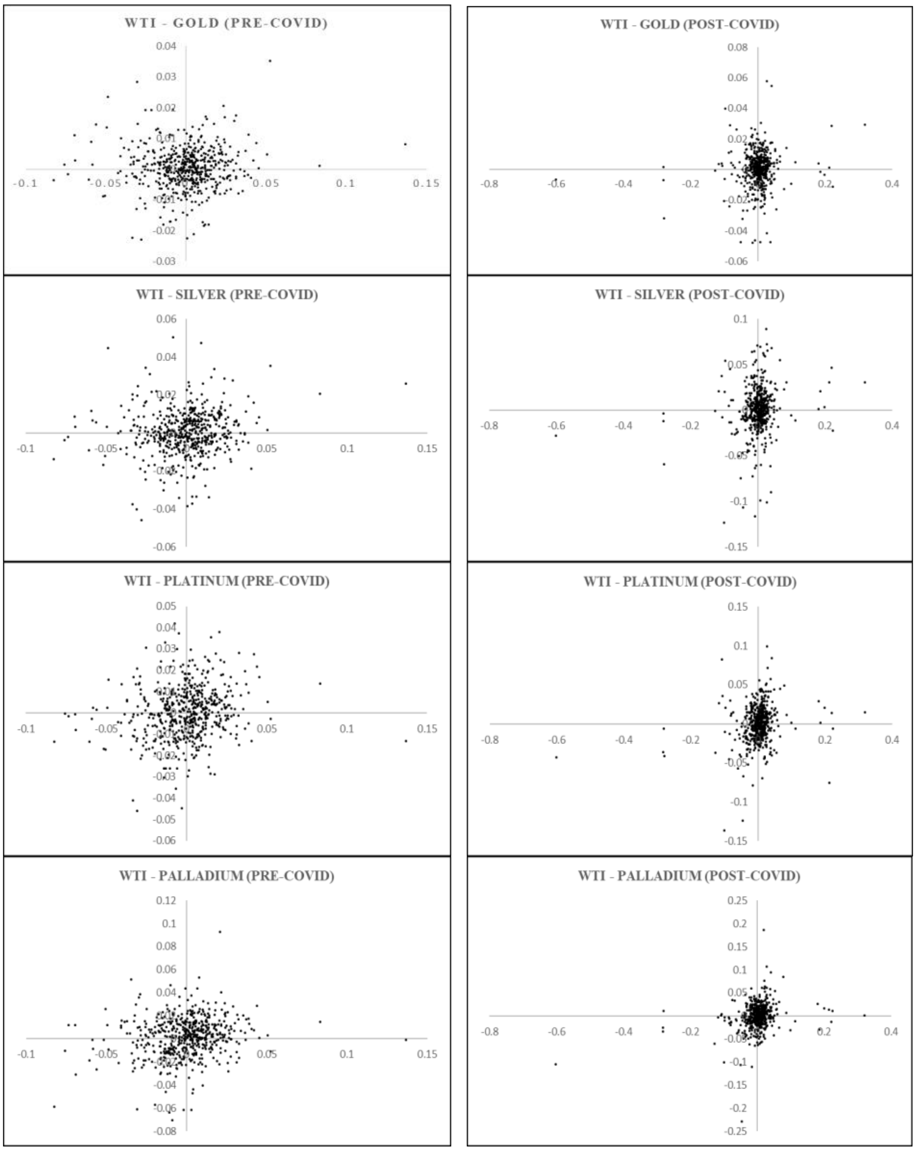

Figure 2. Scatter plots of oil and precious metals

β_0 presents the average relationship between oil and each metal. All of the estimated β_0s are significant and positive. This means that each metal plays a role as a diversifier for oil on average in both periods. Since there is no change in the role of precious metals as a diversifier in the post-pandemic period, the pandemic has little impact on the average relationship between oil and precious metals. This finding is partially consistent with that of Liu and Lee (2022).

4.2 The Role of Precious Metals as a Safe Haven for Oil

The main task of our study is to analyze and compare the role of precious metals as a safe haven for oil across the pre- and post-pandemic periods. As mentioned in the previous section, the sum of β coefficients is used to estimate the overall effect for each quantile. If the sum of β coefficients is nonpositive and all of the coefficients are statistically significant, the metal is regarded as a strong safe haven for oil. If the sum of β coefficients is nonpositive and some of the coefficients are not statistically significant, the metal is regarded as a weak safe haven for oil. If, however, the sum of β coefficients is positive, then, the metal is not regarded as a safe haven for oil.

Table 2. Results for the full sample period

	Gold		Silver		Platinum		Palladium	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
μ	0.00029	1.01	0.00021	0.39	-0.00019	-0.30	0.00087	1.45
β_0	0.03721	4.29***	0.09425	5.20***	0.09332	5.59***	0.13455	7.64***
$\beta_{q2.5\%}$	-0.07798	-3.06***	-0.06137	-0.98	-0.08447	-1.58	0.00738	0.11
$\beta_{q1\%}$	0.06443	2.30**	0.03488	0.54	0.06363	1.23	0.00261	0.04
GJR-GARCH								
α	-0.00002	-2.19**	0.00000	0.04	0.00033	7.19***	0.00012	5.03***
θ	0.21761	4.48***	0.31884	6.15***	0.04764	1.16	0.55887	9.34***
φ	-0.09988	-2.22**	-0.05677	-1.11	0.14833	2.67***	-0.24518	-4.15***
ω	1.08647	9.34***	0.74954	12.51***	-0.12430	-0.89	0.37000	4.70***

Note: This table shows results for the full sample period. β_0 presents the average relationship between oil and each metal. If β_0 is significantly positive (significantly negative or not different from zero), the asset is regarded as a diversifier (hedge) on average. The sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ indicates the overall effect for the 1% quantile and the sum of β_0 and $\beta_{q2.5\%}$ indicates the overall effect for the 2.5% quantile.
*, **, and *** are the 10%, 5%, and 1% significant levels respectively.

First, with the full sample in Table 2, while the sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ for gold is positive (0.03721-0.07798+0.06443=0.02366), the sum of β_0 and $\beta_{q2.5\%}$ for gold is negative (0.03721-0.07798= -0.04077). Since all those β coefficients for gold are statistically significant, gold acts as a strong safe haven for the 2.5% quantile. However, silver is not a safe haven for oil because the sum of its β coefficients for each quantile is positive. Platinum and palladium hold the same position as silver. In fact, only gold appears to serve as a safe haven for oil over the full sample period.

Table 3. Results for the pre-pandemic period

	Gold		Silver		Platinum		Palladium	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
μ	0.00030	0.96	0.00005	0.10	0.00006	0.10	0.00192	2.63***
β_0	0.02992	1.92*	0.09643	3.56***	0.10574	4.34***	0.14220	3.82***
$\beta_{q2.5\%}$	-0.12364	-3.73***	-0.16791	-2.84***	-0.03642	-0.38	-0.02501	-0.22
$\beta_{q1\%}$	0.07839	1.23	0.10860	0.93	-0.00064	-0.00	0.11935	0.95
GJR-GARCH								
α	0.00007	3.20***	-0.00005	-0.50	0.00005	0.53	-0.00003	-0.40
θ	-0.05034	-2.12**	0.04835	1.01	0.05424	0.90	0.15900	2.46**
φ	0.00912	0.28	-0.00512	-0.15	0.00794	0.12	-0.13332	-2.18**
ω	-0.44869	-0.96	1.28947	1.83*	0.58561	0.84	1.03669	3.41***

Note: This table shows results for the pre-pandemic period. β_0 presents the average relationship between oil and each metal. If β_0 is significantly positive (significantly negative or not different from zero), the asset is regarded as a diversifier (hedge) on average. The sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ indicates the overall effect for the 1% quantile and the sum of β_0 and $\beta_{q2.5\%}$ indicates the overall effect for the 2.5% quantile.
*, **, and *** are the 10%, 5%, and 1% significant levels respectively.

Next, we compare precious metals as a safe haven before and after the pandemic. Table 3 shows results for the pre-pandemic period. Gold serves as a weak safe haven for the 1% quantile because the sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ is negative but $\beta_{q1\%}$ is not statistically significant. However, gold serves as a strong safe haven for the 2.5% quantile because the sum of β_0 and $\beta_{q2.5\%}$ is negative and both coefficients are statistically significant. Silver also serves as a strong safe haven for the 2.5% quantile. However, Platinum and Palladium are not regarded as a safe haven for both 1% and 2.5% quantiles.

On the other hand, Table 4 shows different results for the post-pandemic period. While gold performs as a weak safe haven for the 2.5% quantile, silver is not a safe haven at all for both 1% and 2.5% quantiles. Interestingly, platinum serves as a strong safe haven for the 2.5% quantile. This finding is important because platinum also may serve as a safe haven for oil during an atypical event such as the COVID-19 pandemic. Palladium does not serve as a safe haven for both 1% and 2.5% quantiles.

Table 4. Results for the post-pandemic period

	Gold		Silver		Platinum		Palladium	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
μ	0.00045	0.88	0.00037	0.34	-0.00011	-0.09	-0.00074	-0.75
β_0	0.03482	2.84^{***}	0.08236	2.98^{***}	0.07197	3.50^{***}	0.11896	5.33^{***}
$\beta_{q2.5\%}$	-0.05021	-1.51	-0.05921	-1.05	-0.10396	-2.44^{**}	-0.01025	-0.13
$\beta_{q1\%}$	0.03707	0.94	0.02835	0.32	0.12220	1.89^{*}	0.03555	0.44
GJR-GARCH								
α	-0.00003	-1.73^{*}	0.00030	4.27^{***}	0.00051	2.09^{**}	0.00017	5.06^{***}
θ	0.29735	3.28^{***}	0.18333	3.12^{***}	-0.02206	-1.35	0.84371	7.82^{***}
φ	-0.17047	-1.99^{**}	0.17355	2.10^{**}	0.20761	2.81^{***}	-0.38617	-3.27^{***}
ω	1.05030	7.22^{***}	0.21932	1.66^{*}	-0.03803	-0.08	0.25542	3.39^{***}

Note: This table shows results for the post-pandemic period. β_0 presents the average relationship between oil and each metal. If β_0 is significantly positive (significantly negative or not different from zero), the asset is regarded as a diversifier (hedge) on average. The sum of β_0, $\beta_{q2.5\%}$, and $\beta_{q1\%}$ indicates the overall effect for the 1% quantile and the sum of β_0 and $\beta_{q2.5\%}$ indicates the overall effect for the 2.5% quantile.
*, **, and *** are the 10%, 5%, and 1% significant levels respectively.

In summary, palladium is not a safe haven for oil in both pre- and post-pandemic periods. Gold and silver perform as a safe haven for oil in the pre-pandemic period. However, their safe haven properties are weakened in the post-pandemic period. While platinum is not regarded as a safe haven in the pre-pandemic period, it serves as a safe haven in the post-pandemic period. As a result, we identify the asymmetric impact of the COVID-19 pandemic on precious metals as a safe haven for oil. For the purpose of investment, gold and silver are traditionally considered major metals relative to platinum and palladium. Thus, gold or silver returns can be expected to fall more simultaneously with oil returns than platinum or palladium returns due to the simultaneous impact of the pandemic on major investment assets across industries. However, we believe that further research should be done to delve into the asymmetric impact of the pandemic on precious metals as a safe haven for oil in terms of disruption of the supply chain or global impact on the energy sector.

5. Conclusion

The main purpose of our study is to examine the impact of the COVID-19 pandemic on the role of precious metals as a safe haven for oil. Unlike recent studies that focus on the initial impact of the pandemic, our study compares four precious metals as a safe haven across the pre- and post-pandemic periods and extends the sample period to capture the lingering effect of the COVID-19 pandemic as well as its initial impact.

First, we find that gold, silver, platinum, and palladium serve as a diversifier rather than a hedge on average. Second, while gold and silver act as a safe haven in the pre-pandemic period, their safe haven properties are weakened in the post-pandemic period. In fact, silver loses its role as a safe haven in the post-pandemic period. Third, while platinum does not act as a safe haven in the pre-pandemic period, it acts as a safe haven in the post-pandemic period. This is critical in the sense that platinum may be considered a safe haven with gold in the face of an atypical event such as the COVID-19 pandemic. Since most previous studies emphasize the importance of gold as a safe haven for oil, finding the role of platinum as a safe haven is new and interesting. Fourth, palladium is not regarded as a safe haven at all across the pre- and post-pandemic periods. As a result, we identify the asymmetric impact of the COVID-19 pandemic on precious metals as a safe haven because the safe haven properties of gold and silver are weakened in the post-pandemic period, whereas the safe haven property of platinum is strengthened in the post-pandemic period.

Since the recent market crash provoked by the COVID-19 pandemic is fundamentally different from the previous ones triggered by structural vulnerability or defects in financial markets, our study is expected to provide a new insight to policymakers as well as professional investors.

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