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The impact of COVID-19 induced panic on the return and volatility of precious metals

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Abstract

We use TVP-VAR approach to analyze the connectedness between the COVID-19 induced global panic index (GPI) and precious metals return and volatility. We find evidence of positive connectedness between the GPI and precious metals with GPI being a shock transmitter and precious metals, especially gold, being net receivers. While silver shows the highest resistance to shocks, platinum and palladium present a time varying transmission pattern. Our results refute the safe-haven property of precious metals during the COVID-19 outbreak, with the exception of silver.

Keywords: COVID-19; Global panic index; Precious metals; TVP-VAR method

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1. Introduction

The global outbreak of coronavirus (COVID-19) continues to ravage the global economic activities and financial stability with an increased level of uncertainty in both financial and commodity markets (Aslam et al., 2020; Corbet et al. 2020 a; Umar and Gubareva, 2020). This has significantly affected asset allocations and risk management decisions across these markets. The market uncertainty induced by exogenous shocks such as COVID-19 pandemic makes investors and portfolio managers search for safe-haven assets to include in their portfolios (Choudhry et al., 2015; Troster et al., 2019; Umar and Gubareva, 2021). The spillover between financial markets and asset classes becomes the central question to answer (Ji et al, 2018; Kang and Yoon, 2019; Gebka et al, 2006; Umar et al, 2019).

Precious metals, especially gold, have been regarded to act as safe-haven during crisis period (Conlon et al., 2018; Bredin et al., 2015; Baur and Lucey, 2010). Recent studies such as Conlon and McGee (2020), Corbet et al. (2020 a), Umar and Gubareva, 2021a, and Ji et al. 2020) have attempted to examine whether gold holds this safe-haven property during the COVID-19 pandemic in comparison to other asset classes and provide supporting evidence, while other studies such as Kumar (2020) find this property to be compromised. Farid et al (2021) analyzed in intraday volatility transmission among precious metals, energy and stocks and find gold to be second volatility transmitter to other markets after US stocks.

In this paper we show how precious metals returns and volatility have reacted to the panic and uncertainty induced by the COVID-19 outbreak. We provide empirical evidence showing the transmission patterns between the COVID-19 induced panic index, a measure of the level of news chatter that refers to panic or hysteria and coronavirus, and returns and volatility of precious metals including gold, silver, platinum, and palladium.

While our work is related to the literature employing connectedness measures to describe spillovers among assets during crisis (Corbet et al.,2020 a,b; Kang and Yoon, 2019; Tiwari et al., 2021; Umar et al, 2021b, c; Zaremba e al, 2021), we contribute to the literature in three ways. First, we are the first to explore the relation between the COVID-19 induced panic and precious metals' return and volatility. Second, our analysis covers the group of precious metals rather than focusing only on gold. Finally, we reveal the time varying characteristics of the magnitude and the direction of this this relation.

Our results show that the panic induced by COVID-19 is a net transmitter of socks to precious metals market. While silver is particularly resisting to these shocks, gold is a net receiver. Platinum and palladium show a time varying transmission pattern.

2. Data and methodology:

2.1. Data:

We use daily spot price index of S&P GSCI gold, S&P GSCI silver, S&P GSCI platinum, and S&P GSCI palladium observed between 22/01/2020 ¹and 29/07/2020 with 132 daily observations extracted from DataStream.

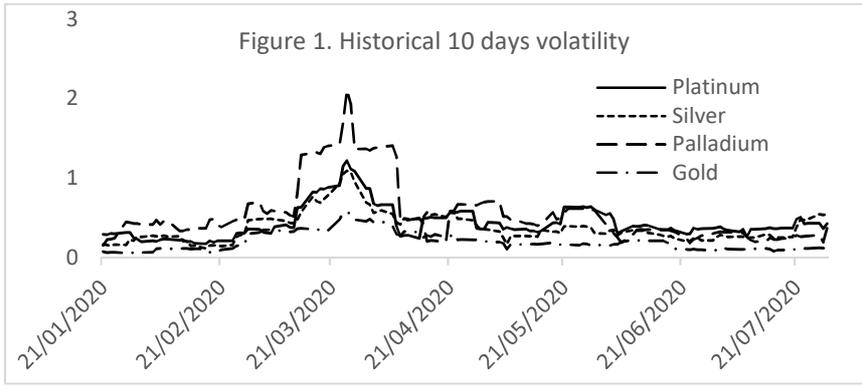
We analyze the connectedness patterns between precious metals daily returns and historical volatility, calculated on 10 days basis, and the COVID-19 induced panic index returns and volatility.

We use the COVID-19 induced panic Index from Ravenpack.² It measures the level of news chatter that refers to panic or hysteria and coronavirus. Values range between 0 and 100 where a value of 7.00 indicates that 7 percent of all news globally is talking about panic and COVID-19. The higher the index value, the more references to panic found in the media.

Summery statistics of precious metals and PI returns presented in table 1 show the non-normality of precious metals and PI returns that present skewed and leptokurtic properties. PI has a higher volatility reflecting a higher variation in news and in the uncertainty about COVID-19 than in the precious metals market. Precious metals markets experienced a huge increase in volatility levels around mid-March 2020 when COVID-19 was declared a global pandemic. Precious metals prices took a hit to the downside before a surge to decade-high peaks. These variations are mainly caused by investors trading activities in these markets. The volatility in the precious metals prices also increased around mid-March 2020 due to selling activities of precious metals in futures markets with a lower volatility for gold than other industrial and financial metals, silver, platinum, and palladium; figure 1.

Table 1: Summary statistics, Daily returns

	Gold	Silver	Platinum	Palladium	PI
Mean	0,002	0,002	0,000	0,000	1,057
Median	0,002	0,002	0,003	0,001	1,128
Maximum	0,056	0,072	0,112	0,229	2,224
Minimum	-0,047	-0,123	-0,122	-0,238	-0,528
Std. Dev.	0,015	0,028	0,031	0,044	0,604
Skewness	0,191	-0,743	-0,392	-0,307	-0,721
Kurtosis	6,158	6,487	6,467	14,685	3,129
Jarque-Bera	55,653	79,029	69,493	753,094	11,542
Probability	0	0	0	0	0.003



¹ This is the time when the world health organization (WHO) announced that the Coronavirus can be transmitted from one individual to others

² <https://coronavirus.ravenpack.com/worldwide/panic>

2.2. Methodology: TVP-VAR Dynamic Connectedness Approach

We analyze the time-varying magnitude and direction of connectedness using the time-varying parameter vector autoregressions (TVP-VAR) dynamic connectedness approach in line with Antonakakis et al. (2018, 2020), Bouri et al. 2020 and Umar et al., 2020a.

We examine the transmission mechanism in a time-varying fashion, following the methodology outlined in Antonakakis and Gabauer (2018). We employ a stationary TVP-VAR (1) with time-varying volatility as per the Bayesian Information Criterion (BIC)

$$Y_t = \beta_t Y_{t-1} + \varepsilon_t \quad \varepsilon_t \sim N(0, S_t) \quad (1)$$

$$\beta_t = \beta_{t-1} + v_t \quad v_t \sim N(0, R_t) \quad (2)$$

$$Y_t = A_t \varepsilon_{t-1} + \varepsilon_t \quad (3)$$

where Y_t , ε_t and v_t are $N \times 1$ vectors and A_t , S_t , β_t and R_t are $N \times N$ matrices. Eq. (3) is the Wold representation of the system. The time-varying coefficients of the vector moving average (VMA) is the fundamental of the connectedness index developed by Diebold and Yilmaz (2012) using the generalized impulse response function (GIRF) and the generalized forecast error variance decomposition (GFEVD) introduced by Koop et al. (1996) and Pesaran and Shin (1998). We focus on the h -step error variance to forecast variable i resulted due to shocks on variable j . Mathematically, we can write this in following manner,

$$\tilde{\varphi}_{ij,t}^g(h) = \frac{\sum_{t=1}^{h-1} \Psi_{ij,t}^{2,g}}{\sum_{i=1}^N \sum_{t=1}^{h-1} \Psi_{ij,t}^{2,g}} \quad (4)$$

With $\tilde{\varphi}_{ij,t}^g(h)$ denotes the h -step ahead GFEVD, $\Psi_{ij,t}^g(h) = S_{ij,t}^{-\frac{1}{2}} A_{h,t} \Sigma_t \varepsilon_{ij,t} \Sigma_t$ the covariance matrix for the error $\varepsilon_{ij,t}$ and $\sum_{j=1}^N \tilde{\varphi}_{ij,t}^g(h) = 1$, $\sum_{i,j=1}^N \tilde{\varphi}_{ij,t}^g(h) = N$. Based on the GFEVD, the total connectedness index (TCI) represents the interconnectedness of the network, formulated by

$$C_t^g(h) = \frac{\sum_{i,j=1, i \neq j}^N \tilde{\varphi}_{ij,t}^g(h)}{\sum_{j=1}^N \tilde{\varphi}_{ij,t}^g(h)} \times 100 \quad (5)$$

First, we focus on the spillovers of variable i to all others j , that represents the total directional connectedness to others defined as follows

$$C_{i \rightarrow j,t}^g(h) = \frac{\sum_{j=1, i \neq j}^N \tilde{\varphi}_{ji,t}^g(h)}{\sum_{j=1}^N \tilde{\varphi}_{ji,t}^g(h)} \times 100 \quad (6)$$

Second, the spillovers of all variables j to variable i , called the total directional connectedness from others are computed as

$$C_{i \leftarrow j,t}^g(h) = \frac{\sum_{j=1, i \neq j}^N \tilde{\varphi}_{ij,t}^g(h)}{\sum_{i=1}^N \tilde{\varphi}_{ij,t}^g(h)} \times 100 \quad (7)$$

Third, we compute the difference between the total directional connectedness to others and total directional connectedness from others to get the net total directional connectedness $C_{i,t}^g$ in following manner

$$C_{i,t}^g(h) = C_{i \rightarrow j,t}^g(h) - C_{i \leftarrow j,t}^g(h) \quad (8)$$

The sign of the net total directional connectedness illustrates whether variable i is driving the network ($C_{i,t}^g(h) < 0$). Last, we split the net total directional connectedness to investigate the bidirectional relationships by computing the net pairwise directional connectedness (NPDC),

$$NPDC_{ij}(h) = \frac{\tilde{\Phi}_{ji,t}^g(h) - \tilde{\Phi}_{ij,t}^g(h)}{N} \times 100 \quad (9)$$

TVP-VAR approach provides an extension to Diebold and Yilmaz (2009, 2012, 2014) vector autoregressive model (VAR) which has been intensively employed in literature to analyze directional connectedness between financial markets (see, for instance, Antonakakis and Vergos, 2013; Batten et al. 2014; Lucey et al. 2014; Balli et al. 2015; Yarovaya et al. 2016; Chau and Deesomsak 2014; Fernández-Rodríguez et al. 2016; Malik and Umar, 2019; Corbet et al. 2018; Umar et al, 2021d,e)³.

The main advantages of the TVP-VAR method is that it does not require to arbitrary set model parameters, like the size of the rolling window in the VAR approach, and that this method is suitable to low frequency datasets.

3. Results

Figure 2 shows connectedness between returns and volatility of precious metals and the COVID-19 induced panic index is time dependent. Total dynamic connectedness becomes more pronounced around mid-March 2020 where the coronavirus was officially declared to be a global infectious disease what increased the panic levels in financial markets.

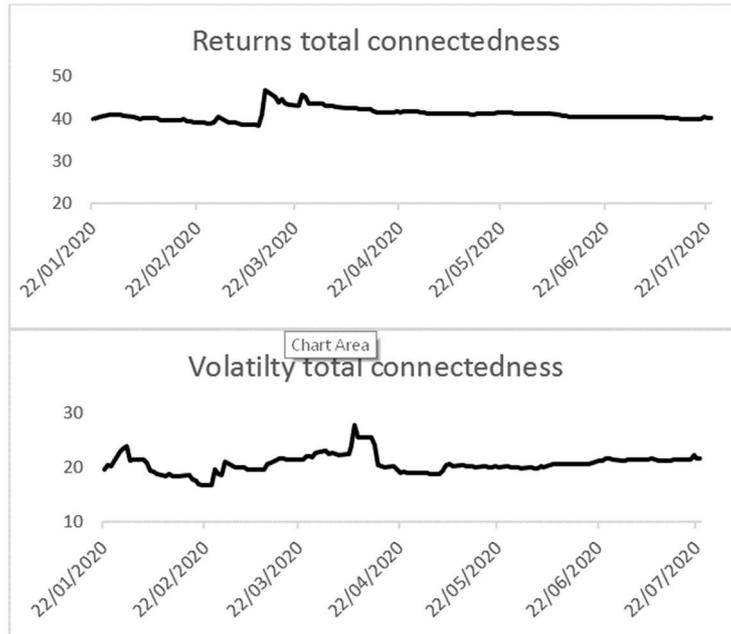


Figure 2: dynamic total connectedness across precious metals and PI returns and volatility

Figure 3 shows that the contribution of PI to total connectedness is always positive which indicates the PI to be a net transmitter of shocks to market affecting precious metals returns and volatility. This contribution is measured by the net directional connectedness (NDC) from PI to precious metals returns and volatility.

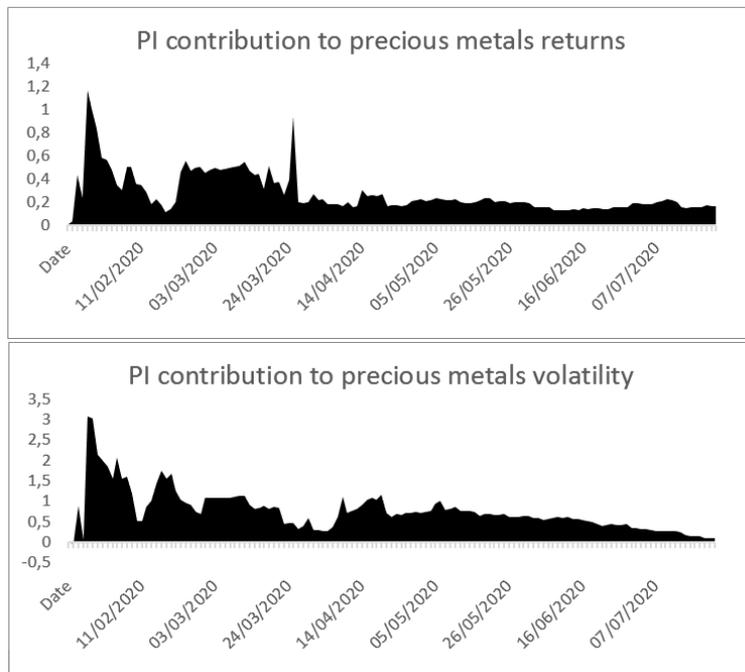


Figure 3: PI contribution to precious metals returns and volatility.

Table 2 shows, on average, gold, platinum, and palladium are the main receivers of shocks with negative NDC while silver and PI are the transmitters. Following analysis shows this transmission is time varying.

Table 2: average NDC and transmission patterns.

	Gold	Silver	Platinum	Palladium	PI
NDC returns	-0,73	2,13	-0,12	-1,36	0,08
NDC Volatility	-0,57	0,34	-0,02	-0,52	0,77

Figure 4 shows the returns and the volatility of gold demonstrate a receiving transmission pattern for almost the whole period of analysis which, in contrast to other studies like Conlon and McGee (2020), Corbet et al (2020 a), Ji et al. (2020) negates the safe haven property of gold during the COVID-19 crisis time. The receiving transmission pattern of gold’s returns and volatility is more pronounced at the beginning of the period and starts of decline afterwards in the same manner as the panic about COVID-19. In fact, while gold is regarded to be a safe-haven, the variations in COVID-19 panic levels are translated into variations in the demand and supply of gold as it affected both producers and consumers of this metal. Gold performed in a similar way as in the 2008 financial crisis. Onset the COVID-19 crisis, Investors with positions in gold futures were forced to sell their gold to meet margin calls, raise cash and buy U.S. treasuries what caused a drop in gold prices before the force of purchasing this traditional safe-haven caused prices to rise again and volatility levels to decrease.

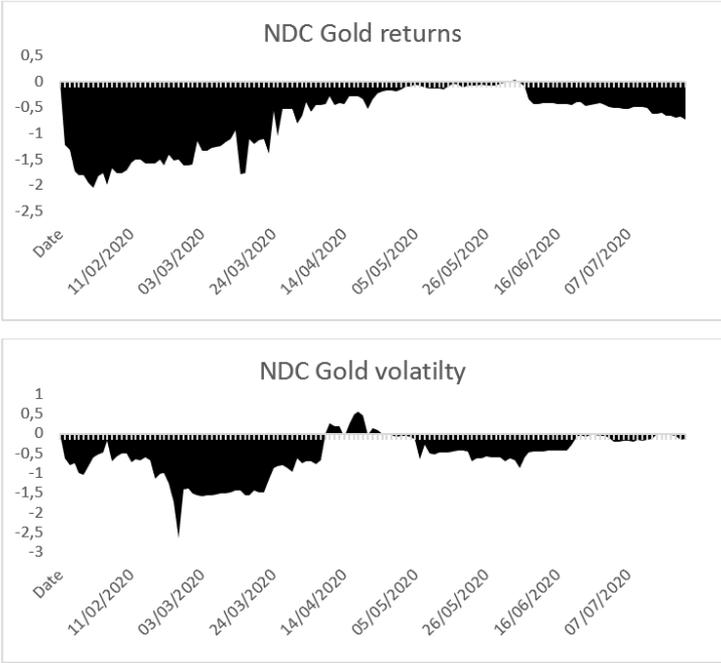


Figure 4: NDC to gold returns and volatility

On the other hand, returns and volatility of silver depicted in Figure 5 tend to weather the shock well with very minimal reception of shocks. This suggests a better hedge or safe-haven property for silver compared to gold for our period of analysis. Although, like gold, silver prices dropped sharply near mid-March following the investors selling of their holdings in this metal, the later resistance of silver to COVID-19 panic can be explained by the industrial demand that, after

the sudden freeze at the beginning of the crisis, re increased with reprise of industrial activities which seem to be less responding to our measure of COVID-19 panic, the panic index.

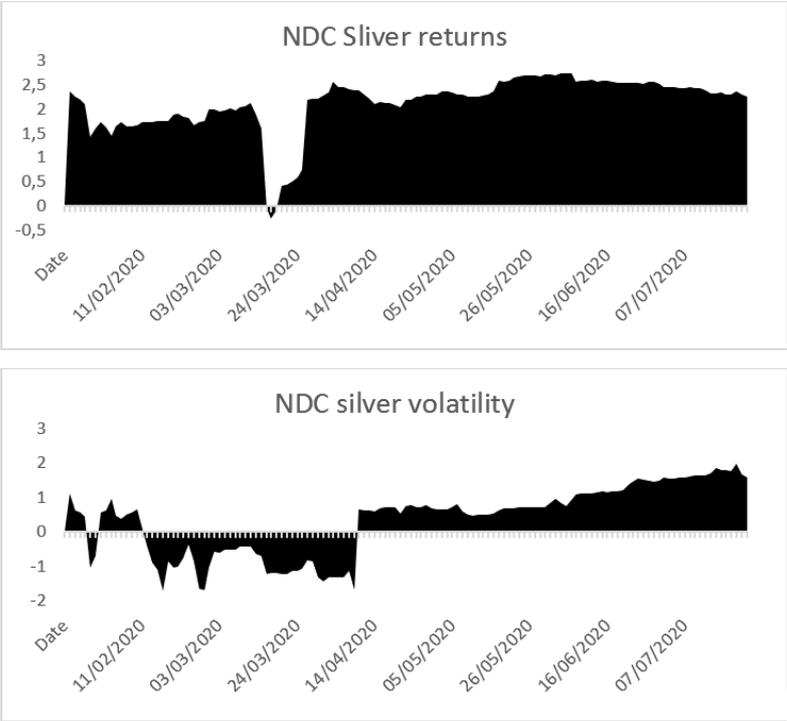


Figure 5: NDC to silver returns and volatility.

Like silver, platinum, and palladium, being both financial and industrial metals; have been dealt a double blow for similar reasons as gold as well as due to lower industrial demand. Platinum and palladium also present a time varying transmission pattern, Figure 6 and Figure 7, respectively. This result can be explained by industrial demand of these metals that tends to temper the effect of COVID-19 panic on platinum and palladium returns and volatility.

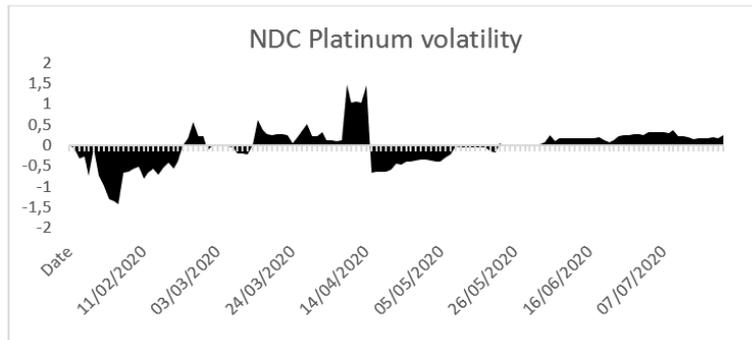
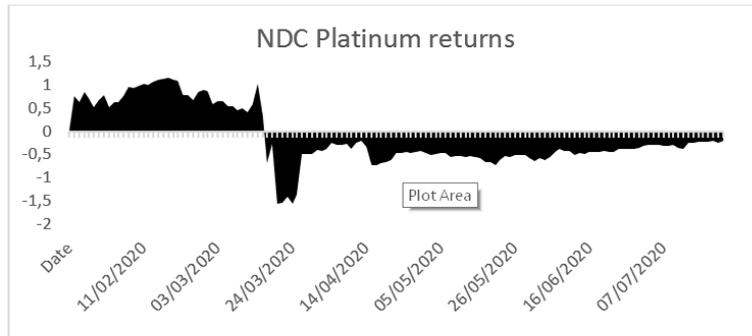


Figure 6: NDC to platinum returns and volatility.

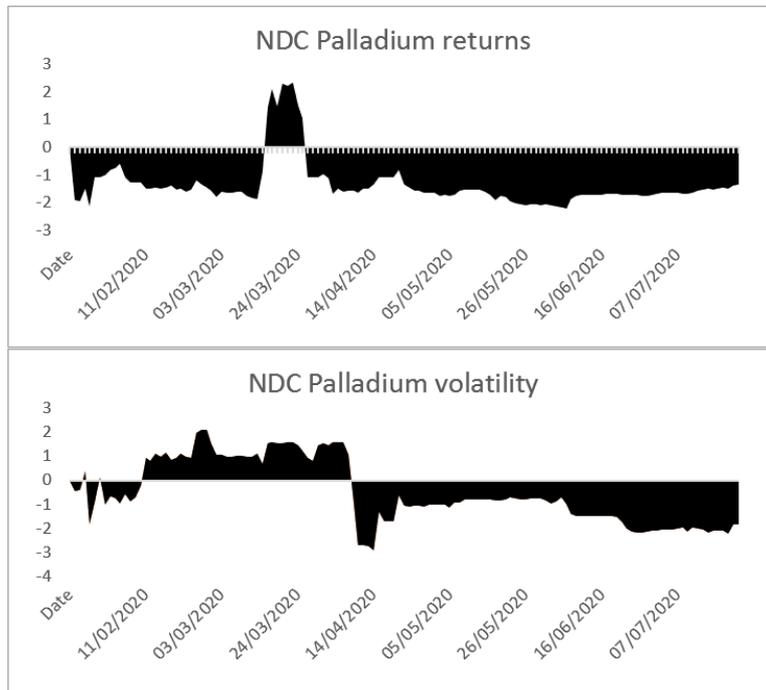


Figure 7: NDC to palladium returns and volatility.

4. Conclusion

We employ the TVP-VAR approach to analyze the magnitude and the direction of connectedness between the COVID-19 induced panic index and returns and volatility of precious metals including gold, silver, platinum, and palladium. Our results permit to prove that the panic induced by COVID19 is a shock transmitter to precious metals market. We found silver to resist to these shocks while gold was a net receiver for almost all the period of analysis. Platinum and palladium on the other hand show a switching time varying patterns of connectedness to COVID-19 panic. COVID-19 panic strongly affected precious metals markets causing unusual trading activities that includes a huge increase in speculation as documented by Sifat et al. (2021). Our results prove that the COVID-19 panic was not in favor of gold investors as suggested in recent studies on this topic Conlon and McGee (2020), Corbet et al. (2020 a), and Ji et al. 2020) and that, in contrast to Farid et al. (2021), gold was a net receiver of shocks transmitted by Covid-19 panic. Gold returns and volatility showed a very high sensitivity to COVID-19 panic and thus gold does not satisfy the safe haven property. The resistance to COVID-19 panic that silver presents within our period of analysis permit us to recommend investors and portfolio managers to include silver in their investment portfolios as an alternative that satisfies better safety needs than gold. However, our results worth more investigation by analyzing the shocks transmission patterns among precious metals mutually and between precious metals and other measures of market sentiment which is left for future research.

References

- Antonakakis, N., Chatziantoniou, I., and Gabauer, D. (2020). Refined measures of dynamic connectedness based on tvp-var. Technical report.
- Antonakakis, N., Gabauer, D., Gupta, R., and Plakandaras, V. (2018). Dynamic Connectedness Of Uncertainty Across Developed Economies: A Time-Varying Approach. *Economics Letters*, 166:63–75.
- Aslam, F., Aziz, S., Nguyen, D. K., Mughal, K. S., and Khan, M. (2020). On the Efficiency of Foreign Exchange Markets in times of the COVID-19 Pandemic. *Technological forecasting and social change*, 120261.
- Balli, F., Balli, H. O., Louis, R. J., and Vo, T. K. (2015). The transmission of market shocks and bilateral linkages: Evidence from emerging economies. *International Review of Financial Analysis*, 42, 349-357.
- Batten, J. A., Ciner, C., and Lucey, B. M. (2015). Which precious metals spill over on which, when and why? Some evidence. *Applied Economics Letters*, 22(6), 466-473.
- Baur, D. G., & Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, 45(2), 217-229.
- Bouri, E., Cepni, O., Gabauer, D., and Gupta, R. (2020). Return Connectedness across Asset Classes around the COVID-19 Outbreak (No. 202047).
- Bredin, D., Conlon, T., and Potì, V. (2015). Does gold glitter in the long-run? Gold as a hedge and safe haven across time and investment horizon. *International Review of Financial Analysis*, 41, 320-328.
- Chau, F., & Deesomsak, R. (2014). Does linkage fuel the fire? The transmission of financial stress across the markets. *International Review of Financial Analysis*, 36, 57-70.
- Choudhry, T., Hassan, S. S., and Shabi, S. (2015). Relationship between gold and stock markets during the global financial crisis: Evidence from nonlinear causality tests. *International Review of Financial Analysis*, 41:247–256.
- Conlon, T., and McGee, R. (2020). Safe haven or risky hazard? Bitcoin during the COVID-19 bear market. *Finance Research Letters*, 101607.
- Conlon, T., Lucey, B. M., and Uddin, G. S. (2018). Is gold a hedge against inflation? A wavelet time-scale perspective. *Review of Quantitative Finance and Accounting*, 51(2), 317-345.
- Corbet, S., Meegan, A., Larkin, C., Lucey, B., and Yarovaya, L. (2018). Exploring the dynamic relationships between cryptocurrencies and other financial assets. *Economics Letters*, 165, 28-34.
- Corbet, S., Larkin, C., & Lucey, B. (2020). The contagion effects of the covid-19 pandemic: Evidence from gold and cryptocurrencies. *Finance Research Letters*, 101554.
- Corbet, S., Hou, Y., Hu, Y., Lucey, B., & Oxley, L. (2020). Aye Corona! The contagion effects of being named Corona during the COVID-19 pandemic. *Finance Research Letters*, 101591.
- Diebold, F. X. and Yilmaz, K. (2009). Measuring Financial Asset Return And Volatility Spillovers, With Application To Global Equity Markets. *Economic Journal*, 119(534):158–171.
- Diebold, F. X. and Yilmaz, K. (2012). Better To Give Than To Receive: Predictive Directional Measurement Of Volatility Spillovers. *International Journal of Forecasting*, 28(1):57–66.
- Diebold, F. X. and Yilmaz, K. (2014). On The Network Topology Of Variance Decompositions: Measuring The Connectedness Of Financial Firms. *Journal of Econometrics*, 182(1):119–134.
- Farid, S., Kayani, G. M., Naeem, M. A., & Shahzad, S. J. H. (2021). Intraday volatility transmission among precious metals, energy and stocks during the COVID-19 pandemic. *Resources Policy*, 72, 102101.

Fernández-Rodríguez, F., Gómez-Puig, M., & Sosvilla-Rivero, S. (2016). Using connectedness analysis to assess financial stress transmission in EMU sovereign bond market volatility. *Journal of International Financial Markets, Institutions and Money*, 43, 126-145.

Gebka, B. and Serwa, D. (2006). Are financial spillovers stable across regimes?: Evidence from the 1997 asian crisis. *Journal of International Financial Markets, Institutions and Money*, 16(4):301–317.

Ji, Q., Bouri, E., Roubaud, D., and Shahzad, S. J. H. (2018). Risk spillover between energy and agricultural commodity markets: A dependence-switching covar-copula model. *Energy Economics*, 75:14–27.

Ji, Q., Zhang, D., & Zhao, Y. (2020). Searching for safe-haven assets during the COVID-19 pandemic. *International Review of Financial Analysis*, 101526.

Kang, S. H. and Yoon, S.-M. (2019). Financial crises and dynamic spillovers among chinese stock and commodity futures markets. *Physica A: Statistical Mechanics and its Applications*, 531:121776.

Koop, G., Pesaran, M.H., Potter, S.M., 1996. Impulse response analysis in nonlinear multivariate models. *J. Econometrics* 74 (1), 119–147.

Kumar, A. (2020). Testing Safe Haven Property of Bitcoin and Gold during Covid-19: Evidence from Multivariate GARCH analysis. *Economics Bulletin*, 40(3), 2005-2015.

Lucey, B. M., Larkin, C., and O'Connor, F. (2014). Gold markets around the world—who spills over what, to whom, when?. *Applied Economics Letters*, 21(13), 887-892.

Malik, F., Umar, Z. (2019). Dynamic connectedness of oil price shocks and exchange rates. *Energy Economics* (In Press). doi: 10.1016/j.eneco.2019.104501

Sifat, Imtiaz, Abdul Ghafoor, and Abdollah Ah Mand. "The COVID-19 pandemic and speculation in energy, precious metals, and agricultural futures." *Journal of Behavioral and Experimental Finance* 30 (2021): 100498.

Tiwari, A. K., Umar, Z., and Alqahtani, F. (2021). Existence of long memory in crude oil and petroleum products: Generalised Hurst exponent approach. *Research in International Business and Finance*, 57-101403.

Troster, V., Bouri, E., and Roubaud, D. (2019). A quantile regression analysis of flights-to-safety with implied volatilities. *Resources Policy*, 62:482–495.

Umar, Z., Shehzad, C. T. and Samitas, A. (2019), "The demand for eurozone stocks and bonds in a time-varying asset allocation framework", *The European Journal of Finance*, Vol. 25, No. 11. pp. 994-1011. <https://doi.org/10.1080/1351847X.2018.1564690>

Umar Z. and Gubareva M., 2020. A Time-Frequency Analysis of the Impact of the Covid-19 Induced Panic on the Volatility of Currency and Cryptocurrency Markets. *Journal of Behavioral and Experimental Finance* 28, 100404. <https://doi.org/10.1016/j.jbef.2020.100404>

Umar, Z., Jareno, F., Escribano, A.M., 2020a. Dynamic return and volatility connectedness for dominant agricultural commodity markets during the COVID-19 pandemic era. <https://www.researchsquare.com/article/rs-75766/v1>

Umar, Z., Kenourgios, D., and Papathanasiou, S. (2020b). The static and dynamic connectedness of environmental, social, and governance investments: International evidence. *Economic Modelling*. 93, 112-124. <https://doi.org/10.1016/j.econmod.2020.08.007> .

Umar, Z. and Gubareva, M., 2021. Faith-based investments and the Covid-19 pandemic: Analyzing equity volatility and media coverage time-frequency relations. *Pacific-Basin Finance Journal*, 67, 101571. <https://doi.org/10.1016/j.pacfin.2021.101571>

Umar Z. and Gubareva M., 2021a. The impact of Covid-19 on commodity markets volatility:

analyzing time-frequency relations between commodity prices and coronavirus panic levels . Resources Policy. Forthcoming.

Umar, Z., Manel, Y., Riaz, Y., and Gubareva, M. 2021b. Return and volatility transmission between emerging markets and US debt throughout the pandemic crisis. *Pacific-Basin Finance Journal*, 67, 101563. <https://doi.org/10.1016/j.pacfin.2021.101563>

Umar, Z., Gubareva, M., Naeem, M., and Akhter, A., 2021c. Return and volatility transmission between oil price shocks and agricultural commodities. *PLoS ONE*, 16(2): e0246886. <https://doi.org/10.1371/journal.pone.0246886>

Umar, Z., Trablesi, N., & Zaremba, A. (2021d) Oil shocks and equity markets: The case of GCC and BRICS economies. *Energy Economics*. 96, 105155. <https://doi.org/10.1016/j.eneco.2021.105155>

Umar, Z., Trablesi, N., & Alqahtani, F. (2021e) Connectedness between cryptocurrency and technology sectors: International evidence. *International Review of Economics & Finance* 71, 910-922 <https://doi.org/10.1016/j.iref.2020.10.021>

Yarovaya, L., Brzeszczyński, J., and Lau, C. K. M. (2016). Intra-and inter-regional return and volatility spillovers across emerging and developed markets: Evidence from stock indices and stock index futures. *International Review of Financial Analysis*, 43, 96-114.

Zaremba A., Kizys, R., Aharon, D.Y and Umar Z.2021. Term spreads and the COVID-19 pandemic: Evidence from international sovereign bond markets. *Finance research Letters*. <https://doi.org/10.1016/j.frl.2021.102042>

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Precious metals, especially gold, have been regarded to act as safe-haven during crisis period (Conlon et al., 2018; Bredin et al., 2015; Baur and Lucey, 2010). Recent studies such as Conlon and McGee (2020), Corbet et al. (2020 a), Umar and Gubareva, 2021a, and Ji et al. 2020) have attempted to examine whether gold holds this safe-haven property during the COVID-19 pandemic in comparison to other asset classes and provide supporting evidence, while other studies such as Kumar (2020) find this property to be compromised. Farid et al (2021) analyzed in intraday volatility transmission among precious metals, energy and stocks and find gold to be second volatility transmitter to other markets after US stocks.

In this paper we show how precious metals returns and volatility have reacted to the panic and uncertainty induced by the COVID-19 outbreak. We provide empirical evidence showing the transmission patterns between the COVID-19 induced panic index, a measure of the level of news chatter that refers to panic or hysteria and coronavirus, and returns and volatility of precious metals including gold, silver, platinum, and palladium.

While our work is related to the literature employing connectedness measures to describe spillovers among assets during crisis (Corbet et al.,2020 a,b; Kang and Yoon, 2019; Tiwari et al., 2021; Umar et al, 2021b, c; Zaremba e al, 2021), we contribute to the literature in three ways. First, we are the first to explore the relation between the COVID-19 induced panic and precious metals' return and volatility. Second, our analysis covers the group of precious metals rather than focusing only on gold. Finally, we reveal the time varying characteristics of the magnitude and the direction of this this relation.

Our results show that the panic induced by COVID-19 is a net transmitter of socks to precious metals market. While silver is particularly resisting to these shocks, gold is a net receiver. Platinum and palladium show a time varying transmission pattern.

2. Data and methodology:

2.1. Data:

We use daily spot price index of S&P GSCI gold, S&P GSCI silver, S&P GSCI platinum, and S&P GSCI palladium observed between 22/01/2020 ¹and 29/07/2020 with 132 daily observations extracted from DataStream.

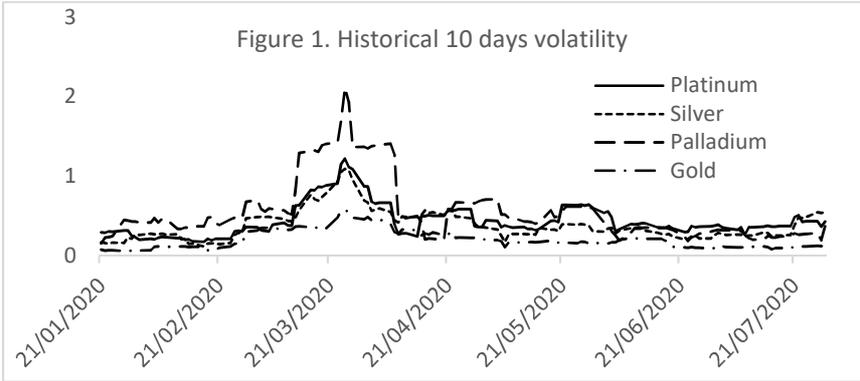
We analyze the connectedness patterns between precious metals daily returns and historical volatility, calculated on 10 days basis, and the COVID-19 induced panic index returns and volatility.

We use the COVID-19 induced panic Index from Ravenpack.² It measures the level of news chatter that refers to panic or hysteria and coronavirus. Values range between 0 and 100 where a value of 7.00 indicates that 7 percent of all news globally is talking about panic and COVID-19. The higher the index value, the more references to panic found in the media.

Summery statistics of precious metals and PI returns presented in table 1 show the non-normality of precious metals and PI returns that present skewed and leptokurtic properties. PI has a higher volatility reflecting a higher variation in news and in the uncertainty about COVID-19 than in the precious metals market. Precious metals markets experienced a huge increase in volatility levels around mid-March 2020 when COVID-19 was declared a global pandemic. Precious metals prices took a hit to the downside before a surge to decade-high peaks. These variations are mainly caused by investors trading activities in these markets. The volatility in the precious metals prices also increased around mid-March 2020 due to selling activities of precious metals in futures markets with a lower volatility for gold than other industrial and financial metals, silver, platinum, and palladium; figure 1.

Table 1: Summary statistics, Daily returns

	Gold	Silver	Platinum	Palladium	PI
Mean	0,002	0,002	0,000	0,000	1,057
Median	0,002	0,002	0,003	0,001	1,128
Maximum	0,056	0,072	0,112	0,229	2,224
Minimum	-0,047	-0,123	-0,122	-0,238	-0,528
Std. Dev.	0,015	0,028	0,031	0,044	0,604
Skewness	0,191	-0,743	-0,392	-0,307	-0,721
Kurtosis	6,158	6,487	6,467	14,685	3,129
Jarque-Bera	55,653	79,029	69,493	753,094	11,542
Probability	0	0	0	0	0.003



¹ This is the time when the world health organization (WHO) announced that the Coronavirus can be transmitted from one individual to others

² <https://coronavirus.ravenpack.com/worldwide/panic>

2.2. Methodology: TVP-VAR Dynamic Connectedness Approach

We analyze the time-varying magnitude and direction of connectedness using the time-varying parameter vector autoregressions (TVP-VAR) dynamic connectedness approach in line with Antonakakis et al. (2018, 2020), Bouri et al. 2020 and Umar et al., 2020a.

We examine the transmission mechanism in a time-varying fashion, following the methodology outlined in Antonakakis and Gabauer (2018). We employ a stationary TVP-VAR (1) with time-varying volatility as per the Bayesian Information Criterion (BIC)

$$Y_t = \beta_t Y_{t-1} + \varepsilon_t \quad \varepsilon_t \sim N(0, S_t) \quad (1)$$

$$\beta_t = \beta_{t-1} + v_t \quad v_t \sim N(0, R_t) \quad (2)$$

$$Y_t = A_t \varepsilon_{t-1} + \varepsilon_t \quad (3)$$

where Y_t , ε_t and v_t are $N \times 1$ vectors and A_t , S_t , β_t and R_t are $N \times N$ matrices. Eq. (3) is the Wold representation of the system. The time-varying coefficients of the vector moving average (VMA) is the fundamental of the connectedness index developed by Diebold and Yilmaz (2012) using the generalized impulse response function (GIRF) and the generalized forecast error variance decomposition (GFEVD) introduced by Koop et al. (1996) and Pesaran and Shin (1998). We focus on the h -step error variance to forecast variable i resulted due to shocks on variable j . Mathematically, we can write this in following manner,

$$\tilde{\varphi}_{ij,t}^g(h) = \frac{\sum_{t=1}^{h-1} \Psi_{ij,t}^{2,g}}{\sum_{i=1}^N \sum_{t=1}^{h-1} \Psi_{ij,t}^{2,g}} \quad (4)$$

With $\tilde{\varphi}_{ij,t}^g(h)$ denotes the h -step ahead GFEVD, $\Psi_{ij,t}^g(h) = S_{ij,t}^{-\frac{1}{2}} A_{h,t} \Sigma_t \varepsilon_{ij,t} \Sigma_t$ the covariance matrix for the error $\varepsilon_{ij,t}$ and $\sum_{j=1}^N \tilde{\varphi}_{ij,t}^g(h) = 1$, $\sum_{i,j=1}^N \tilde{\varphi}_{ij,t}^g(h) = N$. Based on the GFEVD, the total connectedness index (TCI) represents the interconnectedness of the network, formulated by

$$C_t^g(h) = \frac{\sum_{i,j=1, i \neq j}^N \tilde{\varphi}_{ij,t}^g(h)}{\sum_{j=1}^N \tilde{\varphi}_{ij,t}^g(h)} \times 100 \quad (5)$$

First, we focus on the spillovers of variable i to all others j , that represents the total directional connectedness to others defined as follows

$$C_{i \rightarrow j,t}^g(h) = \frac{\sum_{j=1, i \neq j}^N \tilde{\varphi}_{ji,t}^g(h)}{\sum_{j=1}^N \tilde{\varphi}_{ji,t}^g(h)} \times 100 \quad (6)$$

Second, the spillovers of all variables j to variable i , called the total directional connectedness from others are computed as

$$C_{i \leftarrow j,t}^g(h) = \frac{\sum_{j=1, i \neq j}^N \tilde{\varphi}_{ij,t}^g(h)}{\sum_{i=1}^N \tilde{\varphi}_{ij,t}^g(h)} \times 100 \quad (7)$$

Third, we compute the difference between the total directional connectedness to others and total directional connectedness from others to get the net total directional connectedness $C_{i,t}^g$ in following manner

$$C_{i,t}^g(h) = C_{i \rightarrow j,t}^g(h) - C_{i \leftarrow j,t}^g(h) \quad (8)$$

The sign of the net total directional connectedness illustrates whether variable i is driving the network ($C_{i,t}^g(h) < 0$). Last, we split the net total directional connectedness to investigate the bidirectional relationships by computing the net pairwise directional connectedness (NPDC),

$$NPDC_{ij}(h) = \frac{\tilde{\Phi}_{ji,t}^g(h) - \tilde{\Phi}_{ij,t}^g(h)}{N} \times 100 \quad (9)$$

TVP-VAR approach provides an extension to Diebold and Yilmaz (2009, 2012, 2014) vector autoregressive model (VAR) which has been intensively employed in literature to analyze directional connectedness between financial markets (see, for instance, Antonakakis and Vergos, 2013; Batten et al. 2014; Lucey et al. 2014; Balli et al. 2015; Yarovaya et al. 2016; Chau and Deesomsak 2014; Fernández-Rodríguez et al. 2016; Malik and Umar, 2019; Corbet et al. 2018; Umar et al, 2021d,e)³.

The main advantages of the TVP-VAR method is that it does not require to arbitrary set model parameters, like the size of the rolling window in the VAR approach, and that this method is suitable to low frequency datasets.

3. Results

Figure 2 shows connectedness between returns and volatility of precious metals and the COVID-19 induced panic index is time dependent. Total dynamic connectedness becomes more pronounced around mid-March 2020 where the coronavirus was officially declared to be a global infectious disease what increased the panic levels in financial markets.

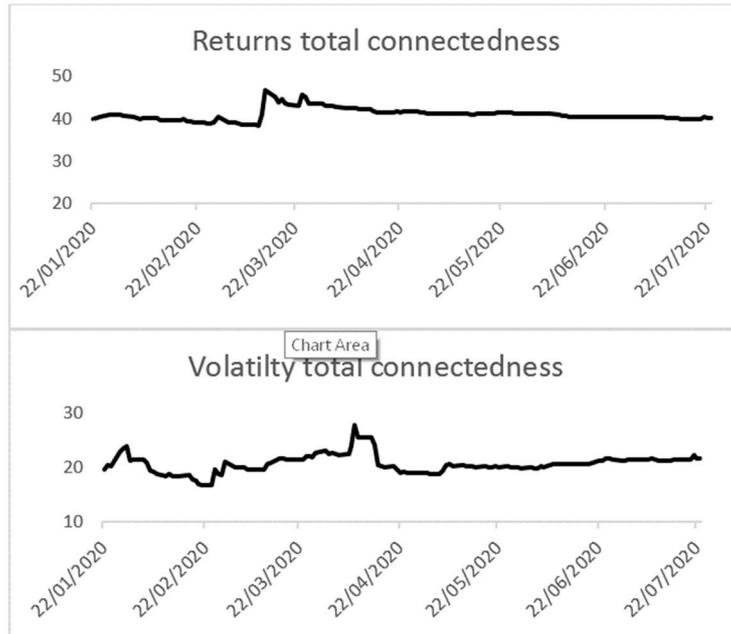


Figure 2: dynamic total connectedness across precious metals and PI returns and volatility

Figure 3 shows that the contribution of PI to total connectedness is always positive which indicates the PI to be a net transmitter of shocks to market affecting precious metals returns and volatility. This contribution is measured by the net directional connectedness (NDC) from PI to precious metals returns and volatility.

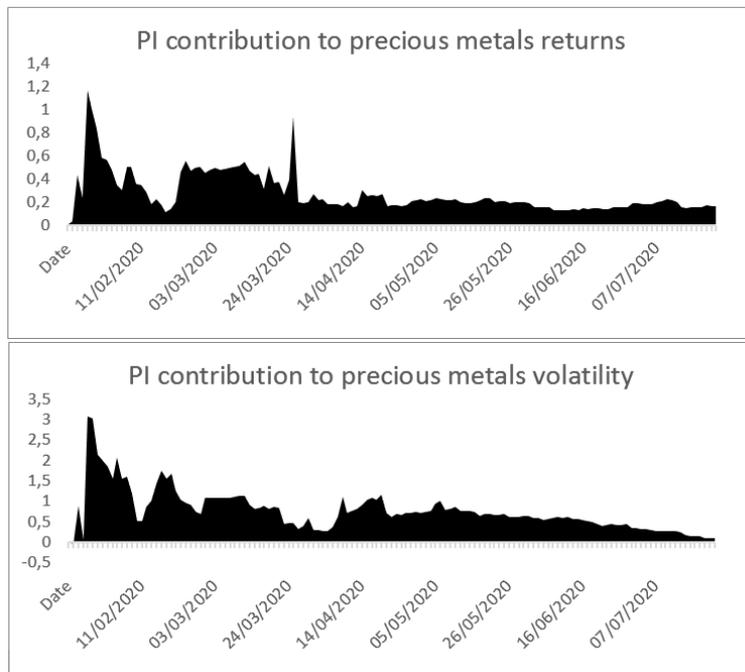


Figure 3: PI contribution to precious metals returns and volatility.

Table 2 shows, on average, gold, platinum, and palladium are the main receivers of shocks with negative NDC while silver and PI are the transmitters. Following analysis shows this transmission is time varying.

Table 2: average NDC and transmission patterns.

	Gold	Silver	Platinum	Palladium	PI
NDC returns	-0,73	2,13	-0,12	-1,36	0,08
NDC Volatility	-0,57	0,34	-0,02	-0,52	0,77

Figure 4 shows the returns and the volatility of gold demonstrate a receiving transmission pattern for almost the whole period of analysis which, in contrast to other studies like Conlon and McGee (2020), Corbet et al (2020 a), Ji et al. (2020) negates the safe haven property of gold during the COVID-19 crisis time. The receiving transmission pattern of gold’s returns and volatility is more pronounced at the beginning of the period and starts of decline afterwards in the same manner as the panic about COVID-19. In fact, while gold is regarded to be a safe-haven, the variations in COVID-19 panic levels are translated into variations in the demand and supply of gold as it affected both producers and consumers of this metal. Gold performed in a similar way as in the 2008 financial crisis. Onset the COVID-19 crisis, Investors with positions in gold futures were forced to sell their gold to meet margin calls, raise cash and buy U.S. treasuries what caused a drop in gold prices before the force of purchasing this traditional safe-haven caused prices to rise again and volatility levels to decrease.

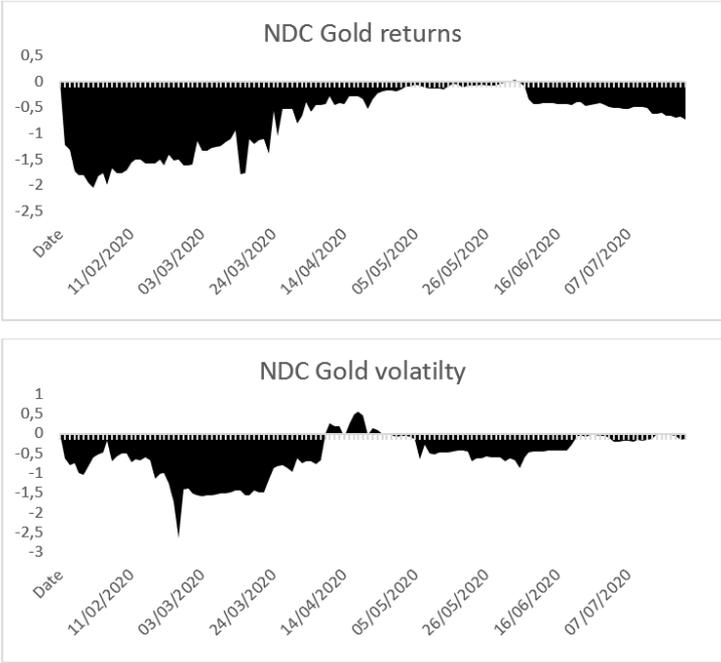


Figure 4: NDC to gold returns and volatility

On the other hand, returns and volatility of silver depicted in Figure 5 tend to weather the shock well with very minimal reception of shocks. This suggests a better hedge or safe-haven property for silver compared to gold for our period of analysis. Although, like gold, silver prices dropped sharply near mid-March following the investors selling of their holdings in this metal, the later resistance of silver to COVID-19 panic can be explained by the industrial demand that, after

the sudden freeze at the beginning of the crisis, re increased with reprise of industrial activities which seem to be less responding to our measure of COVID-19 panic, the panic index.

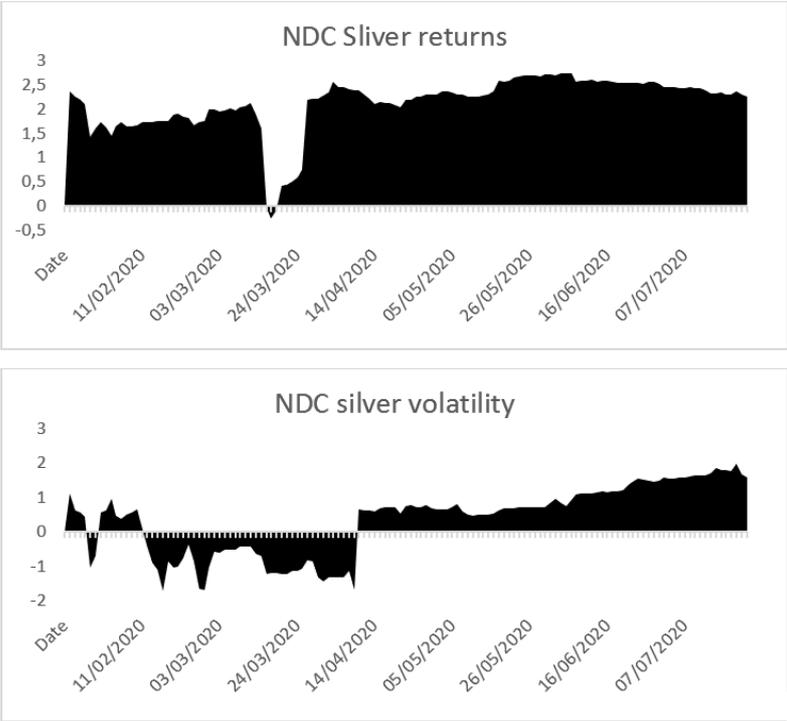


Figure 5: NDC to silver returns and volatility.

Like silver, platinum, and palladium, being both financial and industrial metals; have been dealt a double blow for similar reasons as gold as well as due to lower industrial demand. Platinum and palladium also present a time varying transmission pattern, Figure 6 and Figure 7, respectively. This result can be explained by industrial demand of these metals that tends to temper the effect of COVID-19 panic on platinum and palladium returns and volatility.

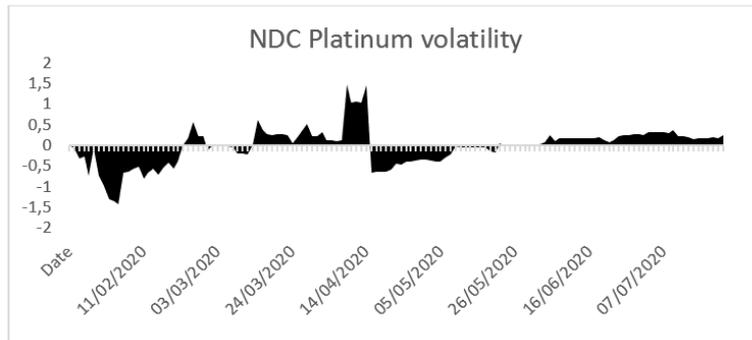
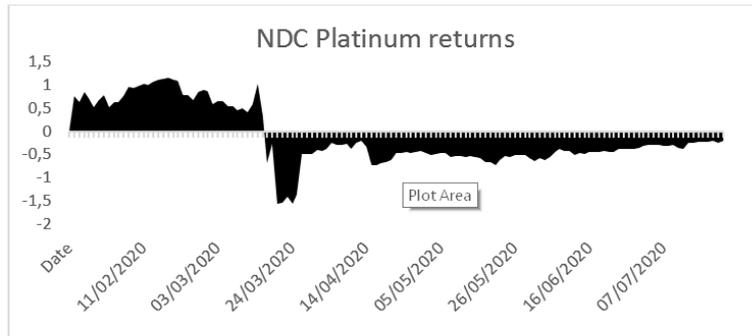


Figure 6: NDC to platinum returns and volatility.

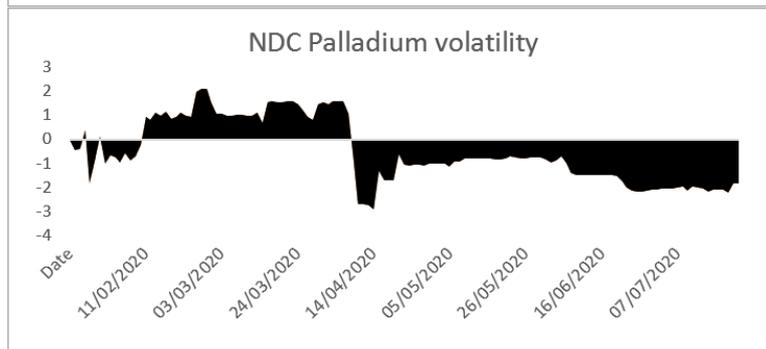
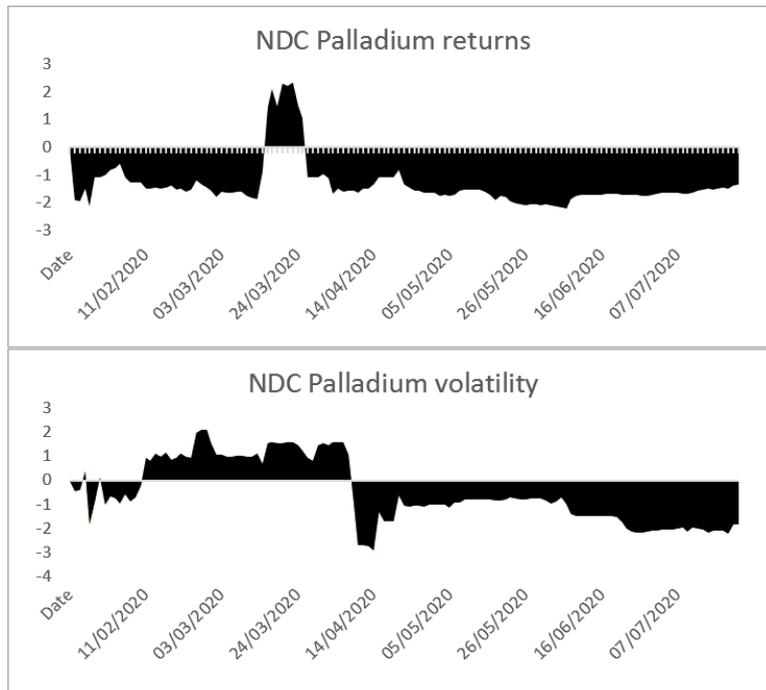


Figure 7: NDC to palladium returns and volatility.

4. Conclusion

We employ the TVP-VAR approach to analyze the magnitude and the direction of connectedness between the COVID-19 induced panic index and returns and volatility of precious metals including gold, silver, platinum, and palladium. Our results permit to prove that the panic induced by COVID19 is a shock transmitter to precious metals market. We found silver to resist to these shocks while gold was a net receiver for almost all the period of analysis. Platinum and palladium on the other hand show a switching time varying patterns of connectedness to COVID-19 panic. COVID-19 panic strongly affected precious metals markets causing unusual trading activities that includes a huge increase in speculation as documented by Sifat et al. (2021). Our results prove that the COVID-19 panic was not in favor of gold investors as suggested in recent studies on this topic Conlon and McGee (2020), Corbet et al. (2020 a), and Ji et al. 2020) and that, in contrast to Farid et al. (2021), gold was a net receiver of shocks transmitted by Covid-19 panic. Gold returns and volatility showed a very high sensitivity to COVID-19 panic and thus gold does not satisfy the safe haven property. The resistance to COVID-19 panic that silver presents within our period of analysis permit us to recommend investors and portfolio managers to include silver in their investment portfolios as an alternative that satisfies better safety needs than gold. However, our results worth more investigation by analyzing the shocks transmission patterns among precious metals mutually and between precious metals and other measures of market sentiment which is left for future research.

References

- Antonakakis, N., Chatziantoniou, I., and Gabauer, D. (2020). Refined measures of dynamic connectedness based on tvp-var. Technical report.
- Antonakakis, N., Gabauer, D., Gupta, R., and Plakandaras, V. (2018). Dynamic Connectedness Of Uncertainty Across Developed Economies: A Time-Varying Approach. *Economics Letters*, 166:63–75.
- Aslam, F., Aziz, S., Nguyen, D. K., Mughal, K. S., and Khan, M. (2020). On the Efficiency of Foreign Exchange Markets in times of the COVID-19 Pandemic. *Technological forecasting and social change*, 120261.
- Balli, F., Balli, H. O., Louis, R. J., and Vo, T. K. (2015). The transmission of market shocks and bilateral linkages: Evidence from emerging economies. *International Review of Financial Analysis*, 42, 349-357.
- Batten, J. A., Ciner, C., and Lucey, B. M. (2015). Which precious metals spill over on which, when and why? Some evidence. *Applied Economics Letters*, 22(6), 466-473.
- Baur, D. G., & Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, 45(2), 217-229.
- Bouri, E., Cepni, O., Gabauer, D., and Gupta, R. (2020). Return Connectedness across Asset Classes around the COVID-19 Outbreak (No. 202047).
- Bredin, D., Conlon, T., and Potì, V. (2015). Does gold glitter in the long-run? Gold as a hedge and safe haven across time and investment horizon. *International Review of Financial Analysis*, 41, 320-328.
- Chau, F., & Deesomsak, R. (2014). Does linkage fuel the fire? The transmission of financial stress across the markets. *International Review of Financial Analysis*, 36, 57-70.
- Choudhry, T., Hassan, S. S., and Shabi, S. (2015). Relationship between gold and stock markets during the global financial crisis: Evidence from nonlinear causality tests. *International Review of Financial Analysis*, 41:247–256.
- Conlon, T., and McGee, R. (2020). Safe haven or risky hazard? Bitcoin during the COVID-19 bear market. *Finance Research Letters*, 101607.
- Conlon, T., Lucey, B. M., and Uddin, G. S. (2018). Is gold a hedge against inflation? A wavelet time-scale perspective. *Review of Quantitative Finance and Accounting*, 51(2), 317-345.
- Corbet, S., Meegan, A., Larkin, C., Lucey, B., and Yarovaya, L. (2018). Exploring the dynamic relationships between cryptocurrencies and other financial assets. *Economics Letters*, 165, 28-34.
- Corbet, S., Larkin, C., & Lucey, B. (2020). The contagion effects of the covid-19 pandemic: Evidence from gold and cryptocurrencies. *Finance Research Letters*, 101554.
- Corbet, S., Hou, Y., Hu, Y., Lucey, B., & Oxley, L. (2020). Aye Corona! The contagion effects of being named Corona during the COVID-19 pandemic. *Finance Research Letters*, 101591.
- Diebold, F. X. and Yilmaz, K. (2009). Measuring Financial Asset Return And Volatility Spillovers, With Application To Global Equity Markets. *Economic Journal*, 119(534):158–171.
- Diebold, F. X. and Yilmaz, K. (2012). Better To Give Than To Receive: Predictive Directional Measurement Of Volatility Spillovers. *International Journal of Forecasting*, 28(1):57–66.
- Diebold, F. X. and Yilmaz, K. (2014). On The Network Topology Of Variance Decompositions: Measuring The Connectedness Of Financial Firms. *Journal of Econometrics*, 182(1):119–134.
- Farid, S., Kayani, G. M., Naeem, M. A., & Shahzad, S. J. H. (2021). Intraday volatility transmission among precious metals, energy and stocks during the COVID-19 pandemic. *Resources Policy*, 72, 102101.

Fernández-Rodríguez, F., Gómez-Puig, M., & Sosvilla-Rivero, S. (2016). Using connectedness analysis to assess financial stress transmission in EMU sovereign bond market volatility. *Journal of International Financial Markets, Institutions and Money*, 43, 126-145.

Gebka, B. and Serwa, D. (2006). Are financial spillovers stable across regimes?: Evidence from the 1997 asian crisis. *Journal of International Financial Markets, Institutions and Money*, 16(4):301–317.

Ji, Q., Bouri, E., Roubaud, D., and Shahzad, S. J. H. (2018). Risk spillover between energy and agricultural commodity markets: A dependence-switching covar-copula model. *Energy Economics*, 75:14–27.

Ji, Q., Zhang, D., & Zhao, Y. (2020). Searching for safe-haven assets during the COVID-19 pandemic. *International Review of Financial Analysis*, 101526.

Kang, S. H. and Yoon, S.-M. (2019). Financial crises and dynamic spillovers among chinese stock and commodity futures markets. *Physica A: Statistical Mechanics and its Applications*, 531:121776.

Koop, G., Pesaran, M.H., Potter, S.M., 1996. Impulse response analysis in nonlinear multivariate models. *J. Econometrics* 74 (1), 119–147.

Kumar, A. (2020). Testing Safe Haven Property of Bitcoin and Gold during Covid-19: Evidence from Multivariate GARCH analysis. *Economics Bulletin*, 40(3), 2005-2015.

Lucey, B. M., Larkin, C., and O'Connor, F. (2014). Gold markets around the world—who spills over what, to whom, when?. *Applied Economics Letters*, 21(13), 887-892.

Malik, F., Umar, Z. (2019). Dynamic connectedness of oil price shocks and exchange rates. *Energy Economics* (In Press). doi: 10.1016/j.eneco.2019.104501

Sifat, Imtiaz, Abdul Ghafoor, and Abdollah Ah Mand. "The COVID-19 pandemic and speculation in energy, precious metals, and agricultural futures." *Journal of Behavioral and Experimental Finance* 30 (2021): 100498.

Tiwari, A. K., Umar, Z., and Alqahtani, F. (2021). Existence of long memory in crude oil and petroleum products: Generalised Hurst exponent approach. *Research in International Business and Finance*, 57-101403.

Troster, V., Bouri, E., and Roubaud, D. (2019). A quantile regression analysis of flights-to-safety with implied volatilities. *Resources Policy*, 62:482–495.

Umar, Z., Shehzad, C. T. and Samitas, A. (2019), "The demand for eurozone stocks and bonds in a time-varying asset allocation framework", *The European Journal of Finance*, Vol. 25, No. 11. pp. 994-1011. <https://doi.org/10.1080/1351847X.2018.1564690>

Umar Z. and Gubareva M., 2020. A Time-Frequency Analysis of the Impact of the Covid-19 Induced Panic on the Volatility of Currency and Cryptocurrency Markets. *Journal of Behavioral and Experimental Finance* 28, 100404. <https://doi.org/10.1016/j.jbef.2020.100404>

Umar, Z., Jareno, F., Escribano, A.M., 2020a. Dynamic return and volatility connectedness for dominant agricultural commodity markets during the COVID-19 pandemic era. <https://www.researchsquare.com/article/rs-75766/v1>

Umar, Z., Kenourgios, D., and Papathanasiou, S. (2020b). The static and dynamic connectedness of environmental, social, and governance investments: International evidence. *Economic Modelling*. 93, 112-124. <https://doi.org/10.1016/j.econmod.2020.08.007> .

Umar, Z. and Gubareva, M., 2021. Faith-based investments and the Covid-19 pandemic: Analyzing equity volatility and media coverage time-frequency relations. *Pacific-Basin Finance Journal*, 67, 101571. <https://doi.org/10.1016/j.pacfin.2021.101571>

Umar Z. and Gubareva M., 2021a. The impact of Covid-19 on commodity markets volatility:

analyzing time-frequency relations between commodity prices and coronavirus panic levels . Resources Policy. Forthcoming.

Umar, Z., Manel, Y., Riaz, Y., and Gubareva, M. 2021b. Return and volatility transmission between emerging markets and US debt throughout the pandemic crisis. *Pacific-Basin Finance Journal*, 67, 101563. <https://doi.org/10.1016/j.pacfin.2021.101563>

Umar, Z., Gubareva, M., Naeem, M., and Akhter, A., 2021c. Return and volatility transmission between oil price shocks and agricultural commodities. *PLoS ONE*, 16(2): e0246886. <https://doi.org/10.1371/journal.pone.0246886>

Umar, Z., Trablesi, N., & Zaremba, A. (2021d) Oil shocks and equity markets: The case of GCC and BRICS economies. *Energy Economics*. 96, 105155. <https://doi.org/10.1016/j.eneco.2021.105155>

Umar, Z., Trablesi, N., & Alqahtani, F. (2021e) Connectedness between cryptocurrency and technology sectors: International evidence. *International Review of Economics & Finance* 71, 910-922 <https://doi.org/10.1016/j.iref.2020.10.021>

Yarovaya, L., Brzeszczyński, J., and Lau, C. K. M. (2016). Intra-and inter-regional return and volatility spillovers across emerging and developed markets: Evidence from stock indices and stock index futures. *International Review of Financial Analysis*, 43, 96-114.

Zaremba A., Kizys, R., Aharon, D.Y and Umar Z.2021. Term spreads and the COVID-19 pandemic: Evidence from international sovereign bond markets. *Finance research Letters*. <https://doi.org/10.1016/j.frl.2021.102042>