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Research article

Gold and the global financial cycle

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Abstract: We examine the potential of gold and other precious metals as safe havens during negative market shocks caused by the Global Financial Cycle (GFCy). We analyze a vast global vector autoregressive (GVAR) model that includes developing and emerging market countries for a total of 33 countries, from 1979:Q2 to 2019:Q4. This approach allows us to account for individual country peculiarities while also considering the transmission of global shocks. We found that during financial market distress caused by a negative GFCy shock, gold, silver and platinum all serve as hedges. Interestingly, our results suggest that silver and platinum are better hedges than gold, offering greater positive returns in response to negative GFCy shocks, especially in recent years. Overall, our findings support the benefits of investing in precious metals, as they can help investors mitigate losses resulting from global financial shocks. While the metals vary in their hedging ability, platinum and silver offer even greater protection than gold.

Keywords: precious metals; safe haven property; global financial cycle; global vector autoregressive model

JEL Codes: C32, G15, Q02

Abbreviations: COVID-19: Coronavirus disease 2019; FOMC: Federal Open Market Committee; GCGy: Global Financial Cycle; GVAR: Global Vector Autoregressive; IMF: International Monetary Fund; VIX: Volatility Index

1. Introduction

Recent literature indicates that there is a global financial cycle that affects cross-border flows and risky asset prices in global financial markets.[1] Studies by Nier et al. (2014), Passari and Rey (2015) and Rey (2018) support this trend. Miranda-Agrippino and Rey (2020) found that a single global factor derived from a range of equities, corporate bonds and safe precious metals, could explain the dominant contribution to the variability in the price of risky assets in global markets. This raises the question of whether gold, a recognized safe haven for investors in times of market downturns, can act as a hedge against unfavorable shocks induced by the global financial cycle. We revisit the safe-haven properties of gold and other precious metals and investigate the impact of negative market shocks induced by the Global Financial Cycle (GFCy). We use a Global Vector Autoregressive (GVAR) framework that accounts for the transmission of shocks for international macroeconomic variables using a large panel of global economic data. The GFCy is partly driven by time-variation in global risk aversion, as noted by Miranda-Agrippino and Rey (2020). This common global factor that governs price dynamics in global risky assets can be considered a single proxy that captures price fluctuations due to possible shocks related to non-financial variables including sentiment, uncertainty and geopolitical risks that have been shown to act as drivers of gold prices. Examining the safe-haven property of gold against shocks induced by the GFCy within the GVAR framework provides a more comprehensive insight into the importance of gold as a safe haven against unfavorable fluctuations in global financial and macroeconomic dynamics.

The “safe haven” nature of gold has been studied extensively in the literature, where it is compared with other markets like the markets for stock, bonds and currency (see papers like Baur and Lucey, 2010; Baur and McDermott, 2010; Reboredo, 2013a; Agyei-Ampomah et al., 2014; Gürgün and Ünalmis, 2014; Beckmann et al., 2015; Balcilar et al., 2020), as well as markets for agricultural produce and non-agricultural produce (Reboredo, 2013b; Low et al., 2016; Tiwari et al., 2020; 2021).[2] Recent studies have also looked at how crises, economic uncertainty, the COVID-19 pandemic, sentiment and geopolitical risks affect gold prices as a safe haven asset. These studies include works by Balcilar et al. (2016, 2017), Bonato et al. (2018) and Baur and Smales (2020), among others. While there is overwhelming evidence in favor of gold as a safe haven or hedge for financial investors, some studies have found exceptions. Hood and Malik (2013) favor the VIX, Agyei-Ampomah et al. (2014) support industrial metals and Balcilar et al. (2020) give account to Swiss Franc, Yen and U.S. Treasuries.

We approach the current issue from a global perspective using the GVAR framework which provides the basis to examine the effect of a negative global shock, originating from the decline in the GFCy index, on the gold market. This framework by Dees et al. (2007) was first proposed by Pesaran et al. (2004) to analyze the international macroeconomic transmission of shocks by considering the drivers of economic activity, interlinkages and spillovers across a large set of global economies as well as the effects of (unobserved or observed) common factors. In our application, the GVAR model is augmented with the GFCy index in addition to the existing country-specific variables and commodity price series. The GVAR approach adopted in our application presents an ideal framework to analyze the “true impact” of a global shock proxied by the GFCy on gold prices as it mitigates the possible omitted variable bias. This approach

[1] The Global Financial Cycle (GFCy) represents a unique global factor in international risky asset prices obtained from a global Dynamic Factor model as explained in more detail in the Data section.

[2] Additionally, there are studies that suggest gold can be used as a hedge against inflation. These studies include works by Beckmann and Czudaj (2013), Bampinas and Panagiotidis (2015), Aye et al. (2016, 2017) and Salisu et al. (2019), among others.

also prevents possible overestimation of the impact, which is likely to result in a single equation approach that relates the GFCy to gold price movements by incorporating in the model various metrics of global economic conditions as controls.[3]

While our focus is primarily on the role of gold as a safe haven against negative market shocks, we also consider precious metals such as silver, platinum, palladium and rhodium with their respective price series added to the underlying GVAR database. Considering a wide range of precious metals allows us to present a comparative analysis and decipher if gold behaves differently from the rest of the metals in this market segment (as discussed in Lucey and Li, 2015). The comparative analysis also allows us to explore which metal(s) actually drive the overall precious metals index in their response to a negative market shock induced by the global financial cycle. To the best of our knowledge, ours is the first study to present a comparative analysis of the safe haven properties of various precious metals in response to unfavorable shocks induced by the GFCy within a GVAR framework.

Utilizing quarterly data over 1979:Q2 to 2019:Q4, we show that gold, silver and platinum react positively to a negative GFCy shock associated with unfavorable performance in global risky asset markets. This suggests that these assets can indeed serve as a hedge against unfavorable global market shocks. Interestingly and contrary to the conventional wisdom, however, silver and platinum are better hedges than gold implied by greater positive returns in response to negative GFCy shocks compared to this traditionally accepted safe haven. Palladium, on the other hand, is found to show a positive, albeit statistically insignificant response to negative GFCy shocks, suggesting that this metal is largely unaffected by global market shocks and can serve as a weak safe haven during such distressed periods. Finally, rhodium is found to exhibit a negative response to an adverse shock to the GFCy that is largely negative and insignificant over the entire forecast horizon, suggesting this metal cannot be utilized as a hedge against declining asset markets, both in economic and statistical terms. Overall, the results support the hedge and safe-haven benefits offered by precious metals, while a great deal of heterogeneity is also observed across the precious metals. After this section, other sections are as follows: while methodology occurs in section 2, data and results is shown in section 3. Our discussion is concluded in section 4.

2. Methodology

We situate our discussion in this section by specifying a link between Global Financial Cycle (GCFy) and precious metals via a GVAR framework which has the potential to account for the transmission of the GCFy-induced shocks to the market for precious metals. The GVAR methodology offers a suitable framework, given that it portrays the global economy as a connection of related nations. This enables it to account for country-specific characteristics, while also capturing the shocks that is either being global and/or regional in nature for the concerned economies.[4] We take into consideration the connections between different market levels and analyze how a positive or negative occurrence in the GFCy can affect the precious metals markets.[5]

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[3] The literature that hinges on the prediction of gold price movements emphasizes the role of economic and financial variables in a more encompassing way (see papers like, Pierdzioch et al., 2014a; b; 2015a; b; 2020; Aye et al., 2015).

[4] We encourage the reader to read article by Pesaran et al. (2004) and that of Dees et al. (2007) for the theoretical sophistication and computational suitability of this framework, and its advantages over the traditional multivariate models.

[5] The literature offers various applications of this methodology to capture the impact of different shocks. Eickmeier and Ng (2015) and Feldkircher and Huber (2016) are good examples that have applied GVAR model to capture the transmission

Taking the view from economic perspective, it is more likely to expect a negative connection between the GCFy and the precious metals market such that a favourable shock to the GCFy will be associated with increasing capital flows into risky assets due to rising risk appetite and as such, a dip in investment in the precious metals as these commodities (especially gold) are usually the net receiver of shocks (Adekoya and Oluyide 2021). In other words, negative (unfavorable) shocks to the GCFy will slow down the financial cycle, which by implication can lead investors to holdings of risky asset markets as they become less attractive given their risks and making precious metals more attractive due to their hedging benefits against the probable losses associated with the financial cycle. To formally examine the GCFy-precious metals nexus, we model N countries as small open economies (constructing a VAR for each of them) and use the United States (US) as the reference country and index it as country 0, resulting in $N+1$ countries, indexed by $i = 0,1,2,\ldots,N$. The GVAR typically has three variables depicting the domestic, foreign and global relationships. The latter part is where the GFCy-precious metals nexus enters the model, but we first begin our GVAR set-up by making individual specification VARs for the countries with both domestic and foreign variables. We refer to these as a $\mathrm{VARX}^*(p_i, q_i)$ model for the ith country which relates a $k_i \times 1$ vector of endogenous domestic macroeconomic variables, x_{it}, to a $k_i^* \times 1$ vector of country-specific foreign variables which by implication are weakly exogenous), x_{it}^*:

$$\gamma_i(L, p_i)x_{it} = \beta_{i0} + \beta_{i1} + \varphi_i(L, q_i)x_{it}^* + \varepsilon_{it} \tag{1}$$

$$t = 1,2 \ldots\ldots, T.$$

where $\gamma_i(L, p_i) = I - \sum_{i=1}^{p_i} \gamma_i L^i$ is the matrix of lag polynomials of the coefficients associated with the domestic variables, and $\varphi_i(L, q_i) = \sum_{i=0}^{q_i} \varphi_i L^i$ are the same for the foreign variables. β_{i0} and β_{i1} are $k_i \times 1$ vectors of the intercepts and coefficients on the deterministic time trends, respectively (both time invariant), and ε_{it} is a $k_i \times 1$ vector of country-specific shocks, where it is believed not to be correlated serially with value mean being zero and a non-singular covariance matrix, Σ_{ii}, that is, $\varepsilon_{it} \sim i.i.d.(0, \Sigma_{ii})$. However, it woworthoting that the lag orders of p_i and q_i are selected on the basis of country-by-country $\gamma_i(L, p_i)$ and $\varphi_i(L, q_i)$ are allowed to take different values countries.

The ordering of the domestic variables follows a basic rule that goes in line with monetary policy transmission mechanism while the foreign variables are derived as the average of the domestic variables for each country. These are then weighted (w_{ij}) using bilateral trade flows data, resulting in:

$$x_{it}^* = \sum_{j=0}^{N} w_{i\,j} x_{jt} \tag{2}$$

where $j = \cdots,2,\ldots,N$, $w_{ii} = 0$, and $\sum_{j=0}^{N} w_{ij} = 1$.

However, for our empirical analysis, the trade weights are derived as follows:

$$w_{ij} = \frac{\sum_{t=1}^{T} Tr_{ij,t}}{\sum_{t=1}^{T} Tr_{i,t}} \tag{3}$$

where $Tr_{ij,t}$ (a variable of bilateral trade flows) is derived as the average of exports and imports of country i alongside country j, during a given year t, what $Tr_{i,t}$ represents is the trade volume of country i at time period t. However, after estimating each country $\mathrm{VARX}^*(p_i, q_i)$ model separately, the endogenous

of shocks at individual country level (see also, Kempa and Khan, 2019; Trung, 2019), while for analysis of regional and/or global shocks, see Bettendorf (2017), De Waal and van Eyden (2016), von Arnim et al. (2018), Beaino et al. (2018), Ong and Sato (2018), Wei and Lahiri (2019), Sikiru and Salisu (2021).

variables, which take the form $k \times 1$ vector and where $x_t = (x'_{0t}, x'_{1t}, \dots, \dots, x'_{Nt})$, are then solved simultaneously with the aid of a linking matrix defined by the country-specific weights.[6] The VARX* model in equation (1) can be further expressed in a compact form as follows:

$$\mu_i(L, p_i, q_i) z_{it} = \eta_{it} \tag{4}$$

where $\mu_i(L, p_i, q_i) = [\gamma_i(L, p_i) - \varphi_i(L, q_i)], z_{it} = (x'_{it,} x'^{*}{}_{it})'$ and $\eta_{it} = \beta_{i0} + \beta_{i1} + \varepsilon_{it}$.

We extend equation (4), following Chudik and Pesaran (2013), by including common/global variables of commodity prices in the GVAR database (the data section gives clearer details) for the GFCy and precious metals variables. This, in a way, provides an avenue to extend global variables in equation (1) and it is expressed as:

$$\gamma_i(L, p_i) x_{it} = \beta_{i0} + \beta_{i1} + \varphi_i(L, q_i) x^*_{it} + \lambda_i(L, m_i) \kappa_t + \varepsilon_{it} \tag{5}$$

where $\lambda_i(L, m_i) = \sum_{i=0}^{m_i} \lambda_i L^i$ is the matrix lag polynomial of the coefficients which reflects the common/global variables – κ_t (GFCy and precious metals), which for ease of estimation, can be taken as weakly exogenous. To allow for feedback effects (as Cashin et al, (2017) that the dominant (common/global) variables can be constructed irrespective of these effects from the domestic variables to the dominant variables through the country-specific averages, we model for κ_t as follows:

$$\kappa_t = \sum_{l=1}^{p_w} \gamma_{\kappa l} \kappa_{i,t-l} + \sum_{l=1}^{p_w} \gamma_{\kappa l} x^*_{i,t-l} + \psi_{\kappa t} \tag{6}$$

Importantly, the foreign variables do not feature contemporaneously and that κ_t (the major variables for the vector) are causal. By combining and solving the conditional model (Equation (5)), and the marginal model (Equation (6)), a complete GVAR model can be formed. There are two stages to analyzing a GVAR model: first, individual VAR models are constructed for each country. These models consist of endogenous domestic variables, which are then augmented with foreign variables and global variables, which are weakly exogenous. Second, weighted matrices are used to link the individual country-level VAR to form the GVAR estimates. The resulting GVAR model is then used to analyze the impulse responses to GFCy shocks.

3. Data and Results

3.1. Data

The variables composition of the GVAR dataset are quarterly macroeconomic variables such as log real GDP, y_{it}, the rate of inflation, dp_{it} and others as well as series on commodity prices which also includes variables such as oil, $poil_t$, metals, $pmetal_t$ and others for 33 economies (which cover over 90% of global GDP), over the period 1979:Q2 to 2019:Q4. For data source check: http://www.econ.cam.ac.uk/people-files/emeritus/mhp1/GVAR/GVAR.html. Mohaddes and Raissi (2020) provide a description of the compilation and the revised form of this dataset. We augment the above set (and model, as discussed above) of the commodities already existing in the GVAR database

6 Pesaran et al. (2004) provides the solution to the GVAR model, using a VARX*(1, 1) model. Also, Chudik and Pesaran (2016) provides a detailed account of the new happenings in GVAR modelling which reflect the features of foundational theories and the empirics.

by including the price series for gold, silver, platinum, palladium and rhodium, (derived from: https://www.kitco.com/), all of which are measured in US dollars.

Along with the commodity prices (along with precious metal prices) that form the set of global/common variables mentioned above, we also include the monthly GFCy index series. This index represents a common global factor in international risky asset prices, obtained from a global dynamic factor model, that captures a significant portion of the variability in global price fluctuations. The data are available at a monthly frequency (from January 1980 to April 2019) on the website of Professor Silvia Miranda-Agrippino.[7] Miranda-Agrippino and Rey (2020) laid the foundation for the GFCy index, which was originally available until 2012, however, Miranda-Agrippino et al. (2020) updated it to include up to 2019. In addition to extending the time-period, they extend the cross-section of risky assets that are included in the computation of the index (in consonant with the derivation of the S&P Global index; for detail check https://us.spindices.com/indices/equity/sp-global-1200). This is done to address the greater visibility of the Eastern, specifically the Chinese. It now includes 1,004 assets (as opposed to the 858 from before). In essence, the GFCy index is created by extracting a common factor from a global dynamic factor model (DFM). The DFM accounts for a comprehensive panel of global risky assets (1,004 to be precise) including equity and corporate bond indices, and commodity prices (without precious metals). The former two indices represent five geographical regions, namely, Asia-Pacific, Australia, Europe, Latin America and North America, with the resulting single factor incorporating more than a fifth of common variable variation in risky assets. This is despite the heterogeneity among the various asset markets include in the study (Miranda-Agrippino and Rey 2020). Given the quarterly frequency of the GVAR data, we cover the period 1980:Q1 to 2019:Q2 and take the three-month average of the GFCy index and the monthly metal prices to convert them into quarterly frequency and add them as exogenous variables to the GVAR data set.

The data used for our analysis, which involves the log-returns of the precious metals (individual and an aggregate, with the latter used to deduce an overall picture of the market), and the GFCy index, have been plotted in Figure A1 in the Appendix of the paper. As we use log-returns, our effective sample covers 1980:Q2 to 2019:Q2, i.e., 157 observations. We also provide some descriptive statistics in Table 1. We find that there is a strong correlation in the prices of risky assets, capital flows, leverage and financial aggregates worldwide during the period after the global financial crisis (GFC). This is demonstrated by the positive mean value of the GFCy index. In contrast, during the pre-GFC period (1980:Q2–2007:Q2), the mean value is negative, indicating a different trend. However, the minimum and maximum values for the two data samples are similar in both sign and magnitude. Overall, the GFCy index is positive based on the full sample. The GFCy is normally distributed, regardless of the data sample, and the skewness and kurtosis statistics follow a similar trend across all three data samples. Additionally, we find that the GFCy index is highly persistent. Therefore, a GFCy shock on global variables such as gold returns, and those of other precious metals, may have a long-lasting effect, as demonstrated by the impulse responses in the following section.

[7] http://silviamirandaagrippino.com/code-data

Table 1. Summary statistics for the global financial cycle.

	Full sample	Pre−GFC	Post−GFC
Mean	0.0041	−0.0609	0.1515
Maximum	2.6807	2.6807	2.6225
Minimum	−2.4052	−2.1979	−2.4052
Std. Dev.	0.9908	0.9982	0.9679
Skewness	0.3239	0.3025	0.4272
Kurtosis	3.2814	2.9598	4.0861
Normality (Jarque−Bera)	3.2638	1.6697	3.8192
Probability	0.1956	0.4339	0.1481
Persistence	0.9192***	0.9899***	0.7612***
Observations	157	109	48

Note: To measure the degree of persistence in the GFCy index, we perform a regression of the variable on a constant and its first lag. If the value obtained is closer to one, it indicates a higher level of persistence, while a value closer to zero suggests a lower level of persistence. *** indicate significance at the 1% level.

3.2. Empirical findings

Figures 1(a)–1(e) present the impulse response functions of gold, silver, platinum, palladium and rhodium log-returns, respectively, to a one standard deviation negative GFCy shock. While the solid line indicates the median response, the dashed lines account for the (5–95%) lower and upper bootstrapped error bands. In Figure 1(a), a one standard deviation negative shock induced by the global financial cycle results in an initial sharp increase in the price of gold. Although the response is not statistically significant immediately, i.e., on impact and at the first quarter, we observe a statistically significant peak impact occurring at the 2nd quarter. The effect then declines starting with the 5th-quarter following the shock, exhibiting a stable tendency in the positive region, with statistical significance holding at the 5% level, thereafter. Clearly, traders overreact to the negative market shock induced by the global financial cycle initially, thus resulting in the over-pricing of gold initially, while this mis-pricing is later corrected after the market processes the information and its potential impact in the intermediate and long runs. Nevertheless, Figure 1(a) clearly shows that a negative shock to the GFCy has a statistically significant positive impact on gold returns in both short and the long-run, providing strong support in favour of the hedging benefit of gold against negative unfavorable market shocks.[8] In a related study, Das et al. (2019) show that gold returns react positively to increased levels of geopolitical risks. Considering that investors' preference towards risky assets, particularly in emerging markets, would be negatively affected by a rise in geopolitical risks which in turn would impose a negative effect on the global financial cycle, our results provide further support to the hedging role of gold during periods characterized by rising risk aversion.

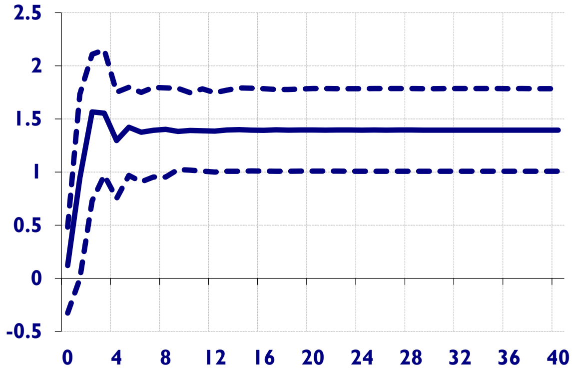
In the same vein, the responses of platinum and silver returns presented in Figures 1(b) and 1(c) show that a negative one standard deviation shock to the GFCy generally follows the same pattern as

[8] Based on the suggestion of an anonymous referee, when we estimated small-scale VARs, using both quarterly and monthly data, involving the GFCy and the log returns of the five precious metals under consideration, the effect on gold returns was consistently statistically insignificant, and in fact was found to decline following a negative one standard deviation shock to the GFCy. Complete details of these results are available upon request from the authors, and is perhaps an indication of the limited information set issue in small-scale VARs, which in turn, tends to produce counterintuitive results.

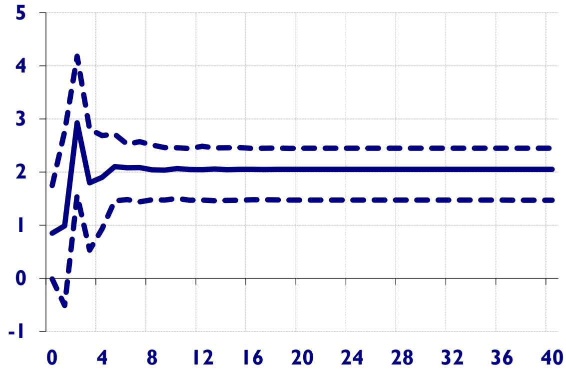
that of gold returns. This suggests that, just like gold, a negative shock to the GFCy has a (slightly delayed) significant positive impact on the returns of these two precious metals in the short- and long-runs, thus confirming their potential to serve as a good hedge against downturns in global risky asset markets. Interestingly, comparing the results for these three metals, we observe that silver exhibits a greater response to negative GFCy shocks (in terms of positive returns), followed by platinum and gold. Subsequently, silver prices experience a greater correction compared to the other metals, which in turn makes platinum the best performing hedge in the intermediate and long runs. Gold, on the other hand, is found to be the worst performing hedging instrument among the three precious metals, while silver seems to be a better hedging tool against global financial shocks. Although this result seems counter to conventional wisdom and evidence in support of gold, it is in fact consistent with Huang and Kilic (2019) who showed that gold is not necessarily a strong hedge as its price falls in recessions, albeit by less than platinum prices and the recent finding by Carpantier (2021) that most commodities do far well than gold when purchasing power is particularly held.

As Klein (2017) notes, platinum and palladium are mostly used for industrial purposes with over 40% of exploited platinum over the last decade used in the automobile industry, as a catalyst for waste gas purification in diesel engines in particular (Alonso et al., 2012) Similarly, palladium has been used for the same purpose in gasoline engine catalytic converters. Accordingly, as Massari and Ruberti (2013) note, this use of these two commodities has boosted the demand for them from major exporting emerging economies including primarily China. Gold and silver, on the other hand, are primarily investment assets which outweighs their industrial usage, although they are also used in the jewelry industry. Therefore, the findings that support the hedging roles of gold and silver against the global financial cycle is consistent with the evidence in the literature that these precious metals serve as a tool to store value and as an investment asset during periods of uncertainty (Baur and Smales, 2020) as well as the evidence that these two commodities couple, displaying similar persistence in variance (Hammoudeh and Yuan, 2008). When it comes to platinum, however, as also noted by Klein (2017), the hedging performance of platinum reflects a potential shift in investors' attitudes towards this metal as an alternative investment as opposed to its industrial use. Furthermore, as noted by Baur and Smales (2020), the hedging role of platinum could be related to the demand for this commodity due to its use in automotive industry, which is dependent on economic growth factors, possibly captured by the fluctuations in the global financial cycle.

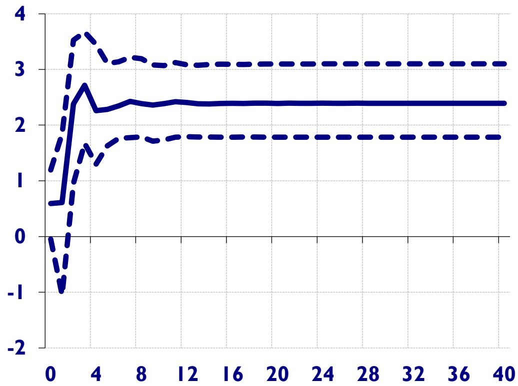
Furthermore, examining the results in Figure 1(d), we see that the initial response of palladium to the negative GFCy shock results in a short-lived increase in returns, followed by a sharp correction around the second quarter. The market then phases into a stable rising pattern, eventually settling in the positive region. However, we found that these responses are not statistically significant, suggesting that palladium cannot serve as a hedge against negative GFCy shocks, although from an economic point of view, we do see an increase in its returns, which however is not statistically different from zero. From another perspective though and considering that palladium prices largely remain unaffected (in statistical terms) by negative GFCy shocks, one can argue that this metal can serve as a weak safe haven, allowing investors to preserve value during negative global financial shocks. Finally, in Figure 1(e), we observe that rhodium exhibits a negative response to an adverse shock to the GFCy that is largely negative and insignificant over the entire forecast horizon. This suggests that rhodium cannot be utilized as a hedge against declining asset markets, both in economic and statistical terms.



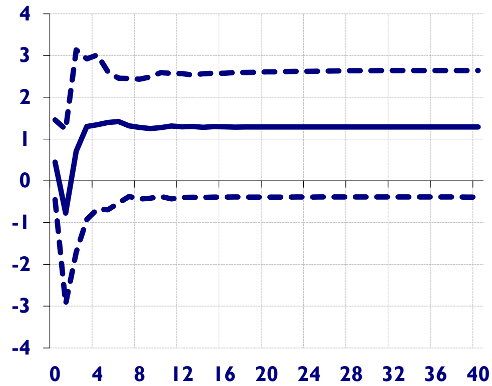
1(a). Gold Returns



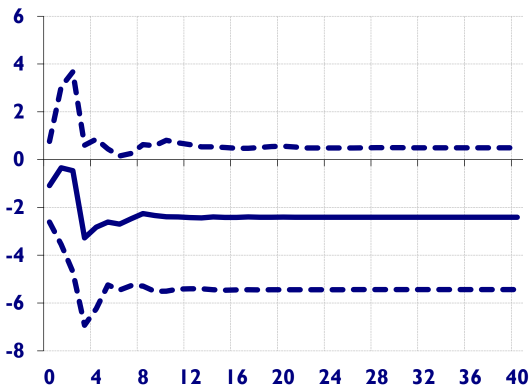
1(b). Silver Returns



1(c). Platinum returns



1(d). Palladium Returns



1(e). Rhodium Returns

Figure 1. Impulse Response Functions of Precious Metals Returns to a One Standard Deviation Negative GFCy Shock.

Finally, as an additional analysis, we also considered an overall index of precious metals, obtained from the International Monetary Fund (IMF)'s Primary Commodity Prices Database available at: https://www.imf.org/en/Research/commodity-prices. Figure 2 presents the impulse response function of the Aggregate Precious Metals Index to a one standard deviation negative GFCy shock. Note that, based on data availability, the analysis involving the overall precious metals index data covers the quarterly period of 1987:2 to 2019:2. As can be seen from Figure 2, the effect of a negative shock to the GFCy on the overall precious metals market returns is positive and statistically significant, further confirming the findings observed in Figures (1a)–1(c). Accordingly, one can conclude that the aggregate precious metals market is primarily driven by the price dynamics for gold, silver and platinum in the wake of financial market downturns.

At this stage, it is important to compare the size of the statistically significant increases in gold, silver, platinum and aggregate precious metals index returns. Close inspection of the figures suggests that the increase in silver returns is the strongest at 2.93% points in the 2nd quarter following a negative one standard deviation shock to the GFCy index. This is followed by platinum (2.72% points at the 3rd quarter following the shock) and gold (1.57% points at the 2nd quarter following the shock). On the other hand, the overall market index reaches a peak of 1.27% points after two quarters following the shock. When we further average the increase in returns over the 41 quarters considered for the IRFs from impact, i.e., 10-years ahead, we find that platinum and silver returns increase by magnitudes of 2.31% points and 2.01% points respectively, while gold and the aggregate precious metals index rise by 1.36% points and 0.86% points respectively. In sum, our results confirm the hedging prowess of the overall precious metal market, though there exists underlying heterogeneity in the hedging ability of gold, silver and platinum against negative global market shocks.

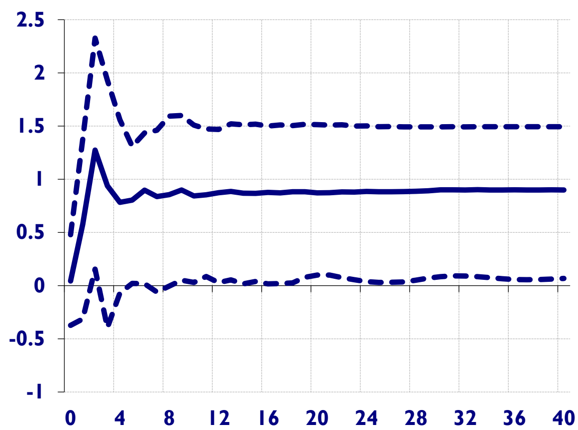


Figure 2. Impulse Response Function of the Aggregate Precious Metals Index to a One Standard Deviation Negative GFCy Shock.

Based on the suggestion of an anonymous referee, we also conduct an additional analysis on a restricted sample from 1980Q2 to 2007Q2, i.e., the pre-GFC period, to investigate whether the hedging potential of gold and perhaps other precious metals is consistent over time. In Figure A2 of the Appendix of the paper, we have presented the impulse responses of the log-returns of the precious metals to one standard deviation GFCy shock. Our findings suggest that the hedging potential of gold, is not episodic, as our conclusion holds true for different time periods, both qualitatively and quantitatively. While, just like the full-sample, silver and platinum returns also increase significantly over the sub-sample, the size of the effect is relatively smaller compared to the full sample. Interestingly, the positive effect on palladium returns is now statistically significant, while rhodium returns are also positively impacted and mildly significant. Our results highlight the consistent time-invariant importance of gold in hedging global financial risks, though the importance of silver and platinum has tended to increase post the GFC.

4. Conclusions

Literature is clear about the "safe haven" feature of gold. As such, investors are often enticed to this precious metal due to this feature for possible portfolio diversification and hedging benefits during periods of economic downturn and uncertainties in the financial markets. Given this, we revisit the property alongside other metals in this category such as silver, platinum, palladium and rhodium) in a more novel perspective by emphasizing the impact of negative market shocks induced by the Global Financial Cycle (GFCy) via a large-scale GVAR model. We favor this methodology as it allows us to capture the transmission of global shocks while at the same time hold sight for individual country differences.

In all, our results show that besides gold, silver and platinum are also good assets to hedge against periods of market distress orchestrated by a sudden negative shock induced by the global financial cycle. Interestingly, the estimated impulse response functions reveal that platinum exhibits the highest average increase in returns, resulting from a negative shock to the aggregate returns on risky assets, over the 40-quarter (10 years) horizon. This is followed by silver with this metal also registering the largest initial increase across all the precious metals. Our results thus imply that this category of assets could benefit investors if they include them in their diversification strategy. Interestingly, a sub-sample analysis tends to reveal that while the hedging ability of gold has stayed time-invariant, that of silver and platinum have come into prominence post 2007. Academically speaking, we provide robust evidence of our findings, as our framework does not suffer from omitted variables-bias. With precious metals serving as a leading indicator (Stock and Watson, 2003), some of the negative shock to the financial market is likely to be insulated by the increase in the returns of these assets, which in turn would cause policy authorities to respond less strongly to recessionary impacts.

As a way to cater for future research, it would be fascinating to extend our analysis to the effects of a negative market shock induced by the global financial cycle on macroeconomic and financial variables at the country level included in the GVAR. Furthermore, given the initial overreaction and subsequent correction in prices documented in this study, it would be interesting to explore whether or not such mispricing patterns can be exploited to generate excess returns. Finally, as pointed out by Miranda-Agrippino and Rey (2020), US monetary policy tends to drive the GFCy. Furthermore, US monetary policy decisions made during the Federal Open Market Committee (FOMC) meetings are known to have significant influence on financial markets and carry a significant risk premium (Liu et al., 2022). In light of this, it would be interesting to evaluate the (in and particularly out-of-sample) predictive effects on both the first and second moments of the gold (and other precious metals) prices at a high-frequency, with the FOMC risk premium serving as a proxy for the GFCy on the monetary policy announcement dates.[9] While our framework is linear, future modeling of the questions we

[9] Preliminary analysis using the *k*-th order nonparametric causality in quantiles test of Balcilar et al. (2018), as reported in Figure A3 in the Appendix of the paper, showed that the FOMC risk premium estimates under relative risk aversion

address in this paper might need to rely on a nonlinear econometric structure as well (see, Chudik et al., 2021), particularly in light of the COVD-19 pandemic, which would allow us to compare the results with the period of the global financial turmoil (Burdekin and Tao, 2021).

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

Author Contributions

Conceptualization, R.G. and S.N.; Methodology, A.A.S and R.G.; Software, A.A.S.; Validation, R.D.; Formal Analysis, A.A.S., R.G., S.N. and R.D.; Investigation, A.A.S., R.G., S.N. and R.D.; Data Curation, R.G. and S.N.; Writing – Original Draft Preparation, A.A.S., R.G., S.N. and R.D.; Writing – Review & Editing, A.A.S., R.G., S.N. and R.D.; Visualization, A.A.S.; Supervision, R.D.

Data Availability

Data are available from the authors upon request.

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