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Do precious metal spot prices influence each other? Evidence from a nonparametric causality-in-quantiles approach

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ABSTRACT

Using a quantile causality approach, we examine the causal relationship among the spot prices of precious metals (gold, silver, platinum and palladium) through mean and variance. This methodology also allows investigation of the causality among precious metals during recessions, booms and normal market states. Employing daily spot price data from April 2000 to July 2016 we found evidence of bi-directional causality in mean and variance among the prices of precious metals. Results indicate a strong causality for the middle quantiles (normal time periods). Robustness of results is also examined by employing weekly spot price data. Overall our results have significant implications for policy makers, portfolio managers and investors.

1. Introduction

The safe-haven properties of precious metals have offered substantial impetus to policy makers and scholars alike to examine their multi-faceted behavior, especially as an alternative investment instrument. Studies in the recent past have suggested the favorable role of precious metals, particularly gold, in hedging and portfolio diversification strategies (Baur and McDermott, 2010; Reboredo, 2013a). Nonetheless, some studies also argue against such diversification benefits (Lucey and Li, 2015; Reboredo, 2013b). However, those studies which argue in favor of the use of precious metals for investments overwhelm those arguing the unsuitability of precious metals as a diversification avenue. Most of the studies have argued in favor of the usage of precious metals for investments, such as the following: safe investment target, a hedging tool against risk and inflation, and highly liquid investment, among others. This hedging property of precious metals is evident from earlier literature, such as that by Jain and Biswal (2016), who argue that investments in precious metals, particularly gold, greatly increase during economic shocks. Baur and McDermott (2010) also report that the nominal prices of gold rose by 42 per cent on the eve of the financial crisis, i.e., July 2007. Other scholars also report gold to be uncorrelated with financial assets during periods of high volatility or financial crisis (Baur and Lucey, 2010; Baur and McDermott, 2010), therefore making it an ideal hedging instrument.

Despite substantial empirical evidence on multifarious aspects of precious metals, there are few studies that investigate interactive and transitive behavior among them. Hammoudeh et al. (2011) examine the dynamics of correlation and volatility in price returns of gold, silver, platinum and palladium and suggest implications for risk management. Sensoy (2013) reports a one-way volatility shift contagion effect from gold to other precious metals and from silver to platinum and palladium. Thus, in this context, the literature encounters some pertinent questions, such as: (a) Is it only gold that dictates the prices of other precious metals? Or (b) do other precious metals (silver, platinum or palladium) also lead gold prices? Or (c) do precious metals influence each other's prices? These questions are intriguing, and to the best of our knowledge, are yet to be answered. Therefore, the objective of this paper is to investigate the causality among precious metal prices by employing the quantile causality technique proposed by Balcilar et al. (2016a). We believe such analysis will help investors and policy makers originate better decisions regarding precious metal price movements.

Though earlier literature emphasizes the relationship among gold, silver, platinum and palladium, they cannot be considered as a single asset class (Pierdzioch et al., 2016). Batten et al. (2010) analyzed the spillovers among four precious metals and suggested a weak integration between gold, silver, platinum and palladium. Interestingly, Lucey and Li (2015) argued that silver, platinum and palladium can exhibit safe-haven properties during times when gold loses its safe-haven

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characteristic. Agyei-Ampomah et al. (2014) revealed the ability of gold to hedge against losses in sovereign bond issues in the case of countries with serious debt problems. Furthermore, they suggested the hedging ability of metals other than gold in sovereign bond market losses during periods of jitters in financial markets.

The existing literature provides useful information on precious metal dynamics; however, little is known about dependence and causality among precious metal prices. Therefore, in this study, we use the recent causality technique proposed by Balcilar et al. (2016a) to investigate the predictability of one precious metal price by the prices of other precious metals through mean and variance. We employ daily spot price data of gold, silver, platinum and palladium for the period of April 1, 2000 to July 25, 2016. To check the robustness of our results, we employ the same methodology on weekly spot prices of precious metals over the same time horizon. Our results show a bi-directional causality among precious metal prices in mean and variance. However, the causality among precious metals varies to some extent between daily and weekly prices.

Our contribution to the literature on precious metals is three-fold. First, the non-parametric quantile approach allows us to consider all the market conditions at the same time (low or high volatility or any other economic shocks). Therefore, the approach allows us to investigate the conditions under which one precious metal price responds to other precious metal prices. Second, we consider both first (mean) and second moments (variance) to analyze the causality between prices of different precious metals. Precious metals may not have causality in mean but could have predictive powers in variance (volatility). Predictive power in volatility could be more useful for better portfolio diversification strategies. Third, we use the application of a recent methodology by Balcilar et al. (2016a) to analyze the dynamics among precious metals.

The rest of the paper is organized as follows. In Section 2 we provide a concise review of literature. The stochastic properties of the data are mentioned in Section 3. The estimation methodology is discussed in Section 4. The empirical results are presented in Section 5. The result of the robustness test is presented in Section 6. Finally, we conclude in Section 7.

2. Review of literature

The earlier literature analyzing the dynamics of precious metals can be segregated into different themes. The first group of studies analyzes the dynamics between precious metal prices considering macro-economic factors. The second group investigates volatilities in precious metals and their modeling. The third class of literature examines conditional volatilities, correlation dependence and spillover effects involving precious metals. The fourth group focuses upon the forecasting of value at risk (VaR) and the modeling of precious metal prices. The last group investigates the hedging properties of precious metals.

On the impact of a volatile economic environment on the dynamics of the precious metal market, Morales and Andreosso-O'Callaghan (2011) investigated the role of Asian and global financial crises in determining the behavior of precious metal markets. The researchers argued that precious metal prices, their volatility and information contained in the precious metal markets influence volatility in other markets. Gold prices and movements in the gold market also reportedly influence the remainder of the metal market. Cochran et al. (2012) reported that volatility in the returns of precious metals has increased after the 2008 crisis. On the one hand, Vivian and Wohar (2012) reported no abrupt increase in volatility during the crisis period. Batten et al. (2010) suggested that monetary variables impact the gold volatilities, but the same is not true for silver. The authors also suggested that gold, palladium, silver and platinum are too distinct to be classified as a single metal class. On the other hand, Sari et al. (2010) argued that precious metals respond to any shock in the exchange rate or shock in the prices of other precious metals. Wang and Chueh (2013) suggested that interest rates negatively influence future gold prices. Reduced interest rates signal to investors that the dollar will depreciate; therefore, investors will ultimately move their capital to the gold market for preservation and speculation. Ming et al. (2016) suggested a double nature of gold prices, whereby they argued that, in the long term, speculation and economic events influence gold prices and that, in the short term, gold acts as a safe investment.

Regarding conditional returns and volatilities of precious metals, Arouri et al. (2012) suggested a long-range dependence between precious metals and argued that the long memory process explains conditional volatility better than structural breaks. Demiralay and Ulusoy (2014) also found evidence indicating the volatility among precious metals to be a long-range dependent process. Hammoudeh and Yuan (2008) analyzed the volatility of gold, silver and copper and reported that gold and silver have similar volatility persistence but that it is greater than copper. The authors indicated that past oil shocks had different impacts on gold, silver and copper, and a crisis period such as the Iraq war increased the metals' volatility. Baur (2012) investigated the impacts of positive and negative shocks on the volatility of gold and suggested an inverted asymmetric response. Positive shocks result in higher volatility than negative shocks. Investors perceive positive shocks to gold as the arrival of adverse conditions and uncertainty in other asset classes.

With regard to the connection between precious metals, Ciner (2001) suggested an unstable relationship between gold and silver prices. The author reported that the long-run relationship between gold and silver prices disappeared in the 1990s. Later, Lucey and Tully (2006) suggested a long-run relationship between gold and silver prices but also reported aberrations in the short run. Sensoy (2013) analyzed the changing relationship between precious metals and reported that gold influences the behavior of other precious metals. Furthermore, the author argued that silver also influences the prices of platinum and palladium. Baur and Tran (2014) analyzed the long-run relationship between gold and silver prices with a focus on the impact of bubbles and financial crises. The authors report a co-integration relationship between gold and silver and the role of financial crises. However, the researchers also reported a lack of a stable relationship between gold and silver. Antonakakis and Kizys (2015) suggested in their study that changes in gold prices are transmitted (spillover) to other assets but are conditional on time and event-specific patterns. More recently, Kang et al. (2016) reported that gold and silver apparently serve as sources of information transmission among the commodity futures markets, and investors demonstrate the flight-to-quality phenomenon during financial crises.

More recently, authors have focused their attention on modeling and forecasting the VaR of precious metals. For example, Hammoudeh et al. (2013) suggested that an optimal portfolio should consist of more gold than any other asset class. Furthermore, gold plays an important role in VaR-based optimal, efficient and diversified portfolio construction. Demiralay and Ulusoy (2014) found that VaR analysis for long and short trading positions of precious metals perform well under long-memory volatility models with Student's t-distribution. However, the FIAPARCH model with Student's t-distribution was found to perform well in one-day ahead VaR predictions. Zhang and Zhang (2016) reported that gold outperforms other precious metals and has the highest VaR. The authors reported palladium to have the most volatile VaR among precious metals.

The hedging properties of precious metals have also been studied extensively. For example, Pierdzioch et al. (2016) reported that precious metals, particularly gold and silver, provide suitable hedging against adverse movements in major exchange rates. Bredina et al. (2017) investigated the role of precious metals in downside risk reduction and argued that gold, silver and platinum reduce risk in the short term but argued against the use of silver and platinum in the long term. McCown and Shaw (2016) suggested the use of platinum over gold as a safe-haven during a period of shocks. However, McCown and Shaw (2016) did not find the same hedging capabilities for palladium