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The effect of investor sentiment on gold market return dynamics: Evidence from a nonparametric causality-in-quantiles approach[☆]

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ABSTRACT

This paper explores the effect of investor sentiment on the intraday return dynamics in the gold market. We build on the recent evidence by Da et al. (2015) that the Financial and Economic Attitudes Revealed by Search (FEARS) index, as a proxy for investor sentiment, has predictive power over stock market returns and extend the analysis to gold intraday returns using a novel methodology developed by Balcilar et al. (2016) to examine nonlinear casual effects of sentiment on gold return and volatility. We find that the effect of investor sentiment is more prevalent on intraday volatility in the gold market, rather than daily returns. The sentiment effect, however, is channeled via the discontinuous (jump) component of intraday volatility, particularly at extreme quantiles, implying that extreme fear (confidence) contributes to positive (negative) volatility jumps in gold returns. The results suggest that measures of sentiment could be utilized to model volatility jumps in safe haven assets that are often hard to predict and have significant implications for risk management as well as the pricing of options.

1. Introduction

The relationship between investor sentiment and stock returns has been examined in numerous studies (see Huang et al., 2015 for a detailed literature review). Traditionally in empirical finance, two approaches have been followed to measure investor sentiment (Bathia and Bredin, 2013; Bathia et al., 2016). Under the first route, investor sentiment is captured by various market-based measures (e.g. trading volume, closed-end fund discount, initial public offering (IPO) first-day returns, IPO volume, option implied volatilities (VIX), or mutual fund flows) acting as proxies for investor sentiment, while survey based indices (University of Michigan Consumer Sentiment Index, the UBS/GALLUP Index for Investor Optimism, or investment newsletters) comprise the second approach.

Recently, Da et al. (2015) develop a new measure of investor sentiment using daily Internet search data from millions of households in the U.S by focusing on particular 'economic' keywords that reflect investors' sentiment towards economic developments. Their findings suggest that the so-called Financial and Economic Attitudes Revealed by Search (FEARS) index can predict short-term stock market reversals, temporary increases in stock market volatility, and mutual fund outflows from equity to bond funds. Da et al. (2015) argue that this 'search-based' measure of investor sentiment reveals attitudes rather than inquire about them, and hence, provides a more accurate proxy for investor sentiment than survey-based measures that may be driven by answers in survey data that have not been cross-verified with data on actual behavior.

Interestingly, among the economic keywords they focus on in their internet search data, Da et al. (2015) observe that the keyword "Gold prices" stands out from the other keywords with the highest level of statistical significance when the keywords are related to the market return. As argued in numerous studies, gold is traditionally considered to be a hedge or safe haven for financial market investors due to its low and sometimes negative correlation with financial market movements, particularly during bad times (e.g. Baur and Lucey, 2010). To that end, it is not unexpected to see 'Gold returns' as a dominant keyword that comes up in the search data that forms the basis for the investor sentiment index developed by Da et al. (2015). Therefore, the main motivation for this study is the natural research question whether the FEARS index as a proxy for investor sentiment has any explanatory

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power over gold market return dynamics. If investor sentiment can predict reversals and increases in volatility in the stock market as Da et al. (2015) document, one can argue that it should also possess similar predictive ability for gold returns as the widely accepted safe haven. Furthermore, it can also be argued that such predictive ability should present itself during periods of extreme fear, which can be captured best by a quantile-based approach.

This paper has several contributions to the literature. First, we examine the causality effect of investor sentiment on gold return dynamics using a novel methodology to detect nonlinear causalities. A number of studies in the literature including Hammoudeh and Yuan (2008), Pukthuanthong and Roll (2011), Reboredo (2013), Beckmann and Czudaj (2013), and Pierdzioch et al. (2014), have used predictive regressions and GARCH-type models to examine the predictive value of various economic and financial variables like stock market returns, exchange-rate movements, oil-price fluctuations, and interest rates over gold market returns. The novel feature of this study is that it employs the causality-in-quantiles test, recently developed by Balcilar et al. (2016), and examine causality effects of sentiment during alternative market states that can be characterized by normal, good and bad markets. To the best of our knowledge, such a quantile-based analysis of causality between investor sentiment and gold return dynamics is the first in the literature.

It must be noted that, other nonlinear causality tests (e.g. Nishiyama et al., 2011) and GARCH-type models could also be used to analyze the impact of investor sentiment on gold returns and/or volatility, but these methods rely on estimations based on the conditional means, and hence fail to capture the entire conditional distribution of gold returns and volatility – something we can do with our approach. In the process, our test is a more general procedure of detecting causality in both returns and volatility simultaneously at each point of the respective conditional distributions. Hence, we are able to capture existence or non-existence of causality at various market states (bear, i.e. lower quantiles, normal, i.e. median and bull, i.e. upper quantiles) for the gold market. Therefore, our method is more likely to pick up causality when conditional mean-based tests might fail to do so. Furthermore, since the procedure does not require the determination of the number of regimes as in a Markov-switching model and can test causality at each point of the conditional distribution characterizing specific regimes, our test also does not suffer from any misspecification in terms of specifying and testing for the optimal the number of regimes.

Another important contribution of this study is that it provides novel insight to the effect of sentiment on market volatility by breaking intraday volatility in the gold market into continuous and discontinuous (i.e. jump) components. Volatility jumps have been well-documented in financial returns (e.g. Barndorff-Nielsen and Shephard, 2004) and several studies have also shown that jump risk can serve as a systematic risk factor in stock returns (e.g. Dunham and Friesen, 2007). To that end, this study examines volatility jumps in novel context and by relating volatility jumps to investor sentiment during various market states, enlarges our understanding of the evidence by Da et al. (2015) that sentiment predicts temporary increases in volatility.

Looking ahead, while we observe no significant causal effects of sentiment on daily gold returns, we find strong evidence of causality on intraday volatility in gold returns. The evidence of causality on intraday volatility is significant across all quantiles of the conditional distribution of intraday volatility. Interestingly, however, we also find that the sentiment effect on gold market volatility is channeled via not the permanent component of return volatility, but rather the discontinuous (jump) component, suggesting that sentiment contributes to volatility jumps in gold returns. This is in fact consistent with the earlier finding by Da et al. (2015) that sentiment predicts temporary increases in stock market volatility, possibly indicating that sentiment contributes to volatility jumps in stock returns as well. Finally, our tests at different quantiles show that causal effect of sentiment on volatility jumps is significant only at upper and lower quantiles, suggesting that extreme fear (confidence) contributes to positive (negative) volatility jumps in gold returns.

These findings have significant implications for volatility forecasting and option pricing as they suggest that measures of investor sentiment can be utilized to predict volatility jumps that are often hard to predict due to their discontinuous nature. In the volatility forecasting context, the findings suggest that sentiment can be utilized to improve volatility jump models while other predictors can be targeted to model the permanent component of volatility. This means that investors and policy makers alike can track investor performance proxies in order to mitigate the negative effects of 'bad jumps' in volatility. Similarly, since volatility is a key parameter in option pricing models, the evidence presented in this paper can be used as basis for sentiment-based option pricing models in which sentiment proxy is integrated into the volatility parameter of the pricing model. Finally, given the evidence that volatility jump risk is priced in the cross-section of stock returns, sentiment proxies can be used as a systematic risk factor in asset pricing models and future studies can build on our evidence to examine whether sentiment uncertainty carries significant price of risk in stock returns.

The rest of the paper is organized as follows: Section 2 presents the methodology and realized measures of gold market dynamics, while Section 3 discusses the data and the results. Finally Section 4 concludes.

2. Methodology

2.1. Detecting nonlinear causality

We present here a novel methodology, recently proposed by Balcilar et al., (2016), for the detection of nonlinear causality. The causality-in-quantile approach combines the frameworks of k-th order nonparametric causality of Nishiyama et al. (2011) and nonparametric quantile causality of Jeong et al. (2012), and unlike the standard causality tests, has the following advantages: First, it is robust to misspecification errors as it detects the underlying dependence structure between the examined time series. Second, via this methodology, we are able to test for not only causality-in-mean (1st moment), but also causality that may exist in the tails of the joint distribution of the variables. Finally, we are also able to investigate causality-in-variance, thereby effect on volatility, as it is possible to have higher order interdependencies even when causality in the conditional-mean is not present.

We denote returns on gold futures as (y_t) and the investor sentiment index as (x_t). Following Jeong et al., (2012), the quantile-based causality is defined as follows[1]: x_t does not cause y_t in the θ-quantile with respect to the lag-vector of $\{y_{t-1}, \ldots, y_{t-p}, x_{t-1}, \ldots, x_{t-p}\}$ if

$$Q_\theta(y_t y_{t-1}, \ldots, y_{t-p}, x_{t-1}, \ldots, x_{t-p}) = Q_\theta(y_t y_{t-1}, \ldots, y_{t-p}) \quad (1)$$

x_t is a prima facie cause of y_t in the θ-th quantile with respect to $\{y_{t-1}, \ldots, y_{t-p}, x_{t-1}, \ldots, x_{t-p}\}$ if

$$Q_\theta(y_t y_{t-1}, \ldots, y_{t-p}, x_{t-1}, \ldots, x_{t-p}) \neq Q_\theta(y_t y_{t-1}, \ldots, y_{t-p}) \quad (2)$$

where $Q_\theta(y_t \bullet)$ is the θ-th quantile of y_t depending on t and $0 < \theta < 1$.

Let $Y_{t-1} \equiv (y_{t-1}, \ldots, y_{t-p})$, $X_{t-1} \equiv (x_{t-1}, \ldots, x_{t-p})$, $Z_t = (X_t, Y_t)$, and $F_{y_t|Z_{t-1}}(y_t \mid Z_{t-1})$ and $F_{y_t|Y_{t-1}}(y_t \mid Y_{t-1})$ denote the conditional distribution functions of y_t given Z_{t-1} and Y_{t-1}, respectively. The conditional distribution $F_{y_t|Z_{t-1}}(y_t \mid Z_{t-1})$ is assumed to be absolutely continuous in y_t for almost all Z_{t-1}. If we denote $Q_\theta(Z_{t-1}) \equiv Q_\theta(y_t|Z_{t-1})$ and $Q_\theta(Y_{t-1}) \equiv Q_\theta(y_t|Y_{t-1})$, we have $F_{y_t|Z_{t-1}}\{Q_\theta(Z_{t-1}) \mid Z_{t-1}\} = \theta$ with probability one. Consequently, the hypotheses to be tested based on definitions

[1] The exposition in this section closely follows Nishiyama et al. (2011) and Jeong et al. (2012).