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Does economic policy uncertainty influence gold prices? Evidence from a nonparametric causality-in-quantiles approach

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A R T I C L E I N F O

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A B S T R A C T

Economic policies play a vital role in shaping economic development of an economy, and any uncertainty in the policies slows down its development process. Several factors are identified as predictors of economic policy uncertainty, and of these, gold price has been identified as the most significant. Therefore, the purpose of this study is to examine the association between economic policy uncertainty and gold prices by using the monthly data from 1995 (January) to 2017 (March). The standard linear Granger causality test and nonparametric causality-in-quantiles approach have been applied for empirical purpose. The standard linear Granger causality test shows that no causal association exists between economic policy uncertainty and gold prices. Then, the nonparametric causality-in-quantiles test given by Balcilar et al. (2016a) is applied. This approach allows for examining the quantile causality-in-mean and variance. The result of the nonparametric causality-in-quantiles shows the rejection of null hypothesis, which implies that economic policy uncertainty causes gold prices in all the examined countries, especially at the low tails. Moreover, the quantile causality-in-variance also shows the acceptance of null hypothesis in the majority of the cases. This study provides valuable implications for academics, policy makers, and investors.

1. Introduction

The economic policy of an economy is a combination of monetary, fiscal and regulatory policy driven by the central bank and government actions (Adjei and Adjei, 2017). Economic policy plays an important role in shaping financial markets and needs frequent adjustment whenever any change occurs in the economy (Adjei and Adjei, 2017). At the same time, economic policymakers' decisions related to monetary, fiscal, or regulatory policy may exacerbate uncertainty. This uncertainty is termed economic policy uncertainty and is referred to as having a non-zero probability of change in the existing economic policies (Baker et al., 2016, 2014).

Many economists identified economic policy uncertainty as an important factor that needs to be analyzed, as economic policy uncertainty slows down economic development process and hinders general economic activities (Gozgor and Ongan, 2017). Economic policy uncertainty also causes unemployment and stimulates the slumps in stock markets; however, apart from its effect on economic actors, economic policy further develops the rules of the game for consumers and investors (Baker et al., 2014; Li et al., 2015). High uncertainty in the economy can influence the decision-making process of consumers and investors. In such circumstances, economic agents become reluctant to invest in the economy (Sum, 2012). The reason behind this reluctant behavior is that consumers and investors prefer to hold money to protect themselves against any risk that may occur in the future due to the uncertainty (Gozgor and Ongan, 2017). Thus, it is of immense importance to predict economic policy uncertainty, as it helps to analyze the business cycles and to make decisions related to investment in the economy (Wang et al., 2015).

Several factors have been identified as predictors of economic policy uncertainty, but gold is among one of the most significant. Gold has been recognized as a commodity that is stored and considered immune to physical deterioration and as a source that can be used for exchange purposes (Jones and Sackley, 2016). Shafiee and Topal (2010) reported that in gold mine production throughout history, for example, 160,000 t, which is approximately 60% of the produced gold, has been used for the purpose of jewelry, while 40% was used for industrial demand and bank reserves. Recently, gold was seen as a safe haven in times of financial crisis and political and economic uncertainty (Gao and Zhang, 2016; Beckmann et al., 2015; Arouri et al., 2015). Additionally, it is seen as a source of hedging against inflation, exchange rates, oil prices, stock and bond prices (Beckmann and Czudaj, 2013a,

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2013b; Beckmann et al., 2015; Balcilar et al., 2016b, 2016c, 2016d). These two properties of gold are also emphasized by the media reports and investors (Balcilar et al., 2016b).

Five strands of previous literature are available. The first strand of literature has focused on economic policy uncertainty and macroeconomic variables nexus, i.e. employment, inflation, and economic growth (Marcus, 1981; Dixit, 1989; Aizenman and Marion, 1993; Bhagat et al., 2013; Bloom, 2009). The second strand focuses on economic policy uncertainty and stock prices association (Wu et al., 2016; Li et al., 2016). The third strand analyzes the role of gold as a safe haven (Baur and McDermott, 2010; Baur and Lucey, 2010). The fourth strand has investigated the hedging properties of gold against macroeconomic and financial variables (Ciner et al., 2013; Beckmann et al., 2015). The last strand of literature examines the role of gold as a predictor of economic policy uncertainty (Wang et al., 2015; Balcilar et al., 2016b; Jones and Sackley, 2016), yet this association is very sparsely discussed.

Further, Wang et al. (2015) studied the relationship between commodity prices and economic policy uncertainty nexus in the US by using the 23 commodity prices and economic policy uncertainty (EPU) index by Baker et al. (2016). They utilized the three different combinations and concluded that commodity prices can be used as the leading indicator to predict economic policy uncertainty. Balcilar et al. (2016a) used the non-parametric causality-in-quantiles approach to study economic policy uncertainty and gold prices, return and volatility. They used different uncertainty measures, which include those of Baker et al. (2016), Rossi and Sekhposyan (2015), and Jurado et al. (2015), and reported mixed results. Their empirical results of monthly and daily data revealed that uncertainty measures affect gold prices, return and volatility. In contrast, the results of quarterly data showed weak causality and were significant for gold volatility only. Jones and Sackley (2016) examined economic policy uncertainty and gold prices association by incorporating economic policy uncertainty index of Europe and US into the short-run pricing model. They concluded that an increase in economic policy uncertainty results in gold prices appreciation.

We find that previous literature provides a direct linkage between economic policy uncertainty and gold prices. Apart from this, an indirect association between economic policy uncertainty and gold prices also exists, as economic policy uncertainty has a significant association with financial and economic factors, and gold acts as a hedge to economic and financial actors (Ciner et al., 2013; Beckmann et al., 2015). This finding indicates that economic and financial factors may exert an impact on gold prices when any change occurs in economic policy, as these factors act as a driver of gold prices (Balcilar et al., 2016b). Thus, direct and indirect linkages between economic policy uncertainty and gold prices highlight the importance of conducting research that examines the association between economic policy uncertainty and gold prices. This paper contributes to the existing literature in the following two ways: (i) This study examines the relationship between economic policy uncertainty and gold prices in eight countries, namely, Canada, China, France, Germany, Japan, Korea, UK and US, without including additional influence factors. (ii) The non-parametric causality in quantiles developed by Balcilar et al. (2016a) is applied to examine the causal relationship between economic policy uncertainty and gold prices. It is a novel approach over techniques in the following three ways: for example, the non-parametric test identifies the underlying dependence structure between the examined time series and is also considered robust to misspecification errors. This approach not only provides causality-in-mean, i.e. first moments, but also estimates the causality that exists in the tails of joint distribution of the variables. The non-parametric test also helps us in analyzing the causality-in-variance, i.e. high-order dependencies.

The remainder of the paper will be organized as follows: Section 2 details the methodology, Section 3 explains the data and empirical results, and Section 4 concludes with policy recommendations.

2. Methodology

The association between gold prices and economic policy uncertainty is analyzed by using the nonparametric causality-in-quantiles approach developed by Balcilar et al. (2016a). This approach combines the frameworks of Nishiyama et al. (2011) and Jeong et al. (2012). This approach is developed with the help of the k-th order nonparametric causality framework introduced by Nishiyama et al. (2011) and the nonparametric quantile causality framework by Jeong et al. (2012). This methodology helps to find the nonlinear causality and has more advantages over the standard causality test (Balcilar et al., 2017a, 2017b, 2017c). Moreover, this technique captures the general nonlinear dynamic dependencies and is also robust to the extreme values in the data. The y_t represents the dependent variable, which is gold prices, whereas X_t represents the independent variable of the model, which is economic policy uncertainty. We follow Jeong et al. (2012) in defining that the quantile-based causality as 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:

$$Q\theta = y_t|y_{t-1}, \ldots.,y_{t-p,} X_{t-1}, \ldots.,X_{t-p}) = Q\theta(y_t y_{t-1}, \ldots.,y_{t-p}), \tag{1}$$

X_t probably causes y_t in the θ-quantile with respect to $\{y_{t-1}, \ldots .,y_{t-p,} X_{t-1}, \ldots .,X_{t-p}\}$, if:

$$Q\theta = y_t|y_{t-1}, \ldots.,y_{t-p,} X_{t-1}, \ldots.,X_{t-p}) \neq Q\theta(y_t y_{t-1}, \ldots.,y_{t-p}), \tag{2}$$

In Eq. (2), $Q\theta = (y_t.\ )$ represents the $\theta - th$ quantile of y_t which is dependent on t, and the quantiles are limited between 0 or 1 i.e., $0 < \theta < 1$.

To present the causality-in-quantiles test in a compressed manner, the following vectors, $y_{t-1} \equiv (y_{t-1}, \ldots.,y_{t-p})$, $X_{t-1} \equiv X_{t-1}, \ldots.,X_{t-p})$, $Z_t = (X_t, y_t)$, are defined. The conditional distribution is also defined, which is $Fy_t|Z_{t-1}(y_t|Z_{t-1})$, and $Fy_t|y_{t-1}(y_t|y_{t-1})$. These distributions signify the distribution functions y_t conditioned on vectors Z_{t-1} and y_{t-1}, respectively. The conditional distribution vector $Fy_t|Z_{t-1}(y_t|Z_{t-1})$, is supposed to be completely continuous in y_t for nearly all Z_{t-1}. By denoting $Q\theta(Z_{t-1}) \equiv Q\theta(y_t|\ Z_{t-1})$, and $Q\theta(y_{t-1}) \equiv Q\theta(y_t|y_{t-1})$, we found $Fy_t|Z_{t-1}\{Q\theta(Z_{t-1})|Z_{t-1}\} = \theta$, which holds the probability equal to 1. On the basis of Eqs. 1 and 2, the following hypotheses are developed for the causality-in-quantiles test:

$$H_0 \ :P\{Fy_t|Z_{t-1}\{Q\theta(y_{t-1})|Z_{t-1}\} = \theta\} = 1, \tag{3}$$

$$H_1 \ :P\{Fy_t|Z_{t-1}\{Q\theta(y_{t-1})|Z_{t-1}\} = \theta\} < 1, \tag{4}$$

Jeong et al. (2012), to better explain the practical implementation of the causality-in-quantiles tests, used the distance measure represented by, $J = \{\varepsilon_t E(\varepsilon_t|Z_{t-1})F_Z(Z_{t-1})\}$. The error term is represented by ε_t, whereas $F_Z(Z_{t-1})$, shows the marginal density function of $Zt-1$. The ε_t drive is based on the null hypothesis developed in Eq. (3), which would be only true if $E[1\{y_t \leq Q\theta(y_{t-1})Z_{t-1}\}] = \theta$, or it can be equal to $1\{y_t \leq Q(y_{t-1})\}] = \theta + \varepsilon_t$, where $1\{\cdot\}$ shows the indicator function. Based on the error term, the distance measure given by Jeong et al. (2012) can be defined as:

$$J = E[\{Fy_t|z_{t-1}\{Q\theta(y_{t-1})|Z_{t-1}\} - \theta\}^2 F_Z(Z_{t-1})], \tag{5}$$

It is essential to understand that in Eq. (3), $J \geq 0$ and the equality $J = 0$ holds if and only if the H_0 in Eq. (5) is true, while $J > 0$ holds under the H_1 in Eq. (4). In Eq. (5), the feasible kernel-based sample analog of J has been explained by Jeong et al. (2012) as:

$$\hat{J}_T = \frac{1}{T(T-1)h^{2p}} \sum_{t=p+1}^{T} \sum_{s\neq P+1}^{T} {}_{s\neq t} K\left(\frac{Z_{t-1} - Z_{s-1}}{h}\right)\hat{\varepsilon}_t \hat{\varepsilon}_s, \tag{6}$$

In Eq. (6), $K(.)$ represents the kernel function, h represents the bandwidth, t represents the sample size, the lag-order is shown by p and $\hat{\varepsilon}_t$ represents the unknown regression error and can be analyzed by the mentioned below equation:

$$\hat{\varepsilon}_t = 1\{y_t \leq \hat{Q}\theta(y_{t-1})\} - \theta, \tag{7}$$