DOI: 10.20472/EFC.2016.006.017

OGUZHAN OZCELEBI

Istanbul University, Turkey

METIN DUYAR

Nevsehir Hacı Bektas Veli University, Turkey

EFFECTS OF GOLD RESERVE POLICY OF MAJOR CENTRAL BANKS ON GOLD PRICES CHANGES

Abstract:

Central banks which are responsible for minting and monetary policy implementations are the institutions carry out sensitive policies for the healthy functioning of the economy. Policies implemented by central banks and its existing institutional structures cannot be dissociated from the political and social development of the country they live in, and the whole of economic policy. In recent years, with increasing pace of globalization, the mobility of international financial markets increased and this effect has extended the decisions of the central bank from national markets to international markets. In this study, we studied the possible impacts of changes in the share of gold in central banks' reserves on gold prices proving empirical evidence from the USA, the Euro area, China and Russia. According to Causality and Forecast Error Variance Decomposition analysis deriving from VEC model, reserve polices of central banks of these countries has considerable effects on variations in gold price in the long-term. Empirical findings reveal the importance of the size of balance sheet of central banks, while it is also stressed that growth potential of economies and investment opportunities are crucial issues in terms storing reserves in terms of gold.

Keywords:

Dynamics of Gold Prices, Central Banks, the USA, the Euro area, China and Russia

JEL Classification: E44, E58, F30

INTRODUCTION

Gold as a financial asset is generally recognized as “safe haven” and a financial instrument to hedge inflation and exchange rate (Capie, Mills and Wood, 2005; Blose, 2010; Pukthuanthong and Roll, 2011; Reboredo, 2013; Batten, Ciner and Lucey, 2014). It can also be assumed that dynamics of gold and currency markets are parallel to each other and some factors can influence the gold prices and exchange rates. More specifically, the role of the macroeconomic conditions, expectations related to the global and domestic economic developments and institutional factors are crucial issues to be considered in term of the relationship between gold and currency markets. According to recent developments in global financial markets, it can be asserted that changes in the monetary policy stance of the FED can rapidly become an indispensable factor of gold market as well as dynamics of gold prices may well stem from the decisions of major central banks in the following periods. In this respect, Kristoufek and Vosvrda (2016) used a wide portfolio of 142 gold price series for different currencies. Accordingly, he found that the relationship between exchange rates and gold prices could be highly under the influence of quantitative easing and rather unorthodox monetary policies together with the investigated illegal collusion of major foreign exchange market participants.

The aim of this study is to understand the impact of countries’ gold reserve policy on gold price changes. In the study, four largest gold stocks holders (the USA, the Euro area, China and Russia) are selected and Vector Autoregression (VAR)-type of modeling is employed to consider the interactions among gold reserves and gold prices. The main hypothesis of this paper is to test whether monetary policy authorities of the USA, the Euro area, China and Russia may lead to considerable amount of impact on the dynamics of gold prices. Hereby, our study fills the gap in literature by estimating the contribution of changes in gold reserves of the USA, the Euro area, China and Russia to the changes in gold prices with Vector Error Correction (VEC) Models’ Forecast Error Variance Decompositions (FEVDs). We also carry Granger Causality Analysis based on VEC modeling, which can be recognized as another contribution since causality analysis is generally implemented on the basis of VAR models in the existing literature.

THEORETICAL CONSIDERATIONS AND PREVIOUS RESEARCH

For more than 100 years, gold has been demanded as one of the main tools for both saving and investment. Demand for jewelry constitutes major part of gold demand and it is mostly held for storing purpose in developing countries and for ornaments in developed countries. Jewelry demand is more than 50% of total gold demand, but it is down to four-year low in the first quarter of 2016 according to the World Gold Council. On the other hand, industrial demand for gold as a raw material are from electronics industry, dental and coin printing, whereas technological demand is approximately 10% of total gold demand. In the last decades, an important part of the gold demand has been sourcing from central banks, gold mutual funds and ETFs in global financial markets due to the increased financial integration process. When the prevalent financial and economic liberalization phenomena are considered, it can be accepted that interrelations between macroeconomic and financial variables may well increase in the long-term. Gold can be recognized as a "safe haven" for investors and central banks particularly in the periods of economic fluctuation; however, volatility in gold prices may well increase along with other financial assets. Following the recent global financial crisis, it can be asserted that central banks may have increased their gold reserves gradually. More specifically, central banks were net sellers until 2009; afterwards they have been in net buyer position. It can be exposed that central banks currently own approximately 15% of the aboveground gold stock and they are also expected to maintain large gold stocks in the future. According to the World Gold Council, gold mutual funds hold nearly 20% of the gold demand and they have generally been in net seller position due to the expected decline in gold prices against USD.

In terms of the interactions between gold prices and macroeconomic and financial variables, Bencivenga, D'Ecclesia and Triulzi (2012) conducted a VEC model for the USA including crude oil prices, the Dollar/Euro exchange rate, the US interest rate, the crude oil Futures open interest, the US oil imports and the gold price over the period 1993–2009. It was found that there existed one cointegrating relationship identifying a long-term equilibrium between the variables. Baruník, Kočenda and Vácha (2016) employed a wavelet approach and used a time-frequency analysis of dynamic correlations between pairs of key traded assets (gold, oil, and stocks) for the period from 1987 to 2012. It was revealed that heterogeneity in correlations across a number of investment horizons between pairs of assets was a dominant feature during times of economic downturn and financial turbulence. Indeed, Baruník, Kočenda and Vácha (2016) detected correlations among all three assets, which became homogenous after the 2008 crisis. Herein, we can assert that it is critically important to determine the optimal quantitative model to analyze the future dynamics of gold prices incorporating the role of volatility. Bentes (2015) analyzed whether the volatility of the gold returns may have long-term temporal dependence. Bentes (2015) divided the full sample into two periods as before and after October 2008 and it was implied that volatility process could be better described by a FIGARCH(1,d,1) model with a statistically significant long memory parameter capturing the dependence in the conditional variance rather than GARCH(p,q), IGARCH(p,q) specifications. It was also emphasized by Bentes (2015) that long memory was an important characteristic of the gold volatility returns and should be incorporated when addressing investment decisions and economic policy formulation. Similar to Bentes (2015), Ewing and Malik (2013) used GARCH-type of models to explore the volatility of gold and oil futures incorporating structural breaks using daily returns from July 1, 1993 to June 30, 2010. Ewing and Malik (2013) explored significant transmission of volatility between gold and oil returns when structural breaks in variance was considered. However, they found that the effect between these two important markets was weak and indirect if structural breaks in variance were ignored. Transmission dynamics between precious metals (gold, silver, platinum, and palladium) spot prices, oil spot prices and the US dollar/euro exchange rate was studied by Balcilar, Hammoudeh and Asaba (2015). They employed the MS-VEC model and the regime dependent impulse response functions. Balcilar, Hammoudeh and Asaba (2015) showed that gold prices were the most informative in the group in the high volatility regime, while gold, palladium, and platinum were the most informative in the low volatility regime. It was also found that gold was the least volatile variable among other precious metals, affirming its use as a "safe haven" asset According to Capie, Mills and Wood (2005), the role of gold as hedging instrument for sterling–dollar and yen–dollar exchange rate hedge was shifting over time, highlighting the effects of unpredictable political attitudes and events. In line with Capie, Mills and Wood (2005), Batten, Ciner and Lucey (2014) suggested that the role of gold acting as a hedging instrument could be varying. More precisely, they revealed that changes in macroeconomic policy could generate time variation in the gold–inflation linkage suggesting that gold's sensitivity to inflation was related to interest rate changes. The results of Batten, Ciner and Lucey (2014) were also supported by Blose (2010) who showed that surprises in the CPI of the USA did not have any impact on gold spot prices, revealing that investors anticipating changes in inflation expectations should design speculation strategies in the bond markets rather than the gold markets. Most recently, Hoang, Lahiani and Heller (2016) attempted to study the role of gold as a hedge against inflation based on local monthly gold prices in China, India, Japan, France, the United Kingdom and the United States of America from 1955 to 2015 by considering the nonlinearity, short-term and long-term asymmetries. NARDL model was employed for this aim and it was found that gold could be an inflation hedge only in the UK, USA, and India, whereas gold could not be used as a hedging instrument against inflation in the long-term in all cases. Moreover, Hoang, Lahiani and Heller (2016) revealed that there existed no long-term equilibrium between gold prices and the CPI in China, India and France due to traditional aspects of gold and custom controls for gold trade in these countries.

Along the regime changes, monetary policy aiming price stability can be recognized as crucial in terms of determining the volatility in gold prices and thus to forecast the prices of gold more accurately. By reviewing the previous literature related to monetary policy announcements and gold prices, Roache and Rossi (2009) showed that gold prices were affected by the specific scheduled announcements in the United States parallel to the gold's traditional role as a safe-haven and store of value. On the other hand, it was revealed by Roache and Rossi (2009) that other commodity prices under the influence of news showed pro-cyclical sensitivities and these increased somewhat as commodities had become increasingly financialized. Zhao et al. (2015) studied the period of the recent financial crisis of 2007–2012 when it can be assumed that gold bubbles might occur. It was concluded that the occurrence of gold bubbles was affected by investors' "safe haven" during financial crises. Zhao et al. (2015) also inferred that a gold bubble might arise as a consequence of global central banks' expansionary monetary policy to stimulate the economy. On the other hand, Baur and McDermott (2010) obtained opposite results in terms of the role of gold as "safe haven" asset. By employing a regression model with the data of major emerging and developing countries from 1979 to 2009, Baur and McDermott (2010) exposed that gold could be a "safe haven" for major European stock markets and the US, but not for Australia, Canada, Japan and large emerging markets such as the BRIC countries. More precisely, Baur and McDermott (2010) implied the role of gold acting as a stabilizing force for the financial system and thus price stability in developed countries by reducing losses in the face of extreme negative market shocks.

Similar to the impacts of inflation expectations, we can infer that other macroeconomic and financial variables can influence the dynamics of gold prices through the changes in interest rates. In this respect, Wang and Chueh (2013) examined the relationship between interest rates, the US dollar, gold prices and oil prices for the USA using the threshold co-integration technique since non-linear relationship between variables was found. Wang and Chueh (2013) found that in the short-term both gold and crude oil prices positively had impact on each other. Moreover, it was revealed that interest rates influenced the future gold prices negatively. More specifically, it was implied that a reduction in interest rates affected investor expectations with respect to depreciation of the dollar, which in turn led to move their capital to the gold market for capital preservation or speculation in the long-term. In order to identify the relationship between monetary policy and gold prices, interactions among variables can be understood by the VAR-type of models incorporating restrictions deriving from economic theory. Ivrendi and Pearce (2014) included 1-month ahead federal funds futures prices, the S&P500 Index, an index measuring the weighted average of foreign exchange values of the US dollar against a subset of currencies, the 1-month ahead futures prices on oil, gold prices and the 1-month LIBOR rate. However, it was revealed that changes in domestic and global interest rates did not have a significant effect on gold prices for the case of the USA. Despite there are studies in the literature analyzing the relationship between gold prices and macroeconomic and financial variables such as inflation, GDP, exchange rates, stock prices, bond prices, the possible effects of changes in the reserves of central banks on the variation in gold prices have not been studied before. Despite it can be accepted that the closest studies to ours are the types of studies examining the effects of interest rates on gold prices, Zhang, Makin and Bai (2016) investigated the dynamics of Bank of Japan's international reserves using GMM estimator. They found that gold reserves and special drawing rights are positively related to yen internationalization, whereas yen internationalization influenced the overall size of the Bank of Japan's international reserves, as well as the ratio of its foreign exchange reserves to international reserves negatively. By studying the effects of central banks' gold reserves on the dynamics of gold prices in our study, we consider the possible effects of central banks on the global liquidity which in turn may influence financial asset prices.

EMPIRICAL FRAMEWORK

The study by Sims (1980) constitutes the base for the derivation of VAR-type models by economic researchers and policy makers to determine the interactions among macro-economic variables. Herein, the unit root properties of the variables are crucial to determine the plausible version of VAR models. Assuming that cointegrating relations between variables exist, VEC models can be accepted as a major tool to expose the causality relations and analyze the economic conditions which is the driving force relating the dynamics of the economic variables to each other. In this study, we employ VEC modeling with quarterly data from 2000:01 to 2015:04 to investigate the relationship between the share of gold in the total reserves of the USA, the Euro area, China and Russia and gold prices. Thereby, the effects the decisions of these countries' central banks in terms of reserve policy changes are considered along with the role of increased financial flows among economies. In this respect, we apply to the statistical database of World Gold Council, and the following variables were obtained: the percentage share of gold in total reserves; $gres_t^{usa}, gres_t^{eur}, gres_t^{chi}, gres_t^{rus}$ and natural logarithm of gold prices; $gpri_t$. In order to carry out the empirical exercise, the plausible tools of J-MuLTi software are used.

THE FRAMEWORK OF VEC MODEL

The VEC modeling employed in our study is derived from the $\mathrm{VAR}(p)$ model with deterministic terms and exogenous variables as specified in (1).

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + B_0 x_t + ... + B_q x_{t-q} + CD_t + u_t \tag{1}$$

where $y_t = (y_{1t}, ..., y_{Kt})'$ refers to a vector of endogenous variables with K elements, $x_t = (x_{1t}, ..., x_{Mt})'$ is a vector containing the exogenous variables. The A_i, B_j and C denotes the parameter matrices of the $\mathrm{VAR}(p)$ model. u_t is an unobservable white noise process, having a positive covariance matrix E($u_t u_t'$)=Σ_u (JMulTi 4.23 Help System). If cointegration relationship among the variables of the model in (1) is found, VEC model can be derived from VAR model specification as shown in (2). VEC model excluding the exogenous variables can be written as below;

$$\Delta y_t = \Pi y_{t-1} + \Gamma_1 \Delta y_{t-1} + ... + \Gamma_{p-1} \Delta y_{t-p+1} + u_t \tag{2}$$

Assuming that all variables can be at most $I(1)$ and thus Δy_t does not contain stochastic trends, the long-term part Πy_{t-1} is $I(0)$ and it has $I(1)$ variables. Π can be accepted as a product of $(K \times r)$ matrices α and β with $\mathrm{rk}(\alpha) = \mathrm{rk}(\beta) = r$ ($\Pi = \alpha\beta'$ when $\mathrm{rk}(\Pi) = r$). More specifically, the rank of the Π is r and it shows the cointegrating rank of the system among the components of y_t. $\beta' y_{t-1}$ including the cointegrating relations can be written by premultiplying $\Pi y_{t-1} = \alpha\beta' y_{t-1}$ with $(\alpha'\alpha)^{-1}\alpha'$. β refers to a cointegration matrix and the loading matrix α has the weights attached to the cointegrating relations in the individual equations of the model. Finally, Γ_i denotes the short-term parameters (Lütkepohl, 2007: 89-90).

Johansen cointegration test depends on the VEC model framework and this test is used to determine whether or not the linear combination of these variables are $I(0)$, namely the variables of the $\mathrm{VAR}(p)$ model are cointegrated;

$$y_t = D_t + x_t \tag{3}$$

where $D_t = \mu_0 + \mu_1 t$ refers to the deterministic part with a linear trend term and x_t has a VAR specification as in equation 1. If we assume that $\mu_1 = 0$, $y_t - \mu_0 = x_t$, and equation (3) has the VEC form as in (4) (Lütkepohl, 2007: 112).

$$\Delta y_t = \Pi(y_{t-1} - \mu_0) + \sum_{j=1}^{p=1} \Gamma_j \Delta y_{t-j} + u_t \tag{4}$$

When it is assumed that $\mu_1 \neq 0$, equation (4) can also be represented. If the trend is confined to some individual variables but is absent from the cointegration relations, $y_t - \mu_0 - \mu_1 = x_t$ and VEC model can be specified as in (5);

$$\Delta y_t - \mu_1 = \Pi(y_{t-1} - \mu_0) + \sum_{j=1}^{p=1} \Gamma_j (\Delta y_{t-j} - \mu_1) + u_t \tag{5}$$

Within the model representation as in (5), Johansen cointegration test can be made. Thus, the pair of hypothesis below is tested to show the cointegrating rank of the system (Lütkepohl, 2007: 112-113).

$$\mathrm{H}_0(0): rk(\Pi) = 0 \text{ versus } \mathrm{H}_1(0): rk(\Pi) > 0$$

$$\vdots \tag{6}$$

$$\mathrm{H}_0 = (K-1): rk(\Pi) = K-1 \text{ versus } \mathrm{H}_1 = (K-1): rk(\Pi) = K$$

THE FRAMEWORK OF CAUSALITY ANALYSIS

On the other hand, the $\mathrm{VAR}(p)$ model can be represented in matrix form in (6). Hereby, the null hypothesis that y_{1t} is not Granger-casual for y_{2t} can tested by $\alpha_{21,i} = 0,\ i = 1, 2, ..., p+1.$ y_{1t} is not Granger-causal for y_{2t} if its lags do not appear in the y_{2t} equation (JMulTi 4.23 Help System). More precisely, y_{1t} is to be causal for a time series variable y_{2t} if the former helps to improve the forecasts of the latter according to the causality concept proposed by Granger (1969).

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \sum_{i=1}^{p+2} \begin{bmatrix} \alpha_{11,i} & \alpha_{12,i} \\ \alpha_{21,i} & \alpha_{22,i} \end{bmatrix} \begin{bmatrix} y_{1,t-i} \\ y_{2,t-i} \end{bmatrix} + CD_t + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix} \quad (7)$$

Granger-causality can also be explored in the framework of the VEC model (Lütkepohl, 2007: 146).

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \alpha\beta' \begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \end{bmatrix} + \sum_{i=1}^{p-1} \begin{bmatrix} \gamma_{11,i} & \gamma_{12,i} \\ \gamma_{21,i} & \gamma_{22,i} \end{bmatrix} \begin{bmatrix} \Delta y_{1,t-i} \\ \Delta y_{2,t-i} \end{bmatrix} + u_t \quad (8)$$

Equation (8) is equivalent to $\gamma_{12,i} = 0 \ (i = 1,..., p-1)$ and the element in the upper right-hand corner of $\alpha\beta'$ is also zero. If it is assumed that $r = 1$, α and β are (2×1) vectors and $\alpha\beta' = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} \beta_1 & \beta_2 \end{bmatrix} = \begin{bmatrix} \alpha_1\beta_1 & \alpha_1\beta_2 \\ \alpha_2\beta_1 & \alpha_2\beta_2 \end{bmatrix}$. Moreover, $\alpha_1\beta_2 = 0$ needs to be checked along with $\gamma_{12,i} = 0$ and there must be Granger-causality in at least one direction since α and β have rank one (Lütkepohl, 2007: 146). y_{1t} can be defined as instantaneously causal for y_{2t} if the value of y_{1t} in the forecast period helps to improve the forecasts of y_{2t} (Lütkepohl, 2007: 147).

EMPIRICAL DATA AND ANALYSIS

EMPIRICAL DATA

The unit root properties of the data included in our empirical exercise is to be identified to determine the type of VAR model. Thus, we employ the most widely used test in the literature, the augmented Dickey–Fuller (ADF) test. Since the critical values of the test change according to the selection of the inclusion of deterministic variables, the Pantula principle proposed by Pantula (1989) is adapted and the lag orders used in the ADF tests are suggested by the Akaike Info Creation (AIC).

Table 1: Augmented dickey–fuller test results

Variables	ADF Test Statistic	Number of Lagged Differences
$gres_t^{usa}$ (c)	-1.64	0
$\Delta gres_t^{usa}$	-8.06	0
$gres_t^{eur}$ (c)	-2.01	0
$\Delta gres_t^{eur}$	-4.71	1
$gres_t^{chi}$ (c)	-2.04	0
$\Delta gres_t^{chi}$	-4.65	0
$gres_t^{chi}$ (c)	-0.93	3
$\Delta gres_t^{chi}$	-6.66	1
$gpri_t$ (c, t)	-0.05	1
$\Delta gpri_t$	-4.56	0

Notes: The 1% critical values for the ADF test with constant (c) and trend (t), constant (c) and no terms are –3.96, -3.43 and -2.56, respectively. The critical values of the ADF test are from Davidson and McKinnon (1993).

Table 1 indicates that all the series can be accepted as to be integrated of order 1-$I(1)$, thus cointegrating relations may exist among the variables of our model. In this respect, we make the Johansen cointegration test based on the VEC model framework. The ordering the of the variables in the models are as; $gres_t^{usa}, gres_t^{eur}, gres_t^{chi}, gres_t^{rus}$ and $gpri_t$, reflecting our assumption that dynamics of gold prices are under the influence of the changes in reserve policy of central banks of the USA, the Euro area, China and Russia.

Table 2: Johansen cointegration test results

Series: $gres_t^{usa}, gres_t^{eur}, gres_t^{chi}, gres_t^{rus}$, $gpri_t$

No. of Included Lags (Levels):4

Null Hypothesis	Test Value	%95 Critical Value	%99 Critical Value
$r = 0$	90.31	69.91	77.29
$r = 1$	41.97	47.71	54.23
$r = 2$	14.13	29.80	35.21

Notes: In this study, AIC imposed a lag length of 9 for our VEC model that led to insufficient number of observations to estimate the model. Therefore, we used a lag length of 4 to capture the nature of dynamics of past one year data since the frequency of our series are quarterly.

According to Table 2, it is indicated that there is cointegration of the first order. Thus, our VEC model can be estimated for the vector $y_t = (gres_t^{usa}, gres_t^{eur}, gres_t^{chi}, gres_t^{rus}, gpri_t)'$. Within this model framework, we can present the results of causality analysis along with estimations of FEVDs to make inferences about the dynamics of reserve policies among the USA, the Euro area, China and Russia and their impacts on the variations in gold prices in future periods.

CAUSALITY RELATIONSHIP AMONG THE VARIABLES

Table 3: Causality tests' results

Series: $gres_t^{usa}$, $gres_t^{eur}$, $gres_t^{chi}$, $gres_t^{rus}$, $gpri_t$ **No. of Included Lags (Levels):** 4 H_0 : $gres_t^{usa}$, $gres_t^{eur}$, $gres_t^{chi}$, $gres_t^{rus}$ **do not Granger-cause** $gpri_t$		**Series:** $gres_t^{usa}$, $gres_t^{eur}$, $gres_t^{chi}$, $gres_t^{rus}$, $gpri_t$ **No. of Included Lags (Levels):** 4 H_0 : **No instantaneous causality between** $gres_t^{usa}$, $gres_t^{eur}$, $gres_t^{chi}$, $gres_t^{rus}$ and $gpri_t$	
Test Statistic	**p-value-** F	**Test Statistic**	**p-value-** χ
2.21	0.00	47.53	0.00

It is generally accepted that the dynamics of gold supply and demand exhibit a considerable amount of variation since demand to gold as a jewel, industrial and technological usage and as a financial asset have been increasing over years. In this respect, it can be inferred that the changes in the reserve policy of central banks may cause variations in gold prices. Herein, we carry out causality analysis for the cases of the USA, the Euro area, China and Russia. Our Granger and instantaneous causality provide results supporting this assertion; more precisely we find that changes in the reserve policy of the central banks of the USA, the Euro area, China and Russia may lead to considerable impacts in the dynamics of gold prices both in short and long-term. Thus, we stress that for transmission of gold prices to producer and consumer prices, inflation is also a crucial issue to be analyzed by the policy makers and researchers.

FEVD ANALYSIS RESULTS

Table 4: FEVDs of the gold prices

	FEVDs of $gpri_t$				
Forecast Horizon	$gres_t^{usa}$	$gres_t^{eur}$	$gres_t^{chi}$	$gres_t^{rus}$	$gpri_t$
1	0.00	0.00	0.00	0.00	1
6	0.01	0.09	0.02	0.02	0.86
12	0.10	0.08	0.14	0.08	0.60
18	0.14	0.10	0.21	0.12	0.43
24	0.14	0.08	0.26	0.12	0.40
30	0.15	0.08	0.27	0.10	0.40
36	0.16	0.08	0.30	0.11	0.35

Table 4 shows that gold prices can be affected by its past values, more precisely our FEVD analysis shows that gold prices are accounted for the approximately 35% of its own values in the following 36th quarter. Thereby, we can infer that technical dynamics of gold market affected from global funds and factors influencing gold demand as for jewelry and storage can become important factors for the in the long-term despite the role of these factors decreases gradually. On the other hand, our FEVD analysis reveal that central banks of the USA, the Euro area, China and Russia can become of a major source of the variations in gold prices. We find that central bank of China accounts for 30% of the variation in gold prices in the following 36th quarter, whereas the share of the USA, the Euro area and Russia explain 35% in the gold price changes. Our finding related to China can be supported by the assertion that relatively high growth rates in China have led to increase in the share of gold in the reserve of the central bank of China. Due to the size of balance sheet of FED and ECB, our findings related to the USA and the Euro area highlight the importance of FED as a determinant factor in global financial markets. We can also assert that central bank of Russia may store its high oil and gas revenues as gold holdings in future periods since there revenues cannot be transferred into real economic activity especially in terms of financing gross fixed capital formation.

CONCLUSIONS

It has been widely assumed that gold price dynamics may have strong links with interest-based instruments, exchange rate, stocks and other assets. Gold can be recognized as a “safe haven” for investors and central banks particular in crisis periods, while the change in the share of gold in central banks reserves is also a critical issue to be analyzed by researchers and policy makers. Due to the fact that major central banks have pumped billions into financial markets and slashed interest rates to record lows in a bid to stimulate growth, low interest rates have led a decrease in the opportunity cost of holding gold and stimulating the volume of gold transactions in world markets. Our VEC model based empirical analysis exposes the possible impacts of changes in gold reserves of the USA, the Euro area, China and Russia on gold price dynamics in the long-term. We found empirical evidence supporting the hypothesis of our study; more precisely FEVDs expose that monetary policy authorities of the USA, the Euro area, China and Russia may lead to considerable amount of proportion on gold prices from demand side. According to FEVD analysis, it is revealed the USA and the Euro area may remain important determinants in gold market due to their size of their central banks’ balance sheet in future periods. We also suggest that FED and ECB can remain as the ‘primary driver’ across global markets, fully expect markets to begin attempting to ‘price-in’ expected moves from both banks well ahead of the meetings. On the other hand, it can be asserted that increases in the storage of gold as a reserve can obstruct financing of new investments and consumption expenditures in Russia. Our results also stress that sustaining economic development particularly in China and Russia is also critical issue to be examined since these phenomena may trigger storing gold as a reserve which in turn may influence gold prices in the long-term.

REFERENCE

BALCILAR, M.; HAMMOUDEH, S. and ASABA, N. A. F. (2015). A Regime-Dependent Assessment of the Information Transmission Dynamics Between Oil Prices, Precious Metal Prices and Exchange Rates, *International Review of Economics and Finance*, 2015, Vol. 40, s. 72–89.

BATTEN, J. A.; CINER, C. and LUCEY, B.M. (2014). On the Economic Determinants of the Gold–Inflation Relation, *Resources Policy*, 2014, Vol. 41, s. 101–108.

BAUR, D. G. and MCDERMOTT T. K. (2010). Is Gold a Safe Haven? International Evidence, *Journal of Banking & Finance*, 2010, Vol. 34, No.8, s. 1886–1898.

BARUNIK, J.; KOČENDA, E. and VÁCHA, L. (2016). Gold, Oil, and Stocks: Dynamic Correlations, *International Review of Economics and Finance*, 2016, Vol. 42, s. 186–201.

BENCIVENGA, C.; D'ECCLESIA, R. L. and TRIULZI, U. (2012). Oil Prices and the Financial Crisis, *Review of Managerial Science*, 2012, Vol. 6, No. 3, s. 227–238.

BENTES, S. R. (2015). Forecasting Volatility in Gold Returns Under the GARCH, IGARCH and FIGARCH Frameworks: New Evidence, *Physica A*, 2015, Vol. 438, s. 355–364.

BLOSE, L. E. (2010). Gold Prices, Cost of Carry, and Expected Inflation, *Journal of Economics and Business*, Vol. 62, No. 1, s. 35–47.

CAPIE, F.; MILLS, T. C. and WOOD, G. (2005). Gold As a Hedge Against the Dollar, *Journal of International Financial Markets, Institutions and Money*, 2005, Vol. 15, No. 4, s. 343–352.

DAVIDSON, R. and MACKINNON, J. G. (1993). Estimation and Inference in Econometrics. London: Oxford University Press.

EWING, B. T., and MALIK, F. (2013). Volatility Transmission Between Gold and Oil Futures Under Structural Breaks, *International Review of Economics and Finance*, 2013, Vol. 25, s. 113–121.

GRANGER, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. Econometrica, Vol. 37, No. 3, s. 424-438.

HOANG, T. H. V.; LAHIANI, A. and HELLER, D. (2016). Is Gold a Hedge Against Inflation? New Evidence from a Nonlinear ARDL Approach, Economic Modelling, 2016, Vol. 54, s. 54–66.

IVRENDI, M. and Pearce, D. K. (2014). Asset Prices and Expected Monetary Policy: Evidence from Daily Data, *Applied Economics*, 2014, Vol. 46, No. 9, s. 985–995.

JMulTi (Time Series Analysis with Java) Econometric Software Help System. Version 4.23.

KRISTOUFEK, L. and VOSVRDA M. (2016). Gold, Currencies and Market Efficiency, Physica A, 2016, Vol. 449, s. 27–34.

LÜTKEPOHL, H. (2007). Vector Autoregressive and Vector Error Correction Models. In LÜTKEPOHL, H. and KRATZIG, M. (Eds.), Applied Time Series Econometrics (pp. 86-158). New York: Cambridge University Press.

PANTULA, S.G. (1989). Testing For Unit Roots in Time Series Data, Econometric Theory, Vol. 5, No. 2, s. 256–271.

PUKTHUANTHONG, K. and ROLL, R., (2011). Gold and the Dollar (and the Euro, Pound, and Yen), *Journal of Banking & Finance*, 2011, Vol. 35, No. 8, s. 2070–2083.

REBOREDO, J. C. (2013). Is Gold a Safe Haven or a Hedge for the US Dollar? Implications for Risk Management, *Journal of Banking & Finance*, Vol. 37, No. 8, s. 2665–2676.

ROACHE, S. K. and ROSSI, M. (2009). The Effects of Economic News on Commodity Prices: Is Gold Just Another Commodity?, *IMF Working Paper*, 2009, WP/09/140, s. 1–28.

SIMS, C. A. (1980). Macroeconomics and Reality, Econometrica, 1980, Vol. 4, No. 1, s. 1–48.

WANG, Y. S. and CHUEH, Y.L. (2013). Dynamic Transmission Effects Between the Interest Rate, the US Dollar, and Gold and Crude Oil Prices, *Economic Modelling*, 2013, Vol. 30, s. 792–798.

ZHANG, Z.; MAKIN, A. J. and BAI, Q. (2016). Yen Internationalization and Japan's International Reserves, *Economic Modelling*, 2016, Vol. 52, s. 452–466.

ZHAO, Y.; CHANG, H. L.; SU, C. W. , NIAN, R. (2015). Gold Bubbles: When Are They Most Likely to Occur? *Japan and the World Economy*, 2015, Vol. 34–35, s. 17–23.