NUML International Journal of Business & Management
Vol. 16, No: 1. Jun 2021
ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Nexus of Gold Price-Exchange rate-interest rate-Oil Price: Lessons for Monetary Policy in Pakistan

Muhammad Akbar[1] Warda Amjad[2] Zahid Iqbal[3]

Abstract

This study aims to evaluate the links among gold price, oil price, exchange rate and interest rate in Pakistan. All these channels are interconnected and have impact on monetary policy of the country. Monthly data ranging from 1995-01 to 2016-12 is used for the analysis based on VAR Model. Exchange rate depreciations are responded by tight monetary policy actions, which seem to have a significant effect on exchange rate stabilization process and raise gold price. Changes in oil prices at global level strongly affect the nexus in Pakistan. Monetary policy managers are suggested to take changes in gold prices as indicators of short-run fluctuations in Pakistan economy. The study contributes in two ways. Firstly, as a case study of Pakistan, it analyzes the role of gold market in response to changes in exchange rate and world oil prices. Secondly, the study links up monetary policy decisions to the nexus of gold price-oil price-exchange rate. Findings of the study may be useful for monetary policy makers, academia, and gold industry alike.

JEL clasificación: E52, O13, Q30, Q43

***Keywords**:* Gold Price; Exchange rate; Monetary Policy; Decomposition Analysis; VAR Model; Pakistan.

Introduction

For a long time, the monetary system is based on gold reserves to exchange all the currency into standard quality of gold on claim. With the Jamaica agreement, International Monetary fund (IMF) agreed to control the swinging exchange rate system systematically. Under this process, currencies are fiat money as money supply is expandable and the market forces control the gold price. There are two channels of gold demand, one is for ornamental use and other is the form of assets. Gold is a costly asset, which is considered by the investors as safe haven. It also provides protection against inflation, and exchange rate instability (*Ghosh et al.*, 2002, Forbes, 1991).

Keeping in view of above, the federal reserve of USA defines the rising gold price as signals of inflationary stress (Lastrapes & Selgin 1995). The other side of the picture shows that investors are trying to stabilize their position in inflationary era and

[1] Forman Christian College, A Chattered University Lahore
[2] Forman Christian College, A Chattered University Lahore
[3] Allama Iqbal Open University Islamabad, E-mail: zahid.Iqbal@aiou.edu.pk

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

during exchange rate fluctuations. At this point of time, gold is considered as hedge against swinging exchange rate (Wang-Lee2011).

The position of gold as safe asset against inflation and fluctuation of exchange rate is found common in the literature of resource economics. In every economy exchange rate, and gold prices are influenced by the price of crude oil. Amano and Nordan (1998) suggested that on international level the crude oil prices are the main cause of exchange rates fluctuation. It happens systematically that increased in oil prices gives appreciation of currencies of oil exporting countries and ultimately cause the depreciation of currencies of oil importing countries. As a result, the profit reduces and investing capability minimizes, and ultimately the organization and the investor seek refuge in gold markets and give shelter to their investment and their portfolio to maintain the buying capability. In addition, the oil price rise decreases the production capability, which causes the reduction in production of gold. These elements become the reason in gold price hike. The two contrary viewpoints are obvious in literature, the connection of exchange rate and commodity prices like gold. One opinion is that the variation in commodity prices gives rise to the fluctuation in exchange rate. Moreover, the commodity prices may be used to forecast exchange rate fluctuations.

Chen and Rogoff (2003) and Chen (2004) base their opinion on macroeconomic and trade – theory arguments. The second opinion is that the reverse of the first one (Engel & West 2005), Rogoff and Stavrakava (2008) and Rossi (2013).

These viewpoints show the causality among exchange rate and commodity prices. It signifies a causal relationship of gold price, exchange rate, and oil prices in different economies.

Since monetary policy tools are used to stabilize economy, hence the policy makers are interested to understand the changes that are considered sensitive with respect to their objectives. Interest rate is a significant monetary policy tool that is decided by the monetary authorities while considering inflation and fluctuations in exchange rate, which has a direct link with gold prices. Pakistan has a small open economy, driven by fluctuating exchange rate system. It is an oil importing country, where the connected value of currency is influenced by the international oil prices. The appreciation or depreciation of US dollar imposes severe effect on rupee, which ultimately influence the gold price because gold is traded in US dollar. In addition, Pakistan has a traditional society that exhibits gold as an ornament metal; these traditional values and customs along with gold as safe haven assets by investing body of the country, strongly effect the price of gold in the country. Since gold price in Pakistan is determined on daily basis by the market forces therefore, understanding the relative role of exchange rate fluctuations and changes in interest rate in explaining gold price movements may have much

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

importance for gold investors as well as monetary policy makers in Pakistan. Moreover, current fluctuations in gold prices and exchange rates in developed and developing countries, choice of gold as savings in some countries and large fluctuations in world oil prices have motivated the economic policy managers to develop their economic policies based upon the understanding of these variations.

However, published literature does not provide information about the causal relationships of the nexus for Pakistan economy. Causal relations of the nexus may have much importance for monetary policy makers and gold investors. Hence, the present study explains causal relations of exchange rate, domestic gold price and interest rate and how changes in world oil price affect the nexus in case of Pakistan economy. Then, these relationships are used to extract implications for monetary policy actions. In light of the above discussion, some specific questions are raised and these questions are answered on the basis of empirical evidence. i.e.

(i). Is gold market considered as a hedge or safe heaven against exchange rate fluctuation?

(ii). Are gold prices taken into account while deciding changes in interest rate level by monetary authorities?

(iii). How changes in global oil price may affect the nexus in Pakistan?

It may be beneficial for gold investors and traders and useful for formation of monetary policy for manager in Pakistan economy. Besides application of standard multivariate time series econometric techniques, the current study explores these relations by decomposing the data of all the four variables. Correlation analysis of decomposed components along with analysis based on VAR model is used to extract causal linkage of the nexus.

Literature Review

Relationship of gold price with other variables like oil price, exchange rates, inflation and stock prices has been analyzed extensively in the literature. However, linkages of the nexus with monetary policy have rarely been discussed. Some studies take gold as an important commodity and hence relationship between gold price and oil price are analyzed (See,Soytas *et al.*, 2009; Narayan *et al.*, 2010) while introducing some other macroeconomic variables like stock indexes (Lee & Lin, 2012) and exchange rates (Sari *et al.*, 2010). Review of the studies about the price dynamics in crude oil market and gold market found that these two markets have strong relationships (Ye, 2007; *Zhang et al.*, 2007). Some other studies take gold as a financial asset and discuss the reaction of gold price to stock markets (see, Davidson *et al.*, 2003) and exchange rate markets (*Capie et al.*, 2005; Sjaastad, 2008; Joy, 2011). As an asset, the role of gold as a hedge or safe haven against inflation and exchange rate fluctuations have also been discussed

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

extensively in the literature. Co-movement of an asset with inflation is considered as an inflation hedge (Dee *et al.*, 2013). Alternatively, an asset that is negatively correlated or uncorrelated with another asset on average is considered as a hedge against the other asset while an asset that is negatively correlated or uncorrelated with another asset at market stress time turmoil is considered as a safe haven (Baur & McDermott, 2010). A number of researchers have empirically, investigated the hedging or safe haven role of gold for a number of economies. However, the mixed and inconclusive results. Dee et al. (2013) shows that gold market acts as a hedge but not as a safe haven for stock and inflation in China. Some studies show hedging role of gold investments against fluctuations in various variables like stock prices, bond prices, the oil price, exchange rates, and inflation (*Beckmann et al.*, (2015), (Beckmann & Czudaj 2013a, 2013b) and Reboredo (2013a, 2013b)). Some other studies prove that gold market is considered as a safe haven in the times of economic stress (see, Baur & Lucey, 2010). According to Baur and McDermott (2010), gold market is taken both as a hedge and as a safe haven for US and major European stock markets but not for stock markets in Canada, Japan, Australia, and some emerging markets.

Literature gives a mix conclusion about the relationship of the nexus, which implies that these relationships may vary economy to economy. No study links up the nexus of these variables with monetary policy actions. Moreover, the literature does not contain such study for the case of Pakistan economy (Ahmed, Qaiser & Yaseen 2016). Hence, the present study would be a useful contribution in the literature as the analyses may be helpful for monetary policy makers in order to tackle fluctuations in Pakistan economy. Moreover, the analysis will be useful for investors in gold market of Pakistan.

As the gold prices are negatively correlated to oil prices, which is an indication of the role of gold as a hedge. Gold prices rise when the Saudi Riyal depreciates, which implies that gold is a good hedge against the dollar. While investing outside the country, with high returns, gold prices in Saudi Arabia are low. Finally, gold acts as a good inflation hedge, as both gold and CPI moves in same direction (Mustapha, Saiti , Shakil, Tasnia 2018).

The risk-averse investors will be willing to pay a high performance fee to switch from a portfolio with gold to a portfolio with bitcoin, an economic analysis of the value shows. These robust results are inclusion of trading costs. We find that it is probable for any stockholder to substitute bitcoin for gold in an investment portfolio and succeed a higher risk adjusted profit (Henriques & Sadorsky, 2018).

Monetary Policy Framework in Pakistan

In Pakistan, monetary policy is the responsibility of State Bank of Pakistan (SBP) under SBP Act 1956. Controlling of inflation and sustained high economic growth are

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

considered as major goals of monetary policy. Before 1990s, SBP had limited role to pursue these objectives but exchange rate policy was the major focus. During 1990s, the government took initiatives for reforming the financial sector. SBP adopted a market-based monetary and credit management system and began to use interest rate as instrument to follow monetary aggregates in the economy. In addition to interest rate, open market operations (OMOs) and changes in cash reserve requirements were also used to manage the targeted monetary and credit expansion. Amendments in SBP Act were made during the last many years to enhance SBP independence. From 2001 onwards, SBP stopped giving indicative credit targets. In 2006, SBP started to monitor the short-term money market interest rate. In 2009, interest rate corridor with ceiling and floor was announced and the overnight money market repo rate was allowed to vary within the announced interest rate corridor. For some years, M2 growth was used as intermediate target. Since 2010, SBP has abandoned targets for M2 growth. Furthermore, money market interest rate instead of M0 has been in use as the operational target since 2009. In recent years, SBP does not fix any intermediate goal of a nominal anchor. Rather, SBP adjusts short aggregate demand vis-à-vis the productive capacity. This monetary policy approach is like inflation targeting approach. Over the years, SBP priority has shifted from growth to balance of payments to inflation.

Methodology

The study uses monthly data of all the variables ranging from January 1995 to December 2016. Many studies have taken gold prices as spot prices in US dollar per ounce or US dollar per troy ounce. This study, however, will take it in local currency of Pakistan as monthly prices in Rupees per troy ounce. The data on gold price (GP) is collected from local gold market of Karachi. Data of exchange rate (ER) and interest rate (IR) i.e. discount rates are taken from the data sources of State Bank of Pakistan. Exchange rate is considered as rupee value of US Dollar. The data for global crude oil prices (OP) are taken as monthly values from January 1995 to December 2016 in US dollar per barrel published by World Bank available at www.indexmundi.com.

In order to determine causal relations of the nexus, the following techniques are employed in the study. Firstly, Census Bureau (X-11) method developed by Bureau of Labor Statistics USA is used to decompose all the series into secular trend, cyclical fluctuations, seasonal variations, and irregular variations. Decomposition has been done by following the four steps. In the first step, 12 months centered moving averages are calculated and then these averages are divided on original data, which gives us seasonal variations. In the second step, 12 months moving averages are plotted on a graph, which shows linear trend, and hence, a linear regression model of the moving averages is fitted

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

taking time trend as explanatory variable. Predictions obtained from this model are taken as Trend Components. Dividing 12 months moving averages by the trend components gives us Cyclical-Irregular components. Third step gives us cyclical fluctuations when 36 months centered moving averages of actual data are calculated. In the last step, Cyclical-Irregular components are divided by cyclical variations and we obtained irregular variations. All the series are decomposed into four components by using the above mentioned four steps procedure called Census Bureau (X-11) method. After decomposition, correlation analysis is conducted between the variables using aggregated data as well as decomposed components of the variables. After correlation analysis, long-run and short-run relations of the nexus are analyzed by using multivariate time series techniques. For this purpose, Johansen's (1988, 1991) maximum eigenvalue and trace tests are used to test long-run relationships. Then VAR model presented by Sims (1980) is estimated to analyze short-run relationships by deriving impulse responses and variance decompositions. Testing of structural break in time series data have been an important part of time series econometric modeling. Hence, Quandt-Andrews unknown breakpoint test and its extended version presented by Bai and Perron (1998, 2003) for multiple unknown breakpoints are used to test one or more structural breakpoints in the data of variables.

Results and Discussion

Causal relations among the nexus of the variables are determined using correlation analysis of aggregated data as well as decomposed time series components of the variables, cointegration analysis and analyses based upon VAR model. Results of correlation coefficients are presented in Table-1. Correlation coefficients of aggregated data, trend component and cyclical fluctuations indicate long-run association of the variables while correlation coefficients of seasonal variations represent seasonal relationships of the nexus. Then multivariate time series analyses are conducted considering domestic gold price, exchange rate and interest rate as endogenous variables while global crude oil price as exogenous variable. Augmented Dickey Fuller test is used to check stationarity of the variables. The results appearance shows that all the variables in the study are non-stationary at level and they are stationary at first difference. Hence, we move to test cointegration of the nexus. For this purpose, Johansen cointegration test is applied to test long-run relationships among exchange rate, domestic gold price and interest rate while considering world oil price as exogenous variable. The test is performed under the assumption that the data at level as well as cointegrating equations have linear trend. Maximum Eigen value test and Trace test statistics are presented in Table-B (Appendix). Both the statistics reveal that no cointegrating vector exists among the nexus. It implies that long-run stable relationship among the variables does not exist.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Hence, VAR model is estimated to determine short-run relationships in the nexus. Since all the variables are integrated to first order and hence, first difference of the variables are taken while estimating VAR model. Before estimation of VAR model, structural breakpoints are tested. For this purpose, Quandt-Andrews Structural breakpoint test and its extended form presented by Bai and Perron (1998, 2003) are applied to each of the variable. Results of the two test statistics are presented in Table-C (appendix). No structural breakpoint is detected in any of the variable under consideration as null hypotheses of no structural breakpoint are accepted. Optimal lag length of the VAR model is specified as lag length 2 on the basis of various criteria as shown by Table-D (Appendix). VAR model is estimated and the results are given in Table-E (Appendix). Stability test of the VAR model is presented in Figure-A (Appendix) which shows that the roots of the estimated VAR model lie within unit circle and, hence the estimated model is stable. The estimated VAR model can now be used to analyze causal relationships of the nexus using variance decompositions analysis and impulse responses. The results of variance decompositions of the nexus over a 12 month time period are given in Table-2 while Figure 1 shows impulse responses of the VAR model up to 12 months time horizon. Putting all the results together, we have tried to extract the following linkages of the nexus and to derive implications for monetary policy actions in Pakistan.

Exchange rate and interest rate show a moderate negative association w.r.t. trend, cyclical fluctuations, irregular variations and overall data while seasonal variations show a mild positive seasonal association. Variance decomposition indicates that 1.64% variations of exchange rate are explained by random shock in interest rate while random shock in exchange rate explains 3.37% variations of interest rate during 12 month time horizon in Pakistan. Impulse responses reveal that a unit shock to exchange rate causes an increase in interest rate which stabilizes in the fifth month. However, a unit shock in interest rate shows mild fluctuations in exchange rate. Hence, results of correlation coefficient for seasonal variations, impulse responses and variance decomposition imply that exchange rate depreciations are responded by an increase of interest rate. Correlation analyses of trend, cyclical fluctuations and irregular variations along with response of exchange rate to interest rate indicate that increase of interest rate causes appreciation of rupee value in dollar.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Table 1: *Correlation coefficients between decomposed components*

Variables	Aggregated Data	Trend	Seasonal Variations	Cyclical Fluctuations	Irregular Variations
Exchange rate & Gold price	.90	1	.20	.92	.99
Exchange rate & interest rate	-.39	-1	.30	-.39	-.83
Exchange rate & Oil price	.83	1	-.09	.89	.92
Gold Price & interest rate	-.15	-1	.99	-.17	-.86
Gold Price & Oil Price	.88	1	.99	.98	.95
Interest rate & Oil Price	-.31	-1	-.98	-.23	-.96

Table 2: *Variance Decomposition*

Periods	D(GP)	D(ER)	D(IR)	D(GP)	D(ER)	D(IR)	D(GP)	D(ER)	D(IR)
1	100.0	.00	.00	.20	99.79	.00	.21	1.65	98.13
2	92.99	6.27	.73	.48	98.98	.52	.31	2.16	97.51
3	83.24	15.7	.99	.34	98.91	0.74	.57	3.12	96.29
4	79.63	19.15	1.21	.32	98.61	1.05	.57	3.22	96.19
5	74.67	24.12	1.19	.27	98.53	1.19	.57	3.32	96.09
6	71.52	27.20	1.27	.25	98.41	1.32	.57	3.32	96.09
7	68.27	30.42	1.30	.23	98.35	1.40	.57	3.34	96.07
8	65.69	32.96	1.33	.22	98.29	1.48	.57	3.35	96.07
9	63.30	35.32	1.36	.21	98.25	1.53	.57	3.36	96.06
10	61.24	37.36	1.39	.20	98.22	1.57	.57	3.36	96.05
11	59.37	39.20	1.41	.19	98.19	1.61	.57	3.37	96.04
12	57.72	40.83	1.43	.18	98.16	1.64	.57	3.37	96.04

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

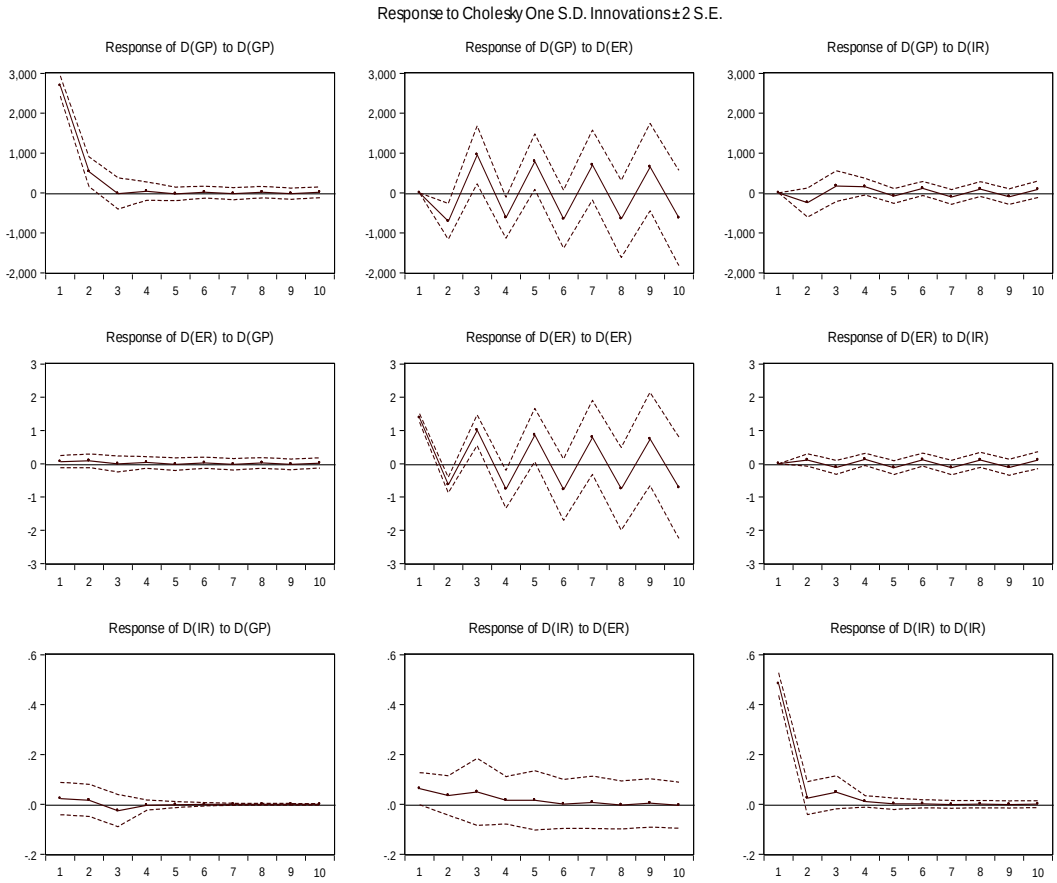


Figure-1: *Impulse Responses*

Results of VAR model show that global oil price significantly and directly affects exchange rate. It implies that increase in global oil price causes depreciation of rupee while oil price decline appreciates rupee in foreign exchange market. Interest rate and global oil price seems to have no association with each other. Gold price and Exchange Rate show strong positive association with respect to trend, cyclical fluctuations, irregular variations and overall data but have no seasonal association. Variance decomposition reveals that random shock of exchange rate explains 41% variations of gold price but gold price does not explain significant variations of exchange rate during 12-month time horizon. Impulse responses indicate that a unit shock in exchange rate causes huge fluctuations in gold price and these fluctuations do not stabilize up to 12 months.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

However, seasonal variations of the two variables are negatively and strongly correlated to each other. Variance decomposition show that random shock of interest rate explains 1.43% variations of gold price but gold price seems to have no contribution in explaining variations of interest rate during 12-month time period. Impulse responses indicate that a unit shock of interest rate in initial period negatively affect gold price but a unit shock of gold price does not affect interest rate. It implies that changes in gold price are not considered while devising monetary policy in Pakistan but monetary policy actions inversely affect gold price. It is because an increase of interest rate causes appreciation of rupee, which negatively affects gold demand, and hence, gold price decreases. Gold price and global oil price show strong positive correlation. Results of VAR model presented reveal that global oil price significantly and positively affect gold price. It is because an increase in oil price depreciates rupee, which causes inflation and uncertainty in the economy. It raises demand of gold and hence gold price increases.

Increase in global oil price causes fluctuations in exchange rate and gold price. These results are in line with Baffes (2007), Sjaastad (2008), *Sri et al.* (2010) and Wang-Lee (2011). Fluctuations of exchange rate are responded by monetary policy actions as increase in the level of interest rate in response to depreciation is observed in the study. (See also Ahmad, 2014). It is because fluctuations of exchange rate create a situation of uncertainty in the economy. Common people and investors raise demand of gold to save their future purchasing power and hence, gold price increases. Monetary policy actions are taken into account to stabilize exchange rate as exchange rate explains significant amount of variations in interest rate. However, gold prices are not taken into account while deciding level of interest rate as gold price seems to have no significant effect upon interest rate. It implies that increase in the level of interest rate appreciates exchange rate as indicated by correlation coefficient of seasonal variations. It causes decline in gold demand as well as gold price. Hence, it may be concluded here that exchange rate, domestic gold price and interest rate is an important short-run nexus of variables in Pakistan. Gold market is taken as a safe haven against uncertainty due to exchange rate fluctuations. Since changes in gold prices seem to have no significant impact upon the other variables of the nexus, which implies that gold, market has no role as hedge against exchange rate fluctuations in Pakistan. These findings are in line with Laughlin (1997) and Pravit (2009) and Ismail *et al.* (2009). Moreover, global oil price significantly affect the nexus in Pakistan. Monetary policy actions are taken to stabilize exchange rate and to control inflation in the economy. According to Kaul and Sapp (2007), an asset is considered to be a safe haven for other asset if it does not co-move with the other asset. Moreover, it is negatively correlated with the other asset in times of stress and not on average. The results show that gold price and exchange rate are negatively correlated.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Moreover, exchange rate shocks strongly affect gold price but not vice versa. Hence, rejection of long-run stable relationship is justified.

Conclusion

The study has been conducted to investigate causal relationships of gold price, exchange rate, interest rate and global oil price and to extract some important implications for monetary policy actions in Pakistan. Monthly data ranging from January 1995 to December 2016 are used for the analysis. All the four variables are decomposed into trend, seasonal variations, cyclical fluctuations and irregular variations while using Census Bureau (X-11) method. Correlation analyses are conducted using aggregated data as well as decomposed components of the four variables. Johansen cointegration test statistic indicates that there is no long-run stable relationship among the variables. VAR model is estimated to extract short-run relationships. Correlation analyses of decomposed components, variance decomposition and impulse responses are put together to derive relationships. Results show that exchange rate depreciation causes severe fluctuations in gold price but gold price does not affect exchange rate. Exchange rate fluctuations are responded by tightening of monetary policy, which causes a decline in gold prices. Moreover, global oil price shows strong direct impact upon exchange rate as well as gold price in Pakistan. It is because an increase in global oil prices causes depreciation in rupee value of dollar, which is responded by an increase in interest rate. The depreciation of exchange rate is responded to by the investors who increase the demand of gold, hence, the gold price increases in Pakistan. It is, therefore, concluded here that gold market is considered as a safe heaven during exchange rate depreciation but it cannot be considered as hedge against exchange rate variations in Pakistan economy. However, gold price is not taken into consideration while deciding monetary policy actions in Pakistan. It may be concluded here that the variables under consideration constitute an important short-run nexus of strong associated variables. Gold is taken as safe haven during uncertainty and therefore, gold price can play a role in combating exchange rate fluctuations in the economy. Hence, macroeconomic policy managers must consider changes of gold price as indicators of fluctuations and uncertainty in Pakistan economy.

References

Ahmed, F., Kashif, M. & Feroz, F. (2018). Dynamic Relationship between Gold Prices, Oil Prices, Exchange Rate and Stock Returns: Empirical Evidence from Pakistan. *NUML International Journal of Business & Management.* 12(1). 109-126

Ahmed, R., Qaiser, I., & Yaseen, M. R. (2016). Nexus between exchange rate volatility and oil price fluctuations: evidence from Pakistan. *Pakistan Journal of Commerce and Social Sciences* (PJCSS), 10(1), 122-148.

Ahmed, Z. (2014). Factors affecting exchange rate fluctuation in Pakistan. *International Journal of Social Sciences and Management Studies*, 1(2), 80-88.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Amano, R. A., &Norden, S. (1998). Exchange rates and oil prices. *Review of International Economics*, *6*(4), 683-694.

Awokuse, T.O. & Yang, J. (2003). The informational role of commodity prices in formulating monetary policy: a reexamination. *Economics Letters*, 79, 219–224.

Baffes, J. (2007). Oil spills on other commodities. *Resources Policy* 32, 126–134.

Bai, Jushan and Pierre Perron (1998). Estimating and Testing Linear Models with Multiple Structural Changes, *Econometrica*, 66(1), 47-78.

Bai, Jushan and Pierre Perron (2003a). Computation and Analysis of Multiple Structural Change Models, *Journal of Applied Econometrics*, 18(1), 1 - 22

Baur, D. G., &Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, *45*(2), 217-229.

Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking & Finance*, *34*(8), 1886-1898.

Beckmann, J., &Czudaj, R. (2013a). Gold as an inflation hedge in a time-varying coefficient framework. *The North American Journal of Economics and Finance*, *24*, 208-222.

Beckmann, J., &Czudaj, R. (2013b). Oil and gold price dynamics in a multivariate cointegration framework. *International Economics and Economic Policy*, *10*(3), 453-468.

Beckmann, J., Berger, T., &Czudaj, R. (2015). Does gold act as a hedge or a safe haven for stocks? A smooth transition approach. *Economic Modelling*, *48*, 16-24.

Beckers, S., & Soenen, L. A. (1984). Gold options, an attractive investment instrument for the non-US investor—The case of the Belgian and Dutch investor. *De Economist*, *131*(1), 80-87.

Capie, F., Mills, T. C., & Wood, G. (2005). Gold as a hedge against the Dollar. *Journal of International Financial Markets, Institutions and Money*, 15(4), 343-352.

Chen, Y. C. (2004). Exchange rate and Fundamentals: Evidence from Commodity Currencies, Technical Report, Department of Economics, University of Washnigton.

Chen, Y. C. &Rogoff, K. (2003). Commodity Currencies. *Journal of International Economics*, 60(1), 133-160.

Ciner, C. (2001). On the long-run relationship between gold and silver: a note. *Global Financial Journal*, 12(2001), 299–303.

Davidson, S., Faff, R., & Hillier, D. (2003). Gold factor exposures in international asset pricing. *Journal of International Financial Markets, Institutions and Money*, *13*(3), 271-289.

Dee, J., Li, L., &Zheng, Z. (2013). Is gold a hedge or a safe haven? Evidence from inflation and stock market. *International Journal of Development and Sustainability*, *2*(1), 1-16.

Dooley, M.P., Isard, P. &Taylor, M.P. (1995). Exchange Rates, Country-specific Shocks and Gold. *Applied Financial Economics*, 5: 121–129.

Engle, C. & West, K. D. (2005). Exchange Rates and Fundamentals, *Journal of Political Economy*, 113, 485-517.

Ghosh, D., Levin, E.J., Macmillan, P. and Wright, R.E. (2002). Gold as an inflation hedge?. Discussion Paper Series, Department of Economics 0021, Department of Economics, University of St. Andrews.

Han, A., Xu, S. &Wang, S. (2008). Australian Dollars Exchange Rate and Gold Prices: An Interval Method Analysis. Proceedings of *The 7th International Symposium on Operations Research and Its Applications*, pp. 46–52.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Henriques, I. & Sadorsky, P. (2018). Can Bitcoin Replace Gold in an Investment Portfolio? . *Journal of Risk and Financial Management. 11(48), 1-19.*

Ismail Y. S. (2009). Forecasting Gold Prices using Multiple Linear Regression method, *American Journal of Applied Sciences*, 6(8), 1509-1514.

Jain, A., & Ghosh, S. (2013). Dynamics of global oil prices, exchange rate and precious metal prices in India. *Resources Policy*, *38*(1), 88-93.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control*, 12(2), 231–254.

Johansen, S., (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, 59(6), 1551–1580.

Joy, M. (2011). Gold and the US dollar: Hedge or haven?. *Finance Research Letters*, *8*(3), 120-131.

Kaul, Aditya, and Stephen Sapp, (2007). Y2K fears and safe haven trading of the U.S. dollar, *Journal of International Money and Finance* , 25(5), 760-779

Lastrapes, William D. & Selgin, George, (1995). The liquidity effect: Identifying short-run interest rate dynamics using long-run restrictions," Journal of Macroeconomics, Elsevier, vol. 17(3), pages 387-404.

Laughlin, J. L. (1997). Gold and Prices Since 1887, *Quarterly Journal of Economics*, 1(3), 319-355.

Lee, W. C., & Lin, H. N. (2012). Threshold effects in the relationships between USD and gold futures by panel smooth transition approach. *Applied Economics Letters*, *19*(11), 1065-1070.

Levin, E.R. & Wright, R.E. (2006): Short-run and Long-run Determinants of the Price of Gold. *World Gold Council Research Study*, No. 32. London.

Lucey, B.M. &Tully, E. (2006). The evolving relationship between gold and silver 1978–2002: evidence from a dynamic cointegration analysis: a note. *Applied Financial Economics Letters*, 2, 47–53.

Narayan, P. K., Narayan, S., &Zheng, X. (2010). Gold and oil futures markets: Are markets efficient?. *Applied energy*, *87*(10), 3299-3303.

Ozturk, F. &Acekalen, S. (2008). Is Gold a Hedge against Turkish Lira? *South East European Journal of Economics and Business*, 3: 35–40.

Pravit K. (2009). Forecasting Thai Gold Prices, http://www.wbiconpro.com/3-Pravit.

Reboredo, J. C. (2013a). Is gold a hedge or safe haven against oil price movements?. *Resources Policy*, *38*(2), 130-137.

Reboredo, J. C. (2013b). Is gold a safe haven or a hedge for the US dollar? Implications for risk management. *Journal of Banking & Finance*, *37*(8), 2665-2676.

Rogoff, K. &Stavrakeva, V. (2008). The Continuing Puzzle of Short Horizon Exchange Rate Forecastings, NBER Working Paper, 14071.

Rossi, B. (2013). Exchange rate predictability. *Journal of Economic Literature*, *51*(4), 1063-1119.

Sari, R., Hammoudeh, S., & Soytas, U. (2010). Dynamics of oil price, precious metal prices, and exchange rate. *Energy Economics*, *32*(2), 351-362.

Shafiee, S. &Topal, E., 2010. An overview of global gold market and gold price forecasting. *Resources Policy* 35, 178–189.

Sims, C.A. (1980). Macroeconomics and reality. Econometrica, 48(1), 1-48.

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Sinton, J. (2014). An Empirical Investigation of the Causal Relationship between Gold Price, Exchange Rate Changes and Jakarta Composite Index. *Proceedings of World Business and Social Science Research Conference*, (pp. 1-10). Paris.

Shakil, M. H., Mustapha' . M., Tasnia, M. & Saiti, B. (2018). Is gold a hedge or a safe haven? An application of ARDL approach. Journal of Economics, Finance and Administrative Science, 23(44) Lima ene. /jun. 2018

Sjaastad, L. A., & Scacciavillani, F. (1996). The price of gold and the exchange rate. *Journal of International Money and Finance*, 15(6), 879-897.

Sjaastad, L.A. (2008). The Price of Gold and the Exchange Rates: Once Again. *Resources Policy*, 33(2): 118–124.

Soytas, U., Sari, R., Hammoudeh, S., & Hacihasanoglu, E. (2009). World oil prices, precious metal prices and macroeconomy in Turkey. *Energy Policy*, *37*(12), 5557-5566.

Sujit, K.S. & Kumar, B.R. (2011). Study on dynamic relationship among gold price, oil price, exchange rate and stock market return. *International Journal of Applied Business and Economic Research*, 9(2), 145-165.

Wang, K.M. & Lee, Y.M. (2011). The Yen for Gold. *Resources Policy*, 36(1), 39–48.

Ye, Y., (2007). Analysis on linkage between gold price and oil price [J]. *Gold*, 28, 4-7

Zhang, Y., XU, L., & Chen, H. M. (2007). An Empirical Study on the Relationship between Prices of Petroleum and Gold Industry [J]. *Research on Financial and Economic Issues*, *7*, 006.

Appendix

Table-A: *Results of ADF test statistic*

Variables	Level With intercept & trend)	Level with intercept	Level with no intercept and no trend	1st Difference with intercept
LER	-1.84(0.68)	-1.158 (0.69)	4.61(1.0)	-8.15 (0.00)
LGP	-1.77(0.77)	0.54 (0.98)	4.26(1.0)	-14.29 (0.00)
IR	-1.20(0.90)	-1.06 (0.73)	-1.01(0.27)	-13.83 (0.00)
LOP	-3.22(0.10)	-0.97 (0.76)	0.95(0.91)	-12.48 (0.00)

Table-B: *Cointegration Test*

Hypothesized No. of CE	λ_{Trace}	$P-Value$	$\lambda_{Max.Eign}$	$P-Value$
$r=0$	34.57068	0.2632	14.99925	0.6345
$r=1$	19.57143	0.2484	14.15599	0.2439
$r=2$	5.415447	0.5378	5.415447	0.5378

ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Table-C: *Structural Breakpoints Tests*

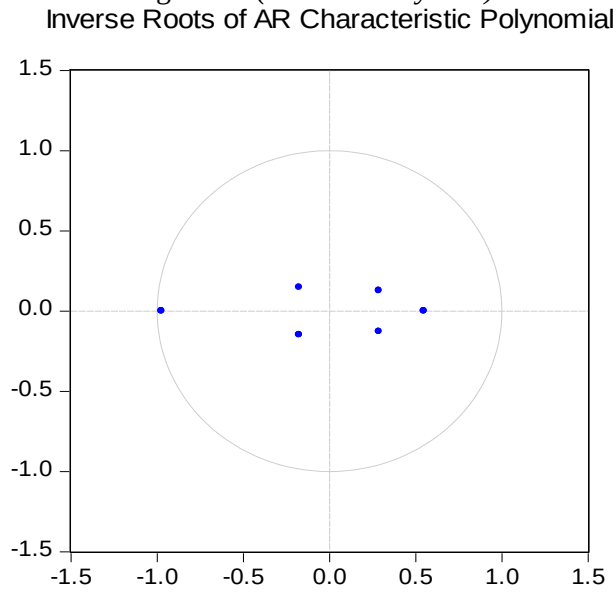
Variables	Quandt-Andrews test Max Wald F Stat. (P-Value)	Bai-Perron Multiple breakpoint F Stat. (Critical value)
D(log(op))	2.97 (0.56)	2.97 (8.58)
D(log(GP))	4.23 (0.34)	4.22 (8.58)
D(log(ER))	5.99 (0.16)	5.99 (8.58)
D(IR)	2.11 (0.75)	2.11 (8.58)

Table-D: *Lag Length Criteria*

Lag	Final Prediction Error test	Akaik Information Criterion	Swartz Bayesian Criterion	Hannan Quinn Criterion
0	4440316.	23.81987	23.91272*	23.85737
1	4035899.	23.72435	23.95648	23.81810*
2	3849116.*	23.67689*	24.04829	23.82689
3	4073039.	23.73328	24.24396	23.93953
4	4262051.	23.77837	24.42833	24.04087
5	4391903.	23.80797	24.59720	24.12671
6	4637259.	23.86173	24.79025	24.23673
7	4580194.	23.84855	24.91634	24.27980
8	4660962.	23.86499	25.07205	24.35249

* Indicates lag order selected by the criterion

Figure-A: *(VAR Stability Test)*



ISSN 2410-5392 (Print), ISSN 2521-473X (Online)
https://doi.org/10.52015/nijbm.v16i1.50

Table-E: *Results of VAR model (Estimates with t statistics)*

	D(GP)	D(ER)	D(IR)
D(GP(-1))	0.213790	4.13E-05	4.92E-06
	[3.22864]	[1.21278]	[0.40904]
D(GP(-2))	-0.046946	-8.23E-06	-1.33E-05
	[-0.70902]	[-0.24187]	[-1.10815]
D(ER(-1))	-492.9798	-0.472551	0.023515
	[-3.09811]	[-5.78106]	[0.81401]
D(ER(-2))	561.3798	0.533689	0.043817
	[2.27313]	[4.20675]	[0.97727]
D(IR(-1))	-503.9856	0.228449	0.052306
	[-1.34254]	[1.18465]	[0.76749]
D(IR(-2))	606.1045	-0.118274	0.094600
	[1.60390]	[-0.60927]	[1.37890]
D(OP)	84.29445	0.035445	-0.001367
	[2.25214]	[1.84351]	[-0.20115]