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Testing for the Asymmetric Impacts of Gold Price on India and South Africa Stock Market: An Asymmetric ARDL Model Approach

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Abstract

This study investigates the asymmetric impacts of gold price on Indian and South Africa stock market prices. This study made use of monthly data that spanned 1997M01-2017M04. The unit root test revealed that the variables employed contained a unit root. An asymmetric ARDL model was set up to achieve the aim of the research. A cointegration test among the variables was passed using the ARDL bound test technique. The test statistics probabilities reject the null hypothesis of asymmetric impact of gold price on the stock market in South Africa and Indian, both in the short and long run respectively.

Keywords

Gold Price, Stock, Asymmetry, ARDL

1. Introduction

In the last few decades, world's economy has experienced several and frequently financial crises such as Asia financial crisis of 1997 and the global financial crisis of 2007-2008, and it has been affecting world financial market. Such events have significant influence and increase the risk to another market such as stock market and commodity market. Therefore, most investors, especially risk-averse investors seek to improve risk-returns tradeoff associated with their investment. They are diversifying their portfolio from risky assets to less risky assets such as Gold which is known as haven asset investments.

A key question is whether gold is a haven asset investment or hedge. Typically investors look at gold in the eyes of safe haven investment during the times of political, social and economic uncertainty. At such times, investors who hold

onto gold can successfully protect their wealth and even use gold to divert from all of the turmoil. An example, Baur and Lucey (2010) financially classified an asset as a hedge asset if it is negatively correlated or uncorrelated to another asset during normal market movements. On the other hand, it is preferred as a safe haven investment if it is negatively correlated or uncorrelated to another asset in times of extreme market movements. Also Baur and McDermott (2010) indicate that gold can be an effective hedge and a safe haven investment depending on market conditions.

In a competitive and efficient market, gold and stock are used as substitute's assets to each other. Piñeiro-Chousa, López-Cabarcos, Pérez-Pico, and Ribeiro-Navarrete (2018) state that when the stock market is bearish, it is reasonable that investors would prefer investing in gold; consequently, the price of gold increases. On the other hand, when the stock market is bullish, the investors would prefer investing in stock; consequently, the price of gold decreases. Hood and Malik (2013) the relationship between gold and stock prices is well known, as the prices of gold increases, the investors prefer to invest in undervalued stocks because of a decrease in stock prices and vice versa.

Gold and stock markets have received widespread attention in the empirical finance literature. Among others, Liu, Chang, Wu, and Chui (2016); Chen and Lin (2014); Tuysuz (2013) and Hussain Shahzad, Raza, Shahbaz, and Ali (2017) indicate that gold is a strong hedge and diversifier for the stock portfolio. The results also suggest that the dependence between stock and gold is not identical, and this depends on the market state if bearish, optimistic or bullish and country-specific factors. Hood and Malik (2013) state that gold serves as a hedge and a weak safe haven for US stock market. Raza, Jawad Hussain Shahzad, Tiwari, and Shahbaz (2016) state that gold prices have a significant positive effect on the stock market prices of emerging economies of BRICS countries and a significant negative impact on the stock markets of Malaysia, Mexico, Chile, Indonesia and Thailand.

Besides, emerging markets, which attract institutional investors' extensive, previous empirical literature, provide evidence of a significant relationship between gold prices and the stock market, such as Raza et al. (2016) for emerging markets, Bouri, Jain, Biswal, and Roubaud (2017) for India, El Hedi Arouri, Lahiani, and Nguyen (2015) for China, Bekiros, Boubaker, Nguyen, and Uddin (2017) for BRICS countries and Tursoy and Faisal (2018) for Turkey.

This paper focuses on the asymmetric impact of a specific commodity, gold, and two emerging stock markets of South Africa and India. Our main inspiration to examine this study arises from the fact that, South Africa is the first-largest gold exporter in Africa and over that 70-year period, South African mines generated approximately 45% of total gold mine supply. While India is the second largest gold market in the world, and also is among the top five countries with the vast gold reserves. At the same time, the role of gold as an asset provides a better and account for the more than 60% as a store value for the Indian

households, thus provides liquidity and collateralization for Indian household (World Gold Council, 2017).

Thus a combination of South African gold supply and the uniqueness behaviour of Indian households for gold, with the special nature of their financial structure regarding the role of gold as a store of value, makes gold important substitute assets to other financial assets in South Africa and India.

Examining the relationship and diversification properties of gold and stock, most of the empirical literature uses symmetric or linear frameworks such as Dirk G. Baur (2014), Tuysuz (2013), and Tursoy and Faisal (2018). On the other hand, some empirical have employed the asymmetric or nonlinear framework of gold and stock market such as Shin, Yu, and Greenwood-Nimmo (2014), Raza et al. (2016), and Bouri, Jain et al. (2017). Any investment strategy which combines both stocks and gold may not provide the same results, hence ignoring the underlying asymmetric dynamics may provide bias results. Therefore, this paper is motivated to examine the asymmetric impact of gold price on the stock market using asymmetric Autoregressive Distributed Lag (NARDL) model by employing monthly data from January 1997 to April 2017.

The remainder of this study is organised as follows: Section 2 provides a brief review of relevant literature, Section 3 explains the data, methodologies, and models, Section 4 presents empirical results and discussion, Section 5 summarises and concludes.

2. Literature Review

Since the asymmetric relationship is our focus in this study, we focus our discussion on the previous relevant empirical papers that examined the relationship directly between gold prices and stock market returns.

Batten, Ciner, Kosedag, and Lucey (2017) used quantile regressions to examine the asymmetric relationship between the prices of gold and gold mining stocks, finding no evidence of an asymmetric relationship between these two markets.

El Hedi Arouri et al. (2015) examine the returns and volatility spillover between gold prices and the China stock market from March 2004 to March 2011. Different frameworks of CCC–GARCH, DCC–GARCH, diagonal BEKK–GARCH, scalar BEKK–GARCH, and full-BEKK–GARCH have used for comparison purpose. The findings indicate the evidence of significant return and volatility cross effects between gold prices and stock prices in China. Also, the results suggest that adding gold to a portfolio of stocks reduces portfolio risk and improves the hedge against stock risk.

Chkili (2016) using asymmetric DCC model for weekly data from January 2000 to July 2014 examines the dynamic relationships between gold and stock markets for the BRICS counties. The findings reveal significant positive and negative dynamic conditional correlations for the period of 2000-2014. These correlations are low to negative during the major financial crises of 2007-2008.

Furthermore, the results reveal that adding gold to a stock portfolio improve its risk-adjusted return.

Reboredo and Ugolini (2017) examine the quantile causality from gold commodity to eight gold stock indices by using bivariate asymmetric DCC model from January 2006 to October 2016. The findings reveal that gold prices Granger-cause Australian gold stock returns in all quantiles. More interestingly, there is no significant evidence causality for either gold stock returns for indices located in Europe, Middle East and Africa regions, also the upper quantiles of stock indices located in America. Therefore, the results indicate that gold price shocks do not translate directly into wealth shocks for gold companies' stock returns.

Bouri, Roubaud, Jammazi, and Assaf (2017) examine short and long-term frequency domain causality between gold and the stock markets of China and India by using implied volatility between March 2011 and March 2017. The findings indicate a significant bi-directional effect between gold and the stock market of China and India in both high and low frequencies. Piñeiro-Chousa et al. (2018) examine the relationship between investor sentiment and gold returns to S & P 500 Index returns by using Granger causality analysis, ARIMA and GARCH models between 2012 and 2016. We also considered whether the influence of sentiment varies according to the user's degree of experience. They conclude a significant effect of gold returns on S & P 500 volatility.

Choudhry, Hassan, and Shabi (2015) examine the nonlinear dynamic co-movements between gold returns and stock market returns during the recent global financial crisis for the FTSE 100 index, the S & P 500 index and Nikkei 225 index by using nonlinear Granger causality from January 2000 to March 2014. The findings reveal significant evidence of nonlinear feedback effect between gold and all three stock indices during the financial crisis period. However, during the pre-crisis period, very limited significant evidence found between these markets. From the perspective of these results, they conclude that gold may not perform well as a safe haven during the financial crisis because of the bidirectional interdependence between stock returns and gold returns.

Gokmenoglu and Fazlollahi (2015) using the ARDL model examine the Interactions among gold, oil, and S & P 500 stock market index by employing daily data between January 2013 and November 2014. The findings indicate a significant long-run relationship between gold price and S & P 500 stock returns. Furthermore, the results reveal that S & P 500 stock market price index converges to its long-run equilibrium level by 1.2% speed of daily adjustment by gold market prices and their volatilities.

Kocaarslan, Sari, Gormus, and Soytas (2017) investigate the asymmetric impact of volatility expectations in oil, gold and currency on dynamic correlations between BRIC and U.S. stock markets between January 2011 and July 2015 by employing VAR-A-DCC-EGARCH and VAR-DCC-EGARCH model. The results

indicate that based on the level of correlations there are significant asymmetric impacts of volatility expectations in gold on the U.S. stock and BRIC markets.

Bekiros et al. (2017) examine the role of gold in globally integrated emerging markets for BRICS countries using a multi-scale wavelet approach and a GARCH-based copula methodology from January 2000 to July 2014. The findings show evidence of the time-scale co-movement patterns between BRICS stock markets and gold market and a strong time-varying asymmetric dependence structure between gold price and those five stock markets indices.

Hood and Malik (2013) investigate the role of gold and other precious metals relative to US stock market volatility from November 1995 to November 2010. The findings indicate that gold price does not have a negative correlation with the US stock market during the periods of extremely low or high volatility. Nguyen, Bhatti, Komorníková, and Komorník (2016) using parametric and nonparametric copulas frameworks examine the relationship between gold price and seven stock markets indices between 1999-2010. The results indicate that gold may be a safe haven asset during a market crash for the case of Malaysia, Singapore, Thailand, the UK and the US markets but not for the Indonesian, Japanese and the Philippines markets.

3. Methodology and Model Specification

Given the nature of this study, we source for monthly data for two stock indices of BSE Sensex (India) and JSE index (South Africa) in term of domestic currency of each economy. Gold price based on the US dollar. The monthly data obtained from Thompson Financial DataStream from January 1997 to April 2017 are employed. We start our investigations sample from 1997 because this year coexists with the beginning of frequent financial crisis such as Asian financial crisis of 1997 and Brazil currency crisis of 1998, which increased turbulence in the financial markets. ADF unit root test is employed to test for the unit root in stock variable and gold price. In order to investigate the asymmetric impacts of gold price on Indian and South Africa stock market price, we employed an asymmetric ARDL model. The optimal lags specification is selected using the information criteria using Eviews software. Technically, we do not describe the bound test approach to testing for cointegration in this study, but the curious readers are advised to consult the reference (Pesaran, Shin, & Smith, 2001).

We adopted a partial sum technique to the gold price variable to detect its asymmetric impact on the stock market which is of great interest in our paper. The generic asymmetric ARDL error correction model is presented below;

$$\begin{aligned}\Delta SP_t = &\sum_{i=1}^{I}\beta_i \Delta SP_{t-i} + \sum_{j=0}^{J}\gamma_j \Delta GP_{t-j}^{+} + \sum_{k=0}^{K}\delta_k \Delta GP_{t-k}^{-} \\ &+ \theta\left(SP - \alpha_0 - \alpha_1 GP^{+} - \alpha_2 GP^{-}\right)_{t-1} + \varepsilon_t\end{aligned} \tag{1}$$

where *SP* and *GP* are stock price and gold price respectively, and $\alpha = (\alpha_0, \alpha_1, \alpha_2)$ is a vector of long-run parameters to be estimated. The partial sums of positive

and negative changes $\left(GP_t^+ \text{ and } GP_t^-\right)$ in Equation (1), in GP_t can be expressed as such

$$GP_t^+ = \sum_{i=1}^{t} \Delta GP_i^+ = \sum_{i=1}^{t} \max\left(\Delta GP_i, 0\right) \tag{2}$$

$$GP_t^- = \sum_{i=1}^{t} \Delta GP_i^- = \sum_{i=1}^{t} \min\left(\Delta GP_i, 0\right) \tag{3}$$

Theoretically, the long-run relation between the gold price and the stock market is negative. Based on the above formulation, the long run relation between the stock market and gold price increases is α_1, which is expected to be positive. Meanwhile, α_2 captures the long-run relation between the stock market and gold price decrease. Since these two variables are expected to move in the same direction, α_2 is expected to be positive. Therefore, these asymmetric effects justified the using the NARDL model to capture the asymmetric effects. We are not interested in the dynamic response, and hence we do discuss the computation of the dynamic multiplier.

4. Data Analysis and Empirical Findings

The probability values for the unit root tests in Table 1 below prompt us to accept the alternative hypothesis at first difference, hence we may conclude that the variables in question are indeed first order integrated variables. This implies that estimating our equation in a different form may be highly spurious and will lead to losses of long-run information; we may, therefore, need to test for cointegration among the variables.

It is wise to select the optimal lag for the ARDL model to be estimated because; the subsequent tests and the dynamic information needed will be based on the model selected for estimation. Estimation of too much parameter will lead to useful information loses and also, selection of too much lag will reduce the available data for estimation, and less degree of freedom will be available thereby making the result shaky. We used the Akaike information criterion to select the optimal lag for the estimated ARDL model. ARDL (2, 0, 2) is selected for the South Africa Stock Market model while ARDL (1, 0, 3) is selected for the Indian Stock market model by the Akaike information criterion respectively.

Table 1. ADF Unit root test results.

	ADF @ Level	ADF @ 1st Difference
South Africa SP	−2.05	−4.86***
India SP	−1.17	−6.80***
GP_t^+	−1.94	−4.77***
GP_t^-	1.96	−4.01***

*, **, *** denotes significance at 10%, 5% and 1% respectively.

Table 2 below shows the ARDL bound test for both the South Africa Stock Market model and the Indian Stock Market model. The calculated bound test F-statistics for the two models are significant at conventional levels, and we may conclude that the long run relation expressed above for the South African and Indian stock market is empirically valid.

The coefficients of the long-run asymmetric relationship between stock price and gold price for the South African and the Indian economy are reported in Table 3. We can see from the results that stock price response positively and significantly to inflation in gold price both in South African and Indian. Interestingly, stock market activities both in South Africa and Indian do not respond significantly to gold price deflation. However, the long run symmetric test result shows that inflation and deflation in gold price impacted asymmetrically on stock price both in South Africa and Indian. Table 4 indicates the outcomes of the short run asymmetric relationship between stock price and gold price in South Africa and Indian. It is obvious that asymmetric gold price historically played a role in the short-run dynamics of the stock price in South Africa and Indian. The error correcting term for both the economy is closed to a reasonable degree of accuracy. The null hypothesis of a short-run symmetric impact of gold price on the stock price for the two economies; South Africa and Indian, are rejected simultaneously.

Table 2. ARDL Bound F-test.

Country	F-test
South Africa	5.49***
Indian	6.14***

*, **, *** denotes significance at 10%, 5% and 1% respectively.

Table 3. Asymmetric ARDL Estimated long-run parameters.

Dependent variable: *SP*

	South Africa	Indian
GP_t^+	18.034***	2.566***
GP_t^-	7.530	0.347
C	11283.58***	1713.76***
Long-run symmetric test		
H_0 = symmetry		
H_1 = asymmetry		
t-statistic	−2507**	3.64***
F-Statistic	6.289*	13.319***
χ^2-(1)	6.289*	13.319***

*, **, *** denotes significance at 10%, 5% and 1% respectively.

Table 4. Asymmetric ARDL Estimated short-run parameters.

Dependent variable: ΔSP_t

	South Africa	Indian
ΔSP_{t-1}	−0.137**	---
ΔGP_t^+	0.884***	0.153***
ΔGP_t^-	5.585**	1.770***
ΔGP_{t-1}^-	5.247**	0.555
ΔGP_t^-	--	1.670***
ecm_{t-1}	−0.048***	−0.059***
Long-run symmetric test		
H_0 = symmetry		
H_1 = asymmetry		
t-statistic	4.437***	4.859***
F-Statistic	19.687***	23.618***
χ^2-(1)	19.687***	23.618***

*, **, *** denotes significance at 10%, 5% and 1% respectively.

5. Conclusion

The central theme of this review is to test for the validity of the asymmetric impact of gold price on stock market price. We use South Africa, and Indian monthly data spanned January 1997 to April 2017 in order to base our findings with robustness. They conclude that there exist a long run asymmetric relationship between the stock market and gold price both in South Africa and Indian. Ultimately, we adopted three types of test to investigate the asymmetric impacts of gold price on Indian and South Africa stock market price. These three tests simultaneously concluded that the impact of gold price inflation and deflation on stock price varies, both in the short run and long run respectively.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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