Reassessment of linkage between stock prices and gold prices: A causal investigation

Tariq Aziz

Abstract This research aims to understand the connection between the capital market and the gold market. To understand the link between gold prices and equity prices and vice versa, the vector autoregression model (VAR) is estimated, and the Granger causality test is performed in the framework of VAR. Unit root tests such as the Augment Dicky Fuller test and Phillips-Pierrion test are conducted to check for the stationarity of the data. Johansen’s cointegration test is conducted to check for cointegration between two time series. We utilized weekly data from June 7, 2009, to December 25, 2021. Stock indices of three countries, namely, Saudi Arabia, the United Arab Emirates, and Turkey, are used in the paper. Gold prices are in the currency of selected stock markets. According to the findings, unidirectional causality exists only in the case of Turkey, where it runs from stock returns to gold returns. Numerous articles have attempted to clarify the connection between the gold market and stock exchanges. This paper utilizes the most recent data and tries to understand the linkages among three countries that are major buyers of gold.

Keywords: stock returns, granger causality, VAR models, Johansen cointegration

1. Introduction

Gold is one of the most unique metals in the world, and since it is scarce, it is also one of the precious metals bought and sold in the world markets. Currently, gold prices are rising again due to a bearish trend in stock markets worldwide. Gold is used in jewelry making, and it is bought as an investment. Investors withdraw from high-risk assets during periods of inflation and economic downturns, preferring instead to buy gold as a hedge against inflation. Gold also serves as a hedge against currency depreciation. As financial markets grow increasingly interdependent, it becomes essential to evaluate the connection between the gold market and the capital market.

A multitude of investigations in the literature address the connection between stock exchanges and gold. Hillier et al. (2006) underline that gold offers significant benefits for diversification during times of extreme market volatility in the U.S. Baur and Lucey (2010) explored how stocks and gold are related. They demonstrate that gold is a hedge against equities and a haven for investors during capital market downturns. In contrast to that assertion, gold is a poor safe haven according to Joy (2011). In their 2013 investigation on the connection between stocks and gold in the context of the U.S., Hood and Malik (2013) note that gold is utilized as a kind of hedge and a safe haven in times of uncertainty. Ji et al. (2020) look into using gold as a secure asset in cases involving the United States, Europe, and China. They noted that in all three, gold is a dependable shelter. Sharma and Karmakar (2022) used the GO-GARCH EVT copula technique to determine whether gold may be used as a hedge and is beneficial for diversifying portfolio risk during a downturn.

In this scenario, examining the linkage between the gold market and the equity market has become important. Researchers have utilized various econometric tools to explore the connection between gold and stock exchanges. The Granger causality model is employed in this work to assess whether there is a connection between the price of gold and the performance of the capital market. This assessment is necessary because previous research has provided findings that are inconsistent with one another. The remainder of this paper is organized as follows: The pertinent literature is discussed in Section 2. Section 3 discusses the methods used in the current study. The findings of the empirical analysis are presented in Section 4 of this document. Section 5 of the paper offers a conclusion.

2. Literature Review

The connection between stock exchanges and gold prices has frequently been an area of exploration in various studies. In this section, a few selected studies are presented.

Smith (2001) examined the connection between the US gold market and the capital market and established a link between the two markets throughout the study period. Miyazaki et al. (2012) explored the connection between US gold and...
stocks. To calculate the correlation between two variables, they employ a dynamic conditional correlation model. They note that gold is a safe haven when the economy is facing financial stress. The comparatively stable state of gold prices in comparison to stock markets was evaluated by Coudert and Raymond (2011). They examined the G7 nations’ markets. They examined the association between two variables using bivariate conditional variance. The authors noted that the G7 nations view gold as a safe haven. Patel (2012) examined the connection between macroeconomic factors and stock market gold prices. Note that all of the variables under investigation have a long-term relationship. From 2000 to 2014, the connection between gold prices and the Istanbul 100 stock index was examined by Aydin and Cavdar (2015). Over the period of the Turkish market under study, they discovered no correlation between gold prices and the capital market. Using the VAR methodology, they examined the connection between gold prices and the stock market. Anand and Madhogaria (2012) examined the connection between gold prices and the capital market in the U.S., the UK, Japan, India, and Germany. Using a Granger sacrifice test, they examined these markets between 2002 and 2011 and discovered that, except for India, stock Granger causes gold, while stock Granger causes gold for all other markets. Chkili (2016) looks into the connection between the BRICS stock exchanges and the gold market. The relationship between stock variables was examined using the DCC model. He points out that gold can serve as a secure hedge when markets are unstable. Shiva and Sethi (2015) investigated the connection between the Indian and US equities and the gold market. They employ the Granger causality test for this purpose. These countries utilize S&P from the USA and CNX NIFTY from India. They contend that there is a causal connection similar to that between gold prices and the CNX, NIFTY and S&P. The connection between Indian stock prices and gold prices was examined by Singh and Sharma (2018). They employed Granger causality, variance decomposition, and the vector error correction model. Precrisis, crisis, and postcrisis periods were used to segment the examination period. Their research demonstrated a long-term connection between pre- and postcrisis characteristics. However, they do not discover any connection to the postcrisis period. Iqbal (2017) investigated the connection between stock exchanges in three distinct nations and gold prices. Quantile regressions and EGARCH modeling were used to assess the relationships between the variables. They noted that although gold serves as a safe haven, this function relies on the health of the gold market. The connection between the stock markets of seven nations and the price of gold from 2002 to 2018 was examined by Tiwari et al. (2019). The authors analyzed the associations using quantile-on-quantile regression. These findings imply no connection between gold prices and stock prices. He et al. (2020) investigate the return and volatility spillover between the Chinese and American stock markets and gold. They use daily data from both countries’ stock and gold markets from January 4, 2000, and November 30, 2018. They discovered that in the cases of China and the U.S., volatility in the gold market affects the stock market. Gold is cointegrated with financial factors and macroeconomic variables, according to Yaqoob and Iqbal (2021). Sivarethanmohan et al. (2021) noted that gold prices Grangerize the Nifty market. Natarajan et al. (2021) examined the connection between the capital market and asset prices. In the case of India, they discover that gold prices have an effect on equity. Information transmission between the S&P 500 and gold prices was explored by Hung et al. (2021) using wavelet coherence and the Diebold and Yilmaz (2012) spillover index. They noted that information transfer overflow affects the S&P 500 and gold prices. The association between gold and ten sectoral Islamic indices was examined by Naeem et al. (2021) using the quantile-on-quantile method. They observe an unbalanced link between Islamic indices and gold. Additionally, they validate the lead-lag relationship between Islamic indices and gold. Saji (2021) investigated the relationship between gold and the Indian capital market. The sample period ranged from January 1999 to December 2019, and monthly data were used. For the purpose of examining the relationship between two variables, they used the Granger causality test and the vector error correction model. They discover a causal connection between gold and Indian stocks. They uncover a long-standing link between the prices of equities and gold. Yousaf et al. (2021) explore the connection between the stock exchanges of a few nations in Latin America and the gold market in 2021. Using daily data from January 2000 to June 2018, they use the VAR-BEKK GARCH approach. According to their findings, in the cases of Brazil and Chile, there is a transmission of volatility in both ways between the gold and stock markets. The relationship between gold and the U.S. stock market was examined by Triki et al. (2021). They employed a dynamic copula to assess the relationship between two variables. The time frame for their sample is January 1985 to December 2018. They observe that gold serves as a safe haven when markets are stressed; otherwise, gold and stock markets do not interact strongly during regular times. Zeinedini et al. (2022) look at the association between gold prices and the capital market in Iran during the COVID-19 epidemic. From February 20, 2022, through January 30, 2021, they collected data daily and employed the quantile regression approach. They detected no causal connection between Iran’s gold market and the capital market. Mamcarz (2022) explored the connection between gold and capital markets in Finland, Sweden, and Norway. She uses the VAR model, variance decomposition, and the impulse response function to investigate the connection between the Nordic stock markets and gold. According to the study’s findings, the gold market affects the Norwegian stock market but not the stock markets in Finland or Sweden. Drake (2022) looks into the connection between capital market returns and gold during several recessions. The study’s data spans January 2, 1990, and March 3, 2021. She used the London Bullion Market’s gold prices and the S&P 500 Total Return Index’s stock index. The analysis reveals a favorable correlation between gold and the stock market during the COVID-19 period. To determine whether the Indian capital market has an equilibrium relationship with gold, Nautiyal (2022) examined this relationship. They deploy the autoregressive distributed lag (ARDL) model for assessing the connection between two variables. Their sample
spans the years 1990 to 2016. They noted that gold and the capital market are in long-term equilibrium. The unpredictability of the gold market may affect its unpredictability both in the short and long term.

3. Data and Methodology

3.1. Data

This study uses time series data obtained from two websites, Investing.com and the World Gold Council. It examines three primary consumers of gold, i.e., Saudi Arabia, the United Arab Emirates, and Turkey. The Tawadul all shares index is used as a proxy for the Saudi Stock Market’s ADX General is used as a proxy for the United Arab stock market, and the BIST 100 is utilized as a proxy for the Turkish stock exchange. Weekly data and sample periods ranged from June 7, 2009, to December 25, 2022. Before applying any tests or models, all the data were converted to their natural logarithmic form.

3.2. Johansen’s cointegration test

Johansen’s cointegration method is one of the most widely used methods for checking for cointegration between variables. The null hypothesis is that there are no cointegrating equations. If more than one nonstationary series combines and the results are stationary, then the combined time series are cointegrated. To apply for Johansen’s cointegration test, unit root tests such as the ADF test and PP test are employed as a first step to check whether existing series are in their level form or stationary. Two likelihood ratios, namely, the trace statistic and max eigenvalue statistic, are employed to check for cointegration in the case of Johansen’s cointegration test. If two statistics provided conflicting results, then the result provided by the trace statistic was considered (Johansen & Juselius, 1990).

3.3. Granger Causality test

This test provides a causal relationship between two variables. This paper explores the variables’ lead-lag connections. The bivariate pth-order VAR model for examining Granger causality is given in Equations (1) and (2). In this paper, there will be a set of three VAR models that check six null hypotheses.

\[SP_t = \sum_{i=1}^{p} \theta_i GP_{t-i} + \sum_{j=1}^{p} \delta_j SP_{t-j} + \epsilon_{1t}\]  

\[GP_t = \sum_{i=1}^{p} \phi_i SP_{t-i} + \sum_{j=1}^{p} \gamma_j GP_{t-j} + \epsilon_{2t}\]  

If equation (1)’s null hypothesis fails to be accepted, the conclusion is that the series SP Granger causes the series GP. In this manner, we can test whether there is causality between two variables or not and whether causality is unidirectional or bidirectional. To use Granger causality in the VAR model, two variables must not be cointegrated. To check whether cointegration occurs between variables, the Johansen cointegration test is used. If Johansen’s cointegration does not show any cointegration between variables, then the Granger causality test in the vector autoregression model is used; however, if cointegration is shown by the Johansen cointegration test, then an error correction model is applied.

4. Empirical Results

Six time series are used to conduct this analysis. Three time series are stock indices that represent three major consumers of gold, namely, Saudi Arabia, the United Arab Emirates, and Turkey, and three time series represent gold prices in the local currency of the respected countries. Table 1 offers descriptive statistics for the time series analyzed in the study. Of the three examined stock indices, the stock index representing the UAE showed the highest variation, whereas the stock index representing Turkey showed the lowest variation. Gold prices are expressed in terms of currencies that correspond to three countries. The highest variation in gold prices is noted in the case of Turkey, whereas the variation in the case of the UAE and Saudi Arabia is similar. The Jarque-Bera test examines the normality of the time series. For all of the time series investigated in the article, the existence of a normality hypothesis was ruled out. Table 2 presents the results of the unit root tests. Unit root tests are performed using the augmented Dickey–Fuller (ADF) test and Phillips–Perron (PP) test. All the stock indices and gold prices of the respective countries are logarithmically converted before the application of the unit root test. The augmented Dickey–Fuller test and Phillips–Perron test both indicate that all the series are nonstationary at the level. Thus, to check for stationarity, we take the first difference between all the timer series and run unit root tests once more. The results obtained indicate that, at the first difference level, each of the series is stationary. Thus, all the time series have first-order integrations. The results obtained from the Johansen cointegration test are presented in Table 3. Johansen’s cointegration test is utilized for assessing whether there is a long-term trend because all the time series have unit roots at that level. The trace statistics and maximum eigenvalue values indicate that there is no cointegration. This means that there is no long-term association between the stock indices of the selected countries and the gold prices of the selected countries. Table 4 provides the results for the lag-length criteria. To establish the right lag length, the Akaike information criterion, the Schwartz information criterion, and the Hannan–Quinn information criterion are utilized. The AIC is used for the selection of the optimal lag length. Table 5 presents the results of the Granger causality test in the framework of the vector
autoregression model. There exists unidirectional causality only in the case of Turkey, where it runs from stock returns to gold returns. In the case of Turkey, the null hypothesis of unidirectional causation is rejected, suggesting that stock returns have an influence on gold returns. Reverse causality does not exist in the case of Turkey. However, there is no causal relationship between Saudi Arabia and the U.S. Emirates. This is because the null hypothesis of a causal connection between stock returns and gold returns, as well as vice versa, is rejected in the case of both countries.

5. Conclusions

This article studies the connection between gold returns and stock returns for selected stock indices of Saudi Arabia, the United Arab Emirates, and Turkey. The Granger causality test in the framework of vector autoregression is employed to explore the connection between two variables. The sample period is from June 7, 2009, to December 25, 2022. Notably, unidirectional causality exists only in the case of Turkey, for which it runs from the stock market to the gold market. However, no causal link is found between Saudi Arabia and the United Arab Emirates. These findings are in line with the findings of Anand and Madhogaria (2012) and Hood and Malik (2013). These results may be utilized by investors who are interested in these countries' stock markets and gold markets and can be used for making decisions while making investment decisions. One limitation of this research is that the sample period was not divided into subsamples. Subsamples enable us to understand whether there has been a shift in linkage between the variables. The sample period can be divided into pre-COVID, during-COVID, and post-COVID periods. This approach helps us demonstrate whether there have been any changes to the connection between the gold market and the equity market. Furthermore, in addition to using a causality check, further analysis can be performed using volatility modeling to determine how volatility in one market affects volatility in another.

Ethical considerations

Not applicable.

Conflict of interest

The authors declare no conflicts of interest.

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References


