The impact of gold and crude oil prices on stock market in Turkey: Empirical evidences from ARDL bounds test and combined cointegration

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ARTICLE INFO

Keywords:
Stock prices
Oil prices
Gold prices
Cointegration
Causality

ABSTRACT

This paper investigates the long-run and short-run interaction between stock prices, gold prices and crude oil prices by applying monthly data from Turkey for the period between January 1986 and November 2016. This study uses the autoregressive distributed lag (ARDL) model to estimate the cointegration and short-run relationship. The robustness of the ARDL bounds test of cointegration is confirmed using the newly-developed combined cointegration, which also provides the same evidence for a strong long-run relationship. Additionally, this study uses FMOLS, DOLS and CCR cointegrating equations to examine the long-run coefficients between the variables. The evidence reveals that both short-run and long-run results confirm negative relationship between the gold price and stock prices, and a positive relationship between crude oil and stock prices. Furthermore, stock price converges to its long-run equilibrium position by 0.39% speed of adjustments using channel of gold prices and crude oil prices. Finally, the result of the Granger causality test indicates a short-run, long-run and joint unidirectional causation from gold prices to stock prices.

1. Introduction

Recently, both oil and gold prices in the global market have experienced substantial changes in value. The oil price (crude oil) has decreased substantially from $133.87 in July 2008 to $46.44 in November 2016; meanwhile, the gold price has increased substantially from $347.48 at the time of the Borsa Istanbul in Turkey was opened in November 2016. This article articulately investigates whether movements in these prices have common effects on stock prices in Turkey. This study is particularly interested in whether gold prices lead a change in stock prices as it is believed that there is substitution between these two markets in the preferences of the investors. Soytas et al. (2009) explained that there is a high level of gold ownership in Turkey. Furthermore, Baur and McDermott's (2010) paper examined the role of gold in the global financial system and tested the hypothesis that gold represents a safe haven against stocks for major emerging and developing countries. Based on their findings, for the major European and US stock markets, gold is both a hedge and a safe haven; however, this assertion is not valid for other countries and emerging markets. This study also argued that gold may act as a stabilizing force for a financial system by reducing losses in the face of extreme negative market shocks. This suggests that, when financial turmoil occurs, investors prefer to hold assets that protect their investments. This raises an important question that should be investigated in terms of whether gold is indeed a secure investment in terms of protecting an investor's portfolio. Therefore, this leads to the motivation for this study, which is to investigate whether the variables concerned are connected or not as well as the sign of this possible connection. Consequently, with the high level of gold ownership and the recent alternative investment opportunities in Turkey (e.g., opening bank accounts for gold or holding gold as an investment), it will be beneficial to investigate the relationship between gold and stock prices. Additionally, the article will examine whether the decrease in crude oil prices in the global market has had any effects on stock prices in Turkey. In the same manner as other prices, the crude oil price is an important barometer for economies as changes in the price can be key indicators for countries. Based on the Efficient Market Hypothesis, when new information enters a market, this can directly impact the investors’ perceptions, causing them to revise their portfolios or investments and these changes are immediately priced in the financial markets. Until June 2008, crude oil experienced a constant upward trend in global markets; however, with the sudden crises that impacted the United States, it began to lose its value. After these crises, it began to increase again until June 2014, when it decreased substantially and reached its lowest level by the end of 2016. After 2008, the price crude oil experienced a series of peaks and troughs. For this reason, this study also investigates crude oil as an important variable in terms of the interaction between stock prices and gold prices. In this regard, the article
will specifically analyse the joint movements and relationship between the prices via applying the ARDL Bounds test and Bayer-Hanck combined cointegration test in order to investigate the long-run equilibrium. Additionally, the long-run coefficients will be produced by FMOLS, DOLS and CCR, and the short-run relationship will be investigated by examining the ARDL short-run coefficients and error correction term. Furthermore, this study will apply the Granger causality in short-run, long-run and joint (short-run and long-run) forms in order to investigate the direction of causality. Moreover, to the extent of the authors’ knowledge, this study is the first to attempt to jointly analyse stock, oil and gold prices in the case of Turkey. The remainder of the article is organised as follows. Section 2 explains the Literature Review. Sections 3 and 4 explain the data and methodology. Section 5 provides the empirical results and discussion. Finally, Section 6 concludes the study.

2. Literature review

There are examples of previous studies that have analysed the relationship between stock, oil and gold prices. For example, Raza et al. (2016) examined the asymmetric impact of gold prices, oil prices and their associated volatilities on the stock markets of emerging economies. Another study by Jain and Biswal (2016) explored the relationship between the global prices of gold and crude oil, the USD-INR exchange rate, and the stock market in India. In another study by Kang et al. (2016), the oil supply shocks on the U.S. real stock return were investigated. Moreover, there have been studies that have analysed the relationship between oil and gold prices from different perspectives. For example, Tiwari and Sahadudheen (2015) explored the relationship between real oil prices and real gold prices. Additionally, Yaya et al. (2016) analysed the volatility persistence and return spillovers between oil and gold markets. The results obtained from this study revealed that the gold market should be used as a hedge against oil price inflationary shocks and the volatility of the oil market can be used to determine the behaviour of the gold market.

3. Data

The data is obtained from the World Bank Commodity Price Data (The Pink Sheet) for crude oil (Brent, $/bbl) (CB) and Gold ($/troy oz) (G), and the data were collected from the International Financial Statistics for stock prices (Equity price – EQ). The data set is on monthly basis and covers the period from January 1986 until November 2016.

4. Methodology

Prior to implementing the cointegration test among the estimated variables in the model, it is important to determine the order of integration by verifying the stationarity of the series. The study period contains significant upheavals that caused structural breaks. The traditional unit root tests such as ADF (Dickey and Fuller, 1979), PP (Phillips and Perron, 1988), DF-GLS (Elliott et al., 1996) and Ng-Perron (Ng and Perron, 2001) do not take structural breaks into account. Given this motivation, the present study utilized the Perron and Vogelsang (1992) unit root test that takes one structural break in a series into account, in order to identify the order of integration. The first form of the test is the additive outlier model (AO) that captures a sudden change in the series, if it exists. The second form is the innovative outlier (IO) model that captures any gradual shift in the series. However, many empirical studies, such as those by Maddala and Kim (2003) and Ben-David et al. (2003), have argued that one endogenous break is insufficient to identify the correct order of integration if the series contains more breaks. Moreover, the Perron and Vogelsang (1992) unit root test fails to deal with more structural breaks. Clemente et al. (1998) modified the unit root test proposed by Perron and Vogelsang (1992) by extending it to two structural breaks with a new set of critical values. Therefore, Clemente et al.’s (1998) unit root method is used, as it has the capacity to accommodate two endogenous structural breaks in the series. Furthermore Clemente et al.’s (1998) approach utilises two different forms of structural breaks, which are innovative outliers (IO) and additive outliers, represented by (AO). The former model allows gradual changes, whereas the latter permits sudden changes in the mean.

4.1. ARDL bounds test of cointegration

In order to investigate the relationship between LEQ, LG, LCB, this study utilises the ARDL bounds testing approach developed by Pesaran et al. (2001) to analyse the cointegration among the estimated variables. Various cointegration approaches, such as those by Engle and Granger (1987), Johansen and Juselius (1990) and have been applied to investigate the long-run relationship among the estimated variables. Although these methods can be applied to those series that have a unique order of integration, the ARDL bounds testing approach is more flexible when compared to the more traditional cointegration methods. This approach can be applied to any series that has a mixed order of integration. However, it must be verified that none of the variables is I(2) and the dependent variable must be I(1). The ARDL model for the standard log-log functional specification between stock price, oil and gold prices is as follows.

\[
\Delta \ln EQ = \beta_\Delta + \sum_{j=1}^{n_1} \beta_{j1} \Delta \ln EQ_{-1} + \sum_{j=1}^{n_2} \beta_{j2} \Delta \ln CB_{-1} + \sum_{j=1}^{n_3} \beta_{j3} \Delta \ln G_{-1} + \lambda \Delta \ln EQ_{-1} + \lambda_2 \Delta \ln CB_{-1} + \lambda_3 \Delta \ln G_{-1} + \nu t.
\]

where \(\nu t\) is the error term that must be white noise, while \(\Delta\) is the first difference operator. In order to analyse cointegration among the selected variables, the bounds test will be applied. The bounds test of cointegration is based on the Joint F-Statistics or Wald test, which is used to test the null hypothesis of no cointegration, \(H_0: \gamma_j = 0\), against the alternative of \(H_0: \gamma_j \neq 0\), where \(f = 1, 2, 3, \ldots\). The Wald test is applied in cases where there is more than one short-run coefficient of the same variable. The F-statistics value will be compared with the upper and lower bounds critical values. If the computed F-statistics value lies above the upper bounds critical values, then the null hypothesis of no cointegration is rejected. If the F-statistics value lies between the upper and lower bounds critical values, then the null hypothesis of no cointegration is inconclusive. In this case, following Kremers et al. (1992) and Banerjee et al. (1998), then the decision regarding the existence of a long-run relationship will be based on the error correction term. If the error correction term is negative and significant, this implies the existence of a long-run relationship among the estimated variables. However, if the F-statistics value lies below the lower bounds critical value, this indicates evidence of no cointegration among the estimated variables.

After the confirmation of cointegration has been established, the short-run model is estimated using the following equation.

\[
\Delta \ln EQ = \gamma_0 + \sum_{j=1}^{p_1} \gamma_{j1} \Delta \ln EQ_{-1} + \sum_{j=1}^{p_2} \gamma_{j2} \Delta \ln CB_{-1} + \sum_{j=1}^{p_3} \gamma_{j3} \Delta \ln G_{-1} + \psi ECT_{-1} + \delta t.
\]

The robustness of the ARDL model is investigated by using the combined cointegration methods. In their study, Bayer and Hanck (2013) reported the robustness of the ARDL model in the presence of a single cointegrating equation. Engle and Granger (1987) pioneered a residual based cointegration approach that is used to detect the presence of a long-run relationship among the variables. The Engle and Granger test can be applied to limited data that has a unique order of integration among the variables. However, a problem associated with this method is that it produces biased results due to its reduced explanatory power properties. Johansen (1988) introduced the maximum
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