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Impact of US Oil and Gold Prices on the Stock Market: An Asymmetric Analysis

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ABSTRACT

Aim of the Study: The research attempts to reconnoiter the asymmetric effects of oil & gold prices on the US stock market and investigates volatility also in the stock markets of incipient economies employing monthly data (January 2010 to June 2021).

Methodology: The researchers applied a non-Linear Autoregressive Distributed Lag model to figure out the short and long-term effects as well. The empirics show that the cost of gold has a positive effect on the cost of the stock market of large emergent BRICS economies, while the Indonesian stock market, Thailand, Mexico, and Chile have an adverse effect. In addition, oil prices hurt all rising stock markets.

Findings: The oil and gold volatility has a counter effect in both the short & long term in all emergent economies' stock markets.

Conclusion: The outcome shows that the emerging economies stock markets are more compromised by awful news reports and occasions that bring about questionable monetary conditions.

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Introduction

Recent decades have seen a rapid increase in the value and volume of emerging country stock markets, creating investment opportunities. Significant capital outflows from developed to emerging countries have also been observed. In spite of this, news and events occurring throughout the world have an impact on the stock markets of developing nations, which can lead to volatility and uncertainty. The globe is set to enter a period of highly volatile oil prices, according to historical swings in crude oil prices. According to Ji (2012), the global financial crisis of 2007–2008 had an effect on the crude oil market mechanism, and since the crisis, the direct link between the stock market & crude oil has been more prominent.

The causal interaction association between the return on the United States crude oil & stock market & gold prices is complicated & often ambiguous. In the empirical literature of macroeconomics and finance, the direction of causality is a controversial issue. Negative political shocks and global financial market anxiety have added to the complexity of their interaction. Gold and crude oil are strategic commodities. They're bought and sold in US dollars. As a result, fluctuations in the US dollar's external value have a substantial impact on crude oil as well as gold prices. The United States dollar is the basis of the global financial system. Undoubtedly, investors care about its worth. It's difficult to explain just why it matters. The justifications are continually changing. A weak dollar, it appears, improves stock prices. This implication, though, may eventually fade into the background. They're also commonly seen in institutional portfolios alongside global securities for risk diversification. Central banks also maintain gold, significant important currencies, and highly liquid secure short-term securities as reserves. Individuals and countries that export crude oil also invest in gold to protect their assets from inflation. In a nutshell, market turmoil causes ripples in other markets.

Parameters in various markets do not necessarily occur at the same time. Variations in inflation, interest rates, and currency rates are all common drivers of change. They have an impact on commodities, capital, currency, and job markets, which affect consumption and investment. As a result, it's critical to gain a better knowledge of how fluctuations in crude oil & gold prices affect stock values. When the market is unstable, gold investments are seen as a safe haven asset, a means of exchange, a foundation of wealth, a store of value, & a hedge against price increases (Baur & Lucey, 2010).

Due to the gold market's simplicity, it might be regarded as an alternative and appealing investment during times of financial uncertainty (Baur and McDermott, 2010). Furthermore, because of its growing association with inflation, gold is a suitable instrument for inflationary hedgerows (Bambinas & Panagiotidis, 2015). Buying gold can at least help you keep your money's worth during higher spans of price hikes (Goodman,1956). It may also be seen as a portfolio expansion due to its weak relationships with other assets, which may help in dampen the whole portfolio risk (Caner et al., 2013). For example, central banks maintain gold as a diversifier and a safety net against economic illiquidity (Caner et al., 2013; Chen and Lin, 2014; Kaufmann & Winters, 1989; Kumar, 2014). In spite of the significance of gold investments in portfolio diversification & equivocation, market precariousness is a negative factor. Gold prices that fluctuate less frequently signal more stable investment conditions (Baur, 2012). Understanding how gold markets operate is therefore crucial in order to make hedging decisions (Ewing & Malik, 2013). Investors are warned by the rising volatility of gold prices, which exposes them to risk and piques their curiosity about how stock markets respond to the volatility of gold price (Tully & Lucey, 2007). A complicated interaction between numerous interconnected economic factors affects stock prices. Macroeconomic considerations, such as the price of gold and crude oil, as well as their volatility, assert a greater influence on stock values.

The objective of the study is to explore the asymmetric impact of gold & oil prices on the stock market in the United States. The focus is on using an asymmetric technique rather than a traditional symmetric approach to make the analysis more relevant and accessible.

The remaining of article is distributed into five segments; section 02 gives the review of the literature, the next is describing the data and methodology, 4^{th} is about the results and finally, section 05 summarizes the concluding remarks and policy suggestions.

Literature Review

This part of the literature is concentrating on the asymmetric impact of oil & gold prices on the United States stock market & related factors such as the ER, interest rate, & unemployment. There are extensive and growing forms of empirical works on the pairwise and trilateral dynamic interactive relationships between/among crude oil, gold, and equity returns across developed and developing countries over various sample periods and using variability of data & econometric techniques. Furthermore, the pairwise link between macroeconomic factors such as changes in the rate of exchange, foreign money reserves, inflation rate, gold prices, and stock value was investigated using a regression equation model. Oil and gold, among other important commodities, have recently attracted a lot of research interest, owing to price hikes, and rising economic usage. The most widely traded commodity in the world is crude oil, whose price is also the most erratic. Since increases in gold's price appear to coincide with price changes in other pricey metals, gold is the market head in the costly metals market. This is a type of investment asset that is usually called a "safe haven" to protect against rising financial market risk. Rahman et al. (2018) investigated how the price of gold and crude oil affected the US stock market. They were taken the data from 1986 to 2016 and the used ARDL approach. They saw that all variables were in agreement that short-term changes in the price of oil & gold have a detrimental impact on the US stock market. While the oil price has little impact, the price of gold has a huge impact. Various techniques are used to analyze the impact. The gold and oil effect was also investigated by (Naeem et al. 2020) using QQR regression and QC methods. Following the GFC, the short-run positive lower tail inter-dependence between gold and the equity markets of the BRICS countries improves, while the long-term positive SR interdependence between gold and simultaneous returns quantiles of oil rises. The connection between crude oil prices, stock indexes, and metal prices in the United States economy from 1990M1 to 2017M3 was examined by (Husain et al., 2019). The findings show that whereas crude oil, silver, steel, titanium, and gold are net recipients of volatility spillover, gold, silver, palladium, and platinum are net sponsors. According to (Willem. 2019), higher oil prices benefit the US, boost the stock market, and have the opposite negative impacts when they decline. The effect of oil prices on United States real stock returns from 1973-2017 was examined by (Equiza-Goni. De, 2018). The local projections method and the empirical analysis were applied to achieve this. Based on the findings, dependent on the type of shock & industry, adverse consequences of oil price shocks are increased while positive advantages are decreased in the case of higher or raised oil prices in advance.

Rafiq et al. (2019) examined the linkages between the Islamic emerging markets & the international commodity market with the US stock market data taken from 1995-2019 & used the ARDL approach. The findings concluded that the Islamic Emerging stock markets and USA stock market are not long-term linked and the relationship between the USA and the international commodity market is also not long-term. Thus, it will be advantageous for the Islamic emerging stock market investors and the United States investors to invest in these markets as an alternative investment. Singhal et al. 2019 evaluated analyzed the relationship between the exchange rate, world oil prices, gold prices, and the Mexican stock market. The findings show that, in contrast to worldwide oil prices, gold prices have a positive effect on Mexico's stock market. While gold prices have no effect on the ER, oil prices have a negative impact. The relationship between crude oil and the American stock market is examined by (Li et al., 2020). The US stock market and crude oil are said to have a strong positive dynamic link that has strengthened over the course of the present financial crisis, according to Chicago Board Options Exchange. The results may project consequences for energy and monetary policy, which may have an impact on the expected process. (Jiang et al. 2020) used a parametric test of Granger causality in quantiles to look at how US partisan disagreements affected the cost of essential commodities. The results imply that the US political split affects oil and gold returns. When the market is in the lower quantiles, the partisan strife affects oil returns; but, when the market is in the higher quantiles, it affects gold returns. (Corner et al. 2015) reviewed the research on gold investments. These studies also discuss the productivity of the gold market, gold market bubbles, and the impact of inflation and interest rates on gold. In 2015, (Baffes et al.) examined the significant drop in oil prices. The finding also provides its causes, consequences, and policy responses. The oil price drop supports global growth and decreases global inflation. Oil price declines are often occurred due to a weak global economy and trailed by a decrease in inflation. The decline in inflation results in economic policy challenges in countries with unpleasantly low inflation. The drop in oil prices also helps with energy subsidies and tax reforms. (Elfakhani *et al.* 2009) studied the volatility in gold prices. These analyses show that the factors that influenced gold prices changed over time. To resolve the financial crisis, nations should refill their gold reserves to stabilize their currencies. The oil prices' impact on stock returns on the Shanghai Stock Exchange is examined by (Khan et al. 2019). The findings shows that oil prices and stock returns are co-integrated, with a raise in oil prices while negatively affecting stock returns on the Shanghai stock exchange and a lower turn in oil prices has a positive assertion.

Data and Methods

Data

The statistics for gold ($/troy oz) and crude oil ($/bbl) were taken from the source of World Bank Commodity Price data (The Pink Sheet), while the information for stock prices (Equity price - EQ) came from the IFS, International Monetary Fund data statistics. The data set is based every month and spans the months of January 2010 to June 2021.

Methodology

It is mandatory to test whether the variables are stationary or not before proceeding with the cointegration among the under-analysis variables in the model. Significant upheavals occurred during the study period, resulting in structural fractures. It is hard for the traditional stationarity tests i.e., unit root testing via ADF and PP etc. to handle the breaks. For this purpose, we are employing The Perron & Vogelsang (1992) test for unit-root, which takes into account one mechanical break in a progression and was utilized in the current investigation to establish the integration order. The first sort of test is the additive outlier model (AO), which detects an abrupt shift in the series if one occurs the innovative outlier (IO) model, on the other hand, captures any incremental change in the under-analysis sequence. Numerous pragmatic studies, of which some notable as by (Maddala and Kim 2003; Ben-David et al., 2003)., posited that if the series has multiple breaks, one endogenic break is inadequate to determine the best integration sequence. Furthermore, greater structural fractures are not taken into account by Perron and Vogelsang's (1992) unit root test. Erron and Vogelsang's (1992) unit root test was extended to two structural breakdowns by Clemente et al. (1998), who also provided a new set of critical values. To account for the two endogenous structural breakdowns of the series, the unit root approach created by Clemente et al. (1998) is used. Additionally, Clemente et al. (1998) employs two distinct types of structural breaks in their methodology: innovative outliers (IO) and additive outliers (AO) (AO). The previous model permits for dramatic alteration in the mean, in contrast to the latter model.

Autoregressive Distributed Lag Bounds Test Approach

So as to the cointegration among the estimated variables and look into the link between LEQ, LG, and LCB, this work used the Autoregressive Distributed Lag limits testing approach described by Pesaran et al. (2001). The long-term relationship between the estimated variables has been examined using a variety of cointegration techniques, including those proposed by Engle and Granger (1987) and Johansen and Juselius (1990). The Autoregressive Distributed Lag bounds method is more adaptable than the more popular cointegration methods, even though both can be used to series with a distinct integration order. Any mixed integration order series can be used with this approach. However, it must be shown that I am the dependent variable and that none of the other variables are I. (1). The ARDL model for the typical log-log functional specification between stock, oil & gold prices is illustrated below.

$$\Delta lneq = \alpha_0 + \sum_{i=1}^{N1} \alpha_{1i} \Delta lneq_{t-1} + \sum_{i=1}^{N2} \alpha_{2i} \Delta lncb_{t-i} + \sum_{i=1}^{N3} \alpha_{3i} \Delta lng_{t-i} + \gamma_1 \Delta lneq_{t-1} + \gamma_2 \Delta lncb_{t-1} + \gamma_3 \Delta lng_{t-1} + \mu_1 \mathrm{t} \qquad (1)$$

υt is the error term and Δ is the 1st difference operator. The bounds test will be used to investigate co-integration among the specified variables. For this unpinning ofb the is cointegration Wald test is utilized in tradition that basically make use of the F-stats, null hypothesis here is for no cointegration.

where the first difference operator is and vt is the residual term is required to be white noise. The boundaries test will be used to investigate co-integration among the variables that have been chosen. The limits test of cointegration is centered on the Common F-statistics or Wald test, which is used to test the null hypothesis of no long-term relationship existence, H0: f = 0, as opposed to the alternate H0: f 0, with f = 1, 2, 3. The Wald test is used when there are numerous short-run coefficients for a single variable. The crucial values of the upper and lower boundaries will be contrasted with the F test value. The null hypothesis that there is no co-integration is rejected if the estimated F-statistics value is greater than the upper boundaries critical values. If the result of the F-statistics is between the upper and lower bound critical values, the null hypothesis that there is no co-integration is inconclusive. (Banerjee et al. 1992) & (Kremers et al. 1992), both noted that the ECM term will be used to determine whether a long-run link exists in this circumstance (1998). If the ECM term is negative and substantial, the calculated variables exhibit a long-term connection. If the F-statistics value is less than the lower limits critical value, there is no proof of co-integration computes for the short-term dynamics within the cointegration between the calculated variables. The equation be; owes after the cointegration theory has been shown:

$$\Delta lneq_t = \beta_0 + \sum_{j=1}^{n1} \beta_{1i} \Delta lneq_{t-i} + \sum_{j=1}^{n2} \beta_{2i}\, \Delta lncb_{t-i} + \sum_{j=1}^{n3} \beta_{3i}\; \Delta lng_{t-i} + \sigma ect_{t-1} + z_t, \quad (2)$$

It is determined whether the ARDL model is valid using integrated cointegration methods. In the presence of a solitary cointegrating equation, Bayer and Hanck (2013) investigated the robustness of the ARDL model. Engle & Granger (1987) developed a method for finding long-run correlations between variables called residual-based cointegration. The Engle & Granger methodology can be employed when there is a lack of data and variables that integrate in a discontinuous order. Nevertheless, because of its weakened explanatory power qualities, this method yields biased outcomes. The maximum Eigen-value test, proposed by Johansen (1988), is used by academics due to the fact that it enables many co-integrating relationships across the series. The Phillips & Ouliaris co-integration test, a novel approach for investigating series co-integration, was created by Phillips and Ouliaris in 1990. While Banerjee et al. developed the ECM model based on the t-test, Boswijk (1994) developed the error correction model based on F-statistics (1998). To address some of the issues with earlier co-integration approaches, such as the ARDL co-integration approaches, this study uses the Bayer & Hanck (2013) joint co-integration methodologies.

This test will only be used for a series with a distinct integration order. The tests conducted by Engle & Granger (1987), Johansen (1988), Boswijk (1994), and Banerjee et al. (1998) support the null hypothesis that there is no co-integration in the Bayer-Hanck combined co-integration. Based on the Boswijk, Johansen, Engle, Granger, and Banerjee et al. tests, the joint results from this co-integration test are more dependable and consistent. Based on the P-values of the individual co-integration tests, Bayer and Hanck's (2013) composite co-integration employs Fisher's equations to calculate the statistical significance level.

$$eng \,\&\, gra - johan = -2[ln(p_{eng\&gra}) + ln(p_{johan})] \quad (3)$$

$$\mathrm{eng\&gra - johan - bos - bdm} = -2[\ln(\mathrm{p_{eng\&gra}}) + \ln(\mathrm{p_{johan}}) + \ln(\mathrm{p_{bos}}) + \ln(\mathrm{p_{bdm}})] \quad (4)$$

we do accept or reject the null hypothesis on the resultant value of the probability. If the p-value is less than 0.05, the critical value, we decide to reject the null hypothesis that posits that there is no cointegration. The Bayer and Hanck (2013) coupled cointegration approach produces these crucial values.

Long-Run Elasticities

The long-run relationship will be examined using a vector that is cointegrated by the single order that will be built. Numerous econometric techniques can be used in this situation to examine the long-term relationship between the estimated variables. As a result, this work makes use of the Stock and Watson's (1993) DOLS estimator and CCR, as well as the FMOLS approach of Phillips and Hansen (1990). By accounting for the serial correlation effect and the endogeneity test that results from the existence of a co-integrating connection, these methods provide asymptotic efficiency. Only when the I (1) variable co-integration condition is satisfied can the FMOLS, DOLS, and CCR be used. As a result, FMOLS, DOLS, and CCR will be used in this work to evaluate long-run elasticities.

Granger Causality Test

The Autoregressive Distributed Lag techniques, and the Bayer & Hanck co-integration test, indicate that the estimated variables have a long-run link, but they don't reveal the causal direction. If there isn't enough evidence of cointegration in a series, the difference variable in a limited VAR context might be used to analyses the causation. If the cointegration tests reveal a long-term link between the variables, an additional term called a one-period lagged error correction term (ECT t1) can be introduced to the model to explore Granger-type causality. This is crucial since Engle & Granger (1987) advised against using VAR estimations in the first difference if cointegrated series of order one are present. The vector error correction in this study can be explained as follows:

$$\Delta \mathrm{lneq} = \gamma_0 + \sum_{i=1}^{P} z_{1i} \Delta \mathrm{lneq}_{t-1} + \sum_{i=1}^{Q} z_{2i} \Delta \mathrm{lncb}_{t-1} + \sum_{i=1}^{R} z_{3i} \Delta \mathrm{lng}_{t-1} + \mathrm{uect}_{t-1} + \rho_{1t} \qquad (5)$$

where *ECTt*−1 represents the ECM term included in all equations. Using equation (5) there are three approaches to investigating Granger causality. Although, there is a lot of criticism on the granger causality but still it is widely use in the economics literature for the sake of to unpin the causality among the variables on stake or under examination. We do employ it regarding the causality determination that employs the Wald pattern algorithms for the long term relationship devours and error correction mechanism for the sake of to detect the short run dynamics within this long run relationship. In the long run, after a short-term shock, the variables in the Joint Causality Test, a two-source causation test, revert to equilibrium. According to Lee and Chang, this is referred to as a strong causality that can be evaluated concurrently utilizing the significance of the related coefficient of the lagged error correction term and the short-term relevant coefficient of the first differenced series (2008).

One advantage of this method, according to Pesaran et al. (2001), is the ability to compute both short- and long-run impacts in a single phase. The computation of 1- 3 normalised on 0 captures long-term effects, while the coefficients of the first differenced variables are used to quantify short-run consequences. They apply a typical F test of joint importance on the lagged level variables in order to determine whether the second can be deemed well-founded until an indicator of cointegration is established (2). As an alternative of using traditional critical values, this test makes use of two new asymptotic critical value bounds. Pesaran et al. (2001) claim that the revised F test design includes new critical values and an upper bound that accounts for all variables (0). It is assumed that there is a long-run relationship if the statistics show values above the upper critical value, regardless of whether the variables are I(0) or I(1), which is true for macroeconomic time order. This eliminates the need for pre-unit root inspection. This formula offers several benefits. First off, the long-run relationship test is better suited to small samples than the majority of conventional cointegration operations. Second, the Engle-Granger two-step method, which is less economical than our one-step formulation, is similar to the standardised ECM.

Table 1: *Empirical Results*

Panel A: Short-run coefficient estimates					
	Lag Order				
	0	**1**	**2**	**3**	**4**
ΔLNEQ		-0.096 (-2.7)			
ΔLNGOLD	-260.98 (-203.45)				
ΔLOIL	106.7 (261.19)	2.93 (2.8)			

Panel B: LR coefficient estimates		
Constant	**LNGOLD**	**LNOIL**
2.7 (2.07)	-334.23 (-55.16)	128.31 (71.56)

Panel C: Diagnostic statistics					
F	***ECM*t-1**	***LM***	***RESET***	***CUS*(*CUS*2)**	***Adj. R*2**
4.2	-0.7 (-56.37)	Prob. Chi-square[0.08]	Prob[0.092]	Stable	0.998

Note:

a. The amount enclosed in parentheses represents the t-absolute ratio's value; if it equals or exceeds 2, the variable will be significant.

b. The F-statistic value of the upper bound as usual 10% as 4.14 significance

c. LM is test for serial correlation. Its prob-chi square is insignificant because it greater than 5% so no serial correlation in the model.

d. Ramsey's specification test is RESET. It has insignificant probability value which is greater than 5% so the model is stable. Cusum test is also stable

Table 2: *Full Information Estimate of Nonlinear Autoregressive Distributed Lag Equation (5)*

Panel A: Short-Run Coefficient Estimates					
	Lag Order				
	0	**1**	**2**	**3**	**4**
ΔLnEQ	14.3 (2.7)	7.39 (1.75)	4.2 (1.32)		
ΔLnGOLD(POS)	-1.7 (-0.17)	-5.7 (-0.41)	2.48 (-0.16)	21.48 (2.00)	
ΔLnGOLD(NEG)	-35.14 (-2.3)	30.34 (1.8)			
ΔLnOIL(POS)	-2.1 (-0.3)	-8.92 (-1.5)			
ΔLnOIL(NEG)	**6.5**	**(1.2)**	**1.8(0.4)**	**-6.7(-1.6)**	**-13.2(-2.7)**

Panel B: LR coefficient estimates				
Constant	**ΔLnGOLD(POS**	**ΔLnGOLD(NEG)**	**ΔLnOIL(POS)**	**ΔLnOIL(NEG)**
25.8 (44.9)	-0.53 (-1.6)	-5.03 (-4.3)	0.5 (2.4)	1.2 (2.45)

Panel C: Diagnostic Statistics					
F	***ECM*t-1**	***LM***	***RESET***	***CUS*(*CUS*2)**	***Adj. R2***
4.04	-17.48(-2.84)	Prob. Chi-square[0.09]	Prob. [0.075]	STABLE	0.99

a. The amount enclosed in parentheses represents the t-absolute ratio's value; if it equals or exceeds 2, the variable will be significant.

b. The F-statistic value of the upper bound as usual 10% as 3.25 significance.

c. LM is test for serial correlation. Its prob-chi square is insignificant because it greater than 5% so no serial correlation in the model.

d. RESET is Ramsey's specification test. It has insignificant probability value which is greater than 5% so the model is stable. Cusum test is also stable.

Note: a. the number within the parenthesis is t-statistic in absolute values for significance its value equal or greater than 2 and if its value less than 2 then variables are not significant.

b. the upper bound critical value of f-statistics is 4.10 at 5% significance this results from perasan at.al (2001).

c. For serial correlation the Breusch-Godfrey Serial Correlation LM Test is used if the probability of Chi-square value is greater than 5% then the serial correlation will not exist if its value equal to or less 5% then the probability is significant and serial correlation will exit.

d. RESET is Ramsey's specification test using for specification error. If t-statistic is not significant then specification error will not exit and vice versa.

e. Normality test is checked on the test of skewness & kurtosis residuals if Jarque-Bera probability is not significant i.e greater than 5% then the model normally distributed and vice versa.

f. All coefficients are tested for stability using the CUSUM and CUSUMSQ procedures.

Conclusion

The research explores the short run and long run links between gold, stock & oil prices in a country Turkey. The Bayer-Hanck Combined Cointegration methodology and the ARDL bound test for cointegration are used in this study to study cointegration. Cointegration techniques are used to show factor cointegration. Using FMOLS, DOLS, and CCR, the long-term connection between the model's variables is also dissected. The long-run coefficient from cointegrating scenarios supports the idea that stock prices and gold prices are not correlated. Our findings are in favour of the notion that gold is a shelter for Turkish financial professionals looking to safeguard their holdings. The Granger causality also supports the association between stock prices & gold prices. According to causation, stock costs are caused by gold costs in the short-term, long-run, and mixed structures. Additionally, there is a positive association between unrefined petroleum and stock costs depending on the cointegrating conditions, indicating that raw petroleum has a major impact on stock costs. In any case, there is no proof of causality between stock costs and raw petroleum. Thus, it very well may be expressed that product costs assume a significant job in and affect the securities exchange in Turkey. Along these lines of different costs, these worldwide costs (oil and gold) are viable pointers for the financial specialists, and, considering these signs, speculators change their portfolios or ventures. Gold gives a chance to financial specialists to move their riches from the securities exchange to the gold market to shield themselves from conceivable speculation dangers. These findings are in line with the investigation by Baur and McDermott (2010), which also presented demonstration in favor of the gold market serving as a haven. We have also discovered proof of the asymmetrical relationship between the oil and gold prices and the US stock market.

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Conflict of Interest

Authors have no conflict of interest.

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