THE IMPACT OF UNCERTAINTY IN GLOBAL GOLD AND OIL PRICES ON STOCK MARKET INDEX RETURNS: THE CASE OF THE MIST COUNTRIES[1]

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ABSTRACT

The current study explores the impact of global gold price uncertainty on the stock markets of the MIST countries: Mexico, Indonesia, South Korea, and Türkiye. The study examined the crisis periods that started with the COVID-19 pandemic and continued with the Russia-Ukraine war, which caused uncertainty in gold and oil prices. Based on this, the study's data set consists of the daily closing prices between March 11th, 2020, and January 31st, 2023. The obtained data were analyzed using the Least Squares (ICC) and panel quantile regression (PQR) methods. There is a significant positive correlation between oil prices and oil volatility index with stock prices for the economies of Türkiye, Indonesia, and Mexico, and a significant negative correlation between gold prices and gold volatility index with stock prices for developing countries. There is also a significant positive relationship between gold and oil prices and stock prices for the developed country, South Korea's economy. A significant negative correlation has also been proposed between gold and oil volatility indices and South Korean stock prices. This study provides a novel contribution to the literature by examining the impact of simultaneous global crises namely the COVID-19 pandemic and the Russia-Ukraine war—on the stock market indices of MIST countries through the lens of uncertainty in both gold and oil markets. While most existing studies focus on a single commodity or analyze crises in isolation, this research distinguishes itself by investigating the combined effects of two major global shocks and incorporating both price and volatility-based uncertainty indicators. The findings suggest that policymakers should develop country-specific and differentiated financial stability policies by taking into account the uncertainties in gold and oil markets during crisis periods.

Keywords: *Covid-19, Russia-Ukraine war, gold volatility, oil volatility index, stock market index, index, oil prices, gold prices, MIST countries, Panel Quantile Regression.*
JEL Codes: *G01, G11, G15*
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[1] Compliance with the ethical rules of the relevant study has been declared.

KÜRESEL ALTIN VE PETROL FİYATLARINDAKİ BELİRSİZLİĞİN HİSSE SENETLERİ PİYASASI ENDEKS GETİRİLERİ ÜZERİNDEKİ ETKİSİ: MIST ÜLKELERİ ÖRNEĞİ

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ÖZ | Bu çalışma MIST ülkeleri olan Meksika, Endonezya, Güney Kore ve Türkiye borsalarının küresel altın ve fiyatlardaki belirsizlikten etkilenip etkilenmediğini belirlemeye çalışmıştır. Çalışmada, Covid-19 pandemisi ile başlamış ve Rusya-Ukrayna savaşı ile devam etmekte olan, altın ve petrol fiyatlarında belirsizliğe neden olan kriz dönemleri incelenmiştir. Buna dayanarak, çalışmanın veri seti 11 Mart 2020 ile 31 Ocak 2023 arasındaki günlük kapanış fiyatlarından oluşmaktadır. Elde edilen veriler En Küçük Kareler (ICC) ve panel kantil regresyon yöntemleri kullanılarak analiz edilmiştir. Çalışmadan, Türkiye, Endonezya ve Meksika ekonomileri için petrol fiyatları ve petrol volatilite endeksi ile hisse senedi fiyatları arasında anlamlı ve pozitif bir korelasyon, gelişmekte olan ülkeler için altın fiyatları ve altın volatilite endeksi ile hisse senedi fiyatları arasında anlamlı ve negatif bir korelasyon olduğu sonucuna varılmıştır. Ayrıca, gelişmiş ülke Güney Kore ekonomisi için altın ve petrol fiyatları ile hisse senedi fiyatları arasında pozitif ve anlamlı bir ilişki olduğu sonucuna varılmıştır. Ayrıca Güney Kore ekonomisi için petrol volatilite endeksi ile altın volatilite endeksi ve hisse senedi fiyatları arasında anlamlı ve negatif bir ilişki olduğu tespit edilmiştir. Bu çalışma, COVID-19 pandemisi ve Rusya-Ukrayna savaşı gibi küresel krizlerin eşzamanlı olarak hem altın hem de petrol piyasalarında oluşturduğu belirsizliklerin MİST ülkeleri borsa endeksleri üzerindeki etkisini incelemesi açısından literatüre özgün bir katkı sunmaktadır. Literatürde çoğu çalışma ya sadece bir emtia üzerine odaklanmakta ya da krizleri tekil dönemler olarak ele almaktadır. Bu bağlamda, iki büyük küresel şokun ortak etkisini ve hem fiyat hem de volatilite düzeyinde belirsizlik göstergeleri kullanılarak yapılan analizler, çalışmanın özgün yönünü oluşturmaktadır. Elde edilen bulgular, politika yapıcıların kriz dönemlerinde altın ve petrol piyasalarındaki belirsizlikleri dikkate alarak ülke bazlı farklılaştırılmış finansal istikrar politikaları geliştirmesi gerektiğini ortaya koymaktadır.

Anahtar Kelimeler: *Covid-19, Rusya-Ukrayna savaşı, altın volatilitesi, petrol volatilite endeksi, borsa endeksi, endeks, petrol fiyatları, altın fiyatları, MIST ülkeleri, panel kantil regresyonu*
JEL Kodları*: G01, G11, G15*
Alan: *İktisat*
Türü: *Araştırma*

1. INTRODUCTION

The stock markets are fundamental building blocks of economies concerning economic prosperity and long-term sustainability. Since it is challenging to determine when and to what extent the factors affecting stock prices will be influential, disclosing these factors along with stock prices may sometimes prove insufficient. In such situations, psychological behaviors tend to emerge among investors, and despite no change in market conditions, significant fluctuations in stock prices can occur due to the impact of these behaviors. Therefore, changes in stock prices depend on numerous economic variables. In this context, studies investigating the relationships between various macroeconomic indicators, including stocks, and making future inferences are becoming increasingly important for countries, investors, and financial circles (Sandal et al., 2017). Particularly in the last three years, following the COVID-19 crisis and the Russia-Ukraine war, global uncertainties have emerged; it is highly likely that factors such as oil and gold, which have wide trading volumes in the financial markets, significantly affect the volatility of stock returns (Engle and Patton, 2001; Bhowmik, 2013; Ma et al., 2016; Wei and Guo, 2016).

In December 2019, COVID-19 first appeared in China and was later declared a pandemic by the World Health Organization (WHO) on 11th March 2020. It has demonstrated its disruptive effects on the stability of the world's economies. To control the rate of spread of the COVID-19 pandemic, which is accelerating, and to minimize its adverse economic effects, all countries have had to take protective measures. The precautions taken to reduce the pandemic's spread have negatively impacted countries' economies, leading to a global crisis. To mitigate the consequences of this crisis, countries have promptly implemented monetary and fiscal policies (Küçükoğlu, 2021). These strict fiscal and monetary policies have caused changes in consumer spending and investment habits. The impacts of the COVID-19 pandemic began to decrease somewhat with the help of vaccines, but on February 24, 2022, the world economy was once again shaken when Russia declared war on Ukraine. Many European Union countries, especially the United States, began imposing sanctions against Russia. Following the sanctions, Russia, responsible for about 23.20% of global natural gas production, introduced price and shipment restrictions, resulting in production slowdowns and constraints in Europe and the United States. The ongoing Russia-Ukraine War, compounded by COVID-19, has dealt a heavy blow to the world's economies and is causing a recession in global economies. With the rise in global inflation due to the recession, countries have started to implement various measures, primarily interest rate hikes. The US Federal Reserve increased interest

rates by 25 basis points to 4.75% in early February 2023, signaling a probable continuation of the recession.

All of these global crises have caused uncertainty in oil and gold prices. The fluctuations in gold prices, known as a safe haven by financiers, can lead to changes in investment decisions. Similarly, fluctuations in oil prices, which are a fundamental input of production, can cause general price levels to rise, decreasing firm profit margins. This study was conducted to contribute to the literature with research results that could help investors make informed investment decisions in the current global crisis environment. The decrease in profit margins of companies traded on the stock market can cause changes in investors' investment decisions and cause a fall in the stock prices of these companies. The purpose of this research is to search whether the uncertainty in global oil and gold prices affects the stock markets of the MIST countries, namely Türkiye, South Korea, Mexico, and Indonesia In line with this purpose, the study considers the crisis periods that started with the COVID-19, which caused uncertainty in gold and oil prices and continued with the Russia-Ukraine war. The study data set consists of daily closing prices between March 11th, 2020, and January 31st, 2023. The dataset begins on March 11, 2020, as this is the date when the World Health Organization (WHO) officially classified COVID-19 as a pandemic.

MIST countries (Mexico, Indonesia, South Korea, and Turkey) have been defined by Goldman Sachs as new emerging markets with high growth potential, following the BRIC countries (O'Neill, 2011). In the literature, it is emphasised that these countries have similar sensitivities to global economic shocks and hold significant positions among developing countries (Sevinç, 2022; Ender Baykut and Diyar, 2021). Additionally, the common structural characteristics of these countries, such as openness to foreign trade, commodity dependence, and investment attractiveness, provide a suitable sample for comparatively analysing the impacts of uncertainties on stock markets during crisis periods. Another reason for selecting these countries is that, according to the IMF classification, Turkey, Indonesia, and Mexico are among the developing countries with similar levels of development. Additionally, Turkey's location in Eurasia, Indonesia's in Asia, and Mexico's in the Americas enhance the generalisability of the findings. The inclusion of South Korea in the study is important as it has successfully managed the pandemic as a developed economy and provides a comparison opportunity with other MIST countries.

In the literature, the effects of uncertainties on financial markets are often assessed through individual commodities such as gold or oil, and the impacts of crises are frequently confined to isolated periods. For instance, studies such as Dontoh et al. (2024) examine the impact of COVID-19 on gold, oil, and stock

markets in oil-exporting African economies; Li vd. (2022) focuses on gold and oil markets during COVID-19 in G7 countries; and Yousef and Shehadeh (2020) analyze the effect of COVID-19 on gold price volatility. These works predominantly investigate either the COVID-19 pandemic or the effects of the Russia-Ukraine war exclusively. Moreover, most of these studies concentrate on developed or BRICS countries. Examples include Morina et al. (2024), who investigate the impact of the COVID-19 pandemic and Russia's invasion of Ukraine on gold markets in the G7; Memon et al. (2024), who provide evidence on the effects of the Russia-Ukraine war and COVID-19 pandemic on stock market efficiency and herding behavior in G20 countries; and Jareño et al. (2023), which explores the effects of the COVID-19 pandemic on the term structure connectedness of BRICS countries. In this context, the present study addresses a significant gap by jointly examining two major global crises and simultaneously analyzing both price- and volatility-based uncertainties in gold and oil markets. Furthermore, this analysis is conducted on the MIST countries, a relatively under-researched but strategically important group of emerging markets. Thus, this study offers a meaningful contribution to the literature on the asymmetric effects of global uncertainties on developing markets.

2. LITERATURE REVIEW

In the literature, the impact of uncertainties on financial markets is mostly evaluated solely through individual commodities such as gold or oil, and the effects of crises are generally limited to specific periods (Dontoh et al., 2024; Li et al., 2022; Yousef and Shehadeh, 2020). Or the effects of the Russia-Ukraine war are generally focused on developed countries or BRICS countries (Morina et al., 2024; Memon et al., 2024; Jareño et al., 2023). In this context, the current study fills a significant gap in the literature by addressing both major global crises together and simultaneously analysing the price and volatility-induced uncertainties in the gold and oil markets. Additionally, this analysis has been conducted on the MIST countries, a relatively under-researched but strategically important group of emerging markets. In this respect, the study makes a significant contribution to the literature on the asymmetric effects of global uncertainties on emerging markets.

In the literature, rather than studies examining the impact of uncertainty in gold and oil prices on the stock markets of the MIST country group, there are more studies focused on the specific countries within the MIST group (Mexico, Indonesia, South Korea, and Turkey). Among these studies, Baek (2022) examined the asymmetric relationship between oil prices and exchange rates for the South Korean economy in the context of COVID-19. As a result of the study,

it was concluded that the COVID-19 pandemic was an important factor in influencing the asymmetric effect of oil prices on the KRW/USD exchange rate in both the short and long term. In their study, Salami et al. (2024) examined the impact of Russia's invasion of Ukraine on the BIST index, the Turkey real estate market index, the Turkey gold market, and the Turkey foreign exchange market. As a result of their studies, they concluded that there is a long-term cointegration relationship among the Turkish markets. The findings also indicate that the shock resulting from Russia's invasion of Ukraine had a positive effect on developed foreign currencies, while it had a negative impact on the currencies of developing countries like Turkey. In Tuna's (2022) study, using 363 days of recorded data from 11/03/2020 to 13/09/2021, the effects of the Covid-19 pandemic crisis on the volatility of oil prices, gold prices, and the VIX index on the Turkey BIST 100 index were examined using the Toda-Yamamoto causality test. As a result of the study, it was concluded that there was no causal relationship between oil prices, gold prices, and the VIX index with the BIST 100 index. In his 2021 study, Mutlu Çamoğlu examined the impact of the Covid-19 pandemic, oil prices, and exchange rates on the BIST petrochemical market. As a result of the study, it was concluded that the most significant determinant of the fluctuations in the BIST petrochemical index was the oil prices. Accordingly, while a shock in oil prices negatively affects the BIST petrochemical index, they noted that the petrochemical index responded positively to the shock in the pandemic index. Denie et al. (2024) in their study utilised data from February 24, 2022, to December 31, 2022, and from April 14, 2024, to April 30, 2024, to examine the impact of geopolitical developments on the Indonesian stock market, specifically the effects of oil, gold, and the DXY index, using the GARCH method. As a result of the study, they concluded that WTI oil price changes have significant positive effects on stock returns in Indonesia, gold price changes have insignificant positive effects on stock returns in Indonesia during geopolitical events, and the DXY Index has insignificant negative effects. In their study, Marwanti and Robiyanto (2021) examined the effects of volatility in oil and gold prices on Indonesian stock returns before and during the Covid-19 pandemic using the GARCH method. As a result of the study, they concluded that the volatility in oil and gold prices did not affect stock returns in either period. In their study, Lubis et al. (2021) examined the impact of the Covid-19 pandemic crisis on oil prices, gold, and currencies on the Indonesia Stock Exchange Index (JCI) using the Arch and Garch methods. As a result of the study, they concluded that crude oil prices did not have a significant effect on the JCI, gold prices had a significant and positive effect on the JCI, and the exchange rate did not have a significant effect on the JCI. In their study, Benavides et al. (2019) examined the impact of oil price

uncertainties on the Mexican stock market using the SVAR-MGARCH model, utilising data from 1975-2018. As a result of the study, they concluded that international oil price uncertainty does not have an instantaneous effect on stock market returns, but there are short-term asymmetric effects in response to positive and negative shocks in international oil prices.

A considerable body of research has analyzed the effect of gold and oil prices on stock returns, considering perspectives from developed and developing economies. Based on previous studies, Zeinedini et al. (2022) employed a method to evaluate the influence of global oil and gold prices on Iranian stock returns during the COVID-19 pandemic. Their analysis revealed no significant correlation between the Iranian stock market and global gold prices; however, a strong negative correlation was observed between OPEC oil prices and the Iranian stock market. Similarly, Chkili (2022) utilized a VAR model to examine the relationship between gold and oil prices and the Islamic stock market during turbulent periods, including the COVID-19 crisis. The study found a strong correlation with stock markets and crude oil prices. Furthermore, gold was identified as a safe haven during volatile market conditions, given the negative or nonexistent relationship between the gold market and the oil and stock markets. In another study, Ghanbari et al. (2022) noted the impact of foreign exchange rates, gold, and oil prices on the Tehran Stock Exchange. Their results indicated that the prices of the dollar, gold, and oil significantly influenced the overall price index of the Tehran Stock Exchange. Xiaozhong et al. (2022) conducted an Autoregressive Distributed Lag (ARDL) test to examine the effects of gold and oil price fluctuations on the Chinese stock market during the COVID-19 period, concluding that both gold and oil prices had a long-term negative impact on the Chinese stock market. Using a time-varying causality test, Zeren and Güngür (2021) assessed the relationship between the stock markets of BRICS-T nations and the prices of gold and Brent crude oil. Their findings suggested a bidirectional, time-varying causal relationship between these commodities and stock markets, with this relationship strengthening during periods of local and global crises. Similarly, Ocaklı (2020) applied Johansen Cointegration and Granger Causality tests to explore the causal link between oil and gold prices and the BIST100 index. The results indicated a long-term co-movement between the series and highlighted a unidirectional causality from the BIST100 index to gold, as well as from gold to oil. Shabbir et al. (2020), through an ARDL approach, analyzed the impact of gold and oil prices on the Pakistan Stock Exchange and concluded that these commodities significantly influenced the stock market. In a study focusing on the South African stock market, Morema and Bonga (2020) employed VAR-ADCC-GARCH methods and found significant volatility

spillover effects between the stock and gold markets, and between the oil and stock markets. Li and Du (2024) explored the dynamic interaction and asymmetric causality between oil and gold prices in the Chinese economy using the Granger Causality test. Their study concluded that changes in gold and oil prices exhibited a significant, fluctuating relationship with asymmetric causality. Finally, Tursoy and Faisal (2018) used the ARDL bounds testing approach to investigate the relationship among stock, oil, and gold prices in Türkiye. Their findings demonstrated a positive correlation between stock and crude oil prices, and a negative correlation between stock and gold prices, both in the short and long run. Similarly, Sandal et al. (2017), using Engle-Granger and Johansen cointegration tests, examined the causal relationship between the Borsa Istanbul (BIST 100) index and the prices of gold and crude oil, concluding that the series were not cointegrated, indicating no long-term equilibrium relationship.

Moreover, the analysis indicated an unidirectional relationship from gold prices to stock prices, with no causal relationships observed in other cases. Using a nonlinear ARDL approach, Raza et al. (2016) highlighted the asymmetric impacts of gold and oil prices, as well as their respective volatility, on the stock markets of developing countries. Their findings indicated that while gold prices positively influenced the stock values of major BRICS economies, they had a negative impact on the stock markets of Indonesia, Thailand, Chile, Malaysia, and Mexico. Additionally, the study suggested that the stock markets of developing nations were negatively affected by oil price declines and by fluctuations in gold and oil prices in both the short and long term. Similarly, Afsal and Haque (2016) examined the relationship between gold and stock prices in the Saudi Arabian economy. Their analysis found no dynamic relationship between the two variables. Gökmenoğlu and Fazlollahi (2015), employing the ARDL cointegration method, investigated the relationship between gold and oil prices and S&P 500 stock returns, concluding that a long-term equilibrium relationship existed among the variables. In another study, Baig et al. (2013) applied the Johansen and Juselius cointegration tests to examine the relationship between gold and oil prices and KSE100 returns. Their findings suggested that volatility in gold and oil prices negatively affects stock markets in developing countries over both the short and long term. Finally, Sreenu (2022) analyzed the impact of crude oil price uncertainty on stock returns in India using the quantile regression (QR) approach, offering further insight into the effects of commodity price volatility on stock market performance.

The volatility in oil prices had a detrimental effect on stock returns. Using a time-varying causality test, Bouslama (2023) evaluated the relationship between the crude oil market and the stock indices of BRICS countries within the

framework of financial crises from 2008 to COVID-19, using daily data from the period of November 14, 2010, to November 29, 2022. As a result of the study, volatility transmission is permanent, and the impact of crises is characterized by fractional cointegration between crude oil and financial markets. There are strong, bidirectional causal connections between the variables, and particularly positive short-term relationships.

3. METHODOLOGY

3.1. Data

This study was conducted to investigate the extent to which the stock markets of MIST countries (Mexico, Indonesia, South Korea, and Türkiye) are affected by uncertainty in global gold and oil prices. Also, the study considers crisis periods starting with the COVID-19 pandemic crisis that led to uncertainty in oil and gold prices, as well as the ongoing crisis resulting from the Russia-Ukraine War. As the first COVID-19 cases in each country occurred at different times (Indonesia on March 2nd, Türkiye on March 11th, Mexico on February 28th, and South Korea on January 20th), daily closing prices between March 11th, 2020, and January 31st, 2023, when Covid-19 was announced a pandemic by the WHO, were used to synchronize the data. Brent crude oil prices in dollars were obtained investing.com, and gold prices in dollars were obtained from onsaltinfiyati.com for the study variables. The gold volatility index was obtained from cboe.com and closing prices of the crude oil volatility index with closing prices of stock market indices were also obtained from investing.com. As the special days of the countries included in the study may differ, prices related to special days for oil, gold, and the stock market were not taken into account for data synchronization purposes. To stabilize variance and achieve normality, all variables considered in this research were transformed using natural logarithms. Table 1 summarizes the characteristics of the series.

Table 1: Variables of the Model

Country	**Stock Market Index**	**Oil Prices (USD)**	**Gold Prices (USD)**	**Gold Volatility Index**	**Crude Oil Volatility Index**
		lnOP	lnGO	lnOVZ	lnOVX
Türkiye	BIST100	https://tr.investing.com/	https://www.onsaltinfiyati.com/gecmis-yilla	https://www.cboe.com/us/indices/dashboard/gvz/	https:// ww
Mexico	IPC (MXX)				

South K.	KOSPI		rdaki-ons-altin-degerleri.php		w.investing.com/
Indonesia	JKSE	Investing.com.			

The data used in the study were obtained from online data platforms such as Investing.com, CBOE (Chicago Board Options Exchange), and onsaltinfiyati.com. Among these sources, Investing.com is frequently referenced in academic research due to its extensive dataset on financial markets and its widespread global use. Similarly, CBOE is an original and reliable source, especially in terms of volatility indices (such as VIX, GVZ). Onsaltinfiyati.com, on the other hand, is a Turkey-based financial portal that provides historical data for gold prices. While the generally used sources are practical and widely accessible, it should be noted that there may be reporting errors or delays, especially in developing countries.

3.2. Model Specification

The research models were constructed as follows, taking inspiration from the studies of Lee and Zeng (2011), Tsai (2012), and Zeinedini et al. (2022).

$$\ln BIST100_t = c + \beta_1 \ln OP_t + \beta_2 \ln GP_t + \beta_3 \ln GVZ_t + \beta_4 \ln OVX_t + \varepsilon_t \quad (1)$$

$$\ln JKS_t = c + \beta_1 \ln OP_t + \beta_2 \ln GP_t + \beta_3 \ln GVZ_t + \beta_4 \ln OVX_t + \varepsilon_t \quad (2)$$

$$\ln KOSPI_{it} = c + \beta_1 \ln OP_t + \beta_2 \ln GP_t + \beta_3 \ln GVZ_t + \beta_4 \ln OVX_t + \varepsilon_t \quad (3)$$

$$\ln IPC(MXX)_{it} = c + \beta_1 \ln OP_t + \beta_2 \ln GP_t + \beta_3 \ln GVZ_t + \beta_4 \ln OVX_t + \varepsilon_t \quad (4)$$

t= March 11, 2020,….., January 31, 2023.

In the models, BIST100 represents the Turkish Stock Exchange, JKS refers to the Indonesian Stock Exchange, KOSPI denotes the South Korean Stock Exchange, and IPC MXX signifies the Mexican Stock Exchange. lnOP shows the logarithm of the Brent oil price, lnGP the logarithm of the gold bullion price, lnGVZ the logarithm of the gold volatility index, and lnOVX the logarithm of the crude oil volatility index. Likewise, logarithms of stock market indices were taken and included in the models.

3.3. Methodology

The study used the Ordinary Least Squares (OLS), a traditional approach, as well as the PQR by Koenker (2004) to identify the dependence structures of the variables under different market conditions. In traditional regression approaches, model estimates are made by defining the conditional mean of the dependent variable as a function of the independent variable. The regression equation can be easily constructed and interpreted with the OLS method. However, when the distribution of the dependent variable is asymmetric, the constant variance assumption of the OLS method is violated. In such a case, the problem of changing variance (heteroscedasticity) can arise due to the sensitivity of the mean to extremely low or high values (Tekin and Bastak, 2022). When the distribution of the dependent variable is asymmetrical, an alternative method, PQR, can be used to avoid the problem of varying variance. The quantile regression (QR) model proposed by Koenker and Bassett (1978), and subsequently extended by Koenker (2004), includes both cross-sectional and time effects. This framework further enables the application of PQR, as shown by Tekin and Bastak (2022).

Binder and Coad (2011) argued that the PQR is safer than traditional approaches. QR, which offers advantages over classical regression methods, enables conditional quantitative estimation and the prediction of specific points within the conditional distribution (Uygur and Han, 2021). Unlike OLS, which depends on accurate error term estimates, QR is more robust, especially in the presence of outliers (Koenker and Bassett, 1978). Additionally, unlike traditional regression, QR does not rely on distributional assumptions (Uygur and Han, 2021). Initially applied to cross-sectional data, the method has since been adapted for time series and panel data sets (Tekin and Bastak, 2022).

The panel linear regression equation to be used in the research is as described in equation 5. The QR equation is explained in equation 6.

$$yit = \alpha_i + \beta(q)x'_{it} + u_{it} \qquad i=1,\ldots,N_1\ t=1,...,T \qquad (5)$$

In the equation, (i) represents the stock market index of the countries, and (t) represents the time dimension. A dependent variable is identified by (yit), while an independent variable is identified by (x). While (q) indicates the amount of conditional distribution ($0 < q < 1$), (α) represents the presence of fixed effects.

$$\min_{\beta,\alpha} \sum_{j=1}^{J}\sum_{t=1}^{T}\sum_{i=1}^{N} w_j p_{tj}(y_{it} - x_{it}\beta - \alpha_i) + \lambda\sum_{i=1}^{N}|\alpha_i| \qquad (6)$$

In this context, the piecewise linear quantile loss function, as proposed by Koenker and Bassett (1978), is $ptj\ (u) = (Tj - (u \leq 0)$. Wj is a given relative weight. Weights determine the influence of individual quantities on the estimation of their effects. λ|αi| serves to shrink the individual impact estimates towards zero to improve the performance of the estimation (Uygur and Han, 2021).

QR can be used when the distribution is normal as well as when the distribution is asymmetrical, thick-tailed, or truncated (Zeinedini et al., 2022). To see how the distribution is in this direction, the change graphs of the variables included in the research between March 11th, 2020, and January 31st, 2023, are given below. All variables generally show normal and/or close-to-normal distributions.

4. RESULTS AND DISCUSSION

In this section, analyses and interpretations related to the model of the study have been conducted.

Table 2: Descriptive statistics

	lnOP	lnGO	lnGVZ	lnOVX	lnBIST100	lnJKSE	lnKOSPI	ln IPC (MXX)
Mean	1.828666	3.256389	1.26965	1.676215	3.253026	3.786529	3.416554	4.664527
Std Dev.	0.1717872	.0217177	0.0838347	.1500972	0.2029535	.0604337	.0707979	.0596862
Min.	1.286232	3.168571	1.147985	1.495544	2.919308	3.595235	3.16365	4.518043
Max.	2.107142	3.315372	1.690019	2.512084	3.751789	3.864394	3.519199	4.752 89
Skewness	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Kurtosis	0.1024	0.0000	0.0000	0.0000	0.3449	0.0795	0.5753	0.0000
Jarque-Bera	269.2	152.3	516.4	458,9	84.52	90.47	37.39	95.67
Observations	746	746	746	746	746	746	746	746

Table 2 displays the descriptives for the variables and the outcomes of the Jarque-Bera test. These statistics furnish a thorough examination of the data's

inherent properties.

When Table 2 is examined, it is observed that the variable with the highest average is lnIPC(MXX) with 4.664527, while the variable with the lowest average is lnOP with an average of 1.82866. It is observed that the variable with the highest standard deviation is the lnBIST100 index with .2029535, while the variable with the lowest standard deviation is lnGO with .0217177. When examining the standard deviations of the dependent variable, which are the stock prices, it is observed that, except for the BIST100 index, the stock prices of the others are close to each other. In this case, we can say that the lnJKSE, lnKOSPI, and IPC(MXX) stock indices are similarly affected by uncertainties in global gold and oil prices, while the BIST100 index is more affected.

To test whether the series follows a normal distribution, the Skewness, Kurtosis, and Jarque-Bera tests are applied. When the results of the Skewness test are examined, it is observed that the coefficients of all variables are zero (0.000), meaning they are not asymmetric and not skewed to the right or left. In this case, it indicates that the series has a normal distribution. Similarly, when the Kurtosis results are examined, it is observed that the coefficient values fall within the threshold values of -1.5 to +1.5, which are accepted in the literature. This situation indicates that the series is not asymmetric, in other words, it is not platykurtic and has a normal distribution. To test whether the series follows a normal distribution, the Jarque-Bera test, which shows the statistical results of the error terms, was applied. As a result of the test, since the Chi(2) values were greater than 0.05, the null hypothesis (H0) stating that the error terms follow a normal distribution was not rejected, and therefore it was concluded that the series is normally distributed. When the series is normally distributed, traditional regression methods can be used, as well as the quantile regression method.

4.2. Test Results of Unit Root

Stationarity is an extremely important issue because when the series is not stationary, the spurious regression problem can arise. This situation is likely to lead to incorrect results and misinterpretations. To prevent this problem, the variables must be stationary. Table 3 shows the findings of the Augmented Dickey-Fuller (ADF) unit root test to evaluate the stationarity of the variables. The ADF test checks whether the statistical properties of a time series change over time, and thus it is a critical step in selecting the correct modelling method. Especially in econometric models, it is extremely important to conduct this test in order to obtain meaningful and reliable results.

Table 3: Results of the ADF Unit Root Test

Variable	Level	Fixed		Trend	
		Test statistic	P-Value	Test statistic	P-Value
lnOil Price	I(0)	10.0221	0.2635	7.5885	0.4747
	I(1)	288.3492	0.0000*	288.3492	0.0000*
lnGold Price	I(0)	30.6038	0.0002*	19.2048	0.0138**
	I(1)	-	-	-	-
lnGVZ	I(0)	7.7665	0.0206**	7.0495	0.0295**
	I(1)	-	-	-	-
lnOVX	I(0)	26.7162	0.0000*	20.5520	0.0000*
	I(1)	-	-		
lnBIST100	I(0)	0.0454	0.9776	0.3155	0.8541
	I(1)	72.0873	0.0000*	47.0865	0.0000*
lnJKSE	I(0)	1.6499	0.4383	4.7969	0.0909
	I(1)	72.0873	0.0000*	53.174	0.0000*
lnKOSPI	I(0)	3.7419	0.1540	1.3283	0.5147
	I(1)	44.204	0.0000*	31.897	0.0000*
lnIPC (MXX)	I(0)	0.1083	0.9473	0.2002	0.9048
	I(1)	102.365	0.0000*	86.384	0.0000*

Table 3 indicates that the stationary levels of variables are investigated both with and without a trend. The lnGold Price, lnGVZ, and lnOVX variables are stationary at the level, while the other variables are not stationary at the level but become stationary when first-order differences are taken. In the following stages of the research, the stationary values of variables will be used. After ensuring the stationarity condition of the variables, the relationship between the variables was examined using both the OLS and PQR methods, and the results are given below.

Table 4. QR Test Results for The Turkish Economy (BIST100)

Variables	OLS	%25	%50	%75
lnOil Price	0.906*** (26.37)	0.677*** (27.36)	0.791*** (34.03)	0.942*** (14.22)
lnGold Price	-0.606** (-2.32)	-0.739*** (-3.92)	-2.130*** (-4.12)	-2.045*** (-4.05)

lnGVZ	-0.312***	-0.079	-0.041	0.049
	(-3.49)	(-1.23)	(-0.68)	(0.28)
lnOVX	0.292***	0.244***	0.208***	0.149
	(5.75)	(6.67)	(6.03)	(1.52)
Cons	3.478***	-0.783	1.199**	7.930***
	(4.03)	(-1.26)	(2.05)	(4.76)
F	252.39	-	-	-
Prob.	0.000	-	-	-
Adj. R^2	0.57	-	-	-
Pseudo R^2	-	0.484	0.468	0.406

Note: * and ** represent statistical significance at the 5% and 1% levels, respectively.

Table 4 presents the OLS and QR results on the impact of oil and gold price uncertainty on the BIST100 index for the Turkish economy. The OLS results show a significant positive relationship between the BIST100 index and both oil prices and the oil volatility index. Specifically, a 1% increase in oil prices leads to a 0.91% increase in the BIST100 index, while a 1% rise in the oil volatility index causes a 0.29% increase. Conversely, a 1% increase in gold prices and gold volatility index results in a 0.61% and 0.31% decrease in the BIST100 index, respectively. These findings align with previous studies (Chkili, 2022; Karakuş, 2021; Kakacak et al., 2020; Tursoy and Faisal, 2018; Akgün et al., 2013; Küçükçolak et al., 2019; Gencer and Musoğlu, 2014).

The analysis suggests that rising oil prices, despite expectations of negative effects due to cost inflation, may increase companies' sales prices and equity, thereby attracting investors. In contrast, gold price increases generally lead to falling stock prices due to investor behavior during economic uncertainty, such as the Russia-Ukraine conflict and COVID-19, which boosts gold prices. These findings support the inverse relationship between gold and stock prices, reflecting investor preferences for safe assets in times of uncertainty.

Table 5. QR Test Results for The Indonesian Economy (JKSE)

Variables	OLS	%25	%50	%75
lnOil Price	0.323*** (65.36)	0.333*** (52.68)	0.346*** (41.51)	0.304*** (49.04)
lnGold Price	-0.075** (-2.00)	-0.133** (-1.98)	-0.150** (-2.36)	-0.157*** (-3.32)
lnGVZ	-0.045*** (-3.48)	-0.028*** (-1.70)	-0.019 (-0.86)	-0.088*** (-5.43)
lnOVX	0.003 (0.37)	-0.004 (-0.40)	0.006 (0.47)	0.015*** (1.68)
Cons	3.444*** (32.43)	3.256*** (20.45)	3.654*** (17.43)	3.841*** (24.65)
F	1683.25	-	-	-
Prob.	0.000	-	-	-
Adj. R^2	0.900	-	-	-
Pseudo R^2	-	0.747	0.674	0.613

Note: *, **,*** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 highlights the OLS and QR results on the effect of gold volatility index, crude oil volatility index, and global gold and oil price uncertainty on the JKSE index. The OLS results show a significant positive relationship between oil prices and the oil volatility index with the JKSE index, with a 1% rise in oil prices associated with a 0.32% increase in the JKSE index. A 1% increase in the oil volatility index results in a 0.003% increase in the JKSE index. In contrast, a 1% increase in gold prices and gold volatility index leads to a decrease of approximately 0.075% and 0.045%, respectively, in the JKSE index, consistent with previous studies (Alamgir and Amin, 2021; Octavia et al., 2018; Adam et al., 2015; Hadi et al., 2009). The model is significant with an R^2 value of 0.9009, indicating that 90.09% of the JKSE index is explained by the variables.

PQR results indicated that global oil price uncertainty has a significant

positive effect on the JKSE index across all quantiles (25%, 50%, and 75%), and global gold price uncertainty has a significant negative effect at all quantiles. The gold volatility index shows a negative effect on the JKSE index, significant only at the high (75%) quantile. Crude oil volatility index has a negative, though not significant, effect at the low (25%) quantile, but a positive, though not significant, effect at the medium (50%) and high (75%) quantiles. The findings for Indonesia's developing economy align with those for Türkiye, showing a positive impact of oil price uncertainty and a negative impact of gold price uncertainty on the stock market. These results show the findings in Table 4.

Table 6: QR Test Results for The South Korean economy (KOSPI)

Variables	OLS	%25	%50	%75
lnOil Price	0.032**	0.079***	0.025	-0.025
	(2.72)	(5.80)	(1.12)	(-1.59)
lnGold Price	0.311***	0.779***	0.368**	0.281**
	(3.50)	(7.47)	(2.19)	(2.39)
lnGVZ	-0.242***	-0.197***	-0.313***	-0.298***
	(-7.94)	(-5.53)	(-5.46)	(-7.40)
lnOVX	-0.220***	-0.099***	-0.232***	-0.237***
	(-12.71)	(-4.86)	(-7.11)	(-10.37)
Cons	3.020***	1.112***	3.293***	3.358***
	(10.27)	(3.23)	(5.95)	(8.65)
F	274.10	-	-	-
Prob.	0.000	-	-	-
Adj. R^2	0.597	-	-	-
Pseudo R^2	-	0.373	0.353	0.336

Note: * and ** represent statistical significance at the 5% and 1% levels, respectively.

Table 6 presents the results of both OLS and QR analyses regarding the impact of oil and gold volatility indices, as well as price uncertainties, on the KOSPI index. The OLS results indicate a positive association between the KOSPI index and both oil and gold prices, whereby a 1% increase in oil and gold prices is associated with a 0.0319% and 0.314% rise in the KOSPI index. In contrast, the oil and gold volatility indices exhibit a negative effect, and the model accounts for 59.67% of the variation in the KOSPI index. PQR results indicate that global oil price uncertainty has a significant positive effect at lower quantiles, but a negative effect at higher quantiles. Gold price uncertainty consistently exerts a positive effect across all quantiles, while gold volatility negatively impacts the KOSPI index at all quantiles. These findings challenge the conventional theory suggesting an inverse relationship between gold prices and the stock market, instead revealing a positive correlation. These results align with the findings of

studies by Tursoy and Faisal (2018), Chkili (2022), Karakuş (2021), Kakacak et al. (2020), Akgün et al. (2013), and Drake (2022).

Table 7: QR Test Results for The Mexican Economy IPC (MXX)

Variables	OLS	25%	50%	75%
lnOil Price	0.255***	0.023***	0.249***	0.251***
	(38.590)	(19.580)	(24.560)	(48.580)
lnGold Price	-0.151***	-0.163**	-0.229***	-0.257***
	(-3.010)	(-1.790)	(-2.970)	(-6.530)
lnGVZ	-0.206***	-0.302*** (-	-0.297***	-0.242***
	(-11.970)	9.710)	(-11.240)	(-17.970)
lnOVX	0.022**	-0.071*** (-	0.028*	0.053***
	(2.250)	3.990)	(1.890)	(6.940)
Cons	3.809***	4.193***	3.796***	3.607***
	(24.280)	(13.960)	(14.860)	(27.760)
F-statistic	838.830	-	-	-
Prob.	0.0000	-	-	-
Adj. R^2	0.818	-	-	-
Pseudo R^2	-	0.632	0.571	0.523

Note: *, **,*** represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7 presents the OLS and QR results on the impact of the gold volatility index, crude oil volatility index, and oil and gold price uncertainty on the IPC (MXX) index. According to the OLS results, there is a positive relationship between oil prices and the oil volatility index with the IPC (MXX) index, where a 1% increase in oil prices causes a 0.255% increase in the index, and a 1% increase in the oil volatility index causes a 0.220% increase. On the other hand, a 1% increase in gold prices leads to a 0.151% decrease in the IPC (MXX) index, and a 1% increase in the gold volatility index results in a 0.206% decrease. These findings are consistent with earlier research, such as Morales Fernández Rafaelly and Santillán-Salgado (2020), Santillán-Salgado et al. (2017), and Valdés et al. (2012), as well as Singhal et al. (2019) and Al-Ameer et al. (2018). In the QR analysis, global oil price uncertainty has a significantly positive impact on the IPC (MXX) index at high (75%), medium (50%), and low (25%) quantiles. Similarly, oil volatility index positively impacts the IPC (MXX) index at medium (50%) and high (75%) quantiles, while it has a negative effect at low (25%) quantiles. Additionally, gold prices and the gold volatility index have a significant negative effect on the IPC (MXX) index at all quantile levels. These results align

with the OLS findings and are consistent with the explanations in Table 4, reflecting the similar impact of oil price uncertainty in developing countries like Mexico and Türkiye.

5. DISCUSSION

This study aims to examine the effects of global gold price uncertainty on the stock markets of MIST countries. The research evaluated the impact of uncertainties in gold and oil prices during the crisis periods that began with the COVID-19 pandemic and continued with the effects of the Russia-Ukraine war on stock prices in these emerging and developed markets. As a dataset, daily closing prices from March 11, 2020, to January 31, 2023, were used, and the analyses were conducted using the ordinary least squares (OLS) and panel quantile regression (PQR) methods.

The findings of the study have revealed that, in terms of the economies of Turkey, Indonesia, and Mexico, oil prices and the oil volatility index are statistically significant and positively correlated with the stock markets. This situation indicates that the increase in oil prices has a positive effect on the stock markets of these countries and that an increase in uncertainty (volatility) in the oil market is observed along with an increase in market values. Countries like Turkey, Indonesia, and Mexico are both oil exporters and consumers. Among these countries, since Mexico is an oil-exporting country, it is thought that the increase in oil prices creates positive effects in the economy and thus contributes to the rise of the stock market. In net oil-importing countries like Turkey and Indonesia, the energy sector holds a significant share in stock market valuations, so increases in oil prices can lead to higher profits for energy companies, causing stock prices to rise. Similarly, in the economies of Turkey and Indonesia, the increase in the oil volatility index indicates increased market activity, which can create opportunities for some investors. Therefore, volatility can have a positive pricing effect during certain periods. As a result, it can be said that the positive and significant impact of oil prices and their volatility on stock markets in these countries is due to the energy sector, as well as the overall economic conditions and the increase in global demand, which positively affect market perceptions. In response to the rise in oil prices, a negative and statistically significant relationship has been identified between gold prices, the gold volatility index, and stock markets in emerging countries (Turkey, Indonesia, and Mexico). The perception of gold as a safe haven by investors, their shift from stocks to gold during crisis periods, and consequently the decline in stock markets support this outcome. On the other hand, in a developed economy like South Korea, a positive relationship has been identified between both gold and oil prices and stock prices. The reason for this can be explained by the economy's high integration with

global trade, strong sector structure, and institutional investor behaviours. Rising energy and gold prices in developed economies, along with signs of economic recovery, may have increased investor interest in stock markets. However, the existence of a negative relationship between gold and oil volatility indices and the South Korean stock markets is thought to be due to the increase in volatility triggering investors' risk-averse behaviour, leading them to exit the stock markets and consequently creating negative pricing pressure in the markets.

These results reveal that the effects of global commodity prices and uncertainties on stock markets in emerging (Turkey, Indonesia, and Mexico) and developed (South Korea) markets are shaped by different dynamics. In developing countries, the positive impact of oil prices on the market is due to the commodity-export-based economic structure of these countries, while the negative impact of gold on stock markets is more pronounced due to its safe-haven characteristic. On the other hand, in developed markets, economic diversity and market depth differentiate the impacts of both commodity prices and volatility indices. As a result, it can be said that the impact of uncertainties in gold and oil markets on stock markets during crisis periods shows heterogeneity on a country basis, and therefore, policymakers and investors should develop strategies taking into account the specific characteristics of each country. Especially for developing markets like the MIST countries, understanding how they are affected by global uncertainties is of critical importance for financial stability and risk management.

6. CONCLUSION

The escalation of economic uncertainty, triggered by the COVID-19 outbreak and the Russia-Ukraine war, has led to a rise in gold and oil prices, which have also affected countries' economies. Although this effect varies according to the development levels of countries, all countries' economies have been affected by these increases. Especially during times of crisis and war, the safe haven function of gold compared to other financial assets is being investigated, and these studies have highlighted the effects of COVID-19 in recent times (Demirdöğen and Emeç, 2022). Similarly, the increases and uncertainties in oil prices have been among the topics that have been researched and discussed in recent times. These developments constitute the motivation of the study.

In the study conducted with this motivation, the degree to which the stock markets of the MIST countries, namely Mexico, Indonesia, South Korea, and Türkiye, are affected by the uncertainty in global oil and gold prices has been examined. In line with this aim, the crisis periods starting with the Covid-19 pandemic crisis, causing uncertainty in oil and gold prices, and continuing with

the Russia-Ukraine war have been taken into account in the study. Accordingly, the study's data set consists of daily closing prices between March 11th, 2020, when COVID-19 was announced a pandemic by the WHO, and January 31st, 2023, when the study was conducted.

The analysis part of the research has two stages. The first is the stationarity condition of the series, which is expressed as a pre-test, and the second is the regression results showing the relationship between the variables. To address the spurious regression issue, the study initially assessed the stationarity of the variables with the Extended Dickey-Fuller (ADF) unit root test. The first-order differences of the non-stationary variables at the I(0) level were taken, and the stationarity condition at the I(1) level was met. Once the stationarity of the variables was confirmed, the relationship between them was analyzed using OLS and PQR tests. The OLS test revealed that a significant and positive relationship exists between stock prices and oil prices, and a significant and negative relationship exists between stock prices and gold prices in the developing economies of Türkiye, Indonesia, and Mexico. Likewise, the effect of oil price volatility on stock prices is significant and positive, and the effect of volatility in gold prices on stock prices is significant and negative for these developing countries' economies. For the advanced economy of South Korea, there is a significant and positive relationship between stock prices and both oil and gold prices. The study has concluded that there exists a significant and negative association between the volatility indices of oil and gold and the stock prices.

According to the PQR analysis, which provides a more detailed analysis, the impact of uncertainty in oil volatility index, gold and oil prices, and gold volatility index on the BIST 100 index in Türkiye at high (75%), medium (50%) and low (25%) quantile levels are similar to the results obtained from OLS. Accordingly, uncertainty in gold and oil prices has a similar effect on the JKSE index at low (%25%), medium (50%), and high (75%) quantile levels for the Indonesian economy. Oil volatility index has a effect on the JKSE index at high (75%) quantile levels similar to the results obtained from OLS, while the effect of oil volatility index on the JKSE index is positive but insignificant at the (50%) quantile level and a negative and insignificant effect at the low (25%) quantile level. The gold volatility index has an effect on the JKSE index at low (25%) and high (75%) quantile levels similar to the results obtained from OLS, while the effect of the gold volatility index on the JKSE index at medium (50%) quantile levels is negative but insignificant.

For the Mexican economy, the impact of uncertainty in gold and oil prices and gold volatility index on the IPC (MXX) index at high (75%), medium (50%), and low (25%) quantile levels is similar to the results of the OLS. The effect of the oil volatility index on the IPC(MXX) index was negative and significant at the low (25%) quantile level, while it had a significant and positive effect at medium (50%) and high (75%) quantile levels.

In the case of the developed country South Korea, the effect of uncertainty in gold volatility index, oil volatility index, gold prices, and oil prices at high 75%, medium (50%), and low (25%) quantile levels varied according to the results of the OLS.

It is thought that the findings and implications of the study will significantly contribute to the literature. Because, in the literature, the effects of uncertainties on financial markets are generally evaluated through singular commodities like gold or oil, and the impacts of crises are mostly limited to specific periods. Again, most studies either focus solely on the effects of the COVID-19 pandemic or the effects of the Russia-Ukraine war separately. Additionally, the majority of the studies focus on developed countries or BRICS countries (Morina et al., 2024; Memon et al., 2024; Dontoh et al., 2024; Jareño et al., 2023; Li et al., 2022; Yousef and Shehadeh, 2020). This study, by addressing the Covid-19 and Russia-Ukraine global crisis together and simultaneously analysing both price and volatility-based uncertainties in the gold and oil markets, fills an important gap. Additionally, the analysis is conducted in MIST countries; these countries are relatively under-researched but strategically important emerging markets. Thus, the study is expected to make a significant contribution to the literature on the asymmetric effects of global uncertainties on emerging markets.

The limitations of this study are confined to the period immediately following the impacts of the COVID-19 pandemic and the Russia-Ukraine war, which may prevent a full reflection of long-term effects. Again, the analyses only examine the impact of uncertainties in oil and gold prices, and the effects of other important commodities or financial instruments (such as exchange rates, other precious metals, energy products, etc.) have not been included in the study. Additionally, since the study focusses solely on MIST countries, it may not be generalisable to other emerging or developed country markets.

Suggestions for Future Studies: In addition to oil and gold prices, the inclusion of other commodities such as copper and natural gas, as well as exchange rates, cryptocurrencies, and bond markets, in the study of the effects of uncertainties could broaden the scope of the research. To compare the responses of different market structures to uncertainties, a comparative analysis of emerging

and developed markets outside the MIST countries can be conducted. Not only price and volatility-based uncertainties, but also the use of different uncertainty indices such as economic policy uncertainty (EPU) and geopolitical risk (GPR) in the analyses can provide more comprehensive results.

Political Implications: The results of this study hold great significance for investors who are interested in investing in financial assets and real estate. The study provides information to investors who wish to diversify their investment portfolios by investing in oil, stock markets, and gold. By focusing on current issues such as gold, which is seen as a safe haven during times of crisis, the study is expected to benefit investment institutions, portfolio managers, and economic decision-makers.

1. Investors who seek to lower the systematic risk in their portfolios and are averse to risk may opt for diversification by investing in both gold and stocks, instead of relying solely on one type of asset or security.
2. Risk-taking investors are recommended to choose one of the assets in their portfolio rather than a combination of gold and stocks. In particular, results from developing countries revealed an inverse relationship between stock and gold prices.
3. To reduce their risk of losses in the stock market, investors who intend to invest in gold, which they regard as a safe haven, will be able to protect their portfolio from volatility in the stock market.
4. The study results are expected to assist policymakers in making decisions in the face of fluctuations and uncertainties in commodity and financial markets.

7. CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

8. FUNDING ACKNOWLEDGEMENTS

This study did not benefit from any funding or support.

9. AUTHOR CONTRIBUTIONS

F.P: Conceptualization, Methodology, Data Collection, Writing - Original Draft.
M.R.G: Methodology, Analysis and Interpretation, Writing - Critical Appraisal and Revision.
M.T: Literature Review, Analysis, Interpretation of Findings.
F.D: Data Collection, Visualization, Table and Graph Preparation.
A.B: Bibliography Editing, Writing - Proofreading and Language Editing

10. ETHICS COMMITTEE STATEMENT

Since the study did not include research involving human participants or animal subjects, approval from an ethics committee was not necessary.

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