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Gold price volatility, stock market, and inflation in Turkey: An ARDL approach

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ABSTRACT

This study aims to examine how anticipated gold price volatility affects Turkey's stock prices and inflation through two distinct models that use Turkey's country-specific economic uncertainty, industrial output index, and interest rate as control variables. For this purpose, the study first employs the GARCH technique to forecast a conditional variance series, which reveals the volatility of the gold price to reflect the underlying uncertainty and instability within financial markets. Second, by employing this new series, the ARDL approach is used to test the effect of gold price volatility on BIST100 and inflation in Turkey. According to the ARDL results, all variables in Model 1 have significant short- and long-term coefficients. All variables except inflation harm the BIST100 index over time. Additionally, the results suggest that volatility and uncertainty increase inflation in Model 2, while lagged interest rates have a significant impact on inflation, indicating that both internal and external shocks impact inflation and stock prices. These results underscore the transmission of both internal and external shocks to the financial system and pricing dynamics. The findings of the paper emphasize that, in an emerging economy like Turkey, marked by structural weaknesses and heightened susceptibility to global uncertainty, gold price volatility is not only a financial occurrence but a vital factor influencing macroeconomic stability and policy efficacy. Furthermore, external shocks highlight the limited effectiveness of monetary interventions in achieving disinflation objectives.

Contribution/Originality: This research contributes to the literature by using the ARDL approach to connect Turkey's macroeconomic fundamentals with gold price volatility, modeled using GARCH. It uniquely integrates the Turkey-specific economic uncertainty index into models of stock prices and inflation, offering innovative insights into the effects of volatility and uncertainty on the effectiveness of monetary policy.

1. INTRODUCTION

As an investment and primary monetary instrument, gold is typically seen as a safe haven due to its capacity to safeguard against inflation (Baur & Lucey, 2010). Due to this, forecasting the volatility of spot gold prices and their relation with stock prices and inflation is crucial for commodities and financial markets in emerging economies. Gold is a vital example of a commodity in the financial market favored by investors in Turkey and globally; therefore, they must account for volatility when making investment decisions, since it is regarded as an indicator of risk. High volatility can result in substantial profits and losses due to its challenges in price prediction.

Empirical studies indicate that, following financial liberalization, stock and commodity markets exhibit increased sensitivity to external and domestic influences. According to the literature reviewed in the research performed by Toraman, Basarir, and Bayramoglu (2011), the determinants of gold prices are more influenced by developments in the US economy, precisely the dollar exchange rate and inflation level, rather than global developments. Additionally, macroeconomic news related to price indexes, GDP, gold and silver prices, and the unemployment rate impacts the gold price. Moreover, stock exchange price indices, interest rates, industrial production, and other factors are claimed to have an empirical role in determining gold prices. Beckmann, Czudaj, and Pilbeam (2015) attribute the volatility in gold prices to fluctuations in exchange rates, since the gold prices are expressed in US dollars, indicating that fluctuations in the US dollar exchange rate impact gold prices. Gold prices increase after the dollar's depreciation. Also, the initial effect of the depreciation of other currencies is adverse on the gold price.

Recent studies have examined the impact of volatility in commodity prices, especially gold, on macrofinancial dynamics. For example, Kuzu (2022) examined the association between inflation and gold prices in Turkey, but did not include volatility. Gök and Tiwari (2022) linked inflation expectations to gold prices. Pata, Usman, Olasehinde-Williams, and Ozkan (2024) investigated the time-varying causal effects of gold and crude oil prices on Turkish stock market returns through a rolling window-based nonparametric quantile causality test, without proposing a model for gold price volatility. The study indicates that gold and oil prices significantly influence the Turkish stock market, with variations observed in their effects based on returns and volatility. Gümüş and Baba (2024) employ ARDL modeling in a broader emerging market panel to demonstrate the long-term relationships among gold prices, inflation, exchange rates, interest rates, and stock markets; nonetheless, they do not specifically consider conditional volatility or incorporate uncertainty variables in their model. Chuang, Gupta, Pierdzioch, and Shu (2024) employed the GARCH-MIDAS methodology to explore the connection between financial uncertainties and gold return volatility, concluding that financial uncertainties enhance the precision of forecasts regarding gold return volatility. Nonetheless, there is currently no study that integrates conditional volatility, macroeconomic fundamentals, and a Turkey-specific economic uncertainty index within a cohesive ARDL-based framework. Also, this is the first study to connect the Turkey-specific economic uncertainty index presented by Kilic and Balli (2024) to the Turkish stock market and inflation. This study addresses the gap by linking GARCH-derived gold volatility to inflation and BIST 100 performance via country-specific modeling.

2. THEORETICAL LITERATURE FOR MODELS

Since this study employs two models to explain the relationships among gold price volatility, stock prices, and inflation, the theoretical literature will be surveyed based on the models listed.

2.1. Theoretical Literature for Model 1: Gold Price Volatility and Stock Market Relationship

Fluctuations in gold prices have a substantial influence on the stock market. Baur and Lucey (2010) assert that while gold possesses the characteristic of serving as a safe haven alternative to the stock market, this is not universally applicable. This attribute tends to diminish, particularly during bullish phases of the stock market. Baur (2012) posits that investors perceive an increase in gold prices as a signal of safe haven acquisitions and an indication of heightened risk or uncertainty in macroeconomic and financial situations, resulting in greater volatility in the gold market. If the gold price declines, uncertainty and volatility diminish. Consequently, positive gold return shocks elevate volatility more than adverse return shocks. Therefore, price volatility can have adverse effects on financial markets, as heightened volatility creates precarious investment conditions, whereas diminished volatility fosters more secure investment conditions (Gokmenoglu & Fazlollahi, 2015).

2.2. The Theoretical Framework for Model 1's Explanatory Variables and Expected Signs

Stock Price and Inflation: The correlation between inflation and stock prices is a contentious topic. The impact of changes in inflation on stock prices might be both advantageous and detrimental. The Fisher Hypothesis posits that an increase in anticipated inflation rates leads to a rise in nominal interest rates, as nominal yields are expected to increase in inflationary contexts. During inflationary circumstances, robust companies are expected to pass on price increases to their product pricing, thereby affecting their profit margins. Therefore, stock prices, such as the BIST100 index, are expected to rise during periods of inflation. Conversely, Tobin (1965) asserts that expansionary policies are predominantly enacted at times of increasing inflation. According to portfolio selection theory and monetary supply models, surplus market liquidity may increase stock demand when interest rates are low, leading to higher stock prices.

Stock Price and Output Level: Increases in output levels are expected to have positive effects on the stock market. According to the Dividend Discount Model (Gordon, 1962), as production increases, firms' sales revenues increase, and a scale effect may occur, resulting in a relative decrease in costs. As a result, dividend payments increase, and firms' market values also increase. According to the Proxy Hypothesis, Fama (1981) posits that stock market returns can serve as a proxy for future increases in economic activity, thereby creating a positive sign between the two variables. According to Consumption-Based Asset Pricing Models (Breeden, 1979), household consumption is associated with output levels. Since individuals' incomes increase with output increases, future consumption will also rise through profits and dividends, establishing a positive association between them. In some cases, adverse effects may also arise between output levels and stocks. These are periods when output levels increase due to overheating. In response, tightening monetary policies may be implemented, accompanied by an increase in borrowing costs resulting from rising interest rates, and the stock values of firms may decrease (Bernanke & Gertler, 1995; Mishkin, 1996). Another perspective, based on Fama (1981), is that the increase in output levels may result in increased inflationary expectations due to the stimulation of demand. The expected profitability of stocks may decrease as a result of this. Finally, suppose the increases in output levels are due to excessive credit growth or speculative reasons. In that case, there may be an expectation of future market instability, which could lead to negative pricing (Minsky, 2008).

Stock Price and Uncertainty: As economic uncertainty escalates, investors' expectations for risk premiums typically rise. The discount rate increases, resulting in a decline in stock values (Pastor & Veronesi, 2012). Uncertainty indices adapted for nations included in the indices established by Baker, Bloom, and Davis (2016) correlate with adverse movements in stock prices following various destabilizing events in that region. Tiryaki and Tiryaki (2019) and Ünlü (2024) identified adverse effects on equities in investigations utilizing several uncertainty indexes.

Stock Price and Interest Rate: The connection between interest rates and stock prices can be elucidated from several viewpoints. Initially, a rise in interest rates may lead to a similar rise in the discount rate, which subsequently diminishes the anticipated future value of stocks, resulting in a decline in stock prices (Gordon, 1962). Moreover, as Tobin (1969) anticipated, increasing interest rates enhance the appeal of bonds, a less volatile investment vehicle, compared to equities; hence, diminishing demand for stocks and their prices. From an investment standpoint, escalating interest rates increase firms' investment expenses, which may diminish anticipated profitability and, therefore, lower stock valuations (Fama, 1981). Moreover, an increase in central bank interest rates can, through the expectations channel, lead to future inflation and excessive growth, thereby diminishing stock market expectations and future growth rates (Bernanke & Kuttner, 2005). Therefore, an inverse relationship is anticipated between interest rates and stock values.

2.3. Theoretical Literature for Model 2: Gold Price Volatility and Inflation Relationship

According to Keynesian theory, assets like gold and silver, as well as nominal currencies such as dollars and euros, serve as the unit of account. As a currency's purchasing power diminishes, the price level increases, indicating that the worth of money, assessed by its purchasing power, inversely correlates with the overall price level (Tymoigne, 2003). Fisher's Quantity Theory of Money underscores the direct correlation between an expansion in the money supply and inflation. Thus, historically, gold is perceived as a refuge against inflation and an indicator of forthcoming inflation. Inflation profoundly affects gold prices (Baker & Van Tassel, 1985; Kaufmann & Winters, 1989; Sjaastad & Scacciavillani, 1996). Since investors increase their demand for gold during inflationary periods, demand

and price changes have been linked. Gold prices and inflation cointegrate, especially over the long term (Batten, Ciner, & Lucey, 2014; Wang, Lee, & Thi, 2011; Worthington & Pahlavani, 2007). Consequently, increasing gold prices and volatility in gold prices may increase expected inflation and cause higher inflation.

The expectations-augmented Phillips Curve suggests that inflation is influenced by anticipated inflation, indicating that gold price volatility can affect consumer and investor choices in economies like Turkey, where gold acts as a significant financial asset and value preserver. No study has evaluated gold price volatility in relation to Turkey's inflation. This study may be pioneering by including gold price volatility in inflation studies, leading future research.

Various transmission mechanisms may exist to correlate gold price volatility and inflation.

- Despite gold's exclusion from CPI estimates, fluctuations in gold prices influence the prices of other commodities, such as oil (Turhan, Sensoy, Ozturk, & Hacihasanoglu, 2014; Yıldırım, Cevik, & Esen, 2020; Zhang, Shi, & Yu, 2018). The price changes of commodities like oil influence the overall price level (Mensi, Nekhili, Vo, & Kang, 2021).
- Peiris and Ding (2012) assert that the rise in global commodity prices during the 2007-2008 global crisis resulted in heightened headline inflation. This procedure examines the impact of global commodity prices on inflation through their influence on the exchange rate. As banks maintain gold in their reserves, variations in gold prices result in corresponding fluctuations in the value of the local currency. Consequently, volatility in exchange rates may induce inflation due to variations in import prices (Goldberg & Knetter, 1996; Peiris & Ding, 2012).
- Given that gold functions as both a wealth indicator and a crucial input in several sectors across certain nations, its price changes might influence production costs, impacting prices and inflation (Anandasayanan, Thevananth, & Mathuranthy, 2019).

2.4. The Theoretical Framework for Model 2's Explanatory Variables and Expected Signs

Inflation and Stock Price: As explained above, the relationship between inflation and stock prices is complicated. First, increases in stock prices may have a welfare effect, prompting individuals to increase their spending. This may subsequently accelerate inflation (Friedman, 1957). Furthermore, gains in stock prices can stimulate investment by lowering firms' cost of capital, also known as the cost of equity. In a near full-employment economy, heightened production could lead to inflation (Blanchard, Amighini, & Giavazzi, 2021; Tobin, 1969). If the stock price increase is attributed to expected future inflation, the Consumer Price Index (CPI) will rise correspondingly due to wage and price adjustments relevant to the new circumstances (Barsky & Sims, 2011; Mishkin, 2007). Suppose stock price gains are perceived as indicative of an overheating economy. In that case, the central bank may implement a restrictive monetary policy as a precautionary measure, which will mitigate inflation and may lead to a decrease in economic activity (Bernanke & Gertler, 2001; Clarida, Gali, & Gertler, 2000).

Consequently, the coefficient of the BIST100 may exhibit either a positive or negative value, contingent upon the actions of the CBRT.

Inflation and Output Level: In the AD-AS model, the connection between output level and inflation is expected to exhibit a positive slope in the short run. Consequently, when firms react to an increase in aggregate demand by increasing production, a positive output gap emerges, resulting in a rise in the general price level. Ultimately, as the economy reaches equilibrium at full employment, production increases will lead to heightened inflation due to wage-price adjustments (Mankiw & Scarth, 2019). According to the New Keynesian framework, the correlation between output levels and inflation indicates that the output gap will invariably lead to an adjustment via inflation due to marginal cost and price-adjustment dynamics (Woodford & Walsh, 2005). The Phillips curve analysis, augmented by expectations, elucidates the short-term inverse relationship between unemployment and inflation, which can be attributed to the positive correlation between inflation and output, a characteristic of the business cycle. Given these factors, a positive correlation is anticipated between the Industrial Production Index (IPI), utilized as a proxy for output levels, and the Consumer Price Index (CPI).

Inflation and Interest Rate: Interest rates are a crucial instrument of monetary policy, particularly for central banks. Economic theory suggests that rises in interest rates are expected to mitigate inflation by reducing aggregate demand. The transition mechanism, as outlined in the IS-LM (AD-AS) analysis, occurs when interest rates rise, thereby increasing borrowing costs, which in turn reduces investment and output, leading to a decline in aggregate demand and, subsequently, a decrease in inflation (Mankiw & Scarth, 2019). From this perspective, an inverse relationship is expected to exist between interest rates and inflation.

Nevertheless, in certain instances, escalating interest rates, particularly in the short term, may paradoxically increase inflation instead of reducing it, as they raise borrowing costs. If companies can swiftly pass these heightened costs on to their prices, they may also exert an upward influence on inflation through the exchange rate. The appreciation of the home currency, along with rising interest rates, reduces import expenses and lowers prices. Nevertheless, if an escalating currency rate induces uncertainty and prompts capital flight, the exchange rate will increase, hence elevating import costs and triggering inflation. In emerging economies, where central bank credibility is regarded as diminished or government debt is substantial (resulting in money printing for repayment), the second scenario is more probable (Brandao-Marques, Casiraghi, Gelos, Harrison, & Kamber, 2024; Brandao-Marques, Gelos, Harjes, Sahay, & Xue, 2020).

Inflation and Uncertainty: Within the context of the Turkish Economic Uncertainty Index, the impact of the variable on inflation should be considered in relation to developing countries. Therefore, since increased fiscal uncertainty affects the supply side more extensively, it increases the country's risk premium and thus undermines confidence, disrupts inflation expectations, increases the mark-up levels, and leads to cost inflation (Fernández-Villaverde, Guerrón-Quintana, Kuester, & Rubio-Ramírez, 2015). On the other hand, inflation uncertainty can affect inflation in developing countries because of the rapid adjustment of cost increases to price-wage levels. For example, Gülşen and Kara (2019) and Atgür (2021), using different analysis methods, it was concluded that inflation uncertainty increases inflation in Turkey. Hence, the expected sign of the determinant of LECSU in Model 2 is positive.

3. EMPIRICAL LITERATURE

3.1. Estimation of Gold Volatility with GARCH Models

Bentes (2015) identified that the linear dependence in the conditional variance of gold returns is best modeled by FIGARCH(1, d, 1); Yurttagüler (2024) determined that the GARCH(1,1) model is the most effective for estimating the volatility of the BIST100 Gold index, surpassing ARCH, GARCH, EGARCH, and TGARCH models; Çankaya and Konuklar (2023) concluded that the EGARCH model is appropriate for estimating gold price volatility; Kumaraswamy, Abdulla, and Panigrahi (2022) observed persistent volatility effects in their analysis of gold price returns during the post-pandemic period, utilizing various models including GARCH, EGARCH, TGARCH, APARCH, and GARCH-M for the years 2009-2021; Tetik (2018) found that the GJR-GARCH model was the most effective for estimating gold price volatility in Türkiye among several models assessed.

3.2. Relationship Between Gold Price Volatility and the Stock Market

Badshah, Frijns, and Tourani-Rad (2013) is an important research paper examining the volatility transmission between the stock market (VIX index) and gold prices (Gold VIX). They do not identify a causal relationship between gold price volatility and stock market volatility within the volatility series estimated using GARCH (1,1); nevertheless, they see a robust causality between stock market volatility and gold volatility. Contuk, Burucu, and Güngör (2013) investigated the impact of gold price volatility on the BIST100 index from 2009 to 2012, revealing that index returns were influenced by their own shocks. However, both variables were also affected by shocks from the other index Gencer and Musoglu (2014) employ the BEKK-GARCH model for Turkey from 2006 to 2013, concluding that there exists a bidirectional shock transmission with adverse impacts on both gold and stock markets Aziz, Sadhwani, Habibah, and Al Janabi (2020) investigated volatility spillover between stock and commodity markets in the United States from 2005 to 2016, utilizing the GARCH (1,1) model. They concluded that no spillover occurred between commodity and stock markets, including gold. Consequently, they propose that investors in the United States diversify their risk by investing in both markets. Arouri, Lahiani, and Nguyen (2015) employed the VAR-GARCH methodology to examine the influence of volatility in global gold prices on the Chinese stock market. They assert that historical gold returns significantly influence the dynamics of conditional return and volatility in the Chinese stock market, necessitating their consideration in future stock return estimations. Yamaka and Maneejuk (2020) investigated the impact of gold shocks on stock markets in Asian emerging economies, focusing on causation and reliance. Their findings reveal that the impact of gold shocks on stock markets is nonlinear, with a greater correlation during crises than in pre- and post-crisis periods. Additionally, they show that the consequences of adverse gold shocks in the Indian and Korean stock markets influence one another. El Abed and Zardoub (2019) utilized the EGARCH approach to identify asymmetric impacts that varied between market downturns and upswings in their analysis of the relationship between gold prices and three distinct financial markets. The study by Mensi, Al Rababa'a, Vo, and Kang (2021) reveals that the asymmetric relationship between the Chinese stock market and gold and crude oil futures demonstrates that spillovers in these commodities and various stock market sectors exhibit an asymmetric effect, with negative spillovers significantly suppressing positive spillovers.

3.3. Relationship Between Gold Price Volatility and Inflation

Tufail and Batool (2013) analyzed the impact of gold and stock markets on inflation in Pakistan, concluding that gold has a significant influence on inflation and serves as a haven for investors against unforeseen inflationary pressures. Balcilar, Ozdemir, Shahbaz, and Gunes (2018) investigated the nonparametric causation between inflation and gold prices in G7 nations with the causality-quantile methodology, revealing that fluctuations in gold prices were not induced by inflation but were influenced by exchange rate and financial shocks. Consequently, gold is established as a safe haven from inflation. Conversely, Ojaghlou and Satvati (2021) investigated the short- and long-term correlation between the CPI and gold prices in Turkey from 2008 to 2021 using the SVAR model. They found no long-term cointegration relationship between gold prices and CPI, while asserting a one-way Granger causality from CPI to gold prices. Safdar and Ayyoub (2023) examined the correlation between local gold prices and anticipated inflation in G7 and Russia, utilizing the ARDL methodology from 1990 to 2022. Although gold prices do not exert an immediate short-term influence on inflation in countries outside the UK, they have long-term repercussions in France. Annual average returns indicate that gold prices have a significant impact on inflation in Italy, Russia, and the United Kingdom. In conclusion, prices of gold and inflation levels are interconnected; yet, the form and intensity of this link fluctuate throughout the years and among various nations.

Despite the substantial literature, no research has yet combined GARCH-based gold price volatility with Turkey's macroeconomic fundamentals while incorporating the Turkey-specific economic uncertainty index (Kilic & Balli, 2024) into an ARDL framework. This paper addresses that gap by offering the first complete evidence on the interrelated dynamics of gold volatility, stock market performance, and inflation in Turkey.

4. THE DATA AND METHODOLOGY

4.1. The Data

This study uses data from two different periods. First, gold price volatility was estimated using monthly US dollar-denominated gold spot data [1] covering the period from January 1990 to March 2025, along with the conditional

[1] https://www.investing.com/currencies/xau-usd-historical-data.

variance series derived from the GARCH (2,2) model. The resulting gold price volatility series (GVOL22) was then included in the datasets created for the ARDL models. These datasets, spanning 2006-2024, contain monthly data[2]. The GVOL22 series represents gold price volatility; the LCPI series[3] is the logarithmic consumer price index for Turkey; the LBIST100 is the logarithmic BIST 100 index[4]; the LIPI is the logarithmic industrial production index[5] to measure output, the LECSU is the logarithm of the Turkey-specific Economic Uncertainty Index[6] to reflect uncertainty, and finally, the LENDING series shows the interest rate on commercial loans[7].

4.2. The GARCH Methodology

The Autoregressive Conditional Heteroskedasticity (ARCH) model, established by Engle (1982), is predicated on the premise that the variance of error factors in time series exhibits variability. A variant of the ARCH model, the Generalized ARCH (GARCH) model, was first proposed by Bollerslev (1986) and is said to be affected by both past error terms and past variances, especially during periods of increased volatility.

The GARCH (2,2) model demonstrated better performance in this study. The GARCH (2,2) model employs the following GARCH *(p, q)* structure to forecast gold price volatility.

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \qquad (1)$$

In Equation 1, α_0, α_i, and β_j represent the estimated parameters; q indicates the order of the ARCH terms, whereas p denotes the ordered set of GARCH parameters. To guarantee that σ_t^2 retains a positive conditional variance at all times t, the conditions $\alpha_0 > 0$, $\alpha_i \geq 0$ (for $i = 1,\ldots,q$), and $\beta j \geq 0$ (for $j = 1,\ldots,p$) are stipulated. When $p = 0$, GARCH *(p, q)* reduces to an ARCH *(q)* process. In ARCH, the conditional variance is defined solely as a linear function of historical sample values, whereas GARCH incorporates the lagged conditional variance into the model. Conversely, in a GARCH (1,1) process, the current conditional variance is modeled as a function of both past squared errors and past variances, providing a more flexible framework for capturing volatility clustering in financial time series σ_t^2 is affected by the previous shock ε_{t-i}^2, similar to ARCH, and is also influenced by the conditional variance from the prior day. Thus, if the volatility at time $t - 1$ has markedly deviated from its mean, it will affect the estimated volatility at time t, which will display increased volatility until it returns to its mean (Schmidt, 2021).

4.3. The ARDL Methodology

Johansen (1991), Johansen (1995), Engle and Granger (1987) and Johansen and Juselius (1990) are among the cointegration tests that have been utilized in the last few decades. Problems with the correct order of variables' integration plagued earlier models.

A new cointegration model with greater flexibility in the variable integration order, specifically I(0) and/or I(1), was proposed by Pesaran and Shin (1998) to address this problem. Both Narayan (2004) and Pesaran, Shin, and Smith (2001) expanded the model. The linear transformation also enables the calculation of the error correction term from the ARDL model.

This article employs the linear ARDL methodology to investigate the short-term and long-term cointegration relationships in two models, where the variables LBIST100 and LCPI are used as dependent variables separately, alongside the GVOL22 series estimated using the GARCH (2,2) model.

The ARDL form of Model 1 is presented at Equation 2 and Model 2 at Equation 3.

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[2] The reason that the first data series spans the period from 1990 to 2025 is that in order to get strong results for GARCH analysis, the data series has to be long.

[3] https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket.

[4] https://tr.investing.com/indices/ise-100-historical-data.

[5] https://data.tuik.gov.tr/Bulten/Index?p=Industrial-Production-Index-January-2024-53770&dil=2.

[6] https://www.policyuncertainty.com/turkiye_index.html.

[7] https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket.

$$DLBIST100_t = \beta_0 + \sum_{i=1}^{p_2} \beta_{1i}\, DLBIST100_{t-i} + \sum_{i=0}^{q_1} \beta_{2i}\, DGVOL22_{t-i} + \sum_{i=0}^{q_2} \beta_{3i}\, DLIPI_{t-i} + \sum_{i=0}^{q_3} \beta_{4i}\, DLCPI_{t-i} + \sum_{i=0}^{q_4} \beta_{5i}\, DLECSU_{t-i} + \sum_{i=0}^{q_5} \beta_{6i}\, DLENDING_{t-i} + \gamma_{1i} LBIST100_{t-1} + \gamma_2 GVOL22 + \gamma_3 LIPI_{t-1} + \gamma_4 LCPI_{t-1} + \gamma_5 LECSU_{\,t-1} + \gamma_6 LENDING_{\,t-1} + \varepsilon_{it} \quad (2)$$

$$DLCPI_t = \alpha_0 + \sum_{i=1}^{p_1} \alpha_{1i}\, DLCPI_{t-i} + \sum_{i=0}^{q_1} \alpha_{2i}\, DGVOL22_{t-i} + \sum_{i=0}^{q_2} \alpha_{3i}\, DLIPI_{t-i} + \sum_{i=0}^{q_3} \alpha_{4i}\, DLBIST100_{t-i} + \sum_{i=0}^{q_4} \alpha_{5i}\, DLECSU_{t-i} + \sum_{i=0}^{q_5} \alpha_{6i}\, DLENDING_{t-i} + \delta_{1i} LCPI_{t-1} + \delta_2 GVOL22 + \delta_3 LIPI_{t-1} + \delta_4 LBIST100_{t-1} + \delta_5 LECSU_{\,t-1} + \delta_6 LENDING_{\,t-1} + \varepsilon_{it} \quad (3)$$

Equation 2 and 3 delineate the Unconstrained Error Correction Model (UECM), consistent with the ARDL bounds test. In model 1, DLBIST100, DGVOL22, DLCPI, DLECSU, and DLENDING are included. Equation 2 represents the differential values of the variables. α_1 to α_6 represent the short-term dynamic connection, while δ_1 to δ_6 indicate the long-term dynamic relationship. q also signifies the lag period of the dependent variable. In model 2, DLCPI, DGVOL22, DLBIST100, DLECSU, and DLENDING are included. Equation 3 represents the differential values of the variables. β_1 to β_6 represent the short-term dynamic connection, while γ_1 to γ_6 indicate the long-term dynamic relationship. q signifies the lag period of the dependent variable, as well.

The short-term form includes the term ECT_{t-1} has been estimated in Equation 4 and 5.

$$DLBIST100_t = \beta_0 + \sum_{i=1}^{p_1} \beta_{1i}\, DLBIST100_{t-i} + \sum_{i=0}^{q_1} \beta_{2i}\, DGVOL22_{t-i} + \sum_{i=0}^{q_2} \beta_{3i}\, DLIPI_{t-i} + \sum_{i=0}^{q_3} \beta_{4i}\, DLCPI_{t-i} + \sum_{i=0}^{q_4} \beta_{5i}\, DLECSU_{t-i} + \sum_{i=0}^{q_5} \beta_{6i}\, DLENDING_{t-i} + \varphi_i ECT_{t-1} + \varepsilon_t \quad (4)$$

$$DLCPI_t = \alpha_0 + \sum_{i=1}^{p_1} \alpha_{1i}\, DLCPI_{t-i} + \sum_{i=0}^{q_1} \alpha_{2i}\, DGVOL22_{t-i} + \sum_{i=0}^{q_2} \alpha_{3i}\, DLIPI_{t-i} + \sum_{i=0}^{q_3} \alpha_{4i}\, DLBIST100_{t-i} + \sum_{i=0}^{q_4} \alpha_{5i}\, DLECSU_{t-i} + \sum_{i=0}^{q_5} \alpha_{6i}\, DLENDING_{t-i} + \theta_i ECT_{t-1} + \varepsilon_t \quad (5)$$

Equation 4 and Equation 5, the term ECT_{t-1} represents the error correction term, while θ_i represents the long-term equilibrium adjustment velocity following a short-term shock. If θ_i (in Equation 4) and φ_i (in Equation 5) are statistically significant and negative, indicating the pace at which the variables return to equilibrium in the long term after a short-term disturbance.

5. EMPIRICAL FINDINGS

5.1. Unit Root Tests

Stationarity tests must be conducted on the series prior to both GARCH and ARDL analyses. The test statistics and probability values derived from the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are presented in the results Table 1.

Table 1. Unit root test results.

Variable	Exogenous term	ADF		PP	
		t-statistic	Prob.	t-statistic	Prob.
LGOLD	Intercept	0.737	0.992	0.903	0.995
	Trend and intercept	-1.998	0.600	-1.915	0.644
	None	2.308	0.995	2.545	0.997
DLGOLD	Intercept	-22.486	0.000	-22.546	0.000
	Trend and intercept	-22.625	0.000	-22.695	0.000
	None	-22.219	0.000	-22.184	0.000
GVOL22	Intercept	-3.562	0.007	-3.535	0.007
	Trend and intercept	-4.371	0.002	-4.556	0.001
	None	-1.535	0.116	-1.231	0.200
LCPI	Intercept	4.340	0.999	6.186	0.999
	Trend and intercept	1.866	0.999	2.754	0.999
	None	2.755	0.998	6.213	0.999
DLCPI	Intercept	-3.297	0.016	-6.890	0.000
	Trend and intercept	-5.575	0.000	-7.982	0.000
	None	-1.800	0.068	-4.818	0.000
LIPI	Intercept	-0.936	0.775	-0.593	0.868
	Trend and intercept	-4.231	0.004	-4.030	0.009

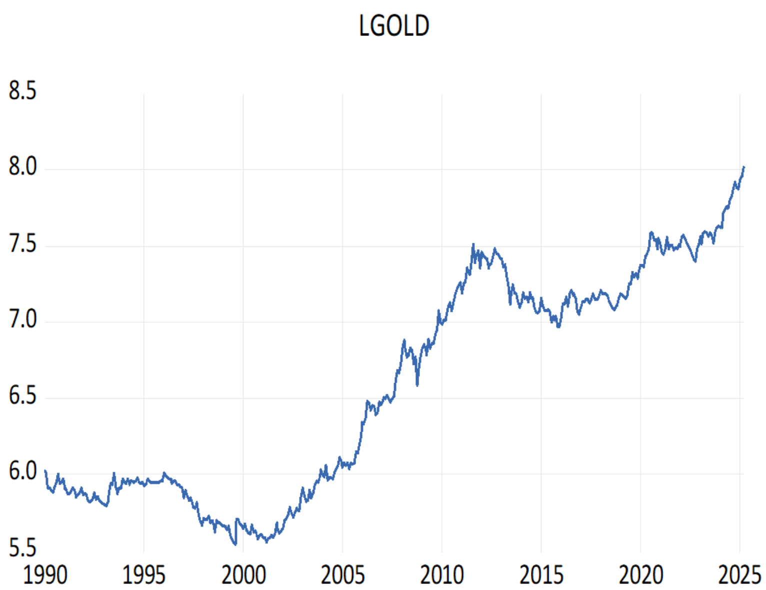
Variable	Exogenous term	ADF		PP	
		t-statistic	Prob.	t-statistic	Prob.
	None	1.558	0.970	2.566	0.997
DLIPI	Intercept	-16.760	0.000	-18.588	0.000
	Trend and intercept	-16.722	0.000	-18.534	0.000
	None	-16.584	0.000	-17.165	0.000
LENDING	Intercept	-0.951	0.770	-0.162	0.939
	Trend and intercept	-1.835	0.684	-1.114	0.923
	None	0.180	0.737	0.712	0.868
DLENDING	Intercept	-7.666	0.000	-7.453	0.000
	Trend and intercept	-7.797	0.000	-7.577	0.000
	None	-7.633	0.000	-7.432	0.000
LECSU	Intercept	-4.664	0.000	-9.671	0.000
	Trend and intercept	-4.697	0.000	-9.775	0.000
	None	-0.391	0.542	-0.151	0.630
DLECSU	Intercept	-17.661	0.000	-29.059	0.000
	Trend and intercept	-17.621	0.000	-28.991	0.000
	None	-17.701	0.000	-29.143	0.000
LBIST100	Intercept	1.590	0.999	1.453	0.999
	Trend and intercept	-0.676	0.972	-0.789	0.964
	None	2.756	0.998	2.668	0.998
DLBIST100	Intercept	-13.978	0.000	-13.977	0.000
	Trend and intercept	-14.256	0.000	-14.258	0.000
	None	-13.652	0.000	-13.691	0.000

According to the ADF and PP test results, as indicated in Table 1, except for the GVOL22 series, which is stationary at the level, all the other series are found to be I (1).

The first difference of the LGOLD series, which denotes the gold price, was incorporated into the GARCH model, and the GVOL22 series was utilized. Subsequently, it was decided that the ARDL cointegration test would be appropriate for the GVOL22 series, which is I(0), and the other variables, which are I(1).

5.2. GARCH Model Results

The graphs presented in Figure 1 indicate that the gold price exhibits significant volatility, with the phenomenon of volatility clustering being evident. Figure 1 indicates a significant clustering in the LGOLD returns, particularly following the 2008 crisis.



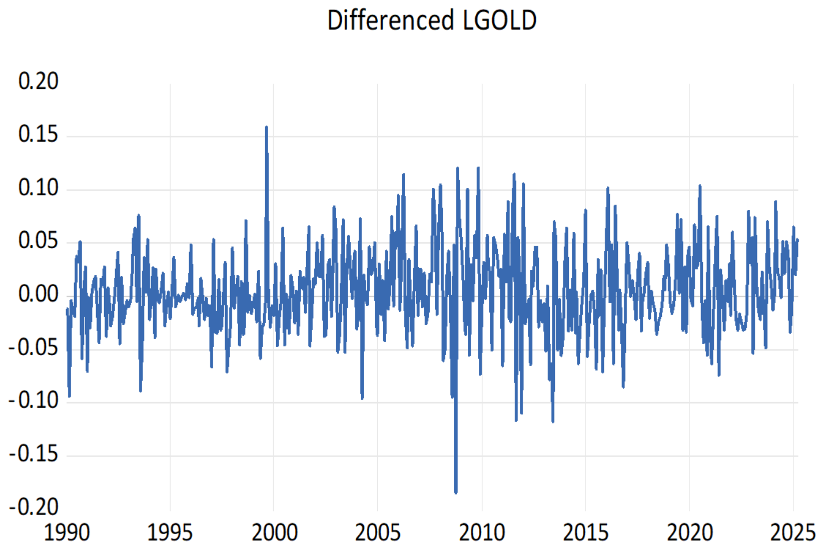


Figure 1. Return graphs of the gold price.

Estimation of the conditional mean equations requires selecting the appropriate ARMA model. To determine whether the gold price series exhibits volatility clustering, an ARCH-LM test must be conducted before constructing the GARCH model (Brooks, 2014). The first step is to run an LM test with the ARMA model. Among all the ARMA models, the model with the lowest negative AIC information criterion value exhibits ARCH effects, as shown in Table 2.

Table 2. ARCH-LM test results.

Variable	ARMA	F-statistic	Prob. F	Obs.*R-squared	Prob. Chi-Square (1)
DLGOLD	ARMA (4,4)	17.216	0.000	16.610	0.000

Table 2 above shows that the probability values are less than 0.05, which indicates that the series is affected by an ARCH effect. To mitigate the ARCH effect, GARCH models should be employed.

Results from the GARCH model's estimation of the gold price series are shown in Table 3.

Table 3. Results of the GARCH (2,2) model.

Coef.	DLGOLD (GARCH (2,2))			R-squared	0.007		
C	1.431e-06			Sum squared resid.	0.772		
RESID(-1)^2 (α_1)	0.118*			Log Likelihood	746.246		
RESID(-2)^2 (α_2)	-0.123*			AIC	-3.508		
GARCH(-1) (β_1)	1.748**			SC	-3.382		
GARCH(-2) (β_2)	-0.743**			HQC	-3.458		
GARCH = 1.4310e-06+ 0.1181*RESID(-1)^2 + -0.1231*RESID(-2)^2 + 1.7482 *GARCH(-1) + -0.7438*GARCH(-2)							
Ljung-box test				ARCH-LM test			
Lags	10	15	20	Lags	1	2	3
Q-Stat	3.943	8.599	11.280	F-Stat	0.170	0.287	0.231
Prob.	0.139	0.282	0.505	Prob.	0.680	0.750	0.874

Note: "*" and "**" denote 5% and 1% significance levels, respectively.

Table 3 displays the optimal GARCH model estimation results for the gold price series. The coefficients of the GARCH (2,2) model exhibit statistical significance for ARCH effects at the 5% level and for GARCH effects at the 1% level. Thus, both ARCH and GARCH effects are evident in gold prices. The sum of the ARCH and GARCH components in the model is calculated to be 0.99944. The GARCH term values being below one (1) indicate that volatility shocks may endure for a prolonged period, and their effects are very lasting.

Table 3 also presents the model's validity tests, including the Ljung-Box and ARCH-LM test results. The Ljung-Box test findings indicate that all calculated p-values for the 10th, 15th, and 20th lag durations are greater than 0.05. The findings demonstrate that the model effectively represents serial correlation, hence corroborating the null hypothesis of the absence of significant serial correlation.

Table 3 also presents the results of the Weighted ARCH LM (Lagrange Multiplier) tests for exploring the potential presence of an ARCH effect in the model residuals. All estimated probability p-values in each instance surpass the 5% significance threshold, so the null hypothesis cannot be rejected, as illustrated in Table 3, which presents the test values for up to three lag lengths. Thus, the residuals of the GARCH model exhibited no indications of an ARCH effect. Therefore, the volatility of gold prices, as analyzed by the GARCH model, can be sufficiently characterized.

Figure 2 shows the graph of the estimated conditional series of gold price volatility, and a new series described as GVOL22 symbolizes gold price volatility for the two established ARDL models.

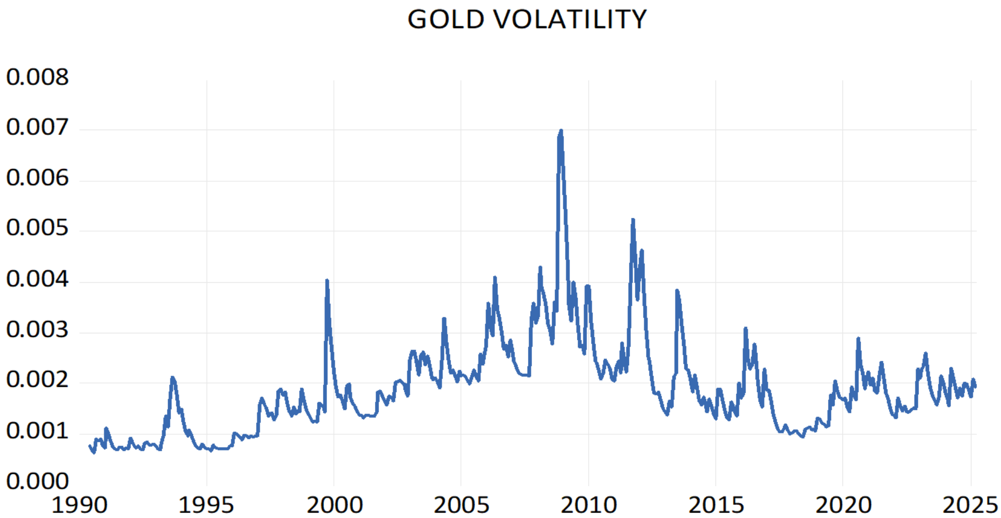


Figure 2. Time series graph of conditional variances of the gold price.

5.3. The ARDL Results

Establishing the appropriate lag lengths is crucial for cointegration tests. Table 4 presents the results of determining the lag order. All four criteria (FPF, AIC, SC, HQ) suggest a lag length of 2 for conductive cointegration.

Table 4. Lag selection.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	323.322	NA	2.13e-09	-2.938	-2.844	-2.900
1	2121.311	3479.443	1.75e-16	-19.252	-18.596	-18.987
2	2224.560	194.068	9.41e-17*	-19.875*	-18.656*	-19.383*
3	2245.105	37.476	1.09e-16	-19.732	-17.951	-19.012
4	2276.626	55.745*	1.14e-16	-19.690	-17.347	-18.744
5	2301.488	42.587	1.27e-16	-19.587	-16.681	-18.413
6	2327.258	42.711	1.41e-16	-19.493	-16.024	-18.091
7	2352.095	39.785	1.58e-16	-19.389	-15.358	-17.761
8	2375.720	36.531	1.80e-16	-19.275	-14.681	-17.419
9	2396.853	31.502	2.11e-16	-19.137	-13.980	-17.054
10	2424.759	40.050	2.33e-16	-19.062	-13.343	-16.752
11	2448.786	33.148	2.69e-16	-18.951	-12.669	-16.413
12	2477.819	38.442	2.98e-16	-18.887	-12.042	-16.122

Note: * denotes the optimal lag length according to the respective information criterion.

Upon establishing that the series employed in unit root tests are stationary at I(0) and I(1) levels and selecting the appropriate lag, it is necessary to investigate the existence of a cointegration relationship among the variables used in the long term, which is assessed using the bounds test approach. Table 5 shows the bound test results for each model.

Table 5. Bound test results.

MODELS	Test statistic	Value	1% level		5% level		10% level	
			I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Model 1	F-statistic	4.344	3.06	4.15	2.39	3.38	2.08	3
Model 2	F-statistic	4.146	3.06	4.15	2.39	3.38	2.08	3

The results in Table 5 show that the F-statistic values for both models are statistically significant at the 1% level and exceed the critical value of the upper limit in the Pesaran et al. (2001) table when neither a constant nor a trend is included. A long-term cointegration relationship is established among the series in models 1 and 2 throughout the study period.

Following bounds tests indicating the long-run relationship in the models, the ARDL and ARDL-ECM methodologies were utilized to evaluate both the long-run and short-run relationships, with detailed estimates provided in Table 6 for Model 1.

Table 6. Short-run estimates for Model 1.

Short-run estimates				
Dependent variable: LBIST100 Regressors	**Coefficient**	**Std. error**	**t-statistic**	**p-value**
LBIST100(-1)	-0.097	0.026	-3.718	0.000
GVOL22	-17.932	7.120	-2.518	0.012
LCPI(-1)	0.180	0.036	4.886	0.000
LIPI	-0.190	0.054	-3.464	0.000
LENDING	-0.001	0.000	-2.350	0.019
LECSU	-0.024	0.011	-2.150	0.032
COINTEQ(-1)	-0.097	0.017	-5.589	0.000
Constant	0.637	0.180	3.537	0.000
Model Statistics		Diagnostic tests	X^2	P-Value
R-sq.	0.140	Serial correlation (Breusch-Godfrey LM)	0.080	0.922
Adj. R-sq.	0.136	Heteroskedasticity (Breusch-Pagan-Godfrey)	1.405	0.204
F-stat.	36.865	Jarque-Bera (Normality test)	8.087	0.017
Prob(F-statistic)	0.000	Ramsey RESET (Functional Form)	2.854	0.092
Durbin-Watson	1.991	CUSUM / CUSUMSQ	-	Stable

The coefficient of the GVOL22 series in the short-term coefficients of the ARDL model for Model 1 is significant at the 5% level. In comparison, the coefficients of all other variables are significant at the 1% level of significance. The volatility of gold prices, presumed to influence the BIST100 index, which is designated as the dependent variable, has a significant adverse impact on the index. A one-unit change in the LCPI variable has a favorable influence on the BIST100 index, increasing it by 18% after one period (one month). A one-unit rise in the LIPI variable, indicative of output level, results in a 19% decline in the BIST100 index within the same timeframe. The rise in the lending rate (LENDING) marginally but notably diminishes the BIST100 index. An increase in the Economic Uncertainty Index for Turkey (LECSU) results in a 2% decline in the BIST100 index. The ECT term (COINTEQ (-1)) at a significance level of 1% signifies that around 9.75% of the departure from the system's long-term equilibrium is rectified in the subsequent month.

The performance tests for Model 1 in Table 6 demonstrate an acceptable fit, as the probability value exceeds 1% according to the Ramsey-Reset test findings. The Breusch-Godfrey test for heteroscedasticity and the Breusch-Pagan-Godfrey test for autocorrelation were employed to evaluate the model for these concerns. Since the probability surpassed 1% in both assessments, no issues of heteroscedasticity or autocorrelation were detected. The F-statistic is 36.86, signifying that the model is significant at the 1% probability level. The Jarque-Bera test was used to assess the normality of the error distribution. The errors in this model have a non-normal distribution, as the probability value of the test result is less than 5%. Figure 3 shows the models' stability with the CUSUM and CUSUMSQ tests. CUSUM indicates an unstable frame; however, CUSUMSQ shows a stable frame. This means the model coefficients fluctuate slowly while the variance remains constant. This suggests structural changes are gradual, not "crisis"-like.

Table 7. Long-run estimates for model 1.

Long-run estimates				
Dependent variable: LBIST100 Regressors	**Coefficient**	**Std. error**	**t-statistic**	**p-value**
GVOL22	-183.833	75.432	-2.437	0.015
LCPI(-1)	1.849	0.290	6.377	0.000
LIPI	-1.949	0.687	-2.837	0.004
LENDING	-0.016	0.008	-1.942	0.053
LECSU	-0.253	0.135	-1.869	0.062
C	6.531	2.097	3.113	0.002

Table 7 presents the long-term coefficients of Model 1. The GVOL22 series negatively impacts BIST100 returns in the long term at a 5% significance level. This suggests that gold may be perceived as a safe haven in Turkey, given the fluctuations in gold prices over both short and long periods, prompting investors to seek gold as a refuge from financial market uncertainty. The long-term impact of LCPI (≈1.85) on the stock market index increases by approximately 100 times. The rise in the LIPI, again at a 1% significance level, exerts an adverse effect on the stock market index that is 100 times greater than in the short run (≈−1.95). A 1-point increase in lending results in a 1.6% rise in the BIST 100 index at a 10% significance level. The LECSU index has a negative impact on the BIST100 index, reducing it by 25% at a 10% significance level over the long term.

This result's economic implications provide us with important insights. What are the adverse consequences of gold price volatility on stock markets? To elucidate this, one must first acknowledge that gold serves as a barometer of market volatility in emerging economies, such as Turkey (Baur & McDermott, 2010). Consequently, when we link this to risk-averse investor behavior, the acceptance of heightened gold price volatility as a sign of uncertainty may prompt a shift from equities, which are riskier assets, to gold, regarded as a safe haven, or to other risk-free assets. Moreover, due to gold's cultural perception as a robust store of value in Turkey, variations in gold prices can significantly influence financial markets. Thirdly, fluctuations in currency rates, particularly for import-dependent enterprises in Turkey, may induce a propensity to withdraw from the stock exchange amid variations in gold prices.

The analysis of the second explanatory variable in Model 1, CPI, aligns with our expectations that an increase in CPI will elevate BIST100. This further substantiates that substantial corporations, comprising a comprehensive index such as the BIST 100, can exhibit these price increases. The findings also corroborate investors' inclination towards stock markets due to the sustained low interest rates stemming from discussions in Turkey.

The results regarding the LECSU, LENDING, and the LBIST are consistent with the theoretical framework.

The relationship between LIPI and LBIST100 findings reflects the antagonistic relationship between output levels and stock market prices. Due to the lower interest rate policy of CBTR, this result could occur, as mentioned by Minsky (2008).

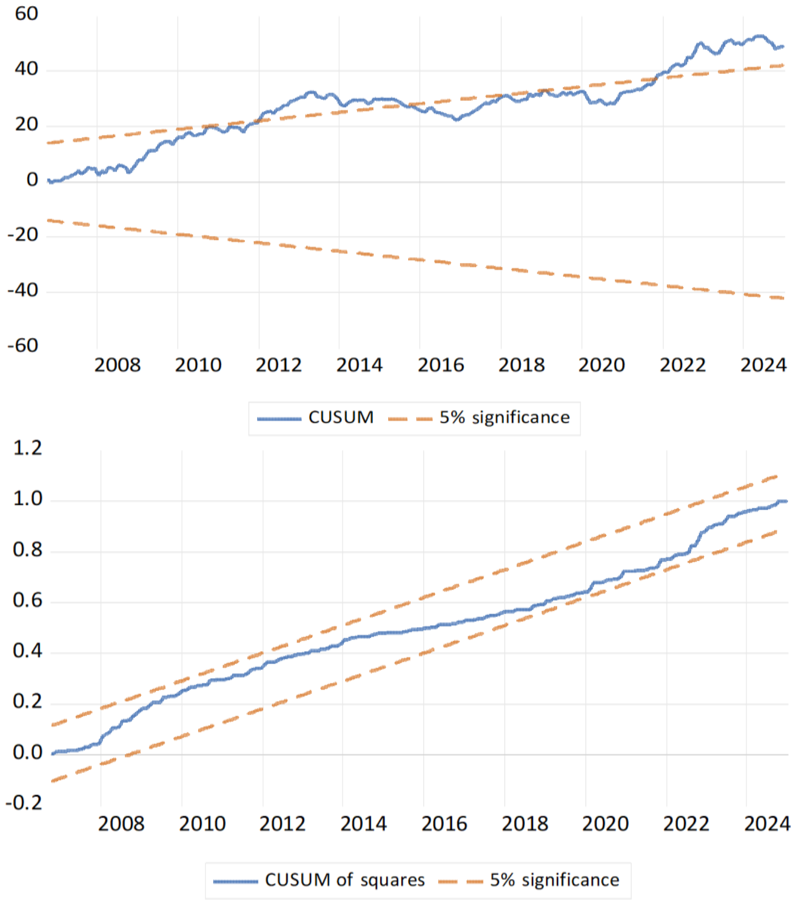


Figure 3. CUSUM and CUSUMSQ for Model 1.

Table 8. Short-run estimates for model 2.

Short-run estimates				
Dependent variable: LCPI Regressors	**Coefficient**	**Std. error**	**t-Statistic**	**p-Value**
LCPI(-1)	-0.001	0.006	-0.148	0.882
GVOL22	1.908	1.143	1.669	0.096
LIPI	0.016	0.009	1.768	0.078
LENDING(-1)	-2.52e-05	0.000	-0.201	0.840
LECSU	0.003	0.001	2.092	0.037
LBIST100(-1)	0.002	0.004	0.459	0.646
C	-0.093	0.029	-3.213	0.001
D(LCPI(-1))	0.509	0.065	7.721	0.000
D(LCPI(-2))	-0.174	0.072	-2.427	0.016
D(LCPI(-3))	0.123	0.064	1.894	0.059
D(LENDING)	0.002	0.000	5.016	0.000
D(LENDING(-1))	-0.001	0.000	-1.154	0.249
D(LENDING(-2))	-0.002	0.000	-3.132	0.001
D(LENDING(-3))	0.001	0.000	3.201	0.001
D(LBIST100)	0.014	0.010	1.405	0.161
D(LBIST100(-1))	0.037	0.010	3.524	0.000
COINTEQ(-1)	-0.001	0.000	-5.464	0.000
Model Statistics		Diagnostic tests	X^2	P-Value
R-sq.	0.610	Serial correlation (Breusch-Godfrey LM)	0.592	0.553
Adj. R-sq.	0.582	Heteroskedasticity (Breusch-Pagan-Godfrey)	1.511	0.103
F-stat.	21.707	Jarque-Bera (Normality test)	1.444	0.000
Prob(F-statistic)	0.000	Ramsey RESET (Functional form)	0.444	0.505
Durbin-Watson	1.979	CUSUM / CUSUMSQ	Stable	-

According to Table 8, which shows the short-run estimates of Model 2, the dependent variable is CPI. The coefficient of the GVOL22 series in the short-term coefficients of the ARDL model for Model 2 is significant at the 10% level with a positive sign. This means that a 1-point increase in gold price volatility causes a rise in CPI of approximately 1.90 points, as expected, which explains how gold price volatility affects inflation in the short run (Worthington & Pahlavani, 2007). According to the results of Model 2 and Table 9, in the long run, there is no significant relation with GVOL22 and LCPI, but there is in the short run. Nonetheless, the significance of this positive correlation in the short term is underscored by the findings of Peiris and Ding (2012), who assert that global commodity prices can influence inflation via the exchange rate channel. Furthermore, it is noteworthy that central banks tend to prefer holding reserves in the form of gold. In this context, Turkey's reserves are characterized by a substantial concentration of gold holdings.[8]

A one-unit increase in the LIPI variable results in approximately a 0.016 (≈1.6%) increase in the LCPI at a 10% significance level. This result is consistent with the economic theory within the Monetarist and New Keynesian approaches.

The interest rate coefficients (LENDING) exhibit a mixed pattern: the first-difference term is positive and substantial, whereas certain lagged differences alternate in sign throughout lags. Theoretically, elevated interest rates are anticipated to mitigate inflation via the aggregate demand channel (IS-LM/AD-AS framework). However, the empirical data indicate that in the short term, interest rate increases may also induce cost-push dynamics or exchange-rate pass-through, resulting in transient inflationary spikes. This contradiction highlights the complexity of monetary transmission in Turkey, underscoring the need for careful interpretation. As mentioned by Brandao-Marques et al. (2020), doubt about the central bank can rapidly affect expectations regarding inflation and fiscal policy in Turkey.

The coefficient for LECSU is positive at the 5% significance level and statistically significant. In other words, heightened uncertainty results in elevated inflation in Turkey. A 1% increase in the index results in a 0.3% rise in monthly inflation. Because the LECSU index encompasses the "uncertainty" and "economy" terms, this result aligns with studies that examine both fiscal and inflation uncertainty (Atgür, 2021; Fernández-Villaverde et al., 2015; Gülşen & Kara, 2019).

The variable D(LBIST100(-1)) exerts a favorable influence on the LCPI at the 1% significance level. Specifically, when the stock market index rises by 1%, the LCPI subsequently increases by three percentage points. This indicates that the CBRT's tightening monetary policy response is ineffective in the equity market.

The error correction term (ECT (-1)) is negative and significant, which is expected; however, the adjustment speed is quite low (–0.001). This implies that each month, only 0.09% of the imbalance gets corrected. The slow correction could result from various structural characteristics of the Turkish economy, including enduring inflationary inertia resulting from backward-looking indexation and price rigidities, insufficient credibility of monetary policy that hinders rapid convergence of expectations to a stable anchor, and structural vulnerabilities like exchange rate pass-through and fiscal dominance, which extend the impact of shocks. Moreover, heightened economic uncertainty, as evidenced by LECSU, may impede the gradual shift by diminishing confidence in long-term stability.

The diagnostic tests for Model 2 in Table 8 indicate an adequate match, as the probability value surpasses 1% based on the Ramsey-Reset test results. The Breusch-Godfrey test for heteroscedasticity and the Breusch-Pagan-Godfrey test for autocorrelation were utilized to assess the model for these issues. As the probability exceeded 1% in both evaluations, no instances of heteroscedasticity or autocorrelation were identified. The F-statistic is 21.70, indicating that the model is significant at the 1% probability threshold. The Jarque-Bera test was employed to evaluate the normality of the error distribution. The errors in this model have a non-normal distribution, as the probability value of the test result is less than 5%. Figure 4 illustrates the stability of the models as assessed by the CUSUM and

[8]https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Istatistikler/Odemeler+Dengesi+ve+Ilgili+Istatistikler/Uluslararasi+Rezervler+ve+Doviz+Likiditesi/

CUSUMSQ tests. CUSUM implies a stable framework; nevertheless, CUSUMSQ reveals an unstable framework. This indicates that the model displays abrupt structural shifts or alterations in variance.

Table 9. Long-run estimates for model 2.

Long-run estimates				
Dependent variable: LCPI Regressors	**Coefficient**	**Std. error**	**t-statistic**	**p-value**
GVOL22	1933.728	12590.833	0.153	0.878
LIPI	16.2789	103.684	0.157	0.875
LENDING(-1)	-0.025	0.255	-0.099	0.920
LECSU	3.980	26.860	0.148	0.882
LBIST100(-1)	2.072	10.550	0.196	0.844
C	-95.050	625.172	-0.152	0.879

Table 9 presents the long-term coefficients of Model 2. Over the long term, none of the regressors (GVOL22, LIPI, LENDING, LECSU, LBIST100) demonstrates statistical significance. The explanatory factors in this model exert a greater influence on inflation in the short term compared to the long term. Recognizing this outcome highlights the importance of short-term dynamics in Turkey's inflationary process, suggesting that long-term factors may lie beyond the current model specification. The ECT (-1) term in Table 8, which indicates the long-term healing effects resulting from short-term shocks, has a significant yet minimal coefficient. This suggests that the impact of the variables does not persist over time.

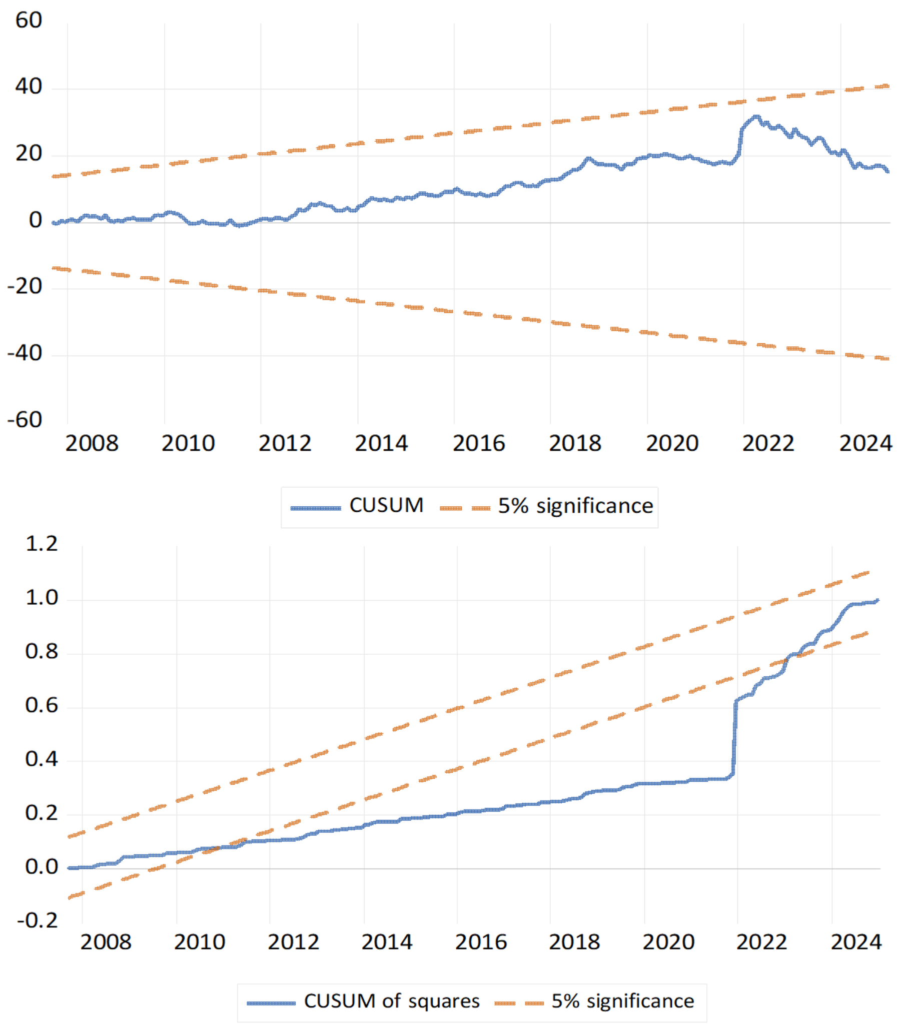


Figure 4. CUSUM and CUSUM2 for Model 2.

6. CONCLUSION

The importance of economic uncertainty and market fluctuations on the financial and economic frameworks of nations is crucial nowadays. In an emerging economy like Turkey, where gold is viewed as a vital financial investment, assessing gold price volatility becomes crucial for understanding its impact on the stock market and inflation. The significance of assessing gold volatility lies in its ability to identify potential risks and opportunities within the financial landscape. Consequently, understanding the correlation between gold price fluctuations and the stock market throughout diverse economic conditions is essential for investors in their decision-making processes, while policymakers must grasp the short- and long-term implications of gold price volatility on inflation.

This study, grounded in robust theoretical arguments, first examines the impact of Turkey-specific economic policy uncertainty, inflation, industrial production, and interest rates on the BIST100 stock market index following the estimation of gold price volatility through GARCH analysis. Subsequently, it examines the effects of these variables on inflation using two distinct models that employ the ARDL method.

The GARCH model, applied to the Gold Spot price series, facilitated the development of a gold price volatility index, which was a crucial variable in our examination of its effects on stock market indices and inflation rates in Türkiye. This strategy facilitated the capture and quantification of fundamental volatility in gold prices, establishing a solid framework for further investigations. By developing two distinct models, the correlation between gold price volatility and key macroeconomic variables may be thoroughly analyzed. This dual-model approach constitutes a methodological contribution to the literature by directly linking volatility shocks to asset prices and inflation within an emerging market environment.

Elevations in gold price volatility significantly affect the short- and long-term depreciation of the BIST 100 index, concurrently exacerbating inflation, especially in the short term. These findings align with prior studies, including Baur and Lucey (2010), which suggests that the connection between gold and stock markets is intricate and contextually dependent. The lending rate adversely affects the BIST100 index in the short term and has a weak negative correlation in the long term, aligning with discount-rate and cost-of-capital mechanisms. Moreover, research conducted by Worthington and Pahlavani (2007) and Wang et al. (2011) substantiates the historical correlation between gold prices and inflation, highlighting gold's dual function as a safeguard against inflation and a predictor of forthcoming inflationary patterns.

The data for Model 2 may prompt us to reach some concerning conclusions. In Model 2, the short-run coefficients of the lending rate are statistically significant yet exhibit alternate signs, indicating a constrained and intricate transmission to inflation. In contrast, the long-term coefficient of LENDING is negligible, indicating that monetary tightening does not have a persistent impact on price stability. This suggests that a sustainable resolution to inflation in Turkey cannot be achieved solely through economic measures. Consequently, further structural solutions need to be developed. Moreover, the LECSU effect of country-specific structural uncertainty exerts a significant influence in the short run. Consequently, policies that induce uncertainty should be eschewed, and emphasis should be placed on managing expectations. Together, these findings underscore that diminishing uncertainty and enhancing institutional legitimacy are equally vital as monetary measures in reinstating long-term stability.

The findings have three significant policy implications. Firstly, for investors, the pronounced and substantial impact of gold price volatility on stock market returns and inflation underscores the necessity of integrating gold into risk management and portfolio strategies, considering its dual function as a safe haven and an inflation indicator in Turkey. Secondly, for monetary authorities, the minimal long-term effects of interest rate modifications underscore the necessity to bolster central bank credibility and the expectations channel; in the absence of enhanced institutional trust, transient measures cannot reliably stabilize inflation. Thirdly, the importance of the LECSU index emphasizes that sustained price and financial stability in Turkey necessitates comprehensive structural reforms beyond mere monetary tightening specifically, mitigating policy-induced uncertainty, establishing consistent macroeconomic frameworks, and enhancing institutional transparency.

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Data Availability Statement: Havva Nesrin Tiryaki can provide the supporting data of this study upon a reasonable request.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

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