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EXPLORING THE INFLUENCE OF FINANCIAL INSTRUMENT PRICES ON TÜRKIYE'S CREDIT VOLUME DURING COVID-19

Abstract: This study addresses a critical question for financial stability: can fluctuations in financial investment instruments, specifically during crises, explain variations in credit volume? This issue is particularly relevant for economies like Türkiye, where COVID-19 introduced significant financial volatility. Using weekly data from January 6, 2020, to July 4, 2022, this paper investigates the relationship between key financial assets and Türkiye's credit volume, employing a Non-linear Autoregressive Distributed Lag (NARDL) model to capture asymmetric responses to both positive and negative price shocks. To enhance robustness and precision in estimating long-term relationships, cointegration approaches such as Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) are utilized. The results reveal significant asymmetric effects, with negative shocks to bond rate and bitcoin exerting stronger adverse impacts in the long run, while positive Borsa Istanbul shocks enhance credit volume. Gold and USD exhibit mixed effects. Findings underline that policymakers need to monitor asset price changes carefully, as they can amplify credit market risks. Specifically, targeted measures to manage volatility in exchange rates and bond yields could help maintain balanced credit growth, reducing systemic risk in times of economic uncertainty. This research contributes to the literature by highlighting the asymmetric effects of financial instruments on credit volume during the pandemic, offering valuable insights for financial stability policy in emerging markets like Türkiye.

Keywords: Credit volume; Investment instruments; COVID-19; NARDL

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INTRODUCTION

The banking sector, especially the credit market, is a key component of financial systems (Longstaff and Wang, 2012). Events like the COVID-19 pandemic and the global financial crisis have underscored how shifts in credit accessibility can greatly influence both asset values and economic conditions. In the aftermath of the 2008–2009 financial crisis, the credit channel became a central focus of monetary policy transmission, emphasizing its importance in driving economic outcomes (Heryán and Tzeremes, 2017). Central banks are at the centre of the credit channel mechanism, and the changes in the policy stances of central banks play the leading determinant role in the expenditures of economic units through the banking sector, which provides financial intermediation (Gambacorta and Marques-Ibanez, 2011; McPhilemy and Moschella, 2019; Ferrara et al., 2022). The global credit conditions during the pandemic period were characterized by a mix of tightening and easing measures implemented by central banks and financial institutions worldwide. At the onset of the pandemic, as economies faced abrupt shocks and heightened uncertainty, credit conditions tightened significantly due to financial market volatility and liquidity pressures. In response, central banks implemented aggressive monetary policies, such as cutting interest rates and injecting liquidity, to stabilize markets and maintain the flow of credit.

Many central banks maintained supportive monetary policies as the pandemic spread to aid in the recovery of the economy. To give financial markets liquidity, the U.S. Federal Reserve, for instance, conducted a number of asset purchase programs and maintained interest rates close to zero. Similarly, the European Central Bank and other major central banks pursued similar measures to ease credit conditions and support lending to households and businesses. It is important to recognize that the effects of global credit conditions differed between countries and regions, influenced by factors like the intensity of the pandemic, the success of policy interventions, and the unique structure of local financial systems. Regarding Türkiye specifically, the country faced its unique set of challenges during the pandemic period. Türkiye’s economy was already under pressure before the pandemic, with high inflation, currency depreciation, and external vulnerabilities. The pandemic further exacerbated these challenges, leading to increased borrowing costs and tighter credit conditions in the country. During the COVID-19 pandemic, the credit channel became increasingly significant within the monetary policy transmission mechanism (Duymazlar, 2022). To mitigate the economic fallout from the pandemic, the Central Bank of the Republic of Türkiye [CBRT] implemented various measures, such as cutting interest rates and boosting liquidity.

Adelson (2020) states that the COVID-19 pandemic affects almost all sectors, not only the housing sector and financial institutions, and therefore the negative picture it creates is different. During the pandemic, GDP growth rates fluctuated due to lockdowns, supply chain disruptions, and changes in consumer behavior, impacting credit demand and supply ('World Economic Outlook…', 2020). High unemployment rates during the pandemic affected individuals' ability to service debt, leading to increased credit delinquencies and defaults, particularly in consumer lending sectors ('OECD Economic Outlook…', 2021). To foster economic growth and facilitate credit expansion, central banks implemented accommodative monetary policies, including reductions in interest rates ('BIS Quarterly Review…', 2021). Fiscal stimulus packages, including direct payments, enhanced unemployment benefits, and small business Credits, influenced credit volume by supporting household incomes and business liquidity, thereby affecting credit demand and repayment capacity ('Budgetary Effects…', 2020). Fluctuations in financial market conditions during the pandemic influenced credit supply dynamics ('Global Economic Prospects…', 2021). The willingness and ability of banks to provide credit during the pandemic were affected by the stability and resilience of the banking sector, which can be assessed through indicators like capital adequacy ratios, non-performing loan ratios, and profitability. Regulatory measures and government support programs aimed at bolstering banking sector health also impacted credit availability ('Financial Stability Review…', 2020). Central banks monitored inflation closely amid pandemic-induced supply chain disruptions and inflationary pressures from fiscal stimulus measures, which influenced monetary policy decisions and credit market dynamics ('Monetary Policy Report…', 2021). However, the effects of these global credit conditions varied across regions, influenced by the severity of the pandemic, the success of policy responses, and the unique structures of national financial systems.

It is important to note that while previous studies have highlighted the importance of bank credit, economic growth, and financial development, there remains a gap in exploring the interaction between credit volume and financial investment instruments. Consequently, this research seeks to fill this gap by analyzing changes in credit volume alongside various financial investment instruments during the pandemic. By doing so, the aim is not only to understand immediate impacts but also to infer future trends in Türkiye's financial market. Most research on credit volume during the pandemic has focused on discrete factors, such as non-performing loans, human capital, or government support programs (e.g., Ari et al., 2021; Purnamawati and Yuniarta, 2021; Žunić et al., 2021). Similarly, Fuhrer et al. (2021) and Degryse and Huylebroek (2023) focused on initiatives and programs offered to firms, which may not fully capture the effects of financial investment instruments' prices on credit volume across various market participants. However, there is a notable gap in examining the specific influence of financial investment instruments on credit volume during crises, particularly in Türkiye. While other studies have examined financial market dynamics in times of crisis, they often overlook the key ways in which changes in the prices of financial investment instruments impact credit volume across various sectors. Investigating this interaction is crucial, as it can offer insights into how market volatility transmits to credit markets and help policymakers devise measures to mitigate systemic risks and bolster financial stability. Regarding the comprehensive examination of the relationship between credit volume and the prices of financial investment instruments during the COVID-19 pandemic, especially considering the various factors affecting credit dynamics in Türkiye's financial market. Furthermore, there is a scarcity of studies that analyze the effects of financial investment instruments' prices on credit volume, especially in the context of a major economic shock such as the COVID-19 pandemic. Although extensive research exists on financial market dynamics during crises, including the influence of asset prices on economic variables, a gap persists in comprehending how changes in the prices of financial investment instruments during the pandemic specifically affected credit volume in Türkiye. Investigating this relationship is crucial for policymakers, financial institutions, and investors to comprehend the transmission mechanisms of market volatility to credit markets and to devise effective measures to manage systemic risks and support financial stability. The research questions guiding this study are as follows:

- How do fluctuations in financial instrument prices affect Türkiye's credit volume during a crisis?
- Are there asymmetric effects in the way positive and negative shocks in these financial instruments impact credit volume?

To answer these questions, this study employs advanced econometric approaches, including Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and the Non-linear Autoregressive Distributed Lag (NARDL) model. These models are selected to capture both long-term relationships and short-term asymmetries in credit volume responses to fluctuations in financial instruments. These models are particularly well-suited for analyzing how both positive and negative shocks in gold prices, the Borsa Istanbul (BIST) index, USD exchange rates, and bond rates influence credit volume, especially in times of crisis.

The remainder of the paper is structured as follows: Section 2 outlines the theoretical foundations of prior research. Section 3 details the methodology of the study, including the measurement specifics for each variable and an overview of the research approach. Following this, Section 4 examines the empirical results, evaluates the suitability of the data, and provides interpretations. After validating the findings, the final section discusses the implications, and limitations, and offers recommendations for future research.

LITERATURE REVIEW

Numerous global studies confirm the influence of the COVID-19 pandemic on consumer credit demand, with consumers adjusting their spending behaviors to match the evolving conditions (Czech and Puszer, 2021). Research from Türkiye shows that the pandemic positively impacted credit volume. Research on credit volume during the pandemic has primarily focused on discrete factors such as non-performing loans, foreign portfolio flows, and the impacts of monetary policy. For instance, Kılıç Depren and Kartal (2021) examined the volume of non-performing loans (NPLs) in Türkiye, identifying significant predictors such as credit volume, USD/TL exchange rate, and the unemployment rate, which highlight the interplay between economic health and credit conditions. Similarly, Kartal et al. (2022) explored the impacts of foreign portfolio flows and monetary policy on Türkiye's stock market during the pandemic, revealing that both factors significantly affected market dynamics, with foreign portfolio flows having a more substantial impact than monetary responses. In addition, Depren et al. (2021) analyzed the changes in gold prices during the

COVID-19 pandemic, finding that monetary policy measures and the foreign exchange rate significantly influenced gold prices, particularly during the pandemic. This underscores the interconnectedness of financial instruments and credit volume, suggesting that fluctuations in asset prices can have profound implications for credit availability.

Bayar et al. (2020) reported that the pandemic had a notable effect on increasing personal credit in Türkiye. On the other hand, Ersoy et al. (2022) revealed that fluctuations in currency value had a negative effect on personal credit volume. These studies suggest that credit helped mitigate some of the economic downturn caused by the pandemic, with non-performing loans decreasing relatively during the pandemic period. Furthermore, all banks, except for foreign institutions, focused on maintaining high levels of short-term securities in the post-pandemic period, leading to a rise in sector deposits during the period analyzed. Engelmann and Lam (2023) also noted that while credit in some sectors saw significant growth during the pandemic, credit demand in sectors such as education and healthcare declined. Additionally, consumer credits and bank protest bills have increased significantly compared to previous years. Sezal (2023) observed fluctuations in commercial and other credits during the pandemic. The preventive measures used by the economic administration to reduce the financial and monetary repercussions of COVID-19 are believed to have caused credit collapses. According to the author, a bubble was created by interest-free credits given to low-income borrowers on the personal side, in addition to aid credits provided by governmental institutions to the real sector and exporting businesses. Moreover, it is hypothesized that business entities, when drawing Turkish lira, use the overseas currency to hedge against price rises. Thus, recurrent interest rate reductions by the Central Bank led to bubbling.

International studies mirror these trends, showcasing a decline in credit distribution during the pandemic period, exacerbated by heightened economic risks (Daniłowska, 2021; Darjana et al., 2022). The severity of local pandemic conditions correlates with reduced credit utilization, reflecting pandemic fatigue (Horvath et al., 2023). Moreover, global studies suggest varying impacts of the pandemic on bank credits, influenced by diverse factors such as financial conditions, market structures, and regulatory environments (Çolak & Öztekin, 2021). The complex connection between financial instruments, especially bank credits, and economic growth has been extensively studied (Thierry et al., 2016; Lay, 2020). Grasping this relationship during crises like pandemics is crucial (Sanfilippo-Azofra et al., 2018). Schumpeter (1949/2011) pioneered the understanding of how credit volume impacts economic growth, highlighting the essential role of financial systems in supporting innovation-driven progress. Later scholars built upon this perspective by incorporating financial development into the discussion (Gurley and Shaw, 1955). It is suggested that the link between economic growth and credit volume is similar to the relationship between financial investment instruments (De Gregorio Rebeco, 1999).

Moreover, while existing literature often focuses on the nexus between credit volume and stock markets, exploring this relationship beyond stocks is crucial for holistic understanding and risk management in the banking sector (Adam et al., 2017; Hansman et al., 2018). Studies also delve into the impact of credit access on market participation, shedding light on asset allocation dynamics (Kozak and Sosyura, 2015). Additionally, research on the effects of gold prices on various financial markets adds key points to this discussion (Ziaei, 2012). On the contrary, comparable research has been conducted internationally. Daniłowska (2021) evaluates the influence of the COVID-19 pandemic on Poland's credit market and finds that the virus had a detrimental effect on the credit industry. Even though interest rates decreased, commercial banks tightened lending rules and conditions due to the country's increasing economic risk, which negatively impacted credit demand. Similarly, Darjana et al. (2022) show that Indonesia's credit circulation fell more during the COVID-19 pandemic era than it did before.

Horvath et al. (2023) investigated how the COVID-19 shock affected consumer credit usage and availability. They noted a steep drop in credit utilization at the onset of the pandemic. Moreover, they found that the severity of the local pandemic had a substantial negative impact on credit use, which continued to decrease as pandemic fatigue set in. Similarly, Çolak and Öztekin (2021) evaluated the global effects of the pandemic on bank credit. They investigated bank and national traits that strengthened or lessened the incidence of the virus in bank lending. According to their research, financial institutions were relatively weak in nations that were more adversely affected by the pandemic. This effect is determined by the bank's fiscal viability, industry structure, legislative and regulatory context, brokerage firms, and the growth of the lending market, as well as the ease with which corporate enterprises may obtain credit capital and the healthcare sector's disaster response. Scientists have extensively investigated the link between economic expansion and financial progress, as well as the impact of financial tools and financial intermediaries (particularly banks) on the market. This interaction becomes even more critical in periods of economic and financial crisis and in the presence of factors that trigger such crises, such as pandemics. Additionally, the relationship between credit volume and financial investment instruments and investments emerges as a separate topic.

According to Longstaff and Wang (2012), in the context of ideal profit and loss sharing, the minimal risk-averse individual will be given credit and be permitted to hold hedged bets in the stock. The scholars also demonstrate how the volatility of asset values is directly tied to the size and location of the credit market. They discovered that the industry's leverage ratio, or the overall quantity of financing in the market, correlates with the variability of stock returns. Hansman et al. (2018), in their study on the relationship between consumer credits and stock prices, mentioned that these two variables are positively related, but it is difficult to determine causality. Ziaei (2012) applied the GMM model to explore how gold prices influenced equities, bonds, and domestic credit in ASEAN+3 nations (China, Japan, South Korea, Malaysia, Indonesia, and the Philippines). The results indicated that gold prices significantly impacted the bond and equity markets but did not affect domestic credit volumes. Kozak and Sosyura (2015) analyzed the role of credit access in market participation, highlighting that banking sector credits are often utilized for stock market investments and asset allocation. Bayram et al. (2022) investigated the connection between commercial credit and exchange rates in Türkiye, concluding that there was no co-integration between the two; however, a causal relationship was identified from commercial credits to the real effective exchange rate. Additionally, Wang et al. (2023) discovered a strong causal link between Bitcoin prices and the money supply, as well as with the Consumer Price Index (CPI) and Economic Policy Uncertainty (EPU).

Schumpeter (1911/1934: 53, 78) stated that the funds transferred by credit institutions to projects involving innovation would increase economic growth, thus laying the groundwork for the connection between credit supply and economic expansion. Using Schumpeter's assertion, it can be deduced that a sound financial framework encourages businesspeople to engage in the organizational context, which boosts growth by increasing investment and savings in the economy. Subsequently, Gurley and Shaw (1955) expanded on Schumpeter's ideas by including financial application development. Investment management tools are anticipated to exhibit a similar link between economic development and credit quantity. Credit expansion results in an expansion of the money supply, which is one of the financial development measures and is an element that increases financial development. When financial development increases, economic growth also increases. Since the level of welfare will increase with economic growth, this situation increases the total amount of money individuals can direct to investments. At the same time, rising markets will increase their attractiveness and make investors demand more cash for investment purposes. The main objective of this study is to determine how and at what level credit volume has a relationship with financial investment instruments.

Previous studies have revealed significant relationships between bank credits and economic growth (Thierry et al., 2016; Lay, 2020), as well as between financial development and bank credits (Sanfilippo-Azofra et al., 2018). These studies examined the relationship between changes in credit volume and various financial investment instruments during the pandemic period. They sought to determine whether the investment instruments preferred by investors during the pandemic period and the credits extended by banks are related or not and to make inferences for the future. Looking at the literature, it is evident that the interaction of credit volume and financial investment instruments is rarely examined. Only a handful of papers have investigated the prominent link between credit volume and investment instruments. Previous research has primarily concentrated on the link between credit volume and the stock market, neglecting the potential for other relationships (Kim and Moreno, 1994; Ibrahim, 2006; Karim et al., 2012; Almutair, 2015; Camba and Camba, 2020). Moreover, the literature often points to a connection between credit usage and stock market investments. Given this, it becomes important to explore the relationship between credit volume and financial instruments beyond the stock market. Such an investigation is vital for the efficient functioning of the banking sector, helping investors understand potential risks, enhance predictability, and make more informed investment decisions. The study's findings are especially relevant for policymakers and central banks developing credit policies, as well as for investors looking to make better choices by considering the broader economic impact.

Despite the extensive exploration a significant literature gap remains. Most studies primarily focus on the relationship between credit volume and stock markets, largely overlooking other critical financial instruments such as gold, bonds, and foreign exchange rates. While some literature touches upon the implications of these instruments on credit dynamics, comprehensive investigations into their interrelationships and asymmetric effects – particularly during crisis periods – are limited. Furthermore, existing research tends to analyze these factors in isolation, without considering the broader context of how multiple financial instruments collectively influence credit volume. Thus, this study seeks to bridge this gap by providing a holistic analysis of the interactions between various financial investment instruments and credit volume in Türkiye during the COVID-19 pandemic, highlighting the implications for effective risk management and policymaking in the banking sector.

METHODS

Data and Variables Description

The goal of this study is to methodologically investigate the influence of various financial instruments on the credit volume during the period of the COVID-19 pandemic in Türkiye. To achieve this goal, the study first identified different financial instruments traded in the Turkish financial industry. Total loan volume was selected as a proxy for the credit volume, while Gold Price, USD Exchange Rate, Bond Rate, Bitcoin Price, and BIST 100 were chosen as independent factors representing potential financial instruments. The selection of financial instruments in a study like this is typically based on their perceived relevance to the research question and their potential impact on the dependent variable. For instance, the study deduce that the total loan volume is chosen as a proxy for credit volume since loans represent a significant portion of credit extended by financial institutions. Tracking changes in total loan volume provides insight into the overall credit conditions in the economy (Benavides-Franco et al., 2023). Second, Gold is often considered a safe-haven asset, with its price influenced by factors such as economic uncertainty, inflation expectations, and currency fluctuations. Changes in the price of gold can reflect shifts in investor sentiment and financial market conditions, which may affect credit availability and demand (Singh and Joshi, 2019). Third, the exchange rate between the Turkish Lira and the USD can impact various aspects of the economy, including trade, inflation, and investor confidence (Avdjiev et al., 2019). Moreover, Bond rates, specifically government bond rates, serve as benchmarks for borrowing costs in the economy. Changes in bond rates can influence interest rates across the financial system, affecting lending and borrowing decisions by businesses and consumers (Ziebart and Reiter, 1992). It is also noteworthy to consider Bitcoin as an important financial instrument because a change in Bitcoin prices reflects broader trends in investor risk appetite, speculation, and market sentiment, which potentially influence credit markets (Henriques and Sadorsky, 2018). Finally, given the predominant focus on the Turkish financial market, it's important to note that the BIST 100 Index tracks the performance of the top 100 companies listed on the BIST 100. Movements in this index can serve as indicators of changes in overall market sentiment, investor confidence, and economic prospects. Consequently, these movements may have an impact on credit conditions within the market. The study collected weekly data starting from January 6th, 2020, which marks the beginning of the COVID-19 pandemic, and ending on July 4th, 2022. By analyzing this data, the study aimed to determine whether these financial instruments significantly impacted the credit volume during the specified period.

To continue the investigation, this paper employs the Non-linear Autoregressive Distributed Lag (NARDL) approach, as utilized in numerous studies, including Rehman et al. (2022), Pan et al. (2022), Khanal et al. (2022), and Zeraibi et al. (2020). The NARDL model is advantageous because it offers a flexible framework for analyzing relationships between variables that exhibit nonlinear dynamics and potential asymmetries. Unlike traditional linear models, NARDL allows for the simultaneous analysis of both short-term and long-term effects while accounting for any asymmetries in the data. This method is particularly suited to the study, which investigates the influence of financial instruments on credit volume in Türkiye during the COVID-19 period, where complex and dynamic interactions between variables are anticipated. Additionally, by applying the NARDL model, can investigate how changes in financial instruments such as Gold Price, USD Exchange Rate, Bond Rate, Bitcoin Price, and BIST 100 Index influence credit volume in Türkiye over time. Furthermore, the nonlinear structure of the NARDL model enables the identification of potential asymmetries and nonlinear connections in the dataset, offering a more detailed insight into the dynamics at work. The data used in this analysis were obtained from reputable sources, including the Central Bank's Electronic Data Delivery System (evds2.tcmb.gov.tr/index.php) and Foreks Digital, which was established in 1990 through a collaboration between Switzerland and Türkiye (*Foreks.com*).

Table 1: Variables Descriptions and Sources

Abbreviation	Variables	Scale	Definition	Sources
TLV	Total Loans Volume	Measured by Commercial and individual credits provided by all deposit banks (Thousand TRY)	The aggregate amount of loans extended by financial institutions within a specified period	The Central Bank Electronic Data Delivery System
GLD	Gram Gold Price in Turkish Lira	Measured in Turkish Lira per gram of gold	The cost of one gram of gold in Turkish Lira	Foreks Digital
UER	USD Exchange Rate	Measured in Turkish Lira per 1 US Dollar	Refers to the value of the United States Dollar (USD), expressed in terms of Turkish Lira (TRY)	Foreks Digital
BRI	Fixed Coupon Government Bond Rate Interest	Measured in percentage points (%)	A type of government bond that pays a fixed rate of interest to investors over the life of the bond	Foreks Digital
BTC	BITCOIN Price in Turkish Lira	Measured in Turkish Lira per 1 unit of Bitcoin	This price indicates how much Turkish Lira is needed to purchase one Bitcoin on a given exchange or trading platform	Foreks Digital
BIS	Borsa İstanbul 100 Index	Measured in units of the performance of the top 100 companies	A stock market index that monitors the performance of the 100 largest companies traded on Borsa İstanbul (BIST), Türkiye's primary stock exchange	Foreks Digital

Source: Own research.

The current paper investigates the following hypothesis

- H1: Changes in financial instruments will significantly impact total loan volume in Türkiye during the COVID-19 period.
- H2: Increases in Gold Price will lead to higher demand for credit, while decreases may reduce credit demand.
- H3: Fluctuations in the USD Exchange Rate will influence total loan volume, with a depreciation potentially decreasing credit demand and a strengthening stimulating it.
- H4: Changes in Bond Rate will affect total loan volume, with higher rates potentially reducing credit demand and lower rates stimulating it.
- H5: Changes in Bitcoin Price will significantly impact total loan volume, reflecting shifts in investor sentiment and risk appetite.
- H6: Movements in the BIST 100 Index will be associated with changes in total loan volume, reflecting shifts in market sentiment and economic prospects.

Model specification

This research utilized the non-linear autoregressive distributed lag approach to analyze the relationships among the variables. The following functional equation, aligned with the works of Balsalobre-Lorente et al. (2021) and Shin et al. (2014), demonstrates the connection between total credit volume (LF1), gold (LF2), USD exchange rate (LF3), bond rate (LF4), Bitcoin (LF5), and BIST index (LF6).

$$LF1 = \int (LF2, LF3, LF4, LF5, LF6) \tag{1}$$

A more consistent way to express equation (1) is as follows:

$$LF1_t = \beta_0 + \beta_1 LF2_t + \beta_2 LF3_t + \beta_3 LF4_t + \beta_4 LF5_t + \beta_5 LF6_t + \varepsilon_t \tag{2}$$

Equation 2 displays the independent variables. Whereas the total Credit volume is considered a proxy for the credit volume. The model's coefficients are β_0 to β_6, moreover, the factor *t* indicates the time span. Subsequently, the ARDL (Autoregressive Distributed Lag) method, introduced by Pesaran et al. (2001), was utilized in this research to analyze the relationship among the variables through the following formula.

$$\Delta LF1_t = \propto_0 + \sum_{i=t}^{p} \propto_1 \Delta LF1_{t-1} + \sum_{i=t}^{p} \propto_2 \Delta LF2_{t-1} + \sum_{i=t}^{p} \propto_3 \Delta LF3_{t-1} + \sum_{i=t}^{p} \propto_4 \Delta LF4_{t-1} + \sum_{i=t}^{p} \propto_5 \Delta LF5_{t-1} + \sum_{i=t}^{p} \propto_6 \Delta LF6_{t-1} + \lambda_1 LF1_{t-1} + \lambda_2 LF2_{t-1} + \lambda_3 LF3_{t-1} + \lambda_4 LF4_{t-1} + \lambda_5 LF5_{t-1} + \lambda_6 LF6_{t-1} + \varepsilon_t \quad (3)$$

Furthermore, in line with Majeed et al. (2020), the study only looks at the pertinent factor in relation to shocks to the dependent variable – both positive and negative. These differences are explained by the following equations.

$$POS(LF2_t) = LF2^{+}{}_q = \sum_{q=1}^{q} \Delta LF2^{+}{}_q = \sum_{q=1}^{q} max\,(LF2^{+}{}_{q,}\, 0) \quad (4)$$

$$NEG(LF2_t) = LF2^{-}{}_q = \sum_{q=1}^{q} \Delta LF2^{-}{}_q = \sum_{q=1}^{q} min\,(LF2^{-}{}_{q,}\, 0) \quad (5)$$

$$POS(LF3_t) = LF3^{+}{}_q = \sum_{q=1}^{q} \Delta LF3^{+}{}_q = \sum_{q=1}^{q} max\,(LF3^{+}{}_{q,}\, 0) \quad (6)$$

$$NEG(LF3_t) = LF3^{-}{}_q = \sum_{q=1}^{q} \Delta LF3^{-}{}_q = \sum_{q=1}^{q} min\,(LF3^{-}{}_{q,}\, 0) \quad (7)$$

$$POS(LF4_t) = LF4^{+}{}_q = \sum_{q=1}^{q} \Delta LF4^{+}{}_q = \sum_{q=1}^{q} max\,(LF4^{+}{}_{q,}\, 0) \quad (8)$$

$$NEG(LF4_t) = LF4^{-}{}_q = \sum_{q=1}^{q} \Delta LF4^{-}{}_q = \sum_{q=1}^{q} min\,(LF4^{-}{}_{q,}\, 0) \quad (9)$$

$$POS(LF5_t) = LF5^{+}{}_q = \sum_{q=1}^{q} \Delta LF5^{+}{}_q = \sum_{q=1}^{q} max\,(LF5^{+}{}_{q,}\, 0) \quad (10)$$

$$NEG(LF5_t) = LF5^{-}{}_q = \sum_{q=1}^{q} \Delta LF5^{-}{}_q = \sum_{q=1}^{q} min\,(LF5^{-}{}_{q,}\, 0) \quad (11)$$

$$POS(LF6_t) = LF6^{+}{}_q = \sum_{q=1}^{q} \Delta LF6^{+}{}_q = \sum_{q=1}^{q} max\,(LF6^{+}{}_{q,}\, 0) \quad (12)$$

$$NEG(LF6_t) = LF6^{-}{}_q = \sum_{q=1}^{q} \Delta LF6^{-}{}_q = \sum_{q=1}^{q} min\,(LF6^{-}{}_{q,}\, 0) \quad (13)$$

Variables are broken down into two groups in equations (4, 5, 6, 7, 8, 9, 10, 11, 12, and 13): negative disturbances (GLD− *q*; UER− *q*; BRI− *q*; BTC− *q*; BIS− *q*) and positive disturbances (GLD+ *q*; UER− *q*; BRI− *q*; BTC− *q*). As a result, an asymmetric approach can be developed and demonstrated as follows:

$$\begin{aligned}\Delta \mathrm{TLV}_t = & \propto_0 + \sum_{i=t}^{p} \propto_1 \Delta LF1_{t\text{-}a} + \sum_{i=t}^{p} \propto_2 \Delta LF2^{+}_{t\text{-}1} + \sum_{i=t}^{p} \propto_3 \Delta LF2^{-}_{t\text{-}1} + \sum_{i=t}^{p} \propto_4 \Delta LF3^{+}_{t\text{-}1} \\ & + \sum_{i=t}^{p} \propto_5 \Delta LF3^{-}_{t\text{-}1} + \sum_{i=t}^{p} \propto_6 \Delta LF4^{+}_{t\text{-}1} + \sum_{i=t}^{p} \propto_7 \Delta LF4^{-}_{t\text{-}1} + \sum_{i=t}^{p} \propto_8 \Delta LF5^{+}_{t\text{-}1} \\ & + \sum_{i=t}^{p} \propto_9 \Delta LF5^{-}_{t\text{-}1} + \sum_{i=t}^{p} \propto_{10} \Delta LF6^{+}_{t\text{-}1} + \sum_{i=t}^{p} \propto_{11} \Delta LF6^{-}_{t\text{-}1} + \lambda_1 LF1_{t\text{-}1} \\ & + \lambda_2 LF2^{+}_{t\text{-}1} + \lambda_3 LF2^{-}_{t\text{-}1} + \lambda_4 LF3^{+}_{t\text{-}1} + \lambda_5 LF3^{-}_{t\text{-}1} + \lambda_6 LF4^{+}_{t\text{-}1} \\ & + \lambda_7 LF4^{-}_{t\text{-}1} + \lambda_8 LF5^{+}_{t\text{-}1} \\ & + +\lambda_9 LF5^{-}_{t\text{-}1} + \lambda_{10} LF6^{+}_{t\text{-}1} + +\lambda_{11} LF6^{-}_{t\text{-}1} + ECM_{t-1} + \varepsilon_t \end{aligned} \qquad (14)$$

The analysis of the error correction models is explained by equation (14).

Stationarity test

To ensure the robustness and reliability of the datasets, the study deployed the Phillips–Perron test (PP) and the Augmented Dickey–Fuller test (ADF) as unit root tests. It starts with the augmented Dickey–Fuller test and makes the assumption that u is an error term for white noise. On the other hand, an adaptive version of the test that considers higher-order lags would be required if u is autocorrelated. Consequently, the analysis is enhanced by employing p (lags) from the initial series (Dickey and Fuller, 1979). Furthermore, the multicollinearity and heteroskedasticity of the inaccuracies are adjusted by the Phillips–Perron test through a direct alteration of the test statistics (Phillips and Perron, 1988). The formulas for the two tests are shown below.

$$\Delta y_t = \psi y_{t-1} + \mu + \alpha t + \sum_{i=1}^{p} \beta \Delta y_{t-1} + u_t \qquad (15)$$

$$\Delta y_t = \psi y_{t-1} + \mu^* + \delta t + u_t, \qquad u_t \backsim I(0), ARMA(p, q) \qquad (16)$$

Equation (15) indicates that the previous autoregressive lags of the differenced term are improved by p. The intercept and the time trend parameter are represented by μ and αt, respectively. In equation (16), ψy denotes the initial value of the data, while u_t signifies stationarity at level I(0). Additionally, δt represents the temporal trend, and μ^* indicates the intercept.

BDS Test

According to Broock et al. (1996), the BDS test has proven to be empirically effective in determining the linearity and nonlinearity of a model. Based on the null hypothesis of the BDS test, samples can be either symmetrically, nonlinearly dispersed, or partially independent (Galadima and Aminu, 2020). Consequently, if the data points exhibit non-linearity, we employ the NARDL method to explore the relationships among the indicators.

$$BDS_{\epsilon,b} = \frac{\sqrt{N}\left[C_{\epsilon,b} - (C_{\epsilon,b})^B\right]}{\sqrt{V_{\epsilon,b}}} \tag{17}$$

Where $\left[C_{\epsilon,b} - (C_{\epsilon,b})^B\right]$ approximate regular distribution where the average is zero; $V_{\epsilon,b}$ is a deviation; b is the proportion of contiguous units utilized to create the frame or embedding scale.

The DOLS estimates

When estimating a long-term relationship in a model where the variables are cointegrated but arranged in a different order, the DOLS method employs a parametric approach (Stock and Watson, 1993). This framework incorporates leads and lags to address issues related to limited sample bias and contemporaneous bias. DOLS estimators can be obtained using least-squares estimations, which are unbiased and asymptotically consistent, even in the presence of endogeneity. Moreover, the parameters account for residual irregularities and potential autocorrelation (Herzer and Nowak--Lehmann, 2006). The formula is presented as follows:

$$y_t = a + bX_t + \sum_{i=-k}^{i=k} \emptyset \Delta X_{t+i} + \varepsilon_t \tag{18}$$

In equation (4), the long-run elasticity is represented by B. The term ∅ signifies the difference between the leads and lags of the I (1) regressors. The other values may be endogenous, autocorrelated, or unconventional; these factors are accounted for by the coefficients. Such parameters are considered undesirable

Robustness check models

In addition, a modified least squares (FMOLS) was employed in this investigation to validate the precision of the DOLS results. In order to maintain the highest interdependent values, Hansen and Phillips (1988) developed the FMOLS analysis in 1990. The FMOLS method helps to account for the effects of the autocorrelation issue in the predictor factors brought on by cointegrating data and the unknown variability.

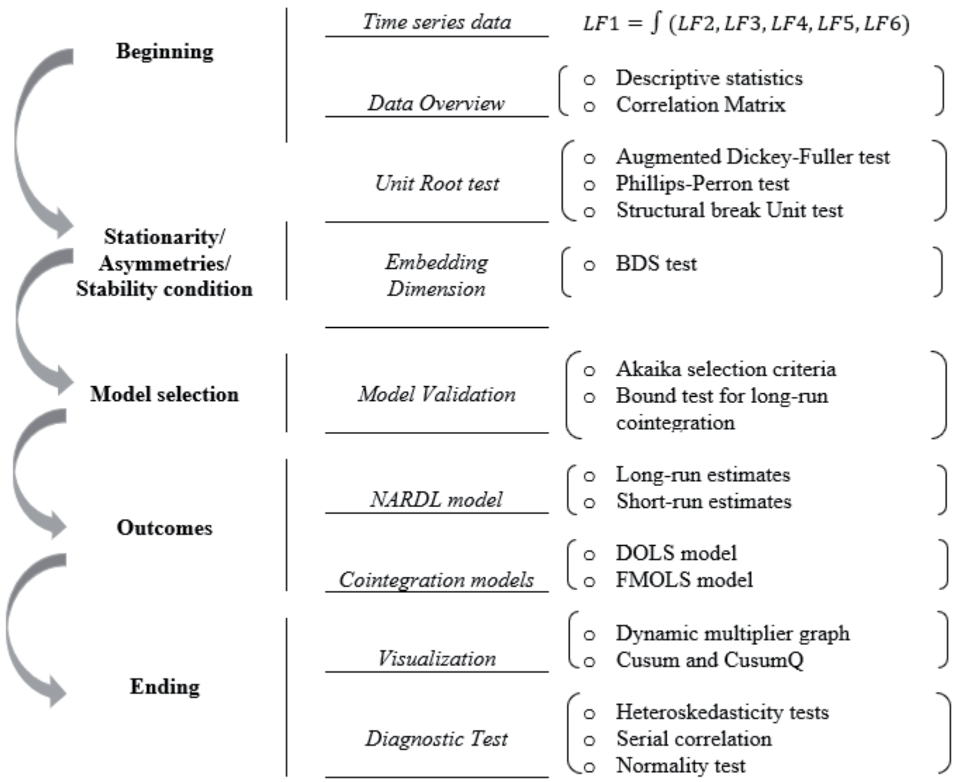
$$ð_{FME} = \left(\sum_{t=1}^{T} Z_t Y_t'\right)^{-1} \left(\sum_{t=1}^{T} Z_t Y_t^{+} - T[\Lambda_{12}^{+}]\right) \tag{19}$$

It is understood that the Y_t^{+}, Z_t^{*} and Λ_{12}^{+} terms remove the autocorrelation issue and hidden heterogeneity. The FMOLS estimator is unbiased and uses an unchanging mixture-normal exponential distribution. Thus, it may be used for standard Wald tests.

Methodological mapping of the study

The Figure 1 provides a general image of the structure in which the study is conducted.

Figure 1: Empirical structure



Source: Authors' draw.

EMPIRICAL RESULTS AND ANALYSIS

A detailed overview and evaluation are illustrated in this part. Table 2 displays the outcomes of the statistical analysis for the identified factors from 01/06/2020 to 07/04/2022. Descriptive statistics are calculated using several metrics. With a constant and zero mean-variance, numerical figures of all the variables in the descriptive data showed an acceptable pattern. The Jarque–Bera test, for example, illustrates the normality test, which shows that the TLV, GLD, UER, BRI, BTC, and BIS deviations are normally dispersed. TLV has a mean value of 9.49 and a maximum and lowest score of 9.32 and 9.69, respectively. For additional verification of the collected statistics, the values of kurtosis (near 3) and skewness (near 0) are employed for each variable under review. A pair-wise correlation is calculated following the statistical analysis to investigate the relationship and the actual link between the factors. All of the variables have a substantial relationship, according to the empirical results. All financial instruments show a positive and robust correlation with the total credit volume.

Table 2: An overview of the statistics

Descriptive statistics						
	TLV	**GLD**	**UER**	**BRI**	**BTC**	**BIS**
Mean	9.4916	2.7161	0.9531	1.2048	5.3433	3.1644
Median	9.4777	2.6855	0.9156	1.2487	5.4950	3.1490
Maximum	9.6967	3.0128	1.2386	1.4266	5.9030	3.4151
Minimum	9.3295	2.4696	0.7691	0.9444	4.5544	2.9334
Std. Dev.	0.0918	0.1482	0.1350	0.1334	0.4098	0.1212
Skewness	0.4257	0.5666	0.8061	-0.3119	-0.4547	0.4618
Kurtosis	2.6077	2.3174	2.3134	2.0888	1.6309	2.3705
Jarque-Bera	4.7979	9.5527	16.759	6.6558	14.746	6.8202
Probability	0.0908	0.0084	0.0002	0.0358	0.00062	0.0330
Observations	131	131	131	131	131	131
Matrix of correlation						
TLV	1.000000	-	-	-	-	-
GLD	0.976717	1.000000	-	-	-	-
UER	0.967541	0.988042	1.000000	-	-	-
BRI	0.892475	0.864925	0.864833	1.000000	-	-
BTC	0.802136	0.748656	0.744497	0.903720	1.000000	-
BIS	0.930868	0.904882	0.917879	0.870905	0.823607	1.000000

Source: Authors' computation.

Table 3 shows that none of the variables have unit roots, which is consistent with the results of the ADF and PP tests. The results of the two tests show that the variables are stationary at the first difference. For instance, we observe that in ADF and PP tests TLV, GLD, UER, BRI, BTC, and BIS are revealing the absence of unit root at the first difference and the rejection of the main hypothesis (H_0) according to the value of 1%.

Table 3: Stationarity tests

ADF test at level							
Variables		**TLV**	**GLD**	**UER**	**BRI**	**BTC**	**BIS**
Constant	t-Statistic	0.9181	-0.4024	0.3666	-0.9214	-1.5677	0.1610
Constant & Trend	t-Statistic	-0.3731	-1.5403	-1.4022	-3.1416	-0.4254	-2.4803
ADF at First difference							
Variables		**TLV**	**GLD**	**UER**	**BRI**	**BTC**	**BIS**
Constant	t-Statistic	-14.1634***	-16.2351***	-16.5310***	-10.9477***	-10.2084***	-9.7241***
Constant & Trend	t-Statistic	-14.2086***	-16.1751***	-16.5588***	-10.9040***	-10.3149***	-9.8039***
PP test at level							
Variables		**TLV**	**GLD**	**UER**	**BRI**	**BTC**	**BIS**
Constant	t-Statistic	0.6730	-0.5256	0.2230	-0.7987	-1.5431	-0.0566
Constant & Trend	t-Statistic	-0.8266	-2.0409	-1.8246	-3.3669	-0.5970	-2.6758
PP test at First difference							
Variables		**TLV**	**GLD**	**UER**	**BRI**	**BTC**	**BIS**
Constant	t-Statistic	-13.8592***	-16.0158***	-16.5739***	-11.1608***	-10.2087***	-9.7481***
Constant & Trend	t-Statistic	-13.9087***	-15.9620***	-16.5588***	-11.1053***	-10.3357***	-9.7779***
1% indicates the rejection of the main hypothesis (H0) according to the significance level							

Note: ***, **, and * signifies a critical value of 1%, 5%, and 10% levels, respectively.
Source: Authors' computation.

Incorporating tests for structural breaks and unit roots into the study is essential for ensuring the reliability and accuracy of data analysis. These tests provide us with invaluable insights into the behavior of data over time, allowing us to identify any significant shifts or changes in economic trends or market conditions. By detecting these structural breaks, better equipped to select the most appropriate econometric models to effectively capture these changes, ultimately leading to more robust and trustworthy results. To conduct further analysis, utilized the Dickey–Fuller test for structural breaks. The empirical findings from the structural break test in Table 4, which were calculated for the ADF and PP tests in the prior unit root tests, indicate a similar stability in the data. Most variables, including TLV, UER, BRI, BTC, and BIS, exhibit stationarity at the first difference, with structural breaks occurring in December 2021, April 2020, and March 2020. In contrast, GLD is integrated at both the level and the first difference, with significant breaks noted in November and December 2021. The identified break dates offer significant insights into the dynamics of each variable. For example, the break on 01/10/2020, corresponding to the onset of the pandemic, could signify pivotal shifts in lending practices and credit demand, particularly in response to heightened economic uncertainty. This period likely witnessed substantial changes in consumer and business behavior, impacting the credit market profoundly. The subsequent break on 12/20/2021 may denote further adjustments in lending behavior, possibly influenced by evolving market conditions and regulatory interventions aimed at stabilizing the economy. Moreover, considering the behavior of financial investment instruments provides additional context. For instance, the break dates for variables such as GLD and BRI shed light on changes in investor sentiment and risk perception during the pandemic. Fluctuations in gold prices may reflect investors' flight to safety amidst market volatility, while shifts in government bond rates could signal changes in monetary policy or market expectations. Similarly, breaks in the UER may indicate shifts in global economic conditions and currency market dynamics, impacting credit availability and exchange rate risk for borrowers and lenders alike. Additionally, breaks in the BTC could reflect the growing prominence of cryptocurrencies as alternative investment assets during times of economic uncertainty, influencing both investor behavior and market liquidity. Finally, the break dates for the BIS offer insights into domestic stock market dynamics and investor confidence. Changes in the index may reflect broader economic trends and investor sentiment, affecting credit market conditions and lending practices.

Table 4: Test of the structural breakdown unit root

Variables	Exogenous	At level I(0)		At first difference I(1)		Verdict
		T-stat	The break period	T-stat	The break period	
TLV	Trend and intercept	-3.119	01/10/2020	-15.69***	12/20/2021	I(1)
GLD	Trend and intercept	-3.650	11/02/2020	-17.59***	12/20/2021	I(1)
UER	Trend and intercept	-5.319**	11/08/2021	-17.91***	12/13/2021	I(0) I(1)
BRI	Trend and intercept	-4.431	07/20/2020	-13.18***	04/20/2020	I(1)
BTC	Trend and intercept	-2.794	12/07/2020	-11.41***	03/09/2020	I(1)
BIS	Trend and intercept	-3.508	03/08/2021	-11.18***	03/16/2020	I(1)

Note: ∗∗∗, ∗∗, and ∗ signifies value of 1%, 5%, and 10% levels, respectively.
Source: Authors' computation.

After determining the stationary condition and the direction of causation of the data, further examined asymmetries within the sample data using the BDS test. The results for TLV, GLD, UER, BRI, BTC, and BIS, presented in Table 5, clearly indicate that the null hypothesis of linearity is rejected at the 1% significance level. This finding suggests that the observed sequence is non-linear and not independently dispersed, highlighting the presence of significant asymmetries. Additionally, Liu et al. (2020) and Ahad and Anwer (2021) noted that when the sample data comprises a mixed series of integration, one-way causality, and dynamic variations, the standard ARDL method is inadequate for assessing both long- and short-term relationships among variables. Consequently, the NARDL framework is employed in this context to investigate the short- and long-term relationships between the indicators.

Table 5: Results of the BDS test

Variables	**B=2**	**B=3**	**B=4**	**B=5**	**B=6**
TLV	0.1922***	0.3227***	0.4121***	0.4738***	0.5165***
GLD	0.1822***	0.3061***	0.3801***	0.4462***	0.4842***
UER	0.1837***	0.3096***	0.3951***	0.4532***	0.4922***
BRI	0.1781***	0.3034***	0.3874***	0.4464***	0.4885***
BTC	0.1955***	0.3346***	0.4287***	0.4936***	0.5362***
BIS	0.1849***	0.3092***	0.3923***	0.4475***	0.4838***

Note: The symbol *** denotes a 1% significance level
Source: Authors' computation.

The proper lag to incorporate is among the measures used to evaluate the ARDL model. Autocorrelation issues may be addressed to demonstrate the length of time a variable takes to respond to other variables by figuring out the ideal lag. Moreover, the examination affirms the accurate nature of the data produced by the estimation model (Dirir, 2023). It is evident from Table 6 lag contenders that lag 3 is the best lag for the study.

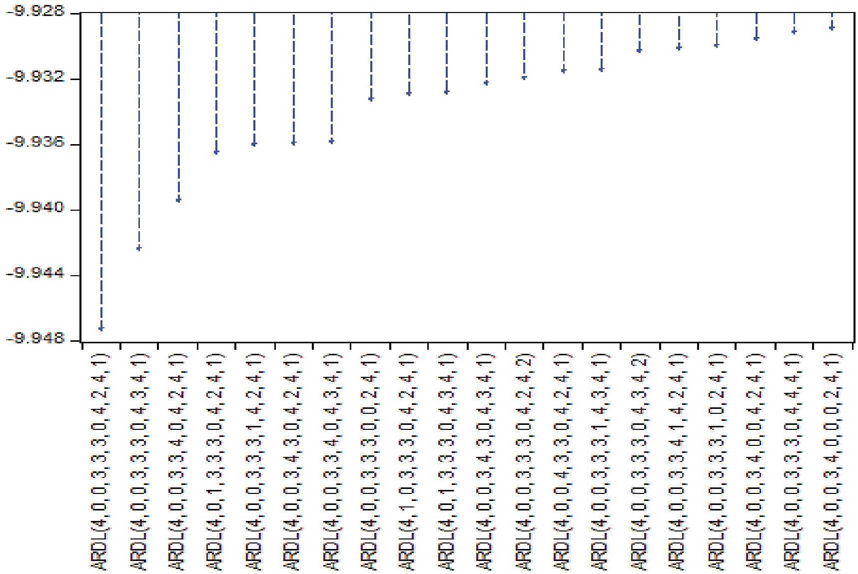
Table 6: Lag selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1173.462	NA	3.61e-16	-18.53114	-18.39607	-18.47626
1	2113.251	1775.157	2.12e-22	-32.87699	-31.93156	-32.49289
2	2283.209	45.11236	4.55e-23	-34.43190	-31.86574	-33.38935
3	2299.064	25.41806	6.37e-23	-34.11213	-30.73560	-32.74035
4	2256.648	257.2049	3.88e-23*	-34.58171*	-32.82592*	-33.86839*

Note: ∗ signifies a value of 10% level
Source: Authors' computation.

Figure 2 provides an overview of the different models that can be performed with the NARDL bounds test. Nevertheless, there is a degree of fitness and reliability. For instance, model 1 and model 2 display the best results among other models. Based on this, the study selected model 1 to carry on with the NARDL model.

Figure 2: Akaike information results



Source: Authors' computation.

According to the Akaike Information Criterion (AIC), it is advisable to construct the F-statistic within a suitable timeframe to facilitate the limits test alongside the co-integration evaluation. As indicated in Table 7, the F-statistic produces values that are statistically significant, suggesting a long-term relationship among the variables being studied. Since the total statistical significance of 6.3591 exceeds the upper threshold, it can be concluded that the components of the study are co-integrated.

Table 7: The NARDL bounds Test for long-term assessment

Model	F-statistics	Significance	I(0)	I(1)	Remark
TLV = f (GLD, UER, BRI, BTC, BIS)	6.3591	10%	1.76	2.77	Co-integration exists
	10	5%	1.98	3.04	
	-	2.5%	2.18	3.28	
	-	1%	2.41	3.61	

Source: Authors' computation.

After confirming the existence of significant long-term relationships in the previous table, the NARDL analysis is utilized to explore the impacts, both positive and negative, of each independent variable on TLV. The findings in Table 8 indicate that in the long run, GLD-, BRI- and BTC+/- are significant. GLD- have a positive coefficient, meaning that a decrease in GLD has a positive long-run effect on TVL. BTC+ and BTC- both have negative coefficients, so increases in BTC have a negative effect, and decreases also have a negative effect. BTC+ is -0.063 and BTC- is -0.079. So both increases and decreases in BTC have a negative long-run effect on the TLV, but the magnitude is slightly larger for decreases. For BIS+, the coefficient is positive and significant at 10%, while BIS- is not significant. So positive shocks to BIS have a positive effect, but negative shocks don't have a significant effect.

Further, the results of the short-term estimates reveal that the relationship between long-term and short-term trends remains stable despite fluctuations in the amplitudes and significance levels of the variables. The variables have lags. The coefficients here show the short-term dynamics. The error correction term is -0.17 and significant. The coefficient is negative and significant indicates convergence to equilibrium. UER_POS(-1) is positive and significant, while UER_NEG(-1) is also positive. UER_NEG in the current period is negative and significant. So an increase in UER_POS in the first lag has a positive effect, but a decrease (UER_NEG) in the current period has a negative effect. For BRI_POS, the current and first lag aren't significant, but the second lag is negative and significant. BTC_POS has some lags significant: the third lag is negative, second lag positive. BTC_NEG at lag 1 is positive and significant. BIS_POS has a positive coefficient in the current and third lag, but negative in the first lag (though not significant). BIS_NEG is negative and significant. The model demonstrates robust explanatory power (R^2=0.97) and stability (Durbin-Watson≈2), though some variables lack significance, suggesting nonlinear relationships.

Table 8: Non-Linear ARDL outcomes (long-run and short-run)

Long-run NARDL results			
NARDL Model: (4, 0, 0, 3, 3, 3, 0, 4, 2, 4, 1)			
Variable	Coefficient	Std. Error	t-Statistic
GLD+	0.061369	0.092594	0.662775
GLD-	0.298932**	0.139429	2.143966
UER+	0.027668	0.118587	0.233314
UER-	-0.332471	0.202761	-1.639717
BRI+	0.110076	0.074895	1.469742
BRI-	-0.263206***	0.05180	-5.080379
BTC+	-0.063938***	0.021735	-2.941639
BTC-	-0.079334**	0.033438	-2.372616
BIS+	0.1789*	0.101281	1.766986
BIS-	0.147460	0.097765	1.508304
Short-run NARDL results			
Variable	Coefficient	Std. Error	t-Statistic
TLV(-1)	-0.1299*	0.074863	-1.735334
TLV(-2)	0.24806***	0.032075	7.733908
TLV(-3)	0.06246**	0.025495	2.449910
UER_POS	-0.03058*	0.016485	-1.855032
UER_POS (-1)	0.26773***	0.017581	15.22890
UER_POS (-2)	0.15342***	0.026523	5.784567
UER_NEG	-0.06418***	0.014293	-4.490461
UER_NEG (-1)	0.26862***	0.011598	23.16144
UER_NEG (-2)	0.11912***	0.027227	4.375315
BRI_POS	0.00049	0.011355	0.043406

Table 8 (cont.)

BRI_POS (-1)	0.00586	0.011330	0.517271
BRI_POS (-2)	-0.02717**	0.011322	-2.400498
BTC_POS	-0.00793	0.005894	-1.346104
BTC_POS (-1)	0.00543	0.006308	0.862022
BTC_POS (-2)	0.01075*	0.006091	1.765167
BTC_POS (-3)	-0.01274**	0.005784	-2.204102
BTC_NEG	0.00685	0.005608	1.222757
BTC_NEG (-1)	0.03160***	0.005610	5.633398
BIS_POS	0.07241***	0.019063	3.798784
BIS_POS (-1)	-0.01878	0.018211	-1.031429
BIS_POS (-2)	0.00774	0.017492	0.442475
BIS_POS (-3)	0.05203***	0.016344	3.183465
BIS_NEG	-0.07628***	0.017017	-4.483026
CointEq (-1)	-0.17277***	0.020156	-8.571635
Constant	1.61153***	0.187904	8.576401
R-squared: 0.968623; Adjusted R-squared: 0.956899; F-statistic: 82.62259; Prob(F-statistic): 0.0000; Durbin-Watson: 2.077145			

Note: ***, ** and * signifies value of 1%, 5%, and 10% levels, respectively.
Source: Authors' computation.

Following the confirmation of the co-integration, DOLS technique is used to look into the long-term influence of GLD, UER, BRI, BTC, and BIS on the credit volume. Consequently, Table 9 presents the outcome of the OLS, DOLS, and FMOLS. The predicted long-run coefficients of GLD and BIS are positive and significant at 1%, and 5% levels respectively, assuming that all other variables remain unchanged, suggesting that a 1% increase in the Gold and BIST results in 0.5% and 0.15% rise in the credit volume during the COVID-19 period. These findings express that the long-run Gold and the BIST in Türkiye contributed to elevating the value of the credit during the COVID-19 pandemic in comparison to other financial instruments which displayed insignificant and noteworthy effects on the credit volume. Moreover, it is noteworthy that the values of the estimated coefficients are correct in theory and practice. The current study assessed how well the estimated model corresponded to the data by using a diagnostic test. The R^2 value of 0.97%, demonstrates how well the generated regression model performs. As a result, it can be concluded that the independent factors can account for 97% of the variabilities in the alteration of the outcome variable.

Table 9: Co-integration models

Dependent: Credits volume (TLV)			
Variable	Least squares	FMOLS	DOLS
GLD	0.5135*** [0.0630] (0.0000)	0.5653*** [0.1020) (0.0000)	0.5135*** [0.1083] (0.0000)
UER	-0.0905 [0.0751) (0.2303)	-0.0966 [0.1203] (0.4235)	-0.0905 [0.1291] (0.4842)
BRI	0.0452 [0.0335) (0.1801)	0.0085 [0.0540] (0.8739)	0.0452 [0.0576] (0.4342)
BTC	0.0131 [0.0089] (0.1441)	0.0212 [0.0145] (0.1462)	0.0131 [0.0153] (0.3939)
BIS	0.1500*** [0.0350] (0.0000)	0.1163** [0.0567] (0.0426)	0.1500** [0.0601) (0.0140)
C	7.5837*** [0.1354)] (0.0000)	7.5574*** [0.2167) (0.0000)	7.5837*** [0.2327] (0.0000)
R2	0.9702	0.9685	0.9702

Note: ***, **, and * signifies a critical value of 1%, 5%, and 10% levels, respectively. The values between the brackets indicate the Std. Error, while the values between the parentheses imply the Prob.

Source: Authors' computation.

Figure 3 (see next page) presents the asymmetric static multiplier effects from the NARDL model, which demonstrate both the positive and negative impacts that various financial instruments can have on credit volume. The thick, dotted black lines in these figures indicate the effects – both beneficial and detrimental – of the components on overall credit volume. This chart of NARDL multiplier effects reveals notable asymmetries in the responses to positive and negative shocks. Additionally, dynamic multiplier graphs were utilized to verify the consistency of the anticipated long-term outcomes. Most graphs display long-term asymmetries, as indicated by the presence of the zero line (dotted solid red line), which remains positioned between the positive and negative shocks, except for the UER and BRI, which tend to hover above these shocks.

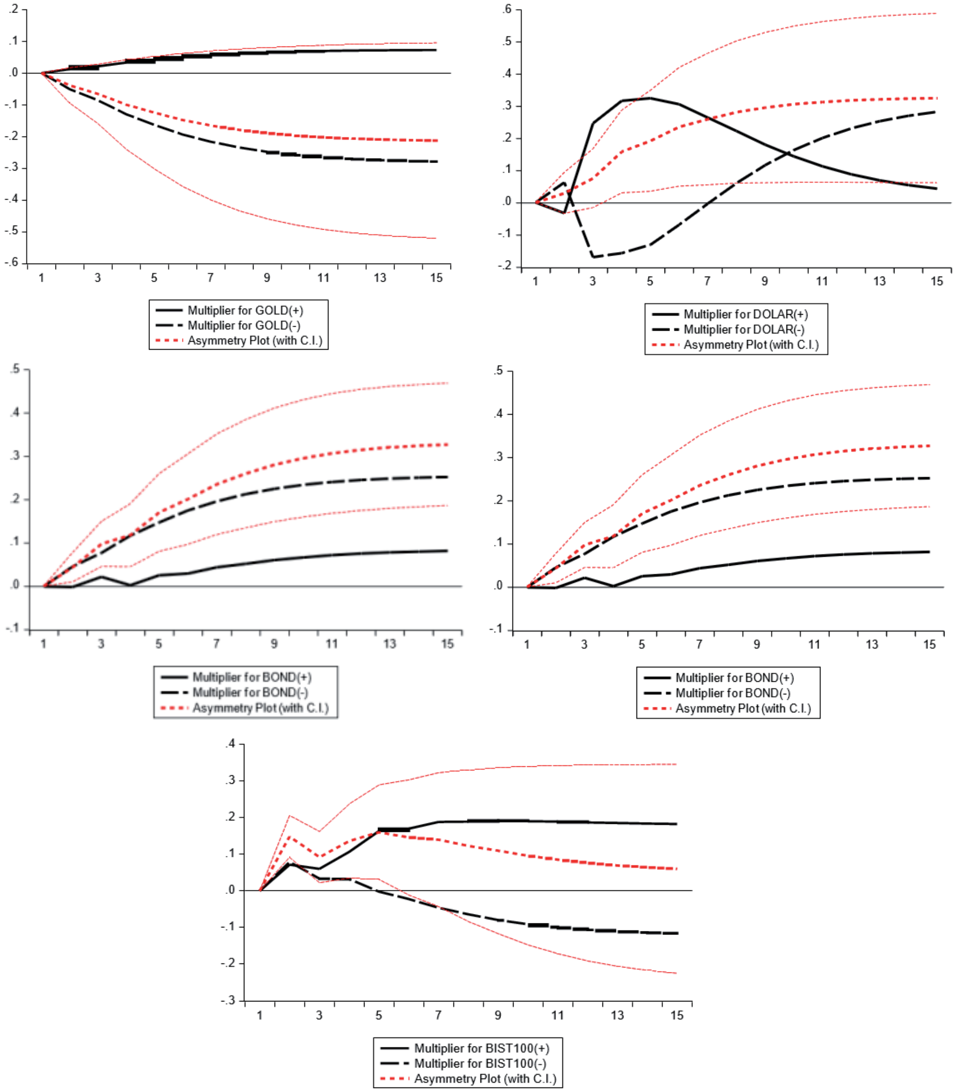
To confirm the validity of the NARDL model, conducted several tests, including autocorrelation (Durbin–Watson), serial correlation (Breusch–Godfrey LM), heteroskedasticity (Breusch–Pagan–Godfrey and Harvey tests), and normality (Jarque–Bera). The results in Table 10 indicate that the model is unconstrained and exhibits optimal distribution concerning autocorrelation, serial correlation, and heteroskedasticity.

Table 10: Diagnostic test

Tests	**Coeff/prob.**
R2	0.9653
Durbin–Watson test	1.9213
Jarque–Bera test for normality	0.1194 (0.9420)
Heteroskedasticity Test: Breusch–Pagan–Godfrey	1.3107 (0.1467)
Heteroskedasticity Test: Harvey	1.1470 (0.3151)
Breusch–Godfrey LM test	0.0484 (0.9527)

Source: Authors' computation.

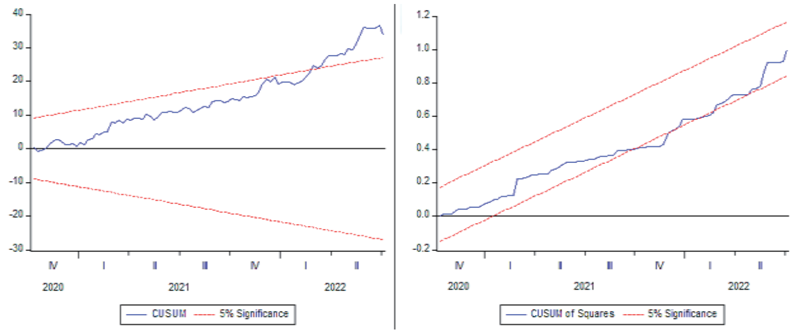
Figure 3: The Dynamic multiplier for variables and the Credit volume



Source: Authors' computation.

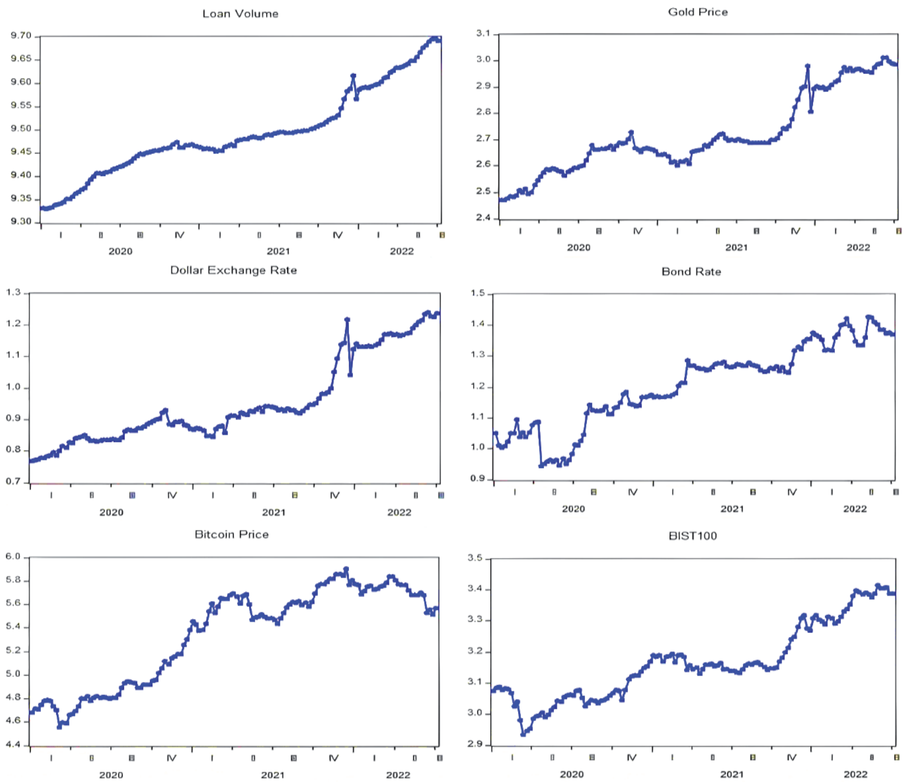
To assess the process for parametric and variance stability, also used the CUSUM and CUSUMQ plots. Except for 2022, Figure 4 illustrates the model's resilience and is inside the significance zone's 5% requirement. The reason why the model departs from the significance bounds at that period can be explained by the fact that Türkiye fully lifted the restriction concerning COVID-19 at the beginning of 2022. This sudden policy rearrangement caused a short-term shock in the financial market. Similar interpretations and scenarios can be observed in studies undertaken by Jamil et al. (2022) and Louail and Benarous (2021).

Figure 4: Cusum Graphs



Source: Authors' computation.

Figure 5: Data trends over the studied period



Source: Author's compliance.

DISCUSSION AND CONCLUSION

The COVID-19 pandemic has not only swept across the world but continues to exert a profound impact on the global marketplace, albeit with varying effects across different economic sectors. While some industries have weathered the storm more resiliently, others have been severely disrupted, prompting a range of responses, including widespread lockdown measures. As economies grapple with the unprecedented challenges posed by the pandemic, both large corporations and small businesses have experienced a significant downturn in productivity. In tandem with the broader economic turbulence, the financial sector has encountered its own set of challenges. The Central Bank of the Republic of Türkiye (CBRT) found itself in a precarious position as early as March 2020, with its exchange reserves already depleted, leaving Türkiye highly vulnerable to volatile capital movements triggered by the pandemic. Moreover, the pandemic-induced uncertainty has exacerbated fluctuations across virtually all economic and financial indicators, with notable impacts observed in the volume of credit transactions and the stock market.

The repercussions of heightened unpredictability have been particularly evident in global financial markets. Amidst escalating ambiguity, total foreign portfolio transfers from stock markets have taken a sharp downturn, exacerbating negative trends. Country Credit Default Swap (CDS) spreads have widened considerably, signaling heightened investor risk perception, while national currency values have experienced marked declines relative to foreign exchange rates. In response to these challenges, nations worldwide have implemented a spectrum of regulatory, monetary, and fiscal measures aimed at mitigating the adverse effects of the pandemic on their economies. These measures encompass a range of interventions, from liquidity injections to interest rate adjustments, all aimed at stabilizing financial markets and bolstering economic resilience. The intertwining factors of the COVID-19 pandemic and escalating economic unpredictability have coalesced to fuel heightened volatility in stock markets worldwide.

It is noteworthy that access to credit remained prevalent throughout the pandemic period. The total amount of cash credits extended by the banking sector surged by 30.40% from March 2020 to March 2021. By April 2022, this figure soared by a staggering 48% over the preceding 12 months. During the research period of this study (January 2020 to July 2022), total credits surged by an impressive 130%. Concurrently, the value of the US dollar rose by 181%, Bitcoin (measured in Turkish lira) surged by 752%, Gold (measured in Turkish lira) increased by 226%, and the BIST 100 index grew by 105%. Throughout this period, investors increasingly viewed cryptocurrencies, notably Bitcoin, as a safe haven amidst market volatility. This sentiment is corroborated by numerous academic studies, including those by Dyhrberg (2016), Murty et al. (2022), and Marobhe (2022). Investors, undeterred by risks, leveraged credits to capitalize on Bitcoin investments, as noted by Pho et al. (2021). These scholars assert that, for risk-tolerant investors, Bitcoin serves as a superior portfolio asset compared to traditional safe havens like gold. Selmi et al. (2018) further highlight Bitcoin's resilience to the political and economic fluctuations of individual nations, potentially surpassing gold as a safe haven asset.

In contrast to the claims of Bitcoin's status as a safe haven during the pandemic, some research (including studies by Wen et al., 2022 and Kumar and Padakandla, 2022) disputes this view, suggesting that gold proves to be a more reliable, safe haven amid increasing oil and stock market prices. Reflecting these differing viewpoints, research explores the safe haven discussion to identify which financial instrument has a stronger correlation with credit volume during the pandemic. This analysis aims to determine the investment vehicle that encourages investors to take on greater risks. To support the examination, analyzed weekly data from the beginning of the COVID-19 pandemic, starting on January 6, 2020, until July 4, 2022. Utilizing a non-linear Autoregressive Distributed Lag (ARDL) model, sought to capture both short-term variations and long-term trends accurately.

The findings from the NARDL analysis underscore significant asymmetric dynamics in both short- and long-run relationships during the COVID-19 period (2020–2022). Long-run results reveal that negative shocks to variables like BRI and BTC exerted stronger adverse effects compared to their positive counterparts, while BIS+ positively influenced the dependent variable. Short-run dynamics highlight lagged adjustments, with UER and BIS exhibiting contrasting impacts from positive/negative shocks, and significant error correction confirming a stable equilibrium convergence rate. These results emphasize the critical role of asymmetric modeling in capturing pandemic-era economic complexities, particularly in volatile markets and policy environments, and imply that policymakers should account for differential responses to shocks when designing interventions.

The adverse shock outcomes associated with exchange rates align with findings by İlhan of Akdeniz (2020), who indicated significant and negative impacts on stock market trading activity attributable to exchange rates and CDS premiums. Furthermore, the study underscores that among macroeconomic factors, the exchange rate wields the most substantial influence.

It's noteworthy that during the COVID-19 pandemic, both positive and negative shocks associated with Bitcoin were observed to have tangible effects on Türkiye's credit volume. These findings support the works of two notable authors. For instance, Tay (2022) posited that Bitcoin was primarily classified as a hedging instrument in Japan during the pandemic. However, Tay's research suggests that such a classification might not hold for emerging economies like Türkiye. This underscores the nature of Bitcoin's role as a financial instrument during periods of heightened uncertainty. Furthermore, Sinlapates et al. (2023) assert that neither Bitcoin nor gold qualifies as a safe haven asset, as their trading behaviors can potentially amplify portfolio losses. This perspective challenges conventional notions regarding the role of cryptocurrencies like Bitcoin in times of economic distress, suggesting that they may not offer the stability and risk mitigation properties traditionally associated with safe havens.

Review of the existing literature and empirical evidence of this study highlight that financial instruments affecting credit volume in Türkiye are crucial in determining the nation's economic framework. A range of elements, including government policies, market dynamics, and individual borrowing habits, all interact to influence the accessibility and extent of credit in the country. Moreover, while credits have served as essential sources of capital for businesses and individuals, they have also contributed to escalating levels of debt and financial instability. The onset of the COVID-19 pandemic has further underscored the importance of effectively managing credits, particularly as businesses contend with economic challenges and individuals confront mounting financial pressures. Given these circumstances, it's imperative for policymakers and financial institutions to closely monitor and regulate these instruments to foster economic growth and stability while mitigating the associated risks of excessive debt. A range of strategies can be deployed through targeted regulatory measures, innovative lending approaches, or enhanced borrower communication to ensure that credits remain a catalyst for economic development in Türkiye. Striking a balance between promoting economic expansion and prudently managing debt levels will be critical for Türkiye's long-term prosperity. By adopting sustainable practices and fostering resilience, Türkiye can pave the way for a stronger and more resilient economy in the years to come.

In summary, this paper underscores several key policy implications for effectively managing credits and promoting economic stability in Türkiye. Firstly, policymakers need to collaborate closely with financial institutions to ensure responsible lending practices. This entails implementing regulations that safeguard borrowers' ability to repay while fostering financial literacy among borrowers. Additionally, exploring alternative lending models with lower risk profiles can enhance the resilience of both lenders and borrowers. Secondly, given the inherent volatility of financial markets, policymakers must remain vigilant in monitoring market conditions to anticipate fluctuations in credit availability and costs. This proactive approach involves developing early warning systems for financial risks, conducting regular market assessments, and fostering international cooperation to share insights and best practices. Thirdly, nurturing small and medium-sized enterprises (SMEs) is crucial for Türkiye's economic growth. However, SMEs often face challenges accessing necessary funding. Policymakers can address this by establishing targeted lending programs and incentives for financial institutions to support SMEs. Additionally, providing training and technical assistance to enhance financial literacy among SMEs can improve their readiness to access financing. Lastly, promoting alternative financing models, such as crowdfunding and peer-to-peer lending, offers avenues for diversifying funding sources and reducing reliance on traditional credit channels. Policymakers can facilitate the adoption of these models by creating a conducive regulatory framework, educating consumers about available options, and fostering the development of innovative financing platforms tailored to diverse borrower needs.

In essence, effective management of the financial instruments influencing credit volume in Türkiye demands a comprehensive strategy that harmonizes the imperatives of economic expansion and financial resilience with the imperative of mitigating debt-related risks. Through a strategic and forward-thinking approach to credit management, policymakers can play a pivotal role in nurturing a resilient and sustainable financial landscape conducive to the long-term prosperity and growth of all stakeholders.

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