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The Impact of Basic Macroeconomic Variables and Market Risks on Borsa Istanbul Indices: A Comparative Sectoral Analysis

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ABSTRACT

The aim of this study is to empirically investigate the impact of various macroeconomic variables on the Borsa Istanbul Benchmark and Sectoral Indices. The impetus for this inquiry stems from the significant fluctuations in macroeconomic variables within the Turkish economy, particularly during the early 2020s. We utilized the Autoregressive Distributed Lag (ARDL) **methodology** to examine the dataset covering the period from 2013 to 2024. **The results** indicate that, in the long term, the Borsa İstanbul (BIST) general indices are negatively affected by interest rates and credit default swaps (CDS) premiums, while exchange rates positively influence them. Notably, there is no discernible impact from US interest rates, inflation, or gold prices; however, the influence of the volatility index (VIX) is observed to be significant only in the short term. When examining sectoral effects, the negative impacts of interest rates and CDS premiums, as well as the positive influence of exchange rates, are consistent across sectors, with particularly pronounced effects in the banking and real estate sectors. Conversely, the effects of US interest rates, inflation, gold prices, and the VIX index mirror those observed in the general indices. An interesting finding is that while the VIX fear index only negatively affects bank and construction company stocks in the long term, companies in almost all sectors are affected by global risks in the short term. **The key conclusion** of the research is that exchange rates and domestic risk indicators — such as interest rates and CDS premiums — are the most influential long-term drivers of Turkey's stock market and sectoral performance, whereas global factors like US monetary policy and the VIX primarily affect short-term dynamics and investor sentiment.

Keywords: macroeconomic variables; stock returns; volatility index (VIX); inflation rate; interest rate; exchange rate; CDS premiums; gold prices; Turkey

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Влияние основных макроэкономических переменных и рыночных рисков на индексы Стамбульской фондовой биржи: сравнительный отраслевой анализ

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АННОТАЦИЯ

Целью данного исследования является эмпирическое изучение влияния различных макроэкономических переменных на индекс Стамбульской фондовой биржи и отраслевые индексы. Поводом для этого исследования послужили значительные колебания макроэкономических переменных в экономике Турции, особенно в начале 2020-х гг. Мы использовали **методологию** авторегрессии с распределенным лагом

(ARDL) для изучения набора данных, охватывающего период 2013–2024 гг. **Результаты** показывают, что в долгосрочной перспективе общие индексы Стамбульской фондовой биржи (BIST) испытывают отрицательное влияние процентных ставок и премий по кредитным дефолтным свопам (CDS), в то время как валютные курсы оказывают на них положительное влияние. Следует отметить отсутствие заметного влияния процентных ставок США, инфляции или цен на золото; однако влияние индекса волатильности (VIX) наблюдается только в краткосрочной перспективе.

При изучении секторальных эффектов негативное влияние процентных ставок и премий CDS, а также позитивное влияние обменных курсов согласуются между секторами с особенно выраженными эффектами в банковском секторе и секторе недвижимости. Напротив, влияние процентных ставок США, инфляции, цен на золото и индекса VIX отражает то, что наблюдается в общих индексах. Интересным результатом является то, что в то время как индекс волатильности VIX отрицательно влияет только на акции банков и строительных компаний в долгосрочной перспективе, компании почти во всех секторах подвержены влиянию глобальных рисков в краткосрочной перспективе. **Основной вывод** исследования заключается в том, что обменные курсы и внутренние индикаторы риска, такие как процентные ставки и премии CDS, являются наиболее влиятельными долгосрочными драйверами фондового рынка Турции и секторальных показателей, тогда как глобальные факторы, такие как денежно-кредитная политика США и индекс VIX, в первую очередь влияют на краткосрочную динамику и настроения инвесторов.

Ключевые слова: макроэкономические переменные; доходность акций; индекс волатильности (VIX); уровень инфляции; процентная ставка; обменный курс; премии CDS; цены на золото; Турция

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Introduction

The effect of macroeconomic indicators on stock market indices is a significant topic, particularly regarding inflation, which is closely monitored by investors. In high-inflation countries, alternative investments such as exchange rates and commodities may divert attention from stocks. Contractionary monetary policies to combat inflation can also affect investor preferences by raising interest rates and altering bond yields. Inflation impacts the stock market by affecting investor sentiment and corporate profits. High inflation reduces consumers' purchasing power, leading to decreased spending and potentially lower stock prices, especially in consumer sectors. Conversely, households may increase stock demand to protect their wealth against inflation, potentially driving prices up. After years of stable inflation, the recent resurgence has drawn attention from households, investors, and policymakers due to its impact on economic activity and the stock market. Since the 1980s, when U.S. inflation peaked at 13.55% from oil crisis shocks, the Federal Reserve has maintained an inflation rate near the 2% target. However, inflation concerns have reemerged due to COVID-19 economic policies, the Russia-Ukraine conflict, and NATO sanctions on Russia. In response, the Federal Reserve raised interest rates in mid-March 2022, leading to policy uncertainty and a significant stock market sell-off as investors anticipated higher discount rates and a potential economic slowdown [1].

The relationship between low- and high-risk assets has been studied since the 1960s [2]. A key finding is that investment decisions depend on the balance between risk and return. Rising interest rates make the bond market more attractive than the stock market, leading to declining stock prices [3]. Higher rates also reduce borrowing, reducing cash flow and investor demand for stocks. Additionally, rate hikes may increase the risk premium for stock investors, boosting demand for bonds and further depressing stock prices. This study aims to provide empirical evidence on whether ignorance of monetary policy interest rates affects stock market returns [4].

In financial markets, information is vital. Stock prices should reflect relevant macroeconomic variables and risks, as forecast errors and unexpected factors can negatively impact them. Deviations in macroeconomic variables can significantly affect stock returns, with research showing that "surprises" have a statistically significant negative impact. Studies on central bank transparency emphasize the influence of information from monetary authorities on market behavior [5]. Greater transparency can reduce volatility, enhance investor responsiveness, and improve financial stability [6]. Central banks aim to narrow the information gap with economic participants to achieve their inflation targets [7]. Therefore, confidence in macroeconomic indicators is essential for stock market returns.

This study examines the effects of key macroeconomic variables and market risks on Borsa Istanbul indices by sector. Key macroeconomic variables include the inflation rate, exchange rate, bond yields, and gold prices, while the volatility index (VIX) and credit default swaps (CDS) assess market risks. This study is significant for two reasons. First, while many studies have analyzed the relationship between stock returns and macroeconomic indicators, none have conducted a sectoral analysis specific to Turkey. This research investigates sectoral differences in the impact of these indicators on the stock market. Second, it is the first study in Turkey to explore the effects of the volatility index (VIX) and credit default swaps (CDS) on stock returns.

Literature review

Many studies have examined the relationship between macroeconomic indicators and stock returns, but the literature shows contradictory findings. The relationship between inflation and stock market returns has been widely studied, with many indicating a negative correlation [8, 9, 10]. A study in the USA found that stock returns are inversely related to inflation, a finding supported by subsequent research across various markets [11, 12]. Generally, stock returns decline as inflation rises due to increased costs eroding corporate profits and higher interest rates reducing the present value of future earnings. While there have been significant studies on the relationship between stock returns and inflation, the majority focus on the aggregate market, and most follow the development of individual sector sentiment. Some sectors may offer a potentially positive relationship and therefore provide protection against inflation risk. Some studies suggest a positive relationship between inflation and stock returns, particularly if companies can adjust prices in response to inflation [13]. This indicates that stocks may serve as a hedge against inflation under certain conditions, allowing returns to rise with increasing prices. Conversely, some research shows no significant relationship between inflation and stock returns [14, 15]. Explanations for a negative relationship include the money illusion effect, where investors sell stocks believing they won't keep pace with inflation, and the proxy effect, which suggests a negative correlation between stock returns and inflation through real output [16, 17].

The economic literature lacks consensus on the causal relationship between exchange rates and stock prices. Two main perspectives exist: the flow-oriented approach, which suggests a positive relationship [18], and the stock-oriented approach, which proposes a negative link [19]. The flow-oriented approach suggests that exchange rates are influenced by a country's external balance, while the stock-oriented view, supported by models like the portfolio balance model and the monetary model, argues for a negative relationship. Several studies support a negative relationship between exchange rates and stock returns. Fluctuations in exchange rates significantly impact company valuations and stock market returns in both developed and emerging markets [20, 21]. This relationship is often linked to multinational corporations: an appreciating domestic currency reduces the value of foreign earnings, leading to lower stock prices, while depreciation can enhance foreign earnings and potentially increase stock returns. This underscores the need for effective exchange rate risk management for companies in international trade and investors with global portfolios. Some studies indicate a positive relationship between exchange rates and stock returns. One study highlighted this connection, especially in countries with significant imports, while another study confirmed a significant correlation between exchange rate fluctuations and stock market returns [22, 23]. This relationship is often seen in economies where stronger domestic currency lowers import costs, reduces inflation, and boosts consumer spending, benefiting stock markets. For example, companies reliant on imports may see increased profitability and stock prices when the local currency strengthens. Additionally, industries like transportation and manufacturing, sensitive to input costs, can gain from favorable exchange rate movements, enhancing stock returns.

Many studies suggest a negative relationship between interest rates and stock returns, largely due to rising interest rates increasing borrowing costs, consumer spending, and business investments, which can lower corporate profits and stock prices. This inverse relationship is well-documented, though some studies suggest a positive correlation, albeit rarely [24–26]. Overall, most research supports the negative link between interest rates and stock market returns.

Investing in gold protects financial assets against inflation and serves as a crucial hedge in asset allocation [27]. Since gold prices are denominated in U.S. dollars, a dollar depreciation usually increases gold's nominal price, preserving its real value. The minimal correlation between gold and stock market prices indicates low systemic risk for gold. Thus, diversifying with both gold and stocks significantly reduces overall investment risk compared to investing solely in stocks, highlighting gold's role as «risk insurance» in portfolios [28]. Research on the relationship between gold prices and the stock market has yielded inconsistent results. Some studies suggest no correlation between gold prices and economic growth or stock market returns, as gold primarily serves as a store of value [29, 30]. A study examined the US, UK, and German markets and found that under normal conditions the relationship between gold prices and the stock market was very weak [31]. In contrast, other studies indicate a negative correlation, suggesting that investors convert funds into gold for protection during stock market declines. In a study conducted in 1983, a negative beta coefficient for gold in the US market was found [32], and in 2009, a study similarly identified a negative correlation between ASEAN stock market returns and international gold market returns [33]. Additional studies also support this negative relationship between gold prices and stock returns. However, some studies suggest a positive correlation between gold spot returns and stock market returns [34, 35].

A study conducted in 2021 provided empirical insights into how sustainability (ESG) and broad-based indices are affected by risk indicators such as VIX, CDS, and foreign exchange rates (FX) volatility index. Results showed that companies in Germany ESG-X, France ESG-X, and SRI-KEHATI are less affected by shocks than those in broad-based indices. In contrast, BIST Sustainability is more impacted than BIST All. Causality tests indicated that VIX has a greater influence on broad-based and ESG indices than other risk indicators [36]. Overall, stock returns are influenced by macroeconomic variables like inflation, exchange rates, interest rates, and gold prices, with no consensus on the nature of these relationships.

Data and methodology

Data

The estimated empirical model is presented in equation (1).

$$lnep = lnir^{tur} + lnir^{us} + lncds + lner + lninf + lngold + lnvix. \quad (1)$$

The study examined the influence of macroeconomic factors on the Turkish stock market by employing the indices established by Borsa İstanbul (BIST) as indicators of stock prices. Initially, general indices of BIST were employed to assess the collective impact on all stocks traded on the exchange. These indices encompass XUTUM, which consists of shares from 543 companies that are listed on the main market, star market, sub-market, and pre-market. The XU 100 represents the stock prices of the top 100 companies listed on the BIST. XU 030 represents the stock prices of the 30 largest companies listed on BIST.

In the second stage, sectoral indices established by BIST were employed to ascertain the sectoral impacts of macroeconomic variables. The analyzed indices encompass: XGIDA; Food, beverage, and tobacco sectors, XINSA; Construction and public works, XKMYA: Chemicals, pharmaceuticals, petroleum and other, XUTEK; Technology in the information and defence sectors, XHOLD; Holdings and investment, XTCRT; Retail and wholesale trade sectors, XGMYO; Real estate investment trusts, XBANK: Banks.

$lnep$ represents the logarithm of one of the aforementioned indices based on the market being analyzed and serves as the dependent variable. $lnir^{tur}$ is the natural logarithm of the Turkish 5-year bond yield and $lnir^{us}$ is the natural logarithm of US 5-year bond yield. $lncds$ signifies the natural logarithm of Turkey 5-year credit default swap (CDS) value. $lner$ stands for the natural logarithm of the nominal exchange rate ($/TL). $lninf$ represents the natural logarithm of the inflation rate in Turkey, $lngold$ denotes the natural logarithm of gold prices (in $/ounce), and $lnvix$ signifies the natural logarithm of the volatility index (VIX). The VIX index provides a measure of the constant, 30-day expected volatility of the US stock market.

The study utilizes data from various sources covering the period from January 2013 to June 2024. Specifically, the $lnir^{tur}$, lner, and lninf data are sourced from the CBRT database, while the index data for lnep are obtained from the BIST database.[1]

[1] URL: BIST Database. URL: https://www.borsaistanbul.com (accessed on 20.07.2024).

Additionally, data for the $lnir^{us}$ variable are retrieved from the St. Louis FED database,[2] and data's on lncds, lngold, and lnvix are sourced from Investing.[3]

Methodology

The study utilizes the Autoregressive Distributed Lag (ARDL) methodology developed by Pesaran and Shin (1999) and Pesaran et al. (2001) to perform both long-term and short-term estimations [37, 38]. ARDL methodology can produce efficient estimates even in situations with small and limited samples [39].

$$\begin{gathered}\Delta \ln ep_t = \alpha_0 + \sum_{i=1}^{m}\alpha_1 \Delta \ln ep_{t-i} + \sum_{i=0}^{m}\alpha_2 \Delta \ln ir_{t-i}^{tur} + \sum_{i=0}^{m}\alpha_3 \Delta \ln ir_{t-i}^{us} + \\ + \sum_{i=0}^{m}\alpha_4 \Delta \ln cds_{t-i} + \sum_{i=0}^{m}\alpha_5 \Delta \ln er_{t-i} + \sum_{i=0}^{m}\alpha_6 \Delta \ln \inf_{t-i} + \\ + \sum_{i=0}^{m}\alpha_7 \Delta \ln gold_{t-i} + \sum_{i=0}^{m}\alpha_8 \Delta \ln vix_{t-i} + \alpha_9 \ln ep_{t-1} + \alpha_{10} \ln ir_{t-1}^{tr} + \\ + \alpha_{11} \ln ir_{t-1}^{us} + \alpha_{12} \ln cds_{t-1} + \alpha_{13} \ln er_{t-1} + \alpha_{14} \ln \inf_{t-1} + \alpha_{15} \ln gold_{t-1} + \\ + \alpha_{16} \ln vix_{t-1} + \varepsilon_t\end{gathered} \quad (2)$$

To investigate the cointegration relationship among the variables, the model outlined in equation (1) of the study is transformed into the unrestricted error correction model (UECM) form, as illustrated in equation (2). In this equation, α_0 is the constant term, and $\alpha_1, \ldots, \alpha_8$ represent the short-term coefficients derived from the lagged value of dependent, and current and lagged values of the independent variable. On the other hand, $\alpha_9, \ldots., \alpha_{16}$ correspond to the long-term coefficients, and ε_t signifies the error term. The parameter *m* denotes the optimum lag length. The bound test is utilized to investigate the cointegration relationship by evaluating the joint significance of the first lags of the dependent and independent variables after estimating model (2) using the Ordinary Least Squares (OLS) method. Hypothesis testing is based on critical values from tables established by Narayan (2005) [40].

$$\begin{gathered}\ln ep_t = \beta_0 + \sum_{i=1}^{q_1}\beta_1 \ln ep_{t-i} + \sum_{i=0}^{q_2}\beta_2 \ln ir_{t-i}^{tur} + \sum_{i=0}^{q_3}\beta_3 \ln ir_{t-i}^{us} + \\ + \sum_{i=0}^{q_4}\beta_4 \ln cds_{t-i} + \sum_{i=0}^{q_5}\beta_5 \ln er_{t-i} + \sum_{i=0}^{q_6}\beta_6 \ln \inf_{t-i} + \sum_{i=0}^{q_7}\beta_7 \ln gold_{t-i} + \\ + \sum_{i=0}^{q_8}\beta_8 \ln vix_{t-i} + e_t.\end{gathered} \quad (3)$$

After establishing the cointegration relationship in equation (2), the model of the study is adjusted to equation (3) to calculate the long-term coefficients. The constant term is denoted as β_0, and the error term is represented by e_t in equation (3). The optimum lag length (q_i) is determined based on the Akaike Information Criteria. The long-term coefficients are computed by dividing the coefficients of the independent variables estimated using the OLS method in the ARDL model $(q_i, \ldots)$ by the difference in the lagged dependent variable coefficient.

$$\begin{gathered}\Delta \ln ep_t = \sigma_0 + \sum_{i=1}^{p_1}\sigma_1 \Delta \ln ep_{t-i} + \sum_{i=0}^{p_2}\sigma_2 \Delta \ln ir_{t-i}^{tur} + \sum_{i=0}^{p_3}\sigma_3 \Delta \ln ir_{t-i}^{us} + \\ + \sum_{i=0}^{p_4}\sigma_4 \Delta \ln cds_{t-i} + \sum_{i=0}^{p_5}\sigma_5 \Delta \ln er_{t-i} + \sum_{i=0}^{p_6}\sigma_6 \Delta \ln \inf_{t-i} + \\ + \sum_{i=0}^{p_7}\sigma_7 \Delta \ln gold_{t-i} + \sum_{i=0}^{p_8}\sigma_8 \Delta \ln vix_{t-i} + \sigma_9 ECT_{t-1} + u_t.\end{gathered} \quad (4)$$

[2] Louis FED Database. URL: https://fred.stlouisfed.org/ (accessed on 20.07.2024).
[3] Investing, URL: https://tr.investing.com/ (accessed on 20.07.2024).

In the final stage, the error correction model (ECM) specified in equation (4) is estimated using the OLS technique to derive findings related to short-term dynamics. In equation (4), σ_0 represents the constant term and u_t denotes the error term. The operator Δ denotes the first difference, and p_i indicates the lag lengths (according to equation (3) $(q_i - 1)$). σ_9 is the coefficient of the error term. The presence of the σ_9 term within the range of 0 to –1 serves as evidence for the existence of a cointegration relationship. Moreover, the proximity of this value to 0 indicates a slower rate at which the impact of a short-term shock, leading to a deviation from the long-term equilibrium, diminishes.

In order to ensure the robustness of the long-term coefficients, they were re-estimated using the Fully Modified Ordinary Least Squares (FMOLS) method introduced by Phillips and Hansen (1990) and the Dynamic Ordinary Least Squares (DOLS) method developed by Stock and Watson (1993) [41, 42]. FMOLS provides efficient and consistent results by integrating a semi-parametric correction to address endogeneity and serial correlation in the stochastic error terms inherent in the Ordinary Least Squares (OLS) method. In contrast, the DOLS approach addresses these issues by incorporating the levels and differences of the independent variables, as well as their leads, in the model. The determination of the optimal lag length and lead values is based on information criteria.

Findings and results

In the ARDL approach, the stationarity of the series is crucial. We conducted the ADF test using models with a constant and a constant plus trend. The results indicate that the lninf variable is stationary at its level, while all other variables are stationary at their first difference, suggesting no stationarity issues in subsequent estimations.

The estimations of the BIST general indices

After the unit root tests, model (2) predicted the XUTUM, XU 100, and XU 030 indices, while model (3) estimated the long-term coefficients. *Table 1* shows the bound test results, long-term coefficients, and diagnostic tests for the estimations. The F test results in *Table 1* show that the statistics exceed the upper critical value (4.23) for the XUTUM, XU 100, and XU 030 models, indicating a cointegration relationship. The Jarque-Bera Normality Test confirms that the null hypothesis of normal distribution is not rejected in any model. The Breusch-Godfrey Serial Correlation LM test and the Breusch-Pagan-Godfrey heteroskedasticity test also do not reject their respective null hypotheses of no serial correlation and equal variance. The Ramsey RESET test supports the null hypothesis of correct model specification. Stability tests (CUSUM and CUSUMSQ) reject the null hypothesis of an out-of-control process. Overall, these diagnostic tests indicate that the estimations are statistically reliable.

The long-term coefficients reveal that lnir^{tur} exerts a statistically significant negative impact on lnbisttum, lnbist100, and lnbist30. Specifically, a 1% increase in lnir^{tur} leads to decreases of –1.07%,—0.96%, and –0.88% in lnbisttum, lnbist100, and lnbist30, respectively. lnir^{us} demonstrates a statistically significant positive effect solely on lnbist30 at a significance level of 10%. Shocks in lncds exhibit a statistically significant negative influence on lnbisttum, lnbist100, and lnbist30, with a 1% increase in lncds resulting in decreases of –1.54%,—1.32%, and –1.24% in lnbisttum, lnbist100, and lnbist30, respectively. Shocks in lner show a statistically significant positive impact on lnbisttum, lnbist100, and lnbist30, with a 1% increase in lner leading to increases of 4.29%, 4.05%, and 3.74% in lnbisttum, lnbist100, and lnbist30, respectively. lngold does not significantly affect lnbisttum but has a statistically significant positive effect on lnbist100 and lnbist30 at the 5% significance level. A 1% increase in lngold results in a 0.92% increase in lnbist100 and a 0.84% increase in lnbist30. lninf and lnvix do not exhibit statistically significant effects in the long term.

In the ARDL estimation for the XUTUM, XU 100, and XU 030 models, the error correction model specified in equation (4) is estimated. The coefficient estimates are detailed in *Table 2*. Notably, the error correction terms fall within the range of 0 to –1. This observation suggests that short-term shocks gravitate towards equilibrium in the long run, implying the presence of a cointegration relationship. In terms of the short-term coefficients, it is observed that shocks in lnvix exhibit a statistically significant and negative impact on lnbisttum, lnbist100, and lnbist30. Additionally, lnir^{us} demonstrates a statistically significant and positive

Table 1
The bound test, long-term coefficients, and diagnostic tests

Variables	XUTUM (5,0,1,0,2,2,0,6)	XU 100 (1,0,1,0,0,0,0,6)	XU 030 (1,0,0,0,0,0,0,6)
	Coefficient	Coefficient	Coefficient
$\ln ir^{tur}$	−1.070*	−0.964*	−0.884*
$\ln ir^{us}$	0.082	0.111	0.202***
lncds	−1.547*	−1.329*	−1.240*
lner	4.293*	4.050*	3.740*
lninf	0.018	−0.037	−0.036
lngold	0.800	0.921**	0.844**
lnvix	0.315	0.053	−0.057
F Test I(0): 3.07 / I(1): 4.23	12.298	13.537	5.615
R^2	0.99	0.98	0.99
	Stat.[Prob.]	Stat.[Prob.]	Stat.[Prob.]
$\chi^2_{J-B\ test}$	2.928 [0.231]	1.151 [0.562]	2.610 [0.271]
$\chi^2_{B-G\ LM\ test}$	1.246 [0.291]	0.588 [0.556]	0.533 [0.588]
$\chi^2_{B-G-D\ test}$	1.111 [0.343]	1.280 [0.217]	1.325 [0.193]
$\chi^2_{RESET\ test}$	0.209 [0.648]	0.013 [0.907]	0.030 [0.861]
CUSUM	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable

Source: Compiled by the author based on the estimations.

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

influence in all three models. Notably, the dummy variable representing the COVID-19 pandemic does not show a statistically significant negative effect in any of the three models.

The estimations of the BIST sectoral indices

In the initial phase, Equation (2) was individually estimated for each index utilizing BIST sectoral stock indices to estimation sectoral trends. Subsequently, Equation (3) was calculated to derive the long-term coefficients. The bound test, long-term coefficients, and diagnostic tests are detailed in *Table 3*.

The bound test reveals that F-statistic values for all sectors exceed the upper bound of 4.23, indicating a cointegration relationship among the variables. Additionally, diagnostic tests including the Jarque-Bera Normality test, the Breusch-Godfrey Serial Correlation LM test, the Breusch-Pagan-Godfrey heteroskedasticity test, the Ramsey RESET test, as well as the CUSUM and CUSUM SQ tests conducted on the estimates indicate the absence of any statistical problems with the estimates.

Upon examining the long-term coefficients, it is evident that $\ln ir^{tur}$ exerts a negative and statistically significant influence on the dependent variables across all sectors. Notably, $\ln ir^{tur}$ demonstrates the most pronounced impact on the XBANK, XGMYO, and XINSA models, while its effect is weakest on the XTCRT, and XGIDA models. In contrast, $\ln ir^{us}$ exhibits a statistically significant negative effect solely on XUTEK and XGMYO models, with a positive impact on the XBANK model. The coefficients associated with $\ln ir^{us}$ in the remaining models are deemed statistically insignificant. Similarly, lncds is found to

Table 2
Error correction model regression

XUTUM		XU 100		XU 030	
Variable	**Coefficient**	**Variable**	**Coefficient**	**Variable**	**Coefficient**
D(lnbisttum(−1))	−0.000	D($\mathbf{lnir^{us}}$)	0.243*	D(lnvix)	−0.159*
D(lnbisttum(−2))	−0.038	D(lnvix)	−0.141*	D(lnvix(−1))	−0.092***
D(lnbisttum(−3))	−0.038	D(lnvix(−1))	−0.093***	D(lnvix(−2))	−0.029
D(lnbisttum(−4))	−0.207*	D(lnvix(−2))	−0.040	D(lnvix(−3))	−0.010
D($\mathbf{lnir^{us}}$)	0.243*	D(lnvix(−3))	−0.026	D(lnvix(−4))	0.061
D(lner)	2.184*	D(lnvix(−4))	0.047	D(lnvix(−5))	−0.083***
D(lner(−1))	−0.759**	D(lnvix(−5))	−0.093**	COVID-19	−0.023***
D(lninf)	−0.016	COVID-19	−0.021	ect(−1)*	−0.428*
D(lninf(−1))	0.016	ect(−1)*	−0.389*		
D(lnvix)	−0.105**				
D(lnvix(−1))	−0.141*				
D(lnvix(−2))	−0.062				
D(lnvix(−3))	−0.078				
D(lnvix(−4))	−0.031				
D(lnvix(−5))	−0.151*				
COVID-19	−0.002				
ect(−1)*	−0.362*				
R^2	0.63	R^2	0.59	R^2	0.60
F-stat	11.430 (0.000)	F-stat	19.749 (0.000)	F-stat	23.523 (0.000)

Note: *, **, *** denote statistical significance at the 1%, 5%, and 10% levels, respetively.

Source: Compiled by the author based on the estimations.

have a statistically significant negative impact on the dependent variables in all sectors, with coefficient magnitudes being relatively consistent except in the XINSA model. lner's coefficient is statistically significant and positive across all models, with the most substantial impact observed on XBANK, and the least impact on XINSA, and XKMYA. Analysis of lninf's coefficients reveals a statistically significant negative impact solely on XGIDA and while showing a positive effect on XKMYA. However, the coefficients of lninf in the other models are statistically insignificant. Notably, lngold's coefficients have no statistical significance in the XHOLD, XTCRT, XGMYO, and XBANK models. Conversely, a positive impact is observed in the XGIDA and XINSA models, while a negative impact is noted in the XKMYA and XUTEK models. Lastly, the coefficients of lnvix indicate a negative impact on XBANK and XINSA, with the remaining coefficients being statistically insignificant.

The error correction regression specified in Equation (4) has been estimated. The results are displayed in *Table 4*. The coefficient for the error correction term is consistently negative and statistically significant across all models. This indicates that disturbances leading to deviations from the long-run equilibrium have a tendency to be corrected, implying the presence of a cointegration relationship.

The analysis of the short-term coefficients reveals noteworthy findings. lnir^{us} exhibits statistically significant positive coefficients in the XGIDA, XKMYA, XHOLD, and XGMYO models, while displaying statistically significant negative coefficients in the XTCRT models. lninf demonstrates statistically significant positive coefficients in certain lagged values within the XGIDA, XTCRT, and XBANK models. lnvix showcases statistically significant negative coefficients in various lagged values across nearly all models. Furthermore, the inclusion of a dummy variable to signify the impact of the COVID-19 pandemic reveals statistically significant negative coefficients in the XINSA, XGMYO, and XBANK models, and statistically significant positive coefficients in the XTCRT model.

Table 3

The bound test, long-term coefficients, and diagnostic tests

	XGIDA, (1,6,1,0,1,5,0,6)	**XINSA (2,2,0,1,0,0,6,0)**	**XKMYA (5,0,1,0,5,1,4,6)**	**XUTEK (1,0,1,0,0,0,0,0)**	**XHOLD (5,0,1,0,6,1,0,6)**	**XTCRT (1,6,5,0,6,2,0,6)**	**XGMYO (1,6,1,0,1,1,0,5)**	**XBANK (1,0,0,5,4,6,0,5)**
Variables	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**	**Coef.**
$\mathbf{lnir}^{tur}$	−0.363*	−0.700*	−0.659*	−0.544*	−0.360*	−0.194*	−0.924*	−1.230*
$\mathbf{lnir}^{us}$	−0.033	−0.065	−0.000	−0.457*	0.056	−0.005	−0.294**	0.305**
lncds	−0.709*	−0.132	−0.423**	−0.929*	−0.536*	−0.547*	−0.659*	−0.877*
lner	2.198*	1.604*	1.777*	2.123*	1.926*	1.929*	2.105*	3.303*
lninf	−0.131*	0.000	0.099***	−0.007	0.024	0.001	0.018	−0.054
lngold	0.977*	1.300*	−0.947**	−1.923*	0.048	0.171	0.332	0.743
lnvix	0.123	−0.220**	0.099	−0.206	0.100	0.101	0.154	−0.535**
F Test I(0): 3.07 I(1): 4.23	7.888	6.705	5.615	6.755	10.069	7.426	6.543	10.014
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98
	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]	Stat. [Prob.]
$\div^2_{J-B\ test}$	0.957 [0.619]	5.335 [0.069]	0.707 [0.701]	1.552 [0.460]	1.605 [0.448]	1.447 [0.484]	4.437 [0.108]	0.329 [0.848]
$\div^2_{B-G\ LM\ test}$	0.829 [0.439]	0.709 [0.494]	0.163 [0.849]	0.102 [0.902]	0.711 [0.493]	0.338 [0.713]	1.184 [0.309]	0.390 [0.678]
$\div^2_{B-G-D\ test}$	1.039 [0.426]	2.674 [0.000]	1.050 [0.412]	0.995 [0.453]	1.087 [0.368]	1.323 [0.143]	1.442 [0.105]	0.705 [0.859]
$\div^2_{RESET\ test}$	2.042 [0.156]	0.084 [0.772]	1.296 [0.197]	0.000 [0.984]	0.468 [0.640]	0.753 [0.452]	0.618 [0.433]	0.170 [0.681]
CUSUM	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable

Source: Compiled by the author based on the estimations.

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

Robustness check

The long-term coefficients of the model, initially estimated with the ARDL approach, have been re-estimated using FMOLS and DOLS methodologies. *Table 5* shows the long-term coefficients for both the general and sectoral BIST indices. The results for lnir^{tur}, lncds and lner from FMOLS and DOLS closely match previous findings, with their influence on the overall indices increasing in the order of XU 030, XU 100, and XUTUM. As before, the XBANK index shows the most significant effect for all three variables. The coefficients for lninf and lngold resemble previous findings, while lnvix remains statistically insignificant on any index over the long term. lnir^{us}, which exhibited statistically significant coefficients for XU 030 and certain sectoral indices in the ARDL approach, demonstrates significant effects in these estimations. Additionally, it is observed to have significant impacts on the remaining overall indices and several other sectoral indices.

Table 4
Error correction model regression

XGIDA		**XINSA**		**XKMYA**		**XUTEK**	
Variable	Coef.	Variable	Coef.	Variable	Coef.	Variable	Coef.
D($lnir^{tur}$)	−0.147*	D(lnbistinsa(−1))	−0.139**	D(lnbistkmya(−1))	0.007	D($lnir^{tur}$)	−0.010
D($lnir^{tur}$ (−1))	−0.098**	D($lnir^{tur}$)	0.005	D(lnbistkmya(−2))	0.018	COVID-19	−0.013
D($lnir^{tur}$ (−2))	−0.136*	D($lnir^{tur}$ (−1))	0.105**	D(lnbistkmya(−3))	−0.029	ect(−1)*	−0.209*
D($lnir^{tur}$ (−3))	−0.104**	D(lncds)	−0.143*	D(lnbistkmya(−4))	−0.194*		
D($lnir^{tur}$ (−4))	0.137*	D(lngold)	0.045	D($lnir^{us}$)	0.137*		
D($lnir^{tur}$ (−5))	0.112*	D(lngold(−1))	−0.335***	D(lner)	0.845*		
D($lnir^{us}$)	0.075***	D(lngold(−2))	−0.253	D(lner(−1))	−0.631*		
D(lner)	1.147*	D(lngold(−3))	−0.693*	D(lner(−2))	0.133		
D(lninf)	−0.023*	D(lngold(−4))	−0.070	D(lner(−3))	−0.326**		
D(lninf(−1))	0.038*	D(lngold(−5))	−0.424**	D(lner(−4))	0.437*		
D(lninf(−2))	0.024*	COVID-19	−0.039*	D(lninf)	0.004		
D(lninf(−3))	0.020*	ect(−1)*	−0.299*	D(lngold)	−0.225		
D(lninf(−4))	0.015*			D(lngold(−1))	0.042		
D(lnvix)	−0.048**			D(lngold(−2))	−0.257		
D(lnvix(−1))	−0.071*			D(lngold(−3))	−0.382**		
D(lnvix(−2))	−0.013			D(lnvix)	−0.068*		
D(lnvix(−3))	−0.015			D(lnvix(−1))	−0.057**		
D(lnvix(−4))	−0.024			D(lnvix(−2))	−0.009		
D(lnvix(−5))	−0.074*			D(lnvix(−3))	−0.045		
covid-19	0.002			D(lnvix(−4))	−0.004		
ect(−1)*	−0.313*			D(lnvix(−5))	−0.080*		
				COVID-19	0.002		
				ect(−1)*	−0.247*		
XHOLD		**XTCRT**		**XGMYO**		**XBANK**	
Variable	Coef.	Variable	Coef.	Variable	Coef.	Variable	Coef.
D(lnbisthold(−1))	0.103	D($lnir^{tur}$)	−0.049	D($lnir^{tur}$)	−0.189*	D(lncds)	−0.759*
D(lnbisthold (−2))	−0.037	D($lnir^{tur}$ (−1))	−0.006	D($lnir^{tur}$ (−1))	0.027	D(lncds(−1))	−0.075
D(lnbisthold(−3))	−0.098	D($lnir^{tur}$ (−2))	−0.032	D($lnir^{tur}$ (−2))	−0.072	D(lncds(−2))	−0.002
D(lnbisthold(−4))	−0.180*	D($lnir^{tur}$ (−3))	0.035	D($lnir^{tur}$ (−3))	0.009	D(lncds(−3))	0.194***
D($lnir^{us}$)	0.110*	D($lnir^{tur}$ (−4))	0.156*	D($lnir^{tur}$ (−4))	0.144*	D(lncds(−4))	0.327*
D(lner)	1.045*	D($lnir^{tur}$ (−5))	0.137*	D($lnir^{tur}$ (−5))	0.117**	D(lner)	2.041*
D(lner(−1))	−0.401*	D($lnir^{us}$)	0.042	D($lnir^{us}$)	0.084***	D(lner(−1))	−1.286**
D(lner(−2))	−0.373**	D($lnir^{us}$ (−1))	−0.079***	D(lner)	0.766*	D(lner(−2))	−0.615
D(lner(−3))	−0.285***	D($lnir^{us}$ (−2))	−0.111**	D(lninf)	−0.014**	D(lner(−3))	−1.932*
D(lner(−4))	0.236	D($lnir^{us}$ (−3))	−0.048	D(lnvix)	−0.058**	D(lninf)	−0.032***
D(lner(−5))	−0.310**	D($lnir^{us}$ (−4))	−0.126*	D(lnvix(−1))	−0.042	D(lninf(−1))	0.048**
D(lninf)	−0.014**	D(lner)	0.663*	D(lnvix(−2))	−0.014	D(lninf(−2))	0.052**
D(lnvix)	−0.051**	D(lner(−1))	−0.477**	D(lnvix(−3))	−0.000	D(lninf(−3))	0.074*
D(lnvix(−1))	−0.055**	D(lner(−2))	−0.192	D(lnvix(−4))	0.065*	D(lninf(−4))	0.050*
D(lnvix(−2))	−0.023	D(lner(−3))	−0.259	COVID-19	−0.043*	D(lninf(−5))	0.020
D(lnvix(−3))	−0.043***	D(lner(−4))	−0.054	ect(−1)*	−0.230*	D(lnvix)	−0.092
D(lnvix(−4))	−0.000	D(lner(−5))	−0.460*			D(lnvix(−1))	0.267*
D(lnvix(−5))	−0.079*	D(lninf)	−0.004			D(lnvix(−2))	0.340*

Table 4 (continued)

COVID-19	0.004	D(lninf(−1))	0.010***			D(lnvix(−3))	0.292*
ect(−1)*	−0.419*	D(lnvix)	−0.019			D(lnvix(−4))	0.285*
		D(lnvix(−1))	−0.019			COVID-19	−0.061*
		D(lnvix(−2))	0.012			ect(−1)*	−0.594*
		D(lnvix(−3))	−0.012				
		D(lnvix(−4))	−0.023				
		D(lnvix(−5))	−0.075*				
		COVID-19	0.029*				
		ect(−1)*	−0.443*				

Source: Compiled by the author based on the estimations.

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

Limitations of the study

This study has several limitations that should be acknowledged. First, the analysis is limited to the Turkish stock market and may not be generalizable to other emerging or developed markets with different macroeconomic structures. Second, the use of annual or monthly macroeconomic data may not fully capture high-frequency fluctuations or sudden market reactions. Third, while the ARDL approach effectively models both short- and long-term relationships, it assumes linear interactions and may not account for potential nonlinearities or structural breaks in the data. Fourth, external shocks such as geopolitical developments or pandemic-related disruptions were not explicitly modeled, despite their possible influence on investor behavior and market performance. Lastly, the study focuses primarily on selected macroeconomic indicators; including additional financial or firm-level variables could provide a more comprehensive understanding of sectoral dynamics in future research.

Discussion and conclusion

This study conducts an econometric analysis of macroeconomic variables' impacts on Turkey's stock markets, aiming to identify factors influencing sectoral fluctuations. Initially, it will examine overall market effects using the XU 030, XU 100, and XUTUM indices as benchmarks. XU 030 and XU 100 represent larger, established companies, while XUTUM includes nearly all BIST-listed companies. The study examines long-term effects, finding that local interest rates and CDS premiums negatively impact stock markets, with CDS premiums being more influential. This impact is less pronounced in indices with larger institutional firms, which can leverage diverse financing options and maintain better cash flow. Exchange rates positively affect stock prices, particularly benefiting export-heavy companies and those with foreign exchange assets, while negatively impacting import-dependent sectors. The influence of US monetary policy is minor, showing a positive association only with XU 030. In emerging markets like Turkey, US interest rates can significantly affect local stock indices, especially those including large companies. Long-term effects of Turkish inflation and the global fear index on stock markets are not evident. Contrary to expectations, gold prices positively impact stock prices for XU 030 and XU 100. In Turkey, as expectations grew that foreign exchange assets, including gold, would yield returns below inflation due to exchange rate controls, economic units shifted to stock investments during a prolonged period of low interest rates and monetary expansion. In the short term, the positive effects of US monetary policy are evident across all stock prices, while increases in the VIX correlate with declines in stock markets. Long-term impacts of other factors can also be observed in the short term.

The analysis of sectoral impacts on stock prices reveals that the exchange rate is the most influential long-term variable, positively affecting all sectors. Rising Turkish interest rates and increased risk premiums negatively impact stock prices, especially in banking. While US interest rates generally have little effect, contractionary US monetary policy decreases technology stock prices and increases bank stock prices. Inflation has no long-term effect except for negatively impacting food companies. In the short term, inflation positively affects stocks in food, trade, and banking, but negatively impacts chemical, real estate, and holding companies. The VIX fear index negatively impacts bank and construction stocks long-term, while short-term effects are felt across nearly all sectors. These effects are linked to investor sentiment and market liquidity, changing with market conditions. High VIX levels particularly harm the banking sector, which relies on financial confi-

Table 5
FMOLS and DOLS regression

	XUTUM		XU 100		XU 030		XGIDA	
	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS
Variables	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
$lnir^{tur}$	−0.887*	−0.842*	−0.868*	−0.836*	−0.790*	−0.778*	−0.308*	−0.267*
$lnir^{us}$	0.277*	0.242**	0.347*	0.312*	0.374*	0.344*	−0.009	−0.020
lncds	−1.351*	−1.213*	−1.270*	−1.165*	−1.208*	−1.150*	−0.645*	−0.592*
lner	3.930*	3.935*	3.707*	3.733*	3.482*	3.534*	1.944*	1.980*
lninf	0.061	−0.004	0.053	−0.011	0.032	−0.030	0.030	−0.010
lngold	0.711**	0.927*	0.738**	0.924*	0.615**	0.761*	0.379	0.415***
lnvix	0.096	−0.076	0.065	−0.089	0.030	−0.098	0.038	−0.012
	XINSA		XKMYA		XUTEK		XHOLD	
	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS
Variables	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
$lnir^{tur}$	−0.497*	−0.490*	−0.484*	−0.491*	−0.322**	−0.239**	−0.370*	−0.358*
$lnir^{us}$	0.134	0.103	0.161**	0.160**	−0.171	−0.1022	0.125*	0.113*
lncds	−0.269**	−0.243*	−0.402*	−0.315*	−0.901*	−0.827*	−0.466*	−0.449*
lner	1.627*	1.653*	1.583*	1.519*	1.575*	1.335*	1.722*	1.728*
lninf	0.081**	0.033***	0.028	0.010*	0.042	0.011	−0.002	−0.017**
lngold	0.684**	0.806*	−0.257	−0.032	−1.426*	−0.951*	0.250	0.293**
lnvix	−0.065	−0.101	0.044	−0.064	−0.079	−0.031	−0.037	−0.073**
	XTCRT		XGMYO		XBANK			
	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS		
Variables	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.		
$lnir^{tur}$	−0.172*	−0.166*	−0.681*	−0.596*	−1.406*	−1.417*		
$lnir^{us}$	−0.067	−0.063	−0.169***	−0.142	0.534*	0.529*		
lncds	−0.574*	−0.579*	−0.676*	−0.569*	−0.846*	−0.794*		
lner	1.898*	1.898*	2.248*	2.128*	2.073*	2.113*		
lninf	−0.012	−0.043*	0.079**	0.030	0.060	−0.020		
lngold	−0.073	0.028	−0.597***	−0.303	0.933***	1.146*		
lnvix	−0.016	−0.038	−0.014	−0.042	0.007	−0.101		

Source: Compiled by the author based on the estimations.

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

dence, and the construction sector, which depends on financing and economic stability. As global risks rise, investors often shift to safer assets, creating selling pressure that can lower stock prices across sectors.

Implications

The empirical investigation of the impact of various macroeconomic variables on the Borsa Istanbul Benchmark and Sectoral Indices can have several practical implications.

Investment strategy formulation. Investors may adjust their portfolios based on the anticipated changes in macroeconomic conditions, optimizing their sectoral investments to minimize risk and maximize returns.

Risk management. Knowing the relationship between macroeconomic factors and stock market indices allows both individual and institutional investors to effectively manage their risk exposure.

Monetary policy impact assessment. The findings can help policymakers understand how changes in monetary policy could impact different sectors of the stock market.

Global comparison and adaptation. The study's findings may help explain why Borsa Istanbul might react differently to other international markets under similar macroeconomic conditions.

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