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DECODING ETF MARKET MOVEMENTS: THE IMPACT OF INTERNAL AND EXTERNAL FACTORS

ETF Piyasası Hareketlerinin Şifrelerini Çözmek: İçsel ve Dışsal Faktörlerin Etkisi

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Keywords:
ETF, Financial Stress Index, CDS, ARDL.

JEL Codes:
G11, G12, G15, G17, F65.

Abstract

The study aims to explore the impact of CDS Türkiye, Dow Jones Islamic Market Türkiye Exchange Traded Fund (DJIMTR), Financial Stress Index (FSI), VIX, and iShare MSCI Türkiye (iShare) indicators on the market capitalization of BIST ETFs (ETF) using monthly data between January 2020 and November 2024. The ARDL method is used to examine the effect in the study. Based on the findings, there is cointegration between the variables. Examining the long-term relationships, CDS, DJIMTR, and ISHARE have a positive and statistically significant effect on ETF, while the FSI has a statistically significant negative effect on ETFs. The VIX and DJIMTR have a positive and statistically significant impact on the ETF in the long term. The error correction model (ECM) results show that the ECT coefficient is negative and statistically significant. Therefore, the shocks occurring on the ETF are effective in the short term, and at least 51% of them spill over to the next period, but these shocks come to balance in the following period and exhibit a convergence feature. So, CDS, FSI, DJIMTR, and ISHARE indicators are significant for determining the investment strategies of ETF investors and fund managers.

Anahtar Kelimeler:
ETF, Finansal Stres Endeksi, CDS, ARDL.

JEL Kodları:
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Öz

Bu çalışma, CDS Türkiye, Dow Jones İslami Piyasa Türkiye Borsa Yatırım Fonu (DJIMTR), Finansal Stres Endeksi (FSI), VIX ve iShare MSCI Türkiye (iShare) göstergelerinin BIST ETF'lerinin piyasa değeri (ETF) üzerine olan etkisini Ocak 2020 ve Kasım 2024 arasındaki aylık verileri kullanarak keşfetmeyi hedeflemektedir. Araştırmada etkinin incelenmesi için ARDL yöntemi kullanılmıştır. Analiz sonuçlarına göre ise değişkenler arasında eşbütünleşme vardır. Uzun dönem ilişkileri incelendiğinde ise CDS, DJIMTR ve ISHARE değişkenleri ETF üzerinde pozitif ve istatiksel olarak anlamlı bir etkiye sahipken, FSI değişkeni istatiksel olarak anlamlı ancak negatif yönde etkiye sahiptir. Hata düzeltme modeli (ECM) sonuçlarına göre ise ECT katsayı negatif ve istatiksel olarak anlamlıdır. Dolayısıyla, ETF üzerinde meydana gelen şokların kısa dönemde de etkili olduğu ve en az %51'inin bir sonraki döneme sarkmaktadır ancak bu şoklar takip eden dönemde dengeye gelmekte ve yakınsama özelliği ortaya koymaktadır. Bu nedenle CDS, FSI, DJIMTR ve ISHARE göstergeleri ETF yatırımcıları ve fon yöneticileri yatırım stratejilerinin belirlenmesi önem arz etmektedir.

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1. Introduction

Investment refers acquisition of assets by individuals or institutions with the aim of generating profit by assuming risk (Bischoff and Wühler, 2019). Governments, banks, businesses, and individuals make investments in a range of instruments traded in financial markets, such as stocks, bonds, commodities, foreign currencies, gold, options, futures, mutual funds, and exchange-traded funds (ETFs), to increase their return and wealth (van den Burg et al., 2017: 3). ETFs, considered one of the best innovations in financial markets (Ozcelebi et al., 2025: 1), are investment vehicles that aim to track an index (Gallagher and Segara, 2006). Traded on the stock exchange (Sermaye Piyasası Kurulu, 2024), ETFs purchase stocks included in tracking indexes on behalf of the fund. ETFs impact many financial variables, but uncertainties such as market volatility, geopolitical risks, and economic indicators also affect ETF returns (Ozcelebi et al., 2025). ETFs are an important investment tool enabling investors to protect themselves from risk via diversification. However, the impact of financial factors on ETFs and their market capitalization plays a crucial role in investors' decisions. Therefore, this study focuses on the effects of DJIMTR, VIX, FSI, CDS, and ISHARE variables on the ETFs market capitalization of Türkiye.

The first ETF was launched on the AMEX in 1993, named "Standard & Poor's Depository Receipts (SPDRs)," designed to track the S&P 500 index (Deville, 2008: 74; Elton and Gruber, 2013: 1016–1017; Lettau and Madhavan, 2018: 135; Narend and Thenmozhi, 2019: 61). Since then, the number of ETFs has increased significantly in the constantly evolving global capital markets due to their high liquidity, low cost, and transparency (Deville, 2008: 67; Ben-David et al., 2018: 2531; Liebi, 2020: 165; Chen et al., 2024: 1; Laborda et al., 2024: 1; Liu, 2025: 1). The success of ETFs stems from their diversity, market significance, and accessibility (Madhavan and Sobczyk, 2016: 86) market value (Annamalah et al., 2019) and unprecedented diversification opportunities (Ben-David et al., 2018: 2531). Their unprecedented diversification opportunities make them a widely used investment tool for financial market access (Ben-David et al., 2017: 4; Narend and Thenmozhi, 2019: 68). Because portfolio diversification has become especially important for investment since the 2008 global financial crisis (Bialkowski et al., 2016: 31), and ETFs inherently have the capacity to meet this need. While ETFs initially track only stock indices, they gradually expand their product offerings by including investments based on commodities, volatility, and crypto-assets (Simpson, 2024).

The concept of volatility functions as a measurement tool of risk and plays a crucial role for financial actors (Sağlam Bezgin and Karaçayır, 2022). The Volatility Index (VIX) is an attractive investment tool in mitigating risks during stock market downturns, as it exhibits an inverse correlation with stock markets (Clowers and Jones, 2016). VIX was first introduced in 1993 by the Chicago Board Options Exchange to monitor financial market volatility in real time (Whaley, 2009; Bialkowski et al., 2016; Kula and Baykut, 2017). While VIX is not a tradable product due to its structure (Clowers and Jones, 2016), growing demand for VIX investments drew the attention of CBOE, leading the CBOE Futures Exchange (CFE) to introduce VIX futures contracts in 2004. Following this, Barclays iPath launched exchange-traded products (ETPs) "VXX and VXZ" trading on the New York Stock Exchange (NYSE) in 2009, which aim to track S&P 500 short-term and medium-term futures contract market products (Alexander and Korovilas, 2013; Bialkowski et al., 2016; Clowers and Jones, 2016).

Early warning systems are a crucial topic in the financial literature after the 2008 financial crisis (Chadwick and Öztürk, 2018). Ahir et al. (2023) use the metaphor of "financial crises are to economists what earthquakes are to geologists" to highlight the significance of financial crises to economists. Just as earthquakes impact various segments of society in different ways, financial crises affect individuals and businesses with varying degrees of severity. Unlike earthquakes, financial crises lack a universally accepted measurement tool akin to a seismograph. Increasing uncertainty in global financial markets and the transmission of financial stress into the real economy heighten the need for early warning systems (Chadwick and Öztürk, 2018). Stress is a product of a fragile structure and external shocks, and in an environment with financial fragilities, shocks are likely to turn into financial stress. The concept of financial stress refers to the pressure exerted by uncertainty and financial losses on economic actors. The Financial Stress Index (FSI) aims to quantify this pressure on a daily basis, with extreme FSI values indicating financial crises (Illing and Liu, 2006). Financial stress indices (FSIs), designed to measure financial stress levels, have a pivotal role in economic policymaking (Chadwick and Öztürk, 2018) and contribute to risk prevention, a fundamental goal of financial risk management (Oet et al., 2015).

Firstly, introduced by the Bank of Canada in the 1990s, the Monetary Condition Index (MCI) covers long-term interest rates, stock prices, and real estate values. Over time renamed as the Financial Condition Index (FCI) or Financial Stress Index in time (FSI), it has gained popularity (Ekinci, 2013). A range of indicators, such as exchange rate, bond, stock market data, housing market, and energy prices, are also used by FSIs and FCIs (Hatzius et al., 2010: 8). For instance, OECD FCI employs different indicators such as stock market, credit conditions, high yield bond spread, real long interest rate, real short interest rate and real exchange rate, while the Federal Reserve FSI uses yield spreads and asset price behavior (Hakkio and Keeton, 2009). On the other hand, the Bloomberg FCI utilizes money, equity, and bond market indicators (Rosenberg, 2009). The FSI of the Office of Financial Research (OFR-FSI), using five indicator categories (credit, equity valuation, funding, safe assets, and volatility), provides a breakdown of stress levels for the United States, other advanced economies, and emerging markets (Office of Financial Research, 2025).

Credit defaults are another prominent factor contributing to financial crises. The 1997 Asian crisis, the 2008 global financial crisis, and the 2009 European debt crisis all resulted from debt (credit) defaults (Claessens and Ayhan Köse, 2013; Naifar, 2014; Ahir et al., 2023). Credit booms typically emerge during or after periods when economies struggle to grow, and credit booms serve as one of the key indicators that precede financial crises (Claessens and Ayhan Köse, 2013). In such periods, credit risk becomes increasingly significant. Credit Default Swaps (CDS), designed for risk management in credit-based debts, were initially used by JP Morgan Inc. in 1994 (Spuchlakova and Misankova, 2017). Their primary purpose is to transfer the risk of non-payment of debt (credit) to another investor if the debtor fails to fulfill its credit obligation (defaults) (Şahin and Özkan, 2018). During and after financial crises, either creditors or debtors are negatively impacted due to price fluctuations, and CDSs serve as financial instruments that allow risk-seeking investors to trade and hedge against such risks. Nevertheless, as Haddad et al. (2021) point out, CDS spreads should typically align with the spreads on the underlying product, as CDS contracts function as insurance against the issuer's default.

The incoming part of the study is organized as follows: Section 2 will provide the relevant literature review. This will be followed by section 3, which includes the description of the data set and the methodology of the research, and section 4 unveils the experimental results and

findings. The study ends with section 5 presenting the conclusion, discussion and suggestions for future research.

2. Literature Review

Many factors are known to affect investment instruments. Due to the different structures of these investment instruments, uncertainty and risks also affect the levels of exposure to them. There are various uncertainties, such as market volatility, geopolitical risks, and economic indicators, affecting ETF returns (Ozcelebi et al., 2025). This paper focuses on the effects of DJIMTR, VIX, FSI, CDS, and ISHARE variables on the ETF market capitalization of Türkiye.

Literature review reveals that there is a considerable amount of studies on Dow Jones Islamic Indices ETFs (Saadaoui and Boujelbene, 2015; Guyot, 2011; Banani and Hidayatun, 2017; Camgoz and Seval, 2018; Al Rahahleh et al., 2020; Mnif et al., 2020; Gökgöz and Kayahan, 2023; Ozcelebi and Pérez-Montiel, 2023; Aziz et al., 2025; Gencer and Tuysuz, 2025; Sadat and Gormus, 2025) and other Islamic ETFs (Fadhlullah Omar et al., 2021; Katterbauer et al., 2022, 2024). The number of studies examining Dow Jones Islamic Market Türkiye Index (DJIMTR) ETF is limited (Gözbaşı and Erdem, 2010; Kalfa Baş and Sarıoğlu, 2015; Hassan et al., 2016) and to the best of our knowledge, there is no study examining the relationship between DJIMTR and the market value of ETFs traded on BIST.

The Dow Jones Islamic Market Türkiye Index (DJIMTR) is recognized as the first Islamic ETF in both Türkiye and the world (BIST, 2010; Yap et al., 2021). Gözbaşı and Erdem (2010) examine DJIMTR and its conventional counterpart UNICORNTR in terms of performance and pricing efficiency. Their study shows that DJIMTR better reflects the performance of the index it tracks and exhibits superior risk-adjusted returns. They also observe temporary deviations between DJIMTR pricing and net asset value due to factors such as transaction volume, costs, and institutional ownership. Kalfa Baş and Sarıoğlu 2015 examine the performance and pricing of 16 ETFs traded in the Turkish market between 2005 and 2013 and find that while the ETFs underperform the tracking indexes stemming from the volatility of the tracking index, they are priced close to their net asset values. Hassan et al. (2016) examine the relationship between volatility and the returns of ETFs traded on BIST (with different types of underlying assets such as Islamic stock index, conventional stock index, US dollar, and commodity), and their findings indicate a negative causality between return and volatility. Causality is stronger for ETFs following a conventional stock index than for ETFs following an Islamic stock index. In addition, the negative effect of the positive returns of ETFs on volatility is higher than the positive effect of the negative returns of ETFs on volatility (except BIST30 and DJIST20). Moreover, the frequency domain support results show that Islamic stock index ETFs perform better in the long term than other types of ETFs, which is an advantage for both Muslim and long-term investors. Alam (2013) compares he performances of Islamic ETFs following their launch and the performances of conventional ETFs between 2008 and 2011. The results show that Islamic ETFs have lower volatility and therefore less risk than conventional ETFs. In addition, Islamic ETFs have higher returns than conventional ETFs in the relevant period. Yilmaz et al. (2015) assess the data of the indices of 10 main sectors in the Dow Jones Islamic market indices between January 3, 1996, and July 9, 2014, and reveal the interaction between these indices through dynamic conditional correlation (DCC) and dynamic eco-correlation (DECO). According to the research findings, the sectors had an upward trend and moved together between 2002 and 2008.

Nevertheless, investment strategies changed through financial innovations such as investment funds and ETFs, and many sectors did not reach their peaks between 2002 and 2008. However, Yap et al. (2021) determine whether Islamic ETFs provide more benefits than conventional ETFs by taking into account the data of ETFs traded between 2010 and 2019 and find that conventional ETFs experience less deviation from the indices they follow and provide higher returns than Islamic ETFs. Prati et al. (2024) conduct similar research examining the annual returns of BlackRock's ISUS (Sharia-compliant Islamic ETF) and Vanguard's VUSA (non-Sharia-compliant non-Islamic ETF) between 2013 and 2022. The findings show that although ISUS underperformed VUSA in terms of returns until 2021, it had a higher return in 2021 and 2022.

The studies on measuring financial stress have become increasingly popular, especially after the 2008 financial crisis (Illing and Liu, 2006: 244; Guichard and Turner, 2008; Hakkio and Keeton, 2009; Rosenberg, 2009; Hatzius et al., 2010: 8; Ekinci, 2013; Chadwick and Öztürk, 2018). The financial stress index (FSI), which is measured by taking into account elements such as credit, funding, and safe assets, is a tool that aims to continuously measure the force that uncertainty and losses in financial markets create on financial actors (Illing and Liu, 2006; Office of Financial Research, 2025). Studies examining the performance or return interactions of FSI and ETFs are limited. For instance, Converse et al. (2020) examine the sensitivity of equity-based ETFs and mutual funds to financial conditions. The findings show that ETFs are almost 2.5 times more sensitive to financial conditions than mutual funds. Another research finding is that the sensitivity of emerging markets to global financial stress levels has increased significantly over the last 15 years, and the importance of ETFs in the markets has continued to increase during this period. As the importance of ETFs and the sensitivity of markets to financial stress increase, the transmission of financial shocks to economies increases through ETFs. Aldasoro et al. (2022) focus on the change in the level of financial stress between 2014 and 2016 and the factors that could be the precursors of this change. The level of financial stress was between 5-10% towards the end of 2014, 37% in 2015, and over 60% in 2016, and inflows to ETFs generally increased during the same period. They try to explain this situation by suggesting that investors shift to less risky investment securities in financial turbulence. Increasing flows to ETFs are considered dangerous for financial markets in situations such as financial stress and illiquidity (Laborda et al., 2024) because ETFs tend to have lower liquidity during periods of increasing financial stress, despite having high liquidity under normal conditions (Pagano et al., 2019). One of the important factors behind the rapid growth of ETFs, as Pagano et al. (2019) suggest, is their high liquidity, but their high liquidity structures could negatively affect ETFs due to the intense selling pressure that occurs during crisis periods. In addition, if ETFs withdraw almost all or completely from stocks held for any reason, this may cause permanent declines in the relevant stocks.

CDS premiums are one of the important indicators used to determine the creditworthiness of companies and countries and to evaluate the default situation. Credit rating agencies classify countries in terms of risk categories. Still, the risk levels of countries in the same class may not be the same, where CDS premiums come into play and provide the opportunity for comparison (Gazel, 2020). As ETFs are established to track an index (Gallagher and Segara, 2006), CDS premiums of the countries in which these indices are traded are one of the factors taken into consideration by ETF investors, but the number of studies on the interaction of CDS and ETFs is limited. Increasing CDS premiums in the market indicate the level of default on debt and generally have a negative relationship with stock markets (Coronado et al., 2012). Gazel (2020) states that countries' CDS premiums also affect ETF investors because the increase in CDS premiums has a

negative impact on ETF prices. Drenovak et al. (2014) compare the returns of sovereign debt ETFs traded in the eurozone and the indices they targeted to track between 2007 and 2010. Their findings demonstrate that the performance of the ETFs remained lower than the indices they track. The results of Drenovak et al. (2014) and Gazel (2020) support Coronado et al. (2012). D'Amico et al. (2020) aim to examine the impact of the FED's primary and secondary market corporate credit facility announcements between March 23 and April 9, 2020, on corporate bonds through the price movements of CDX and bond ETFs. The findings show that assets held by ETFs, called suitable assets (Corporate bonds and IG Corporate Bonds), responded largely positively to the announcements. Haddad et al. (2021) investigate the disruptions in debt markets during COVID-19. The findings of their study show that, in the first three months of 2020, ETFs containing corporate bonds traded at much higher discounts than CDS used against the bonds. During the same period, ETFs containing corporate bonds traded below their net asset value (NAV). However, this decline in bonds and bond-holding ETFs is related to the ETFs first disposing of bonds with high liquidity due to the need for liquidity. Contrary to these studies, Bayat et al. (2024) examine the relationship between the MSCI Türkiye ETF price and CDS premium between 2008 and 2022 and find a positive relationship between CDS premiums and ETF prices.

Chang et al. (2018) investigate the effect of CBOE VIX returns on the returns of ETFs traded in Europe (FEZ, DBXD, and XUKX) and the US (SPY, DIA, and ONEQ). The results reveal that the daily returns of VIX have a significant, strong, and negative effect on ETFs traded in both Europe and the US. However, CBOE VIX returns have a greater effect on ETFs tracking the US markets than on ETFs tracking European markets, which is due to the fact that CBOE VIX overlaps with US market information, aiming to track the volatility of the S&P500. Alomari et al. (2024) test the relationship between ETFs traded in the US between December 30, 2016, and April 16, 2022, and VIX. Based on the findings, the VIX used to explain forward-looking 30-day return expectations is much more effective on the returns of ETFs than on gold and oil returns.

As investor interest in volatility-related products has increased, demand for VIX-based ETPs has caused an upward movement in the prices of the underlying products. This tendency is due to the fear premium, as the fear premium and dealer protection hedge pressure (Dong, 2016). However, the expected value of VIX ETNs is zero in the long term, so long-term investments are likely to result in a loss of all or a significant portion of the investment (Whaley, 2013). Eraker and Wu (2014) examine the returns of VIX-based exchange-traded notes (ETNs) and futures. The research result shows that long-term investments in both VIX futures and VIX ETNs have a negative return. A similar result emerges in the research by Clowers and Jones (2016) on 8 ETNs and ETFs based on VIX and VIX short, medium, and long-term futures contracts traded on the stock exchange between 4 October 2011 and 31 December 2014. The results show that these ETNs and ETFs did not track the relevant indices and had negative returns. In spite of the studies showing that VIX-based ETNs, or ETPs, have negative returns, Alexander and Korovilas (2013) state that the returns and Sharpe ratios of CVIX and CVZ, which are portfolios of VIX-based ETNs XVIX and XVZ, between 2004 and 2012, have positive returns, not negative returns. Bialkowski et al. (2016) conducted a study using VIX ETPs and VIX data, aiming to track the VIX from January 2009 to December 2015, and concluded that the fund flows into VIX ETPs have a significant and positive (negative) impact on the VIX index. Another finding is, this effect does not occur during periods of high volatility. Additionally, Szado (2009) investigates the movements of investment portfolios during the 2008 financial crisis, noting that including VIX products in these portfolios would shield them from substantial losses in times of crisis.

The literature generally focuses on the performance of ETFs, the price movements and performances of the underlying assets, and the errors in tracking the assets they aim to track (Rompotis, 2005; Engle and Sarkar, 2006; Harper et al., 2006; Jares and Lavin, 2004; Gallagher and Segara, 2006; Gözbaşı and Erdem, 2010; Shin and Soydemir, 2010; Rompotis, 2011; Nargunam and Anuradha, 2017; Da and Shive, 2018; Tsalikis and Papadopoulos, 2019), the impact of ETFs on economic indicators (Chu et al., 1999; Switzer et al., 2000; Hasbrouck, 2003; Biktimirov, 2004; Hegde and McDermott, 2004; Richie and Madura, 2007; Huang and Lin, 2011; Karahan and Kayalı, 2015; Ben-David et al., 2018; Agapova et al., 2025), upon the impact of ETF prices (Chu et al., 1999; Madhavan, 2012; Chang et al., 2018; Narend and Thenmozhi, 2019; Gazel, 2020; Bayat et al., 2024).

To the best of our knowledge, no study exists in the literature that examines the effect of external and internal factors on ETFs' capitalization in Türkiye. To this end, this study aims to fulfill this current gap in the literature. By doing so, the effects of financial distress and the volatility structure of independent variables will provide a clear view of assessments on ETFs' capitalization of Türkiye traded on the BIST.

3. Data and Methodology

3.1. Data Set

This study investigates the factors that influence the market capitalization of ETFs traded on Borsa Istanbul. The variables used in the study and the expected effects of these variables are presented in Table 1. The analysis employed a monthly dataset from January 2020 to November 2024. The market capitalization data of ETFs traded on BIST is obtained from the World Federation Exchange database, while the OFR Financial Stress Index (FSI) data is retrieved from the Office of Financial Research database. Dow Jones Islamic Market Türkiye Index (DJIMTR), Türkiye CDS 5-Year USD (CDS), iShares MSCI Türkiye's ETF (Ishares), and CBOE VIX data are obtained from a database available on investing.com. Since FSI data is published daily, the data of the last day of each month was used in the FSI data to ensure the synchronization of the data set.

Table 1. Variables and Expected Signs

Data	Explanation	Source	Expected Sign
ETF	BIST ETFs - Market Capitalization of ETPs	World Federation Exchange	Dependent variable
CDS	Türkiye's "Türkiye CDS 5-Year USD" monthly data	Investing	-
DJIMTR	A monthly price of Dow Jones Islamic Market Türkiye Exchange Traded Fund	Investing	+
FSI	The OFR Financial Stress Index (OFR FSI) is a monthly market-based snapshot of stress in global financial markets.	Office of Financial Research	-
ISHARE	A monthly price of iShares MSCI Türkiye's ETF	Investing	+
VIX	A monthly price of VIX (CBOE Volatility Index)	Investing	-

Equation 1 is established and analyses are conducted to determine the factors affecting the market capitalization of ETFs.

$$ETF_t = \alpha + \beta 1CDSt + \beta 2DJIMTRt + \beta 3FSIt + \beta 4ISHAREt + \beta 5VIXt + \varepsilon \quad (1)$$

Table 2 presents the descriptive statistics of the series. Except for the CDS and iShares data, all the variables in the 59-month data set are not normally distributed. The possible effects of CDS, DJIMTR, FS, iShares, and VIX on ETFs will be revealed through equation (1). Before proceeding with the empirical analysis of the study, descriptive statistics of all variables are first presented. The descriptive statistics of the data set consisting of 59 monthly observation series are provided in Table 2. As shown in Table 2, the mean values for all variables are close to the maximum and/or median values, which is an indication that the series has a normal distribution. As the JB test results indicate, the series exhibits normal distribution.

Table 2. Descriptive Statistics

	ETF	CDS	DJIMTR	FSI	ISHARE	VIX
Mean	29415.27	454.8776	21891.76	0.009460	27.77085	21.77949
Median	9724.150	443.5200	13309.45	-0.021461	26.50000	19.40000
Maximum	111520.2	838.2300	47073.91	1.003000	42.28000	53.54000
Minimum	403.3600	239.8200	6615.770	-0.303000	17.74000	12.44000
Std. Dev.	32722.61	151.5302	14428.65	0.256249	7.535585	8.043214
Skewness	0.888419	0.564416	0.524377	1.731972	0.378550	1.401030
Kurtosis	2.413376	2.769070	1.610251	7.048722	1.707046	5.685409
Jarque-Bera	8.607323	3.263657	7.451916	69.79470	5.518790	37.02979
Probability	0.013519	0.195572	0.024090	0.000000	0.063330	0.000000
Observations	59	59	59	59	59	59

3.2. Methodology

In the study, initially Augmented Dickey Fuller (ADF) and Phillips Peron (PP) unit root tests are applied. Since the dependent variable (ETF) is I(1) and the independent variables (VIX and FSI) are I(0), and the others (ISHARE, CDS, DJIMTR) are I(1), the ARDL method appears to be a proper analysis. To this end, the ARDL model is determined as the best-fitted methodology for the present study.

The ARDL method is a method developed by Pesaran et al. (2001). This method reveals the dynamic interaction between the current and past values of variables, enabling the determination of the long-term coefficients with the help of the Bounds test. Then, the short-term coefficients are obtained with the help of the error correction model (ECM) to see whether the series are cointegrated or not. Analyses were made with the ARDL model exhibited in equation 2 below.

$$\begin{aligned}\Delta ETF_t = \varphi_0 + \varphi_1 dummy + \sum_{i=1}^{p=2} \varphi_{2i}\, \Delta ETF_{t-i} + \sum_{j=0}^{r=6} \varphi_{3j}\, \Delta CDS_{t-j} + \sum_{k=0}^{s=1} \varphi_{4k}\, \Delta DOW_{t-k} \\ + \sum_{l=0}^{t=4} \varphi_{5l}\, \Delta FSI_{t-l} + \sum_{l=0}^{y=6} \varphi_{6m}\, \Delta \mathrm{ISHARE}_{t-m} + \sum_{l=0}^{z=6} \varphi_{7n}\, \Delta \mathrm{VIX}_{t-n} + \beta_1 ETF_{t-1} \\ + \beta_2 CDS_{t-1} + \beta_3 DOW_{t-1} + \beta_4 FSI_{t-1} + \beta_5 ISHARE_{t-1} + \beta_6 VIX_{t-1} + \varepsilon_t\end{aligned} \quad (2)$$

In Equation 2, "Δ" and "ε" represent the difference operator and the error term, respectively. While "p….z" represents the lag lengths, "φ_0" is for the constant term, the short-

term coefficients are represented by "φ_1…..φ_7", whereas "φ_i…..φ_n" are used to represent the long-term coefficients.

3.3. Empirical Findings

In this part, unit root tests of the series are performed within the scope of the analyses. According to the ADF unit root test, ETF, DJIMTR, iShare, and CDS series are not stationary at the level, but these series become stationary after taking their first difference. Contrary, VIX and FSI variables are stationary at the level. According to the PP unit root test, all series except FSI and VIX are not stationary at the level, but these series also become stationary by taking the difference.

Table 3. Phillips-Perron and ADF Unit Root Test Results

PP	**Constant**		**Constant and Trend**		**No Constant and Trend**	
Level	**t-stat.**	**Prob.**	**t-stat.**	**Prob.**	**t-stat.**	**Prob.**
ETF	1.8173	0.9997	-0.6701	0.9704	3.2406	0.9996
DJIMTR	-0.1918	0.9332	-2.0649	0.5539	1.4618	0.9630
VIX	-3.5907	0.0089***	-5.8116	0.0001***	-0.8559	0.3409
ISHARE	-1.2784	0.6339	-3.0638	0.1247	0.0772	0.7034
CDS	-1.9782	0.2954	-2.4021	0.3747	-0.5575	0.4714
FSI	-2.9448	0.0464**	-3.1942	0.0957*	-2.9680	0.0036***
Δ(ETF)	-4.4560	0.0007***	-4.9544	0.0009***	-4.0055	0.0001***
Δ(DJIMTR)	-6.5686	0.0000***	-6.5438	0.0000***	-6.1820	0.0000***
Δ(ISHARE)	-6.6436	0.0000***	-6.5812	0.0000***	-6.6058	0.0000***
Δ(CDS)	-5.9586	0.0000***	-5.9443	0.0000***	-6.0178	0.0000***
ADF	**Constant**		**Constant and Trend**		**No Constant and Trend**	
Level	**t-stat.**	**Prob.**	**t-stat.**	**Prob.**	**t-stat.**	**Prob.**
ETF	1.0824	0.9969	-1.1565	0.9096	2.0174	0.9888
DJIMTR	-0.0922	0.9450	-1.9907	0.5940	1.6827	0.9764
VIX	-3.3858	0.0156**	-5.5943	0.0001***	-2.2055	0.0276**
ISHARE	-1.1345	0.6963	-3.0638	0.1247	0.1085	0.7131
CDS	-1.7018	0.4251	-2.2158	0.4718	-0.4974	0.4965
FSI	-2.7668	0.0694*	-3.1942	0.0957*	-2.7933	0.0060***
Δ(ETF)	-4.5152	0.0006***	-4.9870	0.0008***	-3.9797	0.0002***
Δ(DJIMTR)	-6.5744	0.0000***	-6.5516	0.0000***	-6.1820	0.0000***
Δ(ISHARE)	-6.6261	0.0000***	-6.5792	0.0000***	-6.6475	0.0000***
Δ(CDS)	-6.0395	0.0000***	-6.0438	0.0000***	-6.0921	0.0000***

Note: *** — significant at p <0.01, ** — significant at p <0.05, * — significant at p <0.1.

As reported in Table 3, except for the FSI and VIX variables, which are I(0), all remaining independent variables, together with the dependent variable, are I(1). The ARDL procedure appears to be the proper method as none of the variables is I(2), the dependent variable is I(1), and the independent variables have different levels of stationarity. However, since the above tests do not consider the structural break, the Lee and Strazicich (LS) unit root test is applied to detect the potential structural breaks. The structural break dates and test statistics are presented in Table 4 below.

Table 4. Lee and Strazicich (LS) Unit Root Test Result

Variables	Level			First Difference			Decision
	Lag	Break Period	t-stat.	Lag	Break Period	t-stat.	
ETF	8	2022_{M12} - 2024_{M03}	-9.639***				I(0)
CDS	8	2022_{M03} - 2023_{M07}	-5.1752	1	2020_{M12} - 2022_{M06}	-6.786**	I(1)
DJIMTR	2	2022_{M02}- 2024_{M02}	-6.852***				I(0)
FSI	1	2020_{M11}- 2022_{M04}	-5.540	1	2020_{M11}- 2022_{M01}	-8.832***	I(1)
ISHARE	3	2020_{M11} - 2022_{M09}	-6.063*	3	2022_{M12}- 2024_{M04}	-6.178**	I(1)
VIX	8	2020_{M12} - 2022_{M02}	-6.153**				I(0)

Note: *** — significant at p <0.01, ** — significant at p <0.05, * — significant at p <0.1.

The LS structural break test results indicate that the dependent variable ETF and independent variables DJMTR and VIX variables are stationary at the level, whereas other independent variables CDS, FSI, and ISHARE contain a unit root, and therefore these variables show a structural break. Thus, both external and internal factor variables have a structural break. This situation indicates that the analysis should consider structural breaks, and QUSUM tests are important. Considering the Lee and Strazicich (LS) unit root test results, structural breaks are observed for the ETF (2022M12 – 2024M03), iShares (2022M12 -2024M04), and DJIMTR (2022M02 – 2024M02) series, which overlap or occur in proximity. The devastating Kahramanmaraş earthquake in Türkiye (February 6, 2023) created volatility in the Turkish economy and financial markets. Furthermore, uncertainties arising from the general elections (May 14, 2023) and local elections (March 31, 2024) during the relevant period also contributed to these breaks. Finally, the tightening policies that began with the change of minister to the Republic of Türkiye Ministry of Treasury and Finance on June 4, 2023, and the increase in interest rates (in June 2023 - 8.5%, in September 2023 - 30%, and in March 2024 - 50%) are considered the causes of the observed structural breaks. Therefore, the structural break periods observed in the ETF, iShares, and DJIMTR variables are due to natural disasters, the uncertainty because of political elections, and changes in monetary policies.

A structural break is observed for the CDS series between 2020M12 and 2022M06. Following the change of president of the Central Bank of the Republic of Türkiye in December 2020, the interest rate hikes and tight monetary policies ended in September 2021. During this period, the CBRT president was replaced again in March 2021, and the government adopted an approach to interest rates due to inflation. During this period, significant increases in exchange rates occurred, and the "Currency-Protected Deposit" system was launched in December 2021. These developments led to sudden jumps in Türkiye's CDS premiums. Furthermore, the Ukraine-Russia war, which began in February 2022, increased global and regional risks. In this context, both political issues in Türkiye and global issues caused structural breaks in the CDS series during the relevant period.

The breakout periods in the FSI (2020M11-2022M01) and VIX (2020M12-2022M02), considered global financial risk indicators, occurred almost simultaneously. In this context, the decline in the VIX and FSI, coupled with the easing of increased uncertainty during the COVID-19 period, increased risk appetite. The Fed's inflation-driven interest rate hike in November 2021 and the signals of Russia's war with Ukraine, which began in February 2022, were reflected in the markets earlier. Significant increases in energy and grain prices due to the Russia-Ukraine war have led to increases in the FSI and VIX variables. Thus, the COVID-19 pandemic, the Russia-Ukraine war, and rising energy prices have led to breaks in the FSI and VIX series.

The natural logarithm is applied to interpret the percentage effects of independent variables on the dependent variable, except for the FSI series, which was not log-transformed due to negative "-" values. As a first step, the ARDL bound testing approach was applied to determine cointegration relationships (Table 5).

Table 5. ARDL Bound Test Results

MODEL			
$f(etf) = (cds, djimtr, fsi, ishare, vix)$			
ARDL (2, 6, 1, 4, 6, 6) k:5 m:2			
F PSS : 3.7874** *t* BDM: -3.5931** F Critical Values n=1.000		Co-integrated F Critical Values n=53	
I(0)	**I(1)**	**I(0)**	**I(1)**
2.08	3	2.204	3.21
2.39	3.38	2.589	3.683
3.06	4.15	3.451	4.764

Note: The models were estimated based on case #III. k: number of independent variables; m: lag value; n: number of observations; "**" shows %5 significance level.

As a result of the analyses performed using the appropriate lag length, it is determined that the series are cointegrated at the 5% significance level. Since the *F-statistic* value of 3.7874 is higher than the upper bound values at the 2.5%, 5%, and 10% significance levels, there is a long-term relationship between the series. In other words, CDS, DJIMTR, ISHARE, FSI, and VIX indices affect ETFs in the long term. Following this finding, the long-run coefficients were examined, and the results are presented in Table 6.

Table 6. Long Run Form Coefficient

Variable	**Coefficient**	**t-statistic**	**Probability**
CDS	1.5258***	4.4398	0.0002
DJIMTR	1.3666***	5.4625	0.0000
FSI	-1.3551**	-2.2681	0.0340
ISHARE	2.2108***	3.0846	0.0056
VIX	-0.0081	-0.6371	0.5309

Note: *** — significant at p <0.01, ** — significant at p <0.05, * — significant at p <0.1.

When looking at the statistics regarding the long-term coefficients, the CDS, DJIMTR, and ISHARES variables significantly and positively affect the market capitalization of ETFs. However, the FSI variable has a significant and negative effect. The impact levels of these variables are as follows: A 1% increase in the CDS, DJIMTR, and ISHARE variables results in increases of 1.51%, 1.36%, and 2.21% in the market capitalization of ETFs, respectively, while the FSI results in a decrease of 1.35%. The striking finding here is that while the CDS is expected to be inversely related to the market capitalization of ETFs, it turns out to have a statistically positive relationship with ETFs. No significant impact of the VIX on the market capitalization of ETFs is detected. However, the VIX is considered a global risk indicator. Similarly, the FSI tends to reflect global financial risk, as stress increases with risk, and CDS aims to reflect local

financial risk. In this context, when the result of the negative relationship between FSI and ETFs is evaluated together with the literature, it is supported by Chang et al. (2018), who report a negative relationship between the returns of European and American ETFs and the VIX. However, their study does not support the positive relationship result between CDS and ETFs. Huang and Lin (2011) find that ETFs, particularly in emerging markets, have higher Sharpe ratios and provide portfolio diversification, leading to better performance during potential market crises. This finding does not support the result obtained for FSI but does support the result obtained for CDS.

Recent increases in Türkiye's credit rating have attracted foreign investors. Investors who are risk lovers, particularly those who pay attention to the economic policies implemented, utilize fluctuations in CDS premiums to their advantage. In this case, investors seeking greater risk-reward are turning to ETFs in Türkiye as CDS rates increase. Conversely, increasing risk perception in global markets also increases financial stress. This suggests that some investors reduce their ETF investments to avoid this stress. In this context, Türkiye's ETFs, a developing country, are operating in an integrated manner with developed country ETFs. As demand for ETFs traded in global markets, such as DJIMTR or iShares MSCI Türkiye, increases, ETFs traded in the Türkiye's market are also positively impacted.

Table 7. Short Run Form Coefficient (Error Correction Regression)

Model	Coefficient	t-statistic	Probability
D(ETF(-1))	0.725692***	6.519032	0.0000
D(CDS)	0.271969**	2.105212	0.0475
D(CDS(-1))	-0.657255***	-4.659020	0.0001
D(CDS(-2))	-0.025970	-0.193303	0.8486
D(CDS(-3))	-0.402562***	-3.243183	0.0039
D(CDS(-4))	0.015277	0.146304	0.8851
D(CDS(-5))	0.205441*	1.924081	0.0680
D(DOW)	0.079058	0.414396	0.6828
D(FSI)	0.255147**	2.188249	0.0401
D(FSI(-1))	0.564479***	3.294136	0.0035
D(FSI(-2))	0.360934**	2.770075	0.0115
D(FSI(-3))	-0.294454**	-2.378762	0.0269
D(ISHARE)	0.177754	0.903306	0.3766
D(ISHARE(-1))	-1.810181***	-6.182042	0.0000
D(ISHARE(-2))	-1.182969***	-4.515714	0.0002
D(ISHARE(-3))	-0.551512**	-2.363259	0.0278
D(ISHARE(-4))	-0.744616***	-3.405903	0.0027
D(ISHARE(-5))	-0.396720**	-2.063928	0.0516
D(VIX)	0.004265	1.584825	0.1280
D(VIX(-1))	0.010540**	2.772256	0.0114
D(VIX(-2))	0.012188**	2.705116	0.0133
D(VIX(-3))	0.023206***	4.656810	0.0001
D(VIX(-4))	0.017946***	4.868333	0.0001
D(VIX(-5))	0.007532***	3.263423	0.0037
DUMMY	-0.167848**	-2.123945	0.0457
ECT_{t-1}	-0.513587***	-5.838391	0.0000

Note: *** — significant at p <0.01, ** — significant at p <0.05, * — significant at p <0.1.

The ECT coefficient, showing the ECM established to obtain the short-term coefficients, is negative and statistically significant (Table 7). This shows that the shocks on the ETF are also effective in the short term. In addition, at least 51% of the shocks spill over to the next period and then come back to equilibrium, demonstrating the convergence feature. Therefore, this result also shows that the market is moving on a sanitary basis.

Table 8. Diagnostic Test Results

Diagnostic Test	Statistics	
	Test Value	Prob.
X^2_{SC}	0.0320	0.9684
X^2_{FF}	0.3080	0.5851
$X^2_{NORM(J-B)}$	0.4894	0.7829
$X^2_{HET(ARCH)}$	2.1778	0.1463
$X^2_{HET(BPG)}$	1.3290	0.2509
X^2_{CUSUM} / X^2_{CUSUMQ}	Stable	

The diagnostic test results of the established model are reported in Table 8. Regarding the diagnostic tests, although some evidence of autocorrelation is detected in the model based on a logarithmic series, the serial correlation test performed on the raw data indicated no autocorrelation problem. Therefore, the absence of autocorrelation in the raw data model indicates that this issue arises due to the transformation process rather than a structural problem in the model. This suggests that the limited serial correlation revealed after the log transformation is negligible and does not materially affect the model's reliability. Other diagnostic tests (Jarque-Bera normality, heteroskedasticity tests, Ramsey RESET, and CUSUM/CUSUMQ) showed no significant model misspecifications in analyses conducted with logarithmic series because the probability values were above the 0.05 threshold. Furthermore, CUSUM and CUSUM Square graphs were also shown below to determine whether the established model is stable and whether the coefficients are reliable. Therefore, the results obtained with the model's long-term and short-term coefficients can be considered robust and reliable.

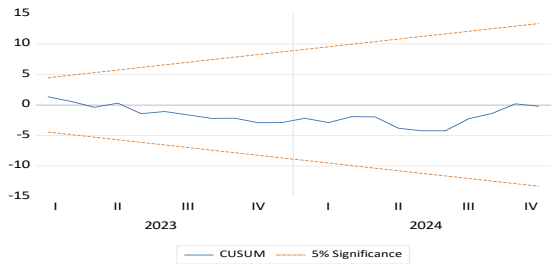

Figure 1. CUSUM Graph

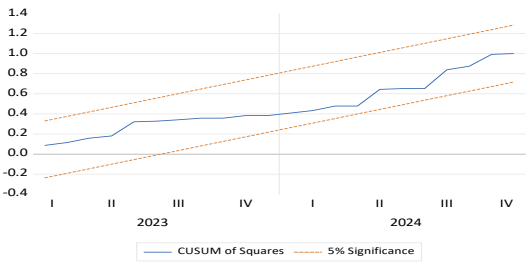

Figure 2. CUSUM Square Graph

CUSUM graphs show that the established models and the obtained coefficients are reliable and sufficient for analysis. In both graphs, the time path graph of the series is between the lower and upper margin limits.

4. Conclusion

Financial markets have witnessed increased importance in ETFs over the last 20 years, reflected in the number and type of funds, net asset values, and trading volume. Though the literature generally focuses on the performance of ETFs, the price movements and performances of the underlying assets, there are just a limited number of studies on the effect of ETF prices. However, to the best of our knowledge, there are no studies on the market capitalization of ETFs traded on BIST. This paper aims to contribute to filling the gap in the literature by examining the impact of CDS, DJIMTR, FSI, iShare, and VIX variables on the market capitalization of ETFs.

As the results of the ARDL test indicate, the market capitalization of ETFs is positively affected in the long term by CDS, DJIMTR, and ISHARE, while FSI has negative effects. According to the results of the ECM, the shocks occurring on the market capitalization of ETFs are effective in the short term, and at least 51% of these shocks spill over to the next period. However, they come to a balance in the following period and exhibit convergence characteristics. Finally, CUSUM and CUSUM Square graphs show that the established models and the obtained coefficients are reliable and sufficient for analysis.

While it is interesting that the VIX does not significantly impact the market capitalization of ETFs, other risk indicators do show their impact. One of the prominent research findings is that CDS has a significant and positive impact on the market capitalization of ETFs, contrary to the expected inverse relationship. This result supports Huang and Lin (2011), who concluded that ETFs, especially in developing country markets, have a higher Sharpe ratio and provide portfolio diversity, resulting in better performance during a possible market crisis. Another finding is that FSI negatively affects the market capitalization of ETFs. This result supports the negative relationship between the returns of ETFs that track European and American indices and VIX returns obtained in the research conducted by Chang et al. (2018).

European and American indices and VIX returns are emphasized as global risk indicators in the research conducted by Chang et al. (2018). In contrast, Huang and Lin (2011) conclude that ETFs, especially in emerging markets, have higher Sharpe ratios and provide portfolio diversification, leading to better performance during potential market crises. VIX is a global financial risk indicator and increases especially during crisis periods. To this end, while FSI can be considered a global risk indicator for worldwide financial markets, CDS assessed as a local risk indicator. The findings related to FSI in this research are supported by the results of Chang et al. (2018) but not by the results of Huang and Lind (2011). However, the exact opposite situation occurs for the CDS findings of this research, because the results of Chang et al. (2018) do not support CDS findings, but the results of Huang and Lind (2011) are supported.

Since DJIMTR and ISHARE are ETFs consisting of products traded on BIST, they are expected to positively affect the market capitalization of ETFs (BIST ETFs). Still, we do not have a determination as to what the result would be when it comes to ETFs that aim to track other market indices. Therefore, this situation can be examined in future studies. Moreover, the effect of the VIX index on the market capitalization of ETFs of other country markets is left to future studies. Another interesting result is that there is no significant relationship between iShares MSCI Türkiye and the market capitalization of ETFs. To this end, in order to preserve stability and avoid short-term shocks, authorities have to monitor the ETF markets more closely. Financial institution authorities must put stress-testing and liquidity support procedures in place to lessen the adverse effects of financial stress on ETFs. Macroprudential policy choices should be

informed by constant surveillance of global indices, including CDS, DJIMTR, and ISHARE. Investors and portfolio managers should get regular market guidance to assist them in reacting to worldwide risk and volatility indicators. Policies supporting ETF diversification and risk-hedging tools can increase market resilience and investor confidence. Eventually, it is suggested that the impact of country ETFs that aim to track other countries' indices on the market capitalization of ETFs in those countries be examined in future studies. Studies that will include exchange rate, inflation, and other uncertainty indices will be important in filling the gap in the literature.

Declaration of Research and Publication Ethics
This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest
There is no potential conflicts of interest in this study.

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