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Effects of FX on ETF Prices: Evidence from BIST

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Döviz Kurunun BYF'ler Üzerindeki Etkileri: BİST'ten Kanıtlar

Abstract

This study better investigates the possible relationship between exchange rates and ETF prices in the BIST to understand ETF investors' behaviour in the Turkish economy. Conventional and Fourier-based co-integration and causality analysis methods were employed to test models. According to findings, although the exchange rate has no direct effect on ETF prices in Türkiye, it is effective on ETF prices indirectly via the risk and share of foreign investors. The originality of the study lies in models built with additional control variables. In doing so, we measure the direct and indirect effects of the exchange rate on the Turkish economy.

Keywords : ETF, MSCI Türkiye, Fourier Toda-Yamamoto Causality Test.

JEL Classification Codes : F31, G12, G23.

Öz

Bu çalışma, Türkiye ekonomisinde BYF (Borsa Yatırım Fonu) yatırımcılarının davranışlarını daha iyi anlamak için döviz kurları ile BİST'teki BYF fiyatları arasındaki olası ilişkiyi araştırmaktadır. Modelleri test etmek için geleneksel ve Fourier tabanlı eş-bütünleşme ve nedensellik analizi yöntemleri kullanılmıştır. Elde edilen bulgulara göre, döviz kurunun Türkiye'deki BYF fiyatları üzerinde doğrudan bir döviz kuru bulunmamakla birlikte, yabancı yatırımcıların riski ve payı aracılığıyla BYF fiyatı üzerinde dolaylı bir etkisi bulunmaktadır. Bu çalışmanın özgünlüğü ek kontrol değişkenleri ile oluşturulan modellerde yatmaktadır. Kurulan model sayesinde döviz kurunun Türkiye ekonomisindeki doğrudan ve dolaylı etkilerini ölçme şansı oluşmuştur.

Anahtar Sözcükler : BYF, MSCI Türkiye, Fourier Toda-Yamamoto Nedensellik Testi.

1. Introduction

ETF is a basket containing securities traded on an exchange like a single stock (Geetha et al., 2020: 356). ETFs aim to replicate the performance of their underlying indices (Williams, 2014: 392). Ramaswamy (2011) expresses the structure of ETFs in two steps. First of all, the market maker buys shares of securities from the stock market. They build a basket of securities through an ETF sponsor who creates shares for the ETF. In the following step, ETFs are supplied to investors in the secondary market. From a different perspective, ETFs are open-end funds comprising securities assembled according to an investment objective and strategy.

When the ETFs are examined historically, the first examples can be seen in the early 1990s. Although Williams (2014) argues that the first launch was in 1996, according to Geetha et al. (2020) and Shin and Soydemir (2010), the first ETF launched in 1993 was the S&P Depository Receipts (SPDR). It tracks S&P500 stock indices. As of 2020, the global volume of ETFs is around $7 trillion, and they are invested in equity, bonds, commodities, and currencies (Todorov, 2021: 41). Increasing ETFs has made ETFs an important financial tool. In this regard, it becomes important to investigate possible determinants of the price and demand of ETFs in an economy.

The exchange rate is also an important indicator for countries with high current account deficits where a fluctuating exchange rate regime is implemented. According to Yıldız (2014), economic theory argues that changes in exchange rates affect the cash flows, investments, and profitability of firms by making their inputs and outputs cheaper or more expensive and have a significant effect on the stocks of the firms (Yıldız, 2014: 77). In this regard, it is rational to think that exchange rate is effective on ETFs either.

Economists examine the relationship between stock prices and exchange rates to understand better how they interact. Because the definition of relationship is crucial for decision-makers responsible for monetary and fiscal policies, firms taking exchange rate risks in their businesses, and investors in stock markets. However, the findings in the literature need to be more conclusive. While results for stock prices are inconclusive, another stock market tool, exchange-traded funds, needs to be investigated better in the context of exchange rate relations.

Increasing volume and price efficiencies of ETFs bring a question into mind: "Is the possible relationship between stock prices and exchange rates valid for ETFs, or does price efficiency and increasing volume of ETFs due to the advantages of ETFs differentiate the strength and direction of the relationship?”. These questions will also help to understand the behaviour of ETF investors and whether they employ ETFs in the same way as single stock shares. To answer these questions, we investigate the MSCI Türkiye ETF and Turkish lira against the U.S. dollar between 2008 and 2022. In this study, we employ the fractional frequency Engle-Granger co-integration test and fractional frequency Fourier Toda-

Yamamoto causality test in addition to conventional co-integration and causality tests to better understand the relation in the case of Türkiye.

A theoretical framework is drawn in the next section, and a possible relation between the exchange rate and stock and/or ETF price is summarised. In the third section, a literature review is presented. In the fourth section, the model is built, and data belonging to the model variables are presented. In the fifth section, empirical findings are summarised and interpreted. At the end of the study, political and theoretical implications are made.

2. Theoretical Background

When a literature survey was made, it was seen that many researchers had investigated the relationship between stock price and exchange rate volatility. Although there has yet to be a consensus about the direction and strength of the relation, alternative theoretical explanations are made in different ways. According to Zhao (2010), the linkage between exchange rates and stock prices has taken two forms. One is the "flow-oriented" model, which Dornbusch and Fischer (1980) suggested. According to them, changes in exchange rates affect international competitiveness and trade balances. Another is the "stock-oriented" model, which was indicated by Branson (1983) and Frankel (1983). This model views the exchange rate as equating the supply and demand for assets such as stocks. This approach determines exchange rate dynamics by giving the capital account a vital role (Zhao, 2010: 104).

Yıldız (2014) classifies the possible relationship between exchange rates and stock prices into four groups in the light of models suggested by Dornbusch and Fischer (1980), Branson (1983) and Frankel (1983). These are conventional, portfolio balance, stock, and asset market approaches.

Positive uni-directional causality running from exchange rate to stock prices can occur, according to Naeem and Rashed (2004). A depreciation in local currency leads to an increase in the competitiveness of local firms. Increasing competition would raise firms' export volume. In the end, the value of firms will increase, and stock prices will rise. Of course, this is valid only for firms with export capability (Naeem & Rasheed, 2004: 536). In the case of importing firms which have been listed on the stock exchange, causation linkage would be the opposite. The positive relation is called the "Conventional approach". According to this approach, volatility in the exchange rate would also affect firms' future payments in terms of foreign currency and business risk, even if it exports or imports (Yıldız, 2014: 79).

According to Naeem and Rashed (2004), the portfolio balance approach implies a negative relationship between stock indices and exchange rates, and uni-directional causality runs from stock price indices to exchange rates. Namely, individuals hold both domestic and foreign assets in their portfolios. It includes stock indices, equities, bonds, and currencies. With an increase in domestic stock prices, demand for it would rise. The investors would exchange foreign and domestic assets to buy more stock indices. In the end, the local currency would be appreciated. Moreover, increasing local asset prices induce an increase in money demand. Increasing money demand would bring interest rate raises together. Again, high interest rates would attract foreign capital, and capital inflows would appreciate local currency due to the rising foreign currency supply. These two approaches are related to "flow-oriented" models, as Zhao (2010) indicated.

The stock approach implies bi-directional causality between the exchange rate and stock price. The exchange rate is a factor that balances the supply and demand of financial assets. Since the values of capital assets are evaluated over the present value of future cash flows, expectations regarding exchange rates play an important role in their price fluctuations. Therefore, stock prices can affect or be affected by exchange rate dynamics (Yıldız, 2014: 79). Moreover, any change in interest rate which affects binary simultaneously, there might be a bi-directional causality.

The last approach, "Asset Market," claims weak or no relationship between variables. A depreciation in local currency might make exporting firms more competitive, but if they import raw materials, that will increase costs and prices. That would induce a loss of competitiveness advantage for firms, and there will be neutrality between variables.

Another explanation of neutrality was made by Naeem and Rasheed (2002). According to them, the exchange rate is the price of an asset. Therefore, like prices of other assets, the exchange rates are determined by expected future exchange rates. Any news/factors that cause changes in the exchange rate will affect today's exchange rate. These factors may differ from those that cause stock price changes (Naeem & Rasheed, 2002: 536). So, there would be no linkage between variables.

The theoretical explanations are valid for exchange rate - stock price relation, but it needs to be clarified if one of them is valid for ETFs or not. Although ETFs are baskets of stock indices, the behaviour of investors in ETFs can be different from that of stockholders. That is why the situation for the ETFs needs to be investigated. In the conclusion section, we compare results with the approaches summarised above.

3. Literature Review

The literature examining ETFs in the context of factors affecting ETF prices is limited. Studies investigating ETFs are generally focused on the relationship between ETF and its underlying assets, such as tracking errors, etc. (please see Shin & Soydemir, 2010; Dedi & Yavas, 2016; Da & Shive, 2018; Tsalikis & Papadopoulos, 2019; Joshi et al., 2021). When we summarise them, it is possible to conclude that they focus on the price efficiency of ETFs in different financial systems.

A few researchers investigate the interaction between ETF and foreign exchange rate volatility. One of them belongs to Shank and Vianna (2016). In their study, one of the ETF types of behaviour of currency-hedged ETFs in U.S. financial markets is investigated. The study's empirical results indicate an interaction between exchange rate shocks and investor behaviours. Although this implication is an initial result for ETF - FX relation, due to the type of ETF, results cannot be generated for all ETFs.

Geetha et al. (2020) investigate the sensitivity of ETFs to an exchange rate fluctuation. They employ exchange rate and ETF in NASDAQ from 2013 to 2018, using GARCH models, and find no direct relation between variables. The authors emphasise that the relationship between ETF and exchange rate might change according to underlying assets.

In another study, Sakarya and Ekinci (2020) analyse the relationship between ETF and exchange rate in the context of uncertainty. They employ MSCI Türkiye ETF data and the EGARCH method. Results suggest an asymmetric behaviour as outflows of ETFs are followed by an exchange rate depreciation with less exchange rate uncertainty, while significantly large inflows of ETFs lead to higher exchange rate uncertainty.

As can be seen, studies investigating ETFs focus on something other than ETF - FX relation. To our knowledge, this is the first study including risk and share of foreign investors in the stock market into the model to investigate the relation between ETF and FX. Also, unlike existing studies, we employ Fourier-based co-integration and causality analysis methods to get more robust results.

4. Data and Methodology

In this study, we investigate the possible interaction between stock price and exchange rate differently. While we measure the direct effects of the exchange rate, we put additional variables to capture indirect effects arising from risk. To do this, we employ credit default swap premium (CDS, hereafter) as a measure of risk and share of foreign capital in the stock market.

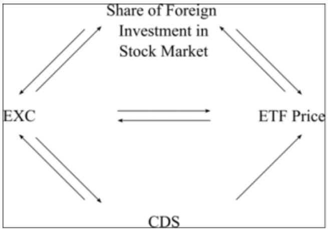
Theoretically, risk is an important factor affecting investment decisions. In this regard, risk will reduce capital investments even if they belong to domestic or foreign investors. In light of empirical evidence in the literature, it is possible to empirically mention the bi-directional causation linkage between exchange rate and CDS premium (Lu et al., 2009; Yang et al., 2010). So, an increase in a country's CDS premium would accelerate exchange rate volatility, and increasing volatility in the exchange rate will affect stock market investments.

CDS premiums would also directly affect stock prices. An increase in CDS premium would reduce stock prices due to increasing risks in the related economy, and investors prefer to stay more liquid. So, the relation between variables runs from CDS premium to stock price. An increase in CDS premium will reduce ETF demand and price (Please see Ngene & Hassan, 2012; Mateev, 2019).

Another variable is the share of foreign capital in the stock market. An increase in the share of portfolio investments of foreign investors in a stock market would increase the performance of the stock market (Singh & Weisse, 1998; Gümüş & Güngör, 2013; Ali & Hussain, 2013). Also, stock market performance might affect foreign capital (Haider et al., 2017). In this regard, a positive relation exists between share of foreign capital and stock price. On the other hand, the exchange rate might affect the share of foreign capital in the stock market. According to Ogundipe et al. (2019), Fidora et al. (2007), and Aydoğan and Vardar (2020), exchange rate volatility is one of the driving factors of foreign portfolio investments. So, an increase in exchange rate volatility would lower foreign portfolio investments in the stock market and reducing investments will reduce stock prices.

In the light of all theoretical explanations, direct and indirect interaction between exchange rate and ETF price can be predicted as follows.

Figure: 1
Relation Between Variables



In the Turkish economy, the behaviour of stock market investors is affected by exchange rate volatility and behaviour of them affects exchange rate volatility (Çiçek & Öztürk, 2007: 98-102). The primary source of this relation is the net reserve position of the economy. In this regard, a change in the investment amount of foreign investors to ETF may also change the exchange rate.

After the 1980s, financial liberalisation started, financial markets improved, and new financial instruments were used. In 2008, Morgan Stanley established an ETF including stock shares from the Borsa Istanbul. We use data belonging to MSCI Türkiye ETF from March 2008 to June 2022. The sources of data are listed in the following Table.

Table: 1
The Source of Data

Variable	Acronym	Source
Exchange Traded Fund price	ETF	MSCI Türkiye
Exchange Rate (U.S. dollar)	EXC	International Monetary Fund, International Financial Statistics
Credit Default Swap Premium (5-year)	CDSTR	Bloomberg
Share of Foreign Investors in BIST	SHARE	Banking Regulation and Supervision Agency

To investigate the relation, two separate models were built. These are:

$$Model\ 1: EXC_t = \beta_0 + \beta_1 ETF_t + \beta_2 CDSTR_t + \beta_3 SHARE_t + e_t \tag{1}$$

$$Model\ 2: ETF_t = \alpha_0 + \alpha_1 EXC_t + \alpha_2 CDSTR_t + \alpha_3 SHARE_t + u_t \tag{2}$$

In models, β_0 and α_0 are constant terms, β_i and α_i are slope parameters for $i = 0,1,2,3$. t is defined as follows: $t = 2008{:}03, 2008{:}05, 2008{:}06, \dots, 2022{:}06$ and e_t and u_t are error terms representing variables which were not included in the model. The sources of data belonging to variables are presented in Table 1. Sources of data are listed also in the same table.

In the first model, the dependent variable is the exchange rate (EXC, hereafter), and the independent variables are ETF, credit default swap premium of the Turkish economy (CDSTR, hereafter), and foreign investment share in the BIST (SHARE, hereafter). In the second model, the dependent variable is ETF, and the independent variables are EXC, CDSTR and SHARE.

In the first step, unit root tests are applied. To test structural breaks in series, we employ both conventional unit root tests, unit root tests taking structural breaks into account and Fourier-based unit root tests taking smooth transition breaks into account. According to unit root test results, all variables are stationary in the first differences, and we accept variable I (1).

In the second step, we test the co-integration relation between variables in the long run by using the conventional Engle-Granger (1987) (EG, hereafter) co-integration test and residual-based co-integration test with a Fourier approximation. The residual-based co-integration test with a Fourier approximation (FEG, hereafter) is developed by Yılancı (2019). It aims to adapt to an unknown number and shape of structural breaks in the presence of soft structural changes with the help of Fourier functions. Yılancı (2019) has shown in his study that it is a test with good size and strength properties in the presence of fractures. In addition, the causal relationships between the variables were also investigated. Traditional Toda-Yamamoto (1995) and Fourier Toda-Yamamoto causality Nazlioglu et al. (2016) tests were used.

Descriptive statistics of the variables considered for both models in the study are presented in Table 2, and the time path graph of the variables is shown in Figure 2.

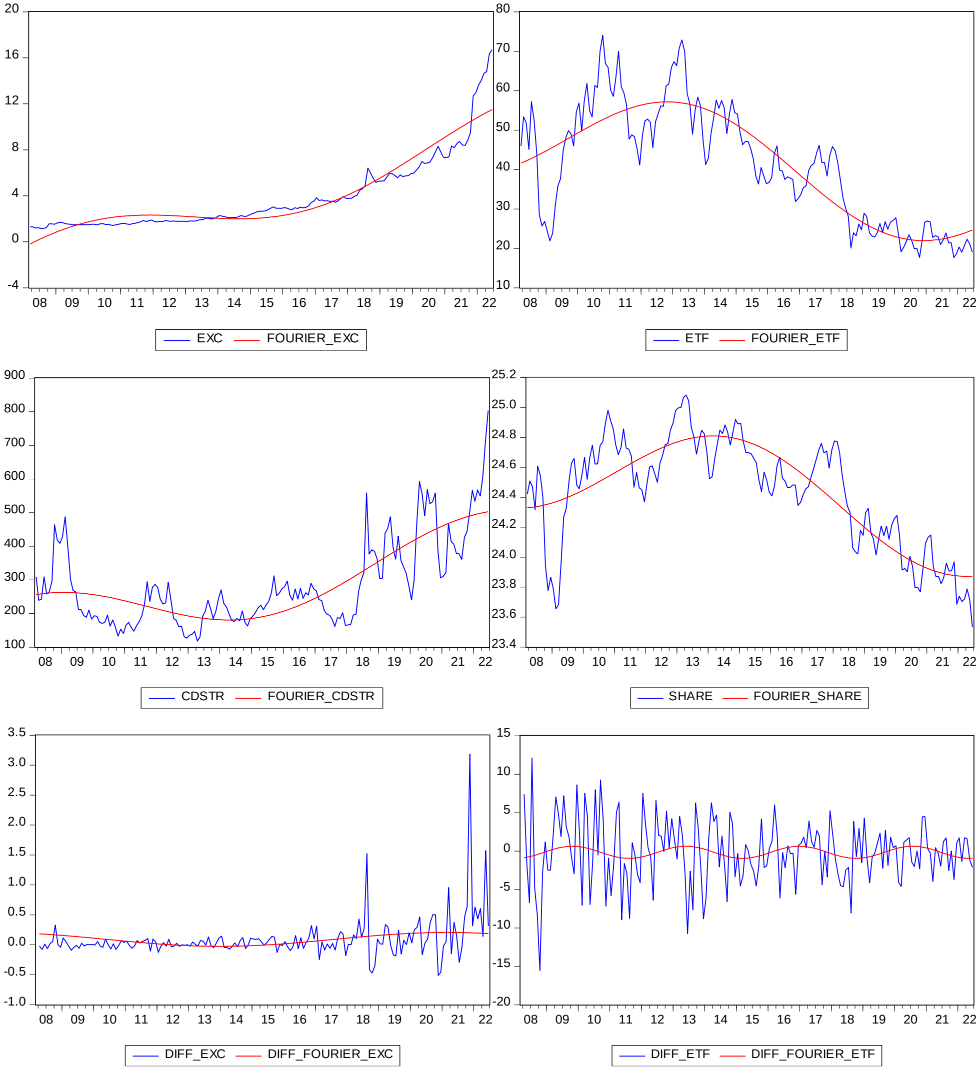
Table: 2
Descriptive Statistics of Variables

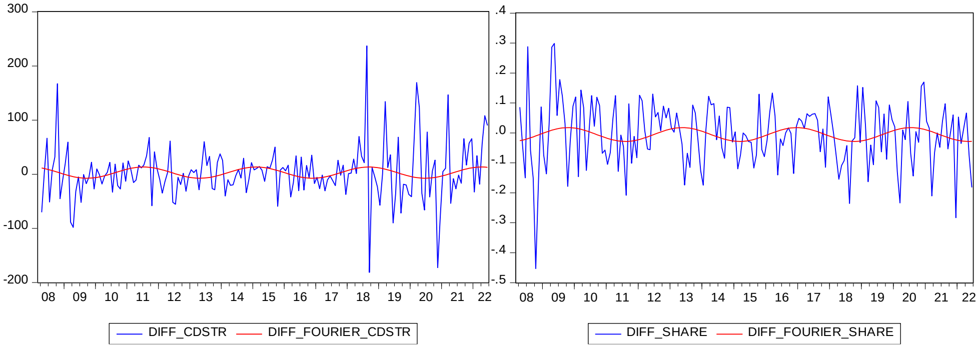
	EXC	ETF	$CDSTR$	$SHARE$
$Average$	3.866	41.365	284.926	24.433
$Median$	2.664	41.832	243.796	24.508
$Maximum$	16.684	74.043	803.610	25.082
$Minimum$	1.159	17.663	117.809	23.532
$Standard\ Dev.$	3.172	14.968	128.495	0.367
$Skewness$	1.966	0.111	1.293	-0.520
$Kurtosis$	6.997	1.922	4.429	2.270
$Jarque-Bera$	225.342 (0.000)	8.678 (0.013)	62.563 (0.000)	11.582 (0.003)

Note: Values in parentheses show probability values.

In Table 2, results imply that series belonging to variables do not show normal distribution.

Figure: 2
Time Path Graph of The Variables





As shown in Figure 2, after taking the difference of the variables, they return to the mean and their appropriate frequencies are seen.

5. Empirical Findings

The first step to investigate the co-integration relation between variables for both models is unit root analysis. The unit root test results are presented in the following tables.

Table: 3
ADF and PP Unit Root Test Results

	Variables	ADF Test Stat.	P-P Test Stat.
Constant	ETF	-0.934 (0.775) [10]	-1.631 (0.465)
	ΔETF	-5.745 (0.000) [9]***	-11.775 (0.000)***
	EXC	3.692 (0.998) [12]	6.455 (0.999)
	ΔEXC	0.576 (0.998) [7]	-10.564 (0.000)***
	$CDSTR$	-1.033 (0.741) [0]	-0.903 (0.786)
	$\Delta CDSTR$	-13.167 (0.000) [0]***	-13.220 (0.000)***
	$SHARE$	-2.031 (0.273) [1]	-1.739 (0.409)
	$\Delta SHARE$	-10.703 (0.000) [0]***	-10.499 (0.000)***
Constant and Trend	ETF	-3.077 (0.115) [6]	-2.883 (0.171)
	ΔETF	-6.007 (0.000) [9]***	-11.741 (0.000)***
	EXC	3.089 (0.997) [12]	5.240 (0.998)
	ΔEXC	-11.264 (0.000) [0]***	-11.264 (0.000)***
	$CDSTR$	-2.251 (0.458) [0]	-2.294 (0.434)
	$\Delta CDSTR$	-13.254 (0.000) [0]***	-13.371 (0.000)***
	$SHARE$	-2.730 (0.226) [1]	-2.484 (0.336)
	$\Delta SHARE$	-10.706 (0.000) [0]***	-10.509 (0.000)***

*Note: *** indicates significance at the 1% level. Values in parentheses present probability, and values in brackets show suitable lag length.*

In Table 3, the unit root test results of Dickey-Fuller (1981) (ADF, hereafter) and Phillips-Perron (1988) (PP, henceforth) are presented. According to results obtained from ADF and PP, the series are stationary in both models with constant and constant trends when we consider the first difference of the series.

Table 4 presents the unit root test results with structural breaks developed by Lee-Strazicich (2003). Results obtained from conventional unit root tests and unit root tests with structural breaks are similar. Model A allows two structural breaks in the model with a constant, and Model B allows two structural breaks in the model with a constant and constant, and the trend is stationary in the series of the first difference.

Table: 4
Lee-Strazicich (2003) Unit Root Test Results

				Critical Value		
Test	Variable	Test Stat.	Break Date	1%	5%	10%
LS (Model A)	ETF	-3.238	2009:11,2018:07	-4.087	-3.579	-3.321
	ΔETF	-9.805***	2014:02,2017:03	-4.087	-3.579	-3.322
	EXC	-0.925	2011:12,2020:08	-4.087	-3.579	-3.321
	ΔEXC	-12.247***	2016:08,2020:12	-4.087	-3.579	-3.321
	$CDSTR$	-3.195	2012:06,2020:02	-4.087	-3.579	-3.321
	$\Delta CDSTR$	-10.076***	2009:12,2020:12	-4.087	-3.579	-3.321
	$SHARE$	-2.640	2018:07,2020:02	-4.087	-3.579	-3.321
	$\Delta SHARE$	-8.900***	2014:02,2016:01	-4.087	-3.579	-3.321
LS (Model C)	ETF	-4.082	2009:08,2013:06	-6.552	-5.801	-5.424
	ΔETF	-11.923***	2010:09,2018:09	-6.299	-5.737	-5.427
	EXC	-5.063	2016:08,2021:01	-6.552	-5.801	-5.424
	ΔEXC	-13.233***	2017:05,2018:08	-6.172	-5.611	-5.321
	$CDSTR$	-4.816	2018:05,2020:11	-6.179	-5.617	-5.327
	$\Delta CDSTR$	-13.864***	2012:06,2020:08	-6.299	-5.737	-5.427
	$SHARE$	-3.906	2009:08,2012:08	-6.179	-5.617	-5.327
	$\Delta SHARE$	-10.749***	2012:06.2013:12	-6.414	-5.720	-5.408

*Note: *** presents a 1% significance level.*

Table 5 presents conventional KPSS (Kwiatkowski, 1992) and Fourier KPSS (Becker et al., 2006) unit root test results. Fourier KPSS unit root test results show that the series presents a stationary level for some models. However, it is possible to conclude that all series are stationary in the first difference when considering the financial series' long-run memory features. In the light of all results, we include series belonging to variables into analyses with their first difference.

Table: 5
KPSS and Fourier KPSS Unit Root Test Results

		KPSS Test Stat.	Freq	Min. SSR	Fourier KPSS Test Stat.	F Test Stat.	Critical Values		
							1%	5%	10%
Constant	ETF	1.106	1	11645.310	0.186	193.505***	0.269	0.172	0.131
	ΔETF	0.069***	4	2924.735	0.698	1.508	0.722	0.459	0.347
	EXC	1.340	1	969.015	0.623	65.492***	0.269	0.172	0.131
	ΔEXC	0.883	1	19.102	0.468	5.004**	0.269	0.172	0.131
	$CDSTR$	0.920	1	1478988.000	0.326	76.810***	0.269	0.172	0.131
	$\Delta CDSTR$	0.263***	4	428214.6	0.318	1.803	0.722	0.459	0.347
	$SHARE$	0.774	1	8.315	0.202	150.192***	0.269	0.172	0.131
	$\Delta SHARE$	0.146***	4	1.911	0.166	1.979	0.722	0.459	0.347
Constant and Trend	ETF	0.228	1	10080.67	0.037	78.133***	0.071	0.054	0.047
	ΔETF	0.031***	4	2920.924	0.034	1.449	0.217	0.147	0.118
	EXC	0.337	1	186.631	0.081	154.464***	0.071	0.054	0.047
	ΔEXC	0.227	1	17.028	0.062	6.585**	0.071	0.054	0.047
	$CDSTR$	0.307	1	1134401.000	0.049	57.045***	0.071	0.054	0.047
	$\Delta CDSTR$	0.044***	4	423979.9	0.060	1.612314	0.217	0.147	0.118
	$SHARE$	0.316	1	7.149	0.044	115.212***	0.071	0.054	0.047
	$\Delta SHARE$	0.023***	4	1.899	0.028	1.858	0.217	0.147	0.118

*Note: *, ** and *** show significance levels of 10%, 5% and 1%, respectively. In a model with constant, F test statistics is used to test KPSS test statistics and significance of trigonometric terms and F statistics critical values for 1%, 5%, and 10% are 0.739, 0.463, 0.347 and 6.730, 4.929, 4.133, respectively. In a model with constant and trend, the critical values of the F test used to test the significance of KPSS test statistics and trigonometric terms are 0.216, 0.146, 0.119 and 6.873, 4.972, 4.162, respectively.*

The second step is co-integration analysis. Table 6 presents conventional Engle-Granger and Fourier Engle-Granger co-integration test results. According to conventional co-integration test results, neither model is statistically significant. On the other hand, the Fourier Engle-Granger co-integration test results imply that in Model 2, variables are co-integrated when we consider smooth structural breaks. In light of this result, it is possible to conclude that there is a long-run relation between variables. To determine the size of the long-run relation, fully modified ordinary least squares (FMOLS, hereafter), dynamic ordinary least squares (DOLS, hereafter) and canonical co-integration regression (CCR) methods are employed in the third step.

Table: 6
Engle-Granger and Fourier Engle-Granger Co-integration Analysis Results

		Test Stat.	Min. KKT	k	Critical Values 1% 5% 10%		
Model 1	EG	-2.762 (0.545)	-	-			
	$Fourier - EG$	-4.166	389.038	4	-5.271	-4.605	-4.252
Model 2	EG	-0.817 (0.992)	-	-			
	$Fourier - EG$	-4.977**	849.237	1	-5.596	-4.957	-4.640

*Note: ***, ** and * denote significance levels 1%, 5% and 10%, respectively; values in parentheses present probability values.*

In Table 7, results belonging to FMOLS, DOLS and CCR analyses are presented. Long-term estimates of results obtained from FMOLS, DOLS and CCR methods are similar. According to these results, all variables, except the exchange rate variable and the trigonometric terms included in the model, are statistically significant. In addition, it is found that the R^2 value, which represents the model's explanatory power, is relatively high in all three methods.

Table: 7
Long Run Analysis Results

Method		Coefficient	Standard Error	Statistical value
FMOLS	EXC	-0.008	0.161	-0.047 (0.962)
	$CDSTR$	0.017	0.007	2.573 (0.011) **
	$SHARE$	42.416	2.442	17.370 (0.000) ***
	$Constant$	-999.791	61.074	-16.370 (0.000)***
	SIN	6.304	0.556	11.329 (0.000)***
	COS	4.434	0.610	7.263 (0.000)***
	R^2	0.98		
DOLS	EXC	0.061	0.208	0.293 (0.770)
	$CDSTR$	0.023	0.009	2.481 (0.014)**
	$SHARE$	44.299	3.263	13.577 (0.000)***
	$Constant$	-1047.595	81.824	-12.803 (0.000)***
	SIN	6.337	0.597	10.610 (0.000)***
	COS	4.471	0.668	6.698 (0.000)***
	R^2	0.98		
CCR	EXC	-0.002	0.164	-0.014 (0.989)
	$CDSTR$	0.020	0.008	2.587 (0.011)**
	$SHARE$	43.012	2.608	16.495 (0.000)***
	$Constant$	-1015.008	65.388	-15.523 (0.000)***
	SIN	6.361	0.561	11.345 (0.000)***
	COS	4.456	0.599	7.436 (0.000)***
	R^2	0.97		

*Note: *** and ** indicate significance at the 1% and 5% levels and represent the probability values in parentheses, respectively.*

Long run analysis results show that $CDSTR$ and $SHARE$ variables are positively effective on ETF price. So, $CDSTR$ and $SHARE$ variables create a positive effect on ETF price. When we interpret results, theoretically, findings belonging to the SHARE variable are significant. Because an increase in portfolio investments from abroad will increase ETF prices; on the other hand, results show that an increase in credit default swap premiums will increase ETF prices. This is opposite to theoretical expectations. In this regard, the share of foreign investments in BIST is the dominant variable affecting ETF price in the long run.

In the fourth step, we made an error correction analysis. Results are also listed in Table 8. ECT represents the error correction mechanism, and according to the results presented in Table 8, it is seen that the error correction mechanism works because it is statistically significant and is between -1 and 0. In addition, it is found that the short-term imbalances in the system are resolved approximately in 18 (1/0.055) months. The causality tests of the variables were carried out, and the traditional Toda-Yamamoto (1995) analysis results are presented in Table 9 below.

Table: 8
Short Run Analysis Results

	Coefficient	Standard Error	t-Statistic	Prob.
EXC	-0.533	0.562	-0.948	0.344
$CDSTR$	-0.006	0.005	-1.338	0.183
$SHARE$	31.251	1.974	15.833	0.000***
$Constant$	0.067	0.170	0.393	0.695
ECT	-0.055	0.029	-1.873	0.063*

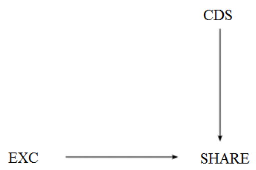
*Note: *** and * indicate significance at the 1% and 10% levels.*

Table: 9
Toda-Yamamoto Causality Analysis Test Results

H_0	Lag Length	Wald Test Stats.	Asymp. Prob Value	Bootstrap Prob. Value
$ETF \nrightarrow EXC$	8	4.877	0.771	0.733
$EXC \nrightarrow ETF$	8	5.321	0.723	0.720
$ETF \nrightarrow CDSTR$	1	2.883	0.089*	0.094*
$CDSTR \nrightarrow ETF$	1	0.024	0.877	0.822
$ETF \nrightarrow SHARE$	8	7.794	0.454	0.457
$SHARE \nrightarrow ETF$	8	6.151	0.630	0.625
$EXC \nrightarrow CDSTR$	1	0.380	0.537	0.484
$CDSTR \nrightarrow EXC$	1	0.293	0.588	0.559
$EXC \nrightarrow SHARE$	8	18.366	0.019**	0.024**
$SHARE \nrightarrow EXC$	8	5.337	0.721	0.674
$CDSTR \nrightarrow SHARE$	2	8.618	0.013**	0.015**
$SHARE \nrightarrow CDSTR$	2	1.629	0.443	0.445

*Note: * and ** present 10% and 5% significance levels, respectively. Number of bootstrap simulations is 10.000.*

Figure: 3
Conventional Toda-Yamamoto Causality Analysis Results



According to conventional Toda-Yamamoto causality test results, there is a uni-directional causality running from ETF to $CDSTR$, from EXC to $SHARE$ and $CDSTR$ to $SHARE$. Results show that exchange rate and CDS premium are effective on share of foreign investors in BIST. Statistical significance is 5% for both variables. On the other hand, statistical significance of effects of ETF on CDSTR is low and theoretically it is almost insignificant. Results are also seen in Figure 3.

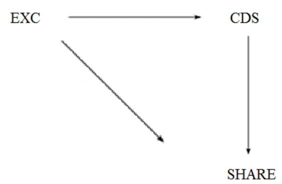
Table: 10
Fourier Toda-Yamamoto Causality Test Results

H_0	Lag length	Frequency	Wald Test Stat.	Asymp. Prob. Value	Bootstrap Prob. Value
$ETF \nrightarrow EXC$	8	1	3.402	0.907	0.878
$EXC \nrightarrow ETF$	8	1	2.559	0.959	0.954
$ETF \nrightarrow CDSTR$	2	1	2.475	0.290	0.298
$CDSTR \nrightarrow ETF$	2	1	1.442	0.486	0.483
$ETF \nrightarrow SHARE$	8	1	9.169	0.328	0.342
$SHARE \nrightarrow ETF$	8	1	6.073	0.639	0.630
$EXC \nrightarrow CDSTR$	8	1	17.546	0.025**	0.072*
$CDSTR \nrightarrow EXC$	8	1	7.493	0.484	0.455
$EXC \nrightarrow SHARE$	8	1	18.742	0.016**	0.018**
$SHARE \nrightarrow EXC$	8	1	5.150	0.741	0.711
$CDSTR \nrightarrow SHARE$	2	1	10.426	0.005***	0.007***
$SHARE \nrightarrow CDSTR$	2	1	0.805	0.669	0.668
$SHARE \nrightarrow CDSTR$		2	1.629	0.443	0.445

*Note: * and ** present 10% and 5% significance levels, respectively. Number of bootstrap simulations is 10.000.*

Fourier Toda-Yamamoto causality analysis results powered by Fourier terms are similar to conventional Toda-Yamamoto causality test results. Uni-directional causation linkages running from EXC to $SHARE$ and $CDSTR$ to $SHARE$ are found. Statistical significance level is 1% for both results. When we compare conventional analysis, significance level is higher than conventional one. On the other hand, there is a uni-directional causality running from EXC to $CDSTR$. This is different from conventional analysis. Also, significance level is 10%. Although statistical significance is low, theoretically increasing exchange rate is risky for both financial and real sectors. Increasing risk will accelerate CDS premium. In the light of results obtained from causality analyses, exchange rate does not have direct effect on ETF prices. But it is effective via share of foreign investors and CDS premium. Results are also presented in Figure 4.

Figure: 4
Fourier Toda-Yamamoto Causality Test Results



6. Conclusion

In recent years, the ETF has been one of the most popular passive investment instruments in the financial markets. As mentioned in the introduction section, the share of ETFs in the stock markets increases yearly. Increasing interest in ETFs made it an important instrument to investigate. There are few studies analysing different aspects of ETFs. The tracking error of ETF with the underlying assets, return and volatility correlation and effect of uncertainty on ETF performance are all tested in different financial markets. A few studies analyse the possible interaction between ETF prices and exchange rates.

This study investigates the relationship between exchange rate and ETF prices in the Turkish economy between 2008 and 2022 via advanced and conventional econometric methods. According to the results, risk premiums and shares of foreign investors effectively affect ETF prices in the long run. On the other hand, the coefficient belonging to the exchange rate is not significant. That means the exchange rate is ineffective on ETF prices in the Turkish economy. Moreover, only the share of foreign investors is effective on ETF prices in the short run. The short and long-run analyses imply that the exchange rate is effective on ETF prices neither in the short nor long run. However, risk premiums and shares of foreign investors are effective on ETF prices.

When we apply causality analysis, it is seen that risk premium and exchange rate affect the share of foreign investors in the BIST. Fourier's causality analysis also indicates a unidirectional relation between the exchange rate and the share of foreign investors in BIST. Combining all these results makes it possible to conclude that there is no direct effect of the exchange rate on ETF price, but it is effective on the share of foreign investors. Also, foreign investors' shares affect ETF prices in the short- or long-term. The transmission mechanism works from the exchange rate to the share of foreign investors in BIST and from the share of foreign investors in BIST to ETF prices. Another mechanism works from exchange rate to risk premium, risk premium to share of foreign investors in BIST and from share of foreign investors in BIST to ETF prices.

We can compare results with the theoretical explanations summarised before. As mentioned earlier, four approaches are trying to explain the relationship between stock prices and exchange rates. Results are similar to the “Asset market” approach, claiming no or weak relation between ETF and exchange rate. But, different from this approach, we have findings indicating an indirect relation. So, it is possible to imply that the relationship between ETF prices and the exchange rate is somewhat different from the stock price exchange rate nexus. This result may come from the structure of the Turkish capital market. As the Turkish economy is an emerging market, the financial system is still on the way to developing. For this reason, a relatively fordable market does not reflect exchange shocks efficiently and induce possible indirect relations, as found in the study.

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