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COVID-19 PANDEMİSİ ALTINDA HİSSE SENEDİ ENDEKSLERİNİN DAVRANIŞINI BELİRLEYEN FAKTÖRLER: BİR LASSO ANALİZİ

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ÖZ

COVID-19 pandemisinin hisse senedi piyasaları üzerinde yarattığı yıkıcı etki ve artan volatilite hisse senedi getirileri ile finansal göstergeler arasındaki ilişkilerin incelenmesi ihtiyacını ortaya koymuştur. Bu çalışma, Türkiye'deki ana akım ve İslami endekslerin, özellikle son küresel sağlık krizi bağlamında, geniş bir faktör kümesine verdikleri tepkileri karşılaştırmalı olarak incelemektedir. Çalışmada, en ilgili faktörlerin seçilmesine ve her bir faktörün göreceli öneminin belirlenmesine olanak tanıyan En Küçük Mutlak Daraltma ve Seçim Operatörü (LASSO) tahmin yöntemi kullanılmıştır. Örneklem periyodu, COVİD-19 öncesi ve COVİD-19 dönemi olmak üzere iki eşit alt döneme ayrılmış olup, salgın dönemi ilk vakanın görüldüğü tarih ile kısıtlamaların kaldırıldığı tarihleri kapsamaktadır. Bulgular, pandeminin endeks getirilerinin belirleyicileri üzerinde kayda değer bir etkisi olduğunu göstermektedir. Salgın öncesinde Döviz Kuru ve Doğal Gaz genel bir etkiye sahipken, salgın sırasında Paladyum, LME Endeksi ve COVID-19 kaynaklı ölüm oranları belirleyici faktörler olarak öne çıkmıştır. Alüminyum, 10 Yıllık Devlet Tahvili ve FTSE 100 Endeksi ise her iki dönemde de hisse senedi davranışlarını güçlü bir şekilde etkilemeye devam etmiştir. En dikkat çekici davranış değişiklikleri BIST Banka, BIST 100-30 ve MSCI İslami Türkiye endekslerinde gözlemlenmiştir.

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DETERMINANTS OF STOCK INDICES' BEHAVIOR UNDER COVID-19 PANDEMIC: A LASSO ANALYSIS

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ABSTRACT

The outbreak of COVID-19 was found to be disruptive to the stock markets, resulting in increased volatility and necessitating the investigation of the relationships between the stock returns and financial indicators in the status quo. This study comparatively investigates the reactions of mainstream and Islamic indices in Turkiye to a large set of factors, focusing on the last global health crisis. We employ the least absolute shrinkage and selection operator (LASSO) estimator, which enables the selection of the most relevant factors and assesses the relative importance of each. Our sample period is divided into two equal sub-periods, as before and during COVID-19; the second covers the period between the first case and the restriction removal dates. Findings reveal that the outbreak significantly affected the determinants of indices' returns. Exchange Rate and Natural Gas had an overall effect before the outbreak, while Palladium, LME Index, and COVID-19 Related Deaths played an important role later. Aluminum, T-Bond 10Y, and the FTSE 100 Index strongly affect stock behavior for both periods. The most significant behavior changes are observed in BIST Bank, BIST 100-30, and MSCI Islamic Turkiye indices.

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INTRODUCTION

At the beginning of the COVID-19 pandemic, researchers turned their attention to the effect of the Great Influenza epidemic (Spanish Flu) on economics to gain a perspective on what can be expected from this new health crisis (Angel et al., 2021; Barro et al., 2020; Burdekin, 2021; Correia, 2020; Gordon, 2020). Similarly, analyzing the COVID-19 pandemic's impact on financial markets offers valuable insights for future generations facing similar crises.

The outbreak of COVID-19 was found to be disruptive to the stock markets, resulting in increased volatility and necessitating the reinvestigation of the relationships between the stock returns and financial indicators in the status quo (Corbet et al., 2020; Zhang et al., 2020). The government intervention in commercial activity and restrictions on social life (i.e., lockdowns) also triggered the destructive effect of this new crisis on the overall economy (Baker et al., 2020).

Some recent studies documented diverse reactions of stock indices to various macroeconomic indicators during COVID-19 (Ashraf, 2020; Alfaro et al., 2020; Al-Awadhi et al., 2020; Anh & Gan, 2020; Baker et al., 2020; He et al., 2020; Topcu & Gulal, 2020). The interconnections among stock indices, gold, and oil markets are reported to be strengthened during the pandemic (Hung & Vo, 2021; Hung, 2022; Ghorbel & Jeribi, 2021; Kyriazis, 2021). In contrast, Majumder (2022) finds that natural gas, crude oil, and aluminum have weak relationships with stock indices during the crisis period, which is bolstered by the findings of Chien et al. (2021)–i.e., low co-movements among the oil market and the stock exchange, exchange rates, and gold markets. However, there is no consensus on the direction and significance of these relationships. A demand and supply shock is also noticed among commodities due to the mobility restrictions between countries during the COVID-19 crisis (Rajput et al., 2021). For example, metal and energy commodities have experienced a price decline due to the

economy's slowdown since the COVID-19 pandemic (Erken, 2020; Ozili & Arun, 2023). Because of the disruption of the supply, consumers' buying and hoarding behavior was sparked during the early days of the pandemic period (Benton, 2020; Hobbs, 2020; Prentice et al., 2020), resulting in increased demand for soft commodities, especially wheat and its byproducts (Vercammen, 2020). Cunningham and Smith (2019) find a low correlation between the price of commodities and stock markets. Ezeaku and Asongu (2020) document a robust and upward trend of soft commodities' prices and their strong, resilient nature compared to hard commodities during the initial phase of the COVID-19 pandemic. Some studies assert that soft commodities (e.g., Wheat, Corn, Cotton, Cocoa, Soybean, Coffee, and Sugar) as safe-haven assets during this pandemic period (Ji et al., 2020; Babirath et al., 2021; Rubbaniy et al., 2021).

However, only a few studies shed light on some determinants of these reactions. Therefore, further investigation is necessary to obtain more comprehensive insights into the responses and determinants. Hence, the primary objective of this study is to analyze the determinants and the behaviors of indices' returns comparatively, focusing on the last global health crisis.

Alongside this, there is an emerging interest in new investment motives. Islamic indices are one of this new trend's focus areas and prominent investment options (Ahmed, 2010; Paltrinieri & Kutan, 2019; Rehman et al., 2020; Trabelsi et al., 2020). These indices are argued to be more crisis-resilient due to their structural characteristics (Ho et al., 2014; Al-Yahyaee et al., 2020; Cheong, 2021; Asutay et al., 2021; Chowdhury et al., 2022; Hassan et al., 2021). Their risk-averse structure and Shari'ah screening criteria (i.e., lower leverage ratios) are argued to be the main reason behind this resilience, yet there are controversial findings. Some researchers state that Islamic indices are more volatile than mainstream ones during crises (Abu-Alkheil et al., 2017; Rejeb et al., 2019). Their increased volatility and high correlations with mainstream indices after the

outbreak of the COVID-19 pandemic imply that their Shari'ah screening criteria are insufficient to provide immunity against financial crises (Hassan et al., 2021). Other studies claim that Islamic equities offer a cushion against risk and a higher return (Kenourgios et al., 2016; Abduh, 2020). Understanding the reactions of Islamic indices against health crises can contribute to the recovery efforts of the economies. The principles of risk-sharing, asset-backing, and ethical considerations inherent in Islamic finance can enable greater soundness than its conventional counterpart. The development of a more effective, culturally sensitive, and inclusive economic recovery with the participation of a significant portion of the global population can be possible with this understanding. However, Islamic equity indices' pre- and post-COVID-19 behaviors have not been explored adequately. For this reason, an additional objective of this study is to compare the impacts of the selected indicators on the Islamic indices during the pandemic.

Accordingly, the role of the possible determinants on the returns of four Islamic and seven mainstream indices in Turkiye is analyzed using the least absolute shrinkage and selection operator (LASSO) from 24 January 2018 to 26 April 2022, which includes the COVID-19 outbreak. This shrinkage method enables the selection of the most relevant factors and assesses the relative importance of each. More constructive and informative techniques are expected to be more beneficial than those provided by the classical econometrics toolkit. Therefore, unlike the previous studies related to the pandemic, the LASSO, a supervised learning method under Machine Learning, is employed in this study. This study analyzes the determinants of the indices' behavior under five groups of indicators: industrial metals, precious metals, energy commodities, soft commodities, and financial factors. The results reveal several consistent factors—i.e., Aluminum, Turkiye T-Bond 10Y, and FTSE 100—that affect the indices' behaviors regardless of the pandemic's outbreak. However, a few variables (USD/TRY and Natural Gas) impact the indices before the pandemic period, and

others (Palladium, LME Index, and COVID-19 Daily Deaths) are after the outbreak. Notably, Gold and Silver have no significant impact on the return of the indices. Other insignificant indicators are the ones that occupy the agenda during COVID-19, such as Brent and Crude. Besides, the findings show the behavioral differences between and within the mainstream and Islamic indices throughout the sample period.

The remainder of this paper is organized as follows: Section 2 describes the data and methodology. Findings and discussion are presented in Section 3. Finally, Section 4 concludes.

DATA AND METHODOLOGY

In this study, the determinants of Turkiye's seven mainstream indices (i.e., BIST All, BIST All-100, BIST 100, BIST 30, BIST 50, BIST 100-30, and BIST Bank) and two Islamic indices' (i.e., DJ Islamic Turkiye and MSCI Islamic Turkiye) returns are compared for pre- and during the COVID-19 period. Borsa Istanbul calculates the mainstream indices, the sole exchange entity of Turkiye, and international providers develop the two Islamic indices. An extended set of independent variables, including various energy commodities, precious and industrial metals, soft commodities, and financial factors, is investigated regarding their effect on the indices' returns. Variable definitions and sources are presented in Table I.

Table I: Variable Definitions and Sources

	Variable	Explanation	Datastream Mnemonic	Source
Stock Indices	BIST All	Bist National All Share - Price Index	TKNATAL	Refinitiv Datastream
	BIST All-100	BIST National All-100 - Price Index	TKNATA1	
	BIST 100	BIST National 100 - Price Index	TRKISTB	
	BIST 100-30	BIST National 100-30 - Price Index	TKNAT13	
	BIST 30	BIST National 30 - Price Index	TKNAT30	
	BIST 50	BIST National 50 - Price Index	TKNAT50	
	BIST Bank	BIST Bank - Price Index	TKBNKSI	
	MSCI Islamic Turkiye	MSCI Turkiye Is - Price Index	MSTKISL	

	DJ Islamic Turkiye	DJ Islamic Turkiye $ - Price Index		S&P Global
Industrial Metals	Tin	LME-Tin 99.85% Cash U$/MT	LTICASH	Refinitiv Datastream
	Zinc	LME-SHG Zinc 99.995% Cash U$/MT	LZZCASH	
	Aluminum	LME-Aluminum 99.7% Cash U$/MT	LAHCASH	
	Copper	LME-Copper Grade A Cash U$/MT	LCPCASH	
	Lead	LME-Lead Cash U$/MT	LEDCASH	
	Nickel	LME-Nickel Cash U$/MT	LNICASH	
	LME Index	LME-LMEX Index - PRICE INDEX	LMEINDX	
	Silicon	Silicon Lumps CIF NWE U$/MT	SILLUMP	
Precious Metals	Palladium	Palladium U$/Troy Ounce	PALLADM	
	Platinum	London Platinum Free Market $/Troy oz	PLATFRE	
	Silver	Silver, Handy&Harman (NY) U$/Troy OZ	SILVERH	
	Gold	Gold Bullion LBM $/t oz DELAY	GOLDBLN	
Energy Commodities	Coal	Coal ICE API2 CIF ARA Nr Mth $/MT - SETT. PRICE	LMCYSPT	
	Oil OPEC Basket	OPEC Oil Basket Price U$/Bbl	OILOPEC	
	Crude Oil	Crude Oil-WTI Spot Cushing U$/BBL	CRUDOIL	
	Brent	Europe Brent Spot FOB U$/BBL Daily	EIAEBRT	
	Natural Gas	S&P GSCI Natural Gas Spot - Price Index	GSNGSPT	
	LNG	Liquid Natural Gas LNG Asia $/mmbtu	LNGASIA	
Soft Commodities	Cocoa	Cocoa-ICCO Daily Price US$/MT	COCINUS	
	Wheat	Wheat No.2,Soft Red U$/Bu	WHEATSF	
	Soybean	Soybean, No.1 Yellow $/Bushel	SOYBEAN	
	Corn	Corn US No.2 South Central IL $/BSH	COTSCIL	
Financial Factors	FTSE 100	FTSE 100 - PRICE INDEX	FTSE100	
	S&P 500	S&P 500 Composite - Price Index	S&PCOMP	
	USD/TRY	NEW TURKISH LIRA TO US $ (WMR) - EXCHANGE RATE	TURKLI$	
	EURO/USD	EURO TO US $ (RFV) - Exchange Rate	EUDOLLR	
	USA T-Bond 10 Year	United States 10-Year Bond Yield	US10YT-X	
	DJ Islamic	DJ ISLAMIC - PRICE INDEX	DJIMKT$	

	S&P Islamic	S&P 500 Shari'ah $ - Price Index	SP500S$	
	Turkiye T-Bond 10 Year	Turkiye 10-Year Bond Yield	TR10YT=XX	CBRT
COVID-19 Measures	Daily Total Vaccination	Daily Total Vaccination		TURCOVID19
	Daily Death	Daily Death		
	Daily COVID-19 Test	Daily COVID-19 Test		

Source: Authors

We use Refinitiv Datastream, Central Bank of the Republic of Turkiye (CBRT), S&P Global, and Turkiye COVID-19 Pandemic Monitoring Screen (TURCOVID19) databases to collect daily frequency data from January 24, 2018, to April 26, 2022, resulting in a total of 1110 observations for testing. The data set is divided into two equal subsets for the pre- and during-COVID-19 periods. The sample country confirmed the first case on March 11, 2020, and lifted all COVID-19-related restrictions on April 26, 2022. This period is counted as COVID-19 in this study, with 555 daily observations. Respectively, an equivalent number of observations from January 24, 2018, to March 10, 2020, are investigated for the pre-COVID-19. We define the time dimension of the series by omitting the weekends and holidays since there are no observations on these dates. Hence, the logarithmic return for any market day is estimated using the closing price of the previous one.

Empirical Methodology

Previous literature has proposed many factors as determinants of stock returns. The proliferation of these potential determinants creates a high dimensionality problem and requires alternative methods to select the most reliable ones (Feng et al., 2020). Recently, the LASSO, initially proposed by Tibshirani (1996), has gained popularity in the asset pricing literature to estimate high-dimensional models (Nagel, 2021). The objective function of the LASSO regression can be written as:

$$\min_{\hat{\beta}_j} \sum_{i=1}^{n} \hat{u}_i^2 + \lambda \sum_{j=1}^{k} |\hat{\beta}_j|$$

where an additional term is added to the minimization problem of the ordinary least squares. This term is called the shrinkage penalty, which forces the coefficient estimates towards zero. The weight of the shrinkage penalty on the minimization problem is decided by λ , which is the tuning parameter. The shrinkage penalty of LASSO regression attenuates the model coefficients toward zero, and some will be precisely zero as long as the penalty term is finite. Thus, this regression results in non-zero coefficients only for a subset of independent variables. LASSO can be used in inference for selected variables in the true model, which usually requires multiple steps to overcome the bias in estimating the coefficients and standard errors under the possibility of omitted variables in a single estimation step. The previous literature provides alternative solutions robust to the model-selection mistakes (i.e., double-selection, partialing-out, and cross-fit partialing-out). We employ Belloni et al.'s (2014) double-selection method that provides reliable coefficients and standard errors for selected focus variables.

A crucial step in LASSO is deciding the penalty parameter's estimation method. Possible choices are CV, adaptive lasso, plugin estimators, and BIC. Among these methods, adaptive LASSO results are the most reliable coefficient selection for cross-sectional regressions. Zou (2006) and Buhlmann and van de Geer (2011) showed that adaptive LASSO selects the variables with non-zero coefficients for large cross-sectional data sets. Besides, this method enjoys the oracle property with weakly dependent regressors (Zou, 2006; Medeiros & Mendes, 2016). However, LASSO might not choose the best model specification when severe nonstationary and cointegrated variables. Lee et al. (2022) proposed the twin adaptive LASSO (TALASSO) approach for consistent variable selection in regressions with mixed roots (i.e., stationary, nonstationary, and cointegrated variables). Their method suggests a second adaptive LASSO estimate following the

first adaptive estimate. Only the variables selected in the first round are used in the second model. They showed that even though a single adaptive Lasso estimator does not have the oracle property under non-stationarity and cointegration, TALASSO enjoys the oracle property and successfully selects the actual model variables irrespective of their level of persistence. In this study, the unit root properties of the variables are investigated with the Augmented Dickey-Fuller (ADF) test. Since all variables are stationary in their returns, the adaptive Lasso approach proposed by Zou (2006) is employed in this study. The robustness of the findings is also checked using the TALASSO method. Since the robustness check supports our main results, the Adaptive LASSO results are presented in the following section.

Findings

Several studies state that the COVID-19 pandemic significantly impacts economic time series. Some of the previous findings even imply structural changes in the data-generating processes. As seen from the time series graphs in Appendix B, marginal changes in commodities and financial indicators occurred after the outbreak of the COVID-19 pandemic. The graphs reveal breakdowns in the stock indices' trends with the pandemic outbreak. Almost all indices experienced a V-shape recovery to a previous peak following a sharp decline since the World Health Organization (WHO) announced the pandemic on March 11, 2020. This quick recovery can be attributed to Turkiye's increasing importance in the sustainable value chain after the COVID-19 pandemic shattered China's position. The recovery continues even though the country reported all validated variants of the illness during the research period. With 69 percent of vaccinations, the country has made significant strides against COVID-19. Noticeably, Turkiye is one of the countries that developed its COVID-19 vaccine. The country's overall macroeconomic indicators performed considerably well throughout the period. Similar to the global trend, the unemployment rate decreased in Turkiye, with 3 million new jobs created in 2021. The country had a positive current account balance in 2019 and a double-digit GDP

growth rate for 2021 after 2020's modest rate. During the same timeframe, the economy was also hit by high inflation and currency shocks. Increasing foreign demand hit a record high, and foreign trade share accelerated by over 10 percent for the first time in the sample country's history.

DESCRIPTIVE ANALYSIS

Table II shows the descriptive statistics of the log-return series for the pre- and during-COVID-19 subsets. Upward trends in the average log returns of all equity indices are observed after the pandemic outbreak. The prevalent negative average returns before the outbreak turn positive for the later period. As suggested by the risk-return tradeoff, the standard deviations also increased during the COVID-19 period, denoting increased riskiness of the indices. The return series of independent variables shows similar patterns, with increasing average returns and sign changes from negative to positive. Significantly, the standard deviations of energy commodities considerably increased after the outbreak.

Table II: Descriptive Statistics for Pre- and During-COVID-19 Subsets

		Before COVID-19 (24.01.2018-10.03.2020)						**During COVID-19 (11.03.2020-**					
		Mea	p50	SD	Min	Max	N	Mea	p50	SD	Min	Max	N
Stock Indices	BIST All	-	0.00	0.013	-	0.04	55	0.00	0.00	0.01	-	0.05	55
	BIST All-	0.00	0.00	0.012	-	0.04	55	0.00	0.00	0.01	-	0.07	55
	BIST 100	-	0.00	0.013	-	0.04	55	0.00	0.00	0.01	-	0.05	55
	BIST 100-30	-	0.00	0.012	-	0.04	55	0.00	0.00	0.01	-	0.06	55
	BIST 30	-	0.00	0.014	-	0.04	55	0.00	0.00	0.01	-	0.05	55
	BIST 50	-	0.00	0.014	-	0.04	55	0.00	0.00	0.01	-	0.05	55
	BIST Bank	-	-	0.022	-	0.06	55	0.00	0.00	0.02	-	0.09	55
	MSCI	0.00	0.00	0.015	-	0.06	55	0.00	0.00	0.01	-	0.06	55
	DJ Islamic	0.00	0.00	0.119	-	0.44	55	0.00	0.00	0.01	-	0.05	55
Industrial Metals	Tin	-	0.00	0.010	-	0.04	55	0.00	0.00	0.02	-	0.15	55
	Zinc	-	0.00	0.015	-	0.05	55	0.00	0.00	0.01	-	0.07	55
	Aluminum	-	-	0.012	-	0.06	55	0.00	0.00	0.01	-	0.04	55
	Copper	-	-	0.010	-	0.04	55	0.00	0.00	0.01	-	0.06	55
	Lead	-	0.00	0.015	-	0.06	55	0.00	0.00	0.01	-	0.07	55
	Nickel	0.00	-	0.016	-	0.08	55	0.00	0.00	0.03	-	0.48	55
	LME Index	-	0.00	0.008	-	0.03	55	0.00	0.00	0.01	-	0.03	55
	Silicon	-	0.00	0.010	-	0.06	55	0.00	0.00	0.04	-	0.98	55
Precious Metals	Palladium	0.00	0.00	0.016	-	0.09	55	-	0.00	0.03	-	0.16	55
	Platinum	-	-	0.012	-	0.05	55	0.00	0.00	0.02	-	0.09	55
	Silver	0.00	0.00	0.011	-	0.04	55	0.00	0.00	0.02	-	0.08	55

	Gold	0.00	0.00	0.006	-	0.02	55	0.00	0.00	0.01	-	0.04	55
Energy Commodities	Coal	-	0.00	0.013	-	0.04	55	0.00	0.00	0.04	-	0.32	55
	Oil OPEC	-	0.00	0.021	-	0.10	55	0.00	0.00	0.03	-	0.22	55
	Crude Oil	-	0.00	0.024	-	0.13	55	0.00	0.00	0.04	-	0.30	55
	Brent	-	0.00	0.023	-	0.11	55	0.00	0.00	0.05	-	0.41	55
	Natural Gas	-	0.00	0.026	-	0.16	55	0.00	0.00	0.03	-	0.15	55
	LNG	-	0.00	0.033	-	0.16	55	0.00	0.00	0.07	-	0.42	55
Soft Commodities	Cocoa	0.00	0.00	0.014	-	0.05	55	-	0.00	0.01	-	0.04	55
	Wheat	0.00	0.00	0.023	-	0.23	55	0.00	0.00	0.02	-	0.19	55
	Soybeans	-	0.00	0.011	-	0.04	55	0.00	0.00	0.01	-	0.06	55
	Corn	0.00	0.00	0.014	-	0.04	55	0.00	0.00	0.03	-	0.39	55
Financials	FTSE 100	-	0.00	0.008	-	0.02	55	0.00	0.00	0.01	-	0.08	55
	S&P 500	0.00	0.00	0.010	-	0.04	55	0.00	0.00	0.01	-	0.08	55
	USD/TRY	0.00	0.00	0.013	-	0.14	55	0.00	0.00	0.02	-	0.11	55
	EURO/USD	0.00	0.00	0.003	-	0.01	55	0.00	0.00	0.00	-	0.01	55
	Turkiye T-	-	0.00	0.029	-	0.22	55	0.00	0.00	0.02	-	0.16	55
	USA T-Bond	0.00	0.00	0.003	-	0.02	55	-	0.00	0.00	-	0.02	55
	DJ Islamic	0.00	0.00	0.008	-	0.03	55	0.00	0.00	0.01	-	0.07	55
	S&P Islamic	0.00	0.00	0.011	-	0.05	55	0.00	0.00	0.01	-	0.09	55
COVID-19 Measures	Daily Total							0.00	0.00	0.41	-	7.63	55
	Daily Death							0.00	0.00	0.13	-	0.91	55
	Daily							0.00	0.00	0.09	-	0.69	55

Source: *Author*

The correlations of the log returns of dependent and independent variables for pre- and during COVID-19 are reported in Tables III and IV (Appendix A), respectively. The tables reveal interesting initial findings regarding the linear co-movements of variables. All equity indices were strongly associated with each other before the COVID-19 period. They remained so after the outbreak, except for the MSCI Islamic Turkiye Index, which moderately correlates with the rest.

Furthermore, the substantial impact of the pandemic on the correlations of the indices with the independent variables is visible in the tables. Notably, all industrial metals except Aluminum and Tin had significant correlations with all indices before the pandemic. However, Zinc, Lead, and Nickel lost their connections with some indices, while Tin replaced them with weak correlations during the pandemic. Since the MSCI Islamic Index did not connect to the industrials during the sample period, except for developing Copper and LME Index relationships, it was separated from the other equity indices.

Before the pandemic, Palladium, Platinum, and Silver exhibited strong correlations with the conventional indices among the precious metals. However, Palladium lost connections with these indices after the outbreak, except for BIST All-100, and Gold developed new relationships. Both Islamic Indices were related only to Palladium and Platinum before the pandemic, but they were diversified in their connections with precious metals during the crisis period. Palladium, heavily reliant on the automotive sector, decoupled from most indices due to pandemic-induced production breaks, supply chain disruptions in the car industry, and potential shifts in investment demand. The continued correlation with the BIST All-100 suggests specific Turkish market factors at play. Conversely, gold, a traditional safe haven, developed new relationships, likely strengthening its inverse correlation with equities due to heightened economic uncertainty, lower interest rates, inflation concerns, and geopolitical tensions evoked by the pandemic. These changes highlight how specific industry factors affect precious metal prices during this period.

It is worth mentioning that this outbreak considerably changed the relationship between energy commodities and stock market indices. Before the pandemic, Crude Oil, Brent, Oil OPEC Basket, and Natural Gas had significant and positive correlations with almost all mainstream indices. However, only the Oil OPEC Basket and Brent retained their connections with these indices during the COVID-19 health crisis. In contrast, the correlations between Islamic indices and energy commodities do not show a unique pattern during the sample period. While DJ Islamic Turkiye lost significant correlations with the energy commodities after the pandemic, MSCI Turkiye remained utterly unrelated to this group of indicators throughout the sample period. Post-pandemic correlations between energy commodities and mainstream indices are affected by the uneven impact of the COVID-19 crisis on energy demand. At the same time, pre-pandemic Crude Oil and Natural Gas echoed broader economic activity; the pandemic's demand destruction, particularly in transportation, decreased crude oil's direct link to indices. However,

benchmarks like the Oil OPEC Basket and Brent maintained some correlation due to their reflection of overall global oil market sentiment. Besides, Islamic indices include fewer energy stocks in their basket due to their compliance with the ethical investment principles guiding these indices, which results in a less direct relationship with commodity price fluctuations during this period of economic shock.

Financial indicators correlating significantly with all equity indices before the pandemic preserved their relationships during COVID-19. The only exception to this is the correlation of USD/TRY and EURO/USD exchange rates, which changed their significance after the pandemic outbreak.

In summary, the correlations between equity indices and determinants were more visible before the pandemic; however, Islamic and mainstream equity indices lost their responsiveness (to some degree) to financial factors during the COVID-19 pandemic. These initial results bolster the findings of LASSO analysis to understand the impact of the same factors on Islamic and mainstream equity indices, considering the pre- and during-COVID-19 periods.

LASSO ANALYSIS

Tables V and VI present the results for the focus variables of LASSO regressions for the pre- and during-COVID-19 subsets, respectively. Each column consolidates the results of models with different focus variables. The focus variable of a model is a control variable of other models in the same column. In total, 256 models in Table V and 283 models in Table VI are estimated for all nine dependent variables (i.e., indices).

The results indicate significant differences between pre- and post-COVID-19 periods. The financial factors are the most influential determinants of indices for both periods. It is worth mentioning that their impacts were more substantial for the pre-COVID-19 period. FTSE 100 positively impacted Turkiye's indices except for the MSCI Islamic Turkiye index, while it had an upward pressure on all indices during the COVID-19 period. Similarly, Turkiye T-Bond 10Y also significantly and negatively affected all

mainstream indices before COVID-19, and its effect persisted for the mainstream and included Islamic indices during the COVID-19 period. Likewise, the USD/TRY exchange rate had a downward pressure on almost all indices before the pandemic. However, this substantial impact vanished after the pandemic, except for MSCI Islamic Turkiye, for which the effect became positive. Other financial factors showed irregular effects, as seen in both periods. The S&P 500 did not significantly impact indices before the pandemic, while it positively impacted BIST All-100 and BIST Bank indices after the outbreak. Lastly, the USA T-Bond 10Y did not impact the indices throughout the sample period.

We also investigated the impact of DJ and S&P Islamic Global indices on the Islamic indices of Turkiye. They impacted only DJ Islamic Turkiye before the pandemic, but lost this nature after the pandemic. These differentiations can be seen in the time-series graphs in Appendix B.

Table V: LASSO Estimation Results for the Pre-COVID-19 Period (11.07.2018-16.03.2020)

		BIST All	BIST All-[illegible]	BIST 100	BIST 100-[illegible]	BIST 30	BIST 50	BIST Bank	MSCI Islami	DJ Islami
Industrial Metals	Tin	-0.046	-0.049	-0.047	-0.051	-0.049	-0.049	-0.077	0.060	0.027
		[0.049	[0.046	[0.050	[0.046	[0.052	[0.051	[0.091	[0.079	[0.047
	Zinc	-0.049	-0.046	-0.050	-0.046	-0.052	-0.051	-0.091	0.019	0.034
		[0.073	[0.069	[0.075	[0.068	[0.079	[0.077	[0.136	[0.071	[0.051
	Aluminum	-0.073	-0.069	-0.075	-0.068	-0.079	-0.077	-0.136	0.117	0.126
		[0.156	[0.137	[0.161	[0.140	[0.171	[0.168	[0.302	[0.112	[0.078
	Copper	-0.156	-0.137	-0.096	-0.140	-0.171	-0.168	-0.302	0.231	0.344
		[0.045	[0.040	[0.046	[0.042	[0.047	[0.047	[0.074	[0.257	[0.165
	Lead	0.038	0.059	0.033	0.091	0.013	0.024	0.043	-0.053	0.017
		[0.049	[0.041	[0.050	[0.045	[0.053	[0.052	[0.086	[0.064	[0.038
	Nickel	0.027	0.007	0.026	0.039	0.028	0.030	0.04	0.040	0.054
		[0.301	[0.273	[0.310	[0.271	[0.328	[0.322	[0.585	[0.504	[0.319
	LME Index	0.388	0.325	0.395	0.394	0.394	0.364	0.796	-0.067	-0.055
		[0.049	[0.037	[0.051	[0.053	[0.051	[0.052	[0.081	[0.067	[0.055
	Silicon	-0.049	0.005	-0.051	0.007	-0.051	-0.052	0.009	-0.045	-0.035
Precious	Palladium	0.039	0.012	0.043	0.025	0.046	0.047	0.045	0.034	0.040
		[0.038	[0.040	[0.039	[0.036	[0.041	[0.040	[0.067	[0.045	[0.035
	Platinum	0.083	0.042	0.087	0.067	0.091	0.090	0.134	0.106	0.049
		[0.054	[0.051	[0.055	[0.050	[0.059	[0.057	[0.086	[0.073	[0.053
	Silver	0.001	-0.003	0.003	-0.003	0.015	0.004	0.053	0.021	-0.053

	Gold	[0.078	[0.082	[0.080	[0.075	[0.085	[0.082	[0.127	[0.108	[0.073
		-	-	-	-0.009	-0.024	-	-	0.140	0.021
		[0.150	[0.147	[0.154	[0.144	[0.160	[0.159	[0.247	[0.187	[0.127
Energy Commodities	Coal	0.020	-0.01	0.024	-	0.032	0.030	0.029	0.060	0.039
		[0.038	[0.036	[0.040	[0.033	[0.042	[0.041	[0.085	[0.048	[0.032
	Oil OPEC	-	0.058	-	0.007	-	-	-	0.005	0.000
		[0.045	[0.060	[0.043	[0.047	[0.044	[0.043	[0.059	[0.052	[0.033
	Crude Oil	0.006	0.012	0.006	0.005	0.009	0.008	0.051	-	-
		[0.033	[0.044	[0.033	[0.038	[0.033	[0.033	[0.048	[0.044	[0.032
	Brent	0.006	-	0.008	0.037	-	0.002	-	-	0.021
		[0.040	[0.047	[0.040	[0.042	[0.040	[0.041	[0.061	[0.054	[0.036
	Natural Gas	0.033	0.005	0.036	0.013	0.040	0.038	0.082	-	0.004
		[0.019	[0.021	[0.019	[0.020	[0.020	[0.019	[0.032	[0.023	[0.017
	LNG	0.009	-	0.010	0.000	0.013	0.013	-	0.024	0.022
		[0.012	[0.012	[0.012	[0.012	[0.013	[0.013	[0.023	[0.015	[0.010
Soft Commodities	Cocoa	0.045	0.002	0.049	0.035	0.054	0.051	0.070	0.003	0.035
		[0.032	[0.031	[0.033	[0.031	[0.035	[0.034	[0.057	[0.042	[0.032
	Wheat	0.029	0.034	0.028	-	0.037	0.033	0.042	0.004	0.027
		[0.021	[0.017	[0.021	[0.020	[0.023	[0.022	[0.034	[0.041	[0.023
	Soybean	0.024	0.004	0.025	0.027	0.023	0.025	0.013	0.124	0.052
		[0.054	[0.043	[0.056	[0.050	[0.059	[0.058	[0.095	[0.077	[0.054
	Corn	-	0.005	-	-	-	-	-	-	-
		[0.039	[0.033	[0.040	[0.037	[0.041	[0.041	[0.067	[0.059	[0.039
Financial Indicators	FTSE 100	0.413	0.321	0.423	0.407	0.425	0.426	0.587	0.145	0.263
		[0.080	[0.100	[0.080	[0.084	[0.082	[0.081	[0.132	[0.097	[0.068
	S&P 500	0.023	-	0.027	-	0.039	0.034	0.046	0.004	0.015
		[0.058	[0.077	[0.057	[0.061	[0.059	[0.058	[0.081	[0.081	[0.058
	USD/TRY	-	-	-	-	-	-	-	-	-
		[0.055	[0.046	[0.056	[0.053	[0.058	[0.057	[0.101	[0.050	[0.045
	EURO/USD	0.020	-	0.039	-	0.092	0.061	0.203	0.573	-0.002
		[0.177	[0.196	[0.180	[0.178	[0.186	[0.187	[0.289	[0.248	[0.179
	Turkiye T-Bond 10	-	-	-	-	-	-	-	0.01	-
		[0.026	[0.020	[0.027	[0.022	[0.028	[0.027	[0.044	[0.026	[0.019
	USA T-Bond 10	-	0.000	-	0.015	-	-	-	-	-
		0.029	3	0.038		0.048	0.044	0.133	0.177	0.001
		[0.183	[0.248	[0.179	[0.206	[0.176	[0.179	[0.258	[0.211	[0.161
	DJ Islami S&P Islami								0.400	0.848
									[0.425	[0.286
									-0.217	-
									[0.475	[0.359
	Variance	-	-	-	-	-	-	-	6.983	31.54
		[16.84	[7.488	[18.55	[13.05	[20.11	[19.57	[6.310	[11.08	[66.35
	Observation	555	555	555	555	555	555	555	555	555

*Note: Standard errors in brackets, * p < 0.1, ** p < 0.05.*

Source: *Authors*

The indices were also responsive to industrial metals. Aluminum had a downward pressure on all mainstream indices during both periods, but it had no significant impact on Islamic indices. Among the other industrial metals, Zinc and Lead impacted BIST 100-30, and Copper affected DJ Islamic Turkiye before the outbreak; however, they all lost their relationship during the pandemic. Lastly, insignificant before the outbreak, the LME Index and Silicon gained a positive impact during the pandemic for some mainstream indices.

However, the results do not show evidence of the determinative role of precious metals on Turkiye's indices during the sample period, except Palladium, which negatively affected the mainstream indices during the COVID-19 period, except for BIST All-100.

The models analyzing the energy commodities group also pose exciting findings. For the pre-COVID-19 period, only Natural Gas and LNG significantly impacted the majority of mainstream indices and DJ Islamic Turkiye, respectively. During COVID-19, Natural Gas failed to maintain its impact on indices except for BIST Bank, while the only other significant effect of the period came from Oil OPEC Basket on Islamic indices.

Table VI: LASSO estimation results for during-COVID-19 period (11.03.2020-26.04.2022)

		BIST All	BIST All-100	BIST 100	BIST 100-30	BIST 30	BIST 50	BIST Bank	MSCI Islamic Turkiy	DJ Islamic Turkiy
Industrial Metals	Tin	-	-	-0.012	0.0029	-	-0.0127	-0.0436	-	-
		[0.030	[0.037	[0.030	[0.034	[0.031	[0.0300	[0.0393	[0.040	[0.033
	Zinc	-	0.0261	-	0.0192	-	-0.0362	-0.0437	0.0311	-
		[0.051	[0.054	[0.054	[0.058	[0.056	[0.0559	[0.0714	[0.071	[0.064
	Aluminum	-	-	-	-	-	-	-	-	-
		[0.064	[0.070	[0.066	[0.070	[0.068	[0.0675	[0.0860	[0.090	[0.079
	Copper	-	-	-	-	-	-0.0314	-	0.0932	0.0487
		[0.055	[0.058	[0.057	[0.069	[0.057	[0.0577	[0.0820	[0.077	[0.074
	Lead	0.0101	0.0313	0.0085	0.0223	0.005	0.0065	0.0121	-	0.0199
		[0.043	[0.051	[0.044	[0.048	[0.047	[0.0460	[0.0633	[0.070	[0.063
	Nickel	0.0002	0.013	-	0.0103	-	-0.0033	-0.0381	0.0402	0.0339
		[0.019	[0.024	[0.019	[0.023	[0.020	[0.0203	[0.0316	[0.028	[0.025
	LME Index	0.2332	0.0712	0.2623	0.1058	0.3218	0.2729	0.5859*	-	0.0187
		[0.139	[0.178	[0.138	[0.179	[0.136	[0.1369	[0.1854	[0.186	[0.174

	Silicon	0.0006 [0.001	0.0018 [0.004	0.0012 [0.001	- [0.002	0.0023 [0.001	0.0031 [0.0015	0.0092* [0.0025	- [0.004	- [0.004
Precious Metals	Palladium	- [0.028	- [0.032	- [0.028	- [0.030	- [0.029	- [0.0292	-0.009 [0.0396	- [0.041	- [0.036
	Platinum	0.0518 [0.043	0.0514 [0.047	0.0509 [0.043	0.0631 [0.046	0.0477 [0.044	0.0504 [0.0437	0.0057 [0.0587	0.0552 [0.054	0.0216 [0.051
	Silver	0.056 [0.069	0.0703 [0.076	0.0506 [0.070	0.084 [0.080	0.0392 [0.068	0.0415 [0.0688	0.0442 [0.0725	0.0918 [0.083	0.1128 [0.084
	Gold	- [0.106	- [0.154	-0.026 [0.105	- [0.131	- [0.103	-0.015 [0.1029	0.0616 [0.1217	- [0.136	- [0.131
Energy Commodities	Coal	- [0.012	- [0.011	- [0.013	- [0.013	- [0.014	-0.0002 [0.0139	0.0005 [0.0185	-0.007 [0.018	- [0.013
	Oil OPEC Basket	-0.016 [0.018	-0.021 [0.020	- [0.018	- [0.017	- [0.020	-0.0141 [0.0197	0.0053 [0.0239	- [0.027	- [0.023
	Crude Oil	- [0.012	- [0.017	- [0.012	-0.013 [0.014	- [0.013	-0.0105 [0.0125	-0.0124 [0.0183	0.01 [0.024	0.0021 [0.002
	Brent	- [0.009	- [0.016	- [0.009	- [0.013	- [0.010	-0.0014 [0.0097	-0.0193 [0.0141	- [0.016	- [0.013
	Natural Gas	- [0.013	0.0072 [0.015	- [0.014	0.0033 [0.014	- [0.015	-0.0049 [0.0149	0.0365* [0.0220	- [0.020	- [0.017
	LNG	0.003 [0.007	- [0.007	0.0035 [0.007	0.0014 [0.007	0.0044 [0.008	0.0043 [0.0082	0.0009 [0.0107	0.0065 [0.010	- [0.009
Soft Commodities	Cocoa	0.0416 [0.045	0.0292 [0.054	0.0452 [0.045	0.0252 [0.050	0.0555 [0.046	0.0501 [0.0461	0.0996 [0.0630	0.1179 [0.059	0.1052 [0.051
	Wheat	0.0219 [0.043	0.0186 [0.035	0.0232 [0.046	0.0019 [0.039	0.0312 [0.050	0.028 [0.0491	0.0076 [0.0447	0.0306 [0.054	0.0105 [0.049
	Soybean	0.0303 [0.045	0.0013 [0.048	0.0368 [0.046	0.0295 [0.051	0.0405 [0.048	0.0395 [0.0474	0.0664 [0.0561	0.0927 [0.064	0.1019 [0.055
	Corn	0.0088 [0.010	0.0178 [0.013	0.008 [0.010	0.012 [0.015	0.0064 [0.010	0.0062 [0.0103	0.0112 [0.0130	0.0213 [0.014	0.0275 [0.010
Financial Indicators	FTSE 100	0.4349 [0.076	0.4074 [0.108	0.4484 [0.076	0.4321 [0.089	0.4596 [0.076	0.4576 [0.0762	0.4994* [0.0831	0.2606 [0.092	0.2503 [0.088
	S&P 500	0.1055 [0.069	0.1906 [0.082	0.0897 [0.070	0.1105 [0.080	0.0789 [0.069	0.0827 [0.0695	0.1288* [0.0682	0.003 [0.089	0.07 [0.087
	USD/TRY	0.0679 [0.097	- [0.066	0.093 [0.105	0.0798 [0.097	0.0991 [0.108	0.1005 [0.1071	-0.1218 [0.1212	0.1749 [0.096	0.1149 [0.094
	EURO/USD	- [0.198	- [0.242	- [0.198	- [0.223	- [0.199	-0.2469 [0.1979	-0.2843 [0.2244	- [0.238	- [0.226
	Turkiye T-Bond	- [0.060	- [0.062	- [0.061	- [0.067	- [0.060	- [0.0613	- [0.0584	- [0.071	- [0.070
	USA T-Bond 10	- [0.185	0.1714 [0.232	- [0.185	0.0066 [0.227	- [0.182	-0.1311 [0.1824	-0.2523 [0.1945	- [0.278	- [0.265
	DJ Islamic								0.1733 [0.301	0.4085 [0.258
	S&P Islamic								- [0.429	-0.356 [0.373
COVID-19	Daily Total	- [0.001 -	- [0.001 -	- [0.001 -	- [0.001 -	- [0.001 -	-0.0017 [0.0012 -	- [0.0012 -	- [0.001 -	-0.001 [0.001 -

Daily	[0.004	[0.005	[0.004	[0.005	[0.005	[0.0050	[0.0060	[0.008	[0.005
Daily COVID-19	0	-	0.0007	-0.001	0.0018	0.0017	-0.004	0.0132	-
	[0.008	[0.011	[0.007	[0.010	[0.007	[0.0076	[0.0086	[0.012	[0.005
Variance	-	0.198	-	-	-	-3.4257	-2.768	-	-
	[2.988	[0.807	[4.579	[5.641	[4.471	[4.1107	[4.8623	[4.615	[5.995
Observati	555	555	555	555	555	555	555	555	555

*Note: Standard errors in brackets, * $p < 0.1$, ** $p < 0.05$. Source: Authors*

The behavior of soft commodities in regards to indices also differs before and after the outbreak. BIST All-100 responded to Wheat, whereas BIST 50 and MSCI Islamic Turkiye responded to Corn before the pandemic. However, these relationships decayed after the outbreak. During COVID-19, both Islamic indices responded to Cocoa. Corn and soybean are the other significant soft commodities that impact the DJ Islamic Turkiye. It can be said that soft commodities have no general role on indices, but their dominant effect on DJ Islamic Turkiye was considerable.

Daily deaths during COVID-19 had a significant negative impact on BIST 100, BIST 30, BIST 50, BIST Bank, and MSCI Islamic Turkiye indices. However, Daily Total Vaccination has an impact only on the BIST Bank index, and daily COVID-19 Tests have no impact.

From the perspective of the dependent variables, the changes in the indices' response behaviors can be seen clearly in the summary table, which shows the significant determinants of indices (see Table VII). Before the outbreak, the behaviors of BIST All, BIST 100, BIST 30, and BIST Bank were identical. Other mainstream indices also showed a similar pattern with some trivial changes. The pandemic disrupted the identical behavior of the four indices mentioned above, but only BIST-100 and BIST-30 remained alike. BIST All's pattern was similar, though BIST Bank became more responsive with more determinants. A conspicuous behavioral gap is visible between the other mainstream indices; especially BIST All-100 and BIST 50 lost their responsiveness to soft commodities during the pandemic.

Table VII: Summary Results

		Aluminum	Copper	Zinc	Lead	LME Index	Silicon	Palladium	Natural Gas	LNG	Oil OPEC Basket	Cocoa	Corn	Wheat	Soybean	FTSE 100	S&P 500	USD/TRY	Turkey T-Bond 10 Year	EURO/USD	S&P Islamic	DJ Islamic	Daily Death	Daily Total Vaccination
Before Covid-19	BIST All	-							+							+		-	-					
	BIST All-100	-												+		+		-	-					
	BIST 100	-							+							+		-	-					
	BIST 100-30	-		-	+											+		-	-					
	BIST 30	-							+							+		-	-					
	BIST 50	-							+				-			+		-	-					
	BIST Bank	-							+							+		-	-					
	MSCI Islamic Turkey												-					-		+				
	DJ Islamic Turkey		+							+						+					-	+		
During Covid-19	BIST All	-				+		-								+			-					
	BIST All-100	-														+	+		-					
	BIST 100	-				+		-								+			-				-	
	BIST 100-30	-						-								+			-					
	BIST 30	-				+		-								+			-				-	
	BIST 50	-				+	+	-								+			-				-	
	BIST Bank	-	-			+	+		+							+	+		-				-	-
	MSCI Islamic Turkiye										-	+				+		+	-				-	
	DJ Islamic Turkiye										-	+	+		+	+			-					

Source: Authors

Interestingly, Islamic indices, which did not have many similarities before the pandemic, have converged in response behaviors after the outbreak.

Their response to financial factors exhibited a similar pattern to mainstream indices during the period.

DJ Islamic Turkiye increased its sensitivity to soft commodities after the outbreak, unique from all other investigated indices. It can be said that soft commodities have no general role in indices, but their dominant effect on DJ Islamic Turkiye was considerable. A similar uniqueness was correct for BIST 100-30 with industrial metals before the pandemic, but its responsiveness to metals was lost after the outbreak.

CONCLUSION

This century has witnessed so many global crises to the degree that is making such events commonplace. Still, the current global health crisis, the COVID-19 pandemic, is unlike the global health crisis with profound economic impacts. The lockdowns squeezed the global output, and the following recessionary pressures markedly stopped aggregate demand. What is more, the implementation of quarantine measures created substantial disruptions to global supply chains. The effect of this crisis spread immediately across different markets, economic agents, and stock markets.

We employ the Least Absolute Shrinkage and Selection Operator (LASSO) method to analyze the responsiveness of both mainstream and Islamic indices to a comprehensive array of indicators, encompassing energy commodities, precious and industrial metals, soft commodities, and financial factors, across pre- and during-COVID-19 periods.

Initial findings reveal that the outbreak of COVID-19 modified or eliminated some links while creating new relationships simultaneously. The LASSO results support these findings by revealing striking differences in the indices' behavior between pre- and during COVID-19. Prior to the pandemic, industrial metals, energy commodities, and financial factors exercised considerable influence on index movements, with Aluminum, Natural Gas, the FTSE 100, the USD/TRY exchange rate, and the Turkish 10-Year Treasury Bond yield identified as key determinants of mainstream

indices. Post-outbreak, while Aluminum, the FTSE 100, and the Turkish 10-Year Treasury Bond yield remained influential, the LME Index, Palladium, and the daily COVID-19 death count emerged as new determinants, indicating a transformation where precious metals replaced energy commodities in their explanatory power.

Both mainstream and Islamic indices displayed diversification in their sensitivities to the analyzed indicators in pre- and post-pandemic periods. Despite some similarities, notable differences within the Islamic index group highlight how seemingly minor variations in Sharia-compliant selection criteria can lead to significant variations in market behavior.

The findings contribute to understanding stock indices' response to an extensive set of indicators under COVID-19 circumstances. We find behavioral differences in Turkiye's indices during the crisis period. While some exceptional cases exist, these differences are particularly evident between mainstream and Islamic index groups, with instances of indices responding to entirely different sets of determinants. Notably, industrial metals predominantly influenced the pre-pandemic BIST 100-30 index, whereas soft commodities became the primary driver for the DJ Islamic Turkiye index post-COVID-19. Most importantly, BIST Bank, which behaved identically with some other mainstream indices before the pandemic, was responsive to the most extensive set of determinants during the later period. It shows a drastic change in behavior with the pandemic.

This study is subject to certain limitations. While providing valuable insights, the dependence on a specific set of indicators and applying the LASSO method as a linear estimator may not catch all relevant factors or alternative model specifications. Furthermore, the focus on Turkish indices deserves carefulness when generalizing findings to other markets with different economic structures and policy responses. Future research could explore the dynamic development of these relationships over a more extended post-pandemic period, investigate the specific channels through which the identified determinants exercise their influence, and compare these findings across a broader range of developed and emerging markets.

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Appendix A

Table III: Pre COVID-19 Correlations Table (24.01.2020-10.03.2022)

		BIST All	BIST All-100	BIST 100	BIST 100-30	BIST 30	BIST 50	BIST Bank	MSCI Islamic Turkiye	DJ Islamic Turkiye	Tin	Zinc	Aluminum	Copper	Lead	Nickel	LME Index	Silicon	Palladium	Platinum	Silver	Gold	Coal	Oil OPEC Basket	Crude Oil	Brent	Natural Gas	LNG	Cocoa	Wheat	Soybean	Corn	FTSE 100	S&P 500	USD/TRY	EURO/USD	Turkiye T-Bond 10 Years	USA T-Bond 10 Years	DJ Islamic	S&P Islamic
Stock Indices	BIST All	1																																						
	BIST All-100	0.81**	1																																						
	BIST 100	1.00**	0.78**	1																																					
	BIST 100-30	0.90**	0.85**	0.88**	1																																				
	BIST 30	0.99**	0.74**	1.00**	0.83**	1																																			
	BIST 50	0.99**	0.75**	1.00**	0.86**	1.00**	1																																	
	BIST Bank	0.89**	0.66**	0.89**	0.74**	0.90**	0.90**	1																																
	MSCI Islamic Turkiye	0.45**	0.27**	0.46**	0.36**	0.46**	0.46**	0.30**	1																																
	DJ Islamic Turkiye	0.70**	0.50**	0.71**	0.63**	0.70**	0.71**	0.47**	0.78**	1																															
Industrial Metals	Tin	0.07	0.08*	0.07	0.07	0.07	0.07	0.06	0.03	0.07	1																														
	Zinc	0.15**	0.12**	0.15**	0.13**	0.15**	0.15**	0.17**	0.03	0.12**	0.19**	1																													
	Aluminum	0.06	0.04	0.07	0.05	0.07	0.07	0.06	0.04	0.10**	0.12**	0.21**	1																												
	Copper	0.24**	0.19**	0.25**	0.21**	0.25**	0.25**	0.22**	0.07	0.21**	0.29**	0.53**	0.31**	1																											
	Lead	0.13**	0.13**	0.13**	0.17**	0.12**	0.12**	0.12**	0.03	0.11**	0.17**	0.40**	0.22**	0.40**	1																										
	Nickel	0.20**	0.16**	0.21**	0.21**	0.20**	0.20**	0.20**	0.05	0.15**	0.25**	0.40**	0.34**	0.52**	0.34**	1																									
	LME Index	0.25**	0.19**	0.25**	0.23**	0.25**	0.25**	0.23**	0.07	0.21**	0.36**	0.65**	0.58**	0.91**	0.51**	0.67**	1																								
	Silicon	-0.02	0	-0.02	0	-0.03	-0.02	-0.01	-0.07	-0.07	-0.02	-0.06	-0.10**	-0.05	-0.03	-0.04	-0.08*	1																							
Precious Metals	Palladium	0.14**	0.10**	0.14**	0.13**	0.14**	0.15**	0.12**	0.07*	0.13**	0.14**	0.26**	0.10**	0.28**	0.20**	0.19**	0.29**	-0.02	1																						

	Platinum	0.19**	0.15**	0.19**	0.17**	0.19**	0.19**	0.18**	0.10**	0.13**	0.12**	0.20**	0.17**	0.34**	0.19**	0.19**	0.34**	0	0.43**	1																				
	Silver	0.09**	0.08*	0.09**	0.10**	0.09**	0.09**	0.11**	0.04	0.03	0.14**	0.14**	0.12**	0.25**	0.17**	0.23**	0.26**	-0.03	0.21**	0.36**	1																			
	Gold	0.02	0.02	0.01	0.04	0.01	0.01	0.03	0.02	-0.02	0.08*	0.04	0.05	0.09**	0.10**	0.13**	0.11**	-0.05	0.15**	0.32**	0.79**	1																		
Energy Commodities	Coal	0.05	0.02	0.05	0	0.06	0.05	0.04	0.07	0.07	-0.01	-0.02	-0.01	0.01	-0.02	-0.01	0	-0.09**	-0.01	0.01	0	-0.04	1																	
	Oil OPEC Basket	0.17**	0.22**	0.16**	0.20**	0.14**	0.15**	0.10**	0.06	0.14**	0.19**	0.14**	0.09**	0.17**	0.09**	0.10**	0.19**	-0.02	0.15**	0.18**	0.10**	0.01	0.10**	1																
	Crude Oil	0.19**	0.21**	0.18**	0.21**	0.17**	0.18**	0.15**	0.03	0.13**	0.23**	0.13**	0.14**	0.24**	0.11**	0.18**	0.25**	0.03	0.07*	0.17**	0.13**	0.04	0.11**	0.69**	1															
	Brent	0.21**	0.22**	0.20**	0.24**	0.19**	0.20**	0.13**	0.07	0.18**	0.22**	0.20**	0.16**	0.27**	0.13**	0.16**	0.29**	-0.03	0.17**	0.16**	0.08*	-0.01	0.14**	0.79**	0.75**	1														
	Natural Gas	0.10**	0.05	0.11**	0.05	0.12**	0.11**	0.13**	-0.01	0.04	0.07*	-0.01	0.04	0.05	0.07*	0.04	0.06	0.03	0.02	0.04	-0.03	-0.07*	0	0	0.06	0.05	1													
	LNG	0.02	-0.02	0.02	-0.01	0.03	0.02	-0.01	0.04	0.06	0.03	0.01	0	0.09**	-0.01	0.01	0.06	-0.01	-0.02	0	-0.04	-0.01	0.08*	-0.01	-0.05	0.03	0.03	1												
Soft Commodities	Cocoa	0.06	0.02	0.06	0.06	0.06	0.06	0.06	-0.01	0.04	0.04	0.02	0.03	0	0.03	0.07	0.03	-0.02	0.04	0.05	0.09**	0.10**	-0.01	0.09**	0.12**	0.09*	-0.01	0	1											
	Wheat	0.11**	0.11**	0.11**	0.03	0.12**	0.11**	0.11**	0	0.07	0.07	0.01	0.03	0.01	0	0.06	0.03	0.09**	0.02	0.03	-0.04	-0.05	0	0	0.05	0.04	0.31**	0	0	1										
	Soybean	0.14**	0.14**	0.14**	0.13**	0.14**	0.14**	0.14**	0.11**	0.11**	0.08*	0.17**	0.09**	0.12**	0.11**	0.13**	0.16**	-0.02	0.09**	0.11**	0.10**	0.06	-0.01	0.12**	0.12**	0.10**	0.06	-0.01	-0.01	0.23**	1									
	Corn	0.06	0.11**	0.06	0.06	0.06	0.05	0.09**	-0.04	-0.01	0.05	0.02	-0.03	-0.01	-0.02	0.11**	0.01	0.07*	-0.03	-0.08*	0.01	0.02	0.08*	0.06	0.05	0.05	0.08*	0.01	0.02	0.34**	0.48**	1								
Financials	FTSE 100	0.36**	0.32**	0.36**	0.35**	0.35**	0.36**	0.31**	0.13**	0.27**	0.13**	0.22**	0.19**	0.36**	0.09*	0.26**	0.37**	-0.07	0.12**	0.16**	0.08*	-0.11**	0.09**	0.46**	0.46**	0.47**	0.04	-0.03	0	0.07	0.18**	0.11**	1							
	S&P 500	0.24**	0.19**	0.24**	0.21**	0.25**	0.24**	0.22**	0.08*	0.17**	0.09**	0.22**	0.10**	0.27**	0.10**	0.21**	0.28**	0.02	0.08*	0.16**	0.03	-0.12**	0.08*	0.37**	0.41**	0.34**	0.11**	-0.03	0.11**	0.02	0.18**	0.05	0.54**	1						
	USD/TRY	-0.32**	-0.29**	-0.32**	-0.31**	-0.31**	-0.31**	-0.41**	-0.15**	-0.10**	0.01	-0.13**	-0.01	-0.10**	-0.01	-0.08*	-0.10**	-0.02	-0.03	-0.09**	-0.12**	-0.10**	-0.05	0	-0.02	-0.03	0	0	-0.03	-0.05	-0.18**	-0.16**	-0.10**	-0.09**	1					
	EURO/USD	-0.04	-0.06	-0.04	-0.08*	-0.03	-0.03	-0.05	0.06	-0.01	-0.05	-0.12**	-0.12**	-0.23**	-0.19**	-0.17**	-0.24**	0.06	-0.12**	-0.30**	-0.32**	-0.40**	0.06	0.08*	0.07	0.08*	-0.01	-0.05	-0.13**	0	-0.06	0.01	0.14**	0.06	0.20**	1				
	Turkiye T-Bond 10 Years	-0.28**	-0.22**	-0.28**	-0.24**	-0.28**	-0.27**	-0.30**	-0.02	-0.09**	0.02	-0.04	-0.07	-0.03	-0.05	-0.02	-0.06	0	-0.03	-0.01	-0.03	0.02	0.03	0	-0.03	-0.01	0.03	0	0.02	-0.04	-0.03	-0.07	-0.07*	-0.03	0.21**	0.03	1			
	USA T-Bond 10 Years	-0.19**	-0.16**	-0.19**	-0.15**	-0.19**	-0.19**	-0.17**	-0.08*	-0.14**	-0.09*	-0.17**	-0.14**	-0.25**	-0.06	-0.14**	-0.26**	0	-0.07*	-0.09**	0.18**	0.32**	-0.09**	-0.34**	-0.37**	-0.32**	-0.16**	0.02	-0.07*	-0.06	-0.10**	-0.06	-0.41**	-0.47**	0.06	-0.10**	-0.01	1		
	DJ Islamic	0.30**	0.26**	0.30**	0.28**	0.30**	0.30**	0.26**	0.10**	0.22**	0.13**	0.27**	0.15**	0.34**	0.14**	0.26**	0.36**	-0.01	0.14**	0.22**	0.09**	-0.08*	0.08*	0.41**	0.43**	0.38**	0.08*	-0.04	0.12**	0.03	0.22**	0.07	0.64**	0.96**	-0.11**	0	-0.06	-0.46**	1	
	S&P Islamic	0.23**	0.18**	0.23**	0.20**	0.23**	0.23**	0.20**	0.08*	-0.03	0.09**	0.22**	0.10**	0.26**	0.11**	0.21**	0.28**	0.02	0.08*	0.15**	0.03	-0.12**	0.07*	0.34**	0.38**	0.32**	0.10**	-0.04	0.11**	0.02	0.19**	0.05	0.52**	0.99**	-0.08*	0.06	-0.04	-0.44**	0.96	1

Note:* * $p < 0.1$ ** $p < 0.5$. *Source: Authors

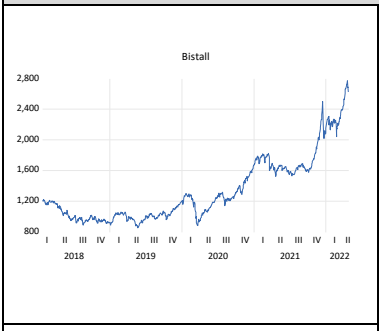
Table IV: During-COVID-19 Correlations Table (11.03.2020-26.04.2022)

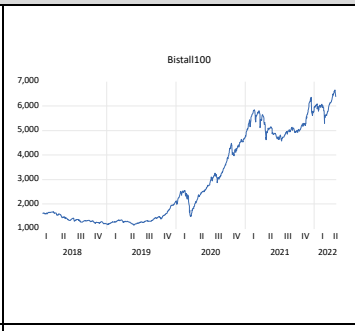
		BIST All	BIST All-100	BIST 100	BIST 100-30	BIST 30	BIST 50	BIST Bank	MSCI Islamic Turkiye	DJ Islamic Turkiye	Tin	Zinc	Aluminum	Copper	Lead	Nickel	LME Index	Silicon	Palladium	Platinum	Silver	Gold	Coal	Oil OPEC Basket	Crude Oil	Brent	Natural Gas	LNG	Cocoa	Wheat	Soybean	Corn	FTSE 100	S&P 500	USD/TRY	EURO/USD	Turkiye T-Bond 10 Year	USA T-Bond 10 Year	DJ Islamic	S&P Islamic	Daily Total Vaccination	Daily Death	Daily COVID-19 Test
Stock Indices	BIST All	1																																									
	BIST All-100	0.85**	1																																									
	BIST 100	0.99**	0.79**	1																																							
	BIST 100-30	0.94**	0.89**	0.91**	1																																							
	BIST 30	0.97**	0.72**	0.99**	0.84**	1																																					
	BIST 50	0.98**	0.75**	1.00**	0.87**	1.00**	1																																			
	BIST Bank	0.78**	0.61**	0.78**	0.64**	0.80**	0.79**	1																																			
	MSCI Islamic Turkiye	0.68**	0.43**	0.71**	0.57**	0.73**	0.73**	0.38**	1																																			
	DJ Islamic Turkiye	0.91**	0.75**	0.91**	0.84**	0.90**	0.91**	0.58**	0.90**	1																																			
Industrial Metals	Tin	0.08*	0.08*	0.08*	0.08*	0.07*	0.07*	0.05	0.04	-0.03	1																																	
	Zinc	0.06	0.09**	0.06	0.07	0.05	0.05	0.04	0.06	0.04	0.33**	1																																	
	Aluminum	-0.03	-0.01	-0.04	-0.05	-0.03	-0.03	-0.01	0.01	0.01	0.29**	0.47**	1																															
	Copper	0.19**	0.19**	0.18**	0.16**	0.18**	0.18**	0.16**	0.10**	0.19**	0.39**	0.55**	0.51**	1																														
	Lead	0.04	0.07	0.04	0.05	0.03	0.03	0.03	0.02	0.07	0.26**	0.48**	0.27**	0.35**	1																														
	Nickel	0.08*	0.08*	0.08*	0.07	0.08*	0.08*	0.06	0.06	0.02	0.19**	0.30**	0.15**	0.22**	0.15**	1																														
	LME Index	0.15**	0.15**	0.15**	0.13**	0.15**	0.15**	0.14**	0.09**	-0.01	0.48**	0.69**	0.69**	0.87**	0.43**	0.51**	1																														
	Silicon	0	-0.01	0	-0.01	0	0	0.02	-0.02	-0.15**	-0.03	-0.02	-0.02	-0.03	-0.02	0.01	-0.02	1																													
Precious Metals	Palladium	0.05	0.09*	0.05	0.03	0.05	0.05	0.09**	0.07	-0.15**	0.24**	0.25**	0.28**	0.23**	0.13**	0.17**	0.33**	-0.02	1																												
	Platinum	0.22**	0.23**	0.21**	0.21**	0.20**	0.21**	0.18**	0.13**	-0.03	0.26**	0.28**	0.21**	0.34**	0.25**	0.22**	0.39**	0.03	0.1	1																									

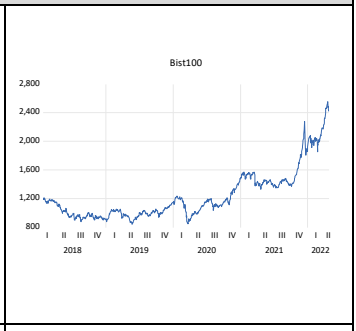
	Silver	0.19**	0.20**	0.18**	0.19**	0.17**	0.17**	0.17**	0.12**	0.15**	0.24**	0.29**	0.20**	0.35**	0.20**	0.19**	0.38**	0.04	0	0	1																						
	Gold	0.10**	0.11**	0.10**	0.09**	0.09**	0.09**	0.11**	0.03	-0.14**	0.12**	0.17**	0.14**	0.22**	0.09**	0.16**	0.25**	0.04	0	0	0	1																					
Energy Commodities	Coal	0	-0.02	0	-0.03	0.01	0.01	0.03	-0.01	0.32**	0	0.09**	0.08*	0.04	0.05	0.05	0.07*	-0.13	0	0	0	0	1																				
	Oil OPEC Basket	0.12**	0.09**	0.13**	0.11**	0.13**	0.13**	0.15**	0	-0.02	0.14**	0.23**	0.14**	0.21**	0.06	0.23**	0.27**	-0.01	0	0	0	0	0	1																			
	Crude Oil	0.03	0.01	0.04	0.02	0.04	0.04	0.04	0.03	0	0.09**	0.14**	0.16**	0.19**	-0.02	0.09**	0.20**	0.08*	0	0	0	-0	0	0	1																		
	Brent	0.09**	0.07	0.10**	0.09**	0.09**	0.09**	0.05	0.01	0.04	0.13**	0.19**	0.20**	0.23**	0.02	0.12**	0.25**	-0.04	0	0	0	0	0	0	0	1																	
	Natural Gas	0.02	0.04	0.02	0.03	0.02	0.02	0.10**	-0.04	0.03	0.04	-0.05	0.04	0.02	0.06	-0.01	0.03	-0.04	0	0	0	0	0	0	0	0	1																
	LNG	0.05	0.03	0.05	0.04	0.05	0.05	0.03	0.05	-0.04	0.03	-0.05	0.03	0.03	-0.02	0.02	0.03	-0.01	-0	0	-0	-0	0	0	0	-0	0	1															
Soft Commodities	Cocoa	0.19**	0.17**	0.18**	0.17**	0.19**	0.18**	0.20**	0.15**	0.02	0.09**	0.10**	0.07	0.20**	0.08*	0.07*	0.17**	0.03	0	0	0	0	0	0	0	0	0	0	1														
	Wheat	-0.02	-0.04	-0.02	-0.04	-0.01	-0.01	-0.02	0.03	-0.03	0.05	0.13**	0.14**	0.04	0.02	0.12**	0.12**	-0.02	0	0	0	0	0	0	0	0	0	0	-0	1													
	Soybean	0.06	0.04	0.07	0.05	0.07*	0.07	0.08*	0.09**	-0.14**	0.14**	0.14**	0.11**	0.18**	0.07	0.09**	0.20**	0.03	0	0	0	0	0	0	0	0	0	0	0	0	1												
	Corn	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.05	0.03	0.05	0.04	0.09**	0.11**	0	0.02	0.10**	0.04	0	0	0	0	0	0	0	0	-0	-0	-0	0	0	1											
Financial Indicators	FTSE 100	0.49**	0.47**	0.48**	0.45**	0.47**	0.48**	0.46**	0.24**	-0.01	0.19**	0.19**	0.10**	0.33**	0.07	0.14**	0.31**	0	0	0	0	0	0	0	0	0	0	0	0	-0	0	0	1										
	S&P 500	0.36**	0.38**	0.34**	0.34**	0.33**	0.33**	0.33**	0.16**	0.14**	0.12**	0.14**	0.10**	0.28**	0.01	0.09**	0.24**	-0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	0	1									
	USD/TRY	-0.04	-0.16**	-0.01	-0.02	0	0	-0.22**	0.10**	0.09*	-0.07	-0.07*	-0.13**	-0.09**	-0.05	-0.04	-0.12**	0.02	-0	-0	-0	-0	0	-0	-0	-0	-0	-0	-0	0	-0	-0	-0	-0	1								
	EURO/USD	-0.20**	-0.20**	-0.20**	-0.18**	-0.20**	-0.19**	-0.19**	-0.09**	0.02	-0.12**	-0.16**	-0.08*	-0.24**	-0.19**	-0.04	-0.22**	0.05	-0	-0	-0	-0	0	0	0	0	0	-0	-0	0	-0	0	-0	-0	0	1							
	Turkiye T-Bond 10	-0.28**	-0.26**	-0.27**	-0.24**	-0.27**	-0.27**	-0.30**	-0.12**	0.05	-0.03	0.06	-0.02	-0.11**	0.03	0.07	-0.05	0.02	0	-0	-0	-0	0	0	-0	0	0	0	-0	0	0	-0	-0	-0	0	0	1						
	USA T-Bond 10	-0.17**	-0.10**	-0.17**	-0.13**	-0.18**	-0.18**	-0.19**	-0.13**	-0.02	0.02	-0.05	-0.08*	-0.05	0	-0.02	-0.07	-0.04	-0	-0	0	0	0	-0	0	-0	0	-0	-0	-0	-0	0	-0	-0	0	-0	0	1					
	DJ Islamic	0.37**	0.41**	0.35**	0.35**	0.34**	0.34**	0.34**	0.17**	0.12**	0.15**	0.18**	0.11**	0.32**	0.07*	0.08*	0.28**	-0.06	0	0	0	0	-0	0	0	0	0	0	0	-0	0	-0	0	0	-0	-0	-0	-0	1				
	S&P Islamic	0.32**	0.35**	0.31**	0.31**	0.29**	0.30**	0.30**	0.14**	-0.23**	0.11**	0.13**	0.08*	0.26**	0.01	0.07*	0.22**	-0.05	0	0	0	0	-0	0	0	0	0	0	0	-0	0	-0	0	0	-0	-0	-0	-0	0	1			
COVID-19 Measures	Daily Total	-0.04	-0.03	-0.04	-0.03	-0.04	-0.04	-0.05	-0.03	-0.07	-0.01	0.02	0.02	0.03	-0.02	0.01	0.03	-0.01	0	0	0	-0	0	-0	0	0	-0	0	0	0	0	0	0	0	0	0	0	-0	0	-0	1		
	Daily Death	-0.09**	-0.02	-0.10**	-0.03	-0.12**	-0.11**	-0.11**	-0.11**	-0.02	-0.02	-0.10**	-0.11**	-0.09**	-0.01	-0.10**	-0.14**	0.01	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	0	-0	-0	-0	-0	-0	0	0	0	0	0	-0	-0	1	
	Daily COVID-19	-0.04	-0.03	-0.04	-0.03	-0.04	-0.04	-0.07	0.03	-0.01	-0.06	-0.02	-0.05	-0.08*	0.09**	-0.02	-0.06	0	-0	0	0	-0	0	-0	-0	-0	-0	0	0	0	0	-0	-0	-0	0	0	0	0	-0	-0	0	0	1

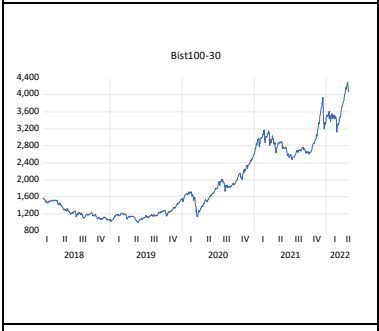
Appendix B: Time series graphs

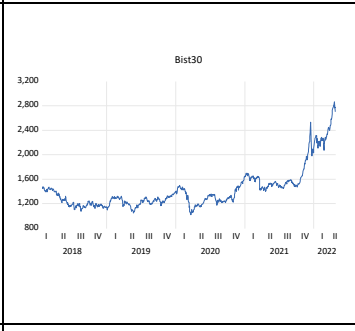
BIST, MSCI, and DJ

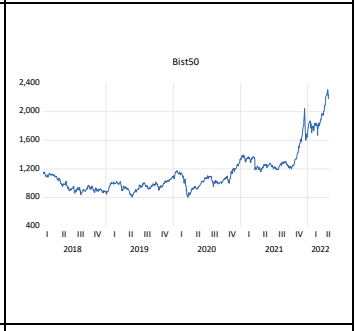


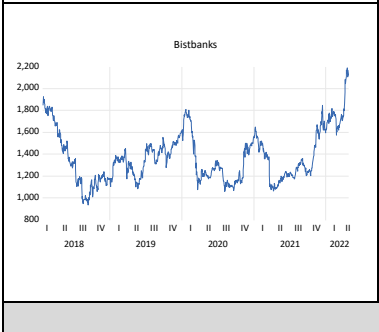


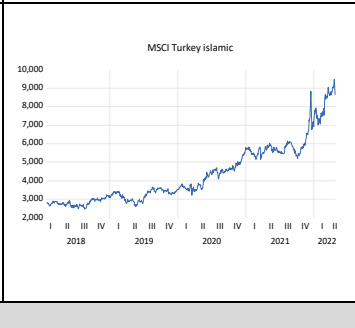


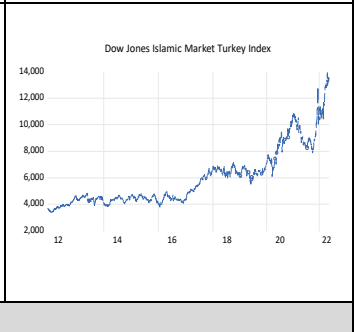




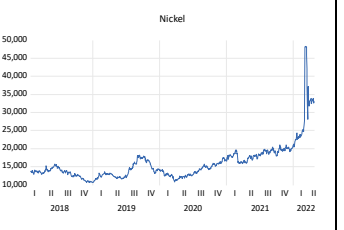


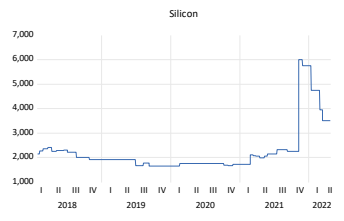




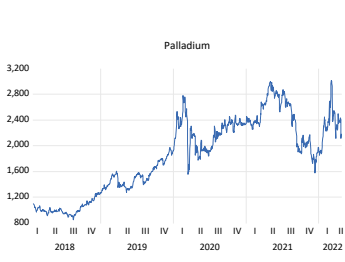


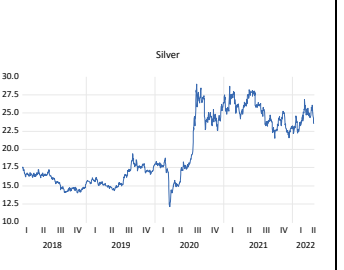
Industrial Metals



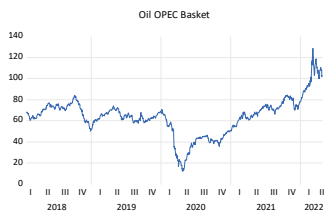


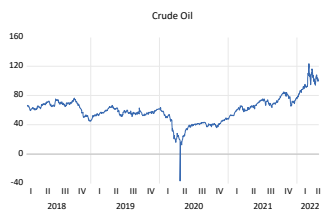
Precious Metals

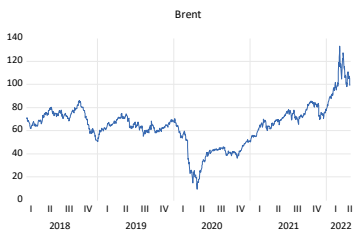


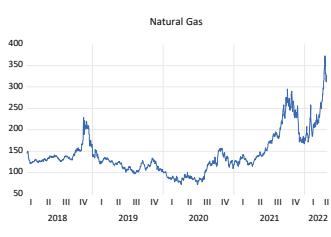


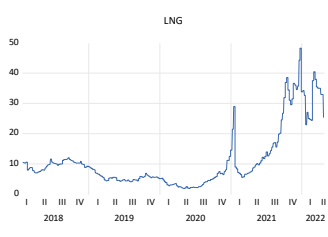
Energy Commodities



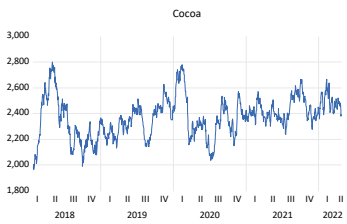


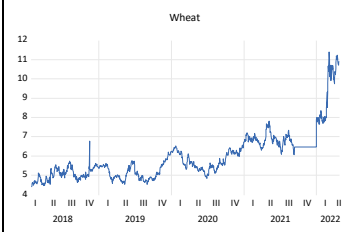


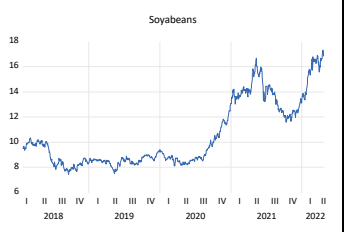


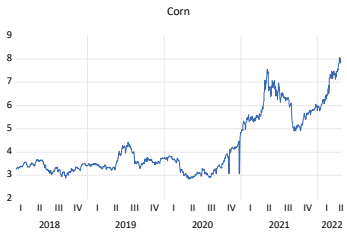


Soft Commodities

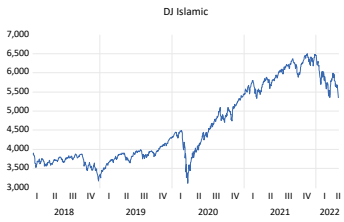




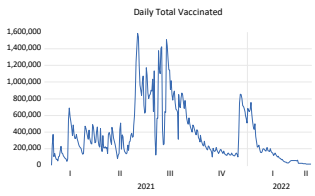


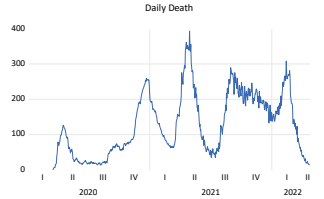


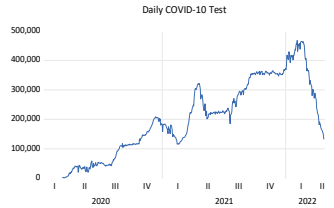
Financial Indicators



COVID-19 Measures







ARAŞTIRMACILARIN KATKI ORANI

Yazarlar bu çalışmaya eşit katkıda bulunmuştur. Temel katkıları şu şekildedir:
Birinci Yazar: Kavramsallaştırma, biçimsel analiz, denetim, inceleme ve düzenleme;
İkinci Yazar: Metodoloji, biçimsel analiz, araştırma, kaynaklar, orijinal taslak yazımı; inceleme ve düzenleme;
Üçüncü Yazar: Orijinal taslak yazımı, veri derleme, biçimsel analiz, inceleme ve düzenleme.

ÇATIŞMA BEYANI

Araştırmada herhangi bir kişi ya da kurum ile finansal ya da kişisel yönden herhangi bir bağlantı bulunmamaktadır. Araştırmada çıkar çatışması bulunmamaktadır.

ARAŞTIRMANIN ETİK İZNİ

Yapılan bu çalışmada "Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi" kapsamında uyulması gerektiği belirtilen tüm kurallara uyulmuştur. Yönergenin ikinci bölümü olan "Bilimsel Araştırma ve Yayın Etiğine Aykırı Eylemler" başlığı altında belirtilen eylemlerden hiçbiri gerçekleştirilmemiştir.

HAKEM DEĞERLENDİRMESİ

En az iki dış hakem / Çift Taraflı Körleme.

AUTHORS' PERCENTAGE-BASED CONTRIBUTIONS

The authors contributed equally to this study. Their specific roles are as follows:

First Author: Conceptualization, formal analysis, supervision, review & editing;

Second Author: Methodology, formal analysis, investigation, resources, writing original draft, review & editing;

Third Author: Writing-original draft, data curation, formal analysis, review & editing.

DECLARATION OF COMPETING INTERESTS

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ETHICAL APPROVAL OF THE STUDY

All rules within the scope of "Instruction on Research and Publication Ethics for the Higher Education Institutions" were observed throughout the study. No actions mentioned in the Instruction's second chapter titled "Actions Against to Scientific Research and Publication Ethics" were taken in the study.

PEER REVIEW

Reviewed by at least two external referees / Double-Blind Review.