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## Testing of Macroeconomic Factors Affecting Capital Markets with Granger Causality Method: Turkey Practice

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ARTICLE INFO	ABSTRACT
<b>Keywords:</b> Capital Markets Exchange Rates Gold Prices Oil Prices Causality	<b>Purpose-</b> In this study, the relationship between the capital market (BIST 100 index) and macroeconomic variables that are thought to affect the capital market (gold prices, oil prices, Euro-US Dollar exchange rate basket, budget balance, foreign trade balance) will be examined with the Granger causality method. <b>Design/methodology/approach-</b> The study covers the period of 2010-2019 on a monthly system. The data were obtained from the CBRT (EDDS) and TurkStat. Statistical package software (Stata and EViews 9) were used in the analysis of the data. BIST 100 index return is included in the model as a dependent variable and macroeconomic factors as an independent variable. The relationship between dependent and independent variables was examined with the VAR-based Granger causality method. <b>Findings-</b> As a result of the study, it has been understood that only the gold price among the macroeconomic factors is the Granger cause of the BIST 100 index. In other words, lagged changes in gold prices explain the variance of the BIST 100 index. When the direction of the relationship was examined, a one-way Granger causality was observed from the Ons variable to the BIST 100 variable. When the action-reaction shocks between the BIST 100 variable and the ONS variable are examined, a shock in gold prices affected the return of the BIST 100 index for about 2 months, and this effect decreased and disappeared from the 5th month. Again, approximately 6.82% of the variance of the BIST100 variable is explained by the Ons variable. <b>Discussion-</b> Developments in the capital markets are followed closely by both institutional investors and individual investors. For this reason, it is extremely important what factors affect the BIST 100 index, which is thought to represent the Turkish capital market. According to the findings of the study, changes in gold prices affect the BIST 100 index return, and the relationship between these two variables should be closely monitored. Addressing the long-term relationship between the BIST 100 index and gold prices in future studies will make an important contribution to the literature.
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### 1.INTRODUCTION

Capital markets are the markets that provide the transfer of medium and long-term loanable funds from the savers who have surplus funds to those who request funds by trading capital market instruments and act as a bridge between these two parties (Kyereboah and Agyire, 2009:369). There are many factors that affect capital markets. These factors consist of macroeconomic parameters and specific factors specific to companies operating in the capital market. Knowing these factors that affect the return of the capital market or the prices of the stocks of the companies traded in the capital market is very important both for the individual and institutional investors who trade in the capital market and for the companies that provide funds from this market through public offering.

The expected return rates of individual and institutional investors trading in the capital markets depend to some extent on the returns of alternative investment instruments. For example, a possible rise in gold prices and therefore an increase in gold returns will cause investors operating in the capital markets to invest in a precious metal such as gold. Again, the increase in interest rates will cause the prices of the stocks to decrease due to the reduction of the cash flows of the companies operating in the capital markets to today, and the decrease in the expected returns from the stocks together with the falling returns (Al-Tamimi, Alwan&Rahman, 2011:5). Also, a possible increase in exchange rates, that is, the depreciation of the domestic currency, will cause investors investing in the capital markets to transfer their investments to foreign currencies. The increase in oil prices, which is one of the macroeconomic parameters, leads to stagnation due to the increase in production costs. The inflation rate, on the other hand, expresses the change in the general

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level of prices and causes an increase in the expected returns in the capital markets due to the rising inflation, while it also indirectly causes an increase in the cost of resources used in the discount rate and decreases in the prices of stocks (Tangjitprom, 2012:106, Sayilgan&Süslü, 2011:74).

BIST 100 index is taken as a basis to represent the capital markets in Turkey. After determining the macroeconomic factors affecting the return of the BIST 100 index, determining the long and short-term relationships between the macroeconomic factors and the BIST 100 index will make it easier to follow these variables. In this study, after the macroeconomic factors that are thought to affect the capital market are determined after examining the domestic and foreign literature, it will be tried to determine which of these variables is the Granger cause of the BIST 100 index return.

## **2. IMPORTANT MACROECONOMIC PARAMETERS AFFECTING THE CAPITAL MARKETS**

There are many parameters that affect the capital markets, both national and international. The basis of studies affecting the returns of capital markets is Markowitz (1952), which deals with the return of portfolios consisting of well-diversified assets. It has been revealed that diversification, which forms the basis of this study, does not eliminate the risk and that the systematic risk, which is expressed as systematic risk, should be determined. Sharpe (1964), Lintner (1965) and Mossin (1966) expressed systematic risk as market risk with the financial asset pricing model (FVFM-CAPM). Later, Ross (1976), Roll and Ross (1980) stated that measuring systematic risk only with market risk would underestimate the risk of capital market return and they developed the Arbitrage Pricing Theory (APT), which they explained with macroeconomic factors. For this reason, it is necessary to determine the macroeconomic factors that are thought to affect the capital market. Some of these parameters; state of the real economy, government debt, export and import figures, interest and inflation rates, exchange rates, gold prices, oil prices, etc. can be sorted.

### **2.1. State of the Real Economy**

An economy basically consists of agriculture, industry, and service sectors. The good performance of the companies operating in these sectors increases the interest of the investors who buy the shares of these companies to these companies, and they channel their funds to these companies through the stock market. On the contrary, investors turn to safer investment instruments and withdraw their savings from the stock market. The increase in the Gross National Product (GNP), which is one of the indicators of the real economy, will contribute to the increase in the disposable income of the people. Increasing disposable income will increase the demand for goods and services. Due to the increasing demand, the earnings of the companies will be affected positively, and the stock prices of the companies will increase (Albeni and Demir, 2005: 6)

### **2.2. Government Debts**

The most important source of income of the state is taxes and money printing. However, in cases where they cannot finance their state investments with the tax revenue they collect, they may prefer to use debt instruments. Debt is divided into internal and external debt. As a result of government borrowing, it pays the principal and interest of the debt to the person or institutions to which it is borrowed. Since this interest is a risk-free and safe investment for investors, they can direct their savings to government debt instruments instead of directing them to the stock market.

### **2.3. Foreign Trade Figures**

One of the main foreign exchange sources of a country is foreign currency entering the country through exports. As a result of exports, foreign currency inflows are provided to the country, while imports cause foreign exchange outflows from the country. The fact that imports are more than exports in recent years causes deficits in foreign trade. Although these deficits are not in the short run, they cause the investor to move away from the capital market of that country in the long run.

### **2.4. Interest and Inflation Rates**

As a result of the increase in interest rates, investors turn to investment instruments such as government bonds and treasury bills that are risk-free and have a guaranteed return. In this case, cash outflow occurs from the stock market and causes the stock market index to decrease. Investors have this type of behavior because they want to have a higher return than a fixed income asset. With the rise in interest rates, the investor will want to

get higher returns from the riskier stocks. If the expected return is below the interest rates, the investor will prefer fixed income securities instead of stocks traded in the capital market.

Inflation, in simple terms, refers to the continuous rise in the general level of prices. This causes the country's currency to depreciate. This, in turn, can affect the size and direction of their investments due to the saving behavior of investors. High inflation affects savings negatively. Since investors are interested in real interest, they increase their savings due to real interest in a low inflation environment. Again, in an inflationary environment, investors prefer to invest in short-term instead of long-term investment instruments. (Kyereboah and Agyire, 2008: 370). In cases where the inflation rate is high, investors expect returns above the inflation rate, so they withdraw their savings from the stock market and turn to investment instruments that provide returns above the inflation rate. Inflation has different effects on the prices and returns of financial assets. While fixed income financial assets such as treasury bills and bonds are more affected by inflation, its effect on stocks is still a controversial issue (Albeni and Demir, 2015:4) There are different opinions on this issue. According to the first view, stock prices are resistant to inflation. In other words, increasing inflation will increase the cash flows of the company issuing the stock, thus increasing the prices of the stock. Another view is that there is a negative relationship between stocks and inflation. Those who support this view defended the representation hypothesis put forward by Fama (1981) (Sayilgan and Süslü, 2011: 76).

## **2.5. Exchange Rate**

In cases where the national currency starts to depreciate, investors can convert their money into foreign currencies. In this case, to protect the value of the investor's money, they can exit the stock market and turn to foreign currencies. There is an inverse relationship between exchange rates and capital markets. Since financial assets traded in foreign exchange rates and capital markets are considered as alternative investment instruments, the prices of stocks and thus their returns will decrease. The rise in exchange rates means the depreciation of the domestic currency. As a result of the depreciation of the domestic currency, the real return of stocks will also decrease (Albeni and Demir, 2005:6) The depreciation in real exchange rates causes foreign capital outflows, which causes the local economy to be deprived of investment-grade financial resources (Kyereboah and Agyire, 2008: 370).

## **2.6. Gold Prices**

Gold prices enter a continuous upward trend during adverse periods (war, epidemic, etc.) in the country and world economy. When savers do not expect an improvement in the economy, they turn to gold, which they see as a haven. The main reason for this situation is that gold is a precious metal that does not lose its value, that is, its liquidity is high. The rise in gold prices is an economic parameter that indicates that investors value their money in gold rather than the stock market. An alternative investment instrument to stocks is precious metals. For this reason, there is an inverse relationship between the prices of stocks traded in the capital markets and the prices of gold, which is one of the most important precious metals (Albeni and Demir, 2005: 7).

## **2.7. Oil Prices**

Oil prices are extremely important in terms of production, as it is an important energy source for the manufacturing industry. The increase in oil prices increases the unit cost of the goods or services produced and decreases the profitability of the enterprises. The rise in oil prices causes a decrease in production, thus a decrease in the value of the stocks of the companies operating in the stock market. In case of a decrease in oil prices, it causes a decrease in the firm values and stock values of oil companies operating in the stock market.

For this reason, oil prices are an important parameter to be followed in terms of capital markets.

## **3.LITERATURE ANALYSIS**

Since the studies conducted to determine the macroeconomic factors affecting the capital markets are examined, it is seen that it is generally done to test the validity of the Arbitrage pricing theory. There have been many studies on this subject in the domestic and foreign literature.

When the foreign literature examining the relationship between the capital market and macroeconomic factors is examined:

Diacogiannis and Tsiritakis (2001) determined the macroeconomic factors affecting the Athens stock market by using principal components analysis. According to the principal components analysis, parameters such as money supply, inflation, exchange rates, wage cost, investment costs and capital account from macroeconomic factors were chosen as significant and positive components. Again, in the same study, he took the years 1980-1992 to price the risk premiums in the changing Greek economy and divided these periods into two sub-periods, 1980-1986 and 1986-1992. It was concluded that it is possible to capture the characteristics of the changing economic environment in the risk premiums calculated with the macroeconomic factors determined in the changing economic conditions.

Kyereboah and Agyire (2008) examined the macroeconomic factors affecting the Ghana stock market using cointegration and error correction model techniques. Quarterly data between 1991 and 2005 were used in the study, and it was concluded that the inflation rate negatively affected the returns in the stock market.

Al-Tamimi, Alwan, and Rahman (2011) discussed the factors affecting the returns of 17 companies traded in the United Arab Emirates capital market, which is one of the emerging markets. The study covers the years 1990-2005 and multiple regression model was used. It was concluded that while the earnings per share (HBK) variable affected the stock returns positively, the inflation and interest rate variable affected the returns of the stocks negatively.

Pal and Mittal (2011) examined the macroeconomic factors affecting the Indian capital markets by using data from January 1995 to December 2008 and error correction model. It was concluded that the inflation rate variable affected the capital markets in a statistically significant way.

Paskevicius and Norkaityte (2011) examined the macroeconomic factors affecting the liquidity of the Estonian, Lithuanian and Latvian capital markets between 2001-2010. The variables of GDP, unemployment rate, trade and services balance and foreign direct investments statistically affected the liquidity of the capital market.

Tangjitprom (2012) examined the macroeconomic factors affecting the Thai capital market using vector error recovery model, Granger causality analysis. It was concluded that the most influential factor in the Thai capital market is the interest rate variable.

Ramadan (2016) analyzed the macroeconomic factors affecting the returns of industrial firms in the Oman stock market (Jordan) using data between 2000 and 2014 and the least squares method. It is concluded that while the interest rate and inflation variables affect the returns of the firms negatively, the GDP and money supply variables affect the returns of the firms positively.

Badullahewage (2018) analyzed the macroeconomic factors affecting the Sri Lankan capital market with the Granger causality analysis method. It was concluded that inflation and exchange rate variables affected the Sri Lankan stock market at a higher rate.

Nicolescu (2020), tried to determine the macroeconomic factors affecting emerging capital markets such as Romania and Hungary. In the study using the data between 2003-2019, mutual funds and stock market indices were handled separately, and it was concluded that the macroeconomic factors affected the stock market indices more than mutual funds, and that the Romanian capital market was more affected by the macroeconomic factors than the Hungarian capital market.

Olokoyo, Ibhagui, and Babajide (2020) examined the macroeconomic factors affecting the Nigerian stock market between 1981 and 2018 using an error correction model. It has been concluded that while the variables of interest rate and inflation rate affect the Nigerian stock market negatively, the GDP growth rate and foreign direct investments variables affect the Nigerian stock market positively. When the domestic literature studies are examined:

Akkum and Vuran (2005) tested the Arbitrage Pricing Theory (APT) model with the Least Squares Method (LCC) for the returns of the stocks of the companies that are constantly in the BIST 30 index in Borsa Istanbul between January 1999 and December 2002. Monthly data was used as the data set, and different models were created to test the macroeconomic factors affecting the return of stocks and whether the APT model is valid. According to the findings, they concluded that the BIST 30 index and the sub-sector indices according to the sectors of the companies are effective on the returns of the stocks.

Albeni and Demir (2005) tested the financial index and the macroeconomic factors affecting the stock prices in

this index with the Least Squares Method, using time series data for the period 1991-2000. German Mark, Portfolio Investments, Republic Gold and Deposit Interest Rates variables were found as macroeconomic factors affecting stocks. They claimed that these factors affect the financial index by 88%, while the remaining 12% are affected by political, psychological, or non-market factors.

Yılmaz, Güngör and Kaya (2006) used monthly data on the relationship between stock prices and macroeconomic variables for the period 1990:01-2003:12. According to the variance decomposition results obtained from the Least Squares Estimation Method, Johansen-Juselius Cointegration Test, Granger Causality Test and VEC model; It was concluded that the Exchange Index, Interest rate (IR), Foreign Trade Balance (FTB), Consumer Price Index (TUFİ), M1 Currency, Exchange Rate (ER) and Industrial Production Index (İPI) variables affected.

Demir and Yağcılar (2009) examined the relationship between the monthly returns of 13 banks traded in the İSE between 2000 and 2006 and the macroeconomic variables affecting these returns, by using the cross-sectional regression method based on the Arbitrage Pricing Model. It was concluded that it is possible to analyze the macroeconomic variables that affect the returns of the banks with the Arbitrage pricing model.

Gençtürk (2009) interpreted the macroeconomic factors affecting the İSE-100 index between the years 1992-2006 using the multiple linear regression method. A negative relationship was found between the Consumer Price Index (TUFİ) and the İSE-100 index during the crisis periods. In non-crisis periods, a negative relationship was found between the US Dollar, Treasury Bill Interest Rate (TBİR) and İSE-100 index, and a positive and statistically significant relationship between İSE-100 index and money supply (M2).

Cihangir and Kandemir (2010) used monthly data in their study in which they tested the validity of the AFT model and the macroeconomic factors affecting the returns of the stocks of 16 companies that are constantly in the BİST 30 index between 1999-2002 according to the Arbitrage Pricing Theory. They concluded that the Consumer Price Index (TUFİ) variable, which is one of the macroeconomic factors, affects the returns of all companies' stocks.

Özer, Kaya and Özer (2011) used monthly data for the period January 1996-December 2009 to examine the relationship between the BİST 100 Index and some macroeconomic variables using the Least Squares Method, Johansen-Juselius Cointegration Test, Granger Causality Test and VEC models. A long-term significant relationship was found between the BİST 100 Index and some macroeconomic variables (Industrial Production Index, Exchange Rate, Consumer Price Index, Gold, Interest, Foreign Trade Balance).

Sayılğan and Süslü (2011) examined the macroeconomic factors affecting stock returns in developing countries between the years 1999-2006 using panel data analysis method. It was concluded that stock returns are affected by exchange rate, inflation, and S&P 500 index, but not by GDP, money supply, oil prices and interest rate.

Albayrak, Öztürk and Tüylüoğlu (2012), using the weekly data for the period 07.01.2005-03.02.2012, the relationship between stocks and capital movements and macroeconomic variables was analyzed with Prais-Winston Regression analysis. They concluded that the US Dollar exchange rate, gold prices, Foreign Portfolio investments have a clear and significant effect on the BİST 100 Index.

Günay (2012), using the monthly data of the 2000-2008 period, examined the sensitivities of 4 different portfolios and BİST 30 Index to domestic and foreign macroeconomic factors, using the stocks included in the BİST 100 Index, with multiple linear regression and factor analysis, and tested the validity of Arbitrage Pricing Theory for Borsa İstanbul. It was concluded that the Arbitrage Pricing Theory is valid in Borsa İstanbul for the period examined and the data set used.

Aktaş and Akdağ (2013), using the monthly data between 2008 and 2012, representing the stock, the macroeconomic factors affecting the BİST 100 index with multiple regression and Granger causality analysis. According to the findings of the study, it has been determined that consumer price index, deposit interest rate, capacity utilization rate, dollar rate, and consumer confidence index have a significant effect on BİST 100. It has been determined that there is a mutual interaction between the capacity utilization rate and the BİST 100 index.

Kaya, Çömlekçi and Kara (2013) examined the relationship between the BİST 100 Index and macroeconomic variables using the Least Squares Estimation method in their study covering the period from January 2002 to

June 2012. It has been determined that there is a negative relationship between stock returns and exchange rate and a positive relationship between stock returns and money supply (m2).

Karcioğlu and Özer (2014), in their study conducted with quarterly data for the years 2002-2011, discussed the internal and external factors affecting stock returns with panel data analysis. Significant relationships were found between Acid-test ratio, size, beta, current ratio, gross margin, economic value added, intellectual value added, earnings/price ratio, cash flows, debt/equity, exchange rate, interest rate, internationalization and money supply variables.

Sevinç (2014), using monthly data from January 2003 to March 2013, returns on stocks traded in the BIST 30 Index and macroeconomic variables examined whether the relationship between Arbitrage Pricing Theory can be determined. According to the findings of the study, it has been determined that the effect of macroeconomic variables on stock returns is significant and can be determined by Arbitrage Pricing Model.

Altınbaş, Kutay and Akkaya (2015) analyzed the macroeconomic factors affecting the BIST 100 index with a data set consisting of monthly data between January 2003 and July 2012, using Multiple regression, Johansen cointegration test, vector error correction model and Granger causality test. The exchange rate variable explained the BIST 100 index in a statistically significant way. It was determined that while the foreign exchange, interest and industrial production index variables were the Granger cause of the BIST 100 variable, the BIST 100 index variable was only the Granger cause of the Oil variable.

Çetin and Bitrak (2015) analyzed the relationship between BIST 100 Index and various macroeconomic variables on the axis of Arbitrage Pricing Theory, using monthly data for the period of January 2000 - December 2009. The least squares method was used in the study, and it was determined that the stock returns were negatively affected by gold prices and savings deposit interests, and positively affected by the broad-defined money supply (m2) and the manufacturing industry capacity utilization rate.

Şenol, Koç and Şenol (2018), using quarterly data between 2010Q1 - 2017Q1; The macroeconomic and company-specific factors affecting the returns of companies operating in the metal goods, machinery and equipment maintenance sector operating in Borsa Istanbul (BIST) were analyzed by dynamic panel data analysis method.

Using the data between December 2007 and September 2017, Topaloğlu and Karakozak (2018) investigated the relationship between the returns of stocks in the Borsa Istanbul Bank Index and macroeconomic factors using panel data analysis. According to the findings of the study, a negative relationship was found between stock returns and money supply, interest rate and exchange rate, while there was no relationship between gold price and inflation rate and stock returns.

Using the monthly data of February 2010 - September 2017 Atıcı, Demir and Ural (2019), analyzed the share returns of 28 companies in the BIST 30 Index and 8 macroeconomic variables using the Arbitrage Pricing Model with multiple regression method. They concluded that the returns of stocks are sensitive to inflation and lag values of stocks.

Durmuş, Yılmaz and Şahin (2019), in the study conducted with monthly data between the periods 2006:5 - 2018:10, the macroeconomic factors explaining the returns of BIST Bank and BIST Financial index were examined with the VAR method. It was stated that the gold prices and Euro exchange rate variables explained the BIST Bank and BIST Financial index returns the most, and the inflation rate variable the least.

When the studies are examined, it is understood that macroeconomic factors such as inflation and interest rates affect the returns of capital markets negatively, while macroeconomic factors such as money supply and GDP growth rate affect the returns of capital markets positively. In this study, rather than which of the factors affecting the capital market determine which direction, it is to reveal which of the macroeconomic factors affecting the capital market is the cause of the return of the capital market and to reveal the direction of the causality relationship between these variables. Thus, it is aimed to contribute to the literature by determining which independent variable is affected by the lagged values of the BIST 100 index dependent variable.

### 3. IMPLEMENTATION

#### 3.1. Data Set and Variables

This study, which examines the macroeconomic factors affecting the capital market, covers the years 2010-2019. Monthly data were used in the study since the publication dates of macroeconomic factors are different. The data of the variables used in the study were obtained from the Central Bank of the Republic of Turkey Electronic Data Delivery System (TCMB EDDS) and the Turkish Statistical Institute (TUIK). The variables used in the study and their abbreviations are shown in Table 1.

**Table 1. Variables and Abbreviations**

Variable Name	Abbreviation of Variable
Return of Borsa Istanbul 100 Index (Dependent Variable)	BIST 100
Change in Brent Oil Price	BRENT
Current Account Balance/GDP	CA
Budget Balance/GDP	DBUDGET
Change in Euro-US Dollar Currency Basket	FX
Change in Ounce Price of Gold	ONS
Change in Consumer Price Index	CPI

#### 3.2. Stabilization of Data

The data to be used in models to be created in time series should not contain unit roots, that is, they should be stationary. If the data contains a unit root, it causes a spurious regression problem in the model created. The fact that the model has spurious regression causes it to appear as if there is a relationship that does not exist. For this reason, unit root test should be applied to the variables and all the data should be made stationary by taking their level values or differences.

The unit root test results of the dependent and independent variables to be used in the study are shown in Table 2.

**Table 2. Unit Root Test Results**

-No	Variable Name	Abbreviation	ADF	Grade
1	Return of Borsa Istanbul 100 Index	BIST 100	-11.62650	I(0)
2	Change in Brent Oil Price	BRENT	-9.541289	I(0)
3	Current Account Balance/GDP	CA	-3.613518	I(0)
4	Budget Balance/GDP	DBUDGET	-9.093859	I(1)
5	Change in Euro-US Dollar Currency Basket	FX	-8.278448	I(0)
6	Change in Ounce Price of Gold	ONS	-8.120218	I(0)
7	Change in Consumer Price Index	CPI	-6.120400	I(0)

When the results in Table 2 are examined, it is observed that the variables except the Budget Balance/GDP variable are stationary in their level values, that is, they do not contain unit roots. The Budget Balance/GDP variable is made stationary by taking the first-degree difference.



### 3.3. Method and Methodology

Single equation models are insufficient to explain some events in finance studies. Because there can be a multifaceted and complex relationship between the variables. In such cases, mostly Vector Autoregressive Model (VAR) models developed by Sims (1980) are used.

In order to apply the VAR model;

- Selection of variables, determination of their properties, ordering,
- Ensuring the stationarity condition,
- Determination of lag lengths,
- Impact-response analysis and variance decomposition analyzes need to be done and interpreted.

After analysis of variance, the "Causality" test was developed by Granger (1969) to determine the direction of causality in the presence of a time-delayed relationship between two variables that are thought to be related.<sup>1</sup>

### 3.4. Findings

To create the VAR model, after determining the dependent and independent variables and providing the stationarity condition of the variables, the optimal lag length for the VAR model should be determined. Optimal lag length results are shown in table 3.

**Table 3. Optimal Lag Length Results**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1611.60	NA	2.22e-22	-29.99	-29.82	-29.92
1	1760.90	276.28	3.42e-23	-31.87	-30.47*	-31.30*
2	1824.55	109.46	2.63e-23*	-32.14*	-29.52	-31.08
3	1869.54	71.46	2.91e-23	-32.07	-28.22	-30.51
4	1903.43	49.12	4.09e-23	-31.78	-26.71	-29.73

\*indicates lag order selected by the criterion

LR: Sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

When the test results in Table 3 are examined, the most verified lag length by the information criteria (LR, FPE, AIC, SC, and HQ) is determined as the optimal lag length. Considering the test results, although the number of verifications for 1 and 2 lag lengths is the same, since the Schwarz information criterion is used in the unit root tests, the 1 lag length verified by the SC (Schwarz Criteria) is accepted as the optimal lag length.

After determining the optimal lag length, it is necessary to determine whether the variables in the model are internal or external. The Block Exogeneity Wald Test results of the model are shown in table 4.

**Table 4. VAR Granger Causality / Block Exogeneity Wald Test**

<i>Dependent variable: BIST100</i>			
Excluded	Chi-sq	df	Prob.
BRENT	2.6156	2	0.2704
CA	5.7468	2	0.0565
DBUDGET	3.1796	2	0.2040
FX	2.6528	2	0.2654
<b>ONS</b>	<b>13.1687</b>	<b>2</b>	<b>0.0014***</b>
TUFE	0.5160	2	0.7726
All	25.5159	12	0.0126

\*\*\* %1 prob.

<sup>1</sup> For details, see Sarıkovanlık et al. (2019). *Econometrics Applications in Finance*, p.113

According to the test results in table 4, it shows that the Change in Gold Prices (ONS) variable is exogenous (Prob.  $0.0014 < 0.05$ ), other variables are not exogenous (Prob.,  $> 0.05$ ). In other words, it is understood that the lagged values of the variables other than the ONS variable do not have a significant effect on the BIST 100 variable.

In the next step, the effect of a shock on the BIST 100 variable in the ONS variable should be examined. The results of the action-reaction analysis between the BIST 100 variable and the ONS Variable are shown in Figure 1.

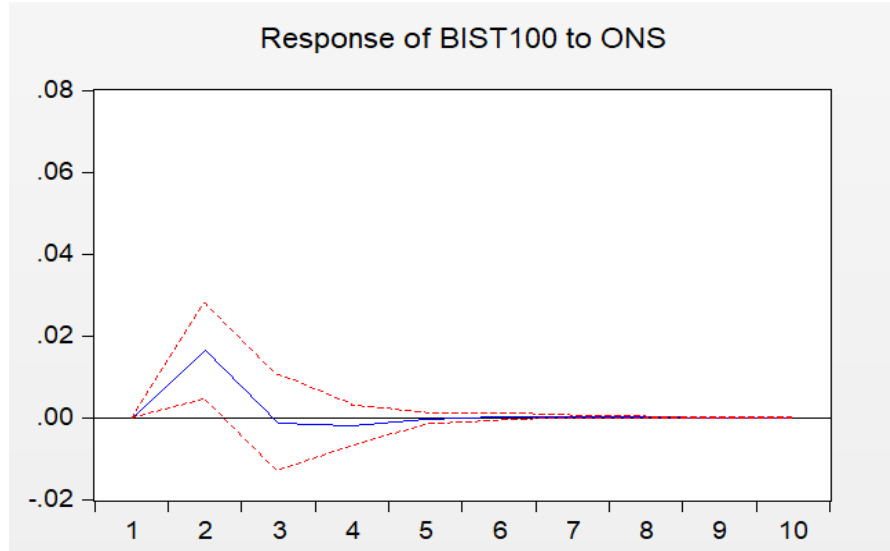


Figure 1. Action-Reaction Analysis Results

According to the graph in Figure 1, a shock in the ONS variable positively affected the BIST 100 variable until the middle of the 2nd month, then gradually decreased and disappeared completely from the 5th month.

After examining the action-reaction analysis results, Table 5 shows how much of the variance of the BIST 100 variable is explained by itself and how much is explained by the ONS variable.

Table 5. Variance Decomposition Results

Variance Period	S.E	BIST100	ONS
1	0.060594	100.0000	0.0000
2	0.062863	93.31095	6.689050
3	0.062907	93.27915	6.720855
4	0.062941	93.18441	6.815586
5	0.062942	93.18019	6.819812
6	0.062943	93.17990	6.820098
7	0.062943	93.17973	6.820273
8	0.062943	93.17972	6.820277
9	0.062943	93.17972	6.820278
10	0.062943	93.17972	6.820278

When Table 5 is examined, it is observed that the variance of the BIST 100 variable is explained by itself in the first period and 6% by the ONS variable in the second period.

After the VAR analysis, the Granger causality test was preferred to observe the short-term relationship between the variables. Granger causality Test results are shown in table 6.

**Table 6. Granger Causality Test Results**

Null Hypothesis	Obs	F-Statistic	Prob.
BRENT does not Granger Cause BIST100 BIST100 does not Granger Cause BRENT	115	0.88057 0.62571	0.3501 0.4306
CA does not Granger Cause BIST100 BIST100 does not Granger Cause CA	115	0.49666 1.18193	0.4824 0.2793
DBUDGET does not Granger Cause BIST100 BIST100 does not Granger Cause DBUDGET	114	2.64168 5.1741	0.1069 0.0248**
FX does not Granger Cause BIST100 BIST100 does not Granger Cause FX	115	8.9E-05 6.90217	0.9925 0.0098
ONS does not Granger Cause BIST100 BIST100 does not Granger Cause ONS	115	6.62123 0.15744	0.0114** 0.6923
TUFE does not Granger Cause BIST100 BIST100 does not Granger Cause TUFE	115	1.30170 0.10541	0.2563 0.7460

\*\* %5 prob.

When the test results in Table 6 are examined, it is understood that the ONS variable is the cause of the BIST 100 variable. That is, the delay values of the ONS variable explain the change in the BIST 100 variable. There is a unidirectional Granger causality from the ounce variable to the BIST 100 variable. In this case, the changes in the ONS variable are effective on the BIST 100 variable.

## CONCLUSION

Capital markets are important markets that show the economic development of a country. The effectiveness of capital markets is extremely important both in terms of investors' evaluation of their savings and meeting the fund needs of companies. The efficiency and high liquidity of these markets is accepted as an important indicator for the development of the economy of that country. There are many important factors that affect capital markets. Some of these factors are country specific and some are international. Some of the factors that are thought to affect the capital markets are the state of the real economy, foreign trade balance, portfolio investments, direct investments, oil prices, gold prices, exchange rates, interest rates, inflation rates, budget balance, etc. can be listed as. Some of these factors are country-specific factors, while others are macroeconomic factors. Therefore, the correct determination of these factors is very important for the development of the capital market. Countries with developed capital markets are both an important investment option for investors to evaluate their savings, and an important source of funds for companies to finance their new investments.

It is aimed to determine the macroeconomic factors affecting the return of the BIST 100 index, which is thought to represent the capital markets in our country, and to determine which of these factors is the Granger cause of the return of the BIST 100 index. In the study, the return of the BIST 100 index (BIST 100) was determined as the dependent variable, and the independent variables were the change in oil prices (BRENT), Current Account Balance/GDP (CA), Budget balance/GDP (DBUDGET), change in the Euro-US Currency Basket (FX), change in the ounce price of gold (ONS) has been determined as the change in the consumer price index (TUFE). Firstly, VAR analysis was performed and because of the VAR analysis, only the ONS variable was statistically significant among the variables affecting the BIST 100 variable. Then, when the results of the impact-response analysis between the BIST 100 index and the ONS variable are examined, a shock in the ONS variable affected the BIST 100 index positively until the 2nd month, and its effect lasted until the end of the 5th month and disappeared after the 5th month. In the next step, a VAR-based Granger causality test was performed between the BIST 100 dependent variable and the independent variables, and according to the test results, it was determined that the ONS variable was the Granger cause of the BIST 100 dependent variable. This means that the lagged values of the ONS variable explain the changes in the BIST 100 variable.

When the findings of the study are compared with the literature, studies are generally in the form of determining the macroeconomic factors that affect stock returns within the scope of arbitrage pricing theory. Tangjitprom (2012) Interest rates in Thailand stock market, Badullahewage (2018) Inflation and exchange rate in Sri Lanka stock market, Özer et al. (2011) Industrial Production Index, Exchange Rate, Consumer Price Index

in Turkish Stock Exchange. , Gold, Interest, Foreign Trade Balance, Aktaş and Akdağ (2013) determined the capacity utilization rate in Turkey, Altınbaş, Kutay and Akkaya (2015) determined that there are foreign exchange, interest and industrial production index variables in Turkey. When the obtained findings are compared with previous studies, it seems partially compatible with the results of Özer et al. (2011) study.

According to the findings, determining whether there is a long-term relationship between the gold prices, which is the Granger reason for the return of the BIST 100 index, and the capital market (representatively the return of the BIST 100 index) in Turkey will make an important contribution to the literature in terms of closely monitoring these two variables.

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