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# ASYMMETRIC CAUSALTY RELATIONSHIP BETWEEN ALTERNATIVE INVESTMENT INSTRUMENTS AND STOCK PRICES: THE TÜRKİYE SAMPLE[1]

# ALTERNATİF YATIRIM ARAÇLARI İLE HİSSE SENEDİ FİYATLARI ARASINDA ASİMETRİK NEDENSELLİK İLİŞKİSİ: TÜRKİYE ÖRNEĞİ

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## ABSTRACT

In economic theory, many economic and financial variables exhibit different behaviors. Therefore, nonlinear techniques can be used to accurately model the relationship between these variables. In the real world, people's responses to shocks also vary. Especially in financial markets, investors may differ from homogeneous behavior. That is, when a random shock occurs in financial markets, each investor may react differently. While some investors prefer to take risks by holding their positions, believing that shocks are temporary, others may be risk averse and change their positions immediately. This means that shocks can have different effects on the market. Therefore, positive and negative shocks may need to be analyzed separately. It may make more sense to use non-linear techniques to understand asymmetric effects. The aim of this study is to examine the relationship between stock prices and other investment instruments using the Hatemi-J (2012) asymmetric causality test for Türkiye using quarterly data for the period from 2003 to 2023. The results show that there is an asymmetric causality relationship between the variables.

## ÖZ

Ekonomi teorisinde, birçok ekonomik ve finansal değişkenlerin farklı davranışlar sergilediği görülmektedir. Bu nedenle, bu değişkenlerin birbirleri ile olan ilişkilerini doğru bir şekilde modellenmesinin yolu, doğrusal olmayan teknikler kullanılarak mümkün olabilir. Gerçek dünyada, yaşanılan şoklara insanların verdikleri tepkiler de çeşitlilik gösterir. Özellikle finansal piyasalarda, yatırımcılar homojen bir davranış göstermek yerine farklılık gösterebilir. Yani finansal piyasalarda rastgele bir şok olduğunda, her bir yatırımcı farklı tepkiler verebilir. Bazı yatırımcılar, şokların geçici olduğuna inanarak pozisyonlarını koruyarak risk almayı tercih ederken, bazıları riskten kaçınarak hemen pozisyonlarını değiştirebilir. Bu durum, şokların piyasaya farklı etkiler yapabileceği anlamına gelir. Bu sebeple, pozitif ve negatif şokların ayrı ayrı incelenmesi gerekebilir. Asimetrik etkileri anlamak için doğrusal olmayan teknikler kullanmak daha mantıklı olabilir. Bu çalışmanın amacı, Türkiye için 2003'ten 2023'e kadar olan döneme ait üç aylık verileri kullanarak, hisse senedi fiyatları ile diğer yatırım araçları arasındaki ilişkiyi Hatemi-J (2012) asimetrik nedensellik testiyle incelemektir. Elde edilen sonuçlar, değişkenler arasında asimetrik nedensellik ilişkisi olduğunu göstermiştir.

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[1] This study has been derived from the unpublished doctoral thesis titled "The Analysis of Relationship Between Alternative Financial Instruments and Stock Prices With The Nonlinear Cointegration Relationship: The Turkey Sample" prepared by Lütfü SİZER at Bursa Uludag University, social sciences institute, conducted under the supervision of Prof. Dr. Özer ARABACI.

## Introduction

Individual investors intend to invest using their savings. They desire to obtain maximum return from the investments they desire. One of the investment instruments that can provide the highest return is stocks for savers. When people cannot invest their savings individually, they may prefer stocks because they have the opportunity to invest in the stock market. With the end of the Second World War, the real estate market, which has been growing rapidly on a global scale since the 1950s, gained a global character by the 1990s (Karan, 2013). With this process, savers have had the opportunity to make real estate investments not only in their own countries but also all over the world. However, the high risk of investments in the stock market has led individual investors to various alternative investment instruments. Among the most important alternative investment instruments that individual investors may prefer are foreign exchange, gold and interest (Güngör & Polat, 2020).

Research indicates that traditional investment instruments generally have a negative impact on stocks. In this context, it may be important to understand the relationship between the exchange rate, interest rate and gold price used as alternative investment instruments and stock prices. This study focuses on one of the traditional investment instruments, the exchange rate, specifically the US dollar. The US dollar is traded not only as a currency but also as an investment instrument. If companies operating internationally have debts or receivables denominated in foreign currencies, the appreciation or depreciation of the national currency against the foreign currency can affect the profit or loss of companies. In addition, losses that may occur in the financing of companies due to exchange rate risk may have a negative impact on the value of the company (Boyacıoğlu and Çürük, 2016).

Precious metals are also available as alternative investment instruments to stocks. The most popular among precious metals for investors is gold. Although people generally use gold as a means of saving, it is still seen that it has not lost any value today due to the fact that it covers the characteristics of money over the years. Although the globalisation of financial markets or the diversification of investment instruments for investors has pushed gold to the background, it has not prevented it from being the most important investment instrument of less developed countries. However, gold is one of the most reliable investment instruments in times of war or crisis. Considering the studies investigating the relationship between stock prices and gold prices, especially in the USA and in our country, it is seen that there is an inverse relationship between stock prices and gold prices (Bekçioğlu, 1984).

Interest rate is an influential macroeconomic factor on stock prices and its important role in determining future cash flows is remarkable. An increase in interest rates causes investors to avoid equity investments by directing them to investment instruments such as bonds and treasury bills that provide fixed interest yields. This situation reduces the demand for stocks, leading to price declines and at the same time adversely affecting firms' production costs. For this reason, high interest rates may reduce the firm's profit margin and lead to a decline in its value. On the other hand, an increase in interest rates may be a favourable situation for depositors, but it increases the cost of borrowing, reduces the volume of investment and again leads to a decrease in stock prices. In this context, it is understood that there is a negative relationship between stock prices and interest rates (Alam and Uddin, 2009).

In recent years, up-to-date econometric methods have been developed for modeling and testing economic theories. By using these methods, more realistic results can be obtained.

In economic theory, it is observed that many economic and financial variables exhibit asymmetric behavior. Therefore, it is possible to accurately model the relationships between these variables using non-linear methods. In this context, people's reactions to shocks encountered in the real world are also different. Especially in financial markets, investors seem to exhibit a heterogeneous structure rather than a homogeneous structure. In other words, when a random shock occurs in financial markets, each investor reacts differently to this shock. This is because some investors believe that shocks are temporary and therefore maintain their positions by taking the risk, while others do not like risk and change their positions immediately. As a result, since the impact of shocks on the market will not be the same, shocks should be analyzed by dividing them into negative and positive shocks (Mert & Çağlar, 2019). For this reason, Hatemi-J (2012) asymmetric causality test, which takes into account the asymmetric effect between variables, is preferred in this study.

In the academic literature, there are many studies examining the relationship between stock prices and macroeconomic indicators. However, it is observed that there is limited research on how factors such as the

BIST 100 index, interest rates, exchange rates and gold prices are considered as investment instruments and the relationship between them. Therefore, this study focuses on determining the relationship between stock prices and other alternative investment instruments.

In the academic literature, there are many studies examining the relationship between stock prices and macroeconomic indicators. However, there is limited research on how factors such as BIST 100 index, interest rates, exchange rates and gold prices are evaluated as investment instruments and the relationship between them. Therefore, the aim of this study is to investigate the causality relationship between stock prices and other alternative investment instruments. In addition, unlike the symmetric causality tests used in previous studies, this study uses the Hatemi-J (2012) asymmetric causality test to explain the relationship between alternative investment instruments and stock prices. This approach seeks to offer a meaningful addition to the existing body of knowledge. Examining quarterly data from 2003Q1 to 2023Q3, this study endeavors to investigate the interplay among exchange rates, gold prices, interest rates, and stock prices in Turkey, employing the Hatemi-J (2012) asymmetric causality test.

In the second part of the study, a summary of the relevant literature is presented. Subsequently, a rundown of the techniques applied in the analysis ensues. The fourth segment delineates the data and the outcomes of its application, with the conclusion centering on interpreting the findings and suggesting policy directives.

## Literature Review

There are national and international studies investigating the relationship between alternative investment instruments and stock prices in the literature. In this context, when the literature is analyzed, it is seen that there are not many studies examining the relationship between alternative investment instruments (gold, dollar and interest rate) and stock prices. However, there are many studies that examine the effect of gold, dollar and interest rate separately on stock prices. Some of the studies examining this relationship are summarized below.

Levin et al. (2006) analyzed the relationship between gold prices and stock prices in the US for the period 1976-2005. According to the results, stocks and gold are complementary to each other in the US market.

Asmy et al. (2009), using monthly data for the period 1999:1-2007:1 for Malaysia, the short- and long-term causal relationship between the Kuala Lumpur Composite Index (KLCI) and selected macroeconomic variables such as inflation, money supply and nominal effective exchange rate were investigated. According to the results, a cointegration relationship was found between stock prices and macroeconomic variables. It is concluded that inflation, money supply and exchange rate significantly affect the KLCI.

Humpe and Macmillan (2009) analyzed the impact of inflation, industrial production, interest rates and money supply on stock prices using monthly data for the period 1965:1-2005:6 for the US and Japan. According to the results, industrial production index has a positive effect on stock prices in the US, while interest rates and inflation have a negative effect on stock prices. In Japan, industrial production has a positive effect on stock prices, while money supply has a negative effect on stock prices.

Balı and Cinel (2011) investigated the effect of gold prices on the ISE 100 Index using panel data analysis. According to the results obtained, gold prices do not have a direct effect on the ISE 100 Index, but it is a factor among the variables that explain the changes in the ISE 100 Index.

Kaya et al. (2013) investigated the relationship between some macroeconomic variables and the ISE 100 Index using monthly data of Türkiye for the period 2002:1-2012:6. Using the least squares estimation method, they found a positive relationship between stock returns and money supply and a negative relationship with exchange rate.

Yıldız (2014) investigated the relationship between the BIST 100 index and interest rate, exchange rate and gold variables to construct an efficient investment portfolio using monthly data for the period 2001:03 to 2013:06. No cointegration relationship was found between the variables. Therefore, Granger causality test, impulse-response analysis and variance decomposition analysis were applied. According to the results obtained, it is concluded that all variables can be used in portfolio diversification in the short run.

Altinbaş et al. (2015) analyzed the impact of exchange rate, interest rate, inflation, oil prices and industrial production index on the BIST100 Index using the Johansen cointegration test, VAR model and Granger causality test. As a result, exchange rate was determined as the only explanatory factor on the stock. It has been concluded that the industrial production index and exchange rate can be used to predict the changes in BIST100, but the reverse does not provide this.

Öncü et al. (2015) examined the relationship between stock index value, gold prices and exchange rate. They applied two-stage Engle-Granger cointegration and Granger causality analysis using daily data for the period January 2002-November 2013. According to the results, it has been determined that the real exchange rate and gold prices are the Granger cause of the BIST100 index. In addition, it was concluded that gold prices are the Granger cause of the real exchange rate.

Polat (2016) analyzed the impact of interest rates, exchange rates and gold prices on BIST 100 using monthly data for the period between January 2005 and March 2016. According to the results, the effect of all three alternative investment instruments on the stock is negative. However, the effect of gold prices was not statistically significant. In addition, the effect of interest rate on stocks was found to be less than that of exchange rate.

Cheah et al. (2017) analyzed the relationship between stock prices and exchange rates in Malaysia using monthly data for the period 1993:1-2015:12 using the non-linear ARDL method. The estimation results reveal that exchange rate movements have significant short-run and long-run effects on stock prices in Malaysia and that the stock market responds asymmetrically to currency appreciation and depreciation. That is, in the long run, changes in the Kuala Lumpur composite index respond only to RM depreciation. We also find that the relationship between stock prices and exchange rates is sensitive to observation periods and changes in exchange rate regimes.

Tiryaki et al. (2018) analyzed the impact of macroeconomic variables on stock returns using data for both the full period 1994:1-2017:5 and the sub-period 2002:1-2017:5 for Türkiye. For this purpose, they tested the relationship between BIST 100, industrial production index, money supply and real exchange rate for Türkiye using the non-linear ARDL method. According to the results, the effects of industrial production, money supply and real exchange rate on stock returns are asymmetric and the asymmetries are larger in the 2002-2017 sub-period than in the full sample period.

Chang and Rajput (2018) tested whether macroeconomic variables have a symmetric or asymmetric effect on the stock prices (SP) of the Karachi Stock Exchange 100 index in Pakistan. Taking monthly data for the period 2004:06-2016:06, they conducted the test using the linear and non-linear ARDL method for the full sample period as well as for the periods before and after the 2008 crisis. According to the results obtained, the relationship between macroeconomic variables and the SP is asymmetric in the short run, but when the whole period is selected, this effect is symmetric in the long run. However, when pre- and post-crisis periods are selected, this effect is also asymmetric in the long run; that is, positive and negative shocks in macroeconomic variables affect the SP differently.

Kassouri and Altintas (2019) applied the non-linear ARDL model, Engle-Granger, TAR and M-TAR asymmetric cointegration to the relationship between stock prices and exchange rate for Türkiye using monthly data for the period 01:2003-12:2018. According to the results, no long-run relationship was found between the variables in the linear ARDL model, while a cointegration relationship was found between the variables according to the non-linear ARDL model. According to the results of the frequency domain causality test, exchange rate, money supply, interest rates and industrial production have a significant predictive power for the estimated future value of stock prices.

Benli et al. (2019) analyzed the effects of consumer price index, industrial production index, money supply and exchange rate on stock prices using the non-linear ARDL method. According to the results obtained, it is determined that the exchange rate has an incomplete pass-through effect on stock prices both in the long run and in the short run, and an asymmetric effect in the short run in all sectors except information services.

Bhutto and Chang (2019) tested whether exchange rate changes have a symmetric or asymmetric effect on stock prices for China. They used both linear and nonlinear ARDL models for the full period 1995:1-2017:12 and for the periods before and after the 2008 crisis. According to the results, the exchange rate has an asymmetric effect

on stock prices in the long run only when the entire sample period is selected. Before the crisis, it was symmetrically affected both in the long and short run, while after the crisis, it was asymmetrically affected both in the long and short run.

Tursoy (2019) tested the relationship between stock prices and domestic interest rates using monthly data for Türkiye for the period 2001:1-2017:4 using the ARDL bounds test and Johansen Cointegration method. The test results show that both prices are dynamically significantly correlated with each other. The results of the cointegration equation show that both coefficients have an elasticity coefficient with a negative sign.

Sheikh et al. (2020) investigated whether the relationship between macroeconomic fluctuations and stock indices is symmetric or asymmetric in nature using monthly data for Pakistan for the period January 2004 to December 2018. A total of three different models are estimated, with separate models estimated for pre- and post-2008 crisis. The results show that in the long run and before the 2008 crisis, investors responded differently to gold and oil prices. In the long run and after the crisis, investors responded differently to all macroeconomic fluctuations. This implies that investors reacted differently to positive and negative shocks to gold prices, exchange rates and interest rates after the crisis. Another result is that after the global financial crisis, investors responded only to positive shocks in gold prices, interest rates and exchange rates in the long run.

Hashmi and Chang (2021) discussed the short- and long-term impact of macroeconomic variables on E7 stock indices for the rise, fall and normal states of stock markets. Therefore, both ARDL and quantitative ARDL (QARDL) models were used. According to the results of the ARDL model, it was found that foreign direct investment (FDI), trade balance and industrial production index (IPI) significantly affected the developing stock indices in the long term. Results based on the QARDL model show that the short-term effect of FDI, consumer price index, interest rate and exchange rate varies in the rise, fall and normal states of emerging stock markets, while the long-term effect varies for all macroeconomic variables except the industrial production index.

Yılmaz (2022) examined the causality relationship between stock prices, exchange rate and housing prices using data from Türkiye. Using monthly data for the period March 2013-January 2022, the causality relationship between BIST 100 index, BIST construction index, USD/TL exchange rate and housing price index is investigated. The relationship between these variables is analyzed using the Granger Causality test. According to the results, bidirectional causality was found between the BIST 100 index and the house price index, between the BIST construction index and the house price index, as well as between the USD exchange rate and the house price index. However, no causality relationship was found between the dollar exchange rate and the BIST 100 index, between the dollar exchange rate and the construction index and between the BIST 100 index and the construction index.

Ilkhan et al. (2022) investigated the correlation among gold prices, exchange rates, and the BIST 100 index in Turkey. They utilized monthly data spanning from May 1986 to October 2021 for this analysis. The Maki cointegration test (2012) was employed to establish the long-term relationship between the BIST 100 and exchange rate variables. The results of this test indicated the existence of a lasting relationship between the dollar and BIST 100 variables. Subsequently, the ARDL bounds test was utilized to assess cointegration between series with distinct stationarity levels. The outcomes of this test demonstrated a cointegration relationship between the exchange rate and the BIST 100. Consequently, it was deduced that an investor engaged in the Turkish markets would not achieve portfolio diversification by investing in these three assets – gold, dollar, and BIST 100 – as they tend to move in tandem over the long term, limiting the potential for risk reduction.

In Çığır's (2023) research, the objective is to identify the prevailing approach within Borsa Istanbul and to explore potential variations in approaches across sector indices. The analysis is conducted on monthly data spanning from January 2010 to December 2020, encompassing BIST-100, BIST Financial, BIST Industrial, BIST Services, and BIST Technology indices, in relation to the nominal USD/TL exchange rate. Various methods such as Granger causality, Johansen cointegration, CCR, DOLS, FMOLS, and DOLS were employed. The findings reveal a cointegration relationship between the USD/TL exchange rate and the five mentioned indices, indicating a unidirectional positive influence from the USD exchange rate to the BIST indices. Consequently, it is inferred that the Traditional Approach holds sway in Borsa Istanbul and its main sector indices.

A review of the related literature reveals that symmetric and asymmetric effects play an important role in understanding this relationship correctly. In this study, Hatemi-J (2012) causality analysis was conducted by taking asymmetric effects into account. This study differs from other studies in terms of the period analyzed and the econometric approach used.

## Econometric Methodology

Just as the concept of cointegration arises from the concept of spurious regression, the concept of causality arises from the concept of spurious correlation. The correlations obtained between many economic time series could not be interpreted in a meaningful way and it was concluded that spurious relationships were obtained. Granger (1969) clarified these spurious correlations with the concept of causality. If some of the information contained in one variable can be obtained from the past value of another variable, it means that there is a causal relationship between these two variables. In order to explain this issue, the concept of causality should be analyzed from two different aspects. The first one is the causality obtained with the help of VAR models. The second one is the causality obtained by cointegration equations. Until the work of Sims (1980), researchers had to decide which variable was endogenous and which variable was exogenous in causality relationships either by themselves or with the help of economic literature. This complexity on behalf of variables ended with the work of Sims (1980) with the acceptance of all variables as endogenous in a VAR system (Engle and Granger, 1987). With the error correction mechanism obtained from cointegration equations, short-run and long-run causality can be determined. If two variables have a cointegration relationship in the long run, there will be an error correction system that corrects imbalances in the short run. Based on this, Hatemi-J (2012) asymmetric causality analysis is analyzed for short-run causality (Mert and Çağlar, 2019).

To ensure the reliability of results in time series analysis, it is imperative to address the problem of spurious regression by assessing the stationarity of variables. Examining variable stationarity, including the presence of unit roots, serves as an important first step in exploring the interrelationships between variables. For this purpose, Augmented Dickey Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests are used to determine the stationarity level of the variables. In addition, in order to capture possible structural breaks in the variables, the stationarity level of the variables was determined by using the Lee-Strazcich (2003) (LS) unit root test, which takes into account two structural breaks (Polat, Alptürk and Gürsoy, 2021).

### Hatemi-J (2012) Asymmetric Causality Test

Causality analyses are widely used to test the validity of economic theories. Many causality tests have been developed since Granger (1969). After Sims (1980)'s VAR model, which has made significant contributions to this field, Toda and Yamamoto's (1995) bootstrap-enhanced causality approach and Hacker and Hatemi-J (2006) causality test are in the literature. However, Hatemi-J (2012) argues that people will react differently to shocks encountered in the real world. For example, it is observed that investors in financial markets exhibit a heterogeneous structure rather than a homogeneous structure. In other words, when a random shock occurs in financial markets, not all investors react to this shock in the same way. Because while some investors believe that shocks are temporary and maintain their positions by taking the risk, some investors do not like risk and change their positions immediately. As a result, Hatemi-J (2012) argues that the impact of shocks will not be the same on the market and should be analyzed by dividing shocks into positive and negative shocks. Causality tests such as Granger, VAR and Toda Yamamoto are based on the assumption that the effects of shocks will be the same. Moreover, another important feature of the Hatemi-J (2012) test is that critical values are obtained by bootstrap. In this test, even if the data set used in the analysis does not have a normal distribution, there is no distortion in the distribution of the test statistic. This is a very important assumption especially for researchers working with financial data. As numerous financial market variables deviate from normal distribution and exhibit time-varying volatility (Hatemi-J, 2012), this test relies on the concealed cointegration approach proposed by Granger and Yoon (2002), tailored for causality assessment.

To reveal the causality between two integrated series, assume that there are two series such as $y_{1t}$ and $y_{2t}$:

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i} \quad t = 1,2,\dots,T \tag{1}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i} \quad t = 1,2,\dots,T \tag{2}$$

Here, $y_{1,0}$ and $y_{2,0}$ denote the initial values. In addition, the error terms $\varepsilon_{1i}$ and $\varepsilon_{2i}$ are designated as white noise. Positive and negative shocks can be represented as follows:

$$\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0)\,, \varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0)\,, \varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0)\,, \varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0) \tag{3}$$

It is also denoted as $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$.

With the above information, the equations of $y_{1t}$ and $y_{2t}$ can be expressed as follows:

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad t = 1,2,\dots,T \tag{4}$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad t = 1,2,\dots,T \tag{5}$$

The cumulative form of the positive and negative compositions of each variable can be expressed as follows:

$$y_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+}\,, y_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}\,, y_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+}\,, y_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-} \tag{6}$$

Assume that the equation $y_t^{+} = y_{1t}^{+} + y_{2t}^{+}$ holds. The causality relationship between the variables $y_{1t}^{+}$ and $y_{2t}^{+}$ shown in equation (7) is obtained by testing the VAR(p) model with "p" lags as in equation (7) below.

$$y_t^{+} = \vartheta + \mathrm{A}_1 y_{t-1}^{+} + \cdots + \mathrm{A}_p y_{t-1}^{+} + u_t^{+} \tag{7}$$

In equation (7), $y_t^{+}$ is a vector of variables of dimension $2\times1$, $\vartheta$ is a vector of constants of dimension $2\times1$ and $u_t^{+}$ is a vector of error term of dimension $2\times1$. Note that the variables represented here are the cumulative sum of positive shocks. The $A_k$ matrix is a parameter matrix of $2\times2$ type for the kth order lag. In the Hatemi-J (2012) test, many different options are offered as information criteria. These are information criteria such as Akaike, Schwarz, Hannan-Quinn, Adjusted Akaike, HJC. Hatemi-J (2012) proposes the HJC information criterion in his study. Equation (8) below shows this information criterion.

$$HJC = \ln(|\,\widehat{\Omega_j}\,|) + \mathrm{j}\left(\frac{n^2 lnT + 2n^2 \ln(lnT)}{2T}\right) \; and \; j = 0,1,\dots,p \tag{8}$$

In equation (8), the coefficient $|\,\widehat{\Omega_j}\,|$ is the determinant of the variance-covariance matrix of the residuals in the VAR model obtained with lag length $j$, $n$ is the number of equations in the VAR model and $T$ is the number of observations. This information criterion was introduced to the literature in Hatemi-J (2003) (Hatemi-J, 2003). Moreover, Hatemi-J (2008a) conducted a simulation study for this information criterion. As a result, these information criteria provide robust results in ARCH models and also perform well when the VAR model is used for forecasting. After deciding on the optimal lag, we test the null hypothesis that "$y_t^{+}$ is not the Granger cause of the ith element of $y_{t-1}^{+}$". Moreover, this test uses the Wald test statistic with asymptotic $\chi^2$ distribution.

As mentioned before, this test is also used when the data are not normally distributed. To cope with this situation, bootstrap simulation technique is utilized (Hatemi-J, 2012).

## Data Set and Model

In this study on Türkiye, quarterly data for the period 2003:Q1- 2023:Q3 are used for the empirical analysis. Detailed information on the variables used in the analysis is presented in Table 1. The natural logarithms of the variables considered in the study were taken and included in the analysis. "EViews 12" and "GAUSS 6" package programs were used to perform the analysis in the applications.

**Table 1.** Information on the Variables Used in the Study

| Variables | Explanation | **Source** |
|---|---|---|
| BIST100 | Natural Logarithm of BIST 100 Index Closing Prices | "Central Bank of the Republic of Türkiye Electronic Data Distribution System (EVDS)" |
| USD | (USD) Natural Logarithm of USD (Bid Price) | |
| GOLD | Natural Logarithm of 1 Ounce Gold London Sales Price (USD/Ounce) | |
| INT | Natural Logarithm of Weighted Average Interest Rates on Bank Deposits (Stock, %)(Monthly) | |

After giving detailed information about the variables used in the model, information about the model structure to be used is given. The equation below shows the model used in the research:

$$BIST100 = f(USD, GOLD, INT) \quad (9)$$

The regression model where BIST100 is the dependent variable and GOLD, USD and INT are independent variables is given in equation (10).

$$BIST100_t = \beta_0 + \beta_1 GOLD_t + \beta_2 USD_t + \beta_3 INT_t + \varepsilon_t \quad (10)$$

## Descriptive Statistics

Table 2 presents descriptive statistics of the logarithmized exchange rate, gold prices, interest rates and BIST100 index variables used in the analysis. When the standard deviations of the variables are analyzed in Table 2, the volatility of the BIST100 index is higher than the volatility of exchange rates, gold prices and interest rates. The lowest volatility is observed in the interest rates series. The skewness value of all variables is close to zero, which is the skewness coefficient of a normal distribution. The BIST100 index and gold price series are left skewed, while the exchange rate and interest rates series are right skewed. When kurtosis values are compared according to the kurtosis coefficient of the normal distribution, which is 3, the kurtosis coefficient of the BIST100 and interest rates series is greater than 3, i.e. thick-tailed, while the kurtosis values of the exchange rate and gold prices series are less than 3, i.e. thin-tailed. Finally, the probability values of the Jarque-Bera test statistic indicate that all three series do not follow a normal distribution.

**Table 2.** Descriptive Statistics for Variables

| | BIST100 | USD | GOLD | INT |
|---|---|---|---|---|
| Mean | 6.528 | 1.021 | 6.974 | 2.603 |
| Maksimum | 8.921 | 3.284 | 7.138 | 3.865 |
| Minimum | 4.557 | 0.173 | 5.799 | 1.816 |
| Standard Deviation | 0.820 | 0.822 | 0.502 | 0.434 |
| Skewness | 0.383 | 1.099 | -0.911 | 0.512 |
| Kurtosis | 4.064 | 3.159 | 2.677 | 2.939 |
| Jarque-Bera | 5.950 | 16.804 | 11.850 | 3.649 |
| Probability | 0.051 | 0.000 | 0.002 | 0.161 |

## Empirical Findings

The research explores the asymmetric causality connection between stock prices and alternative investment instruments. Before delving into the causality link between the variables, it is essential to ascertain the stationarity status of each variable. To accomplish this, commonly utilized unit root tests such as ADF, PP, and KPSS were employed. Furthermore, the Lee-Strazcich (LS) unit root test was utilized to identify potential structural breaks within the variables. The outcomes of these unit root tests are presented in the subsequent tables.

**Table 3.** ADF Unit Root Test Results

| | Constant | | Constant and Trend | |
|---|---|---|---|---|
| **Variables** | **Test Statistic** | **5% Critical Value** | **Test Statistic** | **5% Critical Value** |
| BIST100 | 0.025 (0) | -2.897 | -1.201 (0) | -3.465 |
| USD | 4.395 (0) | -2.897 | 0.188 (0) | -3.465 |
| GOLD | -2.184 (0) | -2.897 | -1.540 (0) | -3.465 |
| INT | -2.153 (1) | -2.897 | -2.841 (1) | -3.466 |
| ΔBIST100 | -7.891** (0) | -2.897 | -7.877** (0) | -3.466 |
| ΔUSD | -6.560 ** (0) | -2.897 | -8.113** (0) | -3.466 |
| ΔGOLD | -7.222 ** (0) | -2.897 | -7.467** (0) | -3.466 |
| ΔINT | -5.904 ** (3) | -2.899 | -6.521 ** (3) | -3.468 |

Note: ** denotes statistical significance at a 5% confidence level. The values in parentheses indicate the lag length determined based on the AIC

**Table 4.** PP Unit Root Test Results

| | Constant | | Constant and Trend | |
|---|---|---|---|---|
| **Variables** | **Test Statistic** | **5% Critical Value** | **Test Statistic** | **5% Critical Value** |
| BIST100 | -1.124 (3) | -2.897 | -1.722 (4) | -3.465 |
| USD | 2.863 (5) | -2.897 | 0.952 (8) | -3.465 |
| GOLD | -2.088 (2) | -2.897 | -1.598 (1) | -3.465 |
| INT | -2.766 (3) | -2.897 | -2.240 (2) | -3.465 |
| ΔBIST100 | -7.867** (2) | -2.897 | -7.849** (2) | -3.466 |
| ΔUSD | -6.507 ** (1) | -2. 897 | -8.219 ** (8) | -3.466 |
| ΔGOLD | -7.209** (3) | -2. 897 | -7.442** (5) | -3.466 |
| ΔINT | -5.144 ** (1) | -2. 897 | -5.442** (2) | -3.466 |

Note: ** indicates significance at 5% significance level. The values in parentheses denote the appropriate Bandwidth lag length determined according to the Newey-West Bandwidth criteria.

**Table 5.** KPSS Unit Root Test Results

| | Constant | | Constant and Trend | |
|---|---|---|---|---|
| **Variables** | **Test Statistic** | **5% Critical Value** | **Test Statistic** | **5% Critical Value** |
| BIST100 | 1.185** (6) | 0.463 | 0.115** (6) | 0.146 |
| USD | 1.134** (6) | 0.463 | 0.315 ** (6) | 0.146 |
| GOLD | 1.001** (6) | 0.463 | 0.240** (6) | 0.146 |
| INT | 0.548** (6) | 0.463 | 0.295** (6) | 0.146 |
| ΔBIST100 | 0.204 (3) | 0.463 | 0.186 (3) | 0.146 |
| ΔUSD | 1.207 (3) | 0.463 | 0.093 (7) | 0.146 |
| ΔGOLD | 0.427 (0) | 0.463 | 0.110 (2) | 0.146 |
| ΔINT | 0.412 (3) | 0.463 | 0.037 (1) | 0.146 |

Note:** indicates significance at 5% significance level. The values in parentheses denote the appropriate Bandwidth lag length determined according to the Newey-West Bandwidth criteria.

**Table 6.** Lee-Strazcich Structural Break Unit Root Test Result

| **Variables** | **Models** | | **Test Statistic** | **Breaks Dates** | | **5% Critic value** | **Result** |
|---|---|---|---|---|---|---|---|
| BIST100 | AA | Level | -1.747 | 2006Q4 | 2020Q4 | -3.563 | I(1) |
| | | 1. Difference | -7.97** | 2004Q4 | 2005Q3 | -3.563 | |
| | CC | Level | -5.613 | 2006Q1 | 2020Q4 | -5.917 | I(1) |
| | | 1. Difference | -8.447** | 2004Q4 | 2005Q3 | -6.108 | |
| USD | AA | Level | -0.799 | 2005Q1 | 2021Q1 | -3.563 | I(1) |
| | | 1. Difference | -5.447** | 2004Q4 | 2005Q3 | -3.563 | |
| | CC | Level | -4.386 | 2012Q1 | 2020Q3 | -6.185 | I(1) |
| | | 1. Difference | -7.703** | 2004Q4 | 2005Q4 | -6.108 | |
| GOLD | AA | Level | -1.891 | 2008Q4 | 2016Q3 | -3.563 | I(1) |
| | | 1. Difference | -6.594** | 2004Q4 | 2005Q2 | -3.563 | |
| | CC | Level | -4.568 | 2011Q2 | 2015Q3 | -6.556 | I(1) |
| | | 1. Difference | -7.69** | 2008Q2 | 2013Q1 | -6.175 | |
| INT | AA | Level | -2.923 | 2009Q3 | 2019Q1 | -3.563 | I(1) |
| | | 1. Difference | -7.342** | 2018Q2 | 2019Q4 | -3.563 | |
| | CC | Level | -5.913 | 2012Q2 | 2019Q1 | -6.185 | I(1) |
| | | 1. Difference | -7.687** | 2017Q3 | 2018Q4 | -6.108 | |

Note:** indicates significance at 5% significance level.

Tables 3, 4 and 5 present the results of ADF, PP and KPSS unit root tests ignoring structural breaks. According to the results obtained, the null hypothesis is rejected at the 5% significance level since the t statistic values calculated in the ADF, PP and KPSS unit root tests for the BIST100 index, interest rates, exchange rate and gold price variables are greater than the critical table values in absolute value. In other words, these four variables are not stationary at level values. When we look at the results of the unit root test applied after taking the first differences of the series, it is observed that all series that are non-stationary at level become stationary after the differencing process.

Table 6 presents the results of the Lee-Strazcich unit root test considering two structural breaks. According to the findings, it is concluded that all variables contain unit root, that is, they are non-stationary at their level values when structural breaks are endogenously determined.

According to the results, both the conventional unit root tests and the unit root test with structural breaks yield similar results. In other words, all variables used in the model were found to be non-stationary at level values but stationary at the first order after the differencing process. After determining the stationarity level of the variables, the causality relationship between the variables can be examined.

## Hatemi-J (2012) Asymmetric Causality Test Results

Table 7 presents the results of the asymmetric causality test between the variables. As can be seen from Table 7, there is a causal relationship from positive shocks of stock prices to positive and negative shocks of gold prices and from negative shocks of stock prices to positive shocks of gold prices. There is a causality from positive shocks of gold prices to negative shocks of stock prices and from negative shocks of gold prices to positive shocks of stock prices. Moreover, no causality relationship was detected from positive and negative shocks of stock prices to positive and negative shocks of exchange rate. However, there is a causality relationship from positive shocks of exchange rate to negative shocks of stock prices and from negative shocks of exchange rate to negative shocks of stock prices. Finally, while a causality relationship was found from negative shocks of stocks to negative shocks of interest rates, an asymmetric causality relationship was found from positive shocks of interest rates to negative shocks of stock prices and from negative shocks of interest rates to both positive and negative shocks of stock prices.

**Table 7.** Hatemi-J (2012) Asymmetric Causality Test Results

| Null Hypothesis | Wald Test Statistic | p-value | Null Hypothesis | Wald Test Statistic | p-value |
|---|---|---|---|---|---|
| $BIST100^{+} \nRightarrow GOLD^{+}$ | 6.465 | 0.02 | $GOLD^{+} \nRightarrow BIST100^{+}$ | 0.645 | 0.44 |
| $BIST100^{+} \nRightarrow GOLD^{-}$ | 3.967 | 0.04 | $GOLD^{+} \nRightarrow BIST100^{-}$ | 6.219 | 0.02 |
| $BIST100^{-} \nRightarrow GOLD^{+}$ | 58.855 | 0.00 | $GOLD^{-} \nRightarrow BIST100^{+}$ | 9.058 | 0.03 |
| $BIST100^{-} \nRightarrow GOLD^{-}$ | 0.911 | 0.35 | $GOLD^{-} \nRightarrow BIST100^{-}$ | 0.410 | 0.38 |
| $BIST100^{+} \nRightarrow USD^{+}$ | 1.377 | 0.29 | $USD^{+} \nRightarrow BIST100^{+}$ | 0.009 | 0.84 |
| $BIST100^{+} \nRightarrow USD^{-}$ | 0.387 | 0.50 | $USD^{+} \nRightarrow BIST100^{-}$ | 6.227 | 0.01 |
| $BIST100^{-} \nRightarrow USD^{+}$ | 1.366 | 0.24 | $USD^{-} \nRightarrow BIST100^{+}$ | 6.299 | 0.01 |
| $BIST100^{-} \nRightarrow USD^{-}$ | 1.129 | 0.30 | $USD^{-} \nRightarrow BIST100^{-}$ | 0.062 | 0.80 |
| $BIST100^{+} \nRightarrow INT^{+}$ | 0.967 | 0.35 | $INT^{+} \nRightarrow BIST100^{+}$ | 1.212 | 0.32 |
| $BIST100^{+} \nRightarrow INT^{-}$ | 1.726 | 0.20 | $INT^{+} \nRightarrow BIST100^{-}$ | 9.728 | 0.04 |
| $BIST100^{-} \nRightarrow INT^{+}$ | 1.851 | 0.19 | $INT^{-} \nRightarrow BIST100^{+}$ | 4.636 | 0.06 |
| $BIST100^{-} \nRightarrow INT^{-}$ | 6.145 | 0.02 | $INT^{-} \nRightarrow BIST100^{-}$ | 19.963 | 0.00 |

Note: $\nRightarrow$ notation indicates the null hypothesis of no causality. When generating critical values, the bootstrap number was taken as 10,000.

## Conclusion

In recent years, up-to-date econometric methods have been developed for modeling and testing economic theories. By using these methods, more realistic results can be obtained by applying economic analyzes.

In economic theory, it is observed that many economic and financial variables exhibit asymmetric behavior. Therefore, it is possible to accurately model the relationships between these variables using non-linear methods. In this context, people's reactions to shocks encountered in the real world are also different. Especially in financial markets, investors seem to exhibit a heterogeneous structure rather than a homogeneous structure. In other words, when a random shock occurs in financial markets, each investor reacts differently to this shock. This is because some investors believe that shocks are temporary and therefore maintain their positions by taking the risk, while some investors do not like risk and change their positions immediately. As a result, since

the impact of shocks on the market will not be the same, shocks should be analyzed by dividing them into negative and positive shocks.

Share certificates, which represent the shareholding interest in the companies in which investors invest, can be classified in different ways in terms of the characteristics they contain. In terms of the rights they provide to their holders, shares can be classified as dividend rights, pre-emptive rights, the right to participate in management and voting rights, the right to share in liquidation and the right to obtain information. While share certificates provide certain rights to their holders, they also give various responsibilities. With the globalization of securities, determining the value of stocks has become more important. Therefore, different stock valuation methods have been developed. In addition, since stocks involve high risks, individual investors will want to identify the factors affecting stock prices. Among the factors affecting stock prices, alternative investment instruments attract the most attention. For this reason, individual investors prefer alternative investment instruments both to stay away from risks and to maximize their profits.

In this study, the relationship between alternative investment instruments and stock prices is analyzed. BIST100 index data representing stock prices and gold price, exchange rate and interest rate variables are used as alternative investment instruments. Quarterly data for the period 2003Q1-2023Q3 are used in the study.

In the application part of the study, firstly descriptive statistics of the variables are given and then Extended Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatowski-Phillips-Schmidt-Shin (KPSS) and Lee-Strazcich unit root tests are applied to determine whether the variables are stationary or not. According to the results of ADF, PP, KPSS and LS unit root tests, all four variables are non-stationary at their level values. However, according to the results of all four unit root tests applied after taking the first differences of the variables, the series are stationary at first differences. In other words, according to the unit root test results, BIST100, gold, dollar and interest rate variables are I(1).

According to the results of the asymmetric causality test, there is a causal relationship from positive shocks of stock prices to positive and negative shocks of gold prices and from negative shocks of stock prices to positive shocks of gold prices. There is a causality from positive shocks of gold prices to negative shocks of stock prices and from negative shocks of gold prices to positive shocks of stock prices. Moreover, no causality relationship was detected from positive and negative shocks of stock prices to positive and negative shocks of exchange rate. However, there is a causality relationship from positive shocks of exchange rate to negative shocks of stock prices and from negative shocks of exchange rate to negative shocks of stock prices. Finally, while a causality relationship was found from negative shocks of stocks to negative shocks of interest rates, an asymmetric causality relationship was found from positive shocks of interest rates to negative shocks of stock prices and from negative shocks of interest rates to both positive and negative shocks of stock prices. The results support those of Asmy et al. (2009), Öncü et al. (2015) and Temelli and Şahin (2019).

Considering the results, Altınbaş et al. (2015) emphasize the importance of using asymmetric causality tests rather than symmetric causality test results to explain the relationship between variables more accurately. This may offer a more original perspective to understand and interpret the complexity of relationships more effectively. When the results obtained are analyzed, it is found that interest rate, dollar exchange rate and gold investments are among the options that investors may consider as alternatives to the stock market index in portfolio diversification.

In addition, considering the relationship between the variables included in the analysis in this study, it is possible to conduct studies using different asymmetric cointegration and causality tests and different alternative investment instruments, and it is thought that this study will shed light on future studies.

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## GENİŞLETİLMİŞ ÖZET

Yatırımcıların yatırım yaptıkları şirketlerdeki ortaklık payını temsil eden hisse senetleri, içerdikleri özellikler bakımından farklı şekillerde sınıflandırılabilmektedir. Sahiplerine sağladıkları haklar açısından hisse senetleri; temettü hakkı, rüçhan hakkı, yönetime katılma ve oy hakkı, tasfiyede pay hakkı ve bilgi alma hakkı olarak sınıflandırılabilir. Hisse senetleri sahiplerine belirli haklar sağlarken aynı zamanda çeşitli sorumluluklar da yüklemektedir. Menkul kıymetlerin küreselleşmesi ile birlikte hisse senetlerinin değerinin belirlenmesi daha önemli hale gelmiştir. Bu nedenle farklı hisse senedi değerleme yöntemleri geliştirilmiştir. Ayrıca hisse senetleri yüksek risk içerdiğinden bireysel yatırımcılar hisse senedi fiyatlarını etkileyen faktörleri tespit etmek isteyeceklerdir. Hisse senedi fiyatlarını etkileyen faktörler arasında en çok alternatif yatırım araçları dikkat çekmektedir. Bu nedenle bireysel yatırımcılar hem risklerden uzak kalmak hem de karlarını maksimize etmek için alternatif yatırım araçlarını tercih etmektedirler.

Araştırmalar, geleneksel yatırım araçlarının genellikle hisse senetlerini olumsuz etkilediğini göstermektedir. Çalışmada, döviz kuru, özellikle ABD doları üzerinde odaklanarak, uluslararası şirketlerin döviz cinsinden finansmanındaki riskin şirket değerine etkisi incelenmiştir. Kıymetli madenlerden özellikle altın, hisse senetlerine alternatif bir yatırım aracı olarak popülerliğini korumaktadır, özellikle kriz dönemlerinde güvenilir bir liman olarak tercih edilmektedir. Hisse senedi fiyatları ile altın fiyatları arasında genellikle ters yönlü bir ilişki gözlemlenmiştir. Faiz oranları, hisse senedi fiyatları üzerinde etkili bir faktördür. Faiz oranlarındaki artış, yatırımcıları sabit getirili araçlara yönlendirerek hisse senedi talebini azaltabilir, bu da fiyat düşüşlerine neden olabilir. Yüksek faiz, firmaların kar marjını düşürebilir ve değerini azaltabilir. Öte yandan, faiz oranlarının yükselmesi mevduat sahipleri için olumlu olabilir, ancak aynı zamanda borçlanma maliyetini artırarak hisse senedi fiyatlarını düşürebilir. Bu nedenle, hisse senedi fiyatları ile faiz oranları arasında negatif bir ilişki bulunmaktadır.

Ekonomik teori bağlamında, birçok ekonomik ve finansal değişkenin asimetrik davranışlar sergilediği gözlemlenmektedir. Bu nedenle, bu değişkenler arasındaki ilişkilerin doğru bir şekilde modellenmesi için doğrusal olmayan yöntemlerin kullanılması mümkündür. Bu bağlamda, bireylerin gerçek dünyadaki şoklara verdikleri tepkiler de çeşitlilik göstermektedir. Özellikle finansal piyasalarda, yatırımcıların homojen bir yapı yerine heterojen bir yapı sergiledikleri gözlemlenmektedir. Başka bir deyişle, finansal piyasalarda rastgele bir şok meydana geldiğinde, her bir yatırımcı bu olaya farklı bir tepki vermektedir. Bu durum, bazı yatırımcıların şokların geçici olduğuna inanarak risk almayı tercih edip pozisyonlarını korurken, bazılarının ise riskten kaçınıp hemen pozisyonlarını değiştirmelerinden kaynaklanmaktadır. Sonuç olarak, şokların piyasa üzerindeki etkisi homojen olmadığından, bu şokları negatif ve pozitif şoklar olarak ayırmak ve analiz etmek gerekmektedir.

Hatemi-J (2012) şokların etkisinin piyasa üzerinde aynı olmayacağını ve şokların pozitif ve negatif olarak bölünerek analiz edilmesi gerektiğini belirtmektedir. Granger, VAR ve Toda Yamamoto gibi nedensellik testleri şokların etkilerinin aynı olacağı varsayımından hareket etmektedir. Ayrıca, Hatemi-J (2012) testinin bir önemli özelliği de bootstrap ile kritik değerlerin elde ediliyor olmasıdır. Bu testte, analizde kullanılan veri seti normal dağılıma sahip olmasa bile test istatistiğinin dağılımında herhangi bir bozulma meydana gelmemektedir. Bu durum özellikle finansal verilerle çalışan araştırmacılar için oldukça önemli bir varsayımdır. Çünkü birçok finansal piyasa değişkenleri normal dağılım özelliği göstermemekte ve oynaklığı zamana göre değişmektedir (Hatemi-J, 2012). Bu test Granger ve Yoon (2002) saklı eşbütünleşme yaklaşımından yola çıkmış ve nedenselliğe uyarlanmıştır.

Bu çalışmada alternatif yatırım araçları ile hisse senedi fiyatları arasındaki ilişki analiz edilmiştir. Hisse senedi fiyatlarını temsilen BIST100 endeksi verileri, alternatif yatırım aracı olarak ise altın fiyatı, döviz kuru ve faiz oranı değişkenleri kullanılmıştır. Çalışmada 2003Q1-2023Q3 dönemine ait üçer aylık veriler kullanılmıştır. Çalışmanın uygulama kısmında öncelikle değişkenlerin tanımlayıcı istatistiklerine yer verilmiş, ardından değişkenlerin durağan olup olmadıklarını belirlemek için Genişletilmiş Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatowski-Phillips-Schmidt-Shin (KPSS) ve Lee-Strazcich birim kök testleri uygulanmıştır. ADF, PP, KPSS ve LS birim kök testlerinin sonuçlarına göre dört değişken de düzey değerlerinde durağan değildir. Ancak değişkenlerin birinci farkları alındıktan sonra uygulanan dört birim kök testinin sonuçlarına göre seriler birinci farklarında durağan hale gelmiştir. Diğer bir deyişle, birim kök testi sonuçlarına göre BIST100, altın, dolar ve faiz oranı değişkenleri I(1)'dir.

Asimetrik nedensellik testi sonuçları, hisse senedi fiyatlarındaki pozitif şoklardan altın fiyatlarındaki hem pozitif hem de negatif şoklara doğru bir nedensellik ilişkisi olduğunu gösteriyor. Aynı şekilde, altın fiyatlarındaki pozitif şoklardan hisse senedi fiyatlarındaki negatif şoklara ve altın fiyatlarındaki negatif şoklardan hisse senedi fiyatlarındaki pozitif şoklara bir nedensellik ilişkisi bulunmuştur. Öte yandan, hisse senedi fiyatlarındaki pozitif ve negatif şoklardan döviz kuru üzerinde herhangi bir nedensellik ilişkisi belirlenememiştir. Ancak, döviz kuru üzerindeki pozitif şoklardan hisse senedi fiyatlarındaki negatif şoklara ve döviz kuru üzerindeki negatif şoklardan hisse senedi fiyatlarındaki negatif şoklara doğru bir nedensellik ilişkisi gözlemlenmiştir. Sonuçlar ayrıca, hisse senedi fiyatlarındaki pozitif ve negatif şoklardan faiz oranlarındaki negatif şoklara bir nedensellik ilişkisi ortaya koyarken, faiz oranlarındaki pozitif şoklardan hisse senedi fiyatlarındaki hem pozitif hem de negatif şoklara doğru asimetrik bir nedensellik ilişkisi bulunduğunu göstermektedir. Bu bulgular, Asmy ve diğerleri (2009), Öncü ve diğerleri (2015) ile Temelli ve Şahin'in (2019) çalışmalarını desteklemektedir. Elde edilen sonuçlara bakıldığında yatırımcıların portföy çeşitlendirmesinde borsa endeksine alternatif olarak düşünebilecekleri seçenekler arasında faiz oranı, dolar kuru ve altın gibi yatırımların olduğu konusunda bir bulguya işaret etmektedir.

Ayrıca bu çalışmada analize dahil edilen değişkenler arasındaki ilişki dikkate alınarak farklı asimetrik eşbütünleşme ve nedensellik testleri ile farklı alternatif yatırım araçlarının kullanılacağı çalışmalar yapmak mümkün olup, bu çalışmanın gelecekte yapılacak olan çalışmalara ışık tutacağı düşünülmektedir.