ANADOLU ÜNİVERSİTESİ

THE IMPACT OF MACROECONOMIC VARIABLES ON STOCK MARKET INDICES: EVIDENCE FROM BIST-100 INDEX

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JÜRİ VE ENSTİTÜ ONAY SAYFASI

ABSTRACT

The Impacts of Macroeconomic Variables on Stock Market Indices: Evidence from BIST-100 Index

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Each individual's investment orientation is different from the past to the present. While some investors turn to real estate, which we call the risk-free group, some investors turn to risk-bearing tools. The most important of these groups is stocks. Although it contains risks, it is preferred by almost everyone. The popularity of this much has created the securities exchanges. The mentioned exchanges are available in every country and open to people in different ways. The Istanbul stock exchange (Borsa Istanbul) stood in Istanbul in Turkey. The most well-known index of the mentioned stock exchange is the BIST-100 index, and many macroeconomic variables affect the returns of this index.

In this context, this study aims is to determine the impacts of macroeconomic variables on the BIST-100 index. The variables used in this study are the exchange rate of TL / USD and TL / Euro, inflation rate, interest rate, money supply, gold price, and geopolitical risk. The data is analyzed by using the VAR model based on monthly data between 01.07.2014 and 01.01.2021. According to the Granger causality test results, there is causality from BIST-100 index to the exchange rate of USD and from money supply to BIST-100 index. On the other hand, the impulse response test also provides a negative bidirectional relationship between the BIST-100 index and the exchange rate of TL/USD. Therefore, different relations between the BIST-100 index and the variables have been determined.

Keywords: BIST-100 Index, VAR model, Macroeconomic variables, Granger causality test

ÖZET

Makro Ekeonomik Değişkenlerin Menkul Kıymet Borsas Endekslerine Etkisi: BİST-100 Örneği

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Geçmişten günümüze her bireyin yatırım yönelimli farklıdır. Kimi yatırımcı risksiz grup olarak adlandırdığımız gayrimenkule yönelirken kimi yatırımcı da risk barındıran araçlara yönelmektedir. Bunların başında hisse senetleri gelmektedir. Risk barındırmasına rağmen hemen hemen herkes tarafından tercih edilmektedir. Bu kadar çok revaçta olması menkul kıymet borsalarını oluşturmuştur. Söz konusu borsalar her ülkede mevcuttur ve farklı ülkedeki insanlara açıktır. Türkiye'deki menkul kıymet borsası ise Borsa İstanbul'dur. Konusu geçen borsada en bilinen endeks BİST-100 endeksidir ve bu endeks getirilerini etkileyen bir çok makroekonomik değişken bulunmaktadır.

Bu bağlamda, çalışmanın amacı makroekonomik değişkenlerin BIST-100 endeksi üzerindeki etkilerinin belirlenmesidir. Bu çalışmada kullanılan değişkenler TL / USD ve TL / Euro kurları, enflasyon oranı, faiz oranı, para arzı, altın fiyatı ve jeopolitik risktir. Veriler 01.07.2014 ile 01.01.2021 arası aylık verilere dayalı olarak VAR modeli kullanılarak analiz edilmektedir. Granger nedensellik testi sonuçlarına göre BIST-100 endeksinden TL/USD kuruna ve ayrıca para arzından BIST-100 endeksine bir nedensellik bulunmaktadir. Öte yandan, Etki tepki testine göre, BIST-100 endeksi ile TL/USD kur arasında çift yönlü negatif bir ilişki sağlanmaktadır. Bu nedenle BIST-100 endeksi ile değişkenler arasında farklı ilişkiler belirlenmiştir.

Anahtar kelimeler: BİST-100 Endeksi, VAR modeli, Makroekonomik değişkenler, Granger nedenselik testi

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ETİK İLKE VE KURALLARA UYGUNLUK BEYANNAMESİ

Bu tezin bana ait, özgün bir çalışma olduğunu; çalışmamın hazırlık, veri toplama, analiz ve bilgilerin sunumu olmak üzere tüm aşamalarında bilimsel etik ilke ve kurallara uygun davrandığımı; bu çalışma kapsamında elde edilen tüm veri ve bilgiler için kaynak gösterdiğimi ve bu kaynaklara kaynakçada yer verdiğimi; bu çalışmanın Anadolu Üniversitesi tarafından kullanılan "bilimsel intihal tespit programı"yla tarandığını ve hiçbir şekilde "intihal içermediğini" beyan ederim. Herhangi bir zamanda, çalışmamla ilgili yaptığım bu beyana aykırı bir durumun saptanması durumunda, ortaya çıkacak tüm ahlaki ve hukuki sonuçları kabul ettiğimi bildiririm.

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- **Bist-100** : **Borsa Istanbul national index**
- **ISE** : **Istanbul Stock Exchange**
- **CPI** : **Consumer Price Index**
- **USD** : **The exchange rate of US dollar**
- **EUR** : **The exchange rate of Euro**
- **GP** : **Gold price**
- **GR** : **Geopolitical riks for Turkey**
- **INR** : **Interest rate**
- **MS** : **Money supply**
- **VAR model** : **Vector autoregression model**
- **IMKB-100** : **Borsa Istanbul national index**
- **GDP** : **Gross domestic product**
- **ADF** : **Augmented Dickey-Fuller t**

INTRODUCTION

Stock markets have been at the heart of economies for decades. Any crisis or instabilities can influence these economics, whether partially or generally. Since the 17th century, the global economy has been plagued by financial and, more importantly, stock exchange market crises. As a result, country economic administrations and policymakers closely monitor the progress of stock markets in order to take precautions in the event of unforeseen instabilities.

Regular stock market fluctuations can be caused by economic and political events, and these fluctuations may derive from these events. On the other hand, stock markets are not immune to domestic and global macroeconomic factors. Plus, the changes in macroeconomic conditions influence investors directly or indirectly, and they base their stock-picking decisions based on the market's overall state. As a result, studying the variables that impact stock market volatility is important for both economies and investors.

The current study focuses on this topic in Turkey and examines the factors that influence the Borsa Istanbul national Index (BIST-100). Turkey has become an excellent emerging economy for several years. The country has liberalized its economic policies and opened its goods and financial markets to foreign nations, particularly since 1980. Afterwards, global trade value, portfolio investments, and foreign direct investments (FDI) all increased significantly due to the progress. The inauguration of the Istanbul Stock Exchange Market in 1985 resulted in significant capital inflows into Turkey. Since the 1980s, the Turkish economy has been in a state of flux. There are substantial economic downturns in the country's economy, especially in 1994, 1999, and 2001. Still, we will not go into depth about these crises because the study's attention is not on Turkey's economic crises, and we only deal with fluctuations.

In recent history, many countries were impacted by the global financial crisis of 2008, which was mostly caused by the US economy. However, it had only a minor effect on the Turkish economy in comparison to the US and continental Europe. But the impacts of the crises were not too long on the Turkish economy and Turkey recuperated

from the negative influences of the crises approximately after one year. Since that time, liquidity has been abundant in the world, which Turkey has benefited from. And therefore, Turkey could take many advantages to its economy in the stage after 2008.

As we back to December 2019 when the Covid-19 novel started for the first time in China and then impacted the whole economic and financial system worldwide. It also influenced Turkey's economy at all, and especially the Borsa Istanbul market. On the other hand, the changes in macroeconomic variables made a considerable impact on the market, and BIST-100 index as a national index in Borsa Istanbul could be affected by these phenomenal changes during the mentioned time. Within this perspective, the study investigates the effects of some macroeconomic variables such as interest rates, inflation rate, exchange rates of the USD and Euro, money supply, geopolitical risks, and gold prices on the BIST-100 index by employing a Vector autoregression (VAR) model over the 01.07.2014–01.01.2021 period.

After providing some information on the structure and history of the Turkish economy, the study continues by dividing it into three chapters. The first chapter presenting information regarding the market concept and Borsa Istanbul. In the second section, we are describing macroeconomic variables and literature based on developed and developing countries, and also about Borsa Istanbul. Lastly, the data and methodological methods of the research, as well as the results of the econometric review, will be presented and discussed in the third chapter.

CHAPTER 1

1. THE MARKET CONCEPT AND BORSA ISTANBUL MARKET

It is important to understand what we mean when we refer to a market. Generally, a market is where a group of buyers and sellers are together for a determined purpose, which may be for buying or selling goods and services at a determined price (Pindyck, 2012, pp. 1-10). It is possible to categorize many markets in an economy into two main groups as real markets and financial markets (Aydın , 2012, pp. 3-6). Real markets; are the markets where goods and services are traded and production issued (Aydın , 2012, pp. 3-6). On the other hand, financial markets are markets where traders can trade financial assets such as; stocks, bonds, commercial papers, debentures, commodities, etc., at a lower cost and in less time. Financial markets have a crucial role in the country's economy by allocating limited resources. It rules as an intermediary between savers and investors by mobilizing funds between them (Kılıç, 2014)

Financial markets can be described as different types of markets according to their nature. Here, we will focus on the two main types of financial markets money markets and capital markets.

1.1. Money Markets

Money markets are a form of the financial market that consists of assets used in short-term borrowing and lending with one-year or shorter maturities (Goodfriend, 2011, pp. 1-41).

1.1.1. Features and functions

Money markets are the types of financial markets that can be determined according to their maturity. Mishkin and Eakin define this as a financial market in which its maturity is less than one year. Generally, only short-term instruments can be traded in the market (Mishkin & Eakins, 2012, pp. 285-288).

According to Aydın, money markets have three main features:

- The risk of non-payment loans is low in the market
- The periods are short in the market

- Money market instruments have a low cost of conversion (Aydın , 2012, pp. 3-6).

Moreover, securities in the market are more traded than securities in long-term markets. Therefore, they are more liquid. One more feature mentioned here is the tradings' safety to its maturity and fewer fluctuations in the prices compared to long-term securities (Mishkin & Eakins, 2012, pp. 285-288).

The function of money markets is to transfer short-term funds easier from surplus fund agents. They can be individuals, governments, financial institutions, or corporations to market participants with a lack of funds based on short-term time. Plus, their crucial role in the country's financial system affects it through its monetary authority (Darskuviene, 2010, p. 33). Money markets allow for performing some functions for financial institutions and somewhat to other non-financial firms such as:

- Rising of fund
- Managing of cash
- Signalling
- Managing of risk
- Speculation
- Provding access to information on prices (Darskuviene, 2010, p. 33).

Money market instruments are normally specified by a high degree of principal protection and are issued most often in units of $1 million or more. Maturities vary from one day to one year, and the most common types are those with three months or less maturity date. For most instruments, active secondary markets allow them to be sold before maturity. Unlike other markets, the money market has no determined location. The market is headquartered in New York, but it is a telephone market and easily accessible not only inside the nation but also in all financial market centers worldwide (Cook & LaRoche, 1998, pp. 188-192). In general, we can summarize the characteristics of the money market as follow:

1- It's a demand for short-term financial assets that can be used as money substitutes.
2- It's essentially a phone-based industry.
3- It's a spot market for short-term debt instruments at the wholesale level.

4- It is a set of markets for different instruments rather than a single market.
5- It aids in the successful execution of a country's central bank's monetary policy.
6- Transactions are carried out without the assistance of brokers.
7- It establishes a connection between central banks with other banks.
8- The central banks, commercial banks, and corporations are all participants in the money market.

There are different types of money market instruments, which are grouped as follow:

Deposits: Deposits, which are the leading instruments traded in the money market, are the desired money given to banks to be withdrawn at the end of the determined time or for a specific term (Karapınar, Bayırlı , Bal, Altay, & Bal, 2014, p. 4).

Treasury Bills: Treasury bills are government securities issued by the treasury of a country with a maturity time, generally for one year or shorter. It has a significant role in financing the country's economy. Therefore, the market is carefully monitored, particularly in stock exchange circles (Karıslı, 2004, p. 412).

Banker's Acceptance: This instrument creates when a bank agrees to guarantee future payment between two parts (Laroche, 1993, p. 75).

Repos Agreements: It is the transaction of selling securities with the promise of repurchase at a fixed price and specific time. The maturity in this agreement can be a day, a night, or a year).

Asset-backed security (ABS): Bonds secured by the cash flow of several pooled receivables or loans are known as asset-backed securities (ABS). ABS may be backed by any cash-flowing commodity, but they are most often secured by consumer and business loans, as opposed to mortgage-backed securities, which are backed by mortgages. ABS are issued by companies to diversify their funding sources, borrow more cheaply, shrink their balance sheets, and free up capital. Besides general finance banks in Turkey partnerships and financial leasing companies can also issue ABSs (Sabarwal, 2005, pp. 3-4).

Financing Bills: These are short-term debt securities issued by joint-stock firms. The maturity of the financing bills is 3 months and its multiples, at most 1 year. Financing bills are also offered for sale at discount like treasury bills. Financing bonds may be sold to brokerage houses or direct investors to meet the short-term financing needs of large and low-risk businesses. Additionally, Financing bonds are issued in multiples of 30 days, not less than 30 days (Altay, 2015, p. 73).

Bank Guaranteed Bills: Partnerships using loans from investment and development banks. It means that these loans issued by the bank will be guaranteed by the banks themself. The banks will receive documents from the creditors to be sure the debts will be backed by the creditors (Unal, 2020).

Moreover, money, check policy, and bills are short-term instruments and can be used as examples of money market instruments.

1.2. Capital Markets

This type of financial market is different from the money market in terms of maturity. Generally, its maturity date is more than one year. Capital market loans are typically used to fund fixed assets such as equipment (Aykut, 2015, p. 5). In other words, it is a securities market where businesses and governments can raise long-term funds. In capital markets, money is lent for long-term periods, generally more than one year. Financial institutions such as banks, insurance companies, and stock exchanges participate in this market, which channels long-term investment funds to commercial and industrial borrowers. Moreover, fixed investments like those in buildings and equipment are usually funded by the market (Jumba, 2010, p. 8).

1.2.1. Features and functions

The capital market's primary function is to collect long-term funds for governments, banks, and companies while offering a forum for bond trading. This fundraising is controlled within the capital market by the performance of the stock and bond markets. The member organizations in the market may issue stocks and bonds to raise funds. On the other side, Investors can purchase the issued stocks and bonds by investing their money in the market. However, the capital markets are not free of risks. It is significant for investors to read market trends and understand the market's direction

before entering the markets (Jumba, 2010, p. 8). In short, the major functions of capital markets can be briefing as below:

- To generate resources for investment.
- To promote the purchase and sale of securities.
- To promote the efficient price discovery process.
- To promote the settlement of transactions in compliance with the time schedules laid down in advance (The Institute of Company Secretaries of India, 2017, pp. 4-5).

On the other hand, Fredholm and Awal believe that this market has an important role in mobilizing savings and pooling, allocating software, exercising business administration, promoting the exchange of goods, and facilitating risk management (Fredholm & Awal, 2006, pp. 21-22).

There are two types of capital markets in terms of participants. They are called the primary market and the secondary market. The primary market is a part of the capital market that deals with the issuance of new securities. In other words, it is a market that directly sells those securities never traded before. (Sarikovanlik, 2014, pp. 57-58). Securities can be issued based on three methods in the market. The methods are the rights issue, IPOs, and preferential issue. Initial public offerings are examples of the primary market which placed based on offering new issuance of securities.

On the other hand, there is another type of capital market called the secondary market. This market is also also known as aftermarket. In this phase, investors can trade with securities issued in the primary market. Some people typically believe this as the stock market, which they already issued before, and now existing in the market as second-hand trading securities. Borsa İstanbul, New York Stock Exchange, and London Stock Exchange are examples of the secondary market (Jumba, 2010, p. 8).

1.2.2. Capital market securities

A wide range of financial instruments characterizes the capital market. These instruments are long-term instruments; that differentiate them from money market instruments (Singhi , 2018, pp. 1-2). In Turkey, capital market instruments include securities and other instruments. Capital market instruments, securities, derivative instruments, and investment contracts, including other capital markets determined to be

within this scope, are tools determined by the board. Securities, shares, other assets such as shares, the relevant warehouse certificates, debt instruments or securitized assets, and debt instruments based on income and warehouse certificates for the said securities. Shares are securities that provide partnership rights, and bonds provide credibility. It can be given as an example of securities. Money, check, policies, and bills can not be counted as tools of the capital market (Ziraatyatirim, 2018). According to SPK, securities are providing partnership and credibility rights. Using as an investment tool by representing a certain amount of money and periodic income with the same expressions and the terms determined by the Turkish capital market board (Sermaye Piyasa Kurulu (SPK), 2015).

According to the definition above, we can describe securities like:

- Stocks and Derivatives
- Bonds and Derivatives
- Treasury Bills, Financing Bills, and Bank Bills
- Profit-Loss Partnership Documents and Investment Fund Participation Documents
- Buying of new shares and Coupons of bond Interest
- Participation Dividend and Revenue Partnership Certificates
- Certificates Real Estate.

On the other hand, other capital instruments are established by the conditions other than securities determined as valuable documents. As an example of these;

- Interest Coupons
- Dividend Coupons
- Option Notes
- Certificates of Deposit.

The Capital Markets Board (CMB) is the largest stock market and institutional regulatory and supervisory body in Turkey. The board is responsible for securing investors' rights and interests (TCMA, 2018).

1.2.3. Capital market institutions

Capital markets are marketplaces where capital-rich producers and capital-poor customers exchange savings and investments. Businesses, governments, and individuals are among the institutions that have capital, while businesses, governments, and individuals are among those seeking capital (Mishkin & Eakins, 2012, pp. 175-178). In brief, a capital market institution is a business or entity that spends money on behalf of others. Mutual funds, pensions, and insurance firms are also examples of financial institutions.

1.2.3.1. *Capital Markets Board (CMB)*

Turkey's Capital Markets Board is the primary administrative and supervisory body responsible for the securities markets. It was established in 1982. Capital markets, investment instruments, and institutions are governed and supervised by the CMB, empowered by the Capital Markets Law. The purpose of the CMB is to ensure secure, equal, and efficient capital markets operation while protecting investors' rights and interests (Altaş & Salttürk, 2018, p. 12).

1.2.3.2. *Turkish Capital Markets Association (TCMA)*

The key objective of TCMA is to contribute to the growth of capital markets and intermediation activities to ensure that its members conduct business efficiently and to avoid unfair competition. TCMA carries out the required activities to achieve these objectives, such as conducting research and providing educational programs, implementing safety measures to avoid unfair competition between members, cooperating with related organizations with the intent of enforcing disciplinary action, considering complaints against its members, and informing the CMB, etc.

The TCMA is made up of banks approved to carry out capital market operations, investment firms authorized by the CMB, fund management companies, and intermediary firms (Altaş & Salttürk, 2018, p. 12).

1.2.3.3. *Borsa Istanbul (BIST)*

The Istanbul stock exchange, formerly known as Borsa Istanbul, was founded in late 1985. The BIST was demutualized in 2013, following the enactment of the new

Capital Market Law. The capital markets exchanges operating in Turkey, namely the Istanbul Stock Exchange, Istanbul Gold Exchange, and Turkish Derivatives Exchange (TurkDex), merged under the umbrella of Borsa Istanbul in 2013. By the end of 2018, Borsa Istanbul went public. Takasbank, Takasbank, Turkey's sole clearing and settlement organization, and MKK, the only central depository in Turkey, were moved to Borsa Istanbul premises in 2017 (Borsaistanbul, 2011).

1.2.3.4. *Turkish Mercantile Exchange (TURIB)*

TURIB was established as a commodity exchange in Turkey in 2018 and started operations in 2019. TURIB is active in the market where electronic warehouse receipts ('ELUS') are exchanged for agricultural products, and futures are traded with ELUS as their underlying properties. TURIB works with Takasbank and CRA on clearing, settlement, central custody, and dematerialized monitoring of ELUS and related derivatives and cooperated with regional merchant exchanges and ELUS business growth markets (TURIB, 2019)**.**

1.2.3.5. *Takasbank (Clearing House)*

Since Takasbank has central counterparty and banking licenses, it provides its members primarily with clearing, settlement, custody, central counterparty, and banking services. Besides, Takasbank is authorized to facilitate cash and securities settlement transactions as the central clearing and settlement institution to Borsa Istanbul equities, debt securities, foreign securities, derivatives, and precious metals markets. In this respect, Takasbank is regulated by the CMB and the Central Bank of the Republic of Turkey, as well as by the Banking Supervision and Supervisory Authority, because of its operations (TakasBank, 2020).

1.2.3.6. *Central Registry Agency (CRA)*

CRA was founded in 2001 as the central depository for all dematerialized capital market instruments. CRA dematerializes and documents capital market instruments and the rights attached in electronic form for issuers, intermediary bodies, and right holders. Government debt securities, hedge funds, real estate certificates, warrants, corporate bonds, ELUS, and exchange-traded funds have all been dematerialized as a result of the CRA (CRA Annual report, 2010)**.**

1.2.3.7. *Other institutions*

Other participating institutions are hosted in the Turkish capital markets, such as the Investor Compensation Centre, which tracks and manages financial institution insolvency and investor compensation, the Capital Markets Licensing Registry and Training Agency Inc., which performs licensing assessments, and the Turkish Association of Appraisers.

1.3. Borsa Istanbul

A stock exchange, also known as a stock market, is a regulated market for the trading of commodities, bonds, and other financial instruments. It provides a marketplace for companies to sell and issue securities in order to raise capital for expansion (stocks and bonds) (Musonera & Vincent, 2008, pp. 63-64). Istanbul Stock Exchange is one of the oldest stock exchange markets in the world which is known as Borsa Istanbul. The Borsa Istanbul is Turkey's single trading body, bringing together the former Istanbul Stock Exchange, the Istanbul Gold Exchange, and the Turkish Derivatives Exchange under one roof.

1.3.1. The History of Borsa Istanbul

In every country with an exchange, stock exchange institutions bring investors together and ensure that trading activities occur in a safe, fair, and competitive environment. The history of stock markets in Turkey extends to the time of the Ottoman Empire. After the invasion of Istanbul in 1453 and to improve economic and political relations, several banks founded in the district of Galata were allowed to carry on their business and went unchecked as long as they paid taxes complied with legal requirements. These banks gained greater influence during the Ottoman period. They acquired a significant role in disseminating financial operations and the recovery of the state's foreign debt (Chambers , 2006, pp. 1-13).

Following the Republic of Turkey's declaration in 1923, the consequences of the First World War made it difficult for the capital market of Turkey to recapture the dynamism it had displayed during the Ottoman period. In the 1960s, when the stock exchange's aggregate capital reached a substantial level, the issuance of corporate shares and government stocks started to gain momentum. However, due to both an insufficient

legal and regulatory order and the capital market's incapacity to meet the needs imposed on it, it was not possible to achieve any substantial growth (Erdogan, 2003, pp. 7-8).

It was not until the adoption of a liberal, free-market economy by the decisions of the 1980s and January 24 that the growth and access to international investors of the Turkish capital market showed substantial forward movements. During this time, the stock market's growth was stimulated by the framing and enacting a practical regulatory and legal framework. The launch of the ISE in 1985 was intended to demonstrate a significant turning point in the growth of the capital market in Turkey. As a result of its first-rate infrastructure and its use of high-tech capabilities, this company has advanced in a positive direction. It has grown into a focal point of interest for international capital markets and allowed the ISE to take on a strong player profile global competition as a stock exchange (Arnes, 2014, pp. 13-14). ISE began trading in 1986, and rates were determined by a standardized pricing structure with many prices. A board system replaced this trading system, and prices began to be written on boards. By the end of 1994, a completely computerized trading system was launched (Ulusan & Şimşek, 2009, pp. 2-4). The institution, which was first established in 1986 under the name of ISE (Istanbul Stock Exchange), and then was named Borsa Istanbul (BIST) on April 5, 2013 (BorsaIstanbul, 2013).

1.3.2. Borsa Istanbul Indices

Borsa Istanbul includes different indices based on the market nature in Turkey. Each of the indices has its terms and conditions for the listed companies. Below are the main indices which are listed in the market.

1.3.2.1. *BIST 100 Index*

The index is known as the primary index on the Istanbul Stock Exchange. It is made up of 100 stocks chosen from the stocks of companies listed on the BIST Stars and BIST main markets and stocks of investment trusts traded on the national real estate market, and venture capital investment trusts traded on the market for collective and structured products. The index automatically includes the stocks of BIST 30 and BIST 50. Moreover, This index; Used as a primary index for Borsa Istanbul Equity Market, and it is taken as a basis for Borsa Istanbul's value (Arnes, 2014, pp. 13-14).

1.3.2.2. *BIST 50 Index*

The index is made up of 50 stocks chosen from companies that operate in BIST Stars and BIST's key markets. The stocks of real estate investment trusts and venture capital investment trusts traded in the collective and structured goods industry. BIST 30 stocks are automatically included in the BIST 50 index. (Borsaistanbul, 2018).

1.3.2.3. *BIST 30 Index*

The index comprises 30 stocks chosen from the stocks of companies listed on the BIST Stars and BIST main exchanges, as well as stocks of real estate and venture capital investment trusts traded on the market for collective and structured goods. (Aykut, 2015, p. 5) (BorsaIstanbul, 2013).

1.3.2.4. *BIST 100-30 Index*

The index consists of 70 stocks that are part of the BIST 100 index but not the BIST 30 index.

1.3.2.5. *BIST Corporate Governance Index*

The index consists of companies listed on the Istanbul Stock Exchanges with the minimum required rating grade for corporate governance (Borsaistanbul, 2018).

1.3.2.6. *BIST All Index*

All stocks traded on the Istanbul Stock Exchanges, excluding Investment Trusts, are included in the index (Borsa Istanbul, 2020).

1.3.2.7. *BIST All-100 Index*

The index comprises company stocks included in the BIST All Index but not in the BIST 100 Index (Borsaistanbul, 2018).

1.3.2.8. *BIST Stars Index*

The index is made up of stocks from companies that trade on the BIST Stars market (Borsa Istanbul, 2020).

1.3.2.9. *BIST Main Index*

The index is comprised of stocks from companies that trade on the BIST Main Market.

1.3.2.10. *BIST City Indices*

Borsa Istanbul has been the main production or activity centre since the beginning of 2009 to monitor companies' price and income performance in the same city; the city started to calculate indices. Companies that operate in the financial sector except for holdings and in the retail sector are not included (Aykut, 2015, p. 5).

1.3.2.11. *BIST Dividend Index*

The index is made up of stocks from companies listed on the BIST Stars and BIST Main Markets, as well as trusts traded on the pooled and organized goods market for real estate investment trusts and venture capital investment trusts that have paid cash dividends in the last three years (Borsaistanbul, 2018, pp. 4-6).

1.3.2.12. *BIST Dividend 25 Index*

The index comprises 25 stocks that rank in the first two-thirds of the BIST Dividend Index constituent list, in descending order by dividend yield on the day of review and with the highest free-float market value.

1.3.2.13. *BIST IPO Index*

The index includes stocks of companies that were publicly traded and began trading on the BIST Stars and BIST main markets, as well as stocks of investment trusts and venture capital investment trusts that were publicly traded and began trading in the collective and structured goods market (Aykut, 2015, p. 5).

1.3.2.14. *BIST SME Industrial Index*

The index is made up of stocks of industrial companies listed on the BIST Stars, BIST Key, and BIST Emerging Companies markets that meet at least one of the requirements for annual net sales or financial balance sheet size, except for the number of employees criterion that appears in the Ministry of Science, Industry, and Technology related ordinance (Borsaistanbul, 2018, pp. 4-6).

1.3.2.15. *Sector Indices and Sub-Sector Indices*

The indices, except Investment Trusts, consist of stocks of companies listed on Borsa Istanbul exchanges (Aykut, 2015, p. 6).

1.2.3.17. BIST Liquid Bank Index

Selected from companies traded on the Star Market, Average FDP PD, and Daily

It consists of high bank shares with Average Transaction Volume (Borsa Istanbul, 2020).

1.2.3.18. BIST Non-Bank Liquid 10 Index

Selected from companies traded on the Star Market, Average FDP PD, and Daily

It consists of 10 non-bank company shares with a high Average Transaction Volume (Borsa Istanbul, 2020).

1.2.3.19. BIST Securities Investment Trusts Index

Securities investment traded on the Star Market, Main Market, and Sub Market. It consists of the shares of its partnerships (Borsa Istanbul, 2020).

CHAPTER 2

2. MACROECONOMIC VARIBLES

The relationship between macroeconomic variables and stock indices has raised many eyebrows during the last decades. Policymakers, traders, and researchers are working to discover the secrets behind the macroeconomic variables and the way of infection between the two fundamental markets worldwide as we look at the research regarding the stock market indices in Turkey. It can be seen that many researchers tried to determine the impacts of these changeable indicators on stock indices.

2.1. The Key Macroeconomic Variables

2.1.1. Exchange rate

The exchange rate is one of the significant terms in finance. In other words, one of the most important concepts in finance is the exchange rate. An exchange rate is the cost of exchanging one currency for another. It is sometimes referred to as the exchange rate of one currency against another. (Isard , 1995, pp. 1-70).

2.1.2. Inflation rate

In economics, inflation is an overall increase in the price level in an economy over time, outcoming a continuing decrease in the money's purchasing power (Robert , 1981, pp. 2-96).

2.1.3. Interest rate

Interest rates are the remuneration paid to a lender (the creditor) by a borrower (the debtor) to use the capital for a while. They are expressed in percentage terms per annum (pa), such as 6,525 per cent pa, to make them comparable (Faure, 2014, pp. 2-25).

2.1.4. Unemployment rate

The unemployment rate is the number of unemployed people in the overall labour force. It means that the staff is called unemployed if they do not work presently, even

though they are qualified and eager to work. The total labour force consists of both working and unemployed persons (Brandolini & Viviano , 2018, pp. 1-12).

2.1.5. Balance of payment

A balance of payment statement is a statistical statement that provides a detailed record of an economy's transactions with the rest of the world for a given period. The current account and the financial account are their main components (St Clair, 1998, pp. 35-41).

2.1.6. Growth Domestic Product (GDP)

The Gross Domestic Product (GDP) is the leading indicator of the nation's development and development in economic terms. This indicates the market value of products and services produced in a country over a given time, usually a year. (Leamer, 2009, pp. 19-38).

2.1.7. Money supply

The total amount of money available in an economy is referred to as the supply of money in macroeconomics. There are numerous ways to calculate "cash," but the most common are circulating currency and demand deposits. (Koti & Bixho, 2016, pp. 294-302).

2.1.8. Public expenditure

Public spending is expenditure on collective needs and wishes by a country's government, such as pensions, provisions, defence, infrastructure, etc. Public spending was restricted until the 19th century, as laissez-faire philosophies thought that money left in private hands might bring better returns (Shah, 2005, pp. 1-256).

2.1.9. Gold prices

Gold is the most common of all the precious metals as an investment. Investors generally buy gold, primarily through futures contracts and derivatives, as a way of diversifying risk. Moreover, the gold market is like other markets, prone to uncertainty and volatility (Elfakhani & Baalbaki, 2009, pp. 161-178).

2.1.10. Economic growth

Economic growth is described as the increase in the inflation-adjusted market value of goods and services produced by an economy over time. Traditionally, statisticians measure growth as a percentage increase in actual gross domestic product, or real GDP (Bhattarai, 2004, pp. 1-40).

2.1.11. Oil price

The price of oil refers to the spot price of one barrel of crude oil under the benchmark. It is possible to determine the price of oil using a balance between its demand and supply. Trade-in oil storage is a strategy in which oil is bought by significant oil firms when costs for immediate storage and distribution are poor (Byrne, Lorusso, & Xu, 2018, pp. 1-47).

2.1.12. Geopolitical risks

Geopolitical risk is a form of threat facing investors, companies, and governments. A business actor's performance the anticipated value of a given economic action will be dramatically affected by political decisions, events, or circumstances (Caldara & Iacoviello , 2018, pp. 2-48).

2.1.13. Savings and investments

Saving means putting money away for an emergency or a potential investment that you won't be able to afford right now. On the other hand, Investing is the act of buying assets for the purpose of the benefit, such as securities, bonds, mutual funds, or real estate. The bulk of investments are made to achieve long-term goals (Lambsdorf, 2011, pp. 647-648).

2.1.14. Imports and exports

Imports are goods and services that citizens of a country purchase from outside the country rather than domestically produced goods. On the other hand, exports goods and services made in one country but sold to customers in another (Bakari & Mabrouki, 2017, pp. 67-69).

2.1.15. Private consumption

The amount of the consumption goods and services purchased and used by households is referred to as private consumption. With a few changes, the sums correspond to personal consumption expenditure recorded in NIPA (Bolleyer, 2020, p. 3).

2.1.16. Terrorist attacks

A terrorist attack is a violent act carried out by individuals attempting to accomplish political goals, typically involving murder and bombing (Global Terrorisim Index, 2016, p. 14).

2.1.17. Technology

Technology refers to a collection of methods, skills, technologies, and processes used in the production of goods and services, as well as the pursuit of objectives such as scientific research. It also opens the door to more improvements and interactions between human beings globally (Aldyan, Sulistiyono, & Pujiyono, 2019, pp. 123-126).

2.1.18. Global factors

These factors include cultural and social forces, legal issues, demographics, political conditions, and changes in the natural environment and technology. The United Nations, the World Bank, and the World Trade Organization are three main organizations involved in international marketing at this level (Jochem & Reitz, 2014, pp. 268-271).

2.1.19. Climate change

Climate change, as described by the IPCC, is a change in the state of the climate that can be observed (e.g., using statistical tests) over time, typically decades or longer, by changes in the mean and variability of its properties. Climate change refers to any change in temperature over time, whether caused by natural variability or human activity (UNFCCC, 2011, pp. 1-7).

2.1.20. Overall taxes

A tax is a mandatory financial fee or any other levy levied by a governmental body on a taxpayer (an individual or legal firm) to finance government spending and

numerous public expenditures (Hashimzade, Heady, Myles, Oats, & Scharf, 2014, pp. 2-72).

2.2. Studies Examining the Effect of Macro Economic Variables on Stock Market Indices

Macroeconomic variables have a crucial role in the stock market. Many investors, researchers, and policymakers want to know the impacts of these variables on the market. Therefore, the relationship between macroeconomic variables and stock indices has been a topic for many researchers. In this study, we are dividing the studies into three different groups, as shown below.

2.2.1. Studies conducted in developed markets

Erdem, Arsalan, and Erdem (2005) studied the effects of macroeconomic variables on all indices registered in the Istanbul Stock Exchange. The Exponential Generalized Autoregressive Conditional Heteroscedasticity model was used in the study. They concluded that the indices could be affected in different ways. For instance, interest rate and inflation can make a unidirectional spillover impact on all stock indices in the market. On the other side, the exchange rate can affect the IMKB 100 and industrial index with the same spillover impact.

Moreover, a spillover relation from M1 money supply to a financial index and zero impact from industrial production for all indices (Erdem, Arslan, & Erdem, 2005, pp. 987-994). Ng (2006) analyzed the role of corruption and how the stock markets are being affected by corruption. According to the findings, corruption can be the source of a company's borrowing cost, a lower valuation of stocks, and worse corporate governance across international markets (Ng, 2006, pp. 822-836).

Geetha, Mohidin, Chandran, and Chong (2011) tried to determine the impacts of expected and unexpected inflation on stock markets in the US, China, and Malaysia by using the Vector Error Correction model. They investigated a long-term relationship between the variables and stock markets in all countries. On the other hand, a short-term relation only existed for Malaysia and the US, not China (Geetha , Mohidin, Chandran, & Chong , 2011, pp. 1-16).

Bai (2014) examined the impacts of inflation on China's stock market by employing the Engle and Granger multivariate cointegration approach. According to the study outcomes, the changes in inflation can make a weak impact on Chine's stock market. Although the effect is not that strong, we have to be careful about that because Chine's stock market has a prominent place in the world's financial market (Bai , 2014, pp. 261-271).

Military expenditure is one of the factors that can impact the country's economy. While a state is in a war, the country's economy may crash due to the deficits that happen to the general budget. Solarin and Sahu (2015) put their fingers on the issue and investigate the impacts of defence expenditure on stock market growth in thirty-six countries. The GMM system estimates results reveal that military spending has a massive effect on stock market performance in all examined countries (Solarin & Sahu, 2015, pp. 272-287).

The Indian stock market has a crucial role in financial markets at all. In 2018 Upadhyaya, Nag, and Mixon Jr analyzed the relationship between stock prices and macroeconomic variables in India. The selected macroeconomic variables are industrial production, money supply, price level, interest rate, exchange rate, and output growth. As they imply by the vector error correction model (VECM), Johansen's cointegration test, Granger causality tests, and variance decomposition, the stock market and variables are related together in both the long term and the short term times. The results show that stock prices are positively associated with the exchange rate and output growth in the long term, while money supply negatively relates to stock market prices. On the other hand, interest rate, exchange rate, and price level seem to have a negative short-term impact on stock market prices in the country above (Upadhyaya, Nag, & Mixon Jr, 2018, pp. 35-47).

2.2.2. Studies conducted in developing countries

Maysami, Howe, and Hamzah (2004) worked on some determined macroeconomic variables and determined their impacts on the Singapore stock market index (STI), including property index, finance, and hotel indices. The macroeconomic variables used in the study include inflation rate, exchange rate, interest rate, money supply, and industrial production. The results based on Arbitrage Pricing Theory

conclude that the STI indices are cointegrating for both short- and long-term relationships with variables like interest rate, money supply, price level, industrial production, and exchange rate (Maysami, Howe, & Hamzah, 2004, pp. 47-77).

Mehrara (2006) employed the Granger causality test to research the relationship between industrial production, money supply, trade balance, and TEPIX index value. The results show a long-run unidirectional after testing the impacts of three macroeconomic variables on the Tehran Stock Exchange. The findings also concluded that the variables lead to stock prices in the market. Meanwhile, the market is not efficient informationally (Mehrara, 2006, pp. 138-148).

Thaker, Rohilina, Hassama, and Bin Amin (2009) examined the relationship between the Kuala Lumpur Composite Index (KLCI) and some variables, namely, nominal effective exchange rate, inflation, and money supply for both short term and long term times. The study was depended on the error correction model, unit root test, and cointegration test. The findings provided a causality relationship between the index and determining variables. It also suggested that the exchange rate, inflation, and money supply significantly affect the KLCI, and the government should emphasize these variables to stabilize stock prices (Thaker M. A., Rohilina, Hassama, & Bin Amin, 2009, pp. 2-33).

Pilinkus (2010) examined the impacts of macroeconomic variables on Baltic countries, namely, Estonia, Lithuania, and Latvia, using Vector auto-regression and Johansen cointegration models to analyze the time-series data. As the findings show, a granger causality relationship exists between macroeconomic variables and some Baltic states. These relations seem to be different from each other, which can be commented on by the country's fiscal and monetary policies. Furthermore, a short-term relationship by vector auto-regression and long-term relationships by Johansen multiple cointegrations existed between the variables (Pilinkus, 2010, pp. 291-304).

Parsva and Lean (2011) documented a study regarding stock prices and exchange rates for six Middle Eastern countries, including Kuwait, Egypt, Jordan, Oman, Iran, and Saudi Arabia. Both of Johansen-Juselius Multivariate Co-Integration Test and Granger Causality Tests were used in the process. The outcomes show a bidirectional causality relationship for both short- and long-term relations between stock prices and

exchange rates for Oman, Egypt, and Iran before the 2007 crisis. It also shows no short-term interaction in Jordan and Saudi Arabia markets, while a causal relationship exists between exchange rates and Kuwait's stock prices (Parsva & Lean, 2011, pp. 156-171).

Eita (2012) used a VECM econometric methodology to research the impacts of macroeconomic indicators on the Namibian stock market. The results concluded that the increases in money supply and economic activities could increase Namibia's stock prices. Simultaneously, increases in the interest rate and inflation lead to increased stock prices in the country, as mentioned above. Finally, it suggests that equities are not a hedge against inflation in Namibia (Eita, 2012, pp. 871-884).

Al-Shami and Ibrahim (2013) investigated the impacts of macroeconomic variables on stock market returns in Kuwait. The variables used in the study were including oil prices, inflation, unemployment rate, interest rate, and money supply by employing the VAR model. The study revealed a one-month positive relationship among the indicators like oil price, inflation and money supply, and stock returns. Meanwhile, a one-month negative relationship was found between interest rate and Kuwait stock market returns (Al-Shami & Ibrahim, 2013, pp. 57-66).

Aigheyisi and Edore (2014) tried to determine the impacts of government expenditure and its debit on the Nigerian stock market by using cointegration and error correction methodologies. The findings demonstrated that the variables had a negative short and long-term impact on the state's stock market transactions in the state (Aigheyisi & Edore, 2014, pp. 1-10).

Aigbovo and Izekor (2015) also imply that short-term and long-term relationships exist between the macroeconomics and stock market indices in Nigeria. They applied the Augmented Dickey-Fuller unit root test, Johansen cointegration test, multivariate Ordinary Least Square (OLS), and the Error Correction Model (ECM) to analyze the collected data (Aigbovo & Izekor, 2015, pp. 18-40).

Alsherfawi AlJazaerli, Sirop, and Mouselli (2016) directed their study to determine the impact of corruption by the Corruption Perception Index (CPI) on GCC's stock market development countries. The study employs by estimation of alternative regression models. As they resulted, the development process has been affected by

corruption from all the countries suffering from degeneration (Alsherfawi AlJazaerli, Sirop, & Mouselli, 2016, pp. 117-127).

Skwofie and Ansah (2018) studied the impacts of two famous macroeconomic variables, namely the exchange rate and inflation rate, on the Ghana Stock Exchange (GSE). The autoregressive distributed lag (ARDL) cointegration technique and the error correction parameterization of the ARDL were used. They could imply a significant long-run relationship between inflation and stock market returns in Ghana, while no short-term relation was noted with the same variable. On the other hand, the exchange rate provided a positive long and short-term relationship with the GSE returns (Kwofie & Ansah , 2018, pp. 1-8).

Devia S.S. (2019) determined the relationship between the exchange rate, inflation rate, and stock market movements in Indonesia by employing the VAR model. According to the results, inflation has no impact on Rupiah's exchange rate against USD, while the exchange rate has an important impact on inflation. On the other hand, the stock market movements continuously increase when inflation rises, and conversely, when the exchange rate moves down, the stock market trend decreases (Devia S.S., 2019, pp. 32-44).

A study done by Bhuyian and Chowdhury (2020) examines the linkage between several macroeconomic variables and different stock indices in the USA and Canada. Financials, healthcare, energy, consumer discretionary, industrial, real estate, and consumer staples indices were used as stock index representatives. They could prove that the selected macroeconomic variables like long-term interest rate, money supply, and industrial production have a long-term relationship with the US's stock market indices but not in Canada. Meanwhile, the Canadian stock market can be explained by the US's money supply and interest rate (Bhuyian & Chowdhury, 2020, pp. 62-74).

2.2.3. Studies conducted in Borsa Istanbul

Kasman (2003) examined the relationship between exchange rate and stock indices in Turkey by applying Johansen's Cointegration techniques and Granger causality test. The results show a long-term relationship between stock indices and exchange rate according to the time-series techniques. Moreover, a causality

relationship existed only for the industrial sector index among all other indices (Kasman, 2003, pp. 70-79).

Erdem, Arsalan, and Erdem (2005) studied the effects of macroeconomic variables on all indices registered in the Istanbul Stock Exchange. The Exponential Generalized Autoregressive Conditional Heteroscedasticity model was used in the study. They concluded that the indices could be affected in different ways. For instance, interest rate and inflation can make a unidirectional spillover impact on all stock indices in the market. On the other side, the exchange rate can affect the IMKB 100 and industrial index with the same spillover impact. Furthermore, a spillover relation from M1 money supply to a financial index and zero impact from industrial production for all indices (Erdem, Arslan, & Erdem, 2005, pp. 987-994).

Kandir (2008) used a multiple regression model to determine the role of macroeconomic variables on stock returns in Turkey. The results reveal that some variables like world market return, exchange rate, and interest rate seem to affect the portfolio returns at all. In contrast, the inflation rate relations were found only with three of the portfolios among twelve portfolios. Besides that, variables like oil price, industrial production, and money supply had no significant influence on stock returns (Kandir , 2008, pp. 36-45). Acicalin, Aktas, and Unal (2008) employed the cointegration tests and vector error correction model to investigate the relationship between macroeconomic variables such as interest rate, GDP, exchange rate, and current account balance with the ISE index. They found a unidirectional relationship between macroeconomic variables and the ISE index. In other words, changes in the current account balance, gross domestic product, and the foreign exchange rate can affect the ISE index, and changes can happen to the interest rate. In contrast, changes occur in country expectations (Acikalin, Aktas , & Unal, 2008, pp. 8-16).

Aydemir and Demirhan (2009) determined a unidirectional causal relationship between stock prices and exchange rates by employing the Toda-Yamamoto Procedure test in Turkey. According to the findings, the exchange rate negatively affects all stock indices in Turkey. In contrast, the relationship from financials, national 100, industrials, and services indices to exchange rate is negatively determined as well (Aydemir & Demirhan , 2009, pp. 208-215).

Karacaer and Kapusuzoglu (2010) researched the relationship between macroeconomic factors such as inflation, industrial output, and exchange rate and stock price indices for short and long-term periods in Turkey. The Augmented Dickey-Fuller, Philips Perron unit root tests, Johansen Cointegration test, and Granger causality test were applied to run the study. They could investigate a unidirectional and a bidirectional causal relationship between the macroeconomic variables and stock indices for a short term time. Plus, a long-term cointegration relation between the selected variables (Karacaer & Kapusuzoglu, 2010, pp. 501-507).

Incilay and Ismail (2011) have examined the relationship between macroeconomic variables and stock indices in Turkey. Researchers applied the Multiplier Linear Regression and Granger causality test by taking an example of Euro-Dollar parity and real effective exchange rate index. The MLR test results show a positive relationship from both of the variables to the IMKB-100 index by 77%, and then the GCT shows a causal relationship from the IMKB 100 index to both of the indices (Can & Incilay, 2011, pp. 323-339). Another study by Kartal (2011) chooses inflation, industrial production index, interest rate, exchange rate, money supply, and gold price between January 2002 and December 2012 based on monthly data. The data is analyzed by the Johansen cointegration test and Granger causality test to analyze the study. The results provide a positive relationship between stock prices and money supply. On the other hand, a negative relationship was found between stock prices and interest rate, exchange rate, inflation, and gold price (Kartal, 2011, pp. 1-95).

Another study by Albayrak, Ozturk, and Tutluoglu (2012) applied the Prais-Winston Regression Analysis. It shows the same positive impact from some determined macroeconomic indicators on ISE-100. The macroeconomic variables used in the study are interest rate, gold prices, USD parity, capital flows, foreign direct investment, and foreign portfolio investment. According to the study results, indicators like Gold price, US dollar parity, and foreign portfolio investment have a precise role in the ISE-100 index (Albayrak, Ozturk, & Tutluoglu, 2012, pp. 1-22). Eryigit (2012) applied the VAR model to examine the dynamic relations between oil price shocks and stock indices in Turkey. The study results show a dynamic relationship between the ISE-100 index and shocks in oil prices in the country (Eryigit, 2012, pp. 263-276).

Bulut 2013 investigates the relationship among some macroeconomic variables such as the price of gold, exchange rate, export petroleum price, inflation, industrial production index, and interest rate with Istanbul stock exchange between 1992:01 and 2012:06 periods. The study uses different methods to determine the unit root test and cointegration of data with the Granger causality test to determine the short-term causality between data. The findings show a positive relationship between industrial production, petroleum prices, inflation, and exchange rate. On the other hand, a negative relationship was found between gold prices, inflation and exchange rate, and the Istanbul stock exchange. Moreover, a bidirectional causality was found between stock prices and exports with a unidirectional causality from stock prices to inflation and prices of petroleum. And finally, a unidirectional causality from industrial production and interest rate to stock prices (Bulut, 2013, pp. 1-213).

In 2014 Sevinc tried to determine the impacts of macroeconomic variables traded on BIST-30 by applying the arbitrage pricing theory on teen different macroeconomic variables and determine their impacts on the BIST-30 index. This study's macroeconomic indicators are BIST-100 index, currency basket, M2 money supply, inflation rate, current account balance, export/import ratio, industrial production index, deposit interest rate, gold exchange rate, and capacity utilization rate. According to the study outcomes, all the variables can significantly impact the stock returns (Sevinc, 2014, pp. 271-292). Moreover, Altin (2014) examined the impact of exchange rate on the BIST-100 index in order to determine the long-run infections between the variables. The methods used in the analysis process were included in the Engle-Granger Two-Step Method and Johansen's Cointegration Analysis method. The results show a significant relationship between the variables (Altin, 2014, pp. 65-78).

Yilmaz 2015 investigates the effects of money supply on some macroeconomic factors, which the BIST-100 index is one of them. The findings show the impacts of the money supply as an independent variable to all other dependent variables include BIST-100 index (Yilmaz, 2015, pp. 1-112). Belen and Gumrah have studied the impacts of inflation on stock market reactions in Turkey. In that context, they have applied the collected data on BIST-100 index and employed the event study methodology to determine the outcomes. They could find that expected, actual and unexpected inflation can not explain abnormal return changes (Belen & Gumrah, 2016, pp. 428-441).

Koyuncu (2017) examined the influence of four different macroeconomic variables on stock market indices. The real economic growth, interest rate, industrial production index, and inflation rate were used as macroeconomic variables, and BIST-100 index represented Turkey's stock market index. The study methods used to analyze the data are DF-GLS unit root test, cointegration test, and FMOLS and DOLS regression analysis methods. The results show that the BIST-100 index increases with the increase of inflation and industrial production index. On the other hand, real economic growth can be affected negatively (Koyuncu, 2017, pp. 615-624). Uzun and Gungor (2017) have determined the impacts of some macroeconomic variables on stock market indices in 50 countries around the world divided into three groups. They used money supply, exchange rate, inflation, interest rate, and industrial production index as an example of macroeconomic variables and employed a panel causality test in the process. The results show a bi-directional relationship between the stock market index and some macroeconomic variables in developed and developing countries (Uzun & Gungor, 2017, pp. 1-30).

Meanwhile, stock indices in less developed countries provided a bi-directional relationship only with interest rates. On the other hand, the non-causality relationship was found between exchange rate and stock indices (Uzun & Gungor, 2017, pp. 1-30). Ucan, Guzel, and Acar (2017) tried to determine the impact of some macroeconomic variables on the BSIT-100 index. Therefore, they exampled five different variables such as CPI, US dollar, Oil price, emission volume, and Euro over the BIST-100 index in ISE by applying the panel data analysis test. They investigated both positive and negative relationships. The relationship of the US dollar, emission volume, and oil price were positive; meanwhile, a negative relationship was observed for Euro and CPI. Nevertheless, the high positive impact on BIST-100 index was reported with the US dollar by 4.28% (Ucan, Guzel, & Acar, 2017, pp. 509-523).

Eyuboglu and Eyuboglu (2018) researched the relationship between exchange rate and sector indices in Borsa Istanbul. They used BIST-100 index with 23 sectors in that context, and then they took the exchange rates for both Dollar/TL and Euro/TL based on daily data by employing the ARDL model. The long-term relationship was noted for the US dollar with Wholesale and Retail Trade and Technology indexes of 24 indexes. And also, a long-term relationship for BIST Textile Leather with Euro/TL. On the other

hand, a short-term relation was noted for the dollar's exchange rate with three other indices negatively with a positive relation for long-term relations (Eyuboglu & Eyuboglu, 2018, pp. 8-28).

On the other hand, Eyuboglu and Eyubgolu had another study regarding the stock market indices and inflation. The study is built based on 15 sectors in Borsa Istanbul, and they used the Bound Test in the cointegration analysis process. The results show that the CPI index has a direct impact on both short and long-term transactions. Nevertheless, the increase in CPI can negatively impact the index returns (Eyuboglu & Eyuboglu, 2018, pp. 89-99). Sengonul, Karadas, and Kosaroglu (2018) have studied the long-term relationship between the macroeconomic variables and BIST-100 index. Borsa Istanbul Index and some macroeconomic variables like IPI, interest rate, inflation, gold price, and currency basked were used in the study. And then, the data analyzed by SVAR analysis as a data analysis model. The results show that the shocks in the exchange rate have a long-term impact on the market. Meanwhile, the industrial production index was less affected by the changes (Sengonul, Karadas, & Kosaroglu, 2018, pp. 63-85).

In 2019 Soyaslan analyzed the relationship between exchange rate and BIST-Tourism Index by taking the US dollar and Euro exchange rates and applying the econometric analysis method. According to the findings, there are no long-term relationships between the exchange rate of the dollar and the BIT index. Meanwhile, a short-term relationship exists between the exchange rate of the Euro and the BIT index. The changes stemmed from 15.22% for Euro and 9.44% for US dollar (Soyaslan, 2019, pp. 774-793). Guney and Salı Ilgın evaluated the long-term and short-term influences of gold prices, exchange rates, and interest rates on the stock prices traded in BIST-100 index. The results of the VAR model provide both unidirectional and bidirectional causality relationships between the variables (Guney & Sakalgin, 2019, pp. 227-245).

Durmus, Yilmaz, and Sahin (2020) threw light on the relationships between the macroeconomic variables and stock indices in Borsa Istanbul. They exampled BIST bank and BIST financial index as stock index representative, and interest rate, the exchange rate of the US dollar and Euro, Gold price, and inflation have taken as macroeconomic variables. According to the VAR model findings, the macroeconomic variables have a negative impact on stock indices (Durmus, Yilmaz, & Sahin, 2020, pp.

870-886). Hatipoglu (2020) used the Granger causality test to determine the relationship between Turkey's stock market and unemployment. The results show no significant causality relations between the two variables, and ISE could not predict the future unemployment rates. Moreover, the increases in stock market activities can not be trusted to reduce unemployment rates (Hatipoğlu , 2020, pp. 327-339). The studies above are the studies in Turkey regarding the relations between macroeconomic variables and stock market indices. Iitas examined the relationship between different types of risks and stock indices by evidencing causality tests for Turkey. The study provides both uni-directional and bi-directional causality relations between the risk factors and BIST100 index based on Hacker and Hatemi causality test and Toda-Yamamoto causality test results (Iltas, 2020, pp. 372-384).

CHAPTER 3

3. THE IMPACTS OF MACROECONOMIC VARIABLES ON BORSA ISTANBUL 100- INDEX

3.1. Aim of the study

Macroeconomic variables have a crucial role in a county's economy. Researchers, policymakers, entrepreneurs, banks, investors, and other financial institutions are in line with the changes of these variables and determine their impacts on the economy. Furthermore, the volatility of these variables can also influence financial institutions and financial markets. Therefore, the relationships between these variables and stock markets have been researched and analyzed by researchers.

Therefore the purpose of this study is to determine whether the selected macroeconomic variables influence the BIST-100 index or not. If yes, in which direction and how they affect the index.

Therefore, we collected some of the researches related to our topic by dividing them into three groups. The first group contains the studies based on developed markets. The second one provides the examinations on developing markets, and the third one includes some of the researches related to Borsa Istanbul. Mainly, its national index is also known as the BIST-100-index. These studies provide different results based on their time-series data, collection of the data, and the method by which the data is analysed.

3.2. Data description and choice of variables

We examine the impacts of macroeconomic variables on stock market indices by taking evidence from Borsa Istanbul national index (BIST-100) index. The key macroeconomic variables which are used in the study as independent variables include consumer price index (CPI) as a measure of inflation, interest rates (INR), foreign exchange rates of the US dollar (USD), and exchange rates of the Euro (EUR), gold prices (GP), money supply (MS), and geopolitical risks (GR) and the BIST-100 index is used as the dependent variable. The data collection starts from 01.07.2014 and ends

with 01.01.2021 based on the average monthly data for each variable. The data consist the average of monthly time series of the variables and obtained from the Central Bank of Turkey database (EVDS, 2021). Besides, the time-series data of Turkey's geopolitical risks gathered from the Economic Policy Uncertainty website (EPUI, 2021).

In response to why we choose these variables, these variables have featured in numerous previous studies (Aykut, 2015, pp. 1-79), (Bulut, 2013, pp. 1-213), (Kartal, 2011, pp. 1-95), (Yilmaz, 2015, pp. 1-112), (Aydemir & Demirhan , 2009, pp. 208-215), (Guney & Sakalgin, 2019, pp. 227-245), and (Eyuboglu & Eyuboglu, 2018, pp. 8-28) that are of a similar nature with our study. Each of them provides various reasons for each variable they used, and this can be helpful to meet our goal in this study. We are providing the reasons why we choose the variables below.

Inflation is one of the essential factors that can influence the economy in different ways. It can impact the company's cash flow, cost of production, sales, prices, and dividends for a company. And also, changes happen to the investors' decisions when inflation occurs. The impacts can be either positive or negative.

Interest rate is also another factor in an economy. A higher interest rate can impact a company’s income statement, and its profit will decrease due to the increase of interest rates. Accordingly, Accordingly, with increasing interest rates, bond prices decline, and stock investors quit stocks in anticipation of higher profits, they will head, and so the stock prices will go down. On the other hand, Since the increase in interest rates in an economy will decrease the demand for stocks, It will lead to a decrease in stock prices. The main reason for this is that investors are willing to invest in interests rather than transfer them to stock prices. These changes can cause investors and traders in the stock market.

Lastly, geopolitical risk is one of the common threats that can influence the activities in the stock market. GPR can impact the investors' behaviour by making uncertainty and investment decisions at all. For a country like Turkey, when there is no stability in the mentioned variables and that can be the reason why we choose the variables above. At the end of the study, we will also compare our findings to the studies we mentioned above.

3.3. Research method and model

The study is based on using Vector Autoregressive Models (VAR) model to analyze the collected data of the variables. In order to run the VAR model, we first have to prepare the data according to the nature of the model. Therefore, we are dividing the process into different phases. The first phase of data analysis describes the features data by using descriptive statistics and summarized the gathered data in a table. The stationary of series is checked by Augmented Dickey-Fuller test (ADF) unit root tests (Dickey & Fuller, 1979) and then, the Vector Autoregressive (VAR) model is applied. The vector autoregression (VAR) model is a multivariate version of the univariate autoregression model (Stock & Watson , 2001, pp. 101-115). The last section of the methodology part will be the Granger Causality (GC) test to study the causality between the variables (Granger, 1987, pp. 251-276). Figure 3.1 provides more detail regarding our process.

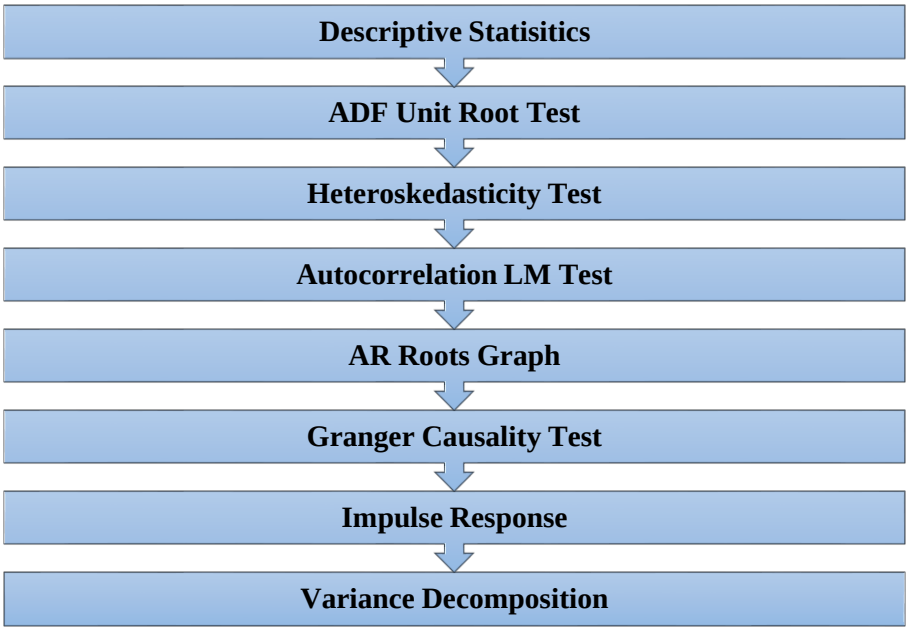

Figure 3.1 *Data analysis process*

3.4. Results and findings

Figure 3.1 shows the aggregate process of the analysis of data. Here, we are applying the first step of the investigation by looking at the descriptive statistics for all the variables, including BIST-100.

Table 3.1. *Descriptive statistics*

	Mean	Std.Dev	Skewnes	Kurtosis	Jarque_bera
BIST-100	**0.007489**	**0.064894**	**-0.085907**	**2.622488**	**0.559115**
CPI	**0.009578**	**0.009781**	**1.780010**	**11.45987**	**273.7900***
EUR	**0.014636**	**0.039981**	**0.480956**	**6.545735**	**43.86691**
MS	**280890.5**	**175670.6**	**-0.68107**	**1.883732**	**10.07991**
GP	**0.020670**	**0.043775**	**0.828391**	**5.867290**	**35.64042**
USD	**0.016024**	**0.040339**	**0.798993**	**6.357774**	**44.94166**
GR	**138.9440**	**37.10296**	**0.522065**	**2.710733**	**3.815125**
INR	**19.81613**	**4.563362**	**1.101056**	**3.968261**	**18.80718**

*%1 **%5 ***%10

As can be seen in Table 3.1, the data with the highest average are MS (280890.5), GR (138.9440), and INR (19.81613), respectively. On the other hand, the data with the lowest average are BIST-100 index (0.007489), CPI (0.009578), EUR (0.014636), USD (0.016024), and GP (0.040339), respectively. Also, among the data, the highest volatility is in MS (175670.6) and GR (37.10296). Furthermore, the BIST-100 index and MS have negative skewness, while other data have positive skewness. Along with these, while CPI, EUR, GP, USD, and INR have low values, BIST-100, MS and GR have high values. Finally, all data are normally distributed among the data except CPI.

Table 3.2. *ADF Unit Root Test*

ADF UNIT ROOT TEST	Intercept	TREND& Intercept
BIST-100	**<0.01**	**<0.01**
CPI	**<0.01**	**<0.01**
EUR	**<0.01**	**<0.01**
MS	**<0.01**	**<0.01**
GP	**<0.01**	**<0.01**
USD	**<0.01**	**<0.01**
GR	**<0.01**	**<0.01**
INR	**<0.01**	**<0.01**

Table 3.2, which consists of the ADF Unit Root Test results, provides a stationary for all the variables, including the BIST-100 index based on intercept and

trend intercept at the level. As the data is stationary, we can now jump to other steps in order to run the VAR model. Therefore, we planned to comment on the results of each variable differently, as shown below:

3.4.1. The results of BIST-100 and inflation rates

After describing the data and applying the ADF unit root test on the data, we will look at the results of the Heteroskedasticity test for the BIST-100 index and inflation rate by taking CPI as a representative of inflation.

Table 3.3. *Heteroskedasticity Test (BIST-100 & CPI)*

Heteroskedasticity test result	
Prob.	**0.2897**

Table 3.3 shows a restriction between time-series data at lag length ten and the probability of data more than ten per cent, which means a heteroskedasticity exists in the computed model. This test is one of the common types of assumptions in time-series data to determine the heteroskedasticity in the data.

Table 3.4 Autocorrelation LM Test (BIST-100 & CPI)

Prob.
0.6325
0.6884
0.6363
0.9209
0.1227
0.3799
0.9852
0.8559
0.6869
0.2398

Table 3.4 provides an autocorrelation for all the values, and all of them are greater than %10. Therefore, the time series data are constrained. This can be helpful to

apply the AR roots test by looking at the graph based on the data. The graph below shows the result of the test:

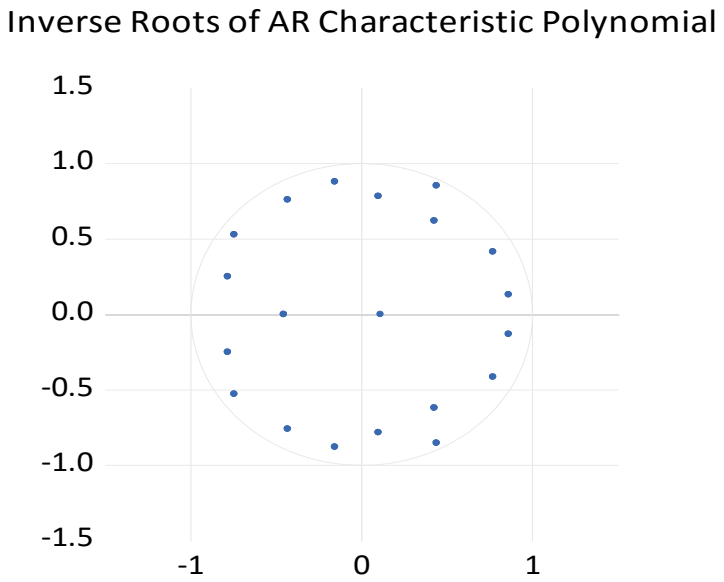

Figure 3.2 *AR Roots Graph (BIST-100 & CPI)*

As we can see in figure 3.2, all the roots are located inside the circle. Plus, the data is stationary and shows that the VAR model is created based on the lag length ten. Then, this helps us to run the Granger causality test as shown below:

Table 3.4 *Granger Causality Test (BIST-100 & CPI)*

Granger Causality	
CPI ≠ > BIST	**0.6469**
BIST ≠ > CPI	**0.2712**

Table 3.5 demonstrates no causality from the CPI index to the BIST-100 index, and there is no causality from the BIST-100 index to the CPI index. In other words, the changes in the BIST-100 index as a dependent variable cannot impact the CPI index. Besides, the changes in CPI as an independent variable cannot influence the BIST-100 index. Hence, there is no causal relationship between the existing variables.

It is important to check the impulse response to assure the relationship between the BIST-100 index and the CPI index. The two critical figures that significant here are the second and third figures in the impulse response test because the mentioned figures illustrate the responses of each variable to the other one.

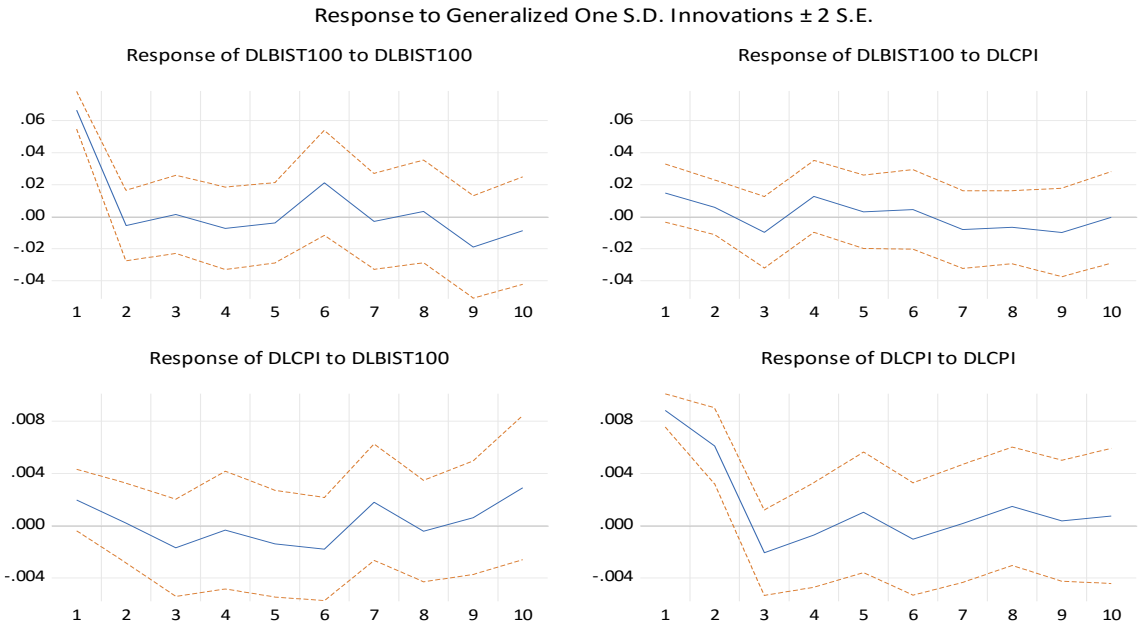

Figure 3.3 *Impulse Response (BIST-100 & CPI)*

Figure 3.3 provide four different responses between the variables. The first figure shows a positive impact on itself. It means that any shock in the BIST-100 index can positively impact the same index for two months. The second and third figures do not provide any meaning. Meanwhile, they are the two important responses between the variables mentioned above. Finally, the last one shows the same positive impact from inflation to inflation itself for three months.

The last step shows the results of the variance decomposition test. This section helps us to determine how much of the variability in the independent variable is lagged by its variance and how much is lagged by the dependent variable's variances. In other words, the test shows us how the variables are connected and how they are created by showing their ratio from the value of themself and the other related variable.

The attached table 24 shows the results of the variance decomposition test between the BIST-100 index and the inflation rate for both the independent and dependent situations. As we look at the BIST-100 index as it is dependent, It is lagged by 93% of its variables and includes only 7% of the inflation as the independent variable. On the other hand, the inflation rate includes 11% of BIST-100 dynamics as an independent variable and 89% of its index dynamics as a dependent variable.

3.4.2. The results of BIST-100 and the exchange rate of the Euro

In this section, we will comment on the results of the exchange rates of the Euro and BIST-100 index as we applied for CPI. Therefore, the first step here will be looking at the heteroskedasticity test as shown below:

Table 3.5 *Heteroskedasticity Test (BIST-100 & EUR)*

Heteroskedasticity test result	
Prob.	**0.2953**

Table 3.6 shows the results of the heteroskedasticity test between time-series data at lag length six as well as the probability of that is more than 10% which means that there is a heteroskedasticity in the computed model. Therefore, now, we can set up an autocorrelation LM test.

Table 3.6 *Autocorrelation LM Test (BIST-100 & EUR)*

Prob.
0.8230
0.3981
0.5224
0.8360
0.9947
0.7622
0.7259
0.7109
0.8681
0.3902

Table 3.7 shows an autocorrelation result for all the values above, and the values are greater than %10. Hence, the time series data are constrained, and it is now ready to apply the AR roots graph as shown below:

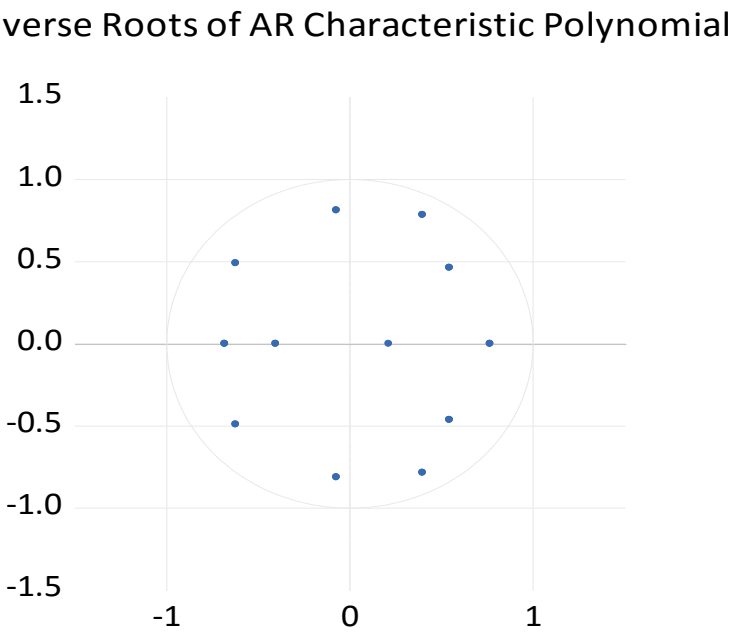

Figure 3.4 *AR Roots Graph (BIST-100 & Eur)*

The figure above illustrates the stationary of the data by showing all the roots inside the circle. Having all the roots inside the table tells us that the data is stationary and can be used to put the data on the Granger causality test as shown below:

Table 3.7 *Granger Causality Test (BIST-100 & EUR)*

	Granger Causality
EUR ≠ > BIST	**0.4396**
BIST ≠ > EUR	**0.1461**

As we can see in table 3.8, there is no causality between the two variables. In other words, the changes that come to the BIST-100 index are not because of the changes of Euro, and also the changes that happen to the Euro are not because of the changes of the BIST-100 index. Thus, there is no relationship between the changes of the exchange rate of the Euro to the BIST-100 index and vise versa.

Thus, we also apply the impulse response to determine the exact relationship between the variables.

Figure 3.5 *Impulse Response (BIST-100 & Euro)*

Figure 3.5 shows the relationship between the shocks in Euro to BIST-100 index and from BIST-100 to the Euro's exchange rate. The results show no meaning, and these figures are meaningless. But, we can note the first and last figure, which is the relationship between each of the variables themself. The first one shows a two monthly positive reaction to the BIST-100 index for each shock that comes to the index. And also, the last one shows the same positive impact from the exchange rate of the Euro for the shocks that comes to the currency for three months.

The results of the variance decomposition test for the BIST-100 index as a dependent variable with its independent variable as determined by Euro has shown in the attached table below. The BIST-100 index variability includes %95 of its dynamics and only lagged by %5 of the exchange rate of the Euro dynamics. Meanwhile, the exchange rate of the Euro includes 12% of BIST-100 dynamics and lagged by 88% of its dynamics.

3.4.3. The results of BIST-100 and the exchange rate of the US dollar

Table 3.8 *Heteroskedasticity Test (BIST-100 & USD)*

Heteroskedasticity test result	
Prob.	**0.1301**

Table 3.9 shows the results of the heteroskedasticity test between time-series data at lag length five. And also, the probability is more than 10% which means that there is heteroskedasticity in the computed model. Thus, we can now use an autocorrelation LM test, as can be seen below:

Table 3.9 *Autocorrelation LM Test (BIST-100 & USD)*

Prob.
0.8028
0.5318
0.6638
0.9749
0.7862
0.6780
0.8040
0.8670
0.9601
0.3427

Table 3.10 shows an autocorrelation result for all the values above, which are bigger than %10. Hence, the time series data are constrained, and the data is ready to use the AR roots graph as below:

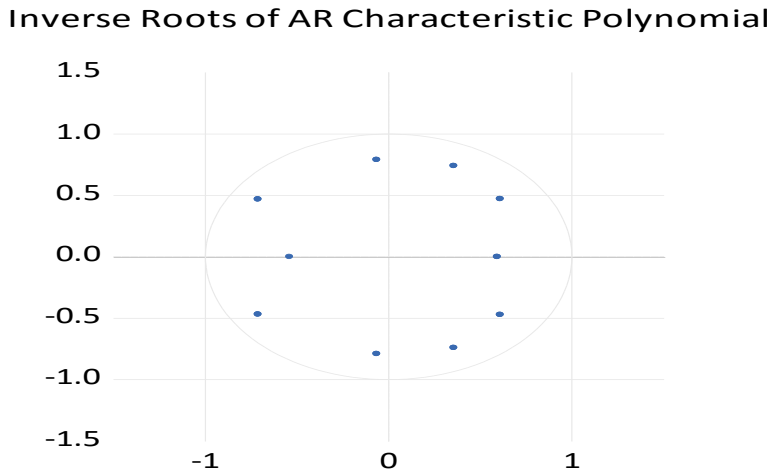

Figure 3.6 *AR roots graph (BIST-100 & USD)*

Figure 3.6 provides results for the AR roots test. It shows that the data is stationary. Because all the roots are located inside the table, therefore, now, we can apply the Granger causality test.

Table 3.10 *Granger Causality Test (BIST-100 & USD)*

Granger Causality	
USD ≠ > BIST	**0.7263**
BIST = > USD	**0.0404**

Table 3.11 shows no causality from the exchange rate of the USD to BST-100. Meanwhile, there is causality from BIST-100 to the exchange rate of the USD. In other words, the volatility of USD can not influence the BIST-100 index. In the intervening time, the changes that come to USD can be returned to the changes that happen to the BIST-100 index. Therefore, there is only a one-way causality relationship between the USD exchange rate and the BIST-100 index. Hence, we can now apply the impulse response test. The figures below show the results of the test.

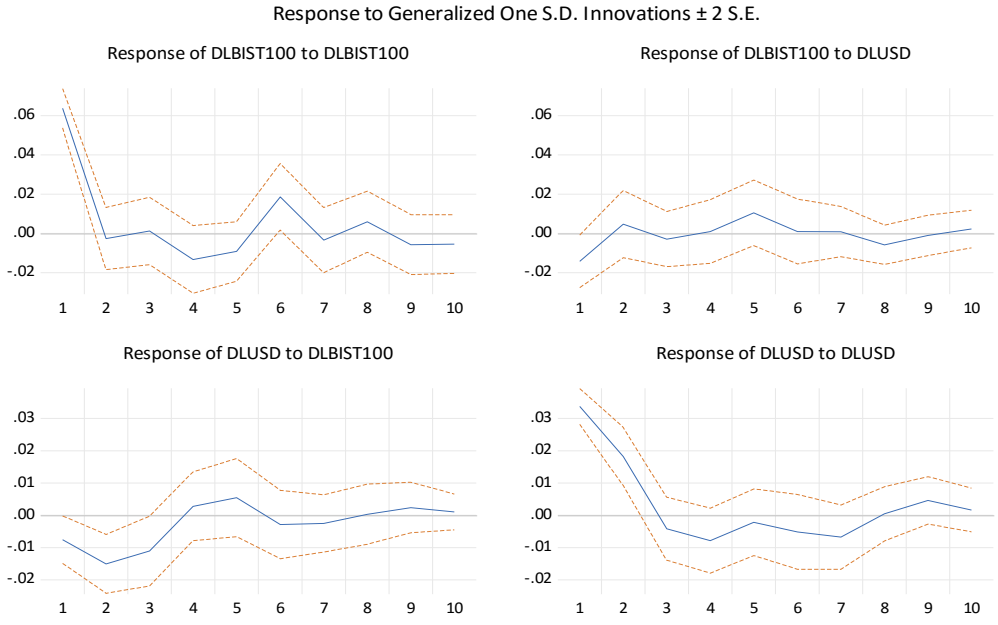

Figure 3.7 *Impulse response (BIST-100 & USD)*

As we look at the figures above, we can see different results between the variables. The first figure shows that the BIST-100 index shocks can affect the index for two months positively. Besides, the BIST-100 index shocks can impact the exchange

rate of the USD for two months negatively. Moreover, the shocks of the exchange rate of the USD can influence the BIST-100 index for two months negatively. And lastly, the shocks of the exchange rate of the USD can influence the same index for three months positively.

The variance decomposition test for the BIST-100 index as a dependent variable and the exchange rate of USD as determined by the independent variable has shown in the attached tables below. The BIST-100 index variability includes %98 of its dynamics and only lagged by %2 of the exchange rate of USD dynamics. Meanwhile, the exchange rate of the USD contains 23% of BIST-100 dynamics and lagged by 78% of its dynamics.

3.4.4. The results of BIST-100 and money supply

Table 3 11 *Heteroskedasticity Test (BIST-100 & MS)*

Heteroskedasticity test result	
Prob.	**0.7527**

Table 3.12 shows the results of the heteroskedasticity test between time-series data at lag length thirteen. And also, the probability is greater than 10%, which means that there is heteroskedasticity in the applied model. Thus, we can now use an autocorrelation LM test, as can be seen below.

Table 3.12 *Autocorrelation LM test (BIST-100 & MS)*

Prob.
0.8215
0.7965
0.4853
0.8141
0.5722
0.9978
0.9271
0.9902

	0.8268
	0.8105

Table 3.13 provides an autocorrelation result for all the values above, which are bigger than %10. Thus, the time series data are constrained.

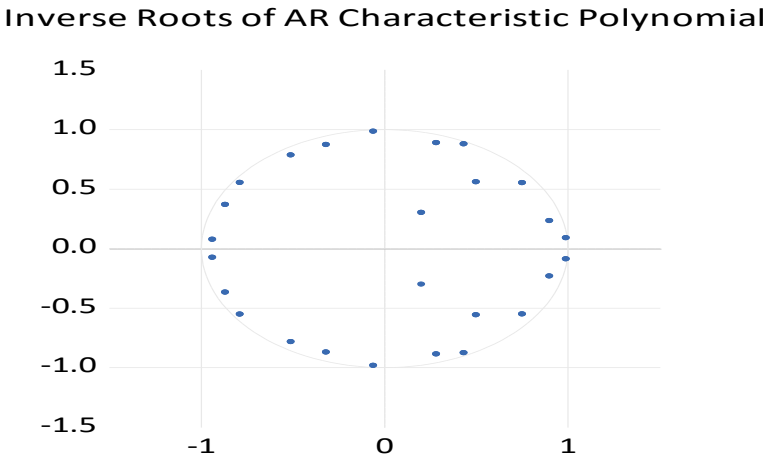

Figure 3.8 *AR roots graph (BIST-100 & MS)*

The results of Figure 3.8 show that the roots are inside the circle, and that means the data is stationary and is ready to be tested by the Granger causality test:

Table 3.13 *Granger causality test (BIST-100 & MS)*

Granger Causality	
MS = > BIST	**0.0023**
BIST ≠ > MS	**0.3127**

As we can see here in Table 3.14, the relationship of the money supply to the BIST-100 index is a causal relationship. In other words, the changes that happen to money supply can impact the BIST-100 index in the short-term time. Meanwhile, there is a non-causality relationship from BIST-100 to the money supply. In other words, there is only a one-way causality relationship between the money supply and the BIST-100 index.

Therefore, the data is ready to use the impulse response test as below:

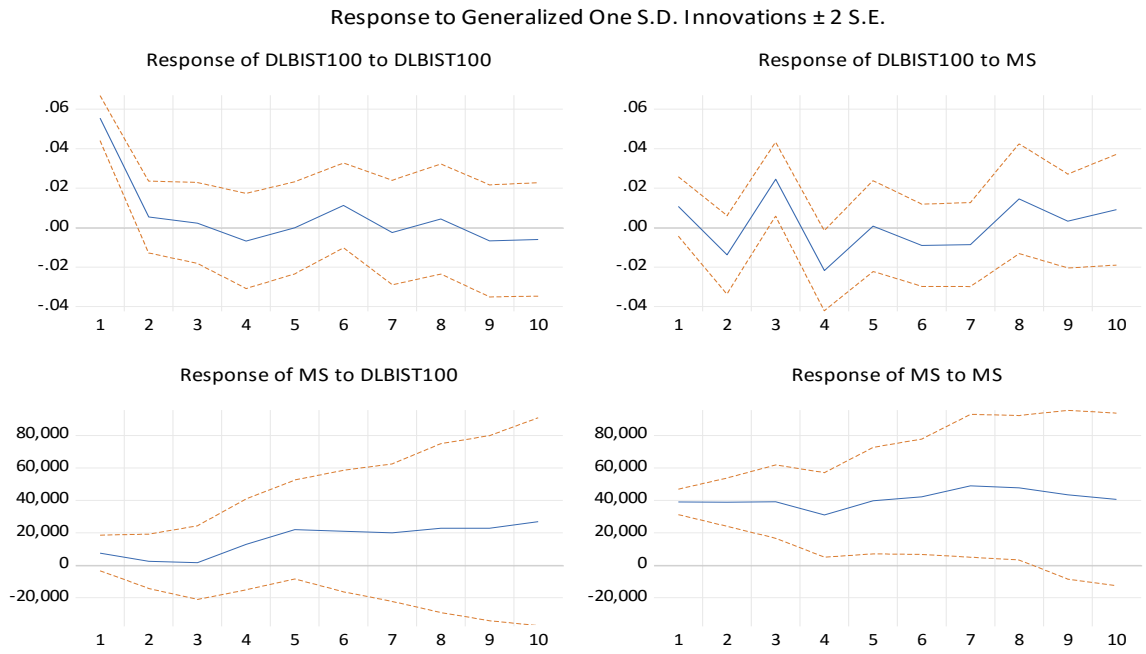

Figure 3.9 *Impulse response (BIST-100 & MS)*

The results of the impulse response, as shown in figure 3.9, is a meaningless result for shocks of the BIST-100 index to the reacts of the money supply. And also, the shocks of money supply can not influence the BIST-100 index. But the surprises of each variable can make changes in the variables themself. The first figure shows that any shock that comes to the BIST-100 index can impact the same index for two months positively. Plus, the shocks of money supply can also positively affect the money supply itself for three months.

The last test here is the variance decomposition test. The results of the test illustrate that the BIST-100 index includes 95% of its dynamics while it is a dependent variable and only lagged by 5% of dynamics of the MS dynamics. On the other hand, the money supply contains 16% of BIST-100 dynamics and lagged by 84% of the money supply dynamics. The tables are attached below.

3.4.5. The results of BIST-100 and gold prices

Table 3.14 *Heteroskedasticity test (BIST-100 & GP)*

Heteroskedasticity test result	
Prob.	**0.4112**

The table above reveals the results of the heteroskedasticity test between time-series data at lag length four. And also, the probability is bigger than 10% which means that there is heteroskedasticity in the applied model.

Table 3.15. *Autocorrelation LM Test (BIST-100 &GP)*

Prob.
0.2385
0.2174
0.3750
0.3012
0.1648
0.8701
0.2598
0.3722
0.9786
0.7426

Table 3.16 reveals an autocorrelation outcome for all the values in the table, which are greater than %10. Hence, the time series data are constrained and ready to be applied by the AR roots test.

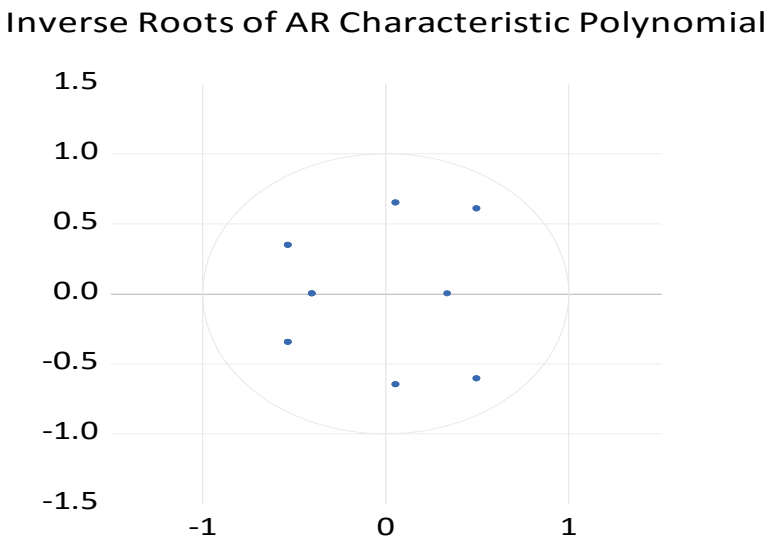

Figure 3.10 *AR roots graph (BIST-100 & GP)*

The figure above shows the stationary of data by collecting all the roots inside the graph. This reveals that the data can be tested by the Granger causality test:

Tablo 3.16 *Granger causality test (BIST-100 & GP)*

Granger Causality	
GP ≠ > BIST	**0.3784**
BIST ≠ > GP	**0.2919**

The results of the Granger causality test show a non-causal relationship between the variables. On the other hand, the variables are not causing each other, and there is no relationship between them.

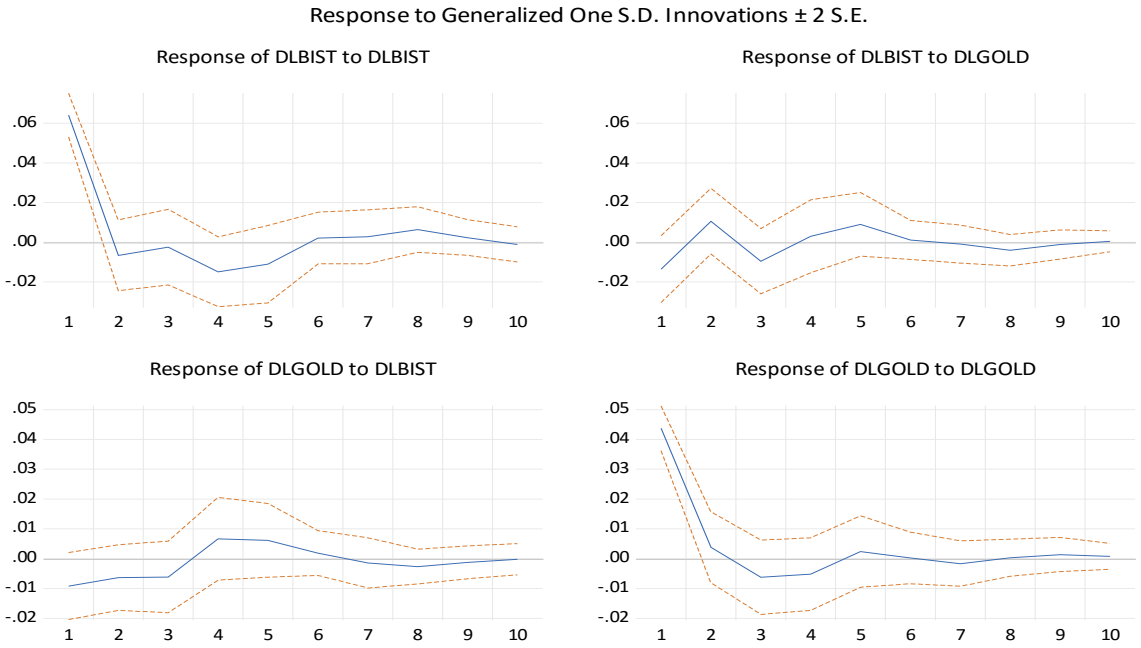

Figure 3.11 *Impulse response (BIST-100 & GP)*

According to the results of figure 11, the shocks of the BIST-100 index can impact the BIST-100 index itself for two months in a positive manner, and also, the shocks of gold prices can influence the same variable for three months. Meanwhile, the amazement of each variable can not affect the other one, and the results are meaningless between the two variables.

The final phase here can be the variance decomposition test, as shown in the attached table. The test results show that the BIST-100 index as a dependent variable contains 95% of its dynamics and 5% of the dynamics of gold price. On the other hand,

the gold prices include 92% of BIST-100 dynamics as a dependent variable with 8% of the gold price dynamics.

3.4.6. The results of BIST-100 and geopolitical risks

Table 3.17 *Heteroskedasticity Test (BIST-100 & GR)*

Heteroskedasticity test result	
Prob.	**0.1923**

According to table 3.18, there is an existing restriction between time-series data at lag length eight. The probability of that is more than 10% which means that we have heteroskedasticity in the computed model.

Table 3.18 *Autocorrelation LM test (BIST-100 & GR)*

Prob.
0.2473
0.8023
0.9213
0.5085
0.5839
0.2744
0.3993
0.7477
0.1025
0.7535

Table 3.19 provides an autocorrelation for all the values above, and all the variables are greater than %10. Thus, the time series data are constrained, and the AR roots test can be applied.

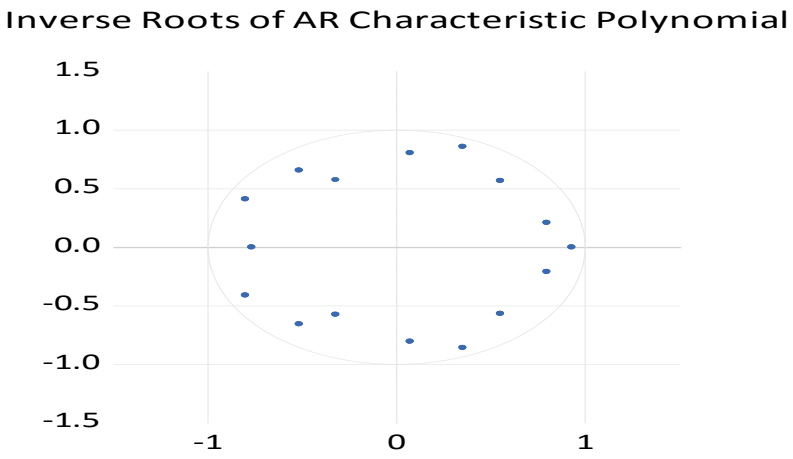

Figure 3.12 *AR Roots graph (BIST-100 & GR)*

The outcomes of Figure 3.12 provide a stationary result based on the roots inside the table. Thus, we can apply the Granger causality test as shown below:

Table 3.19 *Granger causality test (BIST-100 & GR)*

Granger Causality	
GR ≠ > BIST	**0.3874**
BIST ≠ > GR	**0.1238**

According to the Granger causality test results, there is no causality between the BIST-100 index and geopolitical risks. In other words, non of the variables are related to each other and the changes that come to each variable are not related to the other one.

Figure 3.13 *Impulse response (BIST-100 & GR)*

According to figures 3.13, the shocks of each variable are connected to the variables themself. In other meaning, the shocks in the BIST-100 index can affect itself for two months. Meanwhile, it creates no effect on geopolitical risks and provides the same result from geopolitical risks to the BIST-100 index. Lastly, a shock in geopolitical risk can affect the same index for six months.

The results of the variance decomposition test count the BIST-100 index as a dependent variable with 71% variability of its dynamics and only lagged by %29 of geopolitical risk dynamics. This means that 71% of the changes that occur to the BIST-100 index is lagged by its dynamics and 29% by geopolitical risk dynamics. Meanwhile, the changes that happen in the geopolitical risk index create 86% by its dynamics and lag by 14% of BIST-100 index dynamics.

3.4.7. The results of BIST-100 and interest rates

Table 3.20 *Heteroskedasticity Test (BIST-100 & INR)*

Heteroskedasticity test result	
Prob.	**0.1309**

The table above evident that there is a restriction between time-series data at lag length eleven, and the probability of that is more than ten per cent. It is a heteroskedasticity in the computed model, and it is ready to be tested by the Autocorrelation LM test.

Table 3.21 *Autocorrelation LM Test (BIST-100 & INR)*

Prob.
0.4007
0.1715
0.5013
0.2717
0.6510
0.1188
0.6970
0.9992
0.5826
0.6621

As we can see in the table above, there is an autocorrelation between all the values and they are greater than %10, and the data is constrained.

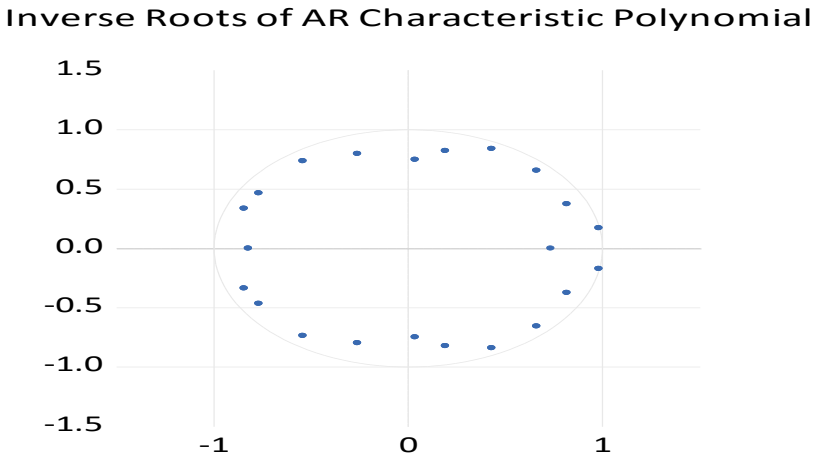

Figure 3.14 *AR Roots Graph (BIST-100 & INR)*

The outcomes of Figure 3.14 provide a stationary result based on the roots inside the table. We can now look at the results of the Granger causality test as shown below:

Table 3.22. *Granger causality test (BIST-100 & INR)*

Granger Causality	
INR ≠ > BIST	**0.5231**
BIST ≠ > INR	**0.5967**

The results of the Granger causality test in this section show no causality between the interest rates and the BIST-100 index. In other words, Non of them affects each other.

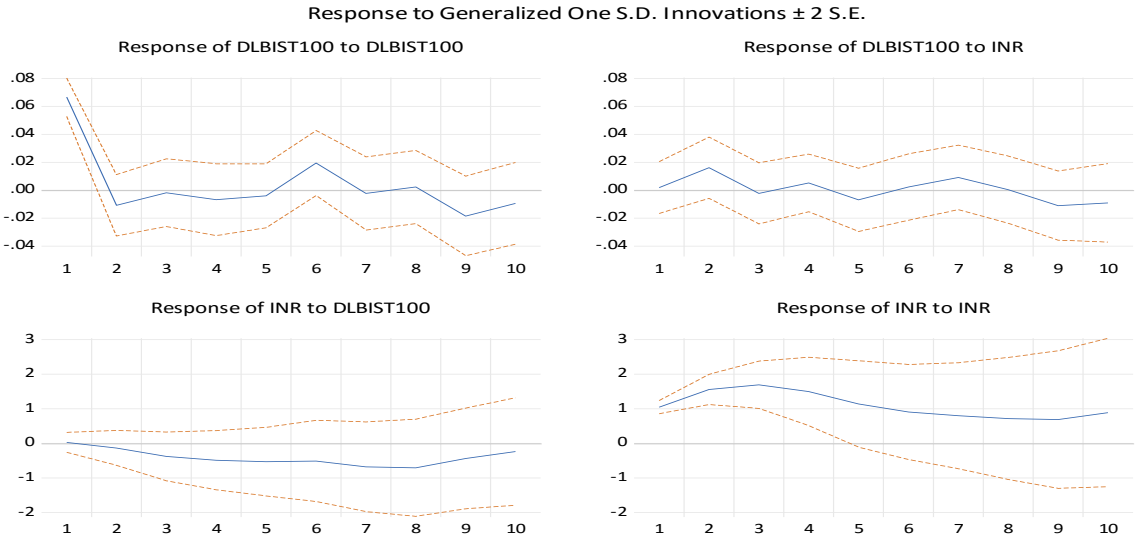

Figure 3.15 *Impulse response (BIST-100 & INR)*

As we look at the figures above, we can see that the BIST-100 index shocks can positively affect the same index for two months. But the shocks of the BIST-100 index can not affect the interest rate direction, and also, the interest rate can not influence the BIST-100 index. Meanwhile, the shocks of interest rate can impact itself for nine months positively.

The results of variance decomposition in the attached table when the BIST100 index is ruling as a dependent variable shows that the BIST-100 index changes include 93% of its dynamics. Meanwhile, it is lagged by only 7% of interest rate dynamics. Besides, when we look at the interest rates as a dependent variable, we can see that the

changes in the index contain 70% of dynamics itself and lagged by 30% of BIST-100 index dynamics.

3.5. Evaluation and Conclusion

Macroeconomics is the branch of economics concerned with the overall operation and productivity of an economy. It focuses on aggregate changes in the economy, such as unemployment, growth rate, GDP, inflation, money supply, exchange rates, and so on. Macroeconomics studies the economy's aggregate metrics as well as macroeconomic influences. Macroeconomic models are using by governments and companies to aid in the formulation of economic policies and strategies. The macroeconomic variables have a crucial role in a country's economy and its developments.

Furthermore, macro-economic factors often move stock markets. Therefore we aimed to study to determine the impacts of macroeconomic variables on stock market indices by taking evidence from the BIST-100 index. The selected variables are the Inflation rate, the exchange rates of the USD and Euro, interest rate, geopolitical risks, gold prices, and money supply from July first, 2014 to January first, 2021, based on monthly data. For this purpose, the Vector autoregression (VAR) model was applied to the variables. The relationships between variables were determined with the Granger causality test, Impact-response functions, and Variance decomposition. In order to establish the VAR model, the necessary conditions are provided on the variables, and the VAR model is set up.

According to the Granger causality test results, it has been determined that there is no mutual relationship between the BIST-100 index and other variables such as the inflation rate, the exchange rate of the TL / Euro, gold price, geopolitical risk, and interest rate. In addition, it has been observed that there is a unidirectional causality relationship between the TL / Dollar exchange rate and the money supply in different directions. This result shows that the BIST-100 index and the changes in the TL / Dollar exchange rate and money supply affect each other in the short term. In other words, the increases and decreases in the BIST-100 index in the short term cause the increase or decrease in the TL / Dollar exchange rate, while the increase or decrease in the money

supply causes the changes in the BIST-100 index, but this is not the case among other variables and the relationship only exists among the mentioned variables.

Studies that can be used as evidence to our findings are the studies by (Kwofie & Ansah , 2018, pp. 1-8) which finds no short-term relationship between inflation and Ghana's stock index, and Iltas finds no causality relationship between geopolitical risk and BIST-100 index (Iltas, 2020, pp. 372-384). Meanwhile, Gazel determines a causality between gold prices and BIST-100 index, which is not contributed with our findings (Gazel, 2016, pp. 337-344).

Some studies mentioned in the literature prove the same result as we found, and that can be a supporter of our findings. Aykut is one of the examples that found the same causality relationship from the BIST-100 index to the exchange rate of USD (Aykut, 2015, pp. 1-79). On the other hand, Bulut finds a bidirectional causality between stock prices and exchange rate (Bulut, 2013, pp. 1-213). Other studies by (Eyuboglu & Eyuboglu, 2018, pp. 89-99) and (Aydemir & Demirhan , 2009, pp. 208-2015) prove that the exchange rate of the TL /USD negatively impacts the index in short-term time. Meanwhile, Guney and Sakalgin found an opposite causality from the exchange rate of TL / USD to the BIST-100 index (Guney & Sakalgin, 2019, pp. 227-245). Moreover, A study by Yilmaz proves that money supply can impact the BIST-100 index (Yilmaz, 2015, s. 1-112).

Figure 3.16 shows the results of the Granger causality test in brief.

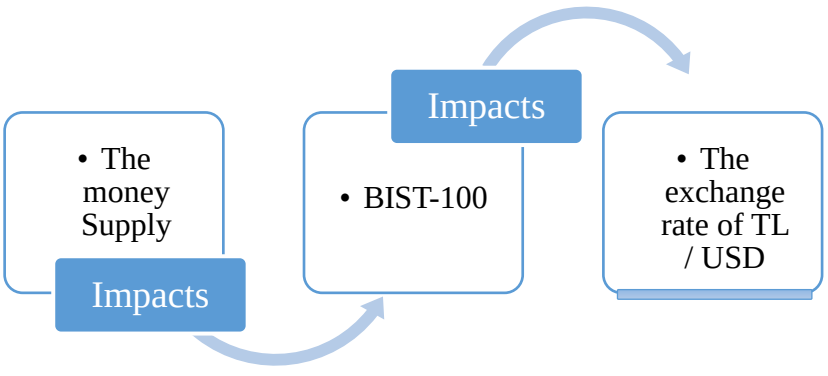

Figure 3.16 *Granger causality test result*

The results of impulse-response functions show that other variables, excluding TL / USD exchange rate, react only in case of a shock in their charts. In other words, the

impulse response results provide no relationship between the variables out of the relationship of TL / USD exchange rate. The shocks of USD can negatively impact the BIST-100 index for two months, and also, the shocks of the BIST-100 index can negatively influence the exchange rate of USD for two months. Therefore, the findings support the Granger causality results. According to this information, individuals, investors, and decision-makers who want to invest in the TL / Dollar exchange rate or the BIST-100 index can make better decisions by examining these graphs and results.

Lastly, the figure below summarizes the results of the impulse response test between the two connected variables:

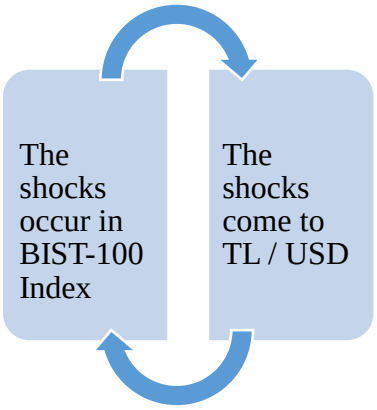

Figure 3.17 *Impulse Response Test Result*

According to the results of variance decomposition, most of the returns of all variables are composed of their own dynamics. Moreover, the findings obtained also support other results. As we look at the BIST-100 index when it is accepted as a dependent variable, the money supply affects its returns more than the other variables. Thus, this can be used as a support to the results we gained in the previous steps.

Finally, when all results are evaluated, it has been observed that there are different relations between the BIST-100 index and the exchange rate of the TL / Dollar and money supply. Therefore, Investors and decision-makers can make better decisions by considering the relationships between these variables, and also, this study can be tested with different models and developed methods in the future.

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Attached tables

Table 23. *Variance decomposition (Bist & CPI)*

Bist100	
Bist-100 Dynamics	**CPI Dynamics**
100.0000	0.000000
98.84663	1.153361
96.54920	3.450798
92.33754	7.662454
92.05412	7.945874
92.71359	7.286409
91.74281	8.257012
90.81671	9.183287
90.84782	9.152177
90.95552	9.074474

Table 24. *Variance decomposition (CPI & Bist-100)*

CPI	
Bist-100 Dynamics	CPI Dynamics
4.916889	95.083110
3.313700	96.686299
5.531041	94.468958
5.601148	94.398851
6.970494	93.029505
9.249452	90.750547
11.412999	88.587000
11.314485	88.685514
11.545827	88.454172
16.665548	83.334451

Table 25. *Variance decomposition (Bist-100 & EUR)*

Bist-100	
Bist-100 Dynamics	EUR Dynamics
100.00000	00.00000
98.019168	1.980833
97.917014	2.082985
97.826825	2.173174
96.689642	3.310357
94.400429	5.599570
93.574503	6.425496
93.368510	6.631489
92.981655	7.018344
93.047892	6.952107

Table 26. *Variance decomposition (EUR & Bist-100)*

EUR	
Bist-100 Dynamics	EUR Dynamics
1.266863	98.73313
7.926213	92.07378
10.476613	89.52338
10.411478	89.58852
12.383341	87.61665
14.012055	85.98794
13.599558	86.40041
13.602701	86.39729
13.448186	86.55181
13.444457	86.55542

Table 27. *Variance decomposition (Bist-100 & MS)*

Bist-100	
Bist-100 Dynamics	Msupply Dynamics
100.0000	00.00000
93.13255	6.867450
78.92724	21.07276
71.39816	28.60184
71.38820	28.61180
70.18072	29.81928
69.20239	30.79761
66.59193	33.40807
66.60681	33.39319
65.44562	34.55438

Table 28. *Variance decomposition (MS & Bist-100)*

M.supply	
Bist-100 Dynamics	MS Dynamics
3.728671	96.27133
2.053925	97.94607
1.417889	98.58211
4.103817	95.89618
9.632384	90.36762
12.34614	87.65386
13.11212	86.88788
14.50131	85.49869
15.81197	84.18803
17.97863	82.02137

Table 29. *Variance decomposition (Bist-100&GP)*

Bist-100	
Bist-100 Dynamics	Gold Dynamics
100.0000	00.00000
97.91215	2.087842
95.53261	4.467384
95.74956	4.250433
94.90918	5.090817
94.86122	5.138774
94.86699	5.133004
94.76143	5.238568
94.75901	5.240983
94.75915	5.240847

Table 30. *Variance decomposition (GP &Bist-100)*

Gold	
Bist-100 Dynamics	Gold Dynamics
4.432336	95.56766
6.402953	93.59704
7.940071	92.05992
9.811340	90.18865
11.32275	88.67724
11.46193	88.53806
11.52550	88.47449
11.81599	88.18400
11.87267	88.12732
11.87150	88.12849

Table 31. *Variance decomposition (Bist-100 & USD)*

Bist-100	
Bist-100 Dynamics	USD Dynamics
100.0000	00.00000
99.57311	0.426884
99.39383	0.606161
99.31655	0.683446
97.68230	2.317692
97.30106	2.692395
97.30760	2.692395
96.89013	3.109860
96.79449	3.205503
96.79570	3.204297

Table 32. *Variance decomposition (USD &Bist-100)*

USD	
Bist-100 Dynamics	USD Dynamics
5.003505	94.99649
17.76562	82.23437
22.97634	77.02365
22.61448	77.38551
23.84598	76.15401
23.73238	76.26761
23.29661	76.70338
23.29741	76.70258
23.19200	76.80799
23.19061	76.80938

Table 33. *Variance decomposition (Bist-100 & GR)*

Bist-100	
Bist-100 Dynamics	G.risk Dynamics
100.0000	00.00000
99.62740	0.372599
97.00450	2.995497
92.33258	7.667412
90.37035	9.629643
89.99324	10.00675
88.74880	11.25119
88.67363	11.32636
89.10408	10.89591
88.55511	11.44488

Table 34. *Variance decomposition (GR &Bist-100)*

G.risk	
Bist-100 Dynamics	GR Dynamics
3.766618	96.23338
3.158532	96.84146
5.503769	94.49623
5.472894	94.52710
5.280527	94.71947
5.331954	94.66804
6.572383	93.42761
16.14809	83.85190
19.46101	80.53898
19.96471	80.03528

Table 35. *Variance decomposition (Bist-100 & INR)*

Bist-100	
Bist-100 Dynamics	INR Dynamics
100.0000	00.00000
94.42776	5.572239
94.33560	5.664396
93.82635	6.173646
92.97283	7.027166
93.42043	6.579563
91.97376	8.026233
91.97983	8.020169
90.71033	9.289669
89.68833	10.31166

Table 36. *Variance decomposition (INR & Bist-100)*

INR	
Bist-100 Dynamics	INR Dynamics
0.078719	99.92128
0.532443	99.46755
2.458136	97.54185
4.402237	95.59776
6.375329	93.62467
7.992222	92.00777
10.86180	89.13819
13.63464	86.36535
14.31435	85.68564
13.88777	86.11222