REPUBLIC OF TURKEY
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INSTITUTE OF GRADUATE STUDIES

Department of Economics and Finance

THE EFFECT OF INTEREST RATE ON THE INFLATION IN TÜRKİYE FOR 2001-2023

Master Thesis

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Supervisor

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Istanbul – 2024

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DECLARATION

I hereby declare that in the preparation of this thesis, scientific ethical rules have been followed, the works of other persons have been referenced in accordance with the scientific norms if used, there is no falsification in the used data, any part of the thesis has not been submitted to this university or any other university as another thesis.

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SUMMARY

This research offers a thorough examination of the relationship between interest rates and inflation in the Turkish economy from 2001 to 2023. The investigation was done using monthly data, with the dependent variable being inflation and the independent variables being money supply, real effective exchange rate, and overnight rate. The study uses a thorough unit root test and correlogram analysis to determine whether the variables are stationarity.

The Autoregressive Distributed Lag (ARDL) model is used to uncover co-integration relationships between these vital economic parameters, shedding light on their long-term interactions. Furthermore, the model undergoes thorough assessments for validity and stability, ensuring the robustness of its application.

The study supports the presence of a long-run equilibrium relationship between the variables based on the Error Correction Model (ECM). The coefficients produced from the ECM demonstrate the positive impact of the Overnight Rate and the lagged CPI on the dependent variable, highlighting their significance.

Key words: Inflation, Interest Rate, Turkish economy, co-integration, ARDL Model.

ÖZET

Bu araştırma, 2001'den 2023'e kadar olan dönemde Türk ekonomisinde faiz oranları ile enflasyon arasındaki ilişkinin kapsamlı bir incelemesini sunmaktadır. Aylık veriler kullanılarak gerçekleştirilen incelemede, bağımlı değişken enflasyon iken bağımsız değişkenler para arzı, gerçek etkili döviz kuru ve gecelik faiz oranıdır. Değişkenlerin durağanlık olup olmadığını belirlemek için ayrıntılı bir birim kök testi ve korelogram tablosu analizi kullanılmıştır.

Bu önemli ekonomik faktörler arasındaki eşbütünleşme ilişkilerini bulmak için gecikmeli dağıtılmış otoregresif (ARDL) modeli kullanıldı. Ardından, bu faktörlerin uzun vadeli etkileşimleri incelendi. Ek olarak, model kararlılık ve geçerlilik açısından kapsamlı incelemelere tabi tutulmuş olup, kullanımının güvenilirliğini göstermiştir.

Bu çalışma, Hata Düzeltme Modeli (ECM) temel alınarak değişkenler arasında uzun vadeli denge ilişkisinin varlığını desteklemektedir. ECM'den üretilen katsayılar, Gecelik Faiz Oranı ve gecikmiş TÜFE'nin bağımlı değişken üzerindeki olumlu etkisini göstermekte, önemlerini vurgulamaktadır.

Anahtar kelimeler: Enflasyon, Faiz Oranı, Türk Ekonomisi, eşbütünleşme, ARDL Modeli.

TABLE OF CONTENT

ABBREVIATIONS

CPI	**:**	Consumer Price Index
REER	**:**	Real Effective Exchange rate
M2	**:**	Money Supply
O/N Rate	**:**	Overnight Policy Rate
CRBT	**:**	Central Bank of the Republic of Türkiye
ARDL	**:**	Autoregressive Distributed Lag

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PREFACE

During the period under scrutiny, spanning more than two decades, Türkiye experienced a multitude of economic challenges, shifts, and transformations. The importance of this research lies in its pursuit of understanding how variations in interest rates have influenced inflation dynamics within the Turkish economy, and the implications these findings hold for economic policy decisions.

The ultimate purpose of the research is to deliver insightful information that will improve our understanding of the Turkish economic environment and serve as a basis for wise financial decisions that will promote stability, prosperity, and growth in the economy. Our goal is that the results of this study will provide a concrete, data-driven viewpoint to the continuing conversation about interest rates and inflation, influencing economic choices for years to come.

INTRODUCTION

Ensuring price stability has a central role in establishing macroeconomic balances. For this reason, the primary purpose of central banks is to control inflation, and all policies are shaped in line with this purpose. High inflation creates significant problems in both microeconomics and macroeconomics, as well as laying the groundwork for future crises. As a matter of fact, the negative trend of savings, investment, production, unemployment, income distribution, foreign trade, and interest variables due to high inflation cause problems in the economic field to increase. Similarly, another important threat to developing countries is high-interest rates, which fail in shock tactics to curb speculation in goods and securities when it gets out of control.

High-interest rates, which cause an increase in credit costs and a shift of savings to non-productive areas, are among the main agenda items of the Turkish economy. As a matter of fact, the increase in interest rates may also lead to an increase in product prices over financing costs. On the other hand, high inflation may result in an increase in interest rates in order to keep real income at positive levels. Based on monthly data from 2001 to 2023, this study aims to empirically analyze the long-term effects of interest and inflation in the Turkish economy.

CHAPTER ONE

LAYOUT OF THE STUDY

The problem statement, study purpose, and framework are described in the first chapter. The concept of interest, its types, theories, and the economic effects of interest on macro variables were covered in the second chapter along with the concept of inflation, its types, causes of inflation in the context of various economic approaches, and the effects of inflation on macro variables. The third chapter provides an overview of the data set and methodology of the analysis. The results and findings are addressed in the last chapter.

1.1. Problem Statement:

Inflation has emerged as one of the most fundamental problems in recent years, especially in developing and underdeveloped countries. In simple terms, inflation, which shows a continuous increase in the general level of prices, is a phenomenon that shows a decrease in the purchasing power of the individuals living in that country. Türkiye is facing the problem of inflation, especially in recent years. The effect of interest rates on inflation in the Turkish economy spanning the period from 2001 to 2023 is a critical and complex issue that warrants a careful analysis. The problem statement concerning the impact of interest rates on inflation in Türkiye between 2001 and 2023 represents a significant challenge in the field of economics and policy analysis. During this extended period, Türkiye has witnessed fluctuations in interest rates and inflation rates, necessitating a comprehensive investigation into the causal relationships and their implications in the short and long term.

1.2. Purpose of the Study

This study aims to investigate the relationship between interest rates and inflation in Türkiye from 2001 to 2023 in a thorough and scientific manner. This study fulfils several important purposes. First and foremost, it seeks to clarify relationships between policy interest rates and inflation in the Turkish setting in the long term. The study aims to enhance comprehension of the nation's monetary policy and economic stability by identifying the coefficient of this correlation in the long and short term.

1.3. Significance of the Study

In the Turkish context, this study is significant for a number of important areas of economics and policy analysis. First of all, it is crucial to comprehend the complex link between these factors because Türkiye has experienced economic difficulties and changes in inflation and interest rates during the previous 20 years. Furthermore, as interest rates and inflation patterns have a substantial impact on investment results in Türkiye's financial markets, this research will provide relevant information to investors and market participants looking to make well-informed decisions.

1.4. Research Questions

The research questions aim to address several fundamental queries pertaining to the impact of interest rates on inflation in Türkiye:

1. What is the quantitative magnitude of the impact of interest rate on inflation levels in Turkish economy between 2001-2023 in short and long-run?
2. What are the time lags involved in the transmission of interest rate changes to inflation?
3. what are the potential policy implications for the Central Bank of Türkiye and other relevant authorities in managing inflation and ensuring economic stability in the country?

1.5. Theoretical/Conceptual Framework

The conceptual framework for examining the effect of interest rates on inflation in Türkiye between 2001 and 2023 is designed as follows:

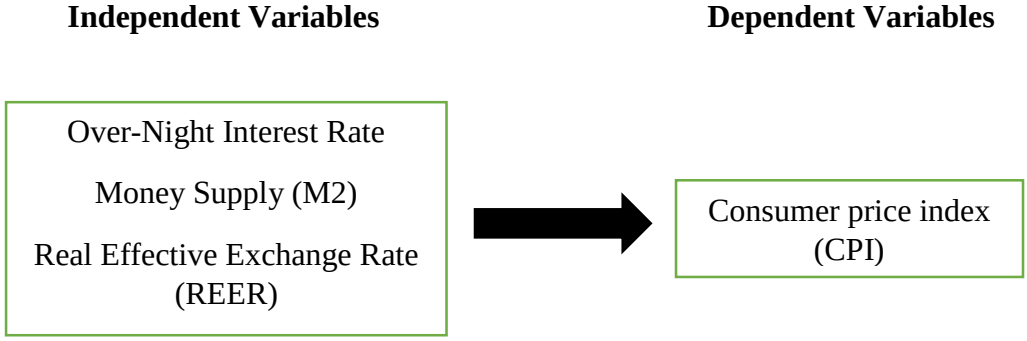


Figure 1. Conceptual framework of interest rate and inflation

CHAPTER TWO

LITERATURE REVIEW

2. The Concept of Inflation

Inflation is the most significant, serious, and economic issue that most nations around the world have experienced and continue to experience, making it a critical issue for study and research. In addition, it is considered the main cornerstone from which to derive economic policies and government programs to achieve macroeconomic policy goals. Increases interest in this phenomenon, especially among decision-makers, and researchers and economists say that inflation causes an economic imbalance that leads to a loss between internal and external macroeconomic balance, either directly or indirectly (Bernanke B. & Posen A., 1999:76-88).

Inflation is a dynamic phenomenon that occurs in a specific sector as a result of the interaction of monetary, real, and structural factors, the economic and social effects of which transcend the rest of the sectors during a given period and then to the national economy. On this basis, economists classified it as a multidimensional and multifaceted phenomenon, which raises many questions from a theoretical and empirical point of view and makes it a point of discussion that sheds a lot of ink to truly diagnose it and know the mechanisms to control it or reduce its unwanted effects (Lardic, S., and Mignon, V., 2003:1–10).

2.1. Inflation Definition

Inflation is a multi-directional aspect and a lot of schools have defined it in different ways. However, inflation is a general rise in prices (Friedman M.,1968: 1-17), for this when the term uses inflation without referring to a particular phenomenon or case the intended is the high prices. Moreover, inflation is a sustainable rise in prices this concept has been considered simply because of problems that appear when placed on the application level, that increase the demand for goods or services. Inflation rate is variable rate overall level of price is an economy.

There are three important points to be emphasized in this definition (Ahmad, S., 2010: 268 –275).

- First, since the general level of prices expresses the general average of the prices of all goods in the economy, inflation is a concept related to the increase in the prices of all goods in the economy, not just the increase in the price of one good.
- Secondly, the price increase in the definition must be “continuous”. In this context, temporary increases in the prices of some goods are not considered inflation. Therefore, continuous increases, not temporary increases in the general level of prices, are characterized as inflation.
- The concept of inflation is the of the balance between aggregate demand and aggregate supply. In some cases, aggregate demand exceeds aggregate supply, and in other cases, aggregate supply exceeds aggregate demand. The fact that the aggregate supply is not large enough to meet the aggregate demand results in increasing prices in order to purchase limited quantities of goods and lower the aggregate demand.

2.2. Types of Inflation

Although inflation expresses significant and continuous increases in the general level of prices. It is divided into different types according to the size of the rate increase in prices, the reason for the increase in prices, and the calculation methods.

According to the size of the rate of increase in the general level of prices, inflation is divided into six main groups as follows:

- Zero Inflation
- Low Inflation
- Moderate Inflation
- High Inflation
- double-digit inflation
- hyperinflation

According to the reasons for the increase in the general level of prices, inflation is divided into three main groups as follows:

- Demand-pull inflation
- Cost-Push Inflation
- Built-In inflation

According to the needs that have arisen recently, the following types of inflation have also become very important:

- Core Inflation
- Headline Inflation
- Expected Inflation
- Unexpected Inflation
- Chronic Inflation
- Imported Inflation
- Global Inflation
- Full employment inflation
- Semi-inflation
- Pure Inflation
- Hidden Inflation
- Structural Inflation
- Suppressed Inflation

2.3. Inflation in the Context of Economic Approaches

Inflation is handled within the framework of different economic approaches, and each of them presents the causes of the problem and solution proposals within the framework of their own views. In this context, regarding the phenomenon of inflation the causes of inflation are discussed according to the Classical, Keynesian, Monetarist, Rational Expectations, Structural approaches.

2.3.1. Inflation According to the Classical theory

The classical economic approach acts on the assumption that economic units act in line with their own interests; it has been accepted that everyone contributes to the development of society at the same time. In such an environment, the intervention of the state in economic activities creates negative results in terms of micro- and macroeconomic balances by disrupting resource distribution (Amaefula, C. G., 2016: 24-28). According to classical economists, if full employment competition conditions and wage and price flexibility are realized, the economy automatically reaches the full employment level. However, state intervention brings about an increase in public expenditures, and increased expenditures also cause financing problems. If public expenditures are met with the resources of the central bank, monetary expansion results in an inflationary effect. Classical economists dealt with the phenomenon of inflation within the framework of the quantity theory of money and associated the increase in the general level of prices with increases in the money supply as follows (Lucas, Robert E. Jr., 2000: 247–274).

$MV = PY$ …… Equation 1

Here M represents the money supply, V the velocity of money, P the general level of prices, and Y the volume of transactions carried out in a certain period.

Transaction volume is assumed to be constant because it is determined by real rather than monetary factors and corresponds to the full employment income level. The velocity of money, on the other hand, is accepted as being size-dependent on social, psychological, and institutional factors and is assumed to be constant as the transaction volume. Therefore, the general level of prices is determined by the money supply, and an increase in the money supply causes the general level of prices to increase in the same direction and at the same rate (Lucas, Robert E. Jr., 2000: 247–274).

2.3.2. Inflation According to the Keynesian Approach

The 1929 Great Depression weakened the system's self-correction assumption without state intervention, and thus the classical and neoclassical understanding of economics was severely shaken. Keynes argues that the economy does not have a mechanism to establish a full employment balance on its own and that in cases where

monetary policy is insufficient, the state should intervene in the economy with fiscal policy measures (Tobin, J., 1955: 42–47).

According to the Keynesian approach, in terms of economic and price stability, it is very important to ensure and maintain the stability of the money. In this context, it is assumed that economic stability suffers mainly due tso monetary reasons. On the other hand, price stability deteriorates as a result of total demand exceeding total supply, and real inflation emerges after it reaches the full employment level (Bernanke B. & Posen A., 1999:76–88).

The Keynesian approach is that an increase in money supply will occur in economies with underemployment, and it argues that it will have positive effects on aggregate demand, output, and employment. The amount of output, total demand, and employment all increase at the same rate as the money supply increases; however, the monetary expansion process that continues after reaching full employment increases total demand but does not change the output level and only increases prices (Bernanke B. & Posen A., 1999:76-88).

2.3.3. Inflation According to the Monetarist Approach

The inadequacy of Keynesian economics in both explaining and solving the stagflation phenomenon that emerged with the oil crises in the first half of the 1970s has prepared a suitable ground for the development of new economic policies. Under the leadership of Milton Friedman, the monetarist approach, which emerged as a reaction to Keynesian economics, became an important economic trend that gained popularity in a short time. The main purpose of this approach can be expressed as revising the principles and suggestions of classical economics and reviving the free market model (Lardic, S., and Mignon, V., 2003:1–10).

In the monetarist theory, the main variable that determines the general balance of the economy and its central position is the money supply. Developments in the money supply affect aggregate demand, production, employment, and the general level of prices. Despite the fact that increases in the money supply increase aggregate demand, if total supply is unable to respond to an increase in total demand with the required level of production, the general level of prices rises. Therefore, according to the monetarist view, inflation is always and everywhere described as a monetary

phenomenon, and the main reason for the increase in the general level of prices is attributed to the continuous increases in the money supply (Lucas, Robert E. Jr., 2000: 247–274). Monetarist economists have tried to explain the inflation phenomenon with the help of modern quantity theory in equation 2, which they developed based on the quantity theory of the Classics (Mankiw, N. G., 1997: 3–19).

$$M = k.P.T \quad \text{Equation 2}$$

Monetarists revised the Cambridge equation in equation 2 as follows: M/P= K.T. Here, M is the money supply, k is the ratio of total transactions to income and the ratio of desired money balances to the total transaction (how much of the total monetary income is kept in cash), T is the transaction volume carried out in a certain period, P is the price level, M/P the real money supply, $k.T$ represent the real money demand. Real money demand according to monetarists depends on permanent income (W), amount of human wealth (w), expected rate of return on wealth (r), inflation expectations (E). Permanent income (W) is the average of individuals' past, current and future incomes. The amount of human wealth (w) is the amount of wealth that is converted into liquidity. The greater the amount of human wealth in individuals' total wealth, the greater their demand for money will be. The expected rate of return on wealth (r) is the expected income from securities such as bonds and stocks that are easy to convert into liquidity. As the expected return on securities increases, the demand for money decreases and as the expected return decreases, the demand for money increases. Expectations about inflation (E), an expectation that the inflation rate will increase cause a decrease in money demand. So k, which represents the real demand for money, on the right-hand side of the equation. Real demand for money function can be written instead of T (Mankiw, N. G. ,1997: 3-19).

$$\frac{m}{p} = f(W, w, r, E) \quad \text{Equation 3}$$

According to the Classic Quantity Theory, an increase in the money supply causes the general level of prices to increase in the same direction and with the same magnitude. According to the Modern Quantity Theory, an increase in the money supply increases the general level of prices in the same direction but at a higher rate. because an increase in the money supply will increase the cost of holding money, which will increase the rate of circulation of money. This is because the money that is not wanted to be held is spent on alternative assets. In this case, the increase in the

money supply causes the k to decrease steadily and the general level of prices to increase more severely than the increase in the money supply. Monetarists, who see inflation as a monetary problem, argue that monetary policy should be used as an effective policy tool to overcome this problem (Nelson and Schwartz, 2008: 3–24).

2.3.4. Inflation According to the Rational Expectations Approach

It is an economic approach that emerged in the 1970s based on the basic principles of classical theory. According to the Rational Expectations Approach, expectations refer to predictions made for future events based on available information. Economic units make the best predictions about the future in light of the information they have. Since it is assumed that individuals trying to predict the future do not make similar mistakes all the time, there is no systematic or repetitive error (Nusair, S. ,2009: 143–159). Being rational enables individuals to have knowledge about the functioning of the economy and to take the necessary precautions by noticing the effects of the policies implemented in advance.

The rational expectations approach is contrary to the Keynesian approach; it assumes that supply and demand conditions change within expectations, wages and prices are flexible according to these expectations, and the economy is at full employment. Therefore, the wage and price assumption, which is flexible according to expectations, ensures that the markets come to equilibrium simultaneously. In an economy that is constantly in balance, it is argued that monetary expansion will increase prices, not production (Laidler, 1989: 403–428).

Anti-inflationary policies become ineffective because individuals who want to get rid of the negative effects of the decisions taken by the government to prevent price increases will act by anticipating these decisions. According to the rational expectations approach, if the money supply is increased, individuals think that their purchasing power will weaken after a certain period and demand an increase in their nominal wages at the rate of inflation. On the other hand, employers will try to increase the prices of the goods they produce in order to protect themselves from inflation. Thus, increasing the money supply will only create an inflationary effect without causing any change in the real national income or employment level (Lucas R., 2000:

645–652). Therefore, the fight against inflation by reducing the money supply requires tax cuts and discipline in public expenditures.

2.3.5. Inflation by Supply Side Approach

Arguing that the demand-side policies of the Keynesian approach were invalid in the resolution of the stagflation crisis that occurred in the 1970s, supply-side economics formed the basis of the election policy of President Ronald Reagan in the USA, especially in 1980, and this policy was also called "Reaganomics" for this reason. Supply-Side Economics argues that to find solutions to economic problems, the supply side of the economy should be given primary importance. The main purpose of this approach focuses on cutting taxes, lowering borrowing rates, and deregulating industries to foster increased production. In this context, it is argued that tax rates should be regulated in order to increase savings, capital accumulation, and tax revenues (Barro R.J. & Sala-i-Martin X., 1991: 223-251).

Reducing tax rates will increase production by encouraging savings and investments, while increasing production will reduce unemployment and break the inflationary pressures caused by insufficient supply (Barro R.J. & Sala-i-Martin X., 1992: 223-251).

Inflation, according to supply-side economics, is related to the increase of the money supply at a higher rate than the increase in production. It argues that measures to increase total supply are more effective than measures to decrease total demand to ensure price stability. A decrease in inflation will increase income and, indirectly, consumption, production, and employment. In addition, it causes an increase in investments by lowering interest rates (Walsh, C. E., 2014).

2.3.6. Inflation According to the Structuralist Approach

Despite the implementation of the monetary approach proposed by the IMF to resolve the inflationary process that emerged in Latin America in the late 1950s where the economy has not been adjusted for inflation. For this reason, ECLAC (Economic Commission for Latin America and the Caribbean) focused on the view that tried to explain inflation with structural reasons as a reaction to the monetary approach.

The structuralist approach, which connects the causes of inflation to structural disorders and bottlenecks in the economy, argues that market disruptions in the economic growth and development process lead to supply-demand imbalances and price increases. According to the structuralist approach, which deals with the inflation problem especially in underdeveloped countries, the problems that cause the increase in the general level of prices can be listed as follows (Guillermo A. Calvo,2013: 145-166):

- In underdeveloped countries, the majority of the population spends a significant part of their income on foodstuffs, therefore, in response to the increasing food demand so insufficient flexibility of agricultural product supply causes prices to rise.
- In particular, the fact that the production of agricultural products in these countries is largely dependent on weather conditions pushes exports to instability.
- In underdeveloped countries, the state increases its current and transfer expenditures in order to increase employment and make income distribution more equitable. The budget deficits that arise as a result of the imbalance between public expenditures and revenues push these economies to the path of deficit financing. In addition, the weakness of tax control and political instability limit tax revenues. Since indirect taxes are generally applied for public revenues that cannot comply with the increase in expenditures, the general level of prices increases.
- Inefficient public administration, lack of coordination, irrational government interventions, low capital accumulation and delay in the completion of public investment projects pave the way for price increases to reach inflationary dimensions.

Since it is accepted that structural problems rather than monetary expansion cause price instability, this approach; sees emissions as the result of inflation, not the cause (Guillermo A. Calvo,2013: 145-166).

Table 1. Inflation causes according to economic approaches

Economic Approaches	**Inflation causes**
Classical	Determined by the money supply.
Keynesian	Imbalance between the aggregate demand and supply
Monetarist	Continuous increases in the money supply.
Rational Expectations	Depends on the expectations of decision economic units
Supply Side	Increase in the money supply more than the increase in output.
Structuralist	Increases in the money supply are the result, not the cause, of inflation.

2.4. The Concept of Interest

The concept of interest is one of the oldest phenomena in the economic life of mankind. Interest, which has been in almost all societies throughout history, has been accepted as a fact of the economy by some societies, and sometimes it has been thought to be a wrong application on the grounds that it has no justification (Clarida R. & Gal J., 1999: 345–380).

In the past, although people did not have the power to obtain goods and services that would meet their needs, At the same time, they did not have the power to protect the property they acquired. Hard-earned goods have always been subject to the dangers of being spoiled, stolen, or attacked. As a solution to this problem, the method of borrowing was developed, and the person who found excess product lent money to the person who did not own the product, on the condition that it be taken back later. Thus, both parties found the opportunity to get what they wanted by giving unrequited payment. However, as the way to preserve the goods was learned, people became more reluctant to lend without return and after a certain period, they started lending on the condition that they take "surplus" with them. The interest evolved with the use of money gained a different dimension and became widespread Therefore, interest has a very old history dating back thousands of years in terms of both theory and practice (Clarida R. & Galí J.,1999: 345-380).

At the same time, they did not have the power to protect the property they acquired. Hard-earned goods have always been subject to the danger of being spoiled, stolen, or attacked. As a solution to this problem, the method of borrowing was developed, and the person who found excess product lent money to the person who did not own the product on the condition that it be taken back later. Thus, both parties found the opportunity to get what they wanted by making unrequited payments. However, as people learned how to preserve the goods, they became less willing to lend without receiving anything in return. and after a certain period, they started lending on the condition that they take "surplus" with them. The interest evolved with the use of money, gained a different dimension, and became widespread. Therefore, interest has a very long history dating back thousands of years in terms of both theory and practice (Clarida R. & Gal J., 1999: 345–380).

Interest in the Middle Ages: In this period when religious tendencies were dominant, attitudes towards interest became increasingly rigid, and taking more than the amount of money given was seen as a complete sin. The idea of prohibiting interest in the Middle Ages was based on the principle that any income obtained without working is not considered legitimate (Knightley A. ,2020).

Interest in the New Age: Due to the new sea routes and continents discovered at the end of the Middle Ages, the rapidly developing international trade and production structure paved the way for a capitalist perspective to gain strength. This

situation has started the process of placing interest on the basis of the economy by removing the phenomenon of interest from the religious and moral framework to a certain extent. In addition to economic developments, reform movements in Christianity significantly altered the understanding of interest. As a matter of fact, important thinkers of the reform movement, such as Martin Luther, John Calvin, and Turgot, pioneered the weakening of the strict approaches to the application of interest. Contrary to the First and Middle Ages, the use of interest gained distinct legitimacy in this period (Smith, J. A. ,2022)

The concept of interest is one of the main topics that is discussed in many dimensions and brings up important discussions, especially in the economic field. There is a common view on the definition of the concept, but no agreement has been reached.

Interest is defined as a price paid as a result of using a certain amount of money for a certain period of time. According to another definition, interest is the rental value of money. On the other hand, those who pay interest describe it as a price that brings together those who have money and those who need money. In addition, the interest covers both the risk of not returning the loaned money and the depreciation caused by inflation. In economic terms, "interest" also refers to the capital's share of total income. Interest is a type of return in the legal context that consists in the payment of a sum of money based on the length of time the lender is deprived of that money for a specified period and at a specified rate (Smith, J. A. ,2022).

2.5. Types of Interest

Interest, which has an important place in the formation of macroeconomic balances, has different types in the literature and in practice. This situation arises depending on the differences in maturity, credit risk, and tax application (Mankiw, 2015).

- Term: While some debts in the economy are short-term, some are long-term. Since the interest rate depends on the maturity of the debt, short-term interest rates are generally low and long-term interest rates are high.
- Credit Risk: The lender must consider the possibility of non-payment by the borrower. The higher the probability of non-payment, the higher the interest

rate. Interest rates on government securities are low, simply because the government is the most reliable borrower. Other than that, it gives loans to people who demand borrowing by issuing debt securities with high-interest rates to cover the credit risk in case of non-repayment.

- Taxation: Interests on different debt securities are taxed in different ways. For example, in some countries, when local governments issue debt securities, those who own these debt securities are exempted from the income tax levied by the central administration. Due to this tax advantage, the interest rates applied by local administrations to debt securities are lower.

The main types of interest rate can be listed as follows:

- Simple Interest-Compound Interest
- Deposit Interest-Loan Interest
- Nominal Interest-Real Interest
- Benchmark Rate
- Policy Rate
- Overnight Interest
- Late Liquidity Window Rate
- Rediscount and Advance Interest
- Remuneration Applied to Required Reserves in Turkish Liras

2.5.1. Simple Interest-Compound Interest

Simple interest is defined as the rate of interest earned by only the principal of an investment during the investment period. Compound interest refers to the return obtained as a result of reinvesting an investment together with the interest earned during the investment period. In other words, compound interest means that interest also earns interest (Smith A. B. ,2022:210-218).

2.5.2. Deposit Interest-Loan Interest

Deposit interest is the interest rate applied to the amount of money deposited by individuals to their time deposit accounts in banks to be withdrawn at the end of a predetermined period. Whereas the loan interest is defined as the interest rate applied by banks to loans, they give under various names such as commercial loans, consumer loans, or housing loans to meet the needs of individuals (Davis, R. M. ,2022:521-535).

2.5.3. Nominal Interest-Real Interest

Nominal interest, which is widely used in the market, expresses the current interest rate, which is not adjusted for the price effect (inflation). For this reason, the money to be obtained at the end of the maturity period, together with the nominal interest income, does not show the change in purchasing power. Because inflation leads to an increase in the general level of prices and reduces the value of money (Clarida R. & Gal J., 1999: 345–380)

The real interest rate, which was developed to solve this problem of the nominal interest, represents the remaining interest after the price effect is subtracted. Therefore, real interest enables the real purchasing power to be revealed. The real interest rate is calculated with the following formula:

$$Real\ Interest\ Rate\ = \frac{1+Nominal\ Interest\ Rate}{1+Inflation\ Rate} - 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation 4}$$

For the real interest rate, the terms "expected" and "realized" are commonly used. At the beginning of the year, the nominal interest rate is known, while the inflation rate is only estimated. While making their decisions, economic units create real interest rate expectations by using their knowledge about nominal interest rates and their forecasts for inflation. Expected and realized real interest rates will also differ depending on the situation of inflation at the end of the year. In this case, whether the decisions are healthy or not depends on the realism of the expectations (Clarida R. & Gal J., 1999: 345–380).

2.5.4. Benchmark Rate

The interest rate in the secondary market of government bonds with maturity of two years, coupon payments every 3 or 6 months, that is widely traded (CBRT, 2012).

2.5.5. Policy rate

It is the interest rate applied by the CBRT when it opens a 1-week repo auction that is determined by the Monetary Policy Committee where repo and reverse repo refer to an agreement to buy or sell a fixed-income security such as government bonds at a future date at a predetermined price (CBRT, 2012: 5).

2.5.6. Overnight Interest

The interest rate charged by the CBRT to banks that want to borrow or lend their remaining funds overnight in order to close their accounts at overnight interest (funding rate, interest rate corridor). The borrowing interest rate announced by the Central Bank is referred to as the "floor," and the lending rate is referred to as the "ceiling." Overnight interest rates always occur between the ceiling and floor rates. In case of a liquidity shortage in the banks, banks can borrow at the overnight CBRT lending rate against their collateral up to their limits. In case of excess liquidity, banks can lend to the central bank in TL an unlimited amount according to the overnight CBRT lending rate (CBRT, 2012).

2.5.7. Late Liquidity Window Rate

The late liquidity window is the borrowing and lending facility that the Central Bank, as the lender of last resort, applies to banks at the end of the day (between 16.00 and 17.00) in order to resolve the problems that may arise in the payment systems and meet their temporary liquidity needs or evaluate their liquidity surplus. Banks can borrow from the Central Bank with unlimited "late liquidity overnight TL borrowing interest" or "late liquidity borrowing interest" in return for their collateral (CBRT Glossary of Terms). This practice includes deterrent interest rates applied to banks that wait until the last moment to close their accounts or lend their money (CBRT, 2015).

2.5.8. Rediscount and Advance Interest

In order to meet the temporary liquidity needs of the banking sector, the Central Bank can accept commercial bills presented by banks for rediscount. The re-discounting of a commercial paper that has been discounted by a bank against a price is referred to as rediscounting. The interest applied by the Central Bank for these transactions is called the "discount rate." There is also an advance option for commercial papers accepted for discount by the Central Bank. In this case, the interest rate applied is called the "advance interest rate" (www.tcmb.gov.tr).

2.5.9. Remuneration Applied to Required Reserves in Turkish Liras

The required reserve is the amount of funds held in reserve by a central bank to ensure that it can meet liabilities in the event of unexpected withdrawals. This cost is created by the reserve requirement reflected by banks' obligations to depositors and borrowers. Based on the interest-free reserves received from the banks, a payment is made to these banks by the Central Bank again under the name of "compensation interest for required reserves." The Central Bank, up to the ratio of the total deposits of banks and financing companies and their own funds to the required reserves, accepted TL. On the other hand, for required reserves accepted in US dollars, interest is paid at the same rate applied to foreign exchange deposit accounts such as reserve options and free accounts (CBRT, 2015).

2.6. Theories of Interest

The views explaining the existence phenomenon of the interest and what determines the interest are called "interest theories". The main interest theories can be listed as follows:

- Classical theory of interest
- Neo-classical theory of interest
- Keynesian theory of interest
- Neo-Keynesian theory of interest
- The portfolio-balance of Tobin theory

- Marxist Theory of Interest

2.6.1. Classical theory of interest

In classical theory, the interest rate is accepted as a real variable. The factors that determine the equilibrium interest level are savings supply and investment demand. According to classical economic thought, equality between savings and investments is also determined by the flexibility of interest rates. In classical interest theory, it is possible to increase savings supply and reduce demand with high interest rates, especially in inflationary environments. Following a high-interest policy in order to suppress demand and following a low-interest policy is also effective in increasing supply (Hammond, J. D., 2005: 1-38).

Figure 2 shows the formation of the interest rate within the framework of classical economic theory. While there is a positive relationship between the interest rate and the supply of savings, there is a negative relationship between the interest rate and investment demand. In other words, while the supply of savings is an increasing function of interest, investment demand is a decreasing function of interest (Hammond, J. D., 2005: 1-38).

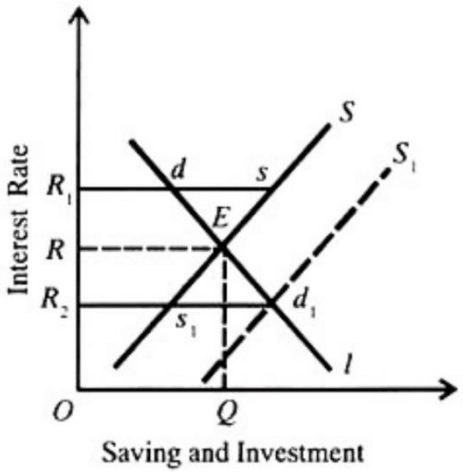


Figure 2. Formation of Interest in Classical Theory
Source: Hammond, J. D., (2005, 1-38)

The equilibrium interest rate is determined at the level corresponding to the intersection of the savings supply and the investment demand. If the interest rate is above the equilibrium rate, the amount of savings to be supplied will be greater than

the amount of credit demanded for investment, and the excess supply of savings will lead to a decrease in the interest rate. On the other hand, if the interest rate falls below the equilibrium interest rate, the amount of savings to be supplied will be lower than the amount of credit to be demanded for investment, and the excess investment demand will lead to an increase in the interest rate. In both cases, the interest will automatically balance (Jareno, F., & Tolentino, M. ,2013: 201-212).

2.6.2. Neo-classical theory of interest

The neo-classical theory's view of how the interest rate is determined extends not just to individual savers and firms but has also included the public sector and the foreign world in this process. According to this theory, the interest rate depends on the supply and demand of loanable funds (Tobin James, 1958:65–86).

The supply of loanable funds consists of the savings of the households, the undistributed profits of the firms, the money they set aside for depreciation if there is a public budget surplus, and the borrowed money from the foreign world. The demand for loanable funds consists of the loans demanded by households for consumption purposes, the loans demanded by companies to finance their investment expenditures, the borrowed money demanded by the government to finance budget deficits, and the borrowed money demanded from the foreign world (Tobin James, 1958:65–86).

The equilibrium interest rate is determined at the level corresponding to the intersection of the loanable fund supply and demand curves. At this point, the supply and demand of loanable funds are equal, and the equilibrium interest rate is called the loanable fund market. Changes in the supply and demand of loanable funds cause the interest rate to change. For example, if an increase in the demand for loanable funds moves the loanable fund demand curve to the right and the equilibrium interest rate rises to the same level.

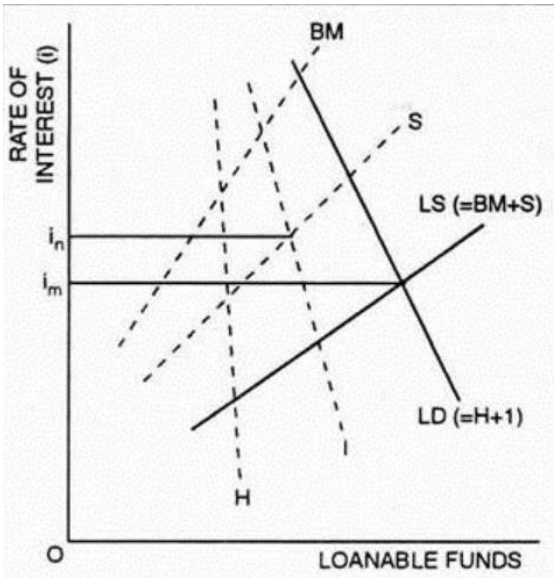


Figure 3. Relationship between loanable funds and interest rate
Source: Tobin James, (1958:65–86)

The equilibrium interest rate, which is formed within the framework of loanable funds theory, is also defined as real interest since it results from the change in real quantities such as consumption and investment (Paya, 2013:135–156). When the real interest rate rises above the equilibrium point, the supply of loanable funds exceeds the demand for funds, and an increase in the propensity to save is observed. High-interest rates increase the amount of savings and, thus, the supply of loanable funds. Interest rates tend to fall as a result of competition among fund suppliers to earn more income, and balance is restored. If the real interest rate falls below the equilibrium point, the demand for loanable funds will exceed the supply of funds, resulting in an increase in the desired investment amount. The resulting shortage of funds will increase the competition among borrowers and cause interest rates to return to the equilibrium point (Jareno, F., & Tolentino, M. ,2013: 201-212).

The equilibrium interest rate is affected by changes in the factors that determine the supply and demand of funds. the profitability of investments and public expenditures, expectations about prices, changes in self-financing opportunities, and the loanable funds demand curve. Many economic factors, particularly wealth and income level, price and interest rate expectations, and tax policy, cause the loanable fund's supply curve to shift. For example, factors such as increasing profitability or strengthening inflationary expectations cause the loanable funds demand curve to move completely to the right. On the other hand, since the decline in wealth and

income levels will decrease savings, it causes the loanable fund supply curve to move completely to the left (Paya, 2013:135).

2.6.3. Keynesian Theory of Interest

According to the Keynesian theory of interest, the interest rate is determined by the money supply and demand. The desire of economic agents to keep a portion of their income or earnings in the form of cash is called "money demand" or "liquidity preference." The main reasons for that are transaction purposes, precautionary purposes, and speculation (Keynes, J. M., 1936).

The transaction purpose refers to the money demanded by economic individuals to meet their daily needs. Money demanded for unforeseen needs and emergencies is known as precautionary demand. The speculative demand for money can be defined as the money demanded to invest in domestic money or foreign currency that is not dictated by real transactions such as trade or consumption expenditure. While the amount of money demanded by economic units for transactions and precautionary purposes depends on income.The speculative demand for money is a decreasing function of the interest rate. As the interest rate rises, the amount of money demanded decreases, and vice versa. Therefore, there is a negative relationship between the interest rate and the amount of money demanded (Mankiw, N. G., 2015).

According to the Keynesian approach, the money supply, which is the other determinant of the interest rate, expresses the total value of financial assets that are accepted as a means of exchange in the economy (Krugman and Wells, 2013). The Central Bank, which is responsible for the control of the banking system and the management of monetary policy, determines the money supply independently of the interest rate.

The Keynesian theory of interest is determined at the level corresponding to the point where money demand and money supply intersect. It has been described as a reward for giving up liquidity (Tobin James, 1958:65-86).

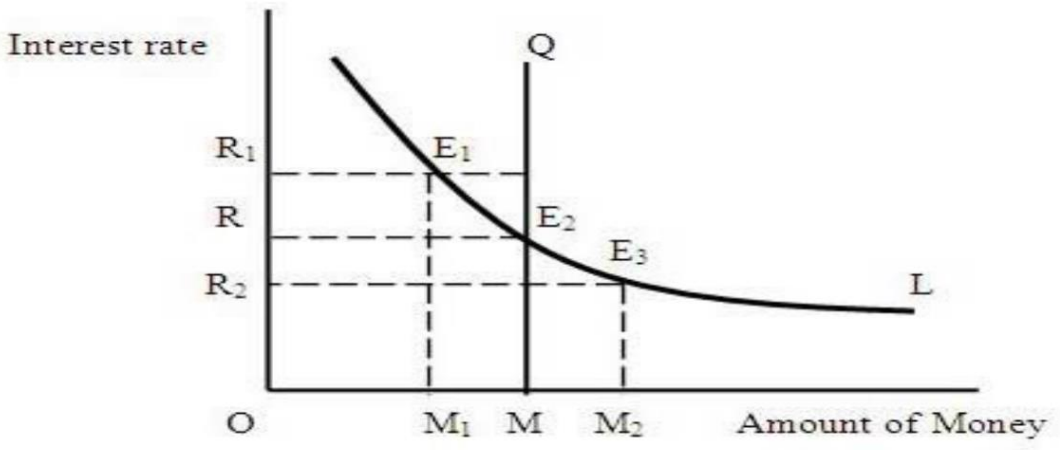


Figure 4. Relations between the interest rate and the money supply
Source: Tobin James, (1958:65–86)

Changes in money demand and money supply affect the equilibrium interest rate. For example, in a situation where income increases while the money supply remains constant, an increase in the demand for money will result in an increase in the equilibrium interest rate. Because, as income rises, so does the demand for money for transactions and precautionary purposes, causing interest rates to rise. Since the amount of money does not change, meeting the increasing demand for money by selling bonds leads to a decrease in bond prices and an increase in interest rates. On the other hand, if the money supply increases while the demand for money remains constant, the interest rate decreases. Because when the money supply rises while the money demand remains stable, economic units tend to buy bonds to get rid of their excess cash. Thus, bond prices increase with the demand for bonds, but this results in a decrease in interest rates (Asemota, O. M., & Bala, D. A. .2011:71-91).

2.6.4. Neo-Keynesian Theory of Interest

Keynes stated that there is an inadequacy in determining the interest rate since saving and investment are interconnected in the classical theory of interest. However, the thesis was put forward that the liquidity preference theory developed by Keynes could not completely eliminate this deficiency. Indeed, the emergence of different liquidity preferences at each income level, the uncertainty about what will happen to money demand for transactional and precautionary purposes, and the fact that liquidity preference for speculation purposes independent of income level demonstrate that the theory of liquidity preference, like the classical interest theory, contains uncertainties.

Hicks and Hansen were able to fill this gap and develop the IS-LM Model. This model includes some elements of classical and Keynesian interest theories (Lucas, Robert E. Jr., 2000: 247–274).

The IS-LM Model, developed by John Hicks and Alvin Hansen, describes how aggregate markets for real goods and financial markets interact to balance the rate of interest and total output in the macroeconomy. While the IS Curve shows different interest and income combinations that provide balance in the goods market, the LM Curve shows different interest and income combinations that provide balance in the money market.

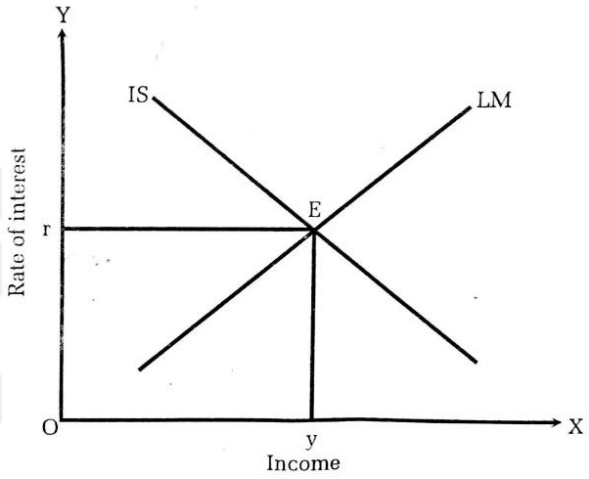


Figure 5. Relation between the interest rate and income

Source: Lucas, Robert E. Jr., (2000: 247–274).

IS-LM Model argues that at each different income level there is a single interest rate that equates investment and savings, and money demand and money supply. The IS curve shows the equilibrium in the goods market, and the LM reflects the equilibrium in the money market. At the intersection of the curve, it is possible to obtain the combination of interest rate and income level that balances both markets at the same time (Hansen, A.H. ,1941: 34-46).

2.6.5. The portfolio-balance of Tobin theory

James Tobin was interested in the fact that some people wanted to keep money and assets in their hands by giving up the interest income. For this reason, the Portfolio Theory developed by Tobin expresses an improved version of Keynes' Liquidity

Preference Theory. According to Keynes' speculative theory of the demand for money, speculators have a certain knowledge of future interest rates. Tobin, on the other hand, assumed that speculators do not have precise information about the future state of interest rates, and unlike Keynes, the future is uncertain (Tobin James, 1958:65-86).

Uncertainty and risk factors are at the core of Tobin's theory of portfolio selection. Uncertainty causes cash to be held instead of interest-bearing assets. Risk allows investors to diversify their assets, not make a choice by sticking to a single asset while forming their portfolios. The reason why investors hold different assets is the uncertainty of future expectations.

The equilibrium interest rate in the IS-LM Model developed by Hicks-Hansen shows both savings and investments and the interest rate that provides equilibrium in the money market. Therefore, when there is a change in money supply or demand, interest rates are affected. Tobin, by including the uncertainties in the analysis of the Portfolio Selection Theory, stated that the risks of different investment instruments will differ, and the resulting interest rates will also differ. Accordingly, as the uncertainties increase, the interest rate also increases (Asgharpur, H., Kohnehshahri, L. A., & Karami, A. ,2007:15-18).

2.6.6. Marxist Theory of Interest

Marx contends that the struggle for economic interests is necessary for the transformation of societies and history. The struggle for economic interests is the conflict between those who own the means of production and the social classes that do not have these means. Turning to the Marxist Theory of Interest in order to reveal the transformation processes of societies throughout history, Marx attempts to prove how the capitalist mode of production will turn into a socialist mode of production by liquidating itself. Moving away from this goal, Marx begins his examination with the concept of the commodity. Meta is the general name of the products that are subject to sale in the market. Capitalist commodity production is based on the exploitation of wage labor by the owners of the means of production (Marx Karl,1959).

On the basis of the capitalist system, there is a conflict between the working class (proletariat), those members of a society whose only possession of significant economic value is their labor power, and the capitalist class (bourgeois), who have

private ownership of the means of production. Since the essence of capitalism is the idea of increasing profits, the current capitalist order is based on the exploitation of the working class by the capitalists and the pursuit of maximum profit through production activities. Marx tries to prove the conflict within the capitalist system and the functioning of the ongoing exploitation mechanism in this conflict through surplus value.

The concept of "surplus value," which forms the basis of Marxist economics, expresses the situation where the labor and wages of the worker do not meet each other. In this context, surplus value is equal to the new value created by workers in excess of their own labor costs. The surplus value that emerges as a result of the worker producing more than the wage, he receives also reveals the exploitation within the capitalist system (Marx, Karl, 1959).

According to Marx, the functioning of capital in the capitalist system is realized primarily by the creation of surplus value and the incorporation of a significant part of this surplus value into capital accumulation by using it in the reproduction process. For this reason, the concentration of the increasing capital accumulation in a single hand creates the conflict between the proletariat class, whose real wage decreases despite the increase in numbers, and the bourgeoisie, which is limited in number but owns the means of production. Increasing exploitation strengthens the sense of solidarity among the working class on the one hand and encourages revolt on the other. The seizure of power by the working class with a counter-revolution abolishes property, and thus the exploitation of workers comes to an end. Marx's socialist mode of production refers to a situation in which all classes vanished under proletarian dictatorship and a classless social order was established (Blinder, A. S., 2015).

Marx, who approaches the subject of interest from a different angle, considers interest to be a component of profit. In other words, this part of the profit paid to the owner of the money is considered interest. In this context, interest is defined as a situation between two capitalists rather than a relationship between a capitalist and a worker (Marx, Karl, 1959: Chapter 5). The capitalist wants to convert his capital, which is in the form of commodity capital, back into money capital. The industrialist, who borrows the capital he needs, must give a part of the surplus value that he has obtained under the name of "profit" to the capitalist. This amount, which is also defined as the interest on the debt, is the transformed form of the surplus value.

Table 2. Theories of Interest

Theories	Determinants of Interest
Classical theory of interest	Determined by the supply of savings and the demand for investment.
Neo-classical theory of interest	Determined by the supply and demand for loanable funds
Keynesian theory of interest	Determined by the money supply and money demand.
Neo-Keynesian theory of interest	Determined by the real and monetary side of the economy
The portfolio-balance of Tobin theory	Determined by the uncertainty that causes the differentiation of investment instruments.
Marxist Theory of Interest	Determined by the debt relationship between the two capitalists.

2.7. Economic Effects of Interest

Interest is among the main economic variables that have direct and indirect effects on macroeconomic variables. Changes in macroeconomic variables can be reflected in social balances. In this context, increases or decreases in interest rates reveal explanatory results on economic as well as social indicators.

2.8. Impacts on Inflation

Inflation is greatly influenced by interest rates. A measure of inflation is the rate of growth in an economy's overall price level for goods and services. In addition, borrowing costs less when interest rates are low, so people and businesses may be more likely to take out loans to invest in new ventures or buy expensive products like cars. The result of this increased spending could be higher pricing or inflation because of the greater demand for products and services.

On the other hand, high interest rates make borrowing more expensive and may discourage individuals and companies from taking out loans. With less money being spent, there may be less of a need for products and services, which could result in disinflation, or a drop in prices.

The interest rate is a tool used by central banks to control inflation; by changing the interest rate, they can influence the money supply, spending, investment, and economic growth. In order to curb inflation when it exceeds the desired level, central banks will either increase interest rates and the money supply that indirectly influence expenditures, and economic expansion. As a result of the strong relationship between interest rates and inflation, changes in interest rates may have an impact on consumer spending, business investment, and economic growth, which may have an impact on consumer demand for products and services (Dierker, E., & Curdia, V., 2019: 1-17).

2.9. Impact on Economic Growth

Interest rates are among the variables that play a key role in economic growth. According to McKinnon (1973) and Shaw (1973), there is a positive relationship between real interest rates and economic growth, as high-interest rates support the increase in savings and create positive effects on economic growth.

On the other hand, high interest rates may cause a decrease in private consumption expenditures based on credit use. In addition, the high loan costs brought about by increasing interest rates may adversely affect the investment decisions of companies. Private consumption and investment spending restraint, on the other hand, may have a negative impact on economic growth by reducing total demand (Smith, J. A.,:2022).

Gregorio and Guidotti (1992), on the other hand, stated that very low or negative interest rates weaken financial intermediation operations and that the rate of return at these levels harms economic growth. Very high real interest rates also reflect a lack of economic policy, and they argued that above-normal rates of return would also harm growth. For this reason, there is an "inverted U" relationship between real interest rates and economic growth.

According to the Mundell-Fleming model, a contractionary fiscal policy under a flexible exchange rate system causes interest rates to rise. Increasing interest rates

also accelerate capital inflows, causing the exchange rate to fall and the volume of imports to expand. The decrease in total demand as a result of the increase in import demand has a negative effect on economic growth (Mankiw, G. ,2019).

2.10. Effect on Exchange Rate

The exchange rate is defined as the rate of change between a national currency and a foreign currency. Therefore, the exchange rate has two components: the local currency and the foreign currency. The foreign currency can be expressed in any national currency. The national currency can also be expressed in terms of any foreign currency (Meese, R., & Rogoff, K., 1983: 3-24). Two different methods can be used to determine the exchange rate between currencies. Fixed exchange rate system in which the Central Bank intervenes in the foreign exchange market as a buyer and seller and ensures the stability of the exchange rate. The success of this system requires the country to have sufficient gold and foreign exchange reserves and keep inflation in check. Because when the demand for foreign currency increases, the monetary authority will have to break the trend by supplying foreign currency to the market to keep the exchange rate at a certain level. In an environment where the demand for foreign exchange is constantly increasing and the monetary authority does not have the required number of reserves may lead to the abandonment of the system with a high rate of devaluation and drag the economy into a crisis environment (Taylor, J. B. ,2001: 47-68)

Another method that can be used to determine the values to be received by the exchange rate is a flexible exchange rate where the rate of change is determined by supply and demand. Many macro variables can affect the exchange rate. One of these variables is the interest rate. An increase in the interest rate of a country compared to other countries causes an abundance of foreign exchange by shifting the capital flow towards this country and creating pressure for the national currency to appreciate. In this case, the exchange rate decreases due to the excess supply of foreign currency, and thus the national currency appreciates.

Özer and Saraç (2010) examined the effect of short-term interest rates on the Turkish economy using the boundary test and time series analysis, they discovered that an increase in short-term interest rates increased the dollar rate both in the long and

short term. Examining the validity of the theoretical correlation between interest and exchange rate in Türkiye with co-integration and the Granger causality test, Uysal et al. (2008) found that the variables are in correlation and the direction of causality is from exchange rate to interest. Karaca (2005), in his study on the Turkish economy, analyzed the relationship between the exchange rate and the interest rate using the co-integration test. Although there is no significant relationship between the two variables, it has been revealed that there is a positive but weak causal relationship between the variables in the 2001–2005 period, when there was a floating exchange rate period.

2.11. Theoretical Framework of the Relationship Between Interest Rates and Inflation

The direction of the relationship between interest and inflation, which is known as one of the most discussed issues in the literature, is very important in terms of the efficiency and rationality of monetary policy practices. The decisions made by policymakers to determine monetary policy instruments have an impact on future interest and inflation rate decisions made by economic units. The nominal interest rate under the Fisher Hypothesis is equal to the sum of the real interest rate and the expected inflation rate (Cooray, 2003:135–150). The Fisher equation, which shows the relationship between inflation and nominal interest rates, can be expressed as follows: (Fisher, Irving, 1930)

$i = r + \pi$……..……Equation 5

Here i represents the nominal interest rate, r the real interest rate, and π the inflation rate.

According to the Fisher Hypothesis, an increase in the expected inflation rate, in the long run, increases nominal interest rates at the same rate. In the Fisher equation, a 1% increase in expected inflation in the nominal interest rate causes a 1% increase in the nominal interest rate. In addition, the Fisher equation can be defined as a one-to-one relationship between the expected inflation and the nominal interest rate, assuming that the real interest rate is constant. Therefore, there is a positive relationship between expected inflation and nominal interest rates (Cooray, 2003:135-150)

The reason why there is such a relationship between inflation and nominal interest rates in the long run, is the real interest rate is not affected by monetary imbalances that affect the inflation rate, and monetary changes only affect the inflation rate. According to Fisher, since the economy will reach equilibrium at the point of full employment in the long run, money becomes neutral, so the increase in money supply cannot affect the real interest rate and causes an increase in the nominal interest rate. Factors affecting the real interest rate are changes in the loanable funds market (Mankiw, 2019).

The increase in the equation of the expected inflation value for individuals to enter into an inflationary expectation in order not to melt the principal in the face of inflation, as well as the nominal interest rate prevailing in the market when lending. The Fisher Effect, which is also defined as the "Inflationary Expectation Effect", can also be expressed as the rise in nominal interest rates with the formation of inflationary expectations (Paya, 2013:135-156).

On the basis of this relationship put forward by Fisher, there is an idea of compensating the decrease in the purchasing power of money as a result of high inflation by acting rationally by the economic units that want to invest and save (Mitchell-Innes et al., 2007:193).

2.12. Previous study:

2.12.1. Previous study in international economics

In the study by Mackinnon (1996), the validity of the Fisher effect was examined using 2000-2012 data on the Malaysian economy. In the study, monthly and quarterly interest rates, interbank interest rates, and Consumer Price Index variables were used. According to the ARDL test results used to analyze the relationship between the variables, it is concluded that there is Fisher Effect in Malaysia's monetary market in the long run.

Mac Kenzie (1998) investigated the relationship between expected inflation and real interest rates in the Israeli economy for the period 1984-1992. According to the findings obtained from the estimation results of the regression model, it has been revealed that there is an inverse relationship between the expected inflation in the Israeli economy and the real interest rates.

Berument et al. (2007) analyzed whether the Fisher Hypothesis, which establishes a positive relationship between expected inflation and interest rates, is valid in 45 developing countries and G7 countries. In the study, the GARCH Model was used, the simple Fisher relation holds in all G7 countries but in only 23 developing countries. There is a positive and statistically significant relationship between interest rates and inflation uncertainty for six of the G7 and 18 of the developing countries. It has been revealed that there is a negative relationship in 7 developing countries.

In the study conducted by Bhar and Mallik (2012), the relationship between interest rates and inflation uncertainties in the New Zealand and Australian economies was examined. In the study, quarterly data for the 1957-2006 period were estimated by the GARCH model. The analysis focuses on the extent to which nominal interest rates affect inflation uncertainty, expected inflation, and the output gap. According to the findings obtained from the analysis, it has been observed that there is a positive relationship between nominal interest rates and inflation in both New Zealand and Australia.

2.12.2. Previous study on the Turkish economy

The results of Kesriyeli's (1994) analysis of the Turkish economy from 1980 to 1993 show that nominal interest rates and inflation have a strong and persistent correlation. By applying Johansen co-integration analysis, the research indicates that there may be a long-term relationship between these two economic factors. This finding suggests a long-term relationship between changes in nominal interest rates and inflation, highlighting the significance of analysing these dynamics in light of Türkiye's economic environment within the designated time frame.

In the study carried out by Eren (2002), the validity of the Fisher Effect in Türkiye between the 2002 – 2011 period was analyzed by nonlinear cointegration method. Monthly data were used in the study for the interest rate between 2002-2011. The Consumer Price Indices (CPI) and nominal interest rates variables applied for time deposits as monthly, three-month, six-month, and twelve-month are used. From the results obtained from the cointegration method, it was concluded that the Fisher Effect was invalid due to inflation targeting and floating exchange rate regime practices in Türkiye in that period.

In the study conducted by Şimşek and Kadilar (2006), monthly data 1987-2004 were used to analyze whether there is a Fisher effect in Turkish economy. It was analyzed by ARDL (Autoregressive Distributed Lag) test to examine the existence of the Fisher effect. According to the results obtained, the existence of the Fisher Effect in the Turkish economy has been determined.

In the study conducted by Yılancı (2009), the validity of the Fisher Hypothesis for the Turkish economy was examined using quarterly data for the period between 1989 – 2008. According to the results of the Engle-Granger cointegration test and nonlinear cointegration test methods, it has been determined that the Fisher Hypothesis is not valid in Turkish economics.

Teker et al. (2012), the long-term relationship between interest rates and inflation rates in the Turkish economy was examined for the period between 2002 and 2011. Employing the threshold vector error correction (T-VEC) analysis was examining the Consumer Price Index and deposit interest rates. According to the estimation results of the model, it was concluded that there is a long-term relationship between inflation and interest rate in the process under consideration in Türkiye.

In the study conducted by Mercan and Peker (2013), the relationship between interest rates and inflation rates in Türkiye was examined using monthly data between 1992 and 2013. According to the results obtained in the study using the ARDL model, it was concluded that there is no relationship between interest rates and inflation in Türkiye.

In the study conducted by Atgür and Altay (2015), data from 2004 and 2013 were used to test the relationship between inflation rates and nominal interest rates for Türkiye. According to the results obtained from the study, it was seen that the Fisher Effect was valid in Türkiye in the period of 2004 and 2013. The Cointegration tests and Dynamic Least Squares (DOLS)method were applied in the study, it has been determined that there is a long-term relationship between inflation rates (ENF) and nominal interest rates (NFO) variables. In this context, it has been concluded that the developments in inflation rates and nominal interest rates in Türkiye for the period of 2004 and 2013 are closely related to each other.

In the study conducted by Akıncı and Yılmaz (2015), the effects of inflation rates on interest rates were analyzed using the Dynamic Least Squares method for the

Turkish economy using the 1980-2012 period data. First, Johansen cointegration test was applied to the variables and as a result of the analysis, long-term relationships were determined. The Granger causality test was applied among the variables. As a result of the test, it was seen that there was a causal relationship in harmony with the expectations. According to Dynamic Least Squares analysis, it has been concluded that the effect of current account balance, inflation, money supply, external debt service, economic growth process, and exchange rate on interest rates has a statistically significant effect.

In the study conducted by Tunalı and Erönal (2016), the validity of the Fisher Hypothesis, which expresses the existence of a long-term relationship between interest rates and inflation, in Türkiye was investigated. In the study, the relationship between the inflation rate and the interest rate series in the presence of a structural break was examined and monthly time series data 2003:1-2014:2 was used. Standard unit root and Zivot Andrews unit root tests for stability, and Gregory-Hansen cointegration test which is considered a structural break have been applied. As a result of these tests, it has been determined that the Fisher Effect is valid in the long term and not valid in the short term for Türkiye.

In the study conducted by Torun and Karanfil (2016), the relationship between inflation rates and interest rates was analyzed using the 1980-2013 period data of the Turkish economy. The inflation rate was used as a dependent variable, and real exchange rate, GDP, and interest rates were used as independent variables. The relationship between these variables in the study was analyzed with Granger causality, Johansen cointegration, and variance decomposition methods. According to the results obtained, it has been observed that there is a long-term relationship between the variables used in the model. It is concluded that there is a causal relationship between GDP and interest rate from inflation. At the same time, it was concluded that there is a bidirectional causality relationship between GDP and interest rate.

According to study conduct by Oğul (2021), Inflation and interest rate are the basic macroeconomic indicators in national economies. The relationship between these indicators is often examined with the Fisher effect. In this study, the validity of the Fisher effect in the Turkish economy is investigated with the annual interest and inflation rate variables for the 1987-2020 period. Zivot and Andrews unit root and the cointegration test were used to examine relationship between the variables with

the ARDL model. According to the ARDL, the short-term effect of inflation is statistically insignificant whereas the long-term results is statistically significant. As a result of the study, it was found that inflation increased the interest rate. In the examined period, a result was obtained that the full Fisher effect is valid in the Turkish economy.

According to study conduct by Arslan and Sari (2023), the validity of the Fisher effect in the Turkish economy between 1971-2021 was tested with ARDL bounds test and unit root tests. In this context, it was concluded that the variables that are not stationary at the level act together in the long run. According to the results of the Toda-Yamamoto causality test, a one-way Granger causality relationship was ranging from the inflation rate to the interest rate. The stationarity of the real interest rate was tested with ADF, Lee- Strazicich and Fourier KPSS unit root tests. The results show that the real interest rate variable is stationary, and the Fisher hypothesis is valid in the Turkish economy.

In the research conducted by Osman Bahadır Sinan (2023), the validity of the Neo-Fisher effect in Turkey has been explored, and a comprehensive examination has been conducted to analyze the impacts of exchange rates, inflation, exports, and imports within the context of implemented interest rate policies. The study employed structural break time series analysis, utilizing monthly data spanning from January 2003 to September 2021, to scrutinize the consumer price index, nominal interest rates, real effective exchange rates, and the interconnections between exports and imports. Multiple structural break unit root tests, specifically the Lee-Strazicich test, were applied, and the ARDL (Autoregressive Distributed Lag Bound) Test method with dummy variables was utilized to investigate both long and short-term relationships among the variables. The findings of the analysis reveal the presence of long-term and short-term cointegration between exports, imports, exchange rates, interest rates, and inflation. Notably, both exports and imports are predominantly influenced by exchange rates in both temporal dimensions, while inflation is affected by both exchange rates and interest rates in the long and short run. Furthermore, the study emphasizes that the impact of the exchange rate on inflation significantly surpasses that of interest rates.

The research carried out by Demirhan, the study is to assess the principal economic repercussions of the monetary policies adopted in Turkey post-2021.

Notably deviating from pre-2000 strategies, the monetary policies implemented in 2021 took an unconventional approach, primarily focused on maintaining low interest rates. However, this led to an escalation of the inflation rate into double digits and a rapid depletion of central bank reserves. In response, orthodox policies were reintroduced in the latter part of 2023, initiating improvements in macroeconomic balances. Despite the implementation of orthodox policies, there hasn't been a substantial reduction in the inflation rate by the second half of 2023, though there is a partial amelioration in reserves. The efficacy of orthodox policies in Turkey hinges on their continuity and the influx of foreign capital.

The investigation conducted by Yalçin and Çiftçi (2023), The inflation targeting strategy stands out as a prevalent approach to addressing inflation, a prominent economic challenge faced by global economies. This study delves into the efficacy of the inflation targeting strategy, emphasizing the widespread utilization of short-term interest rates as an intermediate target in tackling this pervasive macroeconomic issue. While the "Taylor Rule" has been recognized as a strategic indicator for inflation targeting in developed economies, there are instances in developing countries where central banks formulate policies and intermediate targets based on the "Augmented Taylor Rule." Assuming the Turkish economy falls within the developing country category, this research endeavors to estimate the expanded Taylor rule equation, incorporating the exchange rate, using the Autoregressive Distributed Lag Bound Test (ARDL) method for the period spanning January 2003 to August 2022. The analysis results reveal a correlation between the Central Bank of the Republic of Turkey's (CBRT) interest rate decisions and the inflation rate, output level, and exchange rate.

There are many studies in the literature to reveal the relationship between interest rates and inflation. However, some of the findings obtained in these studies reveal that there is a causal relationship between the variables, whereas some results that there is no significant relationship between interest rate and inflation. Table 3 contains summary information about various studies in the literature.

Table 3. Literature Review Summary Between Interest Rates and Inflation

Author(s)	Methodology	Period	Country	Results
Mackinnon	ARDL test	2000-2012	Malaysia	There is Fisher Effect in Malaysia's monetary market in the long run.
Mac Kenzie	Regression Test	1984-1992	Israeli	There is an inverse relationship between the expected inflation in the Israeli economy and the real interest rates.
Berument et al	Autoregressive conditional heteroskedasticity	1957-1998	45 developing countries + G7 countries	There is a positive significant relationship between interest rates and inflation uncertainty for six of the G7 and 18 of the developing countries, whereas there is a negative relationship in 7 developing countries.
Bhar and Mallik	Autoregressive conditional heteroskedasticity	1957-2006	New Zealand and Australian	There is a positive relationship between nominal interest rates and inflation in both

				New Zealand and Australia
Kesriyeli	Johansen cointegration Test	1980-1993	Türkiye	There is a long-run relationship between nominal interest rates and inflation.
Eren	Nonlinear cointegration	2002-2011	Türkiye	The Fisher Effect was invalid due to inflation targeting and floating exchange rate regime practices in Türkiye in that period.
Şimşek and Kadilar	Autoregressive Distributed Lag	1987-2004	Türkiye	The Fisher Effect in the Turkish economy has been determined.
Yılancı	Nonlinear cointegration	1989-2008	Türkiye	The Fisher Hypothesis is not valid in Turkish economics.
Teker et al	Threshold vector error correction – cointegration Test	2002 - 2011	Türkiye	There is a long-term relationship between inflation and interest rate in the process under consideration in Türkiye
Mercan and Peker	ARDL Model	1992 - 2013	Türkiye	There is no relationship between

				interest rates and inflation in Türkiye.
Atgür and Altay	Cointegration tests and Dynamic Least Squares	2004 - 2013	Türkiye	There is a long-term relationship between inflation rates and nominal interest rates variables
Akıncı and Yılmaz	Johansen cointegration test	1980-2012	Türkiye	The effect of current account balance, inflation, money supply, external debt service, economic growth process, and exchange rate on interest rates has a statistically significant effect.
Tunalı and Erönal	cointegration test with structural break	2003-2014	Türkiye	The Fisher Effect is valid in the long term and not valid in the short term for Türkiye.
Torun and Karanfil	Johansen cointegration, and variance decomposition methods	1980-2013	Türkiye	There is a long-term relationship between the variables used in the model and there is a bidirectional causality relationship between GDP and interest rate.

Oğul	ARDL model	1987-2020	Türkiye	The short-term effect of inflation is statistically insignificant whereas the long-term results is statistically significant.
Arslan and Sari	ARDL bounds test	1971-2021	Türkiye	The Fisher hypothesis is valid in the Turkish economy.
Osman Bahadır Sinan	Structural break unit root tests and the ARDL Model	2014-2021	Türkiye	The findings of the analysis reveal the presence of long-term and short-term cointegration between exports, imports, exchange rates, interest rates, and inflation.
Banu Demirhan and Erdal Demirhan	Unorthodox approach	2021-2023	Türkiye	Despite the orthodox policies implemented since the second half of 2023, there is no significant decrease in the inflation rate.
Yalçin and Çiftçi	Autoregressive Distributed Lag Bound Test (ARDL)	2003-2022	Türkiye	The analysis results reveal a correlation between the Central Bank of the Republic

				of Turkey's (CBRT) interest rate decisions and the inflation rate, output level, and exchange rate.

2.13. Development of Interest and Inflation in the Turkish Economy

Until the 1980s, the Turkish economy was managed within the framework of Keynesian theory and its practices, which accepted that full employment could not be achieved by itself and that the state would provide the most appropriate growth, especially by using fiscal policy tools (Buluş, 2015). However, since the second half of the 1970s, high inflation and balance of payments problems, which emerged due to internal and external factors, have adversely affected macroeconomic indicators and damaged growth performance. To solve the problems in the economic field, various stabilization measures were taken to devalue the Turkish lira, increase the prices of basic products, raise interest rates, and restore credibility. As a result of these practices, although the external deficit problem was relatively corrected and inflation rates continued to increase, the implementation of a new economic program became inevitable (Karaçor, 2012). Thus, on January 24, 1980, decisions were put into effect in order to control inflation, close the foreign resource deficit, and make the economy operational.

Between 1980 and 2000, Türkiye underwent significant economic changes, with a focus on addressing high inflation and interest rate volatility. Following the 1980 military coup, stabilisation programmes were implemented to control inflation. Despite efforts, inflation remained a challenge, leading to periodic economic downturns.

Interest rates experienced notable volatility during this period. Financial liberalization measures were introduced to modernize the banking sector, attracting foreign capital but also contributing to occasional banking crises. In the late 1990s, Türkiye transitioned to an inflation-targeting framework, with the Central Bank using interest rate policies to achieve and maintain target inflation rates.

The economic landscape witnessed efforts to modernize the financial sector and align it with global standards. However, external factors, currency devaluations, and challenges in managing external debt influenced interest rate dynamics. Despite achievements, including the modernization of the financial sector, Türkiye faced economic uncertainties and external pressures during these transformative decades.

2.13.1. 2000-2010 Period

It is noteworthy that the stand-by agreement, which was approved in 1999, had a positive impact on macroeconomic balances in the first half of 2000. In this context, interest rates were lowered with inflation, a significant recovery trend emerged in economic activities, foreign financing opportunities were created under favourable conditions, and some structural reforms were implemented. However, increasing domestic demand increases the foreign trade deficit, and foreign capital inflows led to an increase in reserves (Karaçor, 2006).

The economic program, which had contributed to the first half of the year's general improvement in economic indicators, gradually lost its probability of success with the appearance of delays in privatization and structural reforms in the second half of 2000. The delivery of the third tranche loan, which was scheduled to take place in October, has been delayed by the IMF due to implementation issues (CBRT, 2002). As a matter of fact, these negativities increased the anxiety of investors in domestic and foreign markets, causing capital inflows to weaken and short-term interest rates to tend to rise again. Based on these developments, the cash crunch faced by banks with significant government domestic debt securities worsened in November 2000. The Central Bank supplied funds to meet the demand in the liquidity-related markets, but these interventions resulted in a significant decrease in reserves (Akçalayan, 2007), because the cash that the Central Bank put into the markets returned to itself as a demand for foreign currency. To avoid a payment issue brought on by open positions, the banking industry has significantly expanded its foreign exchange purchases. Early in December 2000, the IMF offered an Additional Reserve Facility in response to the financial crisis that resulted from the continuous demand for cash in the financial sector. As a result, short-term capital inflows accelerated to a certain amount, interest

rates declined marginally as a result of additional structural and financial measures, and financial markets saw some relief (CBRT, 2002a).

Despite the fact that the measures taken have had a positive impact on the markets, the November crisis has resulted in increased fragility in the banking sector. After the crisis, borrowing maturities were shortened, and despite the appreciation process of the national currency, the high interest rates raised concerns about the sustainability of the fixed exchange rate system. In addition to increasing these concerns, the existence of structural problems, the increasing debt burden of the public sector, and high inflation rates also had an impact. In such an environment, negotiations were held with the IMF regarding the solution of economic problems and arrangements regarding targets, but a disagreement within the coalition government destroyed confidence in the economic programs implemented. In fact, the monetary authority tried to tighten market liquidity in order to relieve pressure on the exchange rate and keep the fixed exchange rate regime in place in February 2001 when there was an excessive buying desire for foreign currency. However, these efforts sharply increased short-term interest rates. Capital withdrawals could not be stopped in this climate, as overnight interest rates rose to 5,000% and the public banks' cash shortage resulted in a system-wide lockdown. A flexible exchange rate regime was therefore implemented on February 2001 in place of the exchange rate anchor regime that served as the foundation of the anti-inflation campaign in 1999 (CBRT, 2002).

The successive economic crises in the late 1990s and early 2000s, inflation and interest rates above the targeted levels, and fluctuations in foreign exchange markets created a climate of risk and uncertainty in the economy. Problems that arose in the financial sector, in particular, left the real sector's credit demands unrequited, and thus both new investments and the realization of payments were interrupted (GEGP, 2001). Under these conditions, a new agreement was signed with the IMF in May 2001, and the Transition to a Strong Economy Program was announced to restructure the economy, quickly eliminate the confidence problem and instability resulting from the abandonment of the observed exchange rate system and ensure a permanent improvement in the public financial system. The sub-goals determined within the framework of the said program can be listed as follows:

- To ensure and maintain stability in the general level of prices in line with the flexible exchange rate system.

- By restructuring the banking sector, it is strengthening its ties with the real sector.
- Establishing financial discipline.
- To follow a fair income policy in line with inflation targets.
- To establish the legal basis that will enable it to be carried out with efficiency, flexibility, and transparency.

Thus, it is aimed to create a sustainable development environment, paving the way for the effective and efficient use of resources, improve the competitiveness of the country with an open economic model, and increase the welfare level of the country by increasing growth, employment, and investments (GEGP, 2001). To mitigate the negative effects of high rate increases in the general level of prices on macroeconomic aggregates, it was decided to use implicit, then explicit, inflation targeting. This application includes the determination of target levels related to inflation and the pre-announcement of policies that will enable the achievement of these targets. In order to attract inflation to the desired points, the Center Bank granted full operational independence to the Bank, maintaining the flexible exchange rate system, strengthening private banks, and transferring public banks to the private sector at the final stage, shaping public expenditures and public revenues in line with primary surplus targets, improving debt management regarding the Treasury, and making the investment environment more favorable. Important steps have been taken (T.R. Prime Ministry, Undersecretariat of Treasury, 2002). A favorable environment for the switch to explicit inflation targeting was developed as a result of factors including the decline in fiscal dominance, adaptation to the flexible exchange rate system, expansion of the information base, increased depth in financial markets, and the development of communication policies. Additionally, the development of fiscal policies to aid in the implementation of monetary policies by ensuring administrative stability considerably reduced inflation (CBRT, 2006).

When implicit inflation targeting was used from 2002 to 2005, the rate of increase in the overall level of prices fell significantly, from 29.2% to 7.8%. Since the introduction of explicit inflation targeting in 2006, inflation has exceeded predictions and reached a high of 10.1% in 2008, the year the global financial crisis started. In 2009, when the consequences of the global crisis were most felt, this trend briefly

reversed, and local inflation rates both directly and indirectly mirrored the contraction of the world economy and the consequent decline in commodity prices (CBRT, 2010: 30). In addition, the 4.8% contraction of the Turkish economy in the same year contributed to the disinflationary trends by lowering total demand. In spite of a quicker recovery than anticipated in 2010, inflation rose below the target. The Central Bank's judgments regarding interest rates were influenced by changes in the inflation rate, and the other variables also saw comparable adjustments.

Following the 2001 Crisis, the general improvement in basic macroaggregates, particularly inflation, as a result of large-scale implementation of measures taken within the framework of monetary and fiscal policies to address structural problems boosted the Turkish economy's credibility both at home and abroad. In addition, ensuring administrative stability contributed to the reduction of uncertainties and brought about a decrease in the risk premium. In such an environment, the abundance of global liquidity accelerated capital inflows, and a favorable climate for low interest rates was created in the economy. As a matter of fact, the savings deposit interest rate, which was 63.9% in 2001, declined to 7.9% in 2010.

2.13.2. 2010 – 2020 Period

Due to the increase in import prices brought on by the depreciation of the Turkish Lira and the increase in the price of unprocessed food, inflation, which had been on a modestly increasing trend between 2012 and 2016, hit 11.9% in 2017 (CBRT, 2018). The CBRT made a modification to its interest rate corridor policy in the months of March through September of 2016, after the normalization of international financial markets and the reduction of pressures on inflation in the nation. However, the exchange rates of Türkiye and other developing nations surged in November because of the rise in interest rates in the economies of industrialized nations, which in turn caused a rise in interest rates. The weekly repo rate was 8%, while the lending rate set by the central bank was 8.5 percent in December 2016. (CBRT, 2017). Since 2017, interest rates have continued to rise. The main driver of this trend is the need to relieve the pressure on inflation brought on by increases in the exchange rate.

The decision to intensify monetary tightening was made at the CBRT meeting in April 2017, and as a result, the interest rate for late liquidity window lending rose to 12.25%. Up to the year's end, this rise persisted (CBRT, 2018). Similar to the year before, monetary tightening persisted in 2018 as interest rates rose. The CBRT implemented stability-oriented measures and raised the policy interest rate to 24% in September as a result of inflationary pressure brought on by the economy's collapse and the TL's further slide in August. By the end of 2018, an increase in TL and a decline in long-term interest rates were seen as a result of the CBRT's actions (CBRT, 2019).

As inflation rates improved in the first half of 2019, the Central Bank retained the one-week repo rate at 24% and gradually dropped the policy rate to 14% in July, September, and October in response to these improvements (CBRT, 2019). To lessen the financial and economic effects of the epidemic environment, the CBRT extended the interest rate reduction it began in July 2019 into March and May 2020. Since August, coordinated tightening measures have been implemented under regulations unique to the epidemic era, and it has been agreed to maintain the current interest rates in order to reduce the risks of inflation in the future (CBRT, 2020).

2.13.3. 2021 And 2023 Period

The CBRT decided to maintain the restrictive monetary policy stance for a considerable amount of time until substantial evidence pointing to a sustained drop in inflation and price stability appeared, given the 2021 year-end prediction target. The policy rate was still 17% in February 2021. The CBRT stated that a slight decrease in recent lending and deposit rates is necessary in order to enhance the efficiency of the monetary transmission mechanism. The increase in Turkish lira-required reserves is also necessary. In March 2021, the CBRT decided to carry out a large-scale, front-loaded further monetary tightening, considering the risks to inflation expectations, pricing patterns, and the medium-term inflation outlook.

It was emphasized that despite the policy rate increase from 17 to 19 percent during that time, the tight monetary policy stance would be sustained for a considerable amount of time with determination until strong indicators pointed to a permanent decrease in inflation and price stability. While keeping the policy rate unchanged in

April, the CBRT disclosed its prediction that the current monetary environment will have a more noticeable effect on loans and domestic demand in the next period. The MPC meeting decided to maintain the one-week repo auction rate at 19 percent and the tight monetary policy stance. The Committee stressed that there would be uncertainty in the medium-term inflation outlook until there is clear evidence of a persistent decline in prices.

The CBRT modified the reserve requirement rule with an announcement dated July 1, 2021, in order to improve the effectiveness of the monetary transmission mechanism in keeping with the primary goal of price stability. The CBRT stated that the option of retaining necessary Turkish Lira reserves in FX will be gradually reduced and discontinued in October, even though it raised the FX reserve requirement ratios by 200 basis points in all maturity brackets. Banks are anticipated to change the balance on their balance sheets from foreign currency deposit accounts to Turkish lira deposits once the other restrictions published in the CBRT notice on the same date take effect. During the current time, BIST overnight repo rates were volatile in relation to the CBRT policy rate; nonetheless, CBRT funding was facilitated by OMO and swap transactions within a simple operating framework. The CBRT policy rate served as the basis for overnight interest rates. The value of the swap agreement increased to TL 380 billion as of July 19, 2021, from TL 336 billion on April 30, 2021. Over the same period, net OMO financing dropped from TL 337 billion to TL 274 billion.

During its August meeting, the CBRT decided to keep the policy rate at 19%. The Committee continued to emphasize how important it is that retail loans develop moderately in order to lessen the risks to the outlook for inflation and the external balance. In this context, it was stressed how important it is to regularly examine the composition and path of loans for macroeconomic stability. Before the September MPC meeting, the CBRT changed the requirements for utilising and repaying discount credits in order to promote the growth in foreign exchange reserves. The purpose of these modifications was to increase the monetary transmission mechanism's efficacy.

The option to maintain Turkish lira-required foreign currency reserves would be gradually eliminated starting in October, according to the CBRT announcement dated July 1, 2021, even though the ratios for foreign currency reserve requirements had been raised by 200 basis points across all maturity brackets. The announcement from September 15, 2021, said that the facility would cease to exist and that, as of

October 1, 2021, all maturity bands' necessary reserve ratios for the foreign currency deposit/participation fund would be enhanced by 200 basis points.

At the September MPC meeting, the recent increase in inflation was examined to see if supply-side factors, such as price increases for food and imports, supply-process disruptions, price increases that were administered or directed, and demand developments as a result of the opening, were effective and if their effects were due to unrelated factors. Additionally, it was noted that the slowing impacts of monetary tightening on loans and domestic demand remained, and it was stressed that the tightness of the monetary stance started to have a contractionary effect on commercial loans beyond what was anticipated. The Committee determined that the stance of monetary policy needed to be updated in this situation and reduced the policy rate by 100 basis points as a result. In October, the CBRT decided to reduce the policy rate by 200 basis points, restating again that inadvertent factors contributed to the recent spike in inflation. The effects of the strengthened macroprudential policy framework began to be observed as retail loans resumed a moderate course, and it was also highlighted that the tight monetary stance had a contractionary effect on commercial loans above and beyond what had been predicted. Nevertheless, the Committee has concluded that there is minimal chance for a downward correction of the policy rate until the end of the year due to supply-side incidental considerations.

Consumer inflation increased in the third quarter of 2021 due to supply-side problems such growing food and import prices, disruptions in the supply chain, increased administered pricing, and shifts in demand as firms started up again after the pandemic. During this period, consumer inflation was 19.58 percent, compared to the B index's 18.63 percent annual inflation rate. The increase in producer costs during the third quarter put pressure on consumer prices. Rising energy and commodity prices globally, ongoing supply constraints, and ongoing supply chain problems were the main causes of this increase.

At its meeting in November, the CBRT decided to cut the policy rate by 100 basis points, or 15 percent, after evaluating research on supply shocks, core inflation trends, and demand variables that are affected by monetary policy. The recent spike in inflation was ascribed to supply-side factors in the November meeting report. These included growing import costs, especially for food and energy, disruptions in supply chains, an increase in administered or directed pricing, and shifts in demand.

In December, the CBRT decided to cut the policy rate by 100 basis points in order to fully exploit the narrow window of opportunity created by the fleeting effects of supply-side and incidental factors outside the purview of the monetary policy's influence on price increases. The policy rate would therefore reach 14% by the end of 2021.

The CBRT kept the policy rate in place. At its January meeting, the CBRT announced that a mix of supply-side and demand developments, such as price patterns indexed to exchange rates due to unfavorable price formations in the foreign exchange market, global price increases for food and agricultural commodities, and supply chain disruptions, were to blame for the recent spike in inflation. From February to April, the CBRT kept the policy rate at 14 percent. During the Monetary Policy Committee (MPC) sessions held from February to April, the CBRT suggested that the rise in inflation and the rise in energy costs were caused by the harsh war environment and the temporary effects of price structures detached from economic fundamentals.

During the May–July Monetary Policy Committee (MPC) meeting, the CBRT reported that the observed rise in inflation The consequences of pricing structures that stray from economic principles and supply-side variables such as increases in the prices of food, energy, and agricultural commodities worldwide were found to be significant. Strong monetary policy actions are still being implemented in line with the liquidity plan in order to support long-term price stability and financial stability. Under this framework, the credit, collateral, and liquidity policy steps—whose appraisal processes were completed—were implemented, the macroprudential policy set was tightened, and the policy rate was kept at 14 percent for the months of May through July.

In January 2023, the Monetary Policy Committee (MPC) of the Central Bank of Türkiye resolved to maintain the one-week repo auction rate at nine percent. Fears of a worldwide economic downturn persist despite better-than-expected economic activity data, owing to geopolitical risks and interest rate increases. The CBRT is committed to implementing the Liraization Strategy and meeting its medium-term inflation target of 5% in order to establish long-lasting price stability and promote economic growth. (2023 CRBT). However, in response to recent economic developments, the Monetary Policy Committee (MPC) decided to lower the one-week repo auction rate from 9% to 8.5 % between February and May.

Significantly, the Monetary Policy Committee (MPC) increased the policy rate, also known as the one-week repo auction rate, from 8.5 percent to 15 percent. This decision is a step in the monetary tightening process that aims to stabilize inflation expectations, swiftly set a course for disinflation, and allay concerns about diminishing pricing behavior. The MPC is determined to achieve its 5 percent inflation target by all means necessary, and the rate increase will be supported whenever necessary until the inflation outlook materially improves. To preserve long-term price stability, the central bank will also encourage calculated investments that improve the current account balance.

Increasing the one-week repo auction rate from 17.5% to 25% was a major policy rate hike that the Monetary Policy Committee chose to execute in order to promptly establish disinflation, anchor inflation expectations, and restrain decreasing price behavior. Recent data suggests that the underlying trend of inflation has been gradually increasing. Tax regulations, strong domestic demand, pressure on wages and exchange rates, unforeseen inflation expectations, stickiness in the services sector, and shifts in pricing behavior are some of these causes.

In an effort to quickly establish disinflation, anchor inflation expectations, and stop the deterioration of pricing behavior, the Monetary Policy Committee (MPC) has raised the policy rate significantly, increasing the one-week repo auction rate from 25 percent to 30 percent. Because of strong domestic demand, persisting concerns about inflation expectations, rising oil costs, and prolonged stickiness in the services sector, inflation readings have been above expectations in recent months. This suggests that year-end inflation will be close to the top prediction range.

CHAPTER THREE

RESEARCH METHODOLOGY

3. Data Set

In this study, in which the relationship between inflation and interest rate is analysed in terms of the Turkish economy, the variables and data sources used in the monthly basis are given in Table 4.

Table 4. Variables and data sources

Variable	Label	Period	Resource
INF	Consumer price index (CPI)	2001-2023	EVDS
INT	O/N interest rate	2001-2023	EVDS
M2	Money supply m2	2001-2023	EVDS
REER	CPI Based Real Effective Exchange Rate	2001-2023	EVDS

3.1. The importance of variables

1) Inflation rate: The Consumer Price Index (CPI) is used as an indicator of inflation because it tracks changes in the cost of a basket of goods and services that are frequently consumed by households. In addition, it gives a clear picture of how much more expensive it is for households to buy these goods and services. Furthermore, CPI is widely available and simple to monitor over time. Because of its accessibility and ease of measurement, the CPI is also frequently used as an indicator of inflation. National statistics organizations gather the information for the CPI, which is then regularly released on a monthly or quarterly basis to make it simple to track changes over time.

2) Overnight rate: The interest rate at which banks can lend or borrow money from one another overnight is known as the overnight interest rate, sometimes known as the overnight rate or the policy rate. There are several reasons why

the overnight rate is used as an independent variable in the model rather than other interest rates (Gali, J. ,2015).

A. The overnight rate and monetary policy are closely related. The interest rate that the central bank has the most direct influence over is the overnight rate. To affect the total level of interest rates in the economy and to accomplish their monetary policy objectives, central banks use adjustments in the overnight rate.

B. The interest rate that is most closely monitored is the overnight rate. Investors, economists, and decision-makers constantly monitor the overnight rate as a sign of the economy's overall health and the path of monetary policy.

C. The overnight rate is more stable than other interest rates. Other interest rates, such as the long-term interest rate, may fluctuate more than the overnight rate, which can make it harder to identify the underlying trend in interest rates.

3) Money supply (M2): Money supply M2 is used in the inflation equation as it measures the total amount of money in circulation in an economy, and changes in the money supply can have a direct impact on inflation, so by using it as an independent variable in the inflation equation, economists and central bankers can better understand how changes in the money supply affect inflation and make more informed decisions about monetary policy.

4) The real effective exchange rate (REER): The real effective exchange rate (REER) is a measure of a country's currency's value in relation to a basket of other currencies, adjusted for inflation. Because changes in the REER have an impact on the trade balance, economic growth, and inflation as well as the value of imports, economists and central bankers can better understand inflation by including it as an independent variable in the inflation equation.

Moreover, there are some studies that provide support for the inclusion of the chosen variables in a regression analysis with CPI as the dependent variable:

Money supply M2: The connection between money supply and inflation is well-supported by a substantial corpus of research. In Mackinnon's (1996) study, for example, the researchers discovered that the money supply played a major role in influencing Malaysian inflation. Similarly, money supply was found to have a positive and significant impact on inflation in India by Mishra and Rout (2015).

Real exchange rate-based CPI: Since fluctuations in the exchange rate can have an impact on the cost of imported goods and services, the real exchange rate is a significant factor in determining inflation. For example, Bahmani-Oskooee and Pourheydari's (2016) study discovered a substantial correlation between Iran's inflation rate and the actual exchange rate. In a similar vein, Salisu and Adeleke's (2019) study discovered that the real exchange rate significantly impacted Nigerian inflation.

Overnight lending rate: The overnight lending rate is a key indicator of monetary policy, which is used to control inflation. For example, Fakhry and Abbas (2014) discovered that monetary policy significantly affected Egypt's inflation rate. Similarly, Nguyen's (2019) study discovered that monetary policy significantly impacted Vietnam's inflation rate.

In conclusion, the choice of variables in this regression analysis is supported by previous research that has shown that money supply, exchange rate, and overnight rate all have a significant impact on inflation, as measured by the CPI.

3.2. Econometric Method

The methods used to empirically analyze the relationship between inflation and interest rate in the Turkish economy can be listed as follows:

- Unit Root (Stability) Tests
- ARDL Co-integration Test
- Error Correction Model (ECM)

3.2.1. Stability (Unit Root Tests)

While testing the correlation between the variables considered in econometric analysis, the findings should be consistent in economic and statistical terms. In this

context, firstly, the stationarity of the series is tested, and the spurious regression problem is prevented (Dickey, D. A. & Fuller, W. A.,1979:31-74). Although there is no relationship between the variables in the model, Spurious regression expresses the correlation that arises due to the high value of the coefficient of determination (R2) but does not reflect the truth. If the series included in the econometric studies are stationary, the effect of any shock will not be permanent, and the series will fluctuate around their own averages since the series in question will contain a limited amount of historical information. On the other hand, in non-stationary series, since the variance of the series becomes a function of time, the effect of a shock that occurred in the past will also be permanent (Phillips, P. C. B., and Perron, P., 1988: 335-346). Therefore, if a series' mean and variance do not change over time, the covariance between any two terms of the sequence depends only on the relative position of the two terms and not on their absolute position the series is considered stationary. In the presence of a unit root, the difference of the series is taken until it becomes stationary. Augmented Dickey-Fuller (ADF) Test and Phillips Perron (PP) test were used in this study to examine the stationarity of the series.

ADF Unit Root Test: The following equation is used for the ADF test, which is used to measure whether the series contains a unit root.

$$\Delta Y_t=\beta_1+\beta_2 t+\delta Y_{t-1}+\sum_{i=1}^{k} \alpha i\ \Delta Yt-i+\varepsilon t \quad \text{.....Equation 6}$$

Here, ΔYt represents the first difference of the series whose stationarity is tested, t the trend variable, k the optimal lag length, $\Delta Yt{-}i$ the lagged difference terms, and ε the error term. The ADF test tests whether the coefficient δ is statistically equal to zero. The calculated ADF-t statistic is compared with the MacKinnon critical values. The fact that the ADF-t statistic as an absolute value is greater than the critical values means that the series is stationary (Dickey, D.A. and Fuller, W.A,1981).

PP Unit Root Test differs from the ADF test because of its features that assume that the error terms are not statistically independent, there is a weak dependency relationship between them, and that they exhibit a heterogeneous distribution rather than a homogeneous distribution. PP tests, which are generally preferred to detect the presence of a higher order autocorrelation in a time series, are based on the calculation of the regression specified in Equation 7 (Peter C. B. Phillips, 1986).

$\Delta Y_t = \mu + \alpha Y_{(t-1)} + u_t$ ……..…….……Equation 7

Here, ΔY represents the first difference of the series, μ is the constant term, t is the number of periods, α is the coefficient associated with the lagged value of Y, and ut is the error term. In equation 7, first, the lag number of the first difference terms is determined. PP test makes a nonparametric correction to the t-statistic of the δ coefficient to determine the autocorrelation in the error term. Newey-West Robust Standard Errors Mechanism is used to correct the varying variance (heteroscedasticity) and autocorrelation problems. As in the ADF test, the alternative hypothesis that the series does not contain a unit root is tested against the null hypothesis that the series is not stationary in the PP test (Dickey, D. A. & Fuller, W. A.,1979:31-74).

3.2.2. ARDL Cointegration Test

Cointegration analysis is used to analyze the long-run relationship between variables. Especially in studies using macroeconomic variables, cointegration analysis comes to the fore. In essence, time series that do not appear stationary alone can become stationary with linear combinations at a certain level of integration. Therefore, there may be a cointegration relationship between the variables. In short, the long-term relationship between non-stationary series in cointegration analysis is examined.

The long-term relationship between the variables can be examined with cointegration tests. Long- and short-term relationships are discussed. Traditional cointegration tests require variables to be integrated to the same degree. This situation, which creates negativities for cointegration tests, has been resolved by the ARDL approach put forward by Pesaran et al. (1996), which allows I(0) and I(1) variables to be included in the analysis with their main values even if they do not provide the same level of stability . In this approach, which allows the series to be tested without attributing them to being stationary at the same degree, it is possible to examine the cointegration relationship if the variables are stationary at the level or at the first difference (Gujarati, D. N., & Porter, D. C,2009:617-650)

The autoregressive distributed lag (ARDL) model in equation 8 is an econometric model that is used to estimate the long-term relationship between independent and dependent variables, under these assumptions:

- Stationarity: The model assumes that all variables in the model are stationary, meaning that their mean and variance do not change over time.
- Co-integration: The model assumes that there is a long-term relationship between the variables in the model, which is known as co-integration.
- Error correction mechanism: The model assumes that any deviation from the long-term equilibrium relationship between the variables will be corrected in the short-term through an error correction mechanism.
- Linearity: The model assumes that the relationship between the variables is linear.
- Normality: The model assumes that the error term is normally distributed.
- Homoscedasticity: The model assumes that the error term has constant variance across time.
- No multicollinearity: The model assumes that the independent variables are not highly correlated with each other.
- No autocorrelation: The model assumes that the errors are not autocorrelated, which means that the errors in one period are not correlated with the errors in the previous period.

The ARDL bounds test approach examines the existence of a long-term relationship between the variables by the equation follow (Pesaran, M. H., Shin, Y., & Smith, R. J..2001: 289-326)

$$\Delta INF = \alpha + B_1 inf(t-1) + B_2 M_2(t-1) + B_3 INT(t-1) + B_4 REER(t-1) + \sum_{i=1}^{n} \theta_i \Delta INF(t-i) + \sum_{i=1}^{n} \sigma_i \Delta M_2(t-i) + \sum_{i=1}^{n} \varphi_i \Delta INT(t-i) + \sum_{i=1}^{n} \omega_i \Delta REER(t-i) + u_t \quad \text{Equation 8}$$

In Equation 8, α is the constant term; B1, B2, B3, B4 long-term coefficients (parameters of lagged level variables) and θ_i, σ_i, φ_i, ω_i coefficients of lagged difference variables u_t represents the error term, n the optimal lag lengths. Although $\Delta\text{INF}(t-i)$, $\Delta\text{M2}(t-i)$, ΔINT $(t-i)$ and ΔREER $(t-i)$ were added to the model to calculate short-term dynamics.

3.2.3. Error Correction Model (ECM)

The Error Correction Model (ECM) is an essential component of the Autoregressive Distributed Lag (ARDL) Model. The ARDL model is a widely used econometric technique for analyzing the long-run relationships between two or more variables. The ECM is a special type of ARDL model that includes an error correction term that captures the short-term dynamics of the system. The ECM is designed to correct for any disequilibrium in the system caused by the presence of lag variables. This is done by introducing an error correction term, which reflects the difference between the current value of the dependent variable and its long-run equilibrium level. The ECM then uses this error correction term to adjust the coefficients of the lagged variables in the model (Shahbaz, M., Lean, H. H., & Shabbir, M. S. ,2013:1-9).

CHAPTER FOUR

FINDINGS AND RESULTS

4. Graphical Representation

Interest rates, inflation, money supply, and real exchange rates are all key concepts in macroeconomics that are closely interrelated. By graphing these variables together, we can gain a deeper understanding of how they influence one another in figure 6.

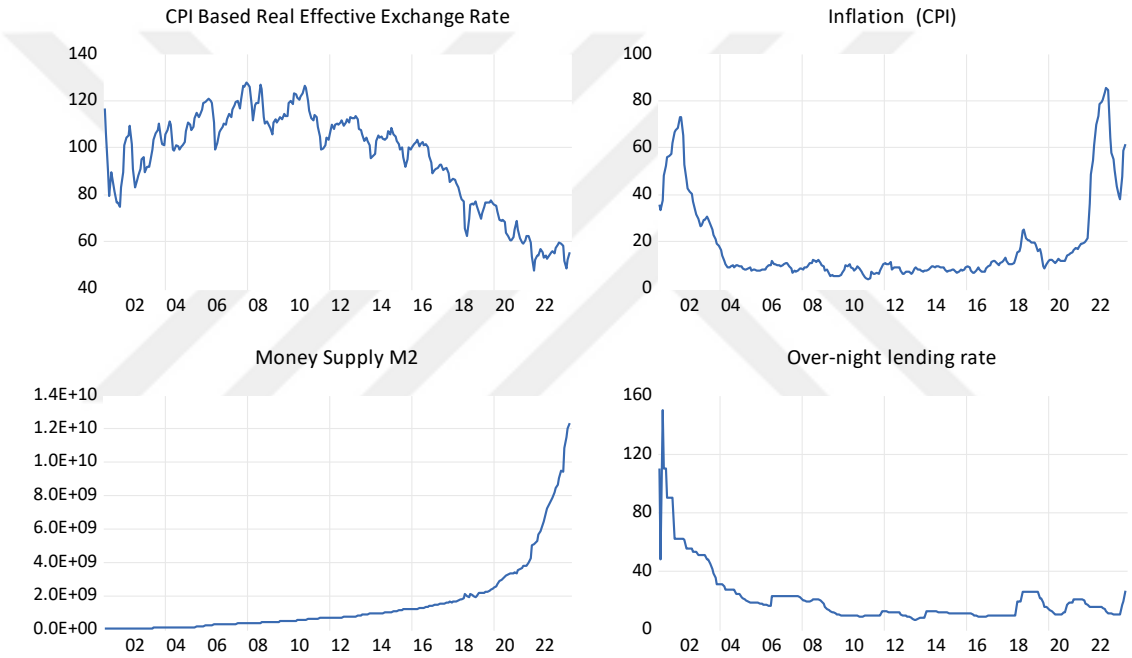


Figure 6. Interest Rates, Inflation, Money Supply, and Exchange Rate for the Turkish Economy (2001-2023)

According to the figure 6, the consumer price index (CPI) in Türkiye between 2001 and 2023 shows a general trend with fluctuations and occasional spikes. There was a peak period in which inflation reached a high of 85.5% in September 2023 and a low of 3.99% in March 2011.

There are fluctuations in the graph of the CPI based on the exchange rate, as there is a general decrease as it reached 47.75% at the end of 2021 compared to the highest value of 127.4% in January 2008.

Moreover, the money supply (M2) in Türkiye has grown significantly over the past two decades, reflecting the country's economic development and expansion. M2 money supply in 2001 was approximately 262 billion Turkish liras (TRY). By the middle of 2023, it had grown to approximately 10.09 trillion TRY, an increase of over 3750.69%.

Referring to the figure 6, the overnight interest rate shows a significant increase until it reached its highest level of 150% at the beginning of 2001. Due to the global financial crisis, there was a significant fall in economic activity and credit demand in 2008, which resulted in a decrease in the overnight interest rate. At the end of 2009, the rate had gradually decreased to around 5% from an average of almost 10% in 2008. A currency crisis that hit the Turkish economy in 2018 caused the value of the Turkish lira to fall and inflation to soar. In September 2018, to maintain the currency and rein in inflation, the Central Bank of the Republic of Türkiye increased the overnight interest rate to roughly 24 percent. The overnight interest rate averaged between 8.5% and 35% between 2019 and 2023.

A helpful tool for examining the autocorrelation of time series data is the correlogram. The findings of the correlogram analysis for the following four variables are discussed: real exchange rate, overnight lending rate, money supply (m2), and CPI. This analysis uses a lag duration of 36 for the 272 observations.

The results of the correlogram analysis show that all four variables are stationary at the first difference. Stationarity is an important characteristic of time series data, as it indicates that the statistical properties of the data remain constant over time. Non-stationarity, on the other hand, indicates that the statistical properties of the data change over time, which can make it difficult to model and forecast.

The graph of autocorrelation and partial correlation also confirms that the variables are non-stationary at the level. Autocorrelation measures the correlation between a variable and its lagged values, while partial correlation measures the correlation between two variables after controlling for the effects of other variables. In this case, the autocorrelation and partial correlation graphs show that the variables have a high correlation with their lagged values at the first few lags. The ACF and PACF graphs show that all variables have significant correlations at the first few lags

and then they slowly die out. This is a common pattern in time series data, known as an autoregressive process.

Moreover, the Q-stat values were also analyzed to check the stationarity of the variables. The Q-stat values at the level were found to be higher, indicating that the variables were non-stationary at the level. However, the Q-stat values at the difference were lower, indicating that the variables were stationary at the first difference.

In conclusion, the results of the correlogram analysis in the E-Views program for the variables CPI, money supply (M2), overnight lending rate, and real exchange rate with a lag length of 12 on a monthly basis show that all of the variables are non-stationary at the level but stationary at the first difference. The analysis also provides insights into the lag structure of the variables, indicating that changes in the variables are highly dependent on their previous values up to lag 1. These findings can be used to inform further analysis and modelling of these variables for forecasting and decision-making purposes.

Table 5. Inflation Rate Correlogram

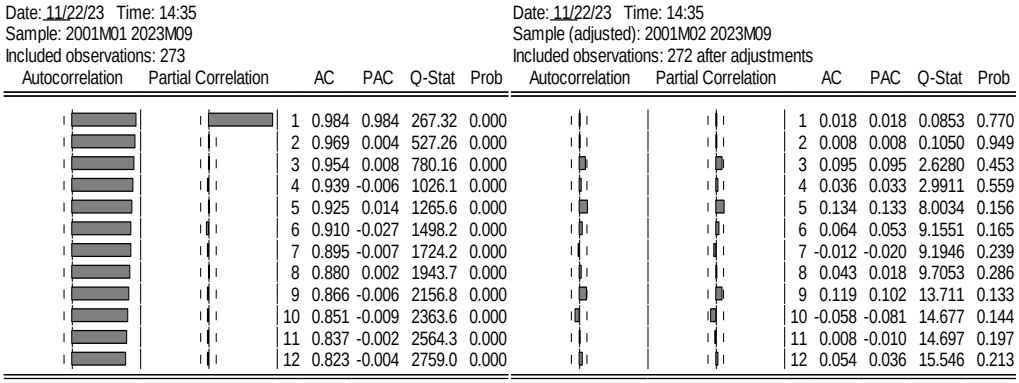
Date: 11/22/23 Time: 14:31
Sample: 2001M01 2023M09
Included observations: 273

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.976	0.976	263.17	0.000
		2	0.946	-0.171	510.84	0.000
		3	0.914	-0.000	743.23	0.000
		4	0.882	-0.031	960.46	0.000
		5	0.851	-0.006	1163.1	0.000
		6	0.816	-0.082	1350.4	0.000
		7	0.778	-0.074	1521.4	0.000
		8	0.739	-0.028	1676.3	0.000
		9	0.699	-0.038	1815.4	0.000
		10	0.659	-0.022	1939.5	0.000
		11	0.618	-0.067	2048.8	0.000
		12	0.578	0.052	2145.0	0.000

Date: 11/22/23 Time: 14:33
Sample (adjusted): 2001M02 2023M09
Included observations: 272 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.344	0.344	32.463	0.000
		2	0.075	-0.049	34.024	0.000
		3	0.051	0.047	34.757	0.000
		4	-0.050	-0.091	35.463	0.000
		5	0.054	0.116	36.267	0.000
		6	0.075	0.020	37.864	0.000
		7	0.002	-0.030	37.865	0.000
		8	-0.001	-0.006	37.866	0.000
		9	-0.063	-0.062	38.979	0.000
		10	-0.041	0.012	39.454	0.000
		11	-0.118	-0.138	43.423	0.000
		12	-0.401	-0.367	89.477	0.000

Table 6. Money Supply Correlogram



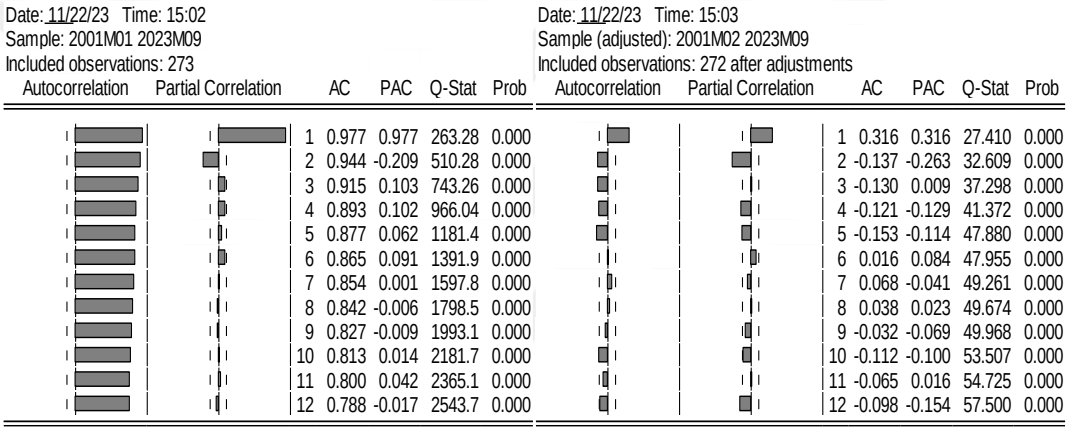
Date: 11/22/23 Time: 14:35
Sample: 2001M01 2023M09
Included observations: 273

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.984	0.984	267.32	0.000
		2	0.969	0.004	527.26	0.000
		3	0.954	0.008	780.16	0.000
		4	0.939	-0.006	1026.1	0.000
		5	0.925	0.014	1265.6	0.000
		6	0.910	-0.027	1498.2	0.000
		7	0.895	-0.007	1724.2	0.000
		8	0.880	0.002	1943.7	0.000
		9	0.866	-0.006	2156.8	0.000
		10	0.851	-0.009	2363.6	0.000
		11	0.837	-0.002	2564.3	0.000
		12	0.823	-0.004	2759.0	0.000

Date: 11/22/23 Time: 14:35
Sample (adjusted): 2001M02 2023M09
Included observations: 272 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.018	0.018	0.0853	0.770
		2	0.008	0.008	0.1050	0.949
		3	0.095	0.095	2.6280	0.453
		4	0.036	0.033	2.9911	0.559
		5	0.134	0.133	8.0034	0.156
		6	0.064	0.053	9.1551	0.165
		7	-0.012	-0.020	9.1946	0.239
		8	0.043	0.018	9.7053	0.286
		9	0.119	0.102	13.711	0.133
		10	-0.058	-0.081	14.677	0.144
		11	0.008	-0.010	14.697	0.197
		12	0.054	0.036	15.546	0.213

Table 7. Real Effective Exchange rate Correlogram



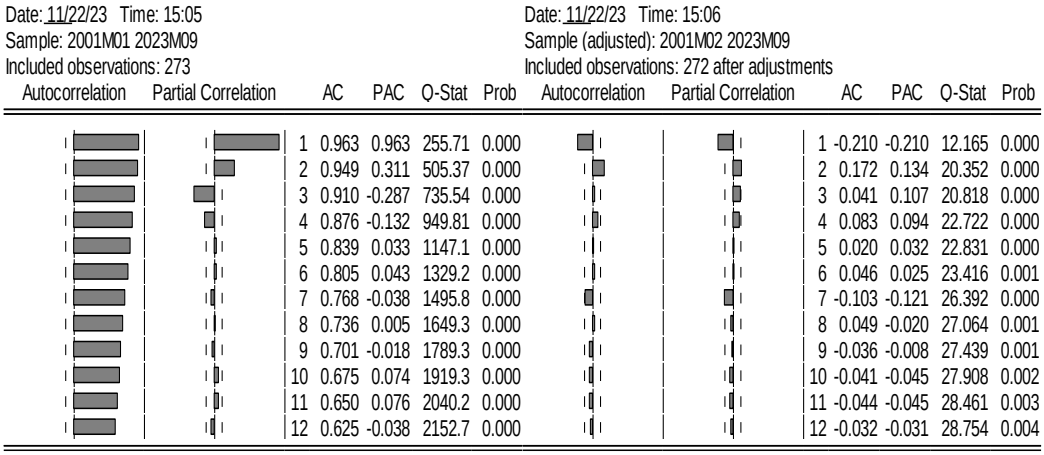
Date: 11/22/23 Time: 15:02
Sample: 2001M01 2023M09
Included observations: 273

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.977	0.977	263.28	0.000
		2	0.944	-0.209	510.28	0.000
		3	0.915	0.103	743.26	0.000
		4	0.893	0.102	966.04	0.000
		5	0.877	0.062	1181.4	0.000
		6	0.865	0.091	1391.9	0.000
		7	0.854	0.001	1597.8	0.000
		8	0.842	-0.006	1798.5	0.000
		9	0.827	-0.009	1993.1	0.000
		10	0.813	0.014	2181.7	0.000
		11	0.800	0.042	2365.1	0.000
		12	0.788	-0.017	2543.7	0.000

Date: 11/22/23 Time: 15:03
Sample (adjusted): 2001M02 2023M09
Included observations: 272 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.316	0.316	27.410	0.000
		2	-0.137	-0.263	32.609	0.000
		3	-0.130	0.009	37.298	0.000
		4	-0.121	-0.129	41.372	0.000
		5	-0.153	-0.114	47.880	0.000
		6	0.016	0.084	47.955	0.000
		7	0.068	-0.041	49.261	0.000
		8	0.038	0.023	49.674	0.000
		9	-0.032	-0.069	49.968	0.000
		10	-0.112	-0.100	53.507	0.000
		11	-0.065	0.016	54.725	0.000
		12	-0.098	-0.154	57.500	0.000

Table 8. Overnight Rate Correlogram



Date: 11/22/23 Time: 15:05
Sample: 2001M01 2023M09
Included observations: 273

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.963	0.963	255.71	0.000
		2	0.949	0.311	505.37	0.000
		3	0.910	-0.287	735.54	0.000
		4	0.876	-0.132	949.81	0.000
		5	0.839	0.033	1147.1	0.000
		6	0.805	0.043	1329.2	0.000
		7	0.768	-0.038	1495.8	0.000
		8	0.736	0.005	1649.3	0.000
		9	0.701	-0.018	1789.3	0.000
		10	0.675	0.074	1919.3	0.000
		11	0.650	0.076	2040.2	0.000
		12	0.625	-0.038	2152.7	0.000

Date: 11/22/23 Time: 15:06
Sample (adjusted): 2001M02 2023M09
Included observations: 272 after adjustments

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.210	-0.210	12.165	0.000
		2	0.172	0.134	20.352	0.000
		3	0.041	0.107	20.818	0.000
		4	0.083	0.094	22.722	0.000
		5	0.020	0.032	22.831	0.000
		6	0.046	0.025	23.416	0.001
		7	-0.103	-0.121	26.392	0.000
		8	0.049	-0.020	27.064	0.001
		9	-0.036	-0.008	27.439	0.001
		10	-0.041	-0.045	27.908	0.002
		11	-0.044	-0.045	28.461	0.003
		12	-0.032	-0.031	28.754	0.004

In order to analyze the relationship between interest rates and inflation in the Turkish economy, the stationarity of the series was tested with ADF and PP tests in order to prevent the emergence of the false regression problem in the first stage.

Table 9. Unit Root Test - ADF

At Level					
		CPI	M2	REER	Overnight rate
With Constant	t-statistic	-1.4368	-0.1175	-0.2461	-3.2521
	Prob.	**0.5641 n0**	**0.9451 n0**	**0.9293 n0**	**0.0182 ****
With Constant & Trend	t-statistic	-1.4452	-1.0985	-1.7399	-2.4189
	Prob.	**0.8454 n0**	**0.9264 n0**	**0.7308 n0**	**0.3689 n0**
Without Constant & Trend	t-statistic	-0.1470	9.5949	-0.9419	-1.1928
	Prob.	**0.6321 n0**	**1.0000 n0**	**0.3080 n0**	**0.2130 n0**
At First Difference					
		CPI	M2	REER	Overnight rate
With Constant	t-statistic	-5.4795	-16.2202	-9.5825	-6.7742
	Prob.	**0.0000 *****	**0.0000 *****	**0.0000 *****	**0.0000 *****
With Constant & Trend	t-statistic	-6.6886	-16.1933	-9.7165	-7.0988
	Prob.	**0.0000 *****	**0.0000 *****	**0.0000 *****	**0.0000 *****
Without Constant & Trend	t-statistic	-11.4864	-3.1895	-9.5399	-6.7672
	Prob.	**0.0000 *****	**0.0015 *****	**0.0000 *****	**0.0000 *****

Notes:
a:(*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

As seen in Table 9, constant, constant & trended, and without constant & trend ADF equations were applied to all series whose logarithms were taken. Taking the logarithm stabilizes the variance, making the data more stationary. When the ADF unit root test results of the level values of the CPI variable are examined, it is seen that the series are not stationary at the 1%, 5%, and 10% significance levels. According to the results of the ADF test on the level values of the M2, CPI, and REER variables, the series is not stationary at the 1%, 5%, and 10% significance levels because the probability values for the model are greater than 0.01, 0.05 and 0.1.

According to the results of the ADF test belonging to the level values of the overnight rate variable, the series is stationary at 5% significance levels with t-statistics of -3.25 for constant model. However, the series is not stationary at 1% significance levels.

According to the ADF test results, since the level values of the series were not stationary, the first difference of the series was taken and the ADF test was applied again, and the results are given in table 9. When the ADF test results of the first-difference series are analyzed, it is seen that the CPI, M2, REER, and the overnight rate series are stationary only at the 1% significance level in all three models.

The results of the PP test about whether the series is stationary or not are given in Table 10.

Table 10. Unit Root - PP

At Level					
		CPI	M2	REER	Overnight rate
With Constant	t-statistic	-1.2859	-0.1471	-0.6398	-2.9827
	Prob.	**0.6367 n0**	**0.9417 n0**	**0.8581 n0**	**0.0378 ****
With Constant & Trend	t-statistic	-1.3238	-1.2817	-1.6067	-2.2361
	Prob.	**0.8798 n0**	**0.8901 n0**	**0.7881 n0**	**0.4671 n0**
Without Constant & Trend	t-statistic	-0.1329	8.7272	-1.2389	-1.3082

	Prob.	**0.6371 n0**	**1.0000 n0**	**0.1978 n0**	**0.1762 n0**
At First Difference					
		CPI	M2	REER	Overnight rate
With Constant	t-statistic	-11.4445	-16.3218	-11.7721	-20.8589
	Prob.	**0.0000 *****	**0.0000 *****	**0.0000 *****	**0.0000 *****
With Constant & Trend	t-statistic	-11.5178	-16.2964	-12.3393	-20.9876
	Prob.	**0.0000 *****	**0.0000 *****	**0.0000 *****	**0.0000 *****
Without Constant & Trend	t-statistic	-11.4609	-14.6684	-11.6902	-20.8775
	Prob.	**0.0000 *****	**0.0015 *****	**0.0000 *****	**0.0000 *****

Notes:
a:(*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1% and (no) Not Significant
b: Lag Length based on SIC
c: Probability based on MacKinnon (1996) one-sided p-values.

According to the results of the PP unit root test, the CPI, M2, and REER series are not stationary in all three models because their probability values are greater than 1%, 5%, and 10%, respectively. The overnight rate, on the other hand, is stationary at a level with t-statistics -2.98 for the constant model.

The first difference of the series was taken, and the PP unit root test was applied again, considering that the other series, except the overnight rate series, were not stationary at the level. In Table 10, the test results of the stationarity of the series with the first difference are given. According to the results given, the data were found to be stationary according to the 1% significance level for all three models.

Considering the ADF and PP unit root test results, we can state that although the overnight rate series is determined to be I(0) at 5% significance level, the other series are I(1) series. Since the degree of integration between the series is different, the

"Autoregressive Distributed Lag" ARDL cointegration approach was used to examine whether there is a long-term relationship between the series.

The optimum lag length is determined to estimate the VAR model. The LR test statistic (LR), final prediction error (FPE), and Akaike information criterion (AIC) were used to determine the most appropriate lag length for the model to be estimated.

After conducting the VAR model, based on the results of the information criteria, it was determined that the optimal lag interval for the endogenous variable is 3. The Akaike information criterion (AIC) has the lowest value at this lag interval with -11.60 indicating that it provides the best fit for the model. This means that a lag of 3 is the most appropriate choice for accurately predicting the behavior of the endogenous variable in the regression analysis. Selecting the optimal lag interval is crucial for producing reliable and accurate results in time series analysis, and the AIC and SC are commonly used metrics to determine the best fit for a model.

Table 11. Var Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-503.6901	NA	0.000575	3.890346	3.944974	3.912305
1	1490.466	3911.907	1.50e-10	-11.26794	-10.99479	-11.15814
2	1548.654	112.3637	1.09e-10	-11.59122	-11.09956*	-11.39359*
3	1566.629	34.15881*	1.07e-10*	-11.60635*	-10.89618	-11.32088
4	1577.306	19.96297	1.12e-10	-11.56556	-10.63687	-11.19226
5	1584.313	12.88614	1.20e-10	-11.49665	-10.34945	-11.03551
6	1598.832	26.25704	1.21e-10	-11.48530	-10.11958	-10.93633
7	1610.117	20.06319	1.26e-10	-11.44918	-9.864944	-10.81237
8	1619.714	16.76594	1.32e-10	-11.40010	-9.597359	-10.67546
9	1624.174	7.656295	1.45e-10	-11.31168	-9.290418	-10.49920
10	1631.623	12.55684	1.55e-10	-11.24615	-9.006375	-10.34583

11	1645.467	22.91470	1.58e-10	-11.22963	-8.771341	-10.24148
12	1659.324	22.51158	1.61e-10	-11.21321	-8.536408	-10.13722

* Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

According to findings in Table 11, an order lag selection analysis using monthly data with 12 lags. The results indicate that the model should include three lags based on the Akaike information criterion (AIC).

Prior to conducting the ARDL test, a dummy variable for the period September 2005 to April 2011 was added to the analysis to not only elevates the model's efficacy by mitigating heteroscedasticity-related concerns but also cultivates more resilient and dependable results. Moreover, the integration of dummy variable enhances diagnostic measures, as exemplified by elevated CUSUM and CUSUM squares, thereby fortifying the precision of evaluating the model's stability and performance across time.

Between 2005 and 2011, the Central Bank of Türkiye embraced the "Explicit Inflation Targeting" regime, officially adopting it in 2006. This strategic framework, initiated in 2005, marked a significant shift in the country's monetary policy. The implementation of policies aimed at mitigating the impact of the 2001 crisis, with the backing of international organizations, yielded positive outcomes for the Turkish economy. Throughout this period, the Central Bank maintained a balanced stance, carefully considering both external and internal variables influencing the country's economic landscape. The relative stability observed during these years can be attributed, in part, to the adoption of inflation targeting, complemented by efforts to strengthen the financial sector. The Central Bank's commitment to transparent communication and its ability to adapt to evolving economic conditions were integral aspects of the monetary policy framework.

The presence of long-run cointegration has been verified using the bond test after it was established that none of the chosen series, I (2) or beyond, and has determined the best order of lag. Table 12 shows the outcomes of the ARDL-bound test of cointegration. Given that the F-statistics have a higher value (6.147) than the upper bound critical value of 3.65 at a 1% significance level provided by Pesaran et

al. (2001), we have good grounds to reject the null hypothesis that there is no long-run relationship, as well as the possibility that the variables under study are cointegrated.

Table 12. ARDL Bound Test Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.147292	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	270		Finite Sample: n=80	
		10%	2.474	3.312
		5%	2.92	3.838
		1%	3.908	5.044

The ARDL (2,0,0,1) model was chosen as the most suitable model. Because the AIC value of this model has a lower AIC value compared to other models. In order to determine whether the estimation results of the ARDL (2,0,0,1) model are economically significant, the sign and size of the coefficients of each variable should be considered.

The ARDL test was performed to determine the long-term relationship between the variables and the findings are presented in Table 13.

Table 13. ARDL Model Result

Dependent Variable: CPI
Method: ARDL
Date: 11/29/23 Time: 15:24
Sample (adjusted): 2001M03 2023M09
Included observations: 271 after adjustments
Maximum dependent lags: 3 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (3 lags, automatic): M2 REER OVERNIGHT_RATE
Fixed regressors: DUMMY C
Number of models evaluated: 192
Selected Model: ARDL(2, 0, 0, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI(-1)	1.241948	0.056122	22.12944	0.0000
CPI(-2)	-0.317568	0.054663	-5.809570	0.0000
M2	-0.028963	0.013183	-2.197031	0.0289
REER	-0.329407	0.071537	-4.604684	0.0000
OVERNIGHT_RATE	0.148648	0.055128	2.696440	0.0075
OVERNIGHT_RATE(-1)	-0.155561	0.055459	-2.804978	0.0054
DUMMY	0.020441	0.017516	1.166984	0.2443
C	2.291266	0.623283	3.676124	0.0003

R-squared	0.981553	Mean dependent var	2.580727
Adjusted R-squared	0.981062	S.D. dependent var	0.730401
S.E. of regression	0.100515	Akaike info criterion	-1.727952
Sum squared resid	2.657136	Schwarz criterion	-1.621617
Log likelihood	242.1375	Hannan-Quinn criter.	-1.685257
F-statistic	1999.146	Durbin-Watson stat	2.011692
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

According to the findings of the ARDL model test, the Consumer Price Index (CPI) at lags 1 and 2 (CPI(-1) and CPI(-2)) have coefficients of 1.241 and -0.317, respectively, indicating that they are statistically significant independent variables. This suggests that past CPI values have a significant impact on the current CPI in short run. Furthermore, the money supply (M2) is statistically significant with the coefficient -0.0289, indicating that changes in the money supply over the period negatively affects the current CPI.

The overnight interest rate and its lagged value at -1 are statistically significant with coefficients of 0.148 and -0.155, respectively, suggesting their influence on the current cpi. The real effective exchange rate (REER) with a coefficient of -0.329. Moreover, the dummy variable is not statistically significant, whereas constant term with a coefficient of 2.82 is significant independent variable in the model. Overall, the ARDL model reveals that the cpi is influenced by its own past values, money supply, the overnight interest rate, the real effective exchange rate, and a constant term, while the dummy variable has no significant impact.

The statistical model being discussed has an R-squared value of 0.98, which indicates that 98% of the variance in the CPI is explained by the independent variables in the model. The Durbin-Watson value is 2.01, which is close to the optimal value of 2, suggesting that there is no significant autocorrelation in the residuals. Moreover, the probability of the F-statistic is 0, which implies that the model is a good fit for the data and that the independent variables are statistically significant in explaining the variation in the dependent variable. Additionally, the F-value indicates that the model is a strong predictor of the dependent variable. Overall, these results suggest that the statistical model is robust and provides a strong fit for the data.

4.1. Long-Run Relationship

In the output level equation of the ARDL MODEL, the dependent variable is CPI (Consumer Price Index), and the independent variables are M2 (money supply), REEF (real effective exchange rate), and overnight rate. The coefficients for these independent variables are -0.383, -4.356, and -0.091, respectively.

Table 14. Level Equation – ARDL MODEL

Level Equation **Case 2: Restricted Constant and No Trend**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2	-0.383	0.189	-2.022	0.0441
REER	-4.356	1.001	-4.348	0.0000
Overnight rate	-0.091	0.344	-0.265	0.7908
C	30.299	9.024	3.357	0.0009

The level of the ARDL model indicates that the model is estimated in levels, meaning that the variables are not transformed or differenced. Therefore, the coefficients represent the change in the dependent variable for a one-unit change in the corresponding independent variable. For example, a one-unit increase in M2 would result in a decrease in the CPI of 0.383 units, all else being equal.

It's important to note that the ARDL model assumes that there is a long-run relationship between the variables, meaning that they are co-integrated. The model also allows for short-term dynamics and adjusts for any potential endogeneity issues.

4.2. Error Correction Model

The error correction model is estimated in order to determine how long it will take for the deviations values to return to the long-term equilibrium values due to the shocks that will occur in the short-term.

Table 15 displays the error correction model outcomes. It is clear that every factor has statistical significance. Also, the coefficient of CointEq(-1) is statistically significant and negative as predicted. The relevance of the lagged error correction term suggests a long-term causal relationship between the inflation rate and all variables in the monetary model. The coefficient of error correction is around -0.075, which means that every month, approximately 7.5% of the short-term disequilibrium in inflation (CPI) is rectified. According to this result, deviations from the long-term equilibrium value will return to the long-term equilibrium value after a 1/0.075 = 13.3 period.

Table 15. Error Correction Model Regression

ECM Regression **Case 2: Restricted Constand and No Trend**				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1))	0.317	0.053	5.935	0.0000
D(Overnight rate)	0.148	0.053	2.784	0.0057
Dummy	0.020	0.012	1.592	0.1125
CointEq(-1)	-0.075	0.013	-5.775	0.0000

Overall, the ECM suggests that there is a long-run equilibrium relationship between the variables and that deviations from this relationship are corrected in the short run. Additionally, the coefficients suggest that both the CPI lagging by one lag

and the overnight rate have a positive impact on the dependent variable, while deviations from the long-run equilibrium have a negative impact.

In order to determine whether the errors obtained from the model estimation meet the necessary assumptions, autocorrelation and heteroskedasticity were performed, and the results are presented in the table below in Table 16.

Table 16. Diagnostic Test Results

Test Description	Test- statistics	P-values
Breusch-Godfrey Serial Correlation LM Test	Obs*R-squared= 1.1424	0.5648
Heteroskedasticity Test: Breusch-Pagan-Godfrey	Obs*R-squared= 9.7964	0.2004

According to the information presented in Table 16, there is no autocorrelation or heteroskedasticity in the error terms obtained from the model because the probability values of these tests were calculated as 0.5648 and 0.2004, respectively. Since these probability values are greater than 0.05, the null hypothesis cannot be rejected, which means the error terms derived from the model don't have any heteroskedasticity or autocorrelation problems.

In addition to the assumption tests, the model should be stable. The stability of the model is very important in determining whether there is a change in the predicted parameters over time. In order to determine the stability of the model, the CUSUM and CUSUM squares test were performed, and the results are given in figure 7 and figure 8.

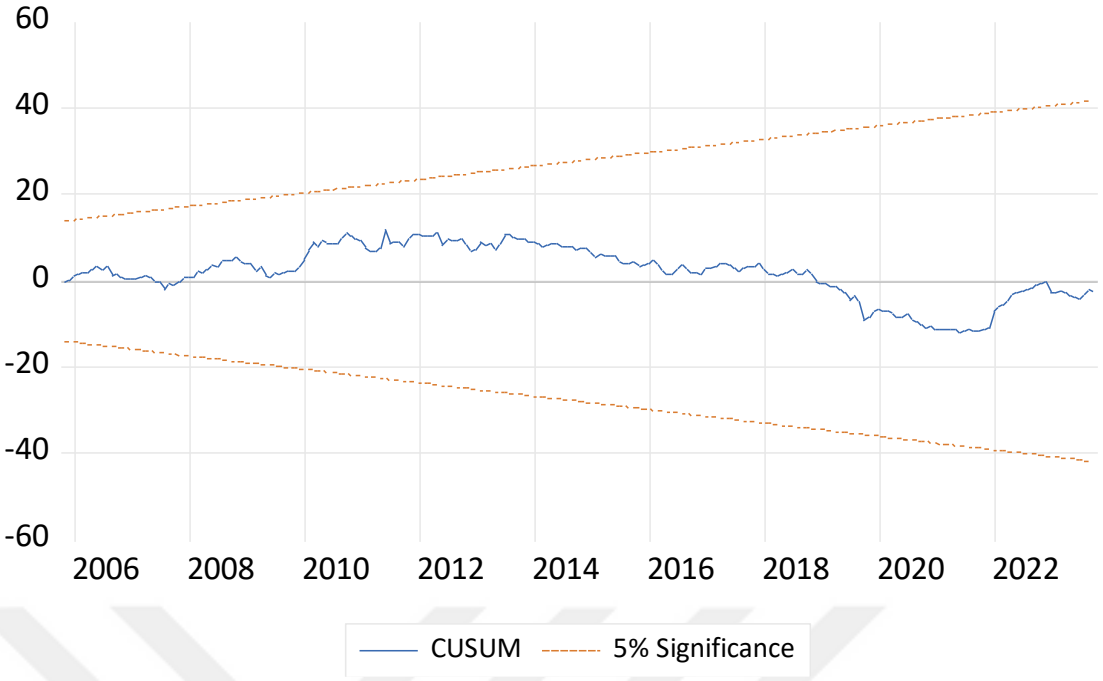


Figure 7. CUSUM Test Result

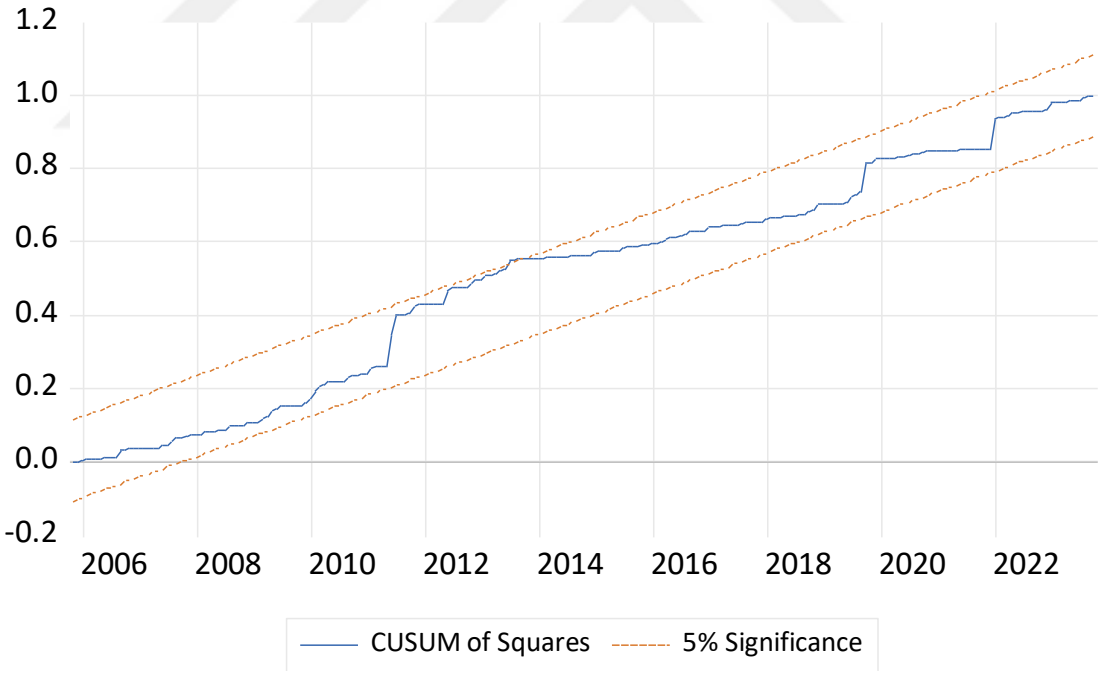


Figure 8. CUSUM Squares Test Result

According to the graphs presented in Figure 7 and 8, the line expressing the cumulative sum of the errors doesn't go beyond the confidence intervals determined for the 5% significance level. Therefore, we can state that the estimated ARDL model is stable

CONCLUSION AND RECOMMENDATION

In summary, the ARDL analysis carried out in this research offers insightful information about the connections between different economic variables, with a primary emphasis on inflation and interest rate. All of the important variables, including the Consumer Price Index (CPI), Money Supply (M2), and Real Effective Exchange Rate (REER), showed stationarity at the first difference, including the analysis of correlogram and unit root tests (ADF, PP), with the exception of the overnight interest rate.

The bound test indicated that a long-term relationship between inflation and the overnight interest rate was formed by the ARDL model. The ARDL model's output yielded coefficients for the independent variables, with the overnight rate, M2, and REER generating coefficients of -0.091, -0.383, and -4.356 respectively. This illustrates the precise effect of these variables on the dynamics of inflation while underscoring the possible impact of exchange rate and monetary factors.

The Error Correction Model (ECM) further supported the notion of a long-run equilibrium relationship among the variables, with deviations being corrected in the short run. The coefficients obtained from the ECM illustrated the positive impact of lagged CPI and the Overnight Rate on the dependent variable, reinforcing the significance of these variables in shaping inflation outcomes.

The model's validity was indicated by the model diagnostics, which showed that the error components in the model had neither autocorrelation nor heteroskedasticity. Furthermore, the model's reliability across the analyzed data period was confirmed by the stability test, as shown by the cumulative sum (CUSUM) and (CUSUM Square) of errors remaining within confidence intervals.

In conclusion, this study's ARDL analysis confirms the robustness and dependability of the model while also illuminating the variables influencing inflation. For researchers and policymakers attempting to comprehend and forecast inflation dynamics within the examined economic framework, the findings offer insightful information.

Central banks should keep a careful eye on changes in exchange rates and money supply because of the strong long-term correlation between inflation and the Real Effective Exchange Rate (REER) and money supply (M2). Inflation can be significantly reduced by making efforts to stabilize the REER and M2 through suitable exchange rates and monetary policy. Reducing the rise in consumer prices can be accomplished in part by preserving a competitive and stable exchange rate.

The results suggest that there is no significant long-term correlation between inflation and the overnight rate. Policy-makers should recognize that monetary policy changes, such as adjusting overnight rate, may have limited direct impact on controlling inflation over the long term.

Although long-term relationships are important, it's crucial to consider short-term dynamics as well. The Error Correction Model (ECM) shows that there is a short-term correlation between the overnight rate and inflation. When addressing inflation concerns in the short run, central banks may need to take into account the impact of the Overnight rate on consumer prices.

The ECM's CointEq(-1) term, with a coefficient of -0.075, indicates that any deviations from the long-term equilibrium relationship are corrected by around 7.5% in the next period. This highlights the importance of maintaining a stable and sustainable economic equilibrium. Policy-makers should focus on policies that help steer the economy back towards its long-term equilibrium whenever it strays, ensuring that deviations do not lead to persistent inflationary pressures.

DISCUSSION

The long-term relationship between the variables was investigated using autoregressive distributed lag (ARDL) models. With a test statistic of 6.147, which is greater than the 1% level of significance, the bound test findings demonstrate that there is, in fact, a substantial long-term association between these variables.

Moreover, with a correlation coefficient of -4.356, the Real Effective Exchange Rate (REER) is discovered to be highly correlated with inflation (CPI)in the long term. This coefficient shows how important changes in exchange rates are in influencing consumer prices; a one-unit gain in REER corresponds to 4.356 units drop in inflation. Furthermore, there is a statistically significant negative correlation between money supply and inflation, as indicated by the coefficient of -0.383.

In addition, there is no correlation between inflation and the overnight rate in the long term. With a coefficient of -0.091, the overnight rate indicates that a one-unit increase in the overnight rate corresponds to a 0.091-unit decrease in inflation.

Moreover, the study conducted by KOCAÖZ and ECEMİŞ delves into the intricate dynamics between interest rates, inflation, and exchange rates in Turkey, spanning the period from July 2012 to September 2022. Employing regression analytical methods, including ARDL boundary tests, cointegration analysis, and Granger causality tests, the research reveals significant insights into both short- and long-term relationships among these economic indicators. The long-term coefficients shed further light on this dynamic, indicating a notable negative impact of -4.274 for exchange rates, a negative impact of -0.027 for interest rate.

However, the study conducted by Turna and Özcan delves into the multifaceted relationship between inflation, interest rates, and exchange rates in the context of Turkey's efforts to maintain price stability through diverse policies. Analyzing data from the Central Bank database covering the period from 2005Q1 to 2019Q2, this research focuses on the macroeconomic variables of interest rates and exchange rates and their impact on inflation. Employing the ARDL (Auto-Regressive Distributed Lag) model, the study rigorously tests the relationships between these variables. The findings, particularly in the long run, underscore the significant coefficients of 0.806 for the exchange rate and 0.214 for interest rates. These coefficients suggest that both exchange rates and interest rates play crucial roles in influencing inflation, contributing

valuable insights to the broader discourse on inflationary dynamics in Turkey. The study emphasizes the importance of considering these macroeconomic variables in the formulation and evaluation of policies aimed at ensuring sustained price stability within the Turkish economy.

An important technique for capturing the short-term changes in the relationship between the variables is the Error Correction Model (ECM), which is introduced. A significant value of -0.075 for the CointEq(-1) term indicates that any divergence from the long-term equilibrium relationship is corrected by around 7.5% in the next period. This shows that the variables usually find their way back to their long-term equilibrium.

In the error correction model, the overnight rate has a coefficient of 0.148, indicating its significance. This suggests that variations in the Overnight rate have a positive impact on inflation in the short term; for example, a rise of one unit in the Overnight rate corresponds to an increase of 0.148 units in inflation.

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