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The Impact of Interest Rates on Inflation: A Case Study of the Turkish Economy

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ABSTRACT: This study investigates how the interest rate affects the rate of inflation in Turkey, one of the most central focuses of economic analysis over these years. Among these analyses is the famous Fisher hypothesis, which assumes a direct relationship between nominal interest rates and expectations of inflation. It uses data from 1989 to 2019 in estimating the relationship between interest rates and inflation using an autoregressive distributed lag model. The empirical results indicate that the interest rates and inflation are negatively related in both short-run and long-run dynamics. These findings represent a great amalgamation of monetarist economic theory, which held that inflation could be curtailed through monetary policy adjustments, namely the raising of interest rates. The lengthiness of the time series and the inclusion of some very significant control variables make this analysis unique compared to other analyses on the subject. Apart from this, the study contributes to policy discussions and carries important lessons for policymakers in Turkey and also for other nations whose inflation problems persist. The research emphasizes that proper monetary policy is the main determinant of inflation stabilization and thus constitutes a timely and relevant contribution to various ongoing debates on strategies of inflation control.

KEYWORDS: Interest rate; Inflation; Fisher Effect; Money Supply; Turkey

1. INTRODUCTION

Whenever the concept of the effect of interest rates on inflation is mentioned, Fisher's effect established by Irving Fisher (1930) is the theory that solves the puzzle. It expresses real interest rates as nominal interest rates minus expected inflation

“Inflation is calculated by the consumer price index and shows the annual difference in the price to par consumer purchasing or buying commodities, which might be fixed or changes at intervals. The common perspective for economists says a higher interest rate leads to decreased inflation. The reason supporting this view is that a high-interest rate increases the price of borrowing and drops demand in the economy, leading to oversupply, thereby decreasing inflation. This view is achieved through many channels, it includes the exchange rates, credit, balance sheet and bank credit channels. (Mishkin, 1996). An economy facing the likelihood of high-than-target inflation can push interest rates, to increase the cost of borrowing, therefore reducing aggregate demand and inflation will return to the desired level. Although some evidence supports that a decreased interest rate results to lower inflation in a short time. The logic is that in a short time when the interest rate is lowered, there will be enough circulating money and prices do not react so fast to excess demand but gradually prices will react and inflation sets in.

Interest rate is a significant tool used in the economy by the central bank to control inflation. It can be defined as the ratio of principal lenders’ charges to borrowers for the loan of funds. It affects the cost of loans, High-interest rate makes the loan more expensive. At higher interest rates, few individuals and businesses would want to loan, this reduces the quota of credit accessible to fund purchases, reducing demand. Simultaneously, people are encouraged to save in view of the fact that they earn more on the savings rate. Capital available to expand businesses is also decreased by higher interest rates.

The opposite effect of a high-interest rate on the economy is a low-interest rate. Cheap mortgage fares are the same outcome as cheap housing costs, encouraging real estate demand. When the savings rate fall, then savers might begin to spend more since less is earned on their deposits. Savers perchance put their funds into low-risk but more beneficial investments, which steer up stock prices, as a result of this, it can accelerate or slow the economy. Central banks manage interest rates to achieve targeted economic growth in the economy. The monetary tools used are (1) Bank rates: The ratio at which the apex bank lends to financial institutions. When there is inflation, the central bank pushes up the bank rate to minimize the money supply in the economy. They ensure commercial banks give less credit, leading to a reduced money supply in the economy. When money is minimized, there is lesser demand and thus price fall. (2) Cash reserve ratio; The quota of deposits that the banks are needed to remain with the central bank in cash. Therefore, if the apex bank increases reserve ratio, the financial institution has to keep more money that cannot be lent. Due

to this, the money supply will cause inflation to drop. (3) Open market Operation: The apex bank buying and selling of government securities; market operation. Perceiving inflation, the central bank sells government securities stocks out and pulls redundant liquidity from the market. The buyer of the securities pays in cash which results in less money supply in the economy. (4) Marginal Standing Facility: this is explained as the panel rate at which banks borrow from the central. It is a tool that helps control volatility in interest rates within inter-bank lending. This monetary policy mechanism also has an indirect effect on the interest rates and money supply in the economy. (5) Statutory Liquidity Ratio: The proportion of deposits the banks are needed to keep in the form of liquid government securities. An increase in the statutory Liquidity ratio means less funds to lend and reduces the money supply in the economy.

In this research work besides interest rate as the major determinant of the inflation rate, it is important to put some control variables in the regression model. These variables are not the interest of the study aim but it is added because they could influence the result. This will help to prevent biases in the research result. Besides interest rate as the independent variables; Money supply (MS), exchange rate (EXC) and, Gross Domestic Product (GDP) will be considered as the control variables.

Money supply is referred to the circulating cash in an economy over a time period. It is essential for monetary policy decision-making, as it is a key variable that moves macroeconomic performance. It has a link with macroeconomic variables such as interest rates and inflation. It is an of the economic variables that are being tracked by investors and economists because it can be used to determine the business cycle. Investors use it for strategic planning and to maximize their portfolios by understanding flows in the business cycle. The apex bank uses money supply to enact monetary policy to maintain economic stability and growth and to tackle inflation in the economy. When demand (spending) is high and supply remains constant, it pushes up the equilibrium rate. High inflation can be a bad omen in the economy because when prices of goods increases but wages do not, it eliminates the purchasing power of the consumers and can easily lead to a decrease in overall spending and economic downturn.

The Monetary policy seeks to check inflation by manipulating the supply of money and interest rate in an economy. When the money supply is high-rise, it fosters consumer spending and investments, which in turn stimulate the economy. In other ways, when the money supply is less, consumer spending and investments decrease, and in the long run, result in a declining economy. Due to this the central keep reserve requirement to meet abnormally high withdrawal needs.

The exchange rate stands for the amount of local legal tender which can be exchanged for foreign tender. Used to decide rates of several currencies in relation to another and it is a parameter to determine trade and capital flow dynamics. It is quoted in two legal tenders; for example; Turkish Lira (TRY) can be paired with U.S.A dollar (USD). The ratio is determined by two factors: Domestic currency and foreign currency purchasing power. The exchange rates collides with a lot of economic elements and variables that make it fluctuate. One of the reasons for exchange rate fluctuations is the interest rate which impacts money value and exchange rate. A high interest in the home country increases the need for home currency, afterward foreign investors are attracted to invest in the currency with high value, thereby infusing foreign capital to the domestic currency. Inflation rates do affect currency and exchange rates too. At high inflation in the domestic economy, the need for home legal tender declines, as the rate of the money falls fast over time than the foreign currency pegged. The rate of exchange is also influenced by government debts. Debts owned by the government of the economy impact the rate of exchange in the currency, - since an economy with high debt has a low chance to attract foreign capital, subsequently leading to inflation. This puts a declining force on home legal tender and reduces her worth in the exchange rate platform. A country's imports and export contribute to the domestic currency value and exchange rate. If the domestic currency export products greater than imports, it will witness a high need for the currency; therefore, its exchange rate increase relative to other foreign currencies. If the same country imports more than it export, there will be a lower need for her currency; therefore, the rate of exchange for her currency decreases parallel to other currencies. Speculations impact countries' exchange rate values as well. When an economy's legal tender is anticipated to appreciate for some perceived basis, investors tend to buy the currency to gain based on expectation. This prompts demand rise on the domestic currency with respect to foreign currency.

Gross domestic product estimates the monetary value of final goods and services produced in a given country over a given of time usually yearly. GDP is an indicator to check an economy's health. "GDP and inflation have always been connected on the basis that governments and central bank rely their decision on figures from them and they work to manipulate it. When an economy is not growing fast enough, the apex bank attempt to lower the rate to make loan appealing". In turn motivates spending, leading to an increase in GDP. The disadvantage of this move is that; it is believed it will trigger inflation in the long term. When an economy is expanding too fast, this could result in a shortage in product supply due to people buying more goods and services faster than the supply, this move may trigger inflation.

1.1 Brief on the Turkish Economy

Turkish economy in 1990; the central bank adopted a program to meet the Market liquidity requirements which must be met without jeopardizing exchange value and interest stability. The inflation target was achieved in 1990; However, as a result of some issues,

such as the pressure placed on the financial sector by the Gulf War in 1991, as well as political problems, inflation recorded a high figure in 1994. In 1995 & 1999 central bank enacted policies to control stability in financial markets by reducing fluctuations in exchange value. However, market hope began to go down in late 2000 with the defeat to achieve the structural changes proposed in the economic program. This erupted in the 2001 crisis in Turkey, and due to this, the planned exchange rate-based stability program was cancelled. In early 2001, the economic problem, the floating exchange act was established with a structural transformation programme commenced in the country. In floating exchange rate act, forces of supply and demand determine the rate of foreign currency. In this act, exchange rates are not a tool for policymaking. The central bank has no control over the level of exchange rates. Though, the Bank closely monitor the exchange market as an essential part of financial stability. The apex bank controls some transactions in the exchange market within the inflation-targeting framework. The year 2001 was a good turn with respect to the control of inflation. At the time of the restructuring processes, it was enacted to change the monetary policy approach as well. Relative to the main objective of price control, the inflation-targeting Act was implemented in 2002. In view of that, the inflation targeting plan implemented in 2002 & 2005 tried to establish the conditions for full action in inflation targeting in a model not to hamper the running of the regime. Asides, the technical and institutional infrastructure of the apex bank has been activated, the bank's data record has also been expanded and the research department has been structured to become an effective research and monetary policy department. Lastly, a formal inflation-targeting plan was implemented in 2006. In Turkey, the demand and supply of foreign currency affect rate system with money on the market. In this system, exchange rates are not a tool for making policy. On the level of currency rates, the Central Bank is uncommitted. Yet, as a crucial component of financial stability, the Bank regularly oversees the foreign currency market stability. In the scope of inflation targeting, the Central Bank engages in two types of foreign currency market transactions. First, the Bank conducts foreign currency buying auctions in accordance with a previously announced program to purchase foreign exchange for predetermined figures and based on foreign exchange liquidity plans and reserve increase strategy, without infringing upon the fundamental tenants and system of the floating exchange rate act. Secondly, the apex bank directly mediates in the foreign market in the possibility of high volatility exchange value. In this method, the bank directly buys & sells foreign exchange in the market. Interventions against excessive exchange market high volatility can be made in both ways. Interventions are not always symmetrical; they sometimes take the form of announcements or warnings to the public.

2. LITERATURE REVIEW

The word inflation means a rise in local goods and services prices that is comparatively higher than a rise in prices of international commodities. The nominal rate is taken into consideration before looking at the inflation outcome before regulating the interest rate with respect to inflation. The modified interest rate with respect to inflation is referred as a real interest rate. The Fisher equation is the name given to this relationship. Given the assumption that real interest rate is stationary. Fisher equation can be described as the relationship between nominal interest rate and projected inflation. The equation, which is same as the Fisher hypothesis, postulates a correlation linking projected inflation and interest rates. Fisher's formula or theory gives a theoretical foundation for investigating how interest rate and anticipated inflation relate to another. The Fisher equations affect creditors and debtors, and they are important to the outcome of monetary policy and the banking industry's effectiveness. Fisher's hypothesis is valid for the industry in general. Dritsaki (2017) studied the link in inflation and nominal interest rate in Germany, Britain and Switzerland from January 1995 to May 2015. Used Autoregressive Distributed Lag for long-run relationship test. The outcome shows Fisher's assumption is valid; means there is cointegration for the investigated three countries. Inflation was influenced by interest rate positively. In the same view, Musa *et al* (2019) in a paper on Interest Rate and Inflation Nexus, using Autoregressive Distributed Lag bound test found a positive link interest rate and inflation as well. In other words, a rise in the interest rate will affect an increase in the inflation rate. Hur *et al* (2018) studied the connectivity of inflation and real interest rate using an econometrics model, showed that inflation is associated with real interest rates. Bondarchuk *et al* (2020) obtained a significant influence of interest rate on the inflation rate in Ukraine using the Taylor rule. Going further, Khumalo *et al* (2017), monitored the connection in inflation and interest rates in Swaziland. The outcome was positive, showing there was a connection in interest rates and inflation for the estimated year 2010 to 2014. Similarly, Matsuki *et al* (2015) in Japan economy studies, added that low-interest rates positively affect the inflation rate. Julitawaty (2015), Analysed inflation and interest rates in Indonesia using the ARDL model and concluded that interest rates significantly affect the rate of inflation in the country with the obtained monthly data. Alexander (2008) used the cointegration approach of econometrics to investigate the link between South Africa's nominal interest rate and projected inflation. He came to conclusion that there is a connection in the nominal interest rate and inflation. The investigation also said the Fisher Equation for South Africa was supported by the data obtained; a connection was found in the long run but no short-run relationship. Saeidi & Valian (2011) studies the link in interest rates and inflation, using the econometric method to verify the Fisher hypothesis for Iran's economy, the year 1991 to 2009, they shared the interest rate into three categories; short-term, mid-term and longtime and divide the exchange rates in groups, i.e., official currency rate and non-official currency with all three-interest rates and found a direct and positive relationship. Million (2014) looked at how the Fisher theory applied to data from the U.S, and utilized the information of the daily closing bids of the secondary market for 3-month Treasury Bills. The period covered by the data for the interest rate was 1951.1 to 1999.12. The empirical study provided compelling support for the real interest rate threshold behaviour and summarized

that the Fisher prediction was strong in some data periods. The Fisher effect was substantial when there was a stochastic trend in the nominal interest rate and inflation, he discovered a high link between these two variables in such a setting. When he took into consideration the relationship's nonlinear aspect, he also obtained substantial Fisher effect evidence. Mehdi & Berument (2012) studied the link in interest rates and inflation. Twenty- six countries were tested using Fisher's hypothesis. A positive relationship was found between nominal interest rates and inflation.

In contrary to the above findings, Jayasinghe & Udayaseelan (2017) investigated the Fisher theory for Sri Lanka, deploying the econometrics co-integration method. Took into account the 3 frequencies' data sets, quarterly data, year 1978 to 2008, annually from 1953 to 1977, and monthly data from 1978 to 2008. The result showed variations in trending of the nominal interest rate and anticipated inflation for various data sets that were gathered monthly, quarterly and annually. In the end, the research found that nominal interest rarely has any long-term relationships with inflation. Same as Ngan Tan *et al*(2018) in a long-run analysis of monetary policy. The results suggested that interest rate has unreasonable impact on inflation in the long run. Similarly, Mirza *et al* (2018) in the paper Casual Relationship in interest rates and Inflation Rate suggested no relationship between trending in interest rates to inflation. Makku (2010) investigated Fisher's hypothesis by conducting a unit root and cointegration test, accessing US data from 1953 to 1990 and concluded that Fisher's theory was logical for the period. Whereas the data from the other time periods, namely 1979:11 to 1990:12, revealed no validity of the proof for the hypothesis. Using quarterly data on nominal interest rates for six nations, Sundqvistemil (2012) investigated the Fisher hypothesis and tested its long-term applicability. During 1993 and 2000, between the US dollar and five other currencies, quarterly exchange data was taken from the IMF. The investigation concluded that, while it holds for some country pairs, such as the US and Japan. It is not valid to others

3. DATA METHOD/ECONOMIC MODEL;

Having gone through previous studies' results, limitations and shortcomings. We intend to test the effect of interest rate on inflation using different variables data rather than the nominal and real interest rates as some previous studies did. In this research paper, we will make use of secondary data from the World development indicator. Data from 1989 to 2019 where the dependent variable is Inflation; means the difference in the cost of goods and services in a country over a period. The explanatory variable is the deposit interest rate which is the yield financial institution pays to individuals and businesses in the economy for keeping their money with them, which they lend to borrowers for investment and other purposes. Control variables includes: First, Money supply: various form of physical currency, demand deposits and liquid instrument in circulation in an economy. Secondly, the exchange rates: This refers to the amount of one currency relative to another currency. Usually affect by the inflation rate and interest rate in the home country. Last of the control variables is Gross domestic product; This summarizes the value of products produced in the whole economy. In the data, GDP deflator was used as a proxy for real GDP was It tells the economic performance of an economy. EViews is used for analyzing the econometrics data. Inflation is our dependent variable while the interest rate and other control variables are the independent variables that affect the dependent variable with a shift or change in slope coefficient. The independent variables were considered due to their impact on the business cycles in the economy and how they impact inflation. Inflation will be denoted as CPI (consumer price index) and Interest rate will be denoted as APR (annual percentage rate). Money supply (MS), Exchange rate (EXC) and Gross Domestic Products (GDP). Getting to know this variable, the population regression function (PRF) will be

$CPI_t = \beta_0 + \beta_1 APR_t + \beta_2 MS_t + \beta_3 EXC_t + \beta_4 GDP_t + u_t$. …… … (1)

Ut is the disturbance term that is serially correlated. We can estimate the disturbance term in the regression as

Ut=$CPI_t - \beta_0 - \beta_1 APR_t + \beta_2 MS_t + \beta_3 EXC_t + \beta_4 GDP_t$…… (2)

Though the unit of measurement for Inflation, interest rate and other control variables are in percentages (%), we will take the Logarithm of the key variables to remove outliers generate symmetric data. Considering taking the log of the variables of some variable; we have CPI=LNCPI, APR=LNAPR, MS=LNMS while exchange rate (EXC) and GDP remain in their natural form. In view of this, we generate a new population regression function.

The population regression function (PRF) will be:

$LNCPI_t = \beta_0 + \beta_1 LNAPR_t + \beta_2 LNMS_t + \beta_3 EXC_t + \beta_4 GDP_t + u_t$…….. (3)

Furthermore, the estimated regression function is:

$\widehat{lncpi}_t = \beta_0 + \beta_1 \widehat{lnapr}_t + \beta_2 \widehat{lnms}_t + \beta_3 \widehat{exc}_t + \beta_4 \widehat{gdp}_t + \hat{u}_t$…… ….. (4)

3.1 ARDL Model. For the purpose of this research, the Autoregressive Distributed Lag model is the best estimator for the model due the order of integration of our variables. ARDL estimates short-run and long-run relationships between variables whose unit root result is difference. It permits the inclusion of lag values of the dependent and independent variables. ARDL is flexible model that estimate both short and long-term dynamics between variables.

The default form of the ARDL Model:

$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} \ldots + \Delta X_t + \Delta X_{t-1} + \Delta X_{t-2} \ldots +$ εt ……5

- ΔY_t stands for the change in Y at time t.
- Y_{t-1} & Y_{t-2}… stands for the lagged values of the dependent variable.

- ΔX_t stands for changes in the independent variable X at time t.
- ΔX_{t-1} & ΔX_{t-2} … stands for the lagged changes in the independent variable.
- εt is the error term.

The ARDL for our variables would be stated:

$\Delta lncpi_{t-1} = \beta_0 + \beta_1 lnapr_{t-1} + \beta_2 lnms_{t-1} + \beta_3 exc_{t-1} + \beta_4 gdp_{t-1} +$ εt …… 6

4. MODEL ESTIMATION AND EMPIRICAL RESULT.

The samples in the model contain 31 observations of each variable. Data from the world bank database. The graphical representation of the variables shows that interest rate and inflation are co-trending with a lag.

Figs: 4.1.1

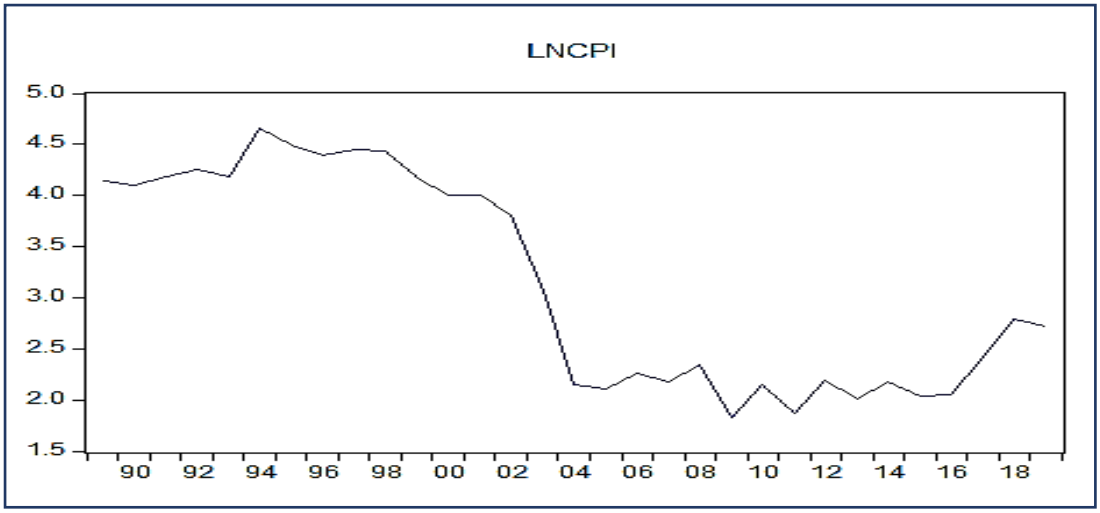


Fig 4.1.2.

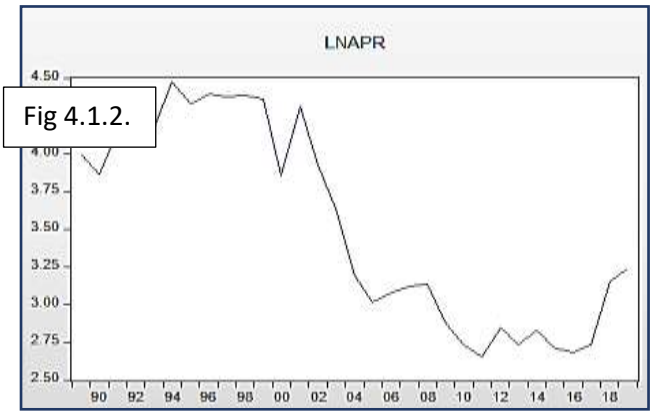


Fig 4.1.3.

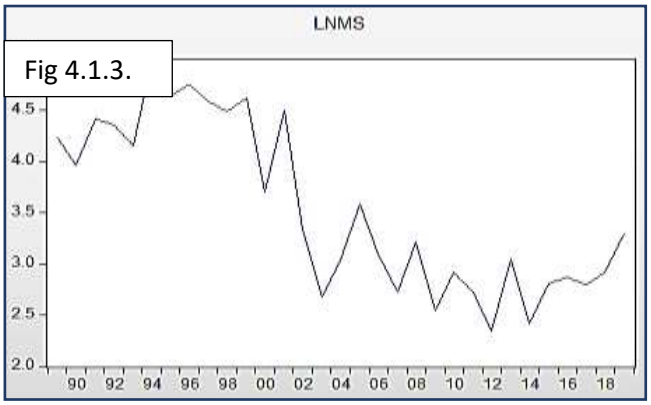


Fig 4.1.4.

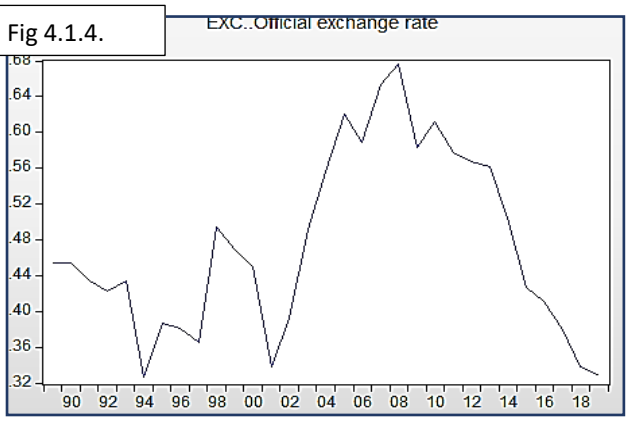
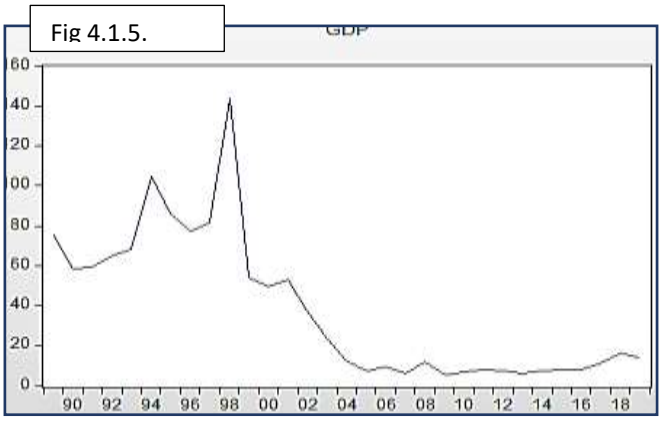


Fig 4.1.5.



As econometric analysis starts by checking the variables other of integration which is Unit root of the variables. Therefore we first

test the unit root having the assumption that if the variables in the analysis are integrated at different degrees other than I(0) or I(1), the proposed framework is not motivated. Should one of the variables be stationary at I(2) the variable has to be discarded or use other estimation models. For example; if the inflation is I(1) and interest rate I(0) series, the Fisher hypotheses are without solid ground(Rose 1988). In this research, the Augmented Dickey-Fuller (ADF) and Philip-Perron tests were used to show the stationarity of the variables.

In applying the ADF and PP model for the stationarity test. If variables are stationary at I(0) or are stationary at I(1) we can use Ordinary Least Square regression estimation (OLS) and should one of the variables be stationary on I(0) and some variables on I(1). There will be need to apply Autoregressive Distributed Lag Models (ARDL) or other regression tools for the estimation. ARDL can be also be applied when all variables are I(1) as well. If a series contains a unit root, it depicts evidence of random walk behavior.

In view of this, we applied Augmented Ducky-Fuller (ADF) test results for the variables with the lag by Schwarz Info Criterion (SIC)

From the test result, the interpretation will be based on probability values (p-Value) at 1%, 5% and 10% significance levels.

H_0=There is no Unit root

H_1=There is a Unit root

Table 4.1.1. Unit root test for stationary at level

Variables	**Level**			
	PP Intercept with trend	**ADF Intercept with trend**	**Null hypothesis**	**Status**
LNCPI	-1.098982 (0.9125)	-0.951332 (0.9361)	Do not Reject Null H_0	Non Stationary
LNAPR	-1.537420 (0.7934)	-1.553253 (0.7874)	Do not Reject Null H_0	Non stationary
LNMS	-3.123084 (0.1193)	-2.991194 (0.1510)	Do not Reject Null H_0	Non stationary
EXC	-1.053804 (0.9204)	-0.960234 (0.9349)	Do not Reject Null H_0	Non stationary
GDP	-2.698098 (0.2443)	-2.791240 (0.2111)	Do not Reject Null H_0	Non stationary

At level, the P-values are over than 1%, 5% and 10% significance level. We conclude there is no stationarity. none of the variables are stationary at I(0) We proceed to test for Unit root at first difference.

Table 4.1.2. Stationarity test at First Difference

Variables	**First Difference**				
	PP Intercept with trends	**ADF Intercept with trend**	**Null hypothesis**	**Status**	**Order**
LNCPI	-4.668953(0.0043)	-4.640149(0.0046)	Reject Null (H_0)	Stationary	I (1)
LNAPR	-5.664763(0.0004)	-5.669273 (0.0004)	Reject Null (H_0)	Stationary	I (1)
LNMS	-9.080014(0.0000)	-5.555728 (0.0005)	Reject Null (H_0)	Stationary	I (1)
EXC	-5.332357(0.0009)	-5.332357(0.0009)	Reject Null (H_0)	Stationary	I (1)
GDP	-7.542009(0.0000)	-5.363037(0.0009)	Reject Null (H_0)	Stationary	I (1)

Test at first difference indicates that the p-values in the table above are below 1%, 5% and 10% significance level. Therefore the results are statistically significant and integrated at I(1).

Confirming the unit root of our variables to be I(1), we can proceed with other estimation parameters to find if there is cointegration between two or more of the variable.
We will test for cointegration of the variables using Johansen cointegration test method in the table below.

Table 4.1.3: Cointegration Test

Hypothesized No. of CE(s)	0.05 Critical values	Probability value
None	88.80380	0.0000
At most 1	63.87610	0.0350
At most 2	42.91525	0.3688
At most 3	25.87211	0.4314
At most 4	12.51798	0.8236

In cointegration, we state our hypothesis to be $H_0=\beta_1=\beta_2=\beta_3=\beta_4 =0$ Series are not cointegrated and H_1= At least one of $\beta_1=\beta_2=\beta_3=\beta_4 \neq 0$ Series are cointegrated. Calculating the p-value at 1%, 5% and 10% levels of significance. The result showed that there are 2 co-integration vectors at 0.05 level. reject the Null hypothesis (H_0) at 5% level and summarize that at least two variables have co-integration for a long-run on inflation output in Turkey for period of 1989 -2019.
Discovering that our variables are both stationary at I (1) and at least two variables have co-integration on Inflation output. We can use Ordinary Least Square (OLS) method or Auto-regressive distributed lag model (ARDL) for the regression estimation. For the purpose of this paper, the ARDL model will be used for the regression. Selecting Schwarz criterion (SC) for the model criterion.

Table 4.1.4: Auto regressive distributed lag model. (ARDL) estimation/regression result.

Variables	β-coefficient	t-statistics	Probability value
LNAPR (-1)	-1.300708	-6.232480	0.0248
LNMS (-1)	0.307461	4.755612	0.0415
EXC	1.079807	3.156058	0.0874
GDP	-0.004032	-5.094769	0.0364
Constant (C)	0.063022	0.202098	0.8585
Error Correction Model			
CoinEq(-1)*	-0.257088	P-value= 0.0008	

The outcome of the Auto-regressive Distribution Lag (ADRL) estimation tables above shows that our estimation is not spurious.
R-square shows the degree of relation, and how close is the data to the average. The degree of relationship is estimated between 0 and 1. The regression R^2=0.999967 close to 1 means linear relationship. It means the interest rate can explain the variation in Inflation by 99%. Adjusted R-squared validated the authenticity of the regression at 99%
The coefficient of interest rate (LNAPR (-1) shows that if interest rate increases by1% inflation will decrease by -1.3% in a lag of one year. Probability value at 5% level is significant.
The other control variable coefficient; LNMS (-1) shows a 1% increase in money supply will rise inflation with 0.3% in a lag of one year. The probability value is significant at a 5% level of significance.
EXC coefficient predicts a 1% change in foreign currency rate will rise inflation at 1.07*100 units and the probability value is statistically significant at a 10% significance level.
GDP coefficient indicates that an increase in the gross domestic product by 1% will pull down the inflation at -0.004*100 units.
The overall significance of the test (F statistics) with p-value=0.000402 states that null hypothesis can be rejected at 1%, 5% and 10% level and conclude, there is an overall significance in the estimation.
Measuring the Serial correlation in the model using Durbin- Watson stat=2.035204. we conclude a no serial correlation problem in the model estimation.
Error correction model probability value =0.0008 is significant at 1%, 5% and 10% level. A negative coefficient of -0.25088 suggesting that at 25% adjustment speed, the difference between short run and long run is corrected within one year.
Concluding and understanding the short- run correlation of the variables, we further examined the long- run relationship and Bond test in the model

Table 4.1.5 Long-run bond test

Test Statistics.	Values.	Significance levels	I (0)	I (1)
Asymptotic n=1000				
F- Statistics	57.651684	10% 5% 1%	2.2 2.56 3.29	3.09 3.49 4.37

Finite Sample: n=35				
Actual Sample Size	27	10% 5% 1%	2.46 2.947 4.093	3.46 4.088 5.532
Finite Sample: n = 30				
		10% 5% 1%	2.525 3.058 4.28	3.56 4.223 5.84

The long-run cointegration and bond test have F-statistics value above the upper and lower bounds of both Asymptotic and Finite sample output.
We conclude by rejecting the null hypothesis and state that at 1%, 5% and 10% significance levels. Therefore, In Turkey, we found a long-run relationship between interest rates and annual inflation rates from year 1989 to 2019.

To enhance the reliability on the regression model we will run a residual diagnostic test for heteroscedastic test.

Table 4.1.6. Heteroscedastic test

Heteroskedasticity White Test	F- statistic 1.615584	Prob. Chi-square 0.4531

For Heteroskedasticity White Test, hypothesis is stated as Ho= 0; Heteroskedasticity problem, $H_1 \neq 0$ No Heteroskedasticity problem. With the Prob. Chi-square value in the table, which is above 1%, 5% and 10% significance level, therefore Null hypothesis rejected and say there is no HC problem.
In other to verify that stability of our models, we conduct a Ramsey stability test

Table 4.1.7

Ramsey Reset Test	F- statistic 0.163395	Probability value 0.7554

In Ramsey reset test, the hypothesis is stated as Ho= 0; misspecification error. $H_1 \neq 0$ No misspecification error. From the probability value in the table; the value is above 1%, 5% and 10 % level. Therefore, null hypothesis can be rejected and we say there is no misspecification error in the model.
Furthermore, instability test was conducted in the model. The related graph of these tests is resented below

Fig 4.2.1

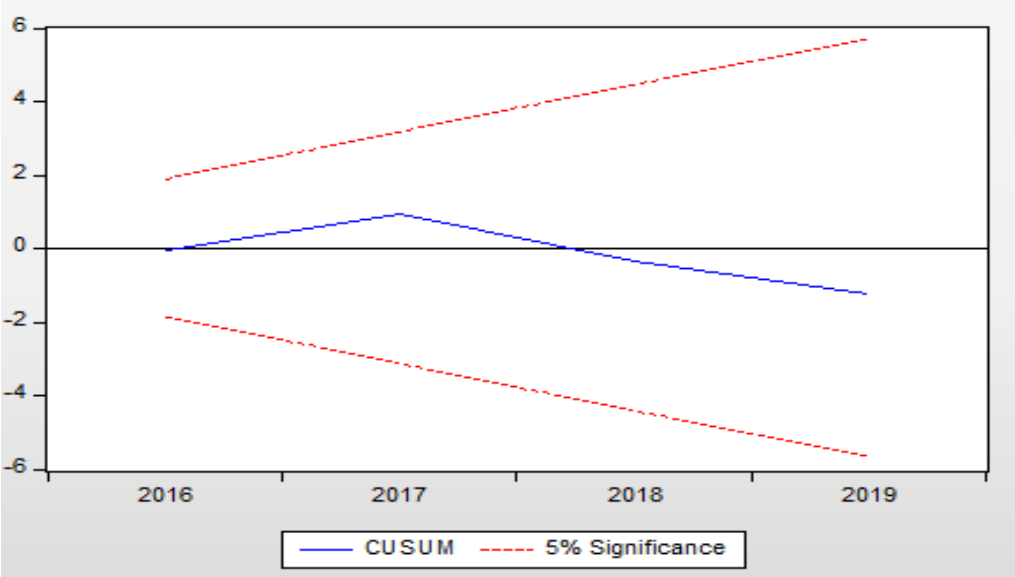
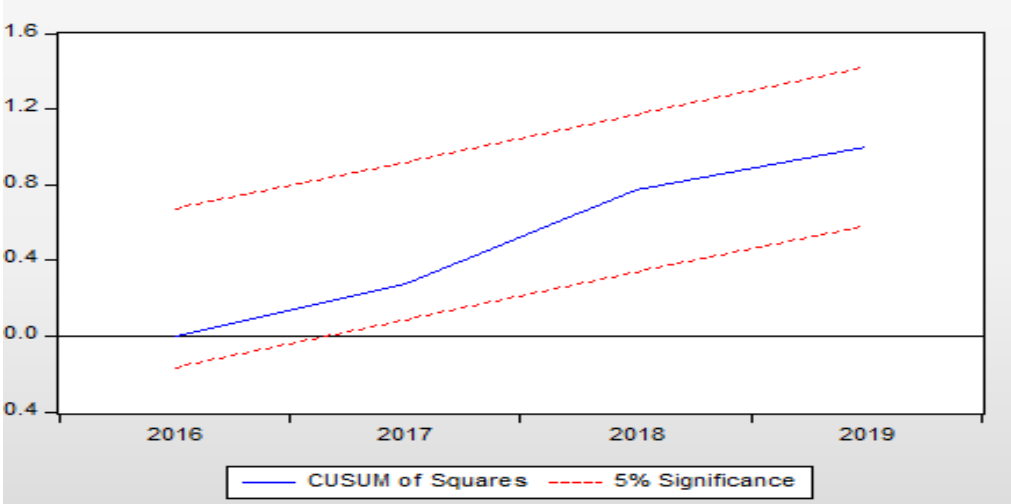


Fig 4.2.2



From the graphical representation above, it can be seen that the CUSUM & CUSUM of square are well laying within the 5% significance level, satisfying that all coefficients in the error correction model are stable. Thus, the output of the model can be adopted for policy making purposes.

5. CONCLUSION

This paper aimed to test the effect of the interest rate on inflation in the Turkish economy. The study of this effect has been an age study in economics and the Fisher hypothesis seems to be the long-tested hypothesis proven to be true in some economies. Having gone through some relevant studies, this research examined the type of effect and degree of relation between these variables, accessing world bank development indicator data from the year 1989 to 2019 using EViews software and running an Auto-regressive Distributed Lag Model (ARDL) regression estimation model and a test for cointegration by the Johansen cointegration test, on the extracted data. Taking inflation as our dependent variable, interest rate as the regressor and some control variables like Money supply, foreign exchange rate, and gross domestic product deflator in the range of years

In our data analysis, we found that all variables were stationary at I(1). Johansen cointegration result shows that our variables are cointegrated. The ARDL model indicates that our estimation is not spurious and free from serial correlation and heteroskedastic problems. The short-run result indicates a negative relationship between interest rates and inflation rates in a lag of one year. Long-run bond test proved a negative relationship in long-run. In this estimation period, our result is significant, proving the monetarist economic theory that predicts that an increase in interest rate has a negative impact on Inflation (reduces inflation) in short run and long run, then vice versa. Therefore, the research contributes to the existing literature and is different from previous literature in the number of years observed and the use of relevant control variables. The literature is recommended for review in solving economic problems in countries facing inflation challenges and recommended for Turkish economic experts. We concluded that our regression is not spurious as the R-square is high. The estimation shows that interest rate and inflation rate is cointegrated. This research can be compared to have found same result with the paper of Harenda Behera *et al*(2017) Natural Interest rate: Assessing the stance of India's monetary policy under uncertainty. The outcome indicate that interest rates has negative impact on Inflation rates. It is different from Chaido Dritsaki (2017) Toda Yamamoto Casualty Test between Inflation and Nominal interest rates: Evidence from three Countries of Europe. Whose result show that the nominal interest rate has a positive relationship with inflation.

RECOMMENDATION:

Turkey and other countries facing economic problems of inflation should consider the use of interest rates to control inflation. Central bank should review its monetary policies and consider making changes on the interest rate which is causing inflationary problem. It should be prudent to systematically raise interest rates to more positive level in order to limit the excessive growth of the money supply and prevent inflation from getting out of control.

Adjust Money supply: The central bank should seek measures to reduce the growth rate of money supply. This can be achieved through open market operation, reserve requirement and other tools at the disposal of central bank. By limiting the increasing in money supply, inflationary pressure can be mitigated.

Fiscal Policy Adjustment: In order to stimulate economic growth and improve GDP, the government should consider implementing fiscal policies which might include; reducing unnecessary government spending and promoting investment in key sectors and providing incentives for businesses to expand and create jobs.

Exchange Rate Management; The central can involve in intervening on the exchange rate when the inflation is high by implementing policies aimed at restoring confidence in the currency.

The central bank should monitor economic indicators and ensure transparency in the management. Policymakers must carefully observe economic indicators and inflationary patterns by openly communicating policy decisions and objective, they can effectively manage inflation expectations and uphold stability in the economy.

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