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RESEARCH ARTICLE

Assessment of Exchange Rate, Interest and Inflation Spiral Based on Neo-Fisher Approach: The Case of Turkey

Tacinur AKÇA[1]

Abstract

In this study, it has been determined whether the Neo-Fisher effect is valid in Turkey, and an examination has been made of the exchange rate, inflation, export, and import effects within the framework of the applied interest policies. In the study, structural break time series analysis was used to examine the consumer price index, nominal interest rates, real effective exchange rate, and export-import linkages in Turkey with monthly data in the period 2003:M1-2021:M9. Lee-Strazicich unit root test was used for multiple structural break unit root test, and the ARDL (Autoregressive Distributed Lag Bound Test) method with dummy variables was used for long and short term relationships between series. In the analysis findings, the existence of long-term and short-term cointegration between exports, imports, exchange rates, interest rates and inflation has been determined. Exports and imports are most affected by the exchange rate in both the long and short run. Inflation is affected by both the exchange rate and interest rates in the long and short run. The effect of the exchange rate on inflation is much greater than that of interest rates.

Keywords: *Foreign Trade, Exchange Rate, Neo-Fisher Effect, ARDL Method*

Jel Codes: *F10, F31, E43, C32*

Neo-Fisher Yaklaşımından Döviz Kuru, Faiz ve Enflasyon Spiralinin Değerlendirilmesi: Türkiye Örneği

Özet

Bu çalışmada Neo-Fisher etkisinin Türkiye'de geçerli olup olmadığı tespit edilmiş, uygulanan faiz politikaları çerçevesinde döviz kuru, enflasyon, ihracat ve ithalat etkisine yönelik bir inceleme yapılmıştır. Çalışmada 2003:M1-2021:M9 döneminde aylık verilerle Türkiye'de tüketici fiyat endeksi, nominal faizler, reel efektif döviz kuru ve ihracat-ithalat bağlantılarını incelemek için yapısal kırılmalı zaman serisi analizi kullanılmıştır. Çoklu yapısal kırılmalı birim kök testi için Lee-Strazicich birim kök testi, seriler arasındaki uzun ve kısa dönem ilişkiler için ise kukla değişkenli ARDL (Autoregressive Distributed Lag Bound Test) metodu kullanılmıştır. Analiz bulgularında ihracat, ithalat, döviz kuru, faiz oranları ve enflasyon arasında uzun dönemli ve kısa dönemli eş bütünleşmenin varlığı tespit edilmiştir. İhracat ve ithalat hem uzun hem de kısa dönemde en fazla döviz kurundan etkilenmektedir. Enflasyon uzun ve kısa dönemde hem döviz kurundan hem de faiz oranlarından etkilenmektedir. Döviz kurunun enflasyon üzerindeki etkisi faiz oranlarına göre çok daha fazladır.

Anahtar kelimeler: *Dış Ticaret, Döviz Kuru, Neo-Fisher Etkisi, ARDL Yöntemi*

Jel Kodu: *F10, F31, E43, C32*

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[1] Asst. Prof., Ordu University, Ünye Faculty of Economics and Administrative Sciences, Department of Economics, Ünye / Ordu, Türkiye **EMAIL:** tacinurakca@odu.edu.tr **ORCID:** 0000-0002-4071-9525

1.INTRODUCTION

The relationship between interest rates and inflation was first introduced by Irving Fisher in 1930. Fisher assumed that real interest rates are equal to the sum of nominal interest rates and expected interest rates. Interest rates are directly related to expected inflation but are independent of inflation rates. Fisher used monthly data for the 1890-1927 period for the United States and 1820-1924 monthly data for England in his study in 1930. Fisher also found that inflation expectations do not immediately affect interest rates. This situation, called the Fisher Effect, has taken place in many studies over different periods and in different countries.

After the 2008 Crisis, in a period when low inflation rates were realized in the USA, the US central bank (FED) preferred a low interest rate policy to increase inflation in its economic programs. However, there was a decrease in inflation after the low interest rate of the FED. Over time, the market perception has been that inflation expectations have increased with the FED's lowering of interest rates. With the shaping of the market perception in this way, if the interest rates fall and the inflation rates decrease, then if the interest rates are increased, the inflation expectation will also increase. The same situation has been experienced in many developed countries, such as the Euro region and Japan. This new theory, called Neo-fisher, has been the subject of debate in many ways in recent years. When it comes to Turkey, especially in 2021, when inflation was high, it was expected that the Central Bank would naturally raise interest rates, but the Central Bank of Turkey, taking this situation experienced in the USA, Japan, and similar countries as an example, preferred to follow a policy of lowering interest rates in an inflationary environment. However, the short-term effect of low interest rate policy in Turkey has been that it triggers inflation even more.

Especially with the inflationary environment created by Covid-19 all over the world, countries generally followed interest-increasing policies. The interest-raising policies in developed countries have also created a reduction in money flow to developing countries such as Turkey. The upward movement of exchange rates in Turkey, which is a serious importer of intermediate goods, has a further fuelling effect on inflation. To briefly summarize the reasons for both the CBRT and the relevant ministries in the low interest policy implementation in Turkey,

- High interest rates cause inflation. (Prices increase because higher interest rates increase costs.)

- The decrease in interest rates will stimulate investments, which will contribute to growth.

- While the fall in interest rates will cause the exchange rate to increase, it will increase export demand and stimulate exports (Export-oriented growth).

- With the increase in exports, positive results will be obtained in the current account balance.

In the study, research was conducted on whether the Fisher effect was valid in Turkey in the recent period when Neofisher policies were discussed. Studies conducted so far generally agree that the Fisher Hypothesis is valid in Turkey. The first discussion topic of the study is to reveal whether the Fisher hypothesis is valid in the last period or not with current data. The second topic of discussion is the effect of the applied interest policies on exports and imports, including inflation data. In the last period, it will be tried to shed light on interest policy discussions with foreign trade, exchange rate, and inflation data. In line with the results obtained, it has been tried to predict what kind of results it will cause or will cause in the interest policies to be applied.

Lee-Strazicich unit root test with two structural breaks was used in the analysis. The ARDL bounds test method, which also includes dummy variables, was used for short and long term regression analysis between variables. The variables used in the analysis; consumer price index, deposit interest rates, real effective exchange rate, export and import figures. The examined time periods is 2003: Q1 and 2021: Q9 monthly periods.

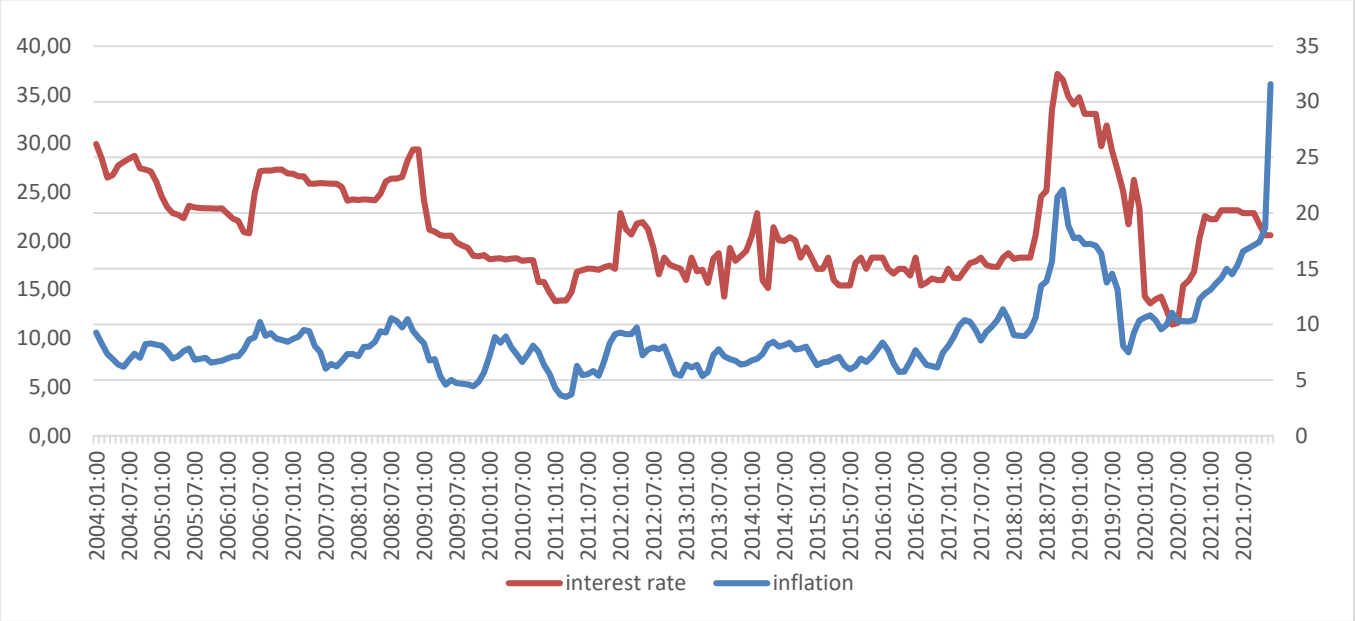
The first part of the study consists of the introduction. In the second part, the macroeconomic outlook in Turkey is mentioned. In the third chapter, related literature studies are given. In the fourth part of the study, preliminary information about the methods and data used in the analysis is given, while the fifth part includes the findings obtained in the analysis, and the sixth part includes the results of the analysis. In the last part, there is the conclusion of the study.

2. Macroeconomic Outlook in Turkey

Due to the fragile nature of Turkey's economic structure, it is greatly affected by global developments. As in most developing countries, one of Turkey's most important economic problems has been inflation. With the amendment made to the Central Bank Law, CBRT's main priority has been to ensure price stability. The CBRT switched to implicit inflation targeting between 2002 and 2005, and to an explicit inflation period in 2006. The financial crisis that took place in the USA in 2008 had serious shocking effects on both developed and developing countries. Therefore, Turkey has made certain policy changes to ensure financial stability. One of them has been financial stability as well as price stability.

Graph 1 shows that inflation and interest rates in Turkey in the post-2003 period. While there is a positive interest rate until 2021 in Turkey, there is a negative real interest rate towards the end of the year, especially since the gap between interest and inflation has gradually widened.

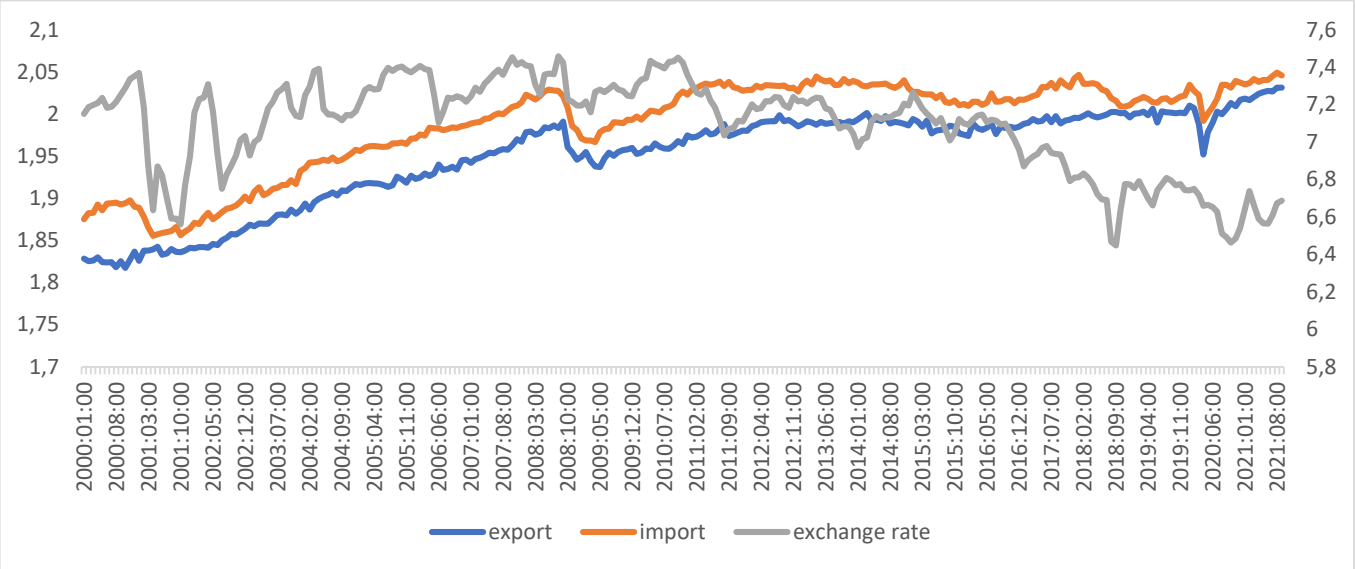
Graph 1: Inflation and Interest Rates in Turkey



Notes: The primary axis is inflation; the secondary axis is the interest rate. The data were obtained from the CBRT website and obtained by me.

Graph 2 shows the export, import, and real exchange rates between 2003 and 2021 in Turkey. In recent years, inflation rates have remained high, both due to the effects of the pandemic and the increase in energy prices. Especially, the excessive depreciation of the Turkish Lira caused domestic goods to become cheaper while the prices of imported goods increased, and the policy preference followed to increase exports with cheap TL caused many economists to criticize it. Despite the temporary recovery in exports, increases in imports caused the current account deficit to increase even more.

Graph 2: Export-Import and Exchange Rate in Turkey



Notes: The primary axes are exports and imports, and the secondary axis is the exchange rate. The logarithmic transformations of the data were used and obtained from the TurkStat website and obtained by me.

3.Literature Review

In the first stage, studies on the validity of the Fisher hypothesis in Turkey were examined. Some studies have determined the validity of the Fisher hypothesis, and some studies have found that the Neo-Fisher effect is valid in Turkey.

Table 1: Brief Summary of Literature Review about Fisher Hypothesis in Turkey

Author(s)-Year	Periods	Method	Results
Felek & Ceylan (2021)	2012-2019	SVAR- Engle-Granger Causality Test	Has a Neo-Fisher effect.
Gürsoy & Akçay (2021)	2005-2020	Hatemi-J Asymmetric Causality Test	Fisher impact is valid.
Altunöz (2020)	1995-2009	ARDL Test	Fisher impact is valid.
Sümer (2020)	2010-2019	EG-FMOLS-DOLS-CCR Analysis	Has a Neo-Fisher effect.
Bal, Erdoğan et al. (2019)	1985-2018	VAR Model	Fisher impact is valid.
Tayyar (2019)	2002-2014	Toda Yamamoto Causality Test	Has a Neo-Fisher effect.
Künü, Başar et al. (2017)	2000-2013	Panel Data Method	Fisher impact is valid.
Akıncı & Yılmaz (2016)	1980-2012	DOLS Analysis	Fisher impact is valid.

Kanca, Üzümcü et al. (2015)	1980:2013	Johansen Co Integration-Engle Granger Causality Test	Fisher impact is valid.

The literature studies dealing with the relationship between foreign trade, the exchange rate, interest, and inflation are given in Table 2.

Table 2: Brief Summary of Literature Review About Foreign Trade, Exchange Rate, Interest Rate and Inflation

Author(s)-Year	**Periods- Country**	**Method**	**Results**
Baylan, Günay et al. (2021)	1971-2019 Export-Import-Inflation (Turkey)	VAR Analysis-Johansen Cointegration Test	Exports affect inflation positively, imports affect it negatively.
Turna & Özcan (2021)	2005- 2019 CPI- Interest Rate- Exchange Rate (Turkey)	ARDL Model	Exchange rate and interest rate causes inflation in the short and long run.
Gedik (2020)	2008-2016 Export-Import-Inflation (Turkey)	Johansen Cointegration-Engle Granger Causality Test	Exports and imports are the cause of each other, while inflation is the cause of exports but not of imports.
Karakış (2019)	Exchange Rate- Inflation	Engle Granger Test	A causal relationship between nominal exchange rate- inflation in Turkey.
Özer & Kutlu (2019)	2003-2019 Exchange Rate- CPI- Export-Import- (Turkey)	VAR Model-Granger Causality Test	Foreign trade and inflation are affected by the exchange rate; the exchange rate is not affected by inflation or foreign trade. No interaction between inflation and foreign trade.
Eygü (2018)	1990-2017 Inflation-Unemployment-Export /Import (Turkey)	OLS Method	There is an inverse relationship between inflation and foreign trade and unemployment.
Şahin (2018)	2005-2018 Export-Import-Inflation (Turkey)	Gregory-Hansen Co integration Test	Not long-run relationship between foreign trade and inflation.
Uslu (2018)	1989- 2018 Inflation-Interest Rate-Exchange Rate -Import-Export (Turkey)	Maki Co integration Test- FMOLS Method	In the long run, an increase in the exchange rate increases exports and decreases imports, an increase in interest rates decreases the exchange rate. An increase in the exchange rate does not change exports in the short run but decreases imports, and an increase in interest rates decreases the exchange rate.

Bozdağlıoğlu & Yılmaz (2017)	1994–2014 Exchange Rate- Inflation (Turkey)	VAR Analysis-	Nominal exchange rate affect negatively to inflation rate.
Petek & Çelik (2017)	1990-2015 CPI- Export-Import (Turkey)	Johansen Co integration- Engle Granger Causality Test	One-way relationship from CPI and exports to imports, and one-way from exchange rates to imports and exports.
Uribe (2017)	1954-2016 (Japan-USA)	SVAR Model	Low interest rates lead to low inflation.
Chaudhary et al. (2016)	1979-2010 Exchange Rate- İmport-Export (South Asian and Southeast Asian Countries)	ARDL Method	A relationship between exchange rate and exports in the long run, no relationship between the variables in the short run.
Yee et al. (2016)	1975-2013 Inflation-Foreign Exchange Rate- Foreign Direct Investment Export-İmport (Malaysia)	OLS Method	Positive relationship between imports and exports, a positive relationship between exchange rates and exports, and a negative relationship between inflation and exports.
Dexter et al. (2005)	1967-1999 Inflation-Unemployment-Real GDP- Export-Import (USA)	OLS Method Granger Causality Test	A positive relationship between exports and imports, and a negative relationship between imports and inflation. The causality running from inflation to exports.
Mihaljek et al. (2001)	1990-2000 13 Developıng Countries	Granger Causality Test	The effect of exchange rate on inflation is greater than that of imports.

The general opinion in the studies conducted for Turkey is that the Fisher effect is valid. In the studies that include exchange rate, export and import, it is concluded that although low interest rates are reflected in the real effective exchange rate and stimulate exports temporarily, it causes inflation to increase more, especially in countries with high imported input imports. In this study, the interest policies implemented in a period of increased inflation in Turkey and the effects of high exchange rates on imports and exports, along with the inclusion of structural breaks in the analysis, are a fundamental feature that distinguishes them from other studies.

4. Data and Methodology

In the study, Lee-Strazicich unit root test with multiple structural breaks was used to determine the stationarity between the variables. The variables used in the analysis were; consumer price index, deposit interest rates, real effective exchange rate, export and import figures. The examined timeframes are the 2003: Q1 and 2021: Q9 monthly periods.

Consumer Price Index: It includes monthly consumer price index figures announced on the website of the Turkish statistical institution.

Deposit Interest Rate: Maximum interest rates actually applied to deposits by banks, monthly % value is used on TL account with a maturity of up to 3 months.

Exchange Rate: Real effective exchange rate based on D-PPI (2003=100) (Monthly)

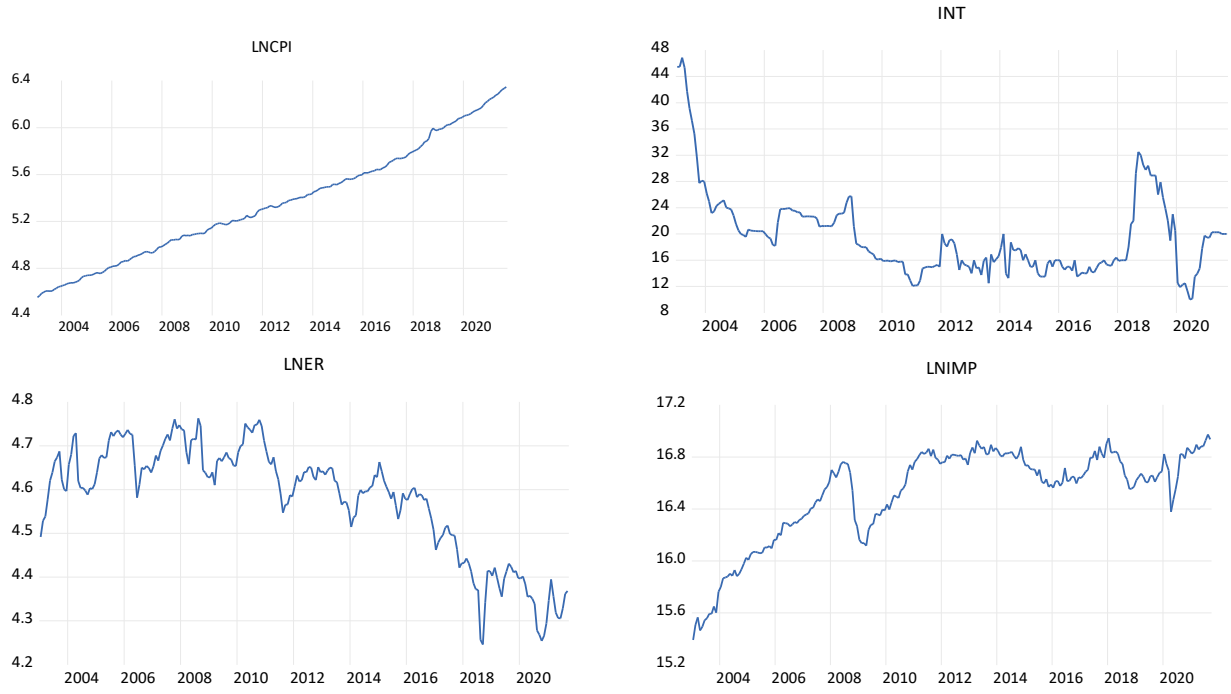
Export: Seasonally and calendar adjusted export quantity index.

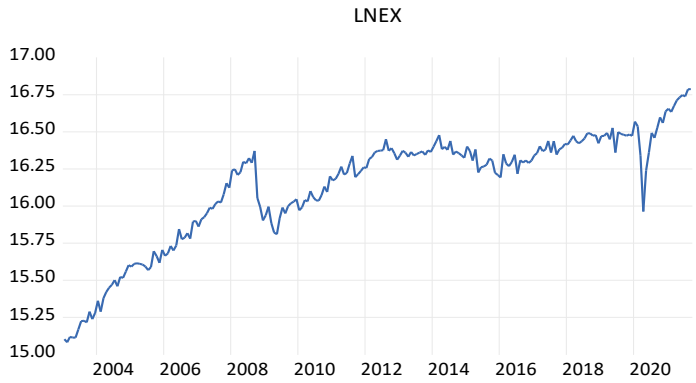
Import: Seasonally and calendar adjusted import quantity index.

Table 3: Variable Definitions

Variables	Symbol	Source
Consumer Price Index	cpi	TURKSTAT
Deposit Interest Rate	dir	CBRT
Exchange Rate	er	CBRT
Export	ex	TURKSTAT
Import	imp	TURKSTAT

Figure 1: Time-Series Graphics for Variables





Regression analysis was used to determine long- and short-term coefficients and relationships; ARDL method, in which dummy variables are included, was used. Pesaran et al. (2001), in the ARDL model they developed, allows analysis regardless of whether the variables are I (0) or I (1). In addition, the long-term cointegration relationship between the variables and the coefficients they have will be determined. The ARDL method can give effective results for both short and long periods of sample length.[2] In ARDL analysis, at the first stage, the appropriate delay length is determined, and the model with the lowest value according to the information criteria (such as AIC and SIC) is preferred as the appropriate delay length. Afterwards, "F" statistical values are determined to determine the cointegration relationship. According to the established hypotheses, if the F test statistic is higher than the critical value of 5%, H_0 is accepted and the existence of a cointegrated relationship is determined. After accepting the existence of a long-term relationship and interpreting the long-term coefficients, ARDL error correction model is estimated and the short-term coefficients are interpreted, Narayan (2004).

Established econometric models;

Model 1: $LnEX_t = \beta_0 + \beta_1 ER_t + \beta_2 INT_t + \beta_3 CPI_t$

Model 2: $LnIMP_t = \alpha_0 + \alpha_1 ER_t + \alpha_2 INT_t + \alpha_3 CPI_t$

Model 3: $CPI_t = \gamma_0 + \gamma_1 ER_t + \gamma_2 INT_t$

Model is a model in which exports are dependent and exchange rate, interest rate, and inflation are independent variables. With this model, it will try to reveal the effect of exchange rate, interest rate and inflation on exports. Model is a model in which imports are dependent and exchange rate, interest rate, and inflation are independent variables. With this model, it will try to reveal the effect of exchange rate, interest rate and inflation on exports. Model 3, on the other hand, is a model in which inflation is dependent, exchange rate and consumer price index are independent. With this model, the effect of exchange rate and interest rate on inflation will be tried to be revealed.

5. Analysis Results

Before starting the analysis, logarithmic transformations of the consumer price index, exchange rate, export and import variables were taken. In the first stage, traditional unit root tests of Augmented Dickey Fuller and Philips Perron unit root tests were conducted to see if the series were stationary. In the test results, all variables became stationary at their first difference. In the

[2] The results of the F test, in which the cointegration relationship was determined in the appendix of the study, allow the sample length to be up to 1000. (Finite sample; n=80 and Asymptotic; n=1000)

second stage, whether the series is stationary or not was examined with the Lee-Strazicich unit root test. In the unit root test results, while the interest rate and exchange rate variables were stationary at the level, the export, import, and inflation variables became stationary at the first difference.

Table 4: Traditional Unit Root Test

	ADF unit root test				Philips Perron unit root test			
	Intercept		Trend and Intercept		Intercept		Trend and Intercept	
Variable	**t-Stat.**	**Prob.**	**t-Stat.**	**Prob.**	**t-Stat.**	**Prob**	**t-Stat.**	**Prob**
lncpi	6.9023	1.000	4.9314	1.0000	2.8815	1.0000	1.3111	1.0000
int	-4.2468	0.0007	-3.7482	0.0212	-4.1984	0.0008	-3.8267	0.0169
lner	-1.2306	0.6614	3.6928	0.0248	-1.2166	0.6676	-3.7396	0.0217
lnex	-2.1952	0.2087	-3.3272	0.0645	-2.1083	0.2417	-3.0258	0.1275
lnimp	-3.0765	0.0598	-2.9422	0.1514	-3.0471	0.0322	-2.9882	0.1379
Δlncpi	-2.8699	0.0450	-4.8592	0.0005	-10.961	0.0000	-11.099	0.0000
Δlner	-11.1474	0.0000	-11.2068	0.0000	-11.740	0.0000	-11.943	0.0000
Δlnex	-18.0085	0.0000	-18.0177	0.0000	-18.550	0.0000	-18.746	0.0000
Δlnimp	-14.6819	0.0000	-14.7561	0.0000	-14.714	0.0000	-14.764	0.0000

The Lee-Strazicih two-structural breaks unit root test, which takes into account the multiple structural breaks of the unit root test series and determines the structural break dates internally, was used. There are two models in the Lee-Strazich unit root test. Model A (crash) allows variables to break only at level, while Model C (break) considers breaks at both level and slope. Therefore, Model C was preferred in practice. In the Lee-Strazicih unit root test results in Table 5, all series became stationary at their first difference.

Tablo 5: Lee-Strazicich Unit Root Test

		Critical Value			Structural Date
	Test Statistic	**%10**	**%5**	**%1**	
lncpı	-5.951287	-5.796120	-6.142440	-6.741640	2009:M02; 2016:M12
int	-5.011392	-5.584520	-5.896973	-6.504520	2006:M04; 2009:M09
lner	-5.734473	-5.405453	-5.770800	-6.585720	2007:M02; 2017:M08
lnex	-4.555091	-5.683840	-6.021120	-6.790933	2006:M09; 2015:M03
lnımp	-4.415169	-5.683840	-6.021120	-6.790933	2006:M02; 2014:M10
Δcpı	-6.753928	-5.764520	-6.108240	-6.698940	-
Δint	-6.813805	-5.578800	-5.890767	-6.497300	-
Δer	-6.603041	-5.401467	-5.766500	-6.578800	-
Δlnex	-6.642642	-5.645333	-5.977233	-6.576000	-
Δlnımp	-6.278887	-5.679600	-6.016300	-6.784667	-

Structural break dates of each dependent variable in the model were added as a dummy variable and the following equations were obtained.

Model 1: $LnEX_t = \beta_0 + \beta_1 LnER_t + \beta_2 INT_t + \beta_3 LnCPI_t + \beta_4 D_{2006} + \beta_5 D_{2015}$

Model 2: $LnIMP_t = \alpha_0 + \alpha_1 LnER_t + \alpha_2 INT_t + \alpha_3 LnCPI_t + \alpha_4 D_{2006} + \alpha_5 D_{2014}$

Model 3: $LnCPI_t = \gamma_0 + \gamma_1 LnER_t + \gamma_2 INT_t + \gamma_4 D_{2009} + \gamma_5 D_{2016}$

Table 6: The Result of Diagnostics Testing for ARDL Bound Test

	Model 1		**Model 2**		**Model 3**	
Test	**F-Statistic**	**%5 Critical Value**	**F-Statistic**	**%5 Critical Value**	**F-Statistic**	**%5 Critical Value**
ARDL Bounds	3.75	2.39-3.38	3.990061	2.39-3.38	16.56039	2.56-3.49
Breusch-Godfrey Serialcorrelation	0.727708	0.4843	0.786327	0.4569	0.323591	0.8574
Breusch-Pagan-Godfrey Heteroskedasticity	1.660371	0.0661	0.375547	0.9762	1.173803	0.3037
Jargue-Bera Normality	1.311362	0.50272	1.751014	0.50137	1.77032	0.50147
Ramsey Reset	0.651255	0.4206	0.010867	0.9171	0.127021	0.7219

Table 6 showed that the result of diagnostics testing for ARDL bound test for all three models. It has been determined that there is no autocorrelation and varying variance in all three models. According to the ARDL bound test result, there is a long-term relationship at the 5% significance

level for all three models. In the short-term test results of the variables, the cointegration coefficient was negative, and since it took values between 0 and -1, the existence of a short-term relationship was determined in all three models.[3]

In the long-term test results of the first model, exports are affected by inflation at the 5% significance level, while they are affected by the exchange rate at the 10% significance level. A 1% increase in the exchange rate increases exports by 1.5%, while a 1% increase in inflation increases exports by 0.5%. In the long-term test results of the Model 2 equation, while imports are affected by the real exchange rate and inflation at the 5% significance level, they are affected by interest rates at the 10% significance level. A 1% increase in the exchange rate increases imports by 1.9%, a 1% increase in interest rates decreases imports by 0.3%, and a 1% increase in inflation increases imports by 0.7%. In the long-term test results of Model 3, the inflation rate is affected by interest rates and exchange rates in both the short and long run. The inflation effect of interest rates is not much, but a 1% increase in the real effective exchange rate reduces inflation by 6%.

6. Conclusion

In the study, the determinants of exports and imports in Turkey, between 2003 and 2021, were examined using the ARDL method using monthly data. In addition, inflation, interest, and exchange rate analysis were performed as a separate model to test the Fisher hypothesis.

In the analysis findings, it was determined that there is cointegration between exports, imports, exchange rates, interest rates, and inflation both in the long run and in the short run. In Turkey, both exports and imports are most positively affected by the real effective exchange rate. While a 1% increase in the real effective exchange rate increases exports by 1.5%, it increases imports by 1.9%. While the export effect of inflation is positive, short-term interest rates do not have an export effect. On the other hand, on imports the effect of interest rates is reflected negatively. In the relationship between inflation, interest, and exchange rate, real effective exchange rate increases have a reducing effect on inflation, while short-term interest rates have a small effect on inflation. The results of the analysis showed that the Fisher effect is valid in Turkey both in the short run and the long run. Findings from Gursoy and Akçay (2021), Altunöz (2020), Bal, Erdogan et al. (2019), Kün, Basar et al. (2017), Akıncı and Yılmaz (2016), Kanca, Üzümcü et al. (2015) showed similarity.

While the 2008 global crisis caused changes in traditional monetary policy practices in many countries, it also brought new debates. Especially developed countries have come out of traditional practices in the inflation-interest dilemma known as the traditional Fisher Hypothesis, and Neo-Fisher policies have just taken their place in economic practices. While these new discussions on the relationship between interest and inflation continued, towards the end of 2021, Turkey also switched to a low interest-low inflation policy.

Turkey started to implement implicit inflation targeting in 2002-2005 period, and full inflation targeting for the period after 2006. Inflation remained in single digits until 2017. However, in 2017 and the following period, inflation rates entered an increasing course, and double-digit periods began. The increase in exports in the 2002-2007 period, when the real exchange rate rose and the Turkish lira appreciated in real terms, was more than the increase in exports in the 2010-2021 period. In the period up to 2013, when the exchange rate was on a downward trend, imports increased. As a result, the findings showed that the relationship between imports and real exchange rate is weak both in the long run and the short run. Especially in the last two years, Turkey has entered an inflationary cycle due to the global negative effects of the pandemic. As the

[3] ARDL Test results are in the appendix.

economic policy, low interest policy was preferred. In the analysis made for Turkey, it was concluded that interest rates create inflation both in the long run and in the short run. In the determined strategies, it is seen that export-oriented growth is adopted, not inflation targeting. However, according to analysis's findings, the long and short-term effects of interest rates on exports are very small. Considering the findings, it is thought that it would be beneficial for Turkey to follow policies that prioritize measures to reduce inflation.

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APPENDIX

ARDL Long Run Coefficients (model 1)

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.562818	0.456946	1.231696	0.2195
LNEX_(-1)*	-0.082012	0.028306	-2.897331	0.0042
LNER_**	0.125253	0.082903	1.510836	0.1324
LNINT_(-1)	-0.022405	0.018619	-1.203329	0.2302
LNCPI**	0.047729	0.035795	1.333389	0.1839
D1(-1)	0.029579	0.017687	1.672382	0.0960
D2**	0.019852	0.018248	1.087854	0.2779
Δ(LNEX_(-1))	-0.310341	0.066243	-4.684884	0.0000
Δ(LNINT_)	-0.091175	0.048697	-1.872288	0.0626
Δ(LNINT_(-1))	0.073776	0.045641	1.616423	0.1075
Δ (LNINT_(-2))	0.138273	0.044737	3.090801	0.0023
Δ (D1)	-0.433089	0.054368	-7.965880	0.0000
Δ (D1(-1))	0.064616	0.060231	1.072813	0.2846
Δ (D1(-2))	0.111314	0.057586	1.932997	0.0546
Δ (D1(-3))	0.154363	0.055287	2.792042	0.0057

* p-value incompatible with t-Bounds distribution.

** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNER_	1.527246	0.919622	1.660733	0.0983
LNINT_	-0.273195	0.238707	-1.144478	0.2538
LNCPI	0.581975	0.287079	2.027230	0.0439
D1	0.360671	0.268579	1.342885	0.1808
D2	0.242058	0.251734	0.961562	0.3374
C	6.862617	5.354613	1.281627	0.2014

EC = LNEX_ - (1.5272*LNER_ -0.2732*LNINT_ + 0.5820*LNCPI + 0.3607*D1
+ 0.2421*D2 + 6.8626)

ARDL Error Correction Regression (model 1)

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ (LNEX_(-1))	-0.310341	0.062642	-4.954184	0.0000
Δ (LNINT_)	-0.091175	0.042681	-2.136181	0.0338
Δ (LNINT_(-1))	0.073776	0.043104	1.711595	0.0885
Δ (LNINT_(-2))	0.138273	0.042834	3.228105	0.0014
Δ (D1)	-0.433089	0.052272	-8.285348	0.0000
Δ (D1(-1))	0.064616	0.057564	1.122511	0.2630
Δ (D1(-2))	0.111314	0.054489	2.042883	0.0423
Δ (D1(-3))	0.154363	0.052037	2.966411	0.0034
CointEq(-1)*	-0.082012	0.015763	-5.202802	0.0000

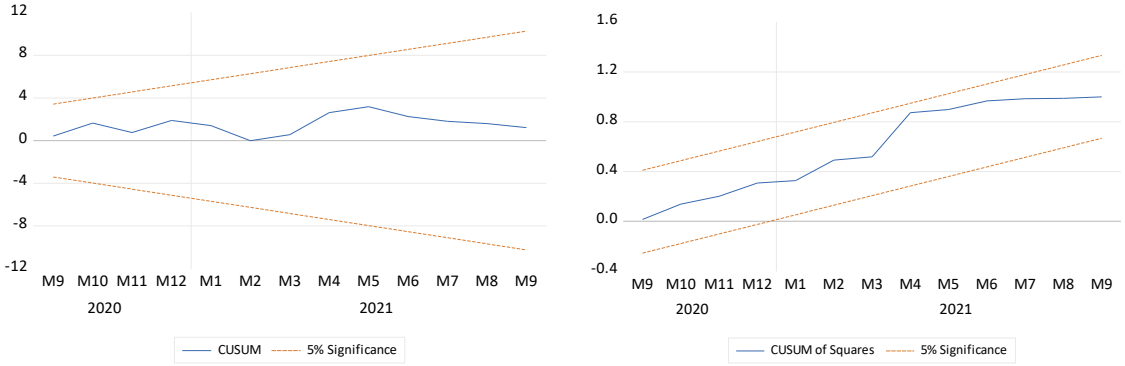
R-squared	0.417768	Mean dependent var	0.007508
Adjusted R-squared	0.395797	S.D. dependent var	0.064792
S.E. of regression	0.050363	Akaike info criterion	-3.099244
Sum squared resid	0.537726	Schwarz criterion	-2.960858
Log likelihood	351.4665	Hannan-Quinn criter.	-3.043366
Durbin-Watson stat	2.054904		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.757577	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Cusum and Cusum of Square (Model 1)



ARDL Long Run Coefficients (model 2)

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.387693	0.362022	1.070909	0.2855
LNIMP_(-1)*	-0.075276	0.016068	-4.684794	0.0000
LNER_**	0.143103	0.057709	2.479736	0.0139
LNINT_**	-0.029146	0.015814	-1.843129	0.0667
LNCPI**	0.053884	0.021976	2.451987	0.0150
D1(-1)	0.016700	0.015594	1.070902	0.2855
D2**	0.001805	0.011069	0.163053	0.8706
Δ (LNIMP_(-1))	-0.034956	0.063368	-0.551639	0.5818
Δ (LNIMP_(-2))	0.077171	0.062701	1.230785	0.2198
Δ (LNIMP_(-3))	0.265895	0.063738	4.171703	0.0000
Δ (D1)	-0.320555	0.044461	-7.209839	0.0000
Δ (D1(-1))	0.061263	0.050011	1.224994	0.2220
Δ (D1(-2))	0.099178	0.050526	1.962885	0.0510
Δ (D1(-3))	0.085938	0.050020	1.718084	0.0873

* p-value incompatible with t-Bounds distribution.

** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNER_	1.901055	0.721727	2.634035	0.0091
LNINT_	-0.387196	0.198352	-1.952062	0.0523
LNCPI	0.715824	0.238823	2.997302	0.0031
D1	0.221849	0.215164	1.031071	0.3037
D2	0.023975	0.146989	0.163110	0.8706

C	5.150311	4.581219	1.124223	0.2622

EC = LNIMP_ - (1.9011*LNER_ -0.3872*LNINT_ + 0.7158*LNCPI + 0.2218*D1
+ 0.0240*D3 + 5.1503)

ARDL Error Correction Regression (model 2)

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ (LNIMP_(-1))	-0.034956	0.061353	-0.569759	0.5695
Δ (LNIMP_(-2))	0.077171	0.059984	1.286525	0.1997
Δ (LNIMP_(-3))	0.265895	0.060583	4.388905	0.0000
Δ (D1)	-0.320555	0.042585	-7.527450	0.0000
Δ (D1(-1))	0.061263	0.046595	1.314807	0.1900
Δ (D1(-2))	0.099178	0.046603	2.128146	0.0345
Δ (D1(-3))	0.085938	0.046678	1.841066	0.0670
CointEq(-1)*	-0.075276	0.014041	-5.360970	0.0000

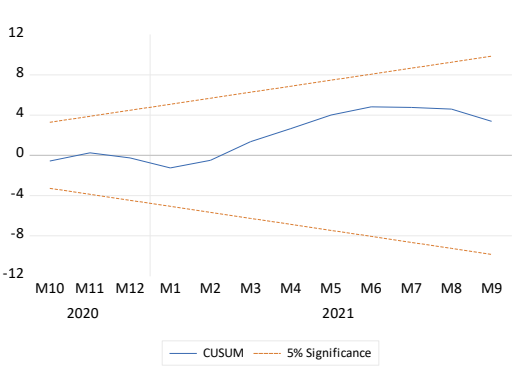
R-squared	0.351090	Mean dependent var	0.006728
Adjusted R-squared	0.329764	S.D. dependent var	0.050449
S.E. of regression	0.041301	Akaike info criterion	-3.500325
Sum squared resid	0.363332	Schwarz criterion	-3.377315
Log likelihood	394.7859	Hannan-Quinn criter.	-3.450656
Durbin-Watson stat	2.014877		

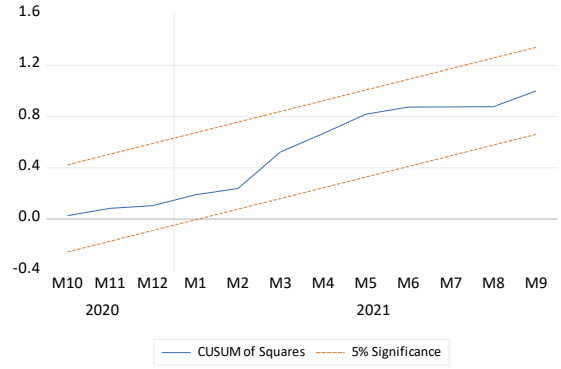
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.990061	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Cusum and Cusum of Square (Model 2)





ARDL Long Run Coefficients (model 3)

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.154694	0.066123	2.339474	0.0203
LNCPI(-1)*	-0.004288	0.002762	-1.552500	0.1221
LNER_(-1)	-0.027060	0.011428	-2.367765	0.0188
LNINT_(-1)	8.87E-05	0.002696	0.032892	0.9738
D1**	0.000486	0.002316	0.209706	0.8341
D2**	0.001160	0.002596	0.446731	0.6555
Δ (LNCPI(-1))	0.242214	0.066325	3.651946	0.0003
Δ (LNCPI(-2))	-0.281128	0.064778	-4.339840	0.0000
Δ (LNER_)	-0.069613	0.022049	-3.157213	0.0018
Δ (LNINT_)	0.007648	0.006797	1.125285	0.2618
Δ (LNINT_(-1))	0.014113	0.006362	2.218426	0.0276
Δ (LNINT_(-2))	0.004967	0.006388	0.777520	0.4377
Δ (LNINT_(-3))	0.013257	0.006427	2.062520	0.0404

* p-value incompatible with t-Bounds distribution.

** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNER_	-6.309980	3.340960	-1.888673	0.0603
LNINT_	0.020681	0.637450	0.032444	0.9741
D1	0.113242	0.546872	0.207073	0.8362
D2	0.270420	0.581924	0.464699	0.6426
C	36.07275	15.40917	2.340992	0.0202

EC = LNCPI - (-6.3100*LNER_ + 0.0207*LNINT_ + 0.1132*D1 + 0.2704*D2 + 36.0728)

ARDL Error Correction Regression (model 3)

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δ (LNCPI(-1))	0.242214	0.065408	3.703124	0.0003
Δ (LNCPI(-2))	-0.281128	0.063496	-4.427470	0.0000
Δ (LNER_)	-0.069613	0.020785	-3.349143	0.0010
Δ (LNINT_)	0.007648	0.006340	1.206454	0.2290
Δ (LNINT_(-1))	0.014113	0.006138	2.299312	0.0225
Δ (LNINT_(-2))	0.004967	0.006195	0.801766	0.4236
Δ (LNINT_(-3))	0.013257	0.006248	2.121570	0.0351
CointEq(-1)*	-0.004288	0.000425	-10.08716	0.0000

R-squared	0.276581	Mean dependent var	0.007922
Adjusted R-squared	0.252807	S.D. dependent var	0.008473
S.E. of regression	0.007324	Akaike info criterion	-6.959724
Sum squared resid	0.011426	Schwarz criterion	-6.836714
Log likelihood	777.0495	Hannan-Quinn criter.	-6.910055
Durbin-Watson stat	2.001858		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	16.56039	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Cusum and Cusum of Square (Model 3)