



Inflation, Exchange Rate and Foreign Trade: Long and Short Run Relationships In The Turkish Economy¹

Bahadır Murat ÇAKMAKLI²

Abstract

Inflation, exchange rate, imports, exports and GDP per capita are key indicators that play a key role in assessing the health and stability of a country's economy. Inflation directly affects price stability and purchasing power, while the exchange rate has a significant impact on international trade and capital flows. Imports and exports reflect an economy's trade balance and competitiveness, while GDP per capita is an important indicator of economic growth and welfare. Understanding the relationships between these variables is of great importance for the effective design of economic policies. The aim of this study is to analyse the relationships between inflation, exchange rate, imports, exports and GDP per capita in the Turkish economy between 1994 and 2023 and to reveal how these variables affect each other and their long-run equilibrium relationships. In this context, the study examines the long-run relationships between the variables using the Johansen Co-integration Test and analyses the short-run dynamics with the Vector Error Correction Model (VECM). The findings of the study show that there are long run cointegration relationships between exchange rate and imports, exports and GDP per capita. However, no significant cointegration relationship was found between inflation and exchange rate and exchange rate and exports. This can be explained by the fact that inflation is affected by structural problems and exogenous shocks, while exports are dependent on global demand conditions and imports. Short-run dynamics reveal that exchange rate fluctuations increase import costs, while there is a bidirectional causality relationship between exports and GDP per capita.

Keywords: *Imports, Exports, Inflation, Exchange Rate*

JEL Codes: *F14, F14, E31, F31*

INTRODUCTION

The Turkish economy experienced significant fluctuations in key macroeconomic indicators, including inflation, exchange rates, imports, exports, and GDP per capita, during the period 1994-2023. High and chronic inflation, exchange rate shocks, changes in the balance of trade and fluctuations in economic growth characterize this period. While the 1994 and 2001 crises, in particular, deeply shook economic stability, the stabilization programs implemented in the early 2000s achieved partial success in controlling inflation and stimulating economic growth (Boratav, 2003, p. 78; Yeldan, 2006, p. 89). However, exchange rate shocks and rising inflation after 2018 have again disrupted economic balances, leading to a slowdown in GDP per capita (CBRT, 2022, p. 23).

Inflation was one of Turkey's most important macroeconomic problems during this period. High inflation was

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² Asst. Prof. Dr. Sinop University, Gerze Vocational School, bahadirmurat@outlook.com OI: 0000-0002-7390-0056. Contribution rates to the study 100 %.

fueled by factors such as an uncontrolled increase in money supply, fiscal indiscipline and exchange rate fluctuations (Akyüz & Boratav, 2003, p. 1549). Especially during the 1994 and 2001 crises, inflation rates exceeded 70%, which seriously damaged economic stability (Boratav, 2003, p. 78).

The effect of inflation on the exchange rate can be explained within the framework of the Purchasing Power Parity (PPP) theory. According to PPP, an increase in the inflation rate in a country leads to a depreciation of the local currency (increase in the exchange rate) (Dornbusch, 1976, p. 1161). In Turkey, although this relationship was partially brought under control with the stabilization programs implemented after 2001, the exchange rate shocks experienced after 2018 showed that the effect of inflation on the exchange rate persists (CBRT, 2022, p. 23). Exchange rate fluctuations also have a direct impact on imports and exports. Depreciation of the local currency may increase exports by making them cheaper, while it may decrease imports by making them more expensive (Dornbusch, 1976, p. 1161). In Turkey, the relative stability in the exchange rate in the post-2001 period contributed to the increase in exports (Yeldan, 2006, p. 89). However, exchange rate shocks after 2018 increased import costs and negatively affected the foreign trade balance (CBRT, 2022, p. 23). While increased exports support economic growth, the rising costs of imports can lead to a current account deficit, threatening economic stability (Boratav, 2003, p. 78).

GDP per capita is a key indicator that measures a country's economic welfare level. In Turkey, controlling inflation and increasing exports in the 2000s led to an increase in GDP per capita (Yeldan, 2006, p. 89). However, economic instability, rising inflation and exchange rate shocks in the post-2018 period slowed down the growth rate of GDP per capita (CBRT, 2022, p. 23).

This study aims to evaluate the effects of these indicators on economic performance by analyzing the relationships between inflation, exchange rates, imports, exports and GDP per capita in Turkey over the period 1994-2023

The contribution of this study to the literature is that it provides both a theoretical and an empirical framework by comprehensively analyzing the relationships among these variables for Turkey. Moreover, the findings of this study provide important guidance for policymakers on controlling inflation, maintaining exchange rate stability, and implementing effective foreign trade policies. In particular, ensuring exchange rate stability and supporting export-led growth strategies will play a key role in improving Turkey's economic performance.

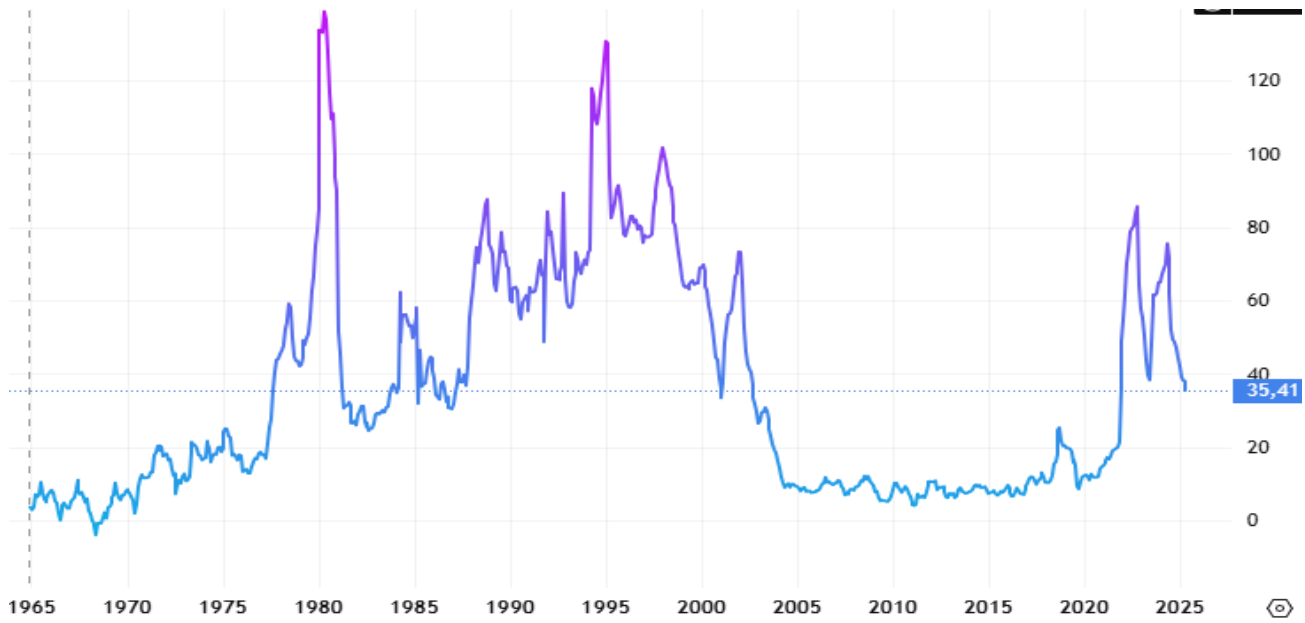
In line with the study's purpose, the second section explains inflation, exchange rates, imports and exports, and GDP per capita, while the third section examines the relationship between these variables. After reviewing the literature on the subject in the fourth section, the data set used in the analysis, analysis methods, and analysis results are evaluated in the fifth section. In the sixth and final section, the results of the analysis are evaluated, and necessary policies are presented to contribute to the literature.

INFLATION, EXCHANGE RATE, IMPORTS AND EXPORTS, GDP PER CAPITA

Inflation

Inflation is defined as a sustained rise in the general price level of an economy and is one of the major problems threatening economic stability, especially in developing countries. Turkey stands out as a country that struggled with high and chronic inflation from 1994 to 2023. The primary causes of inflation include uncontrolled growth in the money supply, a lack of fiscal discipline, and exchange rate fluctuations (Akyüz & Boratav, 2003, p. 1549). Especially during the 1994 and 2001 crises, inflation rates exceeded 70%, which seriously shook economic stability (Boratav, 2003, p. 78). (Graph 1)

Graph 1: Türkiye's Inflation Rates Between 1965 and 2025



Source: <https://tr.tradingview.com/chart/MzDnadiV/?symbol=ECONOMICS%3ATRIRYY>

The effect of inflation on the exchange rate can be explained by the Purchasing Power Parity (PPP) theory. According to PPP, an increase in the inflation rate in a country leads to a depreciation of the local currency (an increase in the exchange rate) (Dornbusch, 1976, p. 1161). In Turkey, although this relationship was partially brought under control with the stabilization programs implemented after 2001, the exchange rate shocks experienced after 2018 revealed that the effect of inflation on the exchange rate persists (CBRT, 2022, p. 23). Moreover, Özatay and Sak (2003, p. 45) argue that the relationship between inflation and the exchange rate in Turkey varies depending on the presence of structural breaks.

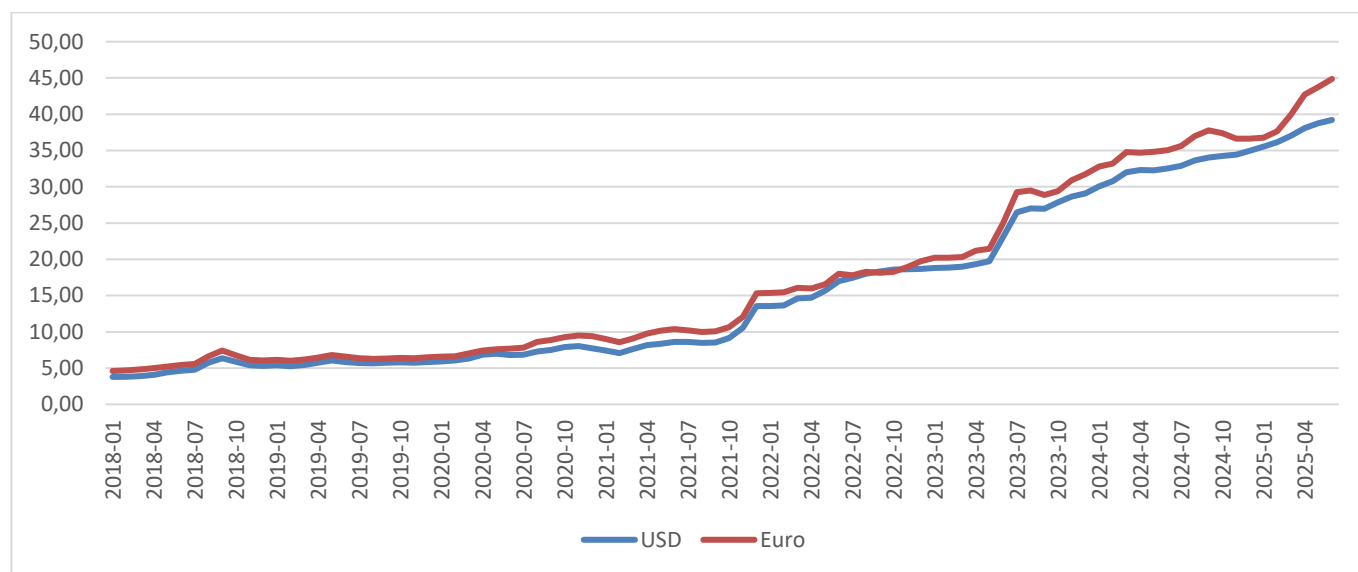
The impact of inflation on economic growth is a controversial issue. While some studies suggest that low and stable inflation supports economic growth (Fischer, 1993, p. 485), it is emphasized that high inflation negatively affects growth by making investment decisions uncertain (Bruno & Easterly, 1998, p. 12). In Turkey, the

reduction of inflation to single digits in the 2000s had a positive impact on economic growth (Yeldan, 2006, p. 89). However, the increase in inflation after 2018 led to a slowdown in economic growth (CBRT, 2022, p. 23).

Exchange Rate

The exchange rate refers to the Value of a country's currency against foreign currencies and plays an important role in economic stability. Exchange rate fluctuations are influenced by macroeconomic factors, particularly inflation, interest rates and the balance of trade (Dornbusch, 1976, p. 1161). In Turkey, the exchange rate increased significantly during the 1994 and 2001 crises, which undermined economic stability (Boratav, 2003, p. 78). Moreover, the relationship between exchange rate and inflation can be explained within the framework of the Purchasing Power Parity (PPP) theory. According to PPP, an increase in the inflation rate in a country leads to a depreciation of the local currency (increase in the exchange rate) (Dornbusch, 1976, p. 1161). Although the stabilization programs implemented in Turkey after 2001 partially mitigated the relationship between the exchange rate and inflation, the exchange rate shocks experienced after 2018 demonstrated that this effect persisted (CBRT, 2022, p. 23). (Graph 2)

Graph 2: Changes in the Exchange Rates of the US Dollar and the Euro in Türkiye Between 2018 and 2025



Source: https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket/collapse_2/5868/DataGroup/turkish/bie_rktufey/#collapse_2

Özatay and Sak (2003) argue that the relationship between the exchange rate and inflation in Turkey varies depending on the presence of structural breaks. This reveals how sensitive the exchange rate is to economic shocks.

Import and Export

Imports and exports are the leading indicators of a country's foreign trade balance and have a significant impact

on economic growth. Turkey experienced significant changes in its import and export balance from 1994 to 2023. Export-led growth strategies play a crucial role in enhancing economic welfare, particularly in developing countries (Helpman & Krugman, 1985, p. 67).

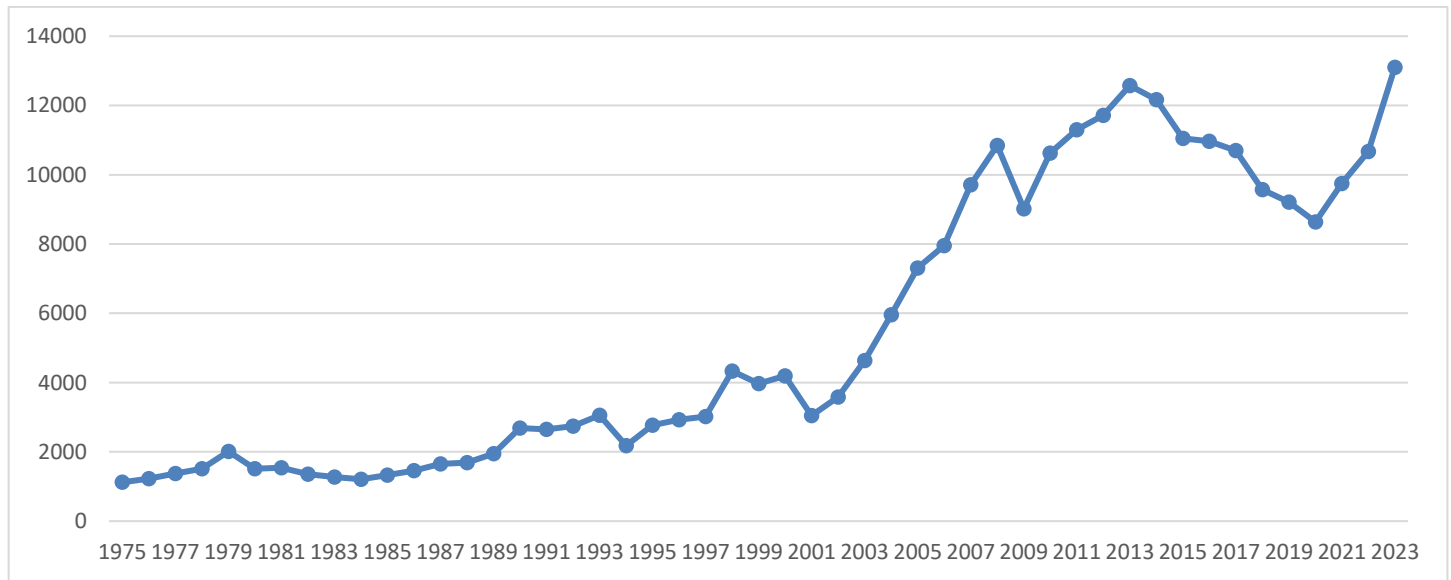
Exports support economic growth by increasing a country's production capacity. The export-oriented policies implemented in Turkey in the 2000s have achieved significant success in increasing GDP per capita (Yeldan, 2006, p. 89). However, the structure of exports is also important. Exports of high-value-added products support economic growth more (Rodrik, 2008, p. 23).

Imports, on the other hand, play a crucial role in supplying the investment goods and intermediate goods necessary to enhance a country's production capacity. However, imports of consumption goods may lead to a current account deficit (Akyüz & Boratav, 2003, p. 45). During the 1994 and 2001 crises in Turkey, sudden increases in exchange rates led to higher import costs and reduced imports (Boratav, 2003, p. 80). However, the failure to stabilise the exchange rate in the long run led to fluctuations in the balance of trade (Öniş & Rubin, 2003, p. 112).

GDP Per Capita

GDP per capita is one of the most important indicators of a country's economic welfare. Turkey experienced significant fluctuations in GDP per capita between 1994 and 2023. (Graph 3)

Graph 3: Change in GDP per capita in Türkiye Between 1975 and 2023



Source: <https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.PCAP.CD&country=>

Factors such as economic growth, inflation, exchange rate and trade balance have a direct impact on GDP per capita (Rodrik, 2008, p. 23).

Export-led growth strategies play an important role in increasing GDP per capita. The export-oriented policies implemented in Turkey in the 2000s have achieved significant success in increasing GDP per capita (Yeldan, 2006, p. 89). However, the structure of imports is also a determinant of GDP per capita. Especially imports of

investment goods and intermediate goods support economic growth by increasing production capacity, while imports of consumption goods may cause current account deficit (Akyüz & Boratav, 2003, p. 45).

INFLATION, EXCHANGE RATE, IMPORT-EXPORT AND GDP PER CAPITA RELATIONSHIP

This study examines the relationship between inflation, exchange rates, imports and exports, and GDP per capita in the Turkish economy for the period 1994-2023. These relationships are analyzed in the light of macroeconomic theories and empirical studies. A framework of the theoretical foundations of these relationships and their place in the literature is presented below.

Inflation and Exchange Rate Relationship

The relationship between inflation and exchange rate can be explained by Parity Theories and Purchasing Power Parity (PPP). According to PPP, the inflation rate in a country causes a depreciation of the local currency (increase in the exchange rate) (Dornbusch, 1976, p. 116). In high-inflation countries like Turkey, the effect of inflation on the exchange rate is more pronounced. Mainly during the 1994 and 2001 crises, it was observed that inflation rapidly increased the exchange rate (CBRT, 2001, p. 45).

Exchange Rate and Import-Export Relationship

The exchange rate has a direct impact on imports and exports. According to the Marshall-Lerner Condition, an increase in the exchange rate (depreciation of the local currency) increases exports and decreases imports (Marshall, 1923, p. 345). However, this effect may occur with a lag in the short run due to the J-curve effect (Magee, 1973, p. 304). In Turkey, during the 1994 and 2001 crises, exchange rate spikes increased import costs and temporarily supported exports (Boratav, 2003, p. 78).

Import-Export and GDP Per Capita Relationship

Imports and exports have significant effects on a country's economic growth and GDP per capita. According to the Foreign Trade and Growth Theory, an increase in exports supports economic growth, while an increase in imports may hurt domestic production (Helpman & Krugman, 1985, p. 67). In Turkey, export-led growth strategies played a significant role in increasing GDP per capita during the 2000s (Öniş & Rubin, 2003, p. 112). However, the structure of imports (predominance of investment goods over consumption goods) also has an impact on growth (Yeldan, 2006, p. 89).

Dynamics Specific to Turkey

The economic crises, structural reforms and foreign trade policies in Turkey during the 1994-2023 period have been decisive in shaping these relations. Especially the stability programs implemented after the 2001 crisis were

effective in controlling inflation and ensuring exchange rate stability (Akyüz & Boratav, 2003, p. 45). However, exchange rate shocks and rising inflation after 2018 increased import costs and slowed economic growth (CBRT, 2022, p. 23).

LITERATURE REVIEW

Table 1: Literature Review

Study	Method	Conclusion
Aktas (2009)	Johansen Co-integration Test and VECM Analysis	In the short run, a bidirectional relationship was found between imports and exports, imports and GDP and exports and GDP.
Aliyu et al. (2009)	VAR Analysis	Exchange rate shocks have a higher impact on import prices than on inflation.
Ca'Zorzi vd. (2007)	VAR Analysis	He found that the exchange rate effect affects import prices more than inflation.
Dornbusch (1976)	Theoretical analysis (Purchasing Power Parity)	Inflation leads to a depreciation of the domestic currency (an increase in the exchange rate). This is particularly pronounced in developing countries (p. 1161).
Edwards (1989)	Panel data analysis (Developing countries)	High inflation pushes up the exchange rate, raising import costs and further fueling inflation (p. 567).
Magee (1973)	Theoretical analysis (J-curve effect)	An increase in the exchange rate increases imports in the short run and exports in the long run. This effect is explained by the Marshall-Lerner Condition (p. 304).
Helpman & Krugman (1985)	Theoretical modeling (Foreign trade and growth)	Export-led growth strategies play a key role in boosting economic welfare, especially in developing countries (p. 67).
Bruno & Easterly (1998)	Panel data analysis (Inflation and growth)	High inflation negatively affects economic growth. Low and stable inflation, on the other hand, supports growth (p. 12).
Eichengreen & Leblang (2003)	Panel data analysis (Exchange rate and foreign trade)	Exchange rate fluctuations adversely affect the balance of trade, especially in developing countries (p. 89).
Rodrik (2008)	Panel data analysis (Real exchange rate and growth)	The impact of exports on economic growth varies depending on the level of industrialization of countries. High value-added exports support growth more (p. 23).
Rittenberg (1993)	Granger Causality Analysis	He found that there is a unidirectional causality (from inflation to exchange rate) between exchange rate and inflation.
Tuncer (2002)	Granger Causality Analysis	He found a bidirectional relationship between GDP and imports, and a unidirectional relationship from GDP to exports and from exports to imports.
Ozatay & Sak (2003)	Time series analysis (inflation and exchange rate in Turkey)	The relationship between inflation and the exchange rate in Turkey varies depending on structural breaks. High inflation increases the exchange rate (p. 45).
Akyüz & Boratav (2003)	Case studies (Turkey's 1994 and 2001 crises)	Exchange rate spikes increased import costs and temporarily supported exports. However, exchange rate stability could not be achieved in the long run (p. 45).
Yeldan (2006)	Time series analysis (neoliberal policies in Turkey)	Export-led growth strategies have had considerable success in raising GDP per capita. However, the structure of imports is also a determinant of economic growth (p. 89).
CBRT (2022)	Time series analysis (inflation and exchange rate in Turkey)	The post-2018 inflation surge and exchange rate shocks increased import costs and slowed economic growth (p. 23).

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METHODOLOGY, DATA SET AND ANALYSIS

Methodology

In this study, the long-term and short-term relationships between inflation (INF), exchange rate (REXCR), imports (DIMPORT), exports (DEXPORT), and real GDP per capita (DGDP) variables were examined using annual data from the Turkish economy for the period 1994-2023. The analysis process was conducted in three stages:

First, the stationarity levels of the series were analyzed using the Augmented Dickey-Fuller (ADF) test. According to the test results, the GDP, imports, exports, exchange rate, and DVZUFE series are not stationary at the level but become stationary when their first differences are taken. In contrast, the inflation (INF) series was found to be stationary at the level. The fact that most of the series are $I(1)$ provides suitability for multivariate cointegration analysis (Enders, 2015, p. 363).

In the second stage, long-term relationships between variables were examined using the Johansen cointegration test (Johansen, 1988; Johansen, 1991). The Johansen test determines the number of cointegration vectors and reveals long-term equilibrium relationships between economic variables.

After identifying long-term relationships, short-term dynamics were analyzed using the Vector Error Correction Model (VECM). VECM models both short-term deviations and long-term equilibrium processes between variables with cointegration relationships (Lütkepohl, 2005, p. 248). Additionally, the directional relationships between the variables were examined using the Granger causality test. This test examines the predictive power of past values of one variable on another (Granger, 1969; Gujarati & Porter, 2009, p. 652).

The hypotheses used in the analysis are as follows:

H1: There is a long-term cointegration relationship between inflation and the exchange rate.

H2: There is a long-term cointegration relationship between the exchange rate and exports.

H3: There is a long-term cointegration relationship between the exchange rate and imports.

H4: There is a long-term cointegration relationship between imports and per capita GDP.

H5: There is a long-term cointegration relationship between exports and per capita GDP.

H6: Exports are a Granger cause of per capita GDP.

H7: Per capita GDP is a Granger cause of exports.

H8: Per capita GDP is a Granger cause of imports.

H9: Imports are Granger causes of per capita GDP.

H10: The exchange rate significantly affects imports in the short term.

H11: Past values of imports affect the exchange rate in the short term.

All analyses were conducted using EViews software. This methodological approach ensures reliable results by employing methods appropriate for the time series characteristics of the data.

Data Set

Table 2: Data Set

Variables	Source
Inflation (INF)	World Bank
GDP per capita (GDP per capita)	World Bank
Export (EXPORT)	TUIK
Imports (IMPORT)	TUIK
Exchange Rate (Real Exchange Rate) (REXCR)	CBRT

Source: Created by Author.

Unit Root Test

The Dickey-Fuller test is a statistical method used to test whether a time series contains a unit root. A unit root indicates that the series is non-stationary. Non-stationary series do not have a constant mean and variance over time, which can lead to misleading results in conventional regression analysis (Dickey & Fuller, 1979, p. 427). The Dickey-Fuller test uses the following regression model to test the stationarity of the series:

$$\Delta y_t = \alpha + B_t + \gamma y_{t-1} + \sum_{i=1}^{i_p} \phi_i \Delta y_{t-i} + \varepsilon_t$$

y_t : Time Series

Δy_t : First difference of the series

α : Constant Term

β_t : Trend Component

γ : Unit Root Coefficient

$\varepsilon(t)$: Error Term

The null hypothesis of the test $\gamma:0$ (existence of a unit root). If the test statistic is smaller than the critical values, the unit root hypothesis is rejected and the series is considered stationary (Dickey & Fuller, 1981, p. 1057).

Granger Causality Test:

Granger Causality Test is a statistical method used to examine the causality relationship between two time series.

Developed by Clive Granger, this test assesses whether past values of one variable make a statistically significant contribution to predicting future values of another variable (Granger, 1969, p. 424). The test is based on the following regression model:

$$y_t = \alpha_0 + \sum_{i=1}^p \alpha_i y_{t-i} + \sum_{j=1}^q \beta_j x_{t-j} + \varepsilon_t$$

where;

Y_t : Dependent Variable

$x(t)$: Explanatory Variable

α_i and β_j : Coefficients

$\varepsilon(t)$: Error Term

The main hypothesis of the test is $\beta_j = 0$. If this hypothesis is rejected, it is concluded that $x(t)$ is the Granger cause of Y_t (Granger, 1980, p. 330).

Johansen Cointegration Test

Johansen co-integration test is a statistical method used to examine the long-run relationship between time series. This test is especially used to determine whether there is a cointegration relationship between more than one variable. Unlike the Engle-Granger (1987) two-stage method, the Johansen test allows us to test for the existence of more than one cointegration vector (Johansen, 1988, p. 231).

The Johansen test is based on a vector autoregressive (VAR) model. The test yields results based on two main statistics: Trace statistic and Maximum eigenvalue statistic. These statistics are used to determine the number of cointegration vectors. The null hypothesis of the test is that the number of cointegration vectors is zero. The alternative hypothesis asserts the existence of at least one cointegration vector (Johansen, 1991, p. 1553).

For example, when the Johansen test is applied to a bivariate system, if the test statistics exceed the critical values, it is concluded that there is a long-run relationship between the variables. This indicates that the variables are cointegrated.

VECM (Vector Error Correction Model)

The Vector Error Correction Model (VECM) is a model used to analyze the short-run dynamics and the long-run equilibrium relationship between cointegrated variables. The VECM is a customized version of the VAR model for cointegrated systems. Co-integrated variables move in an equilibrium relationship in the long run, while deviations (error terms) from this equilibrium can be observed in the short run. VECM focuses on modeling how

these deviations are corrected over time (Engle & Granger, 1987, p. 256).

The basic equation of the VECM is as follows:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{P-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t$$

Δy_t : represents the first difference of the variables.

Π : is the matrix showing the long-run equilibrium relationship and includes cointegration vectors.

Γ_i : coefficient matrices capturing short-run dynamics.

ε_t : Error Term

VECM is frequently used especially in economic and financial data. For example, when analyzing the relationship between interest rates and inflation rates, both short-run fluctuations and long-run equilibrium can be analyzed using VECM (Lütkepohl, 2005, p. 78).

Analysis

Unit Root Test Results

Table 3: Unit Root Test Results

Variable	Test Type	t-Statistic	p-Value	Stationarity (1%, 5%, 10%)
GDP	ADF (Level)	2.598774	0.9966	Not Stable
D(GDP)	ADF (1st Difference)	-4.618590	0.0056	Stationary (1%, 5%, 10%)
IMPORT	ADF (Level)	1.605874	0.9705	Not Stable
D(IMPORT)	ADF (1st Difference)	-4.341429	0.0001	Stationary (1%, 5%, 10%)
EXPORT	ADF (Level)	2.386222	0.9946	Not Stable
D(EXPORT)	ADF (1st Difference)	-4.276083	0.0001	Stationary (1%, 5%, 10%)
INF	ADF (Level)	-2.181024	0.0303	Stationary (5%, 10%)
REXCR	ADF (Level)	-0.579410	0.4572	Not Stable
D(REXCR)	ADF (1st Difference)	-7.464791	0.0000	Stationary (1%, 5%, 10%)

Note: Variables are stable at a 5% significance level.

Source: Created by Author.

In this analysis, unit root tests are used to determine the stationarity of the variables. According to stationarity tests, if the p-value of a series is > 0.10 in level tests, the series is considered non-stationary, while if the p-value is < 0.10 in first difference tests, the series is considered stationary. When significance levels are analyzed, critical values at 1% level are 2.65, critical values at 5% level are 1.95 and critical values at 10% level are 1.61.

According to the test results, GDP, IMPORT, EXPORT, DVZUFE and REXCR series are non-stationary at their levels. However, these series become stationary when their first differences are taken. On the other hand, INF (inflation) series is stationary at level and this stationarity is valid at both 5% and 10% significance levels. These findings suggest that the series have different stationarity properties, and this should be taken into account in the

analysis.

Granger Causality Results

Table 4: Granger Causality Results

Dependent Variable	Excluded Variable	Chi-square (χ^2)	df	p-Value	Causality (at 5% level)
INF	DREXCR	3.183820	2	0.2035	No
INF	All	3.183820	2	0.2035	No
DREXCR	INF	4.000236	2	0.1353	No
DREXCR	All	4.000236	2	0.1353	No
DREXCR	DEXPORT	0.199202	2	0.9052	No
DREXCR	DIMPORT	1.632879	2	0.4420	No
DREXCR	All	3.093426	4	0.5423	No
DEXPORT	DREXCR	2.444738	2	0.2945	No
DEXPORT	DIMPORT	5.966462	2	0.0506	Available (borderline)
DEXPORT	All	-	-	-	-
DIMPORT	DREXCR	2.705985	2	0.2585	No
DIMPORT	DEXPORT	1.147135	2	0.5635	No
DIMPORT	All	-	-	-	-
DEXPORT	DGDP	8.560508	2	0.0138	Available
DEXPORT	All	8.560508	2	0.0138	Available
DGDP	DEXPORT	6.678572	2	0.0355	Available
DGDP	All	6.678572	2	0.0355	Available
DIMPORT	DGDP	5.131527	2	0.0769	None (borderline)
DIMPORT	All	5.131527	2	0.0769	None (borderline)
DGDP	DIMPORT	13.51323	2	0.0012	Available
DGDP	All	13.51323	2	0.0012	Available

Source: Created by Author.

This analysis reveals the causal relationships between variables in the Turkish economy. There is no Granger causality relationship between inflation (INF) and exchange rate (DREXCR) ($p > 0.05$), which indicates that the relationship between inflation and exchange rate is weak. Similarly, there is no significant causality relationship between exchange rate (DREXCR) and exports (DEXPORT) and imports (DIMPORT) ($p > 0.05$), indicating that changes in exchange rate do not significantly affect exports and imports in the short run.

There is a borderline Granger causality relationship between imports (DIMPORT) and exports (DEXPORT) ($p = 0.0506$), suggesting that changes in imports can affect exports. There is a bidirectional causality relationship between exports (DEXPORT) and GDP per capita (DGDP). GDP per capita was found to be the Granger cause of exports ($p = 0.0138$), suggesting that economic growth favors exports. Likewise, exports are also found to be the Granger cause of GDP per capita ($p = 0.0355$), suggesting that increases in exports positively affect economic growth.

When the relationship between GDP per capita (DGDP) and imports (DIMPORT) is analyzed, it is seen that GDP per capita is the Granger cause of imports ($p = 0.0012$), indicating that economic growth increases imports. There

is a borderline Granger causality relationship between imports and GDP per capita ($p = 0.0769$), indicating that changes in imports may affect economic growth.

In conclusion, this analysis highlights the interdependence between economic growth and foreign trade by revealing the bidirectional causality relationship between GDP per capita, exports and imports in the Turkish economy. On the other hand, the absence of causality between inflation and exchange rate suggests that these variables have more complex dynamics.... These findings provide important insights for policymakers in the design of economic growth and foreign trade policies.

Johansen Cointegration Test Results

Table 5: Johansen Cointegration Test Results

Variables	Cointegration Relationship	Degree of Cointegration	Trace Test (p-value)	Max-Eigen Test (p-value)	Normalized Cointegration Coefficients
INF & DREXCR	No	0	0.0864	0.4156	INF = 1.000000, DREXCR = 29.62514
DREXCR & DEXPORT	No	0	0.0618	0.2196	DREXCR = 1.000000, DEXPORT = 8.76E-09
DREXCR & DIMPORT	There is	2	0.0454	0.1735	DREXCR = 1.000000, DIMPORT = -7.98E-10
DEXPORT & DGDP	There is	2	0.0004	0.0077	DEXPORT = 1.000000, DGDP = -3.461769
DIMPORT & DGDP	There is	2	0.0020	0.0082	DIMPORT = 1.000000, DGDP = -5.547905

Source: Created by Author.

This analysis examines the long and short run relationships between variables in the Turkish economy. There is no cointegration relationship between inflation (INF) and exchange rate (DREXCR) (Trace and Max-Eigen tests $p > 0.05$), indicating that there is no long-run equilibrium relationship between these two variables. Regarding the short-run dynamics, the adjustment coefficients for inflation and exchange rate are -0.036926 and -0.021288, respectively, indicating that both variables are in the process of returning to equilibrium, but this process is slow.

There is also no cointegration relationship between exchange rate (DREXCR) and exports (DEXPORT) (Trace and Max-Eigen tests $p > 0.05$), which means that there is no long-run equilibrium relationship. In the short-run dynamics, the adjustment coefficients for exchange rate and exports are 0.018965 and -1.72E+08, respectively. These results indicate that changes in the exchange rate have a limited effect on exports in the short run.

There is a cointegration relationship between exchange rate (DREXCR) and imports (DIMPORT) (Trace test p

= 0.0454, Max-Eigen test $p = 0.1735$). This implies that there is a long-run equilibrium relationship between these two variables. The long-run relationship is expressed as $DREXCR = 1.000000$ and $DIMPORT = -7.98E-10$. In the short-run dynamics, the adjustment coefficients for exchange rate and imports are found to be -0.359583 and $1.13E+09$, respectively. These results suggest that exchange rate changes have a significant impact on imports in both the long and short run.

There is also a cointegration relationship between exports (DEXPORT) and GDP per capita (DGDP) (Trace test $p = 0.0004$, Max-Eigen test $p = 0.0077$). This implies that there is a long-run equilibrium relationship between these two variables. The long-run relationship is expressed as $DEXPORT = 1.000000$ and $DKBGSDPIH = -3.461769$. In the short-run dynamics, the adjustment coefficients for exports and GDP per capita are 0.615039 and 0.862278, respectively. These results indicate that there is a strong relationship between exports and economic growth in both the long and short run.

There is also a cointegration relationship between imports (DIMPORT) and GDP per capita (DGDP) (Trace test $p = 0.0020$, Max-Eigen test $p = 0.0082$). This implies that there is a long-run equilibrium relationship between these two variables. The long-run relationship is expressed as $DIMPORT = 1.000000$ and $DKBGDP = -5.547905$. In the short-run dynamics, the adjustment coefficients for imports and GDP per capita are 0.575155 and 0.523424, respectively. These results indicate that there is a strong relationship between imports and economic growth in both the long and short run.

A cointegration relationship indicates the existence of a long-run equilibrium relationship between variables. Adjustment coefficients express the speed of return to equilibrium in the short run. While negative values support a return to equilibrium, normalized coefficients indicate the direction and magnitude of the long-run relationship. This analysis provides important insights for understanding the dynamic relationships between exchange rates, imports, exports and GDP per capita in the Turkish economy.

VECM Analysis Results

Table 6: VECM Analysis Results

Variables	Cointegration Relationship	Error Correction Term (ECT)	Short Run Dynamics	R ²	Description
DREXCR & DIMPORT	There is	-0.359583 (DREXCR)	D(DREXCR(-1)): -0.851740	0.694194	DREXCR stabilizes faster than DIMPORT. Strong relationship in the short run.
		1.13E+09 (DIMPORT)	D(DIMPORT(-1)): 0.236281	0.544304	The rate of equilibration of DIMPORTE is slower.
DIMPORT & DGDP	There is	0.575155 (DIMPORT)	D(DIMPORT(-1)): -1.040021	0.598743	DIMPORT stabilizes faster than DKBGDP. Strong relationship in the short run.
		0.523424 (DGDP)	D(DGDP(-1)): 1.249289	0.748580	The rate of rebalancing of NGDP is slower.
DEXPORT & DGDP	There is	0.615039 (DEXPORT)	D(DEXPORT(-1)): -1.023073	0.617339	DEXPORT stabilizes faster than DKBGDP. Strong relationship in the short run.
		0.862278 (DGDP)	D(DGDP(-1)): 1.373984	0.709049	The rate of rebalancing of NGDP is slower.

Source: Created by Author.

This analysis reveals the long and short run relationships between exchange rate (DREXCR), imports (DIMPORT), exports (DEXPORT) and GDP per capita (DKBGSDP) in the Turkish economy. There is a cointegration relationship between the exchange rate and imports, indicating that there is a long-run equilibrium relationship between these two variables. The error correction term (ECT) coefficients are -0.359583 (significant, $t = -1.75500$) for exchange rate and 1.13E+09 (significant, $t = 2.05040$) for imports. In the short-run dynamics, past values of the exchange rate strongly affect the current change ($D(DREXCR(-1))$: -0.851740, $t = -4.05943$), while past values of imports affect the current change more weakly ($D(DIMPORT(-1))$: 0.236281, $t = 0.65451$). These results suggest that the exchange rate stabilizes faster than imports and that the exchange rate has a stronger effect on imports in the short run.

There is also a cointegration relationship between imports and GDP per capita. The error correction term

coefficients are 0.575155 (significant, $t = 1.53032$) for imports and 0.523424 (significant, $t = 4.62974$) for GDP per capita. In the short-run dynamics, past values of imports strongly affect the current change ($D(DIMPORT(-1))$: -1.040021, $t = -2.71155$), while past values of GDP per capita also significantly affect the current change ($D(DGDP(-1))$: 1.249289, $t = 2.74121$). These results suggest that imports rebalance faster than GDP per capita and that both variables strongly affect each other in the short run.

There is also a co-integration relationship between exports and GDP per capita. The error correction term coefficients are 0.615039 (significant, $t = 2.06594$) for exports and 0.862278 (significant, $t = 4.65604$) for GDP per capita. In the short-run dynamics, past values of exports strongly affect the current change ($D(DEXPORT(-1))$: -1.023073, $t = -2.73556$), while past values of GDP per capita also significantly affect the current change ($D(DGDP(-1))$: 1.373984, $t = 2.69446$). These results suggest that exports rebalance faster than GDP per capita and that both variables strongly affect each other in the short run.

In general, in this analysis, co-integration relationship is found in all models, which indicates that there is a long-run equilibrium relationship between the variables. Error correction term (ECT) coefficients indicate the speed at which variables return to equilibrium, and negative and significant ECT coefficients indicate that equilibrium has been achieved. In the short-run dynamics, past values of the variables significantly affect the current change, indicating a strong causality relationship between the variables. The explanatory power of the models is high ($R^2 > 0.5$), which increases the reliability of the analysis. This analysis clearly reveals the long and short run relationships between the variables.

CONCLUSION

In this study, Johansen Cointegration Test and VECM (Vector Error Correction Model) analyses were used to examine the relationships between inflation (INF), exchange rate (DREXCR), imports (DIMPORT), exports (DEXPORT), and per capita GDP (DGDP) in the Turkish economy between 1994 and 2023. The results of the analysis reveal long-term cointegration relationships between the exchange rate and imports, exports, and per capita GDP. However, no significant long-term relationship was found between inflation and the exchange rate or between the exchange rate and exports.

In this context, according to the results of the Johansen cointegration test, hypotheses H_1 (There is no long-term relationship between inflation and the exchange rate) and H_2 (There is no long-term relationship between the exchange rate and exports) were not rejected, meaning that there is no long-term cointegration relationship between these variables ($p > 0.05$). This situation can be explained by the fact that structural issues and external shocks influence inflation, while the exchange rate is susceptible to speculative movements, rendering it impossible to establish a long-term equilibrium relationship between the two variables. Similarly, the limited

impact of exchange rate changes on exports stems from Turkey's high dependence on imports and its vulnerability to global demand conditions.

On the other hand, hypotheses H_3 (There is no long-term relationship between the exchange rate and imports), H_4 (There is no long-term relationship between imports and per capita GDP), and H_5 (There is no long-term relationship between exports and per capita GDP) were rejected, and long-term cointegration relationships were determined between these variables ($p < 0.05$). According to these findings, increases in the exchange rate lead to higher import costs, thereby reducing import volumes. At the same time, both imports and exports have significant and lasting effects on per capita GDP.

According to the Granger causality test results, hypotheses H_6 and H_7 have also been rejected, indicating a bidirectional causality relationship between exports and per capita GDP ($p = 0.0138$ and $p = 0.0355$). In other words, increases in exports stimulate economic growth, which in turn increases export capacity.

Additionally, the H_8 hypothesis (per capita GDP is a Granger cause of imports) was rejected, and a significant causal relationship was identified ($p = 0.0012$). In contrast, hypothesis H_9 (imports are a cause of per capita GDP) was found to be marginally significant and was rejected to a limited extent ($p = 0.0769$). This indicates that the effect of imports on growth is weaker and more indirect.

In the VECM short-term analysis, the H_{10} hypothesis (That the Exchange rate does not significantly affect imports in the short term) was rejected. According to the model results, fluctuations in the exchange rate have a significant impact on imports in the short term, reducing the import volume ($t = -4.05943$). In contrast, the H_{11} hypothesis (past values of imports do not affect the exchange rate) was only partially supported. It was found that past values of imports have a weak effect on the exchange rate ($t = 0.65451$), indicating that the relationship is limited in the short term.

Based on these findings, some policy recommendations can be made for the Turkish economy. Monetary policy should be implemented more consistently and predictably within the framework of inflation targeting in order to strengthen the relationship between inflation and the exchange rate and ensure price stability. Macroeconomic stability should be ensured, and speculative capital movements should be controlled in order to reduce exchange rate fluctuations. The dependence of exports on imports should be reduced, and the structure of exports should be strengthened by encouraging the production of domestic intermediate goods. In addition, pricing strategies that increase exchange rate pass-through should be adopted, and cost structures should be reviewed. Export-oriented policies should be continued to support economic growth, and access to global markets should be facilitated. Furthermore, reducing dependence on energy and intermediate goods imports is important for the sustainability of the trade balance. Structural reforms and strengthening fiscal discipline are among the fundamental conditions for economic stability.

In conclusion, this study reveals the long-term and short-term relationships between key macroeconomic indicators in the Turkish economy, providing policymakers with important insights. In particular, the strong links between the exchange rate, imports, exports, and growth indicate the need for a comprehensive approach to economic policies. Future studies are recommended to deepen these relationships further using more up-to-date data sets, different methodological approaches, and sectoral analyses.

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