

**IMPACT OF EXCHANGE RATE VOLATILITY ON ECONOMIC GROWTH:
EVIDENCE FROM TURKEY CASE****Dr. Mustafa ÖZYEŞİL¹, Moaz Kaaka²**¹Istanbul Aydin University, Anadolu Bil Vocational School, Business Management Department, Istanbul, Turkey, Orcid: 0000-0002-4442-7087²Istanbul Aydin University, Business Management Dept, Istanbul, Turkey, Graduate School of Business, Istanbul Aydin University, Turkey**ABSTRACT**

The exchange rate is a major macroeconomic factor that affects trade between countries and the growth of each country's economy.

Gross domestic product (GDP) growth rate is the rate at which a country's economic output grows. This rate shows how quickly a country's economy can grow. The growth rate in many countries is based on the real GDP. Studying how the exchange rate affects the GDP is very important.

The purpose of this paper is to examine the effect of exchange rate volatility on economic growth in Turkey between 1999 and 2021.

We have taken Twenty- three annual observations of two time series data with interval period extend from 1999 to 2021 in Turkey.

The Granger causality test and simple regression model were used to examine the causal linkages between foreign exchange rate volatility and economic growth.

According to empirical evidence, exchange rate volatility has a negative and statistically significant impact on Turkey's economic growth, and there is only one possible path for the causal relationship between exchange rate volatility and economic growth.

KEYWORDS:

Exchange Rate Volatility, GDP, Granger Causality Test, Simple Regression Model, Turkey

1.INTRODUCTION:

Any economic system's ultimate purpose is to experience rapid economic growth. This entails putting in place the appropriate economic policies, stabilizing economic policies, as well as a better comprehension of the variables affecting/influencing economic growth.

The majority of economists agree that while economic instability limits or restrains chances for economic growth, economic stability is a prerequisite for robust economic growth.

Human development and the enhancement of the quality of the labor force and employment in the economy stimulate and enhance economic growth. On the other hand, economic growth provides the resources that permit sustainable improvement in human development.

On the one hand, improved economic performance is a result of increased freedom as well as capacity expansion and sharing, and human development is a key factor in economic success. [1] (Bousari et al., 2008)

The exchange rate is the primary factor influencing the world economy. The US dollar is the most widely used money in the world.

The intermediary between the domestic and global economies is the exchange rate. The exchange rate is one of the most significant factors that influences a country's economic fortunes in a world that is heading toward free trade and an increase in the volume of international trade.

The exchange rate converts domestic prices into foreign pricing and the other way around. [2] (Dolatabadi & Fard, 2015)

The exchange rate indicates that the selected country's currency is valued in the currency of another nation. If we are interested in the Turkish lira and the US dollar, then this is referred to as a currency pair and is indicated as follows: The Tur/USD currency pair denotes the Tur's exchange rate against the US dollar. Daily fluctuations in supply and demand determine the currency's value.

Volatility is the term used to describe the daily swings in currency value.

[3] (Heroja A., 2021)

The variability of unanticipated changes in exchange rates is known as exchange rate volatility. Volatility, to put it more formally, is the likelihood that domestic or foreign currency's purchasing power will change from its current value in the future.

With the implementation of the floating exchange rate system and the abandonment of the fixed exchange rate system after the collapse of the Bretton Woods system, exchange rate volatility has grown to be a significant issue for nations.

According to Levi (2009), volatility is the standard deviation of an asset's or liability's local currency value as a result of unforeseen fluctuations in exchange rates.

[4] (Levi, 2009)

The GDP growth rate, which is the rate at which a nation's economic production increases, defines just how quickly a nation's economy may expand. Real GDP is frequently used by nations to estimate growth rates.

[1] (bousari et al., 2008)

This study's objective is to evaluate and analyze the effects of exchange rate volatility on Turkey's GDP between 1999 and 2021 using an asymmetric causality test and other statistical analytic techniques, such as correlation coefficients and simple regression models.

The effectiveness of the inferred regression model was evaluated using a number of diagnostic statistical analysis techniques.

The rest of this paper is organized as follows: in section 2, Literature review is described; in section 3 data specifications are briefly presented; in section 4, the experimental and statistical results are presented; In the last section, the conclusions are summarized.

1. Literature review:

Due to its negative direct and indirect consequences on economic growth, exchange rate volatility is expensive for the local economy.

The complicated phenomena of economic growth is influenced by a number of factors, including social, economic, political, cultural, etc.

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Yet, there are some justifications for the existence of a relationship between exchange rate regimes and economic growth that have been offered in the literature on the subject.

In fact, fluctuations in exchange rates can have a direct effect on growth over the medium term by absorbing and/or reducing shocks to the economy.

So, it helps to smooth out the changes in economic growth rates because it can have an indirect effect on economic growth and can affect the main factors that affect economic growth, such as investment, foreign trade, the development of the financial sector, and the flow of foreign capital.

[5] (Guellil et al., 2017)

Changes in exchange rates have caused worry in both developed and developing economies because of how they affect exports, job growth, foreign trade, inflation, investment, and growth.

Changes in exchange rates can affect investment and growth in many ways.

In theory, the relationship's sign could be different depending on the assumptions.

Several studies back up the idea that higher exchange rate volatility leads to less international trade and less economic growth.

Because most international trade deals use the currency of the country that is exporting or importing the goods. Since earnings are affected by changes and fluctuations in exchange rates, these things must hurt international trade flows and economic growth.

On the other hand, some studies show that fluctuations in exchange rates are good for international trade and economic growth.

Those who support this idea say that flexible and more volatile exchange rates make it possible for countries to respond to asymmetric shocks, which helps the economy grow.

They also think that volatility makes speculative attacks less likely and stops financial crises from happening. Because of these differences, people are still talking about how unstable exchange rates affect international trade and economic growth.

[6] (Ozata, 2020)

A lot of empirical research has been done on the relationship between the level of the exchange rate and the growth of the economy. Most of this empirical research has shown that the level of the exchange rate is a strong cause of economic growth. In fact, most people seem to agree that the exchange rate is a cause of economic growth.

No one agrees, though, on whether this link between the exchange rate and economic growth is a positive or a negative one. In other words, there is a lot of disagreement about whether the exchange rate helps or hurts economic growth.

The traditional view says that a high exchange rate is good for economic growth. The structuralist view, on the other hand, says that a high exchange rate makes the economy shrink. [7] (Karahan, 2020)

When you look at the research on how changes in exchange rates affect economic growth, you get mixed results. Different countries are affected in different ways. Several studies have found that there are big problems with growth. Other studies have found that fluctuations in exchange rates are good for growth.

Between 1980 and 2021, Turkey had different exchange rate regimes. Using the exchange rate as a way to fight inflation or the current account deficit has also made the exchange rate in Turkey more volatile.

[6] (Ozata, 2020)

With the laws of the 1980s, the economy of Turkey started to change in big and important ways.

Because of these important changes, the floating exchange rate system was put in place, and modern economic policies, especially monetary policies, began to be used.

[8] (Aldalou & Sarsour, 2022)

(Karahan O., 2020) used quarterly data from 2002-Q1 to 2019-Q1 to look at the relationship between the exchange rate and economic growth. He did this by using the Johansen cointegration test and the Granger causality test.

The data showed that there is a negative link between exchange rates and economic growth. [9] (Karahan Ö, 2020)

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The results of long-term estimation show that foreign income and real exchange rate volatility have positive and statistically significant effects on Turkish exports, while relative prices have negative and significant effects on Turkish exports.

The results show that relative prices have a negative and significant effect on Turkish exports, while foreign income has no significant effect and exchange rate volatility has a positive and significant effect. [10] (Altıntaş, et al., 2009)

(Ozata, 2020) looked at how changes in the exchange rate affected economic growth in Turkey from the first quarter of 1998 to the third quarter of 2019.

An autoregressive distributed model (ARDL) was used to figure out how changes in the exchange rate affect the growth of the Turkish economy.

Using the GARCH(1,1) model, the real effective exchange rate is used to figure out how volatile the exchange rate is.

The results of the ARDL model's estimation show that the volatility of the real effective exchange rate hurts economic growth in Turkey in a way that is statistically very clear.

Long-term exports and investments have a large positive effect on real GDP, while changes in imports and exchange rates have a large negative effect on real GDP. [6] (Ozata, 2020)

(UURLU S., 2009) looked at how the real exchange rate and growth in Turkey changed from the first quarter of 1989 to the second quarter of 2005.

Using the Johansen cointegration test, he found proof that a single cointegration vector depends on two sets of variables.

In the base model, a positive exchange rate shock makes GDP go up for the first three periods, but then it goes down, and then it goes down again. In the analysis of variance, he found that the sources of variation in production are the special shocks. He also found that the explanatory ratio of exchange rate over GDP does not disappear in the long run. [11] (UĞURLU S., 2009)

The review above shows that people have different ideas about how exchange rate imbalances and economic growth affect each other.

But a larger number of reviews pointed to a negative link between unstable exchange rates and economic growth. So, it's clear that opinions on how unstable exchange rates affect economic growth are based on a mix of results that don't prove anything.

Aside from this, the hole is also clear when it comes to how the unstable exchange rate affects economic growth, which varies from country to country.

3. Data Description:

First, it is important to refer to that we studied Impact of Exchange Rate Volatility on Economic Growth in Turkey.

The data has been studied over the past twenty-three years, time interval period extend from (1999) to (2021), our data include a total of (23) annual observations.

The data employed in this study is based on the historical annual observations.

The first variable is (**real effective exchange rate**), the base year of the variables is 2003=100, the required data were obtained from the Central Bank of the Republic of Turkey (www.tcmb.gov.tr).

The second variable is (**price level ratio of GDP to market exchange rate**) in Turkey extracted from the site of DataBank | The World Bank (www.databank.worldbank.org).

There are some steps that must be taken before the simple regression model can be made.

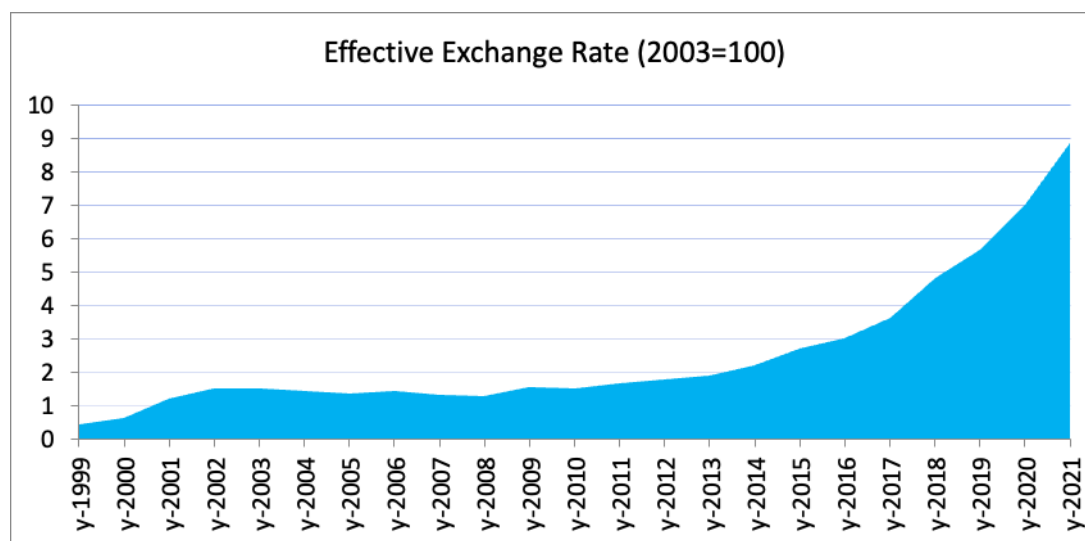
In the first step, the natural logarithm of both variables of the time series data was taken before the analysis. This was done to get rid of the different scale effects between time series that were used in applications to free them from their unit values (bringing them at the same level).

We used Both (EViews V.12) and (Minitab 16) package to obtain statistical analysis of data.

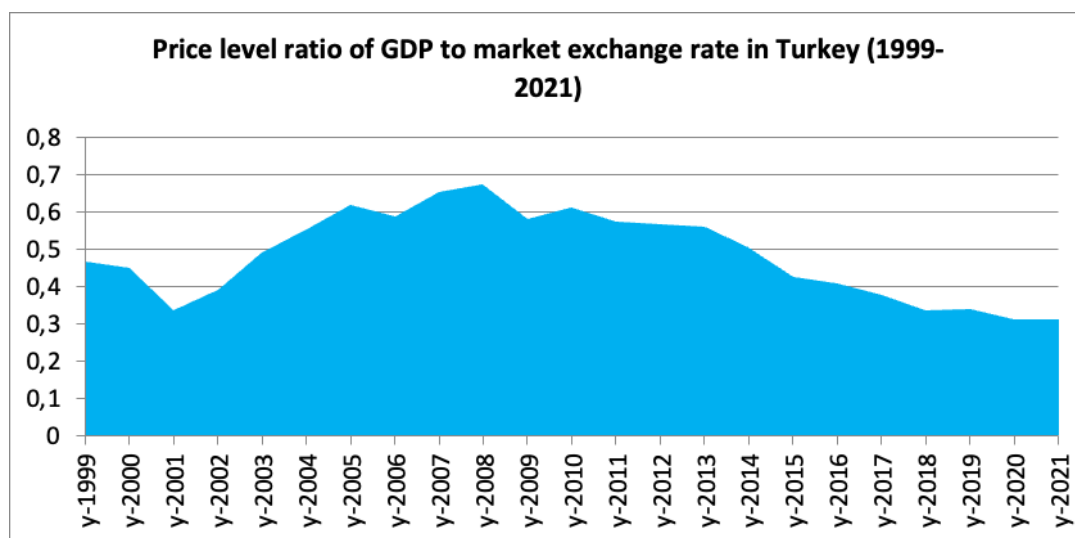
We would like to point out that in all statistical tests we took the value of the significance level equal to 0.05.

Our analysis focuses on two variables: 1- Real effective exchange rate in Turkey, 2- **price level ratio of GDP to market exchange rate** in Turkey.

Figure 1 shows two-time series that described above.



foreign Exchange Rates (1999-2021), Source: own figure.



Price level ratio of GDP to market exchange rate in Turkey (1999-2021), Source: own figure.

Figure 1. Graphical line of time series data.

4. Empirical Analysis and Results:

4.1. Descriptive statistics:

Before we do a natural logarithm transformation on the two variables, it is helpful to show descriptive statistics like measures of central tendency and measures of dispersion for the raw data.

Before any change is made to the data to figure out the average values and how far they are from the mean, descriptive statistics give an initial, simplified description of the data.

Table 1 Shows Descriptive statistics for two studied variables.

Table 1. Descriptive statistics for two studied variables

	Exchange Rate	GDP Rate
Mean	0.485549	2.541099
Median	0.490736	1.549960
Maximum	0.676112	8.850408
Minimum	0.313494	0.418783
Std. Dev.	0.116703	2.123860
Skewness	-0.055723	1.705991
Kurtosis	1.656912	5.045392
Jarque-Bera	1.740626	15.16586
Probability	0.418820	0.50912
Observations	23	23

Source: Author's Computation.

4.2. Test of Normality:

Before we create the regression model between two variables, it should study the normality of the variables.

Anderson-Darling tests are used to find out if two variables are normally distributed. Since the P-value was greater than 0.05, we accept the null hypothesis, which says that the data distribution in two-time series data follows a normal distribution.

Table 2 Shows Anderson Darling test to study the normality for two studied variables.

Table 2. Results of Rayan Joiner test.

Tests of Normality: Anderson Darling test			
	Statistic	df	P-value
Exchange Rate	0.842	23	0.321
GDP Rate	0.963	23	0.236

Source: Author's Computation.

4.3. Dickey-Fuller test to study stationary of time series:

Before applying the Granger causality test, stationarity levels of the variables were analyzed. We must employ Dickey-Fuller analysis to investigate time series data based on unit roots test.

Before running the Granger causality test, the first difference should be taken into account if the Dickey-Fuller test shows that one of the variables is not stationary. If the unit roots test for the first difference shows that the data is not stationary, then the second difference of time series data should be taken into account.

In the two variables, the differences were taken from the first order of both series, and it was found using the Dickey Fuller test that the two series are unstable. After that, the differences were taken from the second order for both series and both series became stable, and therefore the differences must be taken from the second order for the two series to become stable.

Table 3 reports the results of applying the Dickey-Fuller unit root test.

Table 3. Results of Dickey-Fuller test

Variables	ADF lags	statistics	p-value
Exchange Rate	2	1.70369	0.7900
GDP Rate	2	2.38655	0.9915

Source: Author's Computation.

The results for unit roots shown in Table 1 indicate that the p-values of the two-time series data are greater than the significant level of 0.05, and in conclusion, the results indicate acceptance of the null hypothesis that said the two-time series are stationary;

However, the data for the two series are stationary when second-order differences are taken.

4.4. Granger causality relationships test:

The Granger causality test was used to find a link between Exchange Rates and GDP Rate after all of the time series data became stable.

The Granger causality analysis is a way to find out if one time series can correctly predict another. It is made to find the effects of both positive and negative shocks separately by getting rid of the fact that financial time series have different types of information.

Table 4. reports the results of applying **Granger causality test**.

In this case, the period of analysis for Turkey, A One-Way causal relationship of foreign direct investments to exchange rate has been found.

Table 4. Results of Granger causality test.

Null Hypothesis:	F-Statistic	Prob.
GDP Rate does not Granger Cause Exchange Rate	0.98767	0.4290
Exchange Rate does not Granger Cause GDP Rate	2.86659	0.0073

Source: Author's Computation.

From **table 4** we find that there is a one-way causality relation from **Exchange Rates** to **GDP Rate** where $p\text{-value} < 0.05$, and null hypothesis is rejected.

Nevertheless, there was no causality relation from **GDP Rate** to **Exchange Rates** where $p\text{-value} > 0.05$ and the null hypothesis has been accepted.

The results of Granger test indicate that the direction of causality is from **Exchange Rates** to **GDP Rate**, and we can predict the **GDP Rate** by **Exchange Rates**, and the opposite is not true.

Also, this result shows that **GDP Rate** is affected by **Exchange Rates**.

4.5. Pearson Correlation test:

We used Pearson coefficient to examine the relationship between Exchange Rates and **GDP Rate**, from table 5 it is possible to see that Exchange Rates is significantly correlation with **GDP Rate** where $p\text{-value} < 0.05$. The value of the Pearson correlation coefficient was -0.668, and $p\text{-value} < 0.05$, Hence, we accept the alternative hypothesis claim that there is a significant correlation between two variables.

Therefore, there is an intermediate inverse relationship between Exchange Rates and **GDP Rate**.

4.6. Simple linear regression model:

To predict **GDP Rate** (dependent variable) based on **Exchange Rates** variable (independent variable), we applied **simple linear regression model**.

Table 5. reports the results of applying simple linear regression:

Table 5. Results of Simple linear regression.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE	-0.036741	0.008916	-4.120786	0.0005
C	0.578912	0.029263	19.78311	0.0000
Person Correlation	-0.668647	Mean dependent var		0.485549
R-squared	0.447090	S.D. dependent var		0.116703
S.E. of regression	0.088820	Hannan-Quinn criter.		-1.896639
Log likelihood	24.09692	Durbin-Watson stat		0.332296
Sum squared resid	0.165668	F-statistic		16.98088
Prob(F-statistic)	0.000487			

Source: Author's Computation.

According to the results from **table 5.** the regression equation of Exchange Rates:

$$\text{GDP Rate} = 0.578912 - 0.036741 \times (\text{Exchange Rates})$$

P-value < 0.05 for all coefficients of equation; Thus, coefficients values are statistically significance.

The value of the slope of the regression equation was negative, so the percentage of GDP increases with the decrease in the percentage of the exchange rate, and vice versa.

Coefficient of determination (R^2) is 0.447090; Coefficient of determination is the percentage of variance in the dependent variable that is explained by the independent variable. Thus, 44% of the *GDP Rate* series is explained by *Exchange Rates* series.

To check the significant in the equation of regression model **One Way ANOVA** for regression model was applied to examine the significant in the equation of regression model, and P-value = 0.000487 < 0.05 which indicate that the equation is statistically significant.

Therefore, the predictions resulting from the significant regression model can be accepted.

To check the efficacy of regression model we must examine the normality of residuals, Testing Autocorrelation.

We used **Jarque- Bera Test** to investigation of the normality of residuals, p-value = 0.241 > 0.05, then we accept null hypothesis and that mean the residuals are distributed normally.

4.6.2. Durbin-Watson Test for Testing Autocorrelation:

The Durbin-Watson statistic is a way to see if the residuals from a statistical model or regression analysis are related to each other. The value of the Durbin-Watson statistic will always be between 0 and 4. A value of 2.0 means that the sample does not show any autocorrelation. Autocorrelation is positive if the value is between 0 and less than 2, and it is negative if the value is between 2 and 4.

Autoregressive models have been used in the stock market to figure out how dynamic effects change over time in a process. This is based on the idea that the values of the dependent variable in the past have an effect on the values of the dependent variable in the present.

If this hypothesis turned out to be true, the model would need a lagged dependent variable to be able to detect a dynamic effect.

For the general model, the autocorrelation test was used to decide if the lagged dependent variable should be added to the simple regression model. Using the Durbin-Watson test is one way to find out whether or not there is autocorrelation.

If a stock price has a positive autocorrelation, it means that the price yesterday has a strong relationship with the price today. This means that if the price of the stock went down yesterday, it is likely to go down again today.

[12]

A stock price with a negative autocorrelation, on the other hand, has a negative effect on itself over time. This means that if the price went down yesterday, it is more likely to go up today.

In Our model, the P-value for D.W. statistic is 0.00 < 0.05 which points out the test is statistically significant.

Also, the Durbin-Watson test has yielded the test statistic of 0.332296 which rules out the existence of positive autocorrelation for GDP Rate in this study's dataset.

Based on how this value is interpreted in the Durbin-Watson test, we accept the alternative hypothesis that says residuals don't affect each other.

5. Conclusions:

This study attempts to examine the impact of exchange rate volatility on economic growth of Turkey, the results showed that the Economic Growth is statistically significantly affected from exchange rate volatility. The results of empirical analysis show that exchange rates have a negative causal relationship with GDP rate, and that the direction of causality is from exchange rates to GDP rate. This means that we can predict GDP rate from exchange rate variables, but not the other way around.

The results showed that there was a negative intermediate relationship between exchange rates and GDP rate. This means that if the value of the exchange rate went up, the GDP rate would go down. The slope of the regression equation was also negative, which means that the percentage of GDP goes up when the percentage of the exchange rate goes down and vice versa.

This showed that changes in exchange rates have a statistically significant effect on GDP rate. In other words, the value of GDP rate is affected by changes in exchange rates and many other economic and financial factors. This study does not look at them.

Based on our data, the coefficient of determination says that exchange rate explains 44% of GDP.

The results observe that the effects of GDP rate would be different in the short- and long-terms on the exchange rate.

Finally, the analysis of this paper indicates that exchange rate volatility has a negative impact on economic growth in Turkey.

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