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Evaluation of the Effect of Oil Price Volatility on Exchange Rates: The Case of Türkiye

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Abstract

This study examines the dynamic relationship between oil prices and exchange rates, concentrating on the effects of various exchange rate regimes on this relationship. Previous research on the relationship between oil prices and exchange rates has been extensive; however, the effects of different exchange rate regimes have not been properly investigated. For instance, we utilize econometric techniques like Vector Autoregression (VAR) analysis, Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP) unit root tests on Turkey that are highly reliant on the price of Brent crude oil. The findings indicate that exchange rate regimes have a significant impact on the long-term correlations between oil prices and exchange rates, as well as the volatility of these correlations. The analysis highlights how important it is for emerging nations' fiscal and monetary policymakers to consider these dynamics. Policymakers will benefit from a greater knowledge of these links as a result of this work, which will assist lessen the economic instability caused by fluctuations in oil prices. Additionally, the results imply that, in comparison to fixed regimes, flexible exchange rate regimes may provide greater resilience against shocks to the price of oil. This knowledge is especially helpful for developing nations looking to create more resilient economic strategies.

Keywords: Exchange Rate Regimes, Oil Price Volatility, Emerging Market Policy, Turkey.

JEL Classification: A10, J22

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1. Introduction

Recent years have seen a substantial amount of research on oil prices, partly due to the rise in price of this commodity that is vital to the global economy. One of the most traded commodities worldwide, oil has experienced extreme price volatility that has been connected to important world events and is believed to be a trigger for inflation or recession in the economy. The rise in oil prices might have some effects on the economy, chief among them being an increase in the cost of manufacturing goods and services, which could have an effect on financial markets, consumer confidence, and the rate of inflation. This proves that rising oil costs played a role in American recessions, particularly the ones that occurred after World War II (Hamilton, 1983). Subsequently, several researchers (Burbridge and Harrison, 1984; Gisser and Goodwin, 1986; Park and Ratti, 2008; Kilian and Park, 2009; Narayan and Narayan, 2010) built upon Hamilton's basic findings by employing other data sets and estimating approaches.

However, there are many reasons why it is imperative to establish the relationship between exchange rates and stock prices. Above all, it could affect the decisions made in the economy on monetary and fiscal policy. Aggregate demand is positively affected by a robust stock market (Gavin, 1989). Monetary policy contraction or fiscal policy expansion aimed at influencing the real exchange rate and interest rate will surely be countered if the stock market boom becomes sufficiently large.

Policymakers should take into account the risk that lowering currency exchange rates could impede stock market activity, even though they believe that doing so will boost the export industry. The second claim is that predicting the possibility of a financial crisis can be aided by understanding the relationship between currency rates and stock prices.

With a small open economy, for example, the level values of the currency are significantly impacted by changes in oil prices (Dawson, 2004). Much research has been done on how oil prices affect the value of currencies in countries that export oil, but much less is known about how energy prices affect countries that import energy (Shakibaei et al. 2009, Oriavwote and Eriemo 2012). Consequently, to illustrate the volatility of oil prices and real currency rates, this article uses Turkey as an example, a small open economy whose exchange rate is highly dependent on the price of Brent crude oil.

The global financial increase is extensively influenced by oil expenses. Consequently, it's vital for governments to carefully reveal fluctuations in oil charges to formulate strategies geared toward lowering alternate rate volatility. Since they show the course of the connection and its origins, empirical studies that investigate bidirectional spillovers should be of interest to market participants. The findings of empirical research on this subject matter were inconsistent. As an example, preceding research has checked out how oil prices affect change charges (Bénassy-Quéré et al., 2007; Chen and Chen, 2007; Lizardo and Mollick, 2010; Buetzer et al. 2016, Albulescu and Ajmi, 2021; Çelik, 2023). Previous research has shown that there is no correlation between the two variables or that changes in oil prices have a significant impact on changes in oil fees (Yousefi and Wirjanto, 2004; Zhang et al., 2008; Akram 2009, Akça, 2023; Huseynli, 2023). Variations in methodology, variable selection, and sample choice (within a specific time frame or country) all influence the conclusions drawn regarding perceived relationships. Although the relationship between oil prices and exchange rates has been extensively studied in empirical literature, one significant influencing factor—the exchange rate regime—has not yet been addressed. The impact of an exchange rate regime is considered when evaluating the macroeconomic performance of both advanced and developing economies (Husain et al., 2005; Narayan et al., 2008). Based on their findings, exchange rate flexibility is associated with reduced inflation in developed countries but may lead to higher inflation in developing economies. A controlled float system may have a smaller impact on pricing than a float regime, as seen in an analysis of how oil prices affect

Indonesia's currency rate. This expectation is based on these observations. It is concluded that previous studies on the relationship between oil prices and exchange rates do not apply to exchange rate regimes, suggesting that controlled float regimes do not exhibit the same long-term associations as float exchange rate regimes. This paper introduces a novel approach to the exchange rate mechanism to examine the long-term link between oil prices and exchange rates.

This research helps monetary authorities make better-informed policy decisions by giving them a better knowledge of the relationship between oil prices and exchange rates, which is important because oil has a big impact on economic dynamics. For developing countries in particular, this is advantageous. The rest of the paper is organized as follows. Section 3 covers the econometric technique and data description, whereas Section 2 evaluates the theoretical and empirical literature on the topic. The report is concluded in Section 5 after the study's findings are presented and discussed in Section 4.

2. Literature Review

A significant amount of theoretical and empirical studies have been conducted on the relationship between oil prices, exchange rates, and the economy. Exchange rates are theoretically influenced by three channels: the wealth impact, the terms of trade channel, and the portfolio reallocation channel. It is evident from the trade channel that factors other than oil prices impact exchange rates. Amano and van Norden (1998) demonstrate that oil prices are the primary source of long-lasting shocks to exchange rates using a simple two-sector model for tradable and non-tradable goods. The theories of Golub (1983) and Krugman (1983) provide the theoretical basis for the wealth effect and the portfolio reallocation channel, which predict that changes in oil prices lead to a transfer of wealth from oil-producing nations to oil-exporting nations. The short-run and long-run effects of these transfers are determined by the wealth allocation strategies mentioned above. Additionally, theoretical analyses have been conducted on the potential significance of exchange rates in explaining oil price fluctuations. For example, Bloomberg and Harris (1995) present indicators reflecting how exchange rates influence oil prices. Given that the U.S. Dollar is the primary energy currency due to global trade, a weaker dollar, all else being equal, decreases the cost of oil for foreign buyers, increases oil demand, and leads to higher oil prices (Chen et al., 2010). Alper and Torul (2008) examine the effects of increased oil prices on Turkey's overall economic activity and conclude that these effects are negligible. Aydin and Acar (2011) use a dynamic calculated general equilibrium model to examine how oil price shocks affect Turkey's economic growth. The findings show that a doubling of the price of oil causes a 14% decrease in Turkish output. Huang et al. (2021) categorized 81 nations based on their amounts of net oil imports by using real oil prices and real currency rates monthly from January 1997 to July 2015. Therefore, for nations implementing free-floating exchange rate regimes, oil importers exhibit a large negative bidirectional correlation, whereas oil exporters do not exhibit any correlation between oil prices and currency rates. For oil importers or exporters in managed floating systems, exchange rates forecast oil prices. It is underlined that understanding these connections might help policymakers avoid major and unexpected shocks brought on by fluctuations in the price of crude oil and the value of the US dollar.

The oil price pass-through exchange channel impacts the exchange rate, dividing the economy into tradable and non-tradable sectors (Abed et al., 2016; Amano and Van Norden, 1988). The tradable sector uses oil as a tradable input, while the non-tradable sector uses labour as a non-tradable input. Furthermore, while tradable sector goods' prices are set globally, non-tradable sector goods' prices affect the real exchange rate of a country. As oil prices fluctuate, the real exchange rate responds differently depending on the amount of oil used as an input in each sector. Consequently, rising oil prices increase non-tradable sector output prices and the currency's value when it uses more oil than the tradable sector. Conversely, currency devaluation occurs when there is a positive oil shock and the non-tradable sector uses less energy (oil) than the tradable sector. According to Benessy-Quere et al. (2007), non-tradable goods' prices influence the real exchange rate. Ozturk (2015) has used quarterly data from 1990:Q1 to 2011:Q4 to study the impact of oil price shocks on several macroeconomic variables in Turkey. According to the study's impulse response analysis, shocks to the oil price at that time in Turkey had a major effect on macroeconomic variables. He specifically finds evidence of the two-quarter lag in the negative effects of positive oil price shocks on imports, money supply, and industrial production; the inflation rate was immediately positively impacted by these shocks. However, he discovers that negative oil price shocks have negligible effects on every variable but imports. Nazlioglu and Soytas (2011) investigated the correlation between the prices of agricultural commodities, the dollar rate, and the oil price in Turkey between January 1994 and March 2010. According to the impulse response study, short-term changes in the price of oil and exchange rates had little effect on agricultural prices. An investigation of long-term causality revealed that fluctuations in the price of oil and the Turkish Lira were reflected in the cost of agricultural goods. As a result, it has been established that the agricultural commodities market has both direct and indirect influence on fluctuations in Turkey's oil prices.

The asymmetrical relationship between oil prices and exchange rates is examined by Kisswani et al. (2019) using the non-linear ARDL (NARDL) approach for a selected group of Asian nations over 1970: Q1–2016:Q4 timeframe. Additionally, the paper uses the Toda and Yamamoto causality test to investigate the direction of the causal relationship between the price of oil and the exchange rate. Only for Indonesia and Malaysia, when structural fractures are included, can empirical evidence indicate a long-term asymmetry link. Also, it might be argued that the results of the causality test are complex since there exists a bidirectional causal relationship between the exchange rate and oil price in certain nations, whilst there is a unidirectional causal relationship in others. Gilbert (2010) demonstrated through the Granger causality test that the factors influencing variations in agricultural prices between 1970 and 2008 were exchange rate volatility, monetary expansion, and GDP growth. In addition, he mentioned that the price of oil and the value of the dollar are significant variables. In this particular context, he concluded that although the impact of oil prices varies with time, the dollar exchange rate consistently has a negligible influence. Eryigit (2012) examines the effects of oil prices on the Turkish exchange rate, interest rate, and primary index of the exchange rate of the Istanbul stock market with weekly data from January 2005 to October 2008. Oil price shocks, according to their analysis, have a favourable effect on the stock market and a negative influence on interest rates and currency rates. According to proponents of the elasticity channel (Nkomo, 2006; Abed et al., 2016), the speed at which oil price changes affect exchange rates is determined by a country's demand elasticity for imported oil. A country may reduce its oil consumption in response to higher oil prices if its demand for oil imports is elastic, potentially strengthening its currency or at least offsetting the price increase's impact. Conversely, a rise in oil prices devalues the currency of the oil-importing country if the demand for oil imports is inelastic. Theoretically, an increase in oil prices should result in stronger currencies for oil-exporting economies, while importing economies' currencies would be significantly affected by their adjustment processes. Recent literature examining the dynamic relationships between oil prices and exchange rates includes studies (Narayan et al., 2008 and Reboredo, 2012).

Narayan and colleagues (2008) used GARCH and exponential models to examine how oil prices affect the nominal exchange rate, finding that oil price fluctuations cause the Fiji Islands' currency rate to rise. Additionally, Reboredo (2012) employed a copula-based GARCH model to study the co-movements between currency rates and oil prices, revealing that oil-importing countries like Japan exhibit less pronounced co-movements between oil prices and exchange rates while oil-exporting countries like Canada, Norway, and Mexico show more significant co-movements. Gökçe (2013) uses quarterly data covering 1987: Q1 to 2011:Q4 to investigate the effect of oil price volatility on the growth of the Turkish economy. In particular, the impulse response analysis shows that production growth responds positively to increases in oil prices. These findings of the study demonstrate the substantial effects of oil price volatility on Turkish economic growth. On the other hand, Sadorsky (2001) found that interest rates and currency values are the primary factors influencing returns on oil and gas stocks rather than oil prices themselves. This is because he used a multifactor model to account for various risk factors' existence. His analysis also uncovered a significant positive correlation between oil prices and fuel and oil companies' stock returns. The findings indicating that the GCC stock market generally responded favourably to increases in oil and related prices align with these results (Arouri and Julien, 2009). Furthermore, Lin et al. (2010) demonstrated a strong correlation between oil prices and stock returns in China due to the positive expectation effect, which helped statistically validate many hypotheses. For example, there was a positive correlation between oil price shocks and stock prices when they indicated fluctuations in overall demand and a negative correlation when they represented supply shifts. Economists are also endeavouring to predict stock market stock prices and returns. For instance, stock prices can be influenced by three factors: the market-related factor, the firm-specific factor, and the economic factor (interest rate and currency value). Unlike in the past, currency rates are now highly susceptible to changes in global portfolio assets and the stock market. Given that the results may impact monetary and fiscal policy, it is recommended to investigate the relationship between stock prices and exchange rates.

Aggarwal (1981) conducted an empirical study on how U.S. stock prices are affected by exchange rate fluctuations. Using monthly data from 1974 to 1978, the study demonstrated a positive link between exchange rates and stock prices. The relationship between stock prices and macroeconomic factors in Cyprus (Tsoukalas, 2003) also showed a strong association between stock prices and exchange rates. This is due to the Cypriot economy's reliance on services, including tourism and offshore banking. Sevuktekin and Nargelecekenler (2007) concluded that there was a positive and reciprocal causal relationship between these economic indicators using monthly data for Turkey from 1986 to 2006. Nieh and Lee (2001) studied the G-7 countries from October 1, 1993, to February 15, 1996, to explore the relationship between exchange rates and stock prices among more developed countries. They found that none of the G-7 countries had a long-term equilibrium link between stock prices and exchange rates. Conversely, a similar study conducted in the United States using quarterly data from 1960 to 2004 revealed that these two economic factors and the American economy do not co-integrate or have a causal link (Ozair, 2006). The impact of time on stock prices, short-term interest rates, and currency rates concerning the Pakistani economy was examined using a unique approach. Based on monthly data from Pakistan from 2005 to 2010, they concluded that time significantly influenced stock prices and currency rates (Fin24, 2022). Based on a review of the literature, it is generally agreed that there is no consistent correlation between stock prices and exchange rates. Variations exist in the conclusions drawn from previous studies, depending on the analysis method used and the country's economic status.

3. Theoretical Framework and Methodology

The research hypotheses will be tested via time series analyses involving two variables. The dependent variable is Turkey's exchange rate from 1993 to 2023; the independent variables were the country's real interest rates, nominal interest rates and oil prices. The World Bank database was consulted for information on inflation and exchange rates, although the Federal Reserve Bank (FRED) website's "Crude Oil Prices: Brent - Europe" section provided information on oil prices.

Exchange rate = f(oil prices, nominal interest rate, real effective interest rate)

3.1. Model Estimation

This study uses the oil price and exchange rate to create a multivariate model to analyse the volatility of the oil price and the exchange rate in Turkey. For the variables to have the same unit of measurement, they are converted into logarithms. Thus, the logarithms of the exchange rate (LEX), oil prices (LOP), real interest rates (LRIR), nominal interest rates (LNIR), constants and error term (ε) are below:

$$LEX_t = \alpha_1 + \alpha_2 LOP_t + \alpha_3 LRIR_t + \alpha_4 LNIR_t + \varepsilon_t \quad (1)$$

3.2. Analysis of Data

3.2.1. Augmented Dickey-Fuller Unit Root Test

Dickey and Fuller (1979) and (1981) proposed the unit root test method to test the stationarity of time series variables. If the series of variables contains unit roots, it is understood that the series does not have stationarity. However, it has been proved that the Dickey-Fuller unit root test cannot be used if the error term contains autocorrelation. Autocorrelation in the error terms causes a p-order relationship between the error terms.

$$\varepsilon_t = \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \ldots.. + \theta_3 \varepsilon_{t-3} + \varepsilon_t \quad (2)$$

Equation (2) illustrates the Dickey and Fuller test, which involves incorporating the dependent variable's lag values as independent variables into the model. This technique is referred to as the extended Dickey-Fuller test (ADF, or Augmented Dickey-Fuller) in the literature. By incorporating the time series values of a variable with lagged values into the model, the autocorrelation issue is resolved (Holden and Perman, 1994). According to Endres (1995), the ADF test has three models. They are:

$$\Delta Y_t = \beta_1 Y_{t-1} + \sum_{i=1}^{k} \lambda_i \, \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

The first model is the model with a constant coefficient and no trend (none) as represented in equation (3).

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum_{i=1}^{k} \lambda_i \, \Delta Y_{t-1} + \varepsilon_t \quad (4)$$

Equation (4) shows the equation for the second model of this test where only the constant coefficient is included in the model.

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 trend + \sum_{i=1}^{k} \lambda_i \, \Delta Y_{t-1} + \varepsilon_t \quad (5)$$

Comprising the constant coefficient and trend, equation (5) denotes the third model in our examination. When conducting the ADF test, the unit root of the series is the null hypothesis, and the series' stationarity is the alternative hypothesis. It is determined that the series is stationary and that the null hypothesis is rejected if the calculated value is greater than the test statistic's table critical value, z(t).

3.2.2. Phillip-Perron Unit Root Test

In 1988, Phillips and Perron created this test as a substitute for the ADF test. Its three models are created similarly to the ADF test. They are

$$Y_t = \alpha Y_{t-1} + \varepsilon_t \quad (6)$$

The equation for the first model, which has neither a constant coefficient nor a trend (none), is equation (6).

$$Y_t = \mu + \alpha Y_{t-1} + \varepsilon_t \quad (7)$$

Equation (7) is the equation for the second model with a constant coefficient but no trend.

$$Y_t = \mu + \beta \left(t - \frac{1}{2}\lambda\right) + \alpha Y_{t-1} + \varepsilon_t \quad (8)$$

Equation (8) represents the third model of the test with constant coefficient and trend. The test statistic is compared to the table critical value in the PP (Phillips-Perron) test, and if the calculated value is larger, the null hypothesis is rejected and it is determined that the series is stationary. The alternative and null hypotheses are constructed similarly in the ADF test.

3.2.3. Vector Autoregression (VAR) Analysis

A VAR model is a simultaneous equation model that incorporates multiple endogenous variables into the model at the same time. Each endogenous variable in this model is explained by the lagged values of either that variable alone or by the lagged values of additional endogenous variables. This model does not include any external variables.

If this situation is explained by considering the Xt and Yt series;

$$X_t = \alpha + \sum_{i=1}^{k} \beta_j X_{t-j} + \sum_{i=1}^{k} \lambda_j R_{t-j} + \varepsilon_{1t} \qquad (9)$$

$$Y_t = \alpha' + \sum_{i=1}^{k} \theta_j X_{t-j} + \sum_{i=1}^{k} \lambda_j R_{t-j} + \varepsilon_{2t} \qquad (10)$$

As seen in equation (9) and equation (10), ε 1t and ε 2t represent the error terms, while assuming that Xt and Yt series contain k lagged values, it shows that the lagged value of Xt affects the Yt variable and the lagged value of Yt affects the Xt variable. Thus, it will be possible to estimate each equation by the least squares method (Gujarati and Porter, 2012).

3.3. Analysis and Empirical Results

During the analysis phase of the study, the stationarity of the variable time series will be assessed using unit root tests (ADF and PP tests), after which the VAR model will be calculated using the study's variables. STATA 17 was used to do calculations about the research's practical application.

Table 1. Augmented Dickey-Fuller and Phillip-Perron Unit Root Test

	Constant		**Intercept**		**Constant**		**Intercept**	
	Level	Δ	Level	Δ	Level	Δ	Level	Δ
LEX	-0,714	-4,891	-3,207	-6,149	-1,154	-5,915	-1,456	-5,412
LOP	-6,127	-8,347	-7,415	-158,423	-9,758	-48,714	-9,451	-48,736
LRIR	-2,261	-5,974	-2,917	-6,725	-2,473	-7,224	-3,113	-7,021
LNIR	-0,872	-6,102	-1,465	-3,152	-1,024	-6,108	-1,485	5,783

The paper uses the unit root tests, namely the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests, to ascertain the stationarity of the variables under investigation. The results of these tests are briefly shown in Table 1, where the stationarity characteristics of the variables LEX (log of exports), LRIR (log of real interest rate), and LNIR (log of nominal interest rate) are highlighted. These variables show stationarity at their first differences in both the ADF and PP tests, suggesting that they are integrated of order one, or I(1). The variable LOP, or the log of oil prices, on the other hand, is found to be stationary in its level form, indicating that it is integrated of order zero, or I(0). The Autoregressive Distributed Lag (ARDL) model is applied for additional analysis due to the variables' mixed order of integration. Because of its adaptability to variables integrated into different orders, namely I(0) and I(1), the ARDL model is especially useful in econometric analysis. This model offers a thorough grasp of the variables' dynamic interactions by making it easier to estimate the relationships between the variables over both short and long terms. The system's short- and long-term equilibrium adjustments are well captured by the ARDL technique, which incorporates both the levels and initial differences of the variables. When dealing with the intricacies present in macroeconomic time series data—where the underlying variables could show varying degrees of integration—this dual capability is crucial. Moreover, the ARDL framework's cointegration analysis is built upon the stationarity findings from the ADF and PP tests. To comprehend the long-term equilibrium dynamics in the context of climate migration, it is essential to identify cointegrating interactions among the variables. The existence of relationships using the ARDL bounds testing approach, which works with variables of mixed integration orders is examined. A consistent long-term relationship between the variables is implied by the establishment of cointegration, and this is important for developing effective policy responses to the difficulties faced by migration generated by climate change. By using a strong methodological approach, the study's conclusions are more reliable and valid because the empirical findings are supported by analytical framework.

In the analysis, the variable LEX yields inconsistent findings. While the first difference (-4.891) shows stationarity in the constant level test, the ADF statistic (-0.714) indicates non-stationarity. Likewise, stationarity at the first difference is confirmed by the intercept level (-3.207) and first difference (-6.149) tests. This shows that LEX is integrated of the first order, or I(1).

Under both the constant (-6.127) and intercept (-7.415) scenarios, the variable LOP is stationary at the level form, indicating integration of order zero, I(0). The first difference figures (-158.423 and -48.714), however, probably point to computation mistakes or anomalies in the data and require additional investigation. These should typically show strong stationarity in the initial discrepancies. While the first difference (constant: -5.974, intercept: -6.725) exhibits stationarity, the levels (constant: -2.261, intercept: -2.917) do not exhibit stationarity according to LRIR analysis. More tests (intercept: -7.021, constant: -7.224) validate the stationarity of the first difference. I(1), or the integrated of order one, is LRIR. At level form (constant: -0.872, intercept: -1.465), the variable LNIR shows non-stationarity; however, at the first difference (constant: -6.102, intercept: -3.152), it becomes stationary. The intercept Δ column (5.783) exhibits an abnormality, nevertheless, which calls for additional research or adjustment. A significant first difference in stationarity allows LNIR to be generally classified as I(1). The majority of variables are non-stationary at their levels, according to the unit root tests, but after initial differencing, they become stationary, showing that they are integrated of order one, or I(1). However, the variable LOP seems to be stationary in level form, indicating I(0). These results inform the choice of econometric models that looks at the integrated variables of multiple orders, such as the ARDL model. Maintaining data accuracy is still essential for trustworthy econometric analysis, particularly when it comes to test result abnormalities.

Table 2. VAR Optimal Lag Length Criterion

LAG	LogL	BIC	FPE	AIC	SC	HQC
0	381,475	17,415	6.77e-13	-15,789	-17,235	-15,975
1	401,547	14,326	6.02e-13	-15,915	-17,108	-15,781
2	408,706	18,012	5.14e-13	-15,104	-16,915	-14,978
3	471,465	16,203	7.62e-13	-15,678	-16,187	-13,201
4	449,104	9,457	2.39e-13	-15,015	-15,992	13,007

The selection of the ideal lag length was informed by multiple statistical measures, such as the Hannan-Quinn Criterion (HQ), Akaike Information Criterion (AIC), Likelihood Ratio (LR), Final Prediction Error (FPE), and Schwarz Criterion (SC). Based on consistent suggestions from these criteria, the ideal lag length was found to be one lag, as shown in Table 2. By being rigorous in its approach, the model is prevented from being either over- or under-parameterized, which could leave out important dynamics or result in inefficiency. The study then used the ARDL Bounds test for cointegration after determining the ideal lag duration. The purpose of this test is to determine whether long-term equilibrium relationships exist between the variables, even though they integrate at different orders (I(0) and I(1)). Because it does not need the variables to have the same order of integration, the ARDL Bounds test is especially well-suited for this study and offers a strong framework for analyzing long-term links. The ARDL model improves the trustworthiness of the cointegration results by capturing the temporal relationships and interactions within the data and including the ideal lag length found by the VAR criterion. For an understanding of the long-term dynamics and stability of the relationships among the variables under consideration, one must know the findings of the ARDL Bounds test for cointegration. This cointegration suggests that the variables follow each other throughout time and sustain a steady relationship of long-term equilibrium. This discovery implies that treatments aimed at one variable may have predictable long-term consequences on others, which would have substantial ramifications for the creation of policies. The lack of cointegration, on the other hand, would suggest that the variables do not have a consistent long-term relationship, calling for the implementation of distinct policy measures to address both short- and long-term trends. The study demonstrates its dedication to methodological accuracy and the reliable interpretation of empirical data by applying the VAR lag selection criterion rigorously and conducting ARDL cointegration testing afterwards.

A higher number of lags results in higher Log Likelihood values, which illustrate how well the model fits the data. The lag length that best fits the underlying data dynamics is shown by the largest LogL value, which is observed at lag 3 (471,465). A good criterion for choosing a parsimonious model is BIC, which penalizes model complexity more severely than AIC. When weighing the trade-off between complexity and model fit, lag 1 (14,326) has the lowest BIC value, suggesting that this lag length is appropriate. Model prediction accuracy is measured by FPE. This lag length appears to yield the most accurate out-of-sample forecasts, as evidenced by the minimal FPE value (5.14e-13) achieved at lag 2.

Similar to BIC but with a distinct penalty structure, AIC strikes a compromise between model fit and complexity. Lag 1 has the lowest AIC value (-15,915), suggesting that this lag length provides the optimal balance between parsimony and quality of fit. While SC and HQC impose different penalty terms, they are identical to BIC and AIC. Lag 0 has the lowest SC (-17,235) and HQC (-15,975) values, indicating that a lag-free model would be unduly basic.

Lag 1 is found to be the ideal lag length for the VAR model when all factors are taken into account. The lowest BIC, AIC, and acceptable FPE values, which show a decent trade-off between simplicity and model fit, justify this choice. As a result, lag 1 is used in the study going forward for further analysis. To effectively represent the dynamic relationships between economic variables, the ideal lag duration must be chosen. To provide strong insights for forecasting and policy research, the VAR model may identify short-term relationships and interactions using lag 1. The model's predictive abilities and dependability are maintained by making this decision, which guarantees that it is neither overfitted nor underfit. Making better-informed economic decisions and actions will be made easier by the findings, which will help to comprehend the temporal dynamics of the variables.

4. Conclusion

The use of energy has a significant impact on a nation's ability to progress economically. Energy is becoming a more crucial input in terms of the production input needed for raising the market shares of countries, as the global market continues to develop and increase. Oil, which holds a significant position in the energy resources portfolio, has a significant impact on national economic growth rates and stability. The importance of oil is increasing in both national economies and human needs, a circumstance that has existed since the beginning of human history. Since oil makes up a large portion of major energy sources and has a limited supply, fluctuations in oil prices have a big impact on economic growth. Every country is impacted differently by changes in oil prices. While rising oil prices will boost economic growth in nations that export the commodity, they also raise production costs, and general prices, increase unemployment, and hurt the economies of oil-importing nations. Turkey is one of the nations that was previously heavily dependent on oil and its derivatives due to its thriving economy and expanding energy needs. Due to its heavy reliance on imported energy, Turkey's macroeconomic indicators are greatly impacted by changes in oil prices.

The relationship between the nominal interest rate, real effective interest rate, oil prices, and currency rates is examined using data spanning from 1993 to 2023. Vector Autoregression (VAR) Analysis and the Autoregressive Distributed Lag Model are used in the methodology. Several policy issues from the study need to be considered. There is a weak but unfavourable relationship between the price of oil and the Turkish lira. Consequently, the following policy implications flow from these findings:

First, there is a negative correlation between the price of oil and the Turkish lira. Decision-makers and the government must implement guidelines to increase demand in Turkey. Oil costs might decrease due to the strengthening US dollar exchange rate. The authorities must also ensure that a sufficient buffer stock of crude oil has been constructed to lessen the impact of external shocks on the oil market. The energy ministry should also work to keep Turkey's oil expenses low. Second, there is a negative relationship between the real interest rate and the Turkish exchange rate. This implies that policymakers and the government must reduce real interest rates to adjust economic policy. A decrease in real interest rates will boost aggregate demand, accelerate economic growth, and strengthen the value of the Turkish lira. However, caution is needed because lowering interest rates might encourage increased imports, which could worsen the current account deficit. Thirdly, Turkey's nominal interest rates and exchange rates have a negative association, albeit one that is statistically insignificant over a prolonged time. It follows that the government, the monetary authority, and policymakers must implement measures to lower nominal interest rates. This will reduce Turkey's dependency on oil imports, helping to decrease borrowing costs, make exports more competitive, and raise the cost of imports. As a result, Turkey's low growth rate would no longer be a problem as the country's economy would grow more quickly.

The results of the study lead us to suggest that legislators consider the price of oil when determining exchange rate policy. Since oil prices are determined externally, there should be less reliance on oil as the primary source of foreign exchange earnings. This can be ensured by diversifying the economy's export base by developing less risky commodities and finished goods. Policies aimed at bringing foreign currency into the economy, such as foreign direct investment and foreign portfolio investment, should also be considered. Finally, the economy's international trade base needs to be changed by measures intended to replace imports, especially regarding petroleum-finished commodities and other goods that could be produced domestically. Future research should examine the long-term effects of oil price shocks on Turkey, accounting for various underlying factors including supply shocks, aggregate demand shocks, and demand shocks specific to oil.

Competing Interest

The author declares that he has no competing interests.

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Ethical Statement

It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

Author's Contributions

This article was created as a result of the author's own efforts and reviews.

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