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The Relationship Between Interest Rates and Exchange Rates in Türkiye: The DCC-GARCH Approach

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Abstract

This research investigates the dynamic relationship between interest rates and exchange rates in Türkiye from January 2005 to April 2025, employing the DCC-GARCH(1,1) model. The theoretical framework suggests that interest rates should lead to currency depreciation, but empirical research in emerging markets reveals complex relationships due to changing macroeconomic conditions and declining policy credibility. According to the analysis results, there is a negative relationship between the real interest rate and the exchange rate throughout the period. The correlation between the interest rate and exchange rates varies over time. During the 2005-2021 period, the correlation coefficient ranged between −0.13 and −0.21. Between 2021 and 2022, this coefficient increased in absolute terms, reaching its highest point throughout the period. The monetary policies and economic growth strategies implemented during this period created a permanent exchange rate and a high inflation environment. As a result, negative real interest rates were observed for a long period. Economic agents tracked changes in the exchange rate through the future real interest rate. The correlation between the variables returned to the same level as the 2005-2021 period starting from mid-2023, thanks to the confidence provided by the changing economic management. The results indicate that the strength of the interest rate-exchange rate relationship in Türkiye depends on the current policy regime and the reliability of monetary management.

Keywords Real interest rate · Exchange rate · DCC-GARCH model

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The Relationship Between Interest Rates and Exchange Rates in Türkiye: The DCC-GARCH Approach

The relationship between interest rates and exchange rates has been an important research topic for policymakers, financial analysts, and academics. Both variables provide important indicators of the state of a country's market. In the literature, the theory that determines the relationship between interest rates and exchange rates is known as the Uncovered Interest Rate (UIR) condition. The interest rate difference between the two countries should match the anticipated currency depreciation rate according to the UIP theory when markets function efficiently and investors make rational predictions. The domestic currency tends to appreciate when interest rates rise, as capital flows into the country until profit opportunities from arbitrage are exhausted. The empirical evidence contradicts the UIP theory in emerging markets because risk premia and changes in investor sentiment control the theoretical relationship more than expected. According to Engel (2016), deviations from the UIP follow systematic patterns that connect to risk premium movements and economic fundamental changes, thus highlighting the weaknesses of standard exchange rate models in real-world scenarios.

Empirical research indicates that the UIP model is not applicable in emerging market economies. The primary reason for this discrepancy stems from the time-varying risk premia, limited policy credibility, and heightened uncertainty in these economies (Fama, 1984; Flood and Jeanne, 2005). Research on Türkiye indicates that interest rate differentials primarily serve as risk premiums rather than currency appreciation expectations (Akdogan et al., 2025; Berument and Günay, 2003). The high domestic interest rates in Türkiye lead investors to view them as compensation for depreciation rather than signals of stabilisation, which violates the UIP framework. The difference between theoretical models and real-world applications led to the development of the "interest rate defense" approach, which central banks use to fight currency attacks and exchange rate volatility through aggressive interest rate hikes. Dornbusch's (1976) overshooting hypothesis, along with traditional models, predicts that such a policy should initially strengthen the domestic currency's value. Modern empirical research has generated conflicting outcomes in its findings. Montiel (2003) and Furman and Stiglitz (1998) contend that interest rate hikes during market stress periods will not stop currency depreciation and may actually trigger capital outflows while raising default probabilities and worsening economic downturns, which they term the "perverse effect."

The Turkish experience serves as a valuable case study to examine the boundaries of interest rate defense mechanisms. The Turkish central bank implemented triple-digit overnight interest rates during the 1994 currency crisis to protect its fixed exchange rate system. The research by Gümüş (2002) demonstrated through vector error correction modelling (VECM) that high interest rates produced a short-lived and statistically insignificant lira appreciation before leading to a major long-term depreciation. The 2000–2001 crisis demonstrated that large interest rate hikes were insufficient to halt the breakdown of the crawling peg system. The results validate Montiel's theoretical prediction that interest rate defenses provide only short-term benefits when fundamental credibility is absent. The 2018 Turkish lira crisis, along with the post-2021 monetary policy transformation, made this relationship more complicated. The CBRT delayed interest rate hikes during 2018, during depreciation pressures, which led to a market panic. The central bank's policy rate increase to 24% brought temporary stability to the lira, but long-term expectations remained unstable. In 2021, Türkiye abandoned standard monetary policy measures by lowering interest rates despite high inflation to implement an export-driven economic growth model. This led to a significant depreciation of the exchange rate, disrupting the relationship between the exchange rate and the interest rate (Cevik and Yıldırım, 2023). From this perspective, it can be said that the relationship between interest rates and exchange rates depends on the reliability and consistency of the economic policies implemented. The Turkish economy has undergone many policy changes since the early 2000s. In such a structure, it is more appropriate to use an econometric model with a structure that changes over time rather than a structure with fixed parameters. The dynamic conditional correlation GARCH (DCC-GARCH) model proposed by Engle (2002) provides a robust framework for understanding how the direction and degree of the relationship between variables change over time by estimating the conditional correlations over time. Bautista (2003) used the DCC-GARCH method to show how the correlation between interest rates and exchange rates changed during important economic events such as the Philippines' crises.

A review of the literature in Türkiye reveals that there are no recent studies that examine the relationship between interest rates and exchange rates in a time-varying structure. This study addresses the research gap by employing DCC-GARCH for empirical analysis across essential policy periods from 2005 to 2025. The research period extends across important economic moments in Türkiye that include the 2008 global financial crisis together with the 2013 taper tantrum and the 2018 lira crisis as well as the unorthodox monetary policy period starting in 2021. This research investigates monthly data from Türkiye regarding real interest rates and USD/TRY exchange rates to study time-dependent correlations, identify structural changes and analyse interest rate effects on exchange rate stability. The research examines a broad period to study traditional monetary transmission challenges in emerging markets and validate the restrictions affecting Türkiye's economic policy framework.

The real interest rate and the exchange rate maintained a negative correlation relationship throughout the period according to empirical findings. The correlation between real interest rates and exchange rates maintained a steady inverse relationship with minor fluctuations between −0.13 and −0.21 throughout the 2005:01 to 2021:11 period under standard policy conditions. After 2021:11, the absolute value of the correlation experienced a significant increase that peaked in early 2022 due to negative real interest rates combined with high inflation and prolonged currency depreciation. The real interest rate became an increasingly important signal for future exchange rate movements according to market participants during this period even though monetary policy credibility remained low. The exchange rate correlation weakened during mid-2023 until the new economic team took office to restore investor confidence through orthodox monetary policy measures. The interest rate–exchange rate relationship in Türkiye displays varying strength depending on monetary policy conditions and market perception of central bank credibility, which leads to stronger connections when market monitoring is high.

The following sections of the paper follow this order: Section 2 reviews both theoretical and empirical literature about emerging markets with special attention to interest rate–exchange rate nexus studies. Section 3 explains the research approach by describing the DCC-GARCH framework. The fourth section explains and interprets the empirical findings within the framework of recent economic developments in Türkiye. The final section provides a summary of the vital research findings together with their relevant policy implications.

Integrating Theoretical Frameworks in the Turkish Context

The dynamic relationship between interest rates and exchange rates in emerging markets such as Turkey is best understood by synthesising core theoretical models alongside empirical observations. The *Uncovered Interest Parity* (UIP) framework postulates that the difference between domestic and foreign interest rates is equal to the expected change in the exchange rate plus a country risk premium (Fama, 1984; Engel, 2016):

$$i_t - i_t^* = E(e_{t+1}) - e_t + RP_t \tag{1}$$

Where $\mathbf{i_t}$ is the domestic interest rate at time t i_t^* is the foreign interest rate, $\mathbf{e_t}$ is the domestic exchange rate, $E(e_t + 1)$ is the expected exchange rate at time $t + 1$ is the country risk premium incorporating both exchange and default risk on domestic bonds. Under efficient market conditions, an increase in i_t (holding $E(e_{t+1})$ and RP_t constant) should increase the current exchange rate (e_t), following traditional UIP logic.

However, Turkish evidence points to frequent deviations from the UIP—especially during periods of high inflation, political instability, or low policy credibility—due to volatile RP_t and unstable expectations (Flood & Jeanne, 2005; Akdogan et al., 2025). Monetary authorities such as the Central Bank of Türkiye have occasionally implemented aggressive interest rate defences, swiftly raising $\mathbf{i_t}$ in a bid to stabilise $\mathbf{e_t}$ (Montiel, 2003; Gümüş, 2002). Yet during episodes of declining credibility, these rate hikes can provoke the so-called perverse effect (Furman & Stiglitz, 1998; Montiel, 2003): capital outflows, rising sovereign risk, and further currency depreciation, especially as RP_t surges and market expectations $\mathbf{E}(e_{t+1})$ worsen.

$$e_t = f(i_t, E(e_{t+1}), RP_t) \tag{2}$$

with $\frac{\partial e_t}{\partial i_t} < 0$ if credibility is high, but $\frac{\partial e_t}{\partial i_t} > 0$ if risk premium and expectations deteriorate—consistent with the perverse effect and non-linear responses documented in recent Turkish crises (Gümüş, 2002; Cevik & Yıldırım, 2023). Dornbusch's overshooting model (1976) further complements this framework, positing that monetary shocks—particularly in environments of low credibility—cause exchange rates to overshoot equilibrium values, resulting in dramatic short-lived appreciation followed by depreciation as agents update expectations and risk premia. Thus, these frameworks should not be viewed as competing but rather complementary: they jointly capture how risk premia (RP_t), policy credibility, and expectations $(E(e_{t+1}))$ interconnect to shape Turkey's unique interest rate–exchange rate dynamics. DCC-GARCH modelling in recent Turkish studies finds that the strength and direction of the correlation between rates and currency varies with policy regimes and credibility events (Akdogan et al., 2025; Gayaker & Yalcin, 2025; Flood & Jeanne, 2005; Bautista, 2003):

$$\rho_{(i_t,e_t)}(t) \begin{cases} < 0 & (\text{ Credible, orthdox policy }) \\ > 0 & (\text{ Crisis, high risk premium, perverse effect }) \end{cases} \tag{3}$$

This integrated framework—supported by both local and international literature—explains the time-varying, non-linear relationship observed in Türkiye's post-2021 monetary experience.

Literature Review

Academic research on interest rates and exchange rates in emerging markets has gained new significance during the recent economic turmoil caused by COVID-19, policy changes, and rising inflation rates. The COVID-19 pandemic, policy changes, and inflationary pressures have led to an expanding body of empirical literature examining the evolving and often asymmetric relationship between interest rates and exchange rates since 2020, utilising advanced econometric techniques.

Research indicates that emerging markets exhibit unstable interest rate–exchange rate relationships, often displaying nonlinear and time-dependent patterns. Zhao (2020) analysed Chinese data using DCC-GARCH modelling, which revealed a weakly negative and dynamic correlation between interest rates and exchange rates, indicating that higher interest rates lead to domestic currency appreciation under normal market conditions. Karamelikli and Karimi (2022) studied the Türkiye using nonlinear ARDL (NARDL) analysis, which showed that the Turkish lira strengthens substantially when monetary policy tightens, but monetary policy easing does not produce equivalent weakening effects. The research demonstrates that linear models should not be used exclusively because they fail to detect long-term connections, which results in incorrect policy decisions.

With the increasing fragility in the Turkish economy since 2017, the importance of changing models over time has become more obvious. Gayaker and Yalcin (2025) used the TVP-VAR SV model to show that the negative impact of monetary policy shocks on the exchange rate has changed since 2017. In their study, they found that the exchange rate's response to positive shocks to the spread variable, which they created by taking the difference between short-term and long-term interest rates, increased starting in 2017. This indicates that during periods of declining economic confidence, the spread variable, which is related to but ineffective in place of the interest rate, became more strongly correlated with the exchange rate. İlhan et al. (2022) used a Markov transition regime model to investigate the impact of Türkiye's expansionary monetary policy between 2006 and 2019. Their findings show that structural breaks, including the transition from inflation targeting to credit-driven growth, have caused changes in monetary policy transmission mechanisms.

A study using high-frequency data, Gürkaynak et al. (2022) presented findings on how interest rates generally affect the economy during crisis periods. Their study found that interest rate cuts accelerated the depreciation of the Turkish lira during periods of high inflation. Akdogan, Halicioglu, and Demir (2025) noted in their study that the dynamics of the relationship between exchange rates and interest rates are largely dependent on credibility and risk premiums. Using a state-space model, they investigated the validity of the Uncovered Interest Rate (UIP) condition for Türkiye. According to their findings, they determined that the risk premium increased significantly after 2018 due to increased policy uncertainty, high inflation rates, and non-traditional monetary policy measures. In other words, they demonstrated that the effect of nominal interest rate increases on exchange rate stability weakened. The GARCH-based volatility study by Ozkaya and Altun (2024) revealed that the CDS spreads of Türkiye and global risk indicators caused more volatility in the lira than the domestic interest rate adjustments during the COVID-19 period. The FX market exhibits chaotic behaviour with multiple equilibria, leading to rapid exchange rate movements away from fundamental values when investors lose confidence.

The interest rate–exchange rate relationship receives essential foundational understanding from earlier empirical studies, which used multivariate GARCH models. Bautista (2003) employed DCC-GARCH to analyse weekly Philippine data, which revealed that the interest rate–exchange rate correlation does not remain constant, as it changes following capital market liberalisation and during crisis events. The positive correlation between interest rates and exchange rates during the Asian crisis demonstrated that interest rate defenses were ineffective. The research by Berument and Günay (2003) on interest rate behaviour in Türkiye demonstrated that high interest rates during the 1990s were driven by risk premiums rather than expectations of currency appreciation. Nominal interest rates often fail to accurately predict exchange rate movements unless structural risks are properly addressed.

The research by Caskurlu et al. (2008) employed BEKK-GARCH modelling to demonstrate that CBRT's FX interventions frequently failed to stabilise exchange rates, thus highlighting the restricted effectiveness of ad-hoc policy tools in volatile market conditions. Sensoy and Sobaci (2014) analysed Turkish data using DCC (cDCC) and FIAPARCH modelling to demonstrate that interest rate, exchange rate, and stock return volatility shocks produce brief correlation spikes during crisis periods (e.g., 2008–09), which fade away during periods of stability. The study by Mehmet and Dücan (2014) demonstrated, through VAR and GARCH modelling, that interest rates and exchange rates in Türkiye exhibit mutual causality, while monetary policy tends to respond after exchange rate volatility occurs. The research by Öztürk (2010) within the CBRT demonstrated that exchange rate and interest rate volatilities move together strongly, which supports the necessity of exchange rate stabilisation for monetary stability.

In this context, Öztürk (2025) employed Fourier-based cointegration techniques for the period 2006–2024 and demonstrated that while the exchange rate has a strong and persistent long-run pass-through effect on inflation, the direct impact of interest rates remained limited unless accompanied by exchange rate stability policies, reinforcing the argument that rate hikes alone are not sufficient for macroeconomic stabilisation in Türkiye. Similarly, Uçar (2024) applied a VAR framework using 2003–2024 data and found unidirectional causality running from the money supply to both the exchange rate and inflation, highlighting that expansionary liquidity policies — particularly after 2018—amplified currency depreciation and inflationary pressures through the monetary transmission channel. Complementing these findings, Okoth (2025), using ARDL-ECM and FMOLS/CCR estimators for the period 2001–2023, reported a positive long-run association between nominal interest rates, inflation, and the exchange rate, suggesting that interest rate adjustments are transmitted to inflation primarily through expectations and exchange rate channels rather than directly, implying that single-instrument monetary policy frameworks are inadequate under conditions of risk premium shocks and low policy credibility.

The empirical research demonstrates that Türkiye's interest rate–exchange rate relationship depends on state conditions and experiences structural breaks at key times, such as 1994, 2001, 2018, and 2021. The analysis of additional financial market indicators, including stock returns and CDS spreads, helps improve our understanding of policy transmission during volatile market conditions. Taken together, these recent studies reinforce the view that Türkiye's monetary transmission mechanism has become increasingly credibility-sensitive and regime-dependent, especially after 2018. However, despite the growing use of Fourier cointegration, VAR-based causality analysis, and ARDL approaches, the post-2021 heterodox policy regime has not yet been systematically integrated into a unified time-varying dynamic correlation framework that captures evolving risk-premium-driven interactions between interest rates and the exchange rate. This gap highlights the need for a dynamic modelling strategy such as DCC-GARCH to trace correlation shifts across different credibility regimes.

As understood from the literature, especially between 2013 and 2025, due to the economic events and policy changes experienced in Türkiye, the use of time-varying models such as DCC-GARCH will provide more accurate results in analysing the dynamics between interest rates and exchange rates.

Methodology

The dynamic conditional correlation GARCH (DCC-GARCH) model was proposed by Engle (2002) to analyse time-varying correlations between financial time series. In the VECH and BEKK-type multivariate GARCH models, the increase in the number of variables leads to a degree of freedom problem due to the large number of parameters that need to be estimated. The DCC model, however, addresses this issue through its two-stage structure: first, it estimates a single-variable GARCH model and then uses the error terms obtained in the first stage to estimate the correlation dynamics. The DCC-GARCH model is ideal for analysing volatility spillovers and co-movements between assets such as exchange rates and interest rates, as it allows for the examination of time-varying correlations. The assumption of constant-condition correlation in the analysis of relationships between variables can be restrictive due to changes in the dynamics of macrofinancial variables during policy changes or crisis periods. In some developing markets, the theoretical negative relationship between interest rates and exchange rates may become positive during certain periods. This phenomenon is referred to as the "inverse effect" in the literature. The DCC-GARCH model is highly useful in analysing such inverse effects because it enables the identification of correlation changes associated with specific events or market shocks.

Engle demonstrated in his work that dynamically modelling conditional correlations provides important insights into the comovements of time-dependent shocks between assets. Tse and Tsui (2002) independently developed the variable conditional correlation (VCC) model during the same period. In both approaches, the development of the conditional covariance matrix consists of two components. These are (i) variance dynamics defined separately for each series and (ii) a time-varying correlation matrix that indicates the relationship between the series. This structure enables each series to align with its own shocks through univariate GARCH responses, providing an effective method for analysing volatility transmission. The DCC component shows how past comovements affect the evolution of the correlation between series over time. The fundamental work by Engle (2002) and Tse and Tsui (2002) demonstrated that this approach provides a balanced structure between flexible correlation modelling and the minimum set of parameters required to determine the evolution of the correlation. Subsequent research has further developed this approach to address real-world issues such as asymmetries and the consistency of forecasts.

Following the foundational model proposed by Engle (2002), let r_t denote a k - dimensional vector of demeaned asset returns, such that

$$r_t \mid \mathcal{F}_{t-1} \sim \mathcal{N}(0, H_t) \tag{4}$$

The conditional covariance matrix H_t is decomposed into

$$H_t = D_t R_t D_t \tag{5}$$

Here, D_t is a diagonal matrix containing the time-varying standard deviations $\sigma_{i,t}$ of the individual return series, which are obtained via univariate GARCH models. R_t represents the time-varying conditional correlation matrix.

Each element on the diagonal of D_t denoted by $h_{i,t}$ evolves according to the standard GARCH specification:

$$h_{i,t} = \omega_i + \sum_{p_i} \alpha_{p_i} \epsilon^2_{i,t-p_i} + \sum_{q_i} \beta_{q_i} h_{i,t-q_i}, i = 1, ..., k \tag{6}$$

To model the correlation dynamics, the standardised residuals ϵ^*_t are computed by scaling the raw residuals by their conditional standard deviations:

$$\epsilon^*_t = D_t^{-1} r_t \sim \mathcal{N}(0, R_t) \tag{7}$$

This transformation normalises the variance of each return series, allowing us to separately estimate the time-varying correlation structure.

The evolution of the correlation structure is governed by the dynamics of a positive definite matrix Q_t, given by the following recursive equation:

$$Q_t = \left(1 - \sum_m \alpha^*_m - \sum_n \beta^*_n\right) \overline{Q} + \sum_m \alpha^*_m \epsilon^*_{t-m} \epsilon^{*\prime}_{t-m} + \sum_n \beta^*_n Q_{t-n} \tag{8}$$

The conditional correlation matrix R_t is then obtained by normalising Q_t :

$$R_t = diag\left(\tilde{Q}_t\right)^{-1} Q_t diag\left(\tilde{Q}_t\right)^{-1} \tag{9}$$

Here, $\tilde{Q}_t$ is a diagonal matrix whose elements are the square roots of the diagonal entries of Q_t, and $\overline{Q}$ represents the unconditional covariance matrix of the standardised residuals, typically estimated from the first-stage GARCH residuals.

The likelihood function of the DCC model, incorporating both the individual variances and the dynamic correlations, is expressed as follows:

$$\mathcal{L} = -\frac{1}{2} \sum_{t=1}^{T} \left[kln(2\pi) + 2 \ln|D_t| + \ln|R_t| + \epsilon^{*\prime}_t R_t^{-1} \epsilon^*_t\right] \tag{10}$$

The model estimation proceeds in two stages, as proposed by Engle. In the first stage, univariate GARCH models are estimated for each return series independently, assuming a constant correlation matrix (e.g., identity matrix). This method reduces the joint log-likelihood function to the sum of the individual univariate log-likelihoods. In the second step, the standardised residuals obtained in the first step are used to maximise the total probability in equation (4) and estimate the DCC parameters in equation (3). This two-step estimation approach and its theoretical properties are explained in detail by Engle and Sheppard (2001).

Empirical Results

This section reports the findings obtained from analysing the dynamic relationship between the exchange rate and the real interest rate in Türkiye from January 2005 to April 2025. The DCC-GARCH model, which focuses on changing volatility and comovement dynamics over time, was used in the analysis. The dataset consists of monthly observations, and the real interest rate was calculated by adjusting the overnight lending rate of the Central Bank of the Republic of Türkiye, used as the nominal policy rate, for inflation according to the Fisher equation. The USD/TRY exchange rate was used as the currency variable. Due to the monetary policies implemented, macroeconomic variables in Türkiye have exhibited exponential growth trends since 2018. The nonlinear patterns in the data have led to substantial growth in variance after 2018. The logarithmic transformation of the exchange rate series became necessary to achieve variance stationarity and a linear trend structure, as recommended by Türe & Akdi (2006). In the empirical analysis, the interest rate and the exchange rate are denoted by the symbols *ir* and *exc*, respectively. All data were retrieved from the Electronic Data Delivery System of the Central Bank of the Republic of Türkiye.

Before model estimation, the stationarity properties of the series were assessed using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Because DCC-GARCH models are typically specified in mean-corrected returns or stationary series, verifying the absence of unit roots is a necessary requirement for valid inference. The test results indicate that both the logarithm of the exchange rate and the interest rate series are non-stationary in levels but become stationary after first differencing, satisfying the stationarity requirement for the DCC estimation (Table 1).

Table 1

Unit Root Results

	Level		First Difference	
	ADF	PP	ADF	PP
ln(exc)	2.809	2.891	−10.953	−9.968
	(1.000)	(1.000	(0.000)	(0.000)
ir	-2.171	−1.142	−5.934	−8.634
	(0.217)	(0.700)	(0.000)	(0.000)

The values in parentheses denote the p-values corresponding to the test statistics. The null hypothesis (H_0) of both the ADF and PP tests states that the variable contains a unit root (i.e., it is non-stationary).

Subsequently, the bivariate DCC-GARCH(1,1) model was estimated to capture the dynamic conditional correlation between the two variables. The results, reported below, provide insights into the evolving nature of the correlation and volatility transmission between the interest rate and the exchange rate over the sample period.

Table 2
DCC(1, 1) estimates

Coeff.	Estimate	S.E.	*t*-value
ω_1 (Δln(*exc*)	8.2897	3.0467	2.7209
α_{11} (Δln(*exc*)	0.7396	0.4555	1.6237
β_{11} (Δln(*exc*)	0.0000	0.0166	0.0000
ω_2 (Δ*rir*)	0.0026	0.0012	2.1839
α_{21} (Δ*rir*)	0.0634	0.0205	3.0841
β_{21} (Δ*rir*)	0.9126	0.0008	1099.8573
μ_1 (Δln(*exc*))	0.5272	0.4865	1.0836
μ_2 (Δ*rir*)	0.0279	0.1754	0.1593
α^* (*DCC*)	0.0272	0.0120	2.2599
β^* (*DCC*)	0.8440	0.0966	8.7412

Log-Likelihood: −1803.228
Number of Observations: 244
Information Criteria:
AIC: 14.871
BIC: 15.028
Shibata: 14.867
Hannan-Quinn: 14.934

Table 2 reports the estimated parameters of the DCC-GARCH(1,1) model for the period January 2005-April 2025, capturing the time-varying conditional correlations between exchange rate changes and interest rate changes in Türkiye. The model includes univariate GARCH components for each series as well as dynamic conditional correlation parameters. The results for the exchange rate equation indicate a significant ARCH effect, with α_{11}estimated at 0.7396 (t = 1.62), although it is only marginally statistically significant at conventional levels. Interestingly, the GARCH term β_{11} is estimated to be zero, suggesting that volatility persistence is minimal in the exchange rate process during the sample period. This suggests that exchange rate volatility is primarily driven by short-lived shocks rather than long-term dynamics. The conditional variance constant ω_1 is positive and statistically significant (t = 2.72), supporting the existence of a baseline level of volatility. For the interest rate equation, both ARCH (α_{21} = 0.0634; t = 3.08) and GARCH (β_{21} The terms with p-values of 0.9126 (t > 1000) are highly significant, indicating strong volatility clustering and persistence. The large value of β_{21} confirms that interest rate volatility adjusts slowly to shocks, a typical feature of monetary series in emerging markets. The conditional variance constant ω_2 is also significant (t = 2.18), suggesting a steady component in the interest rate volatility. Turning to the dynamic correlation parameters, the DCC-GARCH estimates show that both the short-run (α^* = 0.0272; t = 2.26) and long-run (β^* = 0.8440; t = 8.74) components are statistically significant. The sum α^* + β^* equal 0.8712, which lies below unity, satisfying the stationarity condition for the correlation dynamics. These results imply that while shocks to the conditional correlation between interest rate and exchange rate changes have a modest immediate impact, the persistence of these shocks is high, indicating that correlation dynamics evolve slowly over time.

The estimated means ($\mu_1$and μ_2) are statistically insignificant, consistent with the assumption that the input series are zero-mean stationary processes (e.g., returns or first differences). Overall, the DCC-GARCH model effectively captures the conditional heteroskedasticity and dynamic dependence structure, with the model fit supported by a log-likelihood value of −1803.23 and information criteria within acceptable ranges.

In summary, the empirical findings reveal asymmetric volatility dynamics across the two series and confirm the presence of a time-varying, yet persistent, correlation between changes in interest rates and exchange rates. These results highlight the relevance of dynamic modelling frameworks in capturing the evolving interplay between monetary policy instruments and currency movements in an emerging market context such as Türkiye.

While Table 2 provides point estimates of the GARCH and DCC parameters, the evolving nature of the relationship between the interest rate and exchange rate changes is more effectively illustrated through graphical analysis. To this end, Figure 1 plots the time-varying conditional correlation obtained from the DCC-GARCH model, alongside the underlying series for interest rate and exchange rate changes. This visual representation enables a clearer assessment of how the strength and direction of the co-movement between these two macro-financial variables have changed throughout the sample period, particularly in response to major policy shifts and episodes of financial stress.

Figure 1

Interest rate, depreciation rate, and their correlation

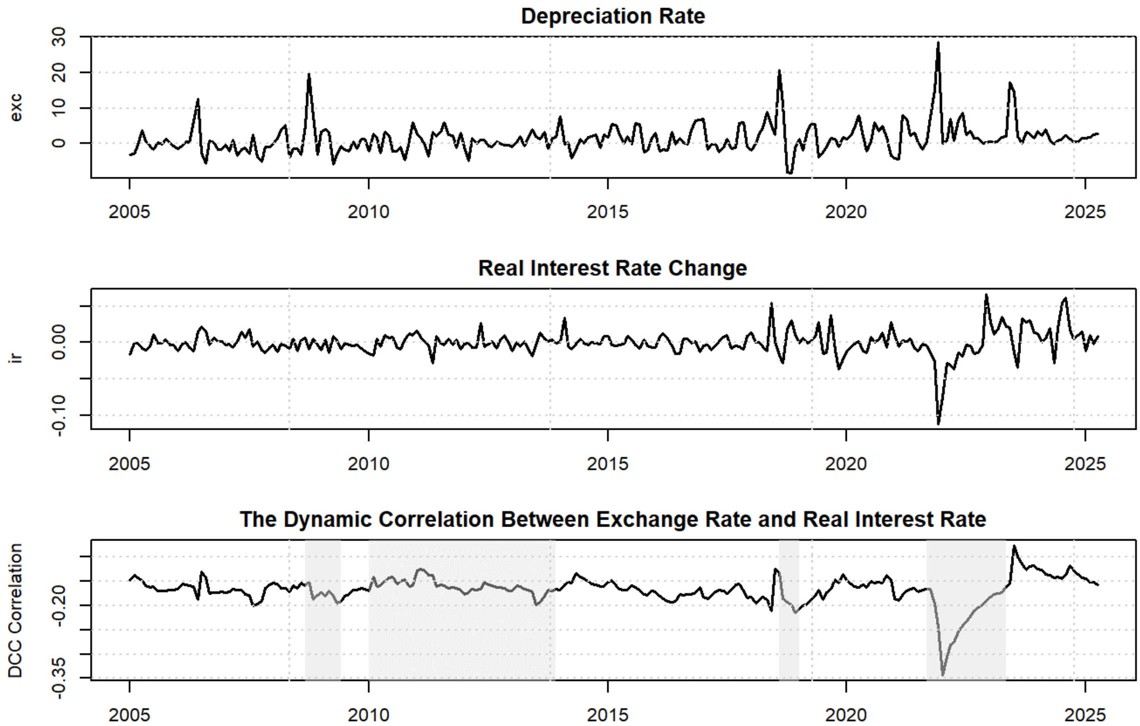

Figure 1 presents a three-panel illustration of the dynamics between the exchange rate and the interest rate over the period 2005 m01 to 2025 m04. The top panel displays the monthly depreciation rate of the domestic currency ($\Delta ln(exc)$), the middle panel shows the monthly change in the real interest rate Δrir), and the bottom panel plots the time-varying conditional correlation between the two variables, estimated using the DCC-GARCH(1,1) model.

The horizontal axis in all panels represents time (in years), while the vertical axes measure the magnitude of changes in the respective series. The depreciation rate and interest rate change are expressed in percentage points, and the correlation coefficient ranges between −1 and 1. The red dashed line in the bottom panel indicates the zero correlation threshold, enabling a clear visual distinction between periods of positive and negative comovement. Notably, the shaded areas in all three panels indicate periods of major economic or policy disturbances relevant to the exchange rate–interest rate nexus in Türkiye. Specifically, the first shaded area (2008–2009) corresponds to the global financial crisis, which triggered heightened volatility and capital flight in emerging markets. The second shaded region (2010–2013) reflects the quantitative easing era of advanced economies, characterised by large capital inflows and low global interest rates, which impacted domestic monetary dynamics. The third shaded area (2018–2019) represents the Turkish currency crisis, during which sharp depreciation and emergency interest rate hikes occurred. The final shaded area (2021–2023**)** encompasses the period of heterodox monetary policy implementation, commonly referred to as the “new economic model,” during which policy rates were significantly reduced despite rising inflation and pressure on the exchange rate. The highlighted periods facilitate a better understanding of how the observed changes impact the series data and their conditional correlation values.

The DCC-GARCH analysis revealed negative dynamic correlations between the real interest rate and the nominal exchange rate (USD/TRY) throughout the entire observation period. During the 2005:01 to 2021:11 period, correlation coefficients moved between −0.13 and −0.21 indicating real interest rate increases caused limited appreciation effects on exchange rates under standard monetary policy conditions. Research findings about Türkiye’s interest rate-exchange rate relationship match previous studies that show how the Uncovered Interest Parity (UIP) theory does not apply to emerging economies (Fama, 1984; Flood & Jeanne, 2005; Akdogan et al. 2025). The studies confirm that Turkish interest rate differentials function as risk premia instead of currency appreciation indicators, thus violating the UIP theoretical framework.

After 2021:11, the absolute correlation values between variables reached their maximum point during the entire period during 2022:01. Market participants took the negative real interest rate policy introduced through the "New Economic Model" framework as a powerful indicator of upcoming exchange rate movements. The Turkish lira lost its attractiveness through monetary policy rate reductions, thus creating a strong demand for foreign currencies, which increased the exchange rate value. The real interest rate fluctuations acted as the main determinant for market expectations during this time even though the policy credibility faced questions. The currency depreciation from 2021 post-interest rate cuts in an inflationary environment matches Cevik and Yıldırım's (2023) findings, yet the market responded more intensely to interest rate changes during this period according to the current study.

Akdogan et al. (2025) shows that risk premia expanded substantially while interest rate increases failed to stop currency depreciation. The most interesting point in this situation emerges from how market participants used real interest rate changes as useful signals despite the high risk premia. The research findings align with those of Bautista (2003) and Gayaker and Yalcin (2025), who demonstrated that certain policy regimes and market perceptions can cause interest rate–exchange rate correlations to increase.

The high negative correlation in 2022 shows similarities with the "perverse effect" identified by Montiel (2003) and Furman and Stiglitz (1998), which occurs when interest rate defenses prove useless during crises while credibility erodes. The increased relationship between real interest rates and exchange rates in Türkiye demonstrates investor responsiveness to policy guidance and economic projections rather than enhanced interest rate sensitivity.

The absolute value of the correlation between the variables declined steadily from 2023:04 until it reached its minimum at −0.07 during 2023:07. Market expectations stabilised during this specific period. Starting from 2023:07 until the end of the sample period, the correlation grew more negative until it reached −0.16 by the conclusion. The appointment of Mehmet Şimşek as Minister of Treasury and Finance on June 3, 2023 after the general elections on May 28, 2023 contributed to this correlation increase. The research shows that monetary policy credibility improvements enhance the relationship between interest rates and exchange rates, as supported by Gayaker and Yalcin (2025) and Bautista (2003). The leadership transition brought orthodox policy approaches that modified how investors viewed the situation.

The interest rate–exchange rate relationship in Türkiye exhibits dynamic behaviour because it reacts differently based on various economic and policy conditions. Volatility shocks together with confidence factors prove essential in determining this relationship according to Sensoy and Sobaci (2014) and, Öztürk (2010). The DCC-GARCH model provides an effective way to detect temporal variations and governance transitions across different policy periods.

Conclusion

This study investigated the dynamics of real interest rates and the nominal exchange rate (USD/TRY) in Türkiye between 2005 and 2025 using the DCC-GARCH model to account for the changing nature of their relationship during different monetary periods. The empirical evidence demonstrates that real interest rates and exchange rates showed a negative correlation throughout the analysed period. Real interest rates and exchange rates demonstrated a stable inverse relationship from 2005:01 to 2021:11, as indicated by the correlation range between −0.13 and −0.21.

A significant change emerged in 2021:11 as the absolute correlation values climbed steeply to reach a maximum of −0.21 during the "New Economic Model" phase when real interest rates were negative, inflation was high, and the exchange rate experienced upward pressure. During this period, market participants interpreted the real interest rate changes, despite limited policy credibility, as robust signals about future exchange rate movements. The market's enhanced sensitivity demonstrates an increased response to policy direction and macroeconomic expectations rather than a revival of traditional transmission mechanisms.

The absolute value of correlation dropped to its lowest point at −0.07 in 2023:07 and then started rising back to −0.16 when the study ended. The correlation strength increased at the same time when Mehmet Şimşek took the position of Minister of Treasury and Finance, thus indicating a shift towards orthodox policies along with enhanced market trust. The research supports the conclusion that better policy credibility enhances the power of interest rates to influence currency values. The evidence shows that interest rate adjustments cannot stabilise exchange rates unless they form part of a clear macroeconomic policy framework supported by credibility and consistency in communication. The 2021-2022 Turkish experience showed that lowering interest rates in an inflationary period results in fast depreciation, but the 2023 developments indicate that trustworthy policy changes can improve market trust while enhancing monetary signal effectiveness.

Based on the DCC-GARCH correlation path, policy implications should be interpreted period-specifically rather than through general theoretical expectations. For instance, during 2021–2022, when the correlation moved towards its historical peak in absolute terms (-0.21), the real interest rate acted less as a price instrument and more as a credibility signal. This suggests that in low-credibility regimes, interest rate decisions are not transmitted via traditional UIP channels but operate as a proxy for anticipated policy reversals.

Conversely, the partial recovery of correlation after mid-2023 (-0.16) shows that the same nominal adjustment in interest rates can have stronger currency effects once policy guidance and communication restore a degree of expectation anchoring. This finding aligns with Bautista (2003) and Flood and Jeanne (2005), who argue that correlation regimes contain more information for policymakers than static interest rate elasticities.

Therefore, instead of evaluating monetary policy merely through the level of the policy rate, the results indicate that policymakers should monitor the time-varying correlation itself as a high-frequency credibility indicator. A rising negative correlation—as observed after 2023—is not only a statistical outcome but also a measurable sign that policy signals are once again being priced in by currency markets.

The DCC-GARCH methodology enables policymakers in emerging economies to track monetary policy instruments alongside exchange rate behaviour by showing how markets adapt to changing conditions. The correlation structure obtained in this study can thus be operationalised into a policy monitoring tool: when the correlation weakens (as in mid-2023), it signals that interest rate decisions are no longer interpreted as meaningful, whereas a strengthening correlation (2023–2025) reflects the restoration of transmission credibility.

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