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EFFECTIVENESS OF THE INTEREST RATE TRANSMISSION CHANNEL UNDER DIFFERENT EXCHANGE RATE REGIMES: EMPIRICAL FINDINGS FROM THE TURKISH ECONOMY

Abstract

Purpose: The primary aim of this paper is to investigate the effectiveness of the interest rate transmission channel in the Turkish economy for different exchange rate regimes.

Methodology: In this study, the TVAR model is estimated covering the period from 2002:1 to 2023:12. Furthermore, impulse response functions obtained from the linear VAR model are also included for comparison. The endogenous variables vector consists of the short-term interest rate, the nominal exchange rate, industrial production, and consumer prices, whereas the annual percentage change in the nominal exchange rate is used as the threshold factor.

Results: Based on empirical findings, 12.21% is calculated as the optimal threshold value. Thus, periods of higher exchange rates are defined as periods in which the nominal exchange rate increases at or above this value. The empirical results from the threshold VAR model, the interest rate transmission channel is only effective for the Turkish economy in the lower exchange rate regime.

Conclusion: The study concludes that, to increase the efficiency of the interest rate channel, the central bank should also consider the exchange rate markets.

Keywords: Interest rate transmission channel, exchange rate, threshold VAR

1. Introduction

The effectiveness of monetary policies depends heavily on achieving inflation targets, which are defined and publicly announced by central banks. On the other hand, monetary policy instruments are designed to guide aggregate demand and inflation expectations accordingly. Changing monetary policy affects the real economy through monetary transmission mechanisms, in which changes first occur in monetary policy instruments, influencing economic agents' decision-making processes, resulting in fluctuations in production and general price. Monetary transmission determines the degree to which changes in monetary policy affect aggregate demand and production, and determines the time lag with which these changes take place (Yalçın & Gürel, 2020, p. 444).

Changing central bank economic objectives may result in a change in monetary policy regimes, which may have a positive or negative effect on the functioning of monetary transmission channels. The Central Bank of the Republic of Turkey (CBRT) has changed its policy instruments and economic objectives several times since the early 2000s. For example, following the 2001 economic crisis, the government implemented the Transition to a Strong Economy Program, adopting an inflation targeting regime along with various structural reforms. During this period, the CBRT made price stability its ultimate goal, with the CBRT being granted operational independence. However, following the 2008 global financial crisis, central banks worldwide adopted a new approach toward financial markets. Similar to many central banks, starting in 2010, the CBRT incorporated financial and price stability into its objectives (Güvenoğlu & Serel, 2020, pp. 446–447). To this end, it expanded its use of traditional monetary policy instruments while adopting a new approach.

This study examines the effectiveness of the interest rate channel with the nonlinear Threshold Vector Autoregression (TVAR) model in which the annual percentage change of the nominal exchange rate was used as the threshold factor. For comparison purposes, the results of the linear VAR model are also included in the study. The analysis used monthly data when the Turkish economy adopted an implicit inflation-targeting regime, specifically from January 2002 to December 2023. The endogenous variables included in the VAR model were the shortterm interest rate, exchange rate, industrial production, and consumer price indexes.

The next section provides theoretical explanations of the monetary transmission, particularly the interest rate transmission channel. This is followed by a general overview of monetary policies implemented in the Turkish economy since the implicit inflation-targeting period. The third section presents selected empirical studies from the literature on the interest rate transmission channel. The fourth section explains data and the TVAR model. Finally, after interpreting the findings, the study ends with the conclusion.

2. Monetary transmission mechanism and monetary policies implemented in Turkey

The monetary transmission reveals the impacts of monetary policy decisions on economic activity and the overall price level. The extent, channels, and time lag over which these effects occur can also be assessed through monetary transmission mechanisms. Because these mechanisms may vary depending on the condition, size, and openness of the economic structure, these functions can be different across countries (Cengiz, 2009, p. 226).

The central bank, economic agents, the financial sector, and policies enacted by both domestic and international authorities are the components of this mechanism (Warjiyo & Juhro, 2019, p. 115). In spite of its effectiveness, monetary policy may occasionally produce undesirable consequences, and therefore, policymakers need to carefully assess not only the potential impacts, but also the timing of monetary interventions (Mishkin, 1995, p. 4). Generally, there are four main transmission channels: interest rates, asset prices (stocks and credit), exchange rates, and expectations. These transmission channels influence economic activity and price levels through the decisions of the central bank. For example, based on the interest rate transmission channel, a decrease in policy rates following monetary expansion reduces the cost of capital, leading to an increase in investment expenditures. This increase in investment spending, in turn, induces aggregate demand, and the transmission is complemented by an increase in output level (Mishkin, 1996, p. 2). An essential feature of the monetary transmission is that transmission channels do not operate independently, but rather as complementary elements of related transmissions (CBRT, 2013, pp. 5–7).

Domestic and global crises, the state of the economy, and developments in financial markets often influence the policy regimes adopted by central banks (Balmumcu & Süslü, 2017, p. 11). For instance, in the aftermath of the 2001 economic crisis, the CBRT introduced a floating exchange rate regime and implemented structural reforms to achieve its main objective of price stability. Additionally, the central bank gained operational independence, allowing it to determine its own monetary policy and instruments. The new regulation also prevented using resources of the central bank for public financing. Consequently, the CBRT revised its policy framework by adopting an inflation-targeting regime, prioritizing price stability and utilizing short-term interest rates as the main policy instrument (CBRT, 2018, pp. 14–15). Countries adopting an inflation-targeting regime while operating under a floating exchange rate system can draw on several technically different approaches to determining the primary policy instrument. However, short-term interest rates are revealed through changes in the balance sheet size of the central bank (Kara, 2015, p. 3). If the short-term policy interest rate is the primary tool, then the transmission of interest rate shocks through specific monetary transmission channels and the extent to which these channels can affect macro-financial risks are not key concerns. In other words, for the monetary authority, the key objective is to steer inflation back toward the target. However, for a monetary authority that values financial stability, it may be insufficient to rely solely on the policy interest rate. Instead, it may be necessary to investigate both the exchange rate and the credit channels separately (Kara, 2012, p. 7).

In the last quarter of 2008, economic policymakers implemented policies to mitigate the adverse effects of the global financial crisis. In order to maintain the effectiveness of the credit markets and the financial system, the CBRT provided liquidity support and lowered interest rates. The post-crisis increase in short-term capital inflows to emerging economies contributed to the appreciation of the Turkish lira and facilitated easier access to credit. Accordingly, the Turkish economy experienced a greater divergence between domestic and external demand. The weight of portfolio investments and short-term capital inflows increased in order to finance the resulting current account imbalance. Due to growing concerns about financial and macroeconomic stability, alternative policy approaches have been proposed. Consequently, from 2010, the CBRT began to address macro-financial risks in its policy statements (Başçı & Kara, 2011, pp. 2–4).

The CBRT has strengthened its inflation-targeting framework by including both price and financial stability as key objectives. In addition to employing short-term interest rates as its primary policy tool, the central bank has introduced complementary instruments, such as interest rate corridors, reserve option mechanisms, and reserve requirements. Through these new instruments, the CBRT focused on credit and exchange rate channels to sustain both price and financial stability (CBRT, 2013, pp. 12–13). Following the normalization of global monetary policies, a new roadmap has been defined. Accordingly, starting in August 2015, the central bank narrowed the interest rate corridor and simplified the funding provided to other commercial banks (CBRT, 2018, p. 15).

Following the declaration of the new coronavirus (COVID-19) pandemic by the World Health Organization in 2020, central banks have been forced to reassess their monetary policies to minimize its economic effects. In order to minimize the effects of the pandemic on Turkey's financial and real economies, the CBRT continued to reduce interest rates, which began in in July 2019, and continued to do so between March and May 2020. In this period, the one-week repo auction interest rate was the most frequently used tool of monetary policy. Meanwhile, the bank employed expansionary policies to boost consumer confidence, reduce financing costs, and increase employment and growth (Ülger Danacı, 2022, p. 118; CBRT, 2020). As a result of the monetary expansion during the pandemic, there has been an increase in the overall price level and exchange rate volatility, as well as a crisis in the balance of payments. The CBRT responded to these developments by implementing monetary tightening measures in November 2020 (Kuzucu, 2022, p. 276), but by 2021 it reverted to expansionary monetary policy measures. To be more specific, the policy interest rate was gradually reduced by 500 basis points between September and December 2021. In this period, the Turkish lira depreciated by approximately 50% against the U.S. dollar (İlhan, 2024, p. 286). The base effect reduced the rate of increase in the nominal exchange rate in 2022, but the depreciation continued. In June 2023, the bank once again tightened its monetary policy.

3. Literature review

In the empirical literature, the interest rate transmission mechanism has primarily focused on determining the effects of policy interest rates on the overall price level and production. The number of studies on the pass-through of interest rates has also increased in recent years. There is also an interesting aspect of the literature related to the general tendency to use VAR models (Bagliano & Favero, 1998: 1170). Despite its simplicity, this approach has the advantage of demonstrating the effects of monetary policy shocks on the economy by using a minimal number of restrictions. VAR models assume all variables are endogenous, which is a significant advantage for investigations into dynamic interrelationships within the economic system. This framework also provides insight into the specific transmission channels through which these effects are propagated (Örnek, 2009, p. 105; Bayır, 2020, p. 72).

Employing the panel VAR model, Papadamou et al. (2015) investigated the impact of central bank transparency on the interest rate channel across 23 emerging markets over the period 1998–2010. The empirical findings indicate that monetary policy is more effective during the higher transparency periods. Saldías (2017) employed the TVAR approach to assess the effectiveness of the interest rate channel under varying financial stress regimes in Australia, Canada, the U.K., and the U.S. from January 1984 to October 2014. The results suggest that monetary policy exerts a stronger influence on output during periods of lower financial stress. Using a panel VAR methodology, Brownbridge et al. (2017) investigated the role of financial inclusion in shaping monetary policy transmission mechanisms across four African countries between 2001Q1 and 2016Q4, finding that economies with higher levels of financial inclusion exhibit more effective transmission channels. Montes and Gea (2018) analyzed the effect of central bank transparency on monetary policy transmission across 48 economies from 1998 to 2014, reporting that greater transparency is associated with lower policy interest rates and reduced volatility.

Employing the dynamic factor model, Lopez-Buenache (2019) examined the effectiveness of the U.S. monetary transmission channel from April 1973 to May 2016. The impulse response functions derived from the model display consistent patterns up until the onset of the Great Recession, after which they diverge significantly. Examining the 2000:1–2019:7 period for four Eurozone countries using the VAR method, Durcova (2021) showed that responses to interest rate shocks are consistent with theoretical expectations but neither strong nor stable. Li et al. (2021) applied a nonlinear autoregressive distributed lag (NARDL) model to weekly data from the first week of 2015 to the last week of 2018 to examine the transmission of the interest rate channel in the Chinese economy. The findings indicated that the effect of interest rate liberalization on the transmission mechanism was not as strong as expected. At the same time, policy interest rate cuts also did not have the desired effect on the real economy.

Using panel data analysis for 37 African economies over the period 1990–2017, Fiador et al. (2022) reported that financial development enhances the effectiveness of monetary policy transmission. Galindo and Steiner (2022) employed ARDL and NARDL to study the Colombian economy from 2002:5 to 2022:1. The researchers found that the policy interest rate is a significant factor in setting deposit and loan retail interest rates, whereas interest rate passthrough differs across types of products. Using the ARDL method, Oyadeyi (2023) investigated the effect of financial development on interest rate pass-through in the Nigerian economy for 1981–2021. Financial development weakens the impact of monetary policy on transmission. Taş and Yılmaz (2023) used panel data analysis to examine the effectiveness of the interest rate channel in developed economies from 1995 to 2021. Panel causality tests and structural break panel cointegration analysis were conducted, followed by a panel VAR model specification. The results showed that interest rate shocks had only limited effects on economic activity, while the general price level responded weakly to interest rate shocks.

Several studies have examined the interest rate transmission channel for the Turkish economy. For instance, Doğan (2012) employed the VAR model to assess the effectiveness of this channel using quarterly data from 2000Q1 to 2011Q3. The results indicate that production volume decreased following the interest rate shock, whereas general prices increased in the short term. Saraç and Uçan (2013) examined data from 1990Q1 to 2011Q4 by means of the Kalman filter and identified narrowing and expansionary periods. Based on the results, it was concluded that the inflation-targeting regime not only effectively reduced inflation but also improved the transmission of interest rates. Using the VAR model with the Discrete Sample Chow Test, Arabacı and Baştürk (2013) examined the effectiveness of the channel from May 2001 to May 2008. In light of the initial findings, the sampling period was divided into two sub-periods: 2001–2004 and 2004–2008. Based on the impulse response functions derived for these sub-periods, the interest rate transmission channel appears to have become more effective after 2004.

Employing the ARDL model, Şıklar et al. (2016) examined the transmission mechanism of the policy interest rate for the Turkish economy with monthly data between 2003 and 2013. Based on the findings, the pass-through of the policy rate to individual interest rates in the banking sector is more substantial than its impact on economic activity and prices. Moreover, the policy interest rate has positive and negative effects on economic activity and prices, respectively. Taking into account the divergence between market and policy interest rates in Turkey due to the unconventional monetary policies, Binici et al. (2019) examined the interest rate transmission mechanism in the Turkish economy by using alternative interest rates. Specifically, researchers conducted the panel data approach from June 2010 to December 2014 to investigate the interactions between distinct short-term interest rates and credit/deposit rates regarding the transmission mechanism. Results indicated that credit/deposit interest rates were more sensitive to effective interest rates than to policy rates. In particular, monetary transmission was driven by the interbank interest rate. Using the TVAR model, Özdemir (2020) analyzed the reaction function of the central bank under different exchange rate regimes from 2002:1 to 2017:8. The findings show that the effectiveness of interest rate channels is asymmetric, depending on the prevailing exchange rate regime. In particular, the Taylor rule holds for the high exchange rate regime. Lastly, Baştav (2020) used Toda-Yamamoto and Granger causality tests to investigate the effectiveness of the interest rate channel from 2011Q1 to 2018Q2. The findings indicated that the interest rate channel was not effective. More specifically, an increase in demand resulted in an upward movement in prices, thereby affecting interest rates.

4. Dataset and methodology

The CBRT adopted implicit inflation-targeting for the first time in 2002. Hence, the present study examines the impacts of the interest rate transmission channel on Turkey's economy under different exchange rate regimes from this year using monthly frequency data from 2002:1 to 2023:12, depending on the availability of the data set. The variables included in the analysis were derived from the Federal Reserve Economic Data and International Financial Statistics.

In this study, the short-term interest rate (*int*), the nominal exchange rate (*er*), and the industrial production index (*ip*) represent monetary policy, exchange rate, and economic activity variables, respectively. The nominal exchange rate is defined as the value of the U.S. dollar against the Turkish lira, while the industrial production index is preferred to represent economic activity due to its larger sample size and higher frequency. Finally, the general price level is indicated by the consumer price index (*cpi*).

The estimated VAR model is expressed in the following linear form:

$$Y_t = \sum_{i=1}^{p} A_i Y_{t-1} + \varepsilon_t \,. \tag{1}$$

In this model, the vector of endogenous variables at time t is represented by $[int_t\ er_t\ ip_t\ cpi_t]'$. In the system of equations above, where the coefficient matrix is denoted by the symbol A, the structural shocks at time t are represented by ε_t.

The linear VAR models developed by Sims (1980) describe the relationships among variables and reveal how shocks are transmitted dynamically within the system. However, these models may be inadequate in the presence of regime shifts (Koç & Akgül, 2013, p. 45). For this reason, after estimating the linear VAR model, the effectiveness of the interest rate transmission mechanism is also examined in a nonlinear structure. Instead of predefining potential regime changes, the TVAR model, which allows for the endogenous investigation of regime shifts, analyzes the nonlinear nature of monetary transmission. The state process is the key difference that distinguishes threshold regression or TVAR models, which allow for regime change analysis, from Markov Regime Switching (MS) models. The state process, which reflects nonlinear dynamics, is latent (implicit) in MS models. On the other hand, in the prediction process of threshold models, nonlinear effects are maintained through observable changing variables (Chan et al., 2017, p. 159).

The estimated TVAR model is defined based on Balke (2000) and Atanasova (2003) as follows:

$$\begin{aligned} Y_t &= A^1 Y_t + B^1(L) Y_{t-1} + \\ &(A^2 Y_t + B^2(L) Y_{t-1}) I(c_{t-d} < \gamma) + U_t. \end{aligned} \tag{2}$$

In this equation, t and d represent the time dimension and the lag parameter, respectively. As previously stated, Y_t consists of a vector of endogenous factors. The polynomial lag matrices are represented by $B^1(L)$ and $B^2(L)$, and U_t denote the error terms, which are independent and identically distributed. The threshold variable, which indicates the regime in which the system operates, and its optimal values, calculated endogenously, are represented by and , respectively. The dummy indicator function, denoted as , is equal to 1 when the threshold variable reaches or exceeds its optimal $(c_{t-d} \geq \gamma)$. In contrast, when $(c_{t-d} < \gamma)$, the dummy variable function takes a value of 0. In the TVAR model, in addition to the changes in the lag polynomials depending on the regime, the contemporaneous relationships between the variables may also differ. Thus, the coefficients A^1 and A^2 represent the structural contemporaneous dynamics of the variables in two different regimes (Balke, 2000, p. 344; Atanasova, 2003, p. 6; Çatık & Martin, 2012, p. 1441; Çatık & Karaçuka, 2012, p. 1238).

In the model, the threshold variable is defined as the annual percentage change in the nominal exchange rate. That is, in addition to the linear VAR results, the study evaluates the effectiveness of the interest rate transmission channel under both higher and lower exchange rate regimes. Before estimating the TVAR model, specific preliminary analyses must be conducted. More specifically, the test developed by Tsay (1998) should be used to examine whether the estimated model is linear. This test is designed to test the nonlinearity of threshold effects in a multivariate model, specifically for situations where the model might exhibit nonlinearity in a single equation-ordered regression setting.

After defining the lag parameter d using the $C(d)$ test, the optimal value of the threshold, denoted by γ, must be determined. To identify the optimal threshold value, the model is estimated separately for all potential breakpoints of the threshold variable using the least squares method. In simpler terms, the threshold variable is divided into reference lines (a grid) that encompass all potential breakpoints before the TVAR model is calculated separately for each reference value. The value that minimizes the chosen selection criterion is defined as the optimal threshold value (Balke, 2000, p. 345). After determining the threshold value, the values greater than or equal to the threshold are defined as belonging to the higher regime, whereas the values smaller than the threshold are defined as belonging to the lower regime. By calculating the impulse response functions for both regimes, the researcher can then determine how the behavior of the interest rate transmission mechanism changes in line with the specific exchange rate regime.

In a linear VAR, the responses remain constant over time and are symmetric with respect to the magnitude and direction of structural shocks. However, linear responses may fail to accurately capture the effects of the shock when the likelihood of regime shifts during the response period is non-negligible. These foundational assumptions are relaxed in nonlinear models such as the TVAR model. Accordingly, Koop et al. (1996) introduced generalized impulse response functions, which account for the possibility that certain shocks may induce transitions between regimes (Tsagkanos et al., 2018, p. 389).

Considering the nonlinear structure of the TVAR model, given the knowledge of the value of an external shock, i.e., u_t, the generalized impulse response functions are identified as the change in the conditional expectation of Y_{t+k} (Balke, 2000, p. 346; Atanasova, 2003, p. 9):

$$E[Y_{t+k}|\Omega_{t-1}, u_t] - E[Y_{t+k}|\Omega_{t-1}] \, . \tag{3}$$

Here, the information set up to period t is represented by Ω_{t-1}, while u_t represents the error terms in the standard linear VAR model. The vector containing the responses of the variables at the horizon k is Y_{t+k} (Tsagkanos et al., 2018, p. 389). According to the above model, calculating the generalized impulse responses requires knowing the quantitative magnitude and direction of u_t, as well as the initial conditions, i.e., Ω_{t-1}. The conditional expectations, i.e., $E[Y_{t+k}|\Omega_{t-1}, u_t]$ and $E[Y_{t+k}|\Omega_{t-1}]$, are obtained through model simulation (Atanasova, 2003, p. 10).

5. *Empirical findings*

Before model estimation, time series exhibiting seasonality were adjusted for these effects using the TRAMO-SEAT method. The interest rate is considered at its level value, while the other variables included in the analysis were log-transformed. The stationarity properties of the series were examined using the Lee and Strazicich (2003) unit root test, which allows for two structural breaks. The test defines structural breaks in two ways: Model A (Crash Model), which incorporates breaks in the intercept, and Model C (Trend Break Model), which encompasses breaks in both the intercept and the trend (İlhan & Akdeniz, 2020, p. 264). The test results are displayed in Table 1.

The test results show that, for the level values of the series, the short-term interest rate and exchange rate variables in Model A contain a unit root. In contrast, the consumer price index at the level value is not stationary for either Model A or Model C. The results for the first differences of the variables indicate that all the series are stationary. The break dates for the level values of the variables indicate that both local and global shocks caused breaks in the series.

Table 1 Lee-Strazicich structural unit root test

Variables	Model A (Crash Model)		Model C (Trend Break Model)	
Level	**LM Statistics**	**Break Dates**	**LM Statistics**	**Break Dates**
int	-2.276	2005:1–2018:7	-5.823***	2006:3–2008:10
er	-1.826	2018:7–2021:10	-4.950*	2013:4–2021:2
ip	-5.181***	2007:11–2018:7	-6.676***	2008:7–2010:12
cpi	-1.655	2005:7–2018:9	-4.116	2010:2–2020:1
First Difference	**LM Statistics**	**Break Dates**	**LM Statistics**	**Break Dates**
int	-5.282***	2005:6–2012:12	-8.956***	2005:9–2018:10
er	-3.491*	2010:9–2016:12	-14.428***	2008:3–2021:8
ip	-11.201***	2009:5–2018:11	-21.531***	2016:11–2020:7
cpi	-6.055***	2018:7–2021:10	-10.182***	2018:6–2021:5

Note: *, **, *** denote the statistical significance levels of 10%, 5%, and 1%, respectively. The optimal lag length was selected based on the general-to-specific modeling approach.
Source: Authors' estimation

After the unit root analysis, the threshold nonlinearity test was conducted as part of the preliminary tests necessary for estimating the TVAR model. The results, presented in Table 2, show that the probability values for the test statistics are significant for all delay parameters, which indicates that the usage of the nonlinear model is appropriate.

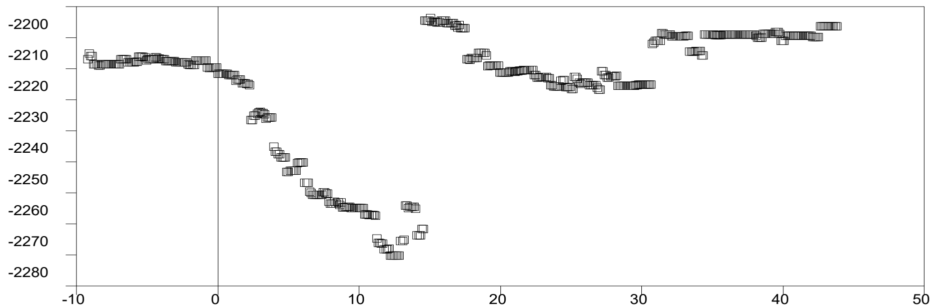
Table 2** C(d) **Test statistics

Delay Parameter	Recursive Estimates	Test Statistics	Probability Values
1	50	52.38	0.000
1	100	50.08	0.000
2	50	36.43	0.013
2	100	35.52	0.017
3	50	44.37	0.001
3	100	39.70	0.005
4	50	43.86	0.001
4	100	43.05	0.002

Source: Authors' estimation

Recursive estimation was performed for the potential threshold points of the threshold variable. In calculating its optimal value, the 10-90 percentiles were defined as the breakpoints, while the TVAR model was estimated separately for each of the 500 reference lines using the Akaike Information Criterion (AIC). The value where this criterion was minimized was defined as the optimal value of the threshold variable. Figure 1, which presents the AIC values calculated for each breakpoint, indicates that the optimal value of the threshold is obtained at an AIC value of -2270.196, corresponding to 12.213. In other words, the higher exchange rate regime becomes valid where the threshold value reaches 12.213.

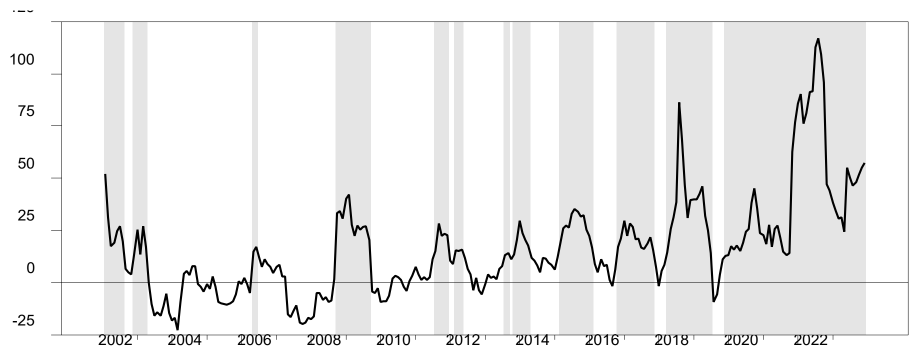
Figure 1 AIC values for arranged regression and break points



Source: Authors' estimation

Figure 2 provides a graphical representation of the threshold variable, with the dark bands representing those periods when the higher exchange rate regime is valid.

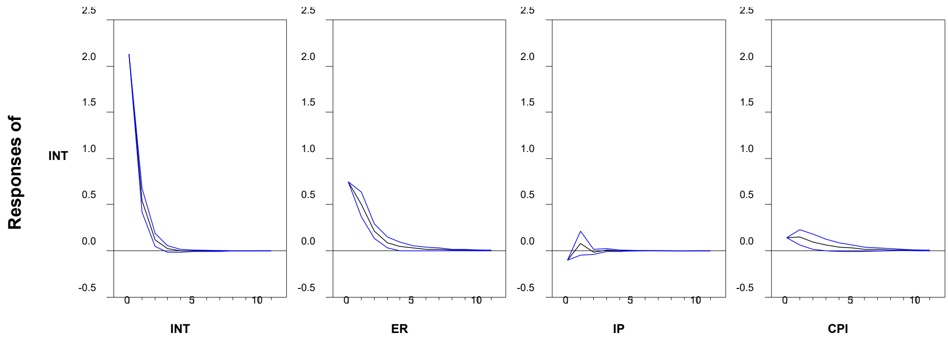
Figure 2 Threshold variable



Source: Authors' estimation

As shown in Figure 2, the exchange rate in Turkey fluctuated sharply between 2002 and 2023. In particular, due to structural reforms and the prevailing economic environment, the Turkish lira appreciated significantly after the 2001 financial crisis. The most extended period of the lower exchange rate regime was from 2003 to 2008, before the global financial crisis led to a significant increase in exchange rate volatility, with the nominal exchange rate sharply rising due to capital outflows. On the other hand, global monetary expansion mitigated the effects of the crisis as capital inflows into emerging economies, including Turkey, accelerated. To minimize the negative effects of capital flows, the CBRT began reducing the policy rate and expanding the interest rate corridor downward from the end of 2010 (CBRT, 2012, p. 34). Therefore, between 2010 and 2014, the lower exchange rate regime generally dominated. However, this relatively stable period was disrupted in 2018 due to a political crisis with the United States, leading to sharp increases in the exchange rate. In September 2018, for example, the Turkish lira depreciated by nearly 80% against the U.S. dollar (İlhan et al., 2023, pp. 164–165). In response to the exchange rate shock, the CBRT made an active monetary policy to help curb the Turkish lira's depreciation (Ulug et al., 2023, p. 2864). The tight monetary policy during this period allowed for monetary easing during the early months of the pandemic. The CBRT significantly reduced the policy interest rate to stimulate production, which led to inflation and exchange rate increases after the pandemic. Accordingly, as shown in Figure 2, the higher exchange rate regime has generally dominated since 2018.

Figure 3 Linear VAR responses



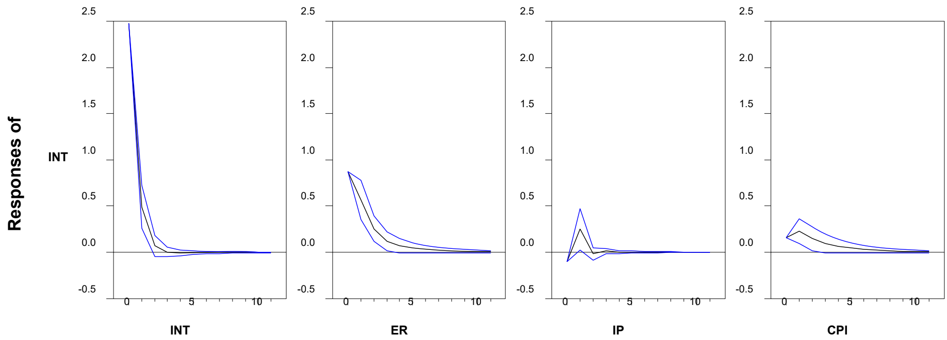
Source: Authors' estimation

Before estimating the TVAR model, the impulse response functions derived from the linear VAR can be compared. Figure 3 shows the responses of the components of the endogenous variable vector over 12 periods following a positive shock to the short-term interest rate.

As shown in Figure 3, the response of the short-term interest rate to its shock is positive and gradually diminishes over time. Similarly, the nominal exchange rate responds positively to a contractionary policy shock, with this response ceasing by the end of the 5th period. As expected, the industrial production index reacts negatively to an interest rate increase. However, this response is statistically significant only in the first period. Finally, the response of the consumer price index to a contractionary policy shock is statistically significant, although its positive direction suggests that the monetary transmission does not function as expected.

Based on the linear VAR model responses in Figure 3, it is not possible to claim that the interest rate transmission channel operated effectively during the sample period. Figures 4 and 5 present the responses of the endogenous variable vector to a contractionary monetary policy under the higher and lower exchange rate regimes, as defined by the TVAR model for a 12-period horizon. They show that, following a positive shock to the short-term interest rate, the responses under the higher exchange rate regime are similar to those derived from the linear VAR.

Figure 4 Higher exchange rate regime

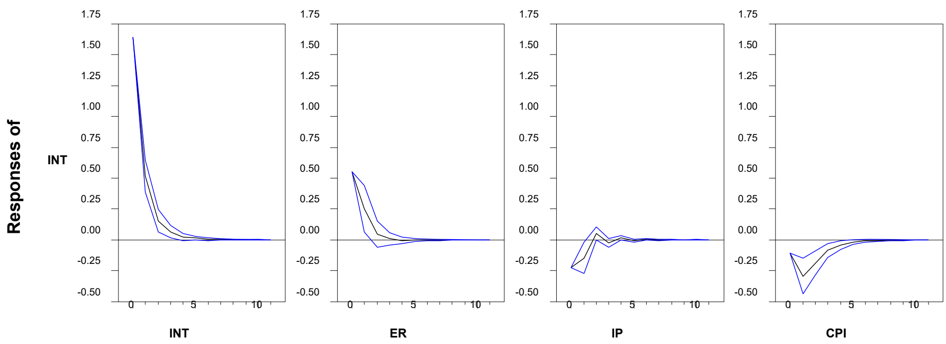


Source: Authors' estimation

More specifically, the response of the short-term interest rate to its shock is positive and gradually converges to zero. Likewise, the response of the nominal exchange rate to a contractionary policy shock is also positive but diminishing after the 5th period. The industrial production index, which represents economic activity, reacts negatively but is significant only in the first period following the shock. Like the responses obtained from the linear VAR model, the consumer price index reacts positively and statistically significantly to the short-term monetary policy shock, which contradicts the theoretical expectations of the monetary transmission mechanism.

Figure 5, which presents the responses obtained from the threshold VAR model under a lower exchange rate regime, shows that when the shock is applied to the short-term interest rate, the response of each variable to its shock is positive and gradually diminishing. Similarly, the response of the nominal exchange rate to a contractionary monetary policy shock is also positive and statistically significant up to the 3rd period. The response of the industrial production index to the contractionary policy shock is negative and remains significant until the end of the 2nd period. The response of the consumer price index to a positive policy shock is negative, which is different from the responses in the other models, which gradually decrease closer to zero after the 5th period. Based on the results obtained from both the linear VAR and TVAR models, it can be concluded that the interest rate channel is effective under the lower exchange rate regime.

Figure 5 Lower exchange rate regime



Source: Authors' estimation

6. Conclusion

Researchers examining the effects of monetary policies on the real economy do not agree on how the intermediate phases of this process function. These uncertainties in studies regarding the effects of monetary policy have led to the characterization of the monetary transmission mechanism as a "black box" (Bernanke & Gertler, 1995, p. 27).

Due to the complex nature of the monetary transmission and its effectiveness, which may vary depending on the implemented monetary policy and the instruments used, it is more appropriate to use nonlinear models for empirical analysis. In this context, the TVAR model is employed to examine the effectiveness of the interest rate channel in the Turkish economy for the period from 2002:1 to 2023:12. The threshold value is obtained based on the annual percentage change in the nominal exchange rate because the stability of the price level is critically dependent on it (Büyükakın et al., 2009, p. 187).

Results indicate that the high exchange rate regime occurs at or above the estimated optimal threshold of 12.21%. The study also presents results from linear VAR models for comparison purposes. The findings from the linear model suggest that the exchange rate responds positively to contractionary shocks, whereas economic activity responses are generally insignificant. In contrast to the transmission mechanism, contractionary monetary policy shocks lead to an increase in the price level. Endogenous variables also behave similarly to policy shocks in the higher exchange rate regime. Conversely, under the lower regime, an interest rate shock results in a decline in prices. This aligns with theoretical expectations. Furthermore, the exchange rate responds positively to contractionary monetary policy, whereas economic activity reacts in the opposite direction. Overall, empirical evidence supports the analysis of Özdemir (2020) within a nonlinear framework of the Taylor model.

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