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## Interest Rates, Exchange Rates and Macroeconomic Performance

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### Abstract

In recent years, there has been a renewed interest in the fact that a change in exchange rates has an impact on main economic indicators and therefore on macroeconomic performance. The aim of this paper is to study the implications of the relationship between exchange rates and changes in short-term interest rates on macroeconomic performance in the Turkish economy. The results of this study show that monetary policy shocks may affect financial sector and real sector through exchange rates.

**Key Words:** Interest Rate, Exchange Rate, VAR Analysis.

**JEL Classification Numbers:** C13, E40, E52, E58.

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## **INTRODUCTION**

Although there has been little agreement in the literature, exchange rates are thought of as variables influenced by monetary policy. According to Dekle et al. (2001), in reviewing the literature there have been two aspects: a traditional view and a revisionist view.

The traditional view asserts that tight monetary policies may lead exchange rates to appreciate. High interest rates that provide a higher rate of return for foreign investors may reduce capital flight and discourage speculative trends. On the other hand, according to the revisionist view, an increase in interest rates has an adverse impact on exchange rates. For the advocates of this view, contractionary monetary policies and high interest rates may result in capital outflows and exchange rate depreciation due to a financial crisis. The cause of both a financial crisis and a default probability that may weaken a national currency is high interest rates (Dekle et al., 2001).

Given the findings of empirical studies, it would not be wrong to say that both the traditional view and the revisionist view have their own strengths. However, an attempt to study the relationship between interest rates and exchange rates accounts for only one side of the effect of monetary policy. The effect of a change in interest rates through exchange rates on other macroeconomic variables should be analyzed in more detail to help policymakers.

In reviewing the literature, a number of studies have addressed the channel through which a change in interest rates has an impact on product and price levels over exchange rates. This paper seeks to remedy the effect of a change in interest rates through exchange rates on several macroeconomic variables, including financial and real sectors, like the study of Smets and Peersman (2001) that analyzed the impact of monetary policy on both financial sector and real sector in the Euro area in the period 1980-1998.

The paper has been organized in the following way: The first section of the paper reviews the literature. The second section describes the econometric analysis and the findings of the study. Section 3 offers some concluding remarks.

### **1. LITERATURE REVIEW**

Most studies that discuss the relationship between interest rates and exchange rates have only focused on crisis periods whereas other studies have paid attention to a broader period of time. For instance, Dekle et al. (2001) studied exchange rates in response to an increase in interest rates in the Korean economy during the Asian Crisis (September 1997-August 1998). The results of the study are consistent with the traditional view. In other words, an increase in interest rates may have led nominal exchange rates to appreciate, implying that the findings of their study do not support the revisionist view. Gould and Kamin (2000) analyzed the effect of monetary policy on exchange rates for countries that were mostly affected by the Asian financial crisis such as: Malaysia, Philippines, Thailand and Mexico. They concluded that interest rates had no remarkable effect on exchange rates during the financial crisis period. Baig and

Goldfajn (2002) showed the relationship between monetary policy and exchange rate during the crisis in five Asian countries. According to their study, there is no evidence showing the fact that higher interest rates may lower exchange rates. Gümüş (2002) analyzed the relationship between interest rates and exchange rates in the 1994 crisis in the Turkish economy. The results, showing that higher interest rates were accompanied by depreciation in exchange rates, are consistent with the revisionist view. Cho and West (2003) investigated the effect of an increase in interest rates on exchange rates during the period of 1997-1998 when the currency crisis erupted in Korea, Philippines and Thailand. They concluded that an increase in interest rates may have led exchange rates in Korea and Philippines to appreciate whereas exchange rates depreciated in Thailand. According to the study of Kim and Ratti (2006) for Thailand, Indonesia, Malaysia, Korea and Philippines in the period July 1997-July 1998, the national currency depreciated in Thailand, Philippines and Korea due to an increase in interest rates. Brailsford et al. (2006) analyzed the effect of higher interest rates on exchange rates in Thailand, Malaysia, Philippines and South Korea in the course of the Asian financial crisis. In the study, the results are consistent with the traditional view.

On the other hand, Caporale et al. (2005) showed the success of the monetary policy in avoiding speculative attacks on exchange rates in countries such as: Thailand, Indonesia, South Korea and Philippines that implemented the contractionary monetary policy in the period from February 1991 to October 2001. The results vary on the basis of economic conditions. For instance, monetary tightening at the time, fluctuations in economic indicators were stagnant, may have caused tightening on nominal exchange rates. Zettelmeyer (2004) examined the impact of monetary policy shocks on exchange rates for Australia in the period 1990-2000, Canada in the period 1994-1999, and New Zealand in the period 1990-2000. The results of this study support the traditional view for both good and bad times. Gül et al. (2007) showed the presence of causality running one-way from interest rates to exchange rates in Turkey. Özer and Saraç (2009) investigated the relationship between the short-term interest rate and the US Dollar exchange rate in the period from January 1994 to December 2008 in Turkey. In the study, they concluded that there was a causal relationship between the short-term interest rate and the US dollar exchange rate; however the impact of a change in short-term interest rates on exchange rates were limited for the period in question.

## **2. EMPIRICAL ANALYSIS**

In this paper, the effect of the relationship between interest rates and exchange rates on macroeconomic factors was studied in the period from January 1995 to September 2008 in Turkey. The monthly data were obtained from the Central Bank of Turkey. The variables that were used in the study are as follows: real GDP growth rate, the inflation index (the wholesale price index was added to the model and the 1995 base year series (1995=100) were used), nominal interest rate (interbank overnight interest rates that are a

monetary policy tool for the Central Bank were regarded as nominal interest rates for the period in question)<sup>4</sup>, real exchange rate, total debt stock, foreign direct investment, foreign trade balance, net portfolio movement (as the sum of assets and liabilities), public sector borrowing requirement, private investment, and public investment.

The augmented Dickey-Fuller (ADF) test (Dickey and Fuller (1979) and Dickey and Fuller (1981)) was performed for the unit root test. So the hypotheses for the unit root test are in the following way:

Null Hypothesis: If  $H_0: p=1$ , then there is a unit root

Alternative Hypothesis: If  $H_1: p=0$ , then there is no unit root

$$\Delta Y_t = \rho Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + e_t \quad (1)$$

$$\Delta Y_t = \alpha + \rho Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + e_t \quad (2)$$

$$\Delta Y_t = \alpha + \beta t + \rho Y_{t-1} + \sum_{i=1}^p \beta_i \Delta Y_{t-i} + e_t \quad (3)$$

In this study, as Wickens and Motto (2001) suggest, a vector autoregression (VAR) analysis was done to estimate the impulse-response of a change in any variable on any other variables.

## 2.1. Unit Root Test

Due to the fact that the results obtained by non-stationary series may lead to spurious regression, a unit root test was performed to check whether series are stationary. Before the unit root test, however, the test for the presence of seasonality in time series was done. According to the findings of the study, a seasonal effect was found for growth rate thus the Tramo-Seats method (firstly used by Gómez and Maravall (1996)) was applied to the series. As can be seen from Table 1, series (growth rate, foreign trade balance, interest rate, portfolio movement, and real exchange rate) are stationary at the level whereas the first differences of series (total debt stock, foreign direct investment, inflation, public investment, public sector borrowing requirement, and private investment) are stationary therefore the autoregressive distributed lag known as ARDL approach was used to facilitate the causality test.

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<sup>4</sup> Note that interest rates were determined by the domestic borrowing strategy that the Turkish Treasury announced in the period 1996-97. The Central Bank played no direct role in determining interest rates. The mobility in interest rates in the interbank money market were reduced and they were used as a benchmark. The decisions on interest rates, based on economic conditions, were announced. In 1998, the Central Bank used short-term interest rates in an attempt to restrain an increase in its own assets (Güloğlu and Altunoğlu, 2002, p.23). The Central Bank of Turkey that implemented the inflation targeting regime has used short-term interest rates as a key policy tool to fight against inflation and interbank overnight interest rates have been regarded as a benchmark since 2002 (Çavuşoğlu, 2010, p.58).

## **2.2. Granger Causality Test**

In a VAR analysis, the Granger causality test should be first performed; however, due to a number of series in the model, it may be difficult to check if the model is appropriately estimated. Therefore, the analysis was divided into two main sub-groups: financial sector and real sector. Series for the financial sector included the interest rate, real exchange rate, public sector borrowing requirement, total debt stock, portfolio movement and inflation compared to the interest rate, real exchange rate, public investment, foreign direct investment, private investment, real GDP growth rate, and inflation for the real sector. The findings of the Granger causality test show that the mechanism through which interest rates may affect inflation in the financial sector is in the following manner: interest rate → exchange rate → public sector borrowing requirement → debt → portfolio movement → inflation whereas for the real sector it is as follows: interest rate → exchange rate → public investment → foreign direct investment → foreign trade balance → private investment → growth rate → inflation.

## **2.3. Chow Test**

As Inandım suggests (2005, p.54), it can be said that there have been three different exchange rate regimes in Turkey: controls over exchange rates together with a low degree of capital mobility and controls over interest rates in the period 1980-1988; controls over exchange rates accompanied by perfect capital mobility, flexible interest rates and an inactive monetary policy in the period 1989-2001; and finally a floating exchange rate regime accompanied by perfect capital mobility, controls over interest rates and an active monetary policy since 2001. The Chow test was performed for the presence of a structural break in an attempt to analyze the impact of the crisis (2000-2001) and a change in monetary policy in both financial and real sectors. According to the findings, a structural break was found thus two exogenous artificial variables that represent monetary policy and the crisis were introduced to the model in order to eliminate this effect.

## **2.4. Likelihood Ratio Test**

In order to select an optimum lag length, the likelihood ratio (LR) test was performed for both financial and real sectors. As can be seen from Table 2 and Table 3, the lag length is 4 for the real sector whereas 5 is its chosen lag length for the financial sector.

## **2.5. Impulse Response Function Analysis in the Real Sector and Financial Sector**

As mentioned previously, the impulse-response functions are helpful to analyze the impact of a shock to any variable on other variables. As shown in Figure 1, in the real sector a shock to interest rates has a downward trend on exchange rates despite the fact that it has no effect on private investment, public investment, foreign direct investment, and foreign trade balance. On the other hand, a shock to interest rates has a positive impact on inflation.

Concerning the financial sector, it can be seen from Figure 2 that a shock to interest rates has a downward trend on exchange rates whereas it has no impact on public sector borrowing requirement. A shock to interest rates is positively correlated with debt stock; it may be due to higher borrowing costs. On the other hand, inflation increases further in response to a positive shock to interest rates whereas a positive shock to interest rates has no influence on portfolio movements.

## **2.6. Reliability Test**

In an attempt to analyze the reliability of the results, the test for autocorrelation in the VAR model was performed. First of all, according to the findings, all roots in both financial and real sectors lie on the unit circle and therefore the solution is stationary. Secondly, depending on the results of the Lagrange multiplier (LM) test, there is no autocorrelation. Finally, the test to check if variances change over time was done. Based on the Chi-Square and probability values for both real sector and financial sector, it is possible to hypothesize that there is no change in variances.

## **3. CONCLUSION**

The study was designed to determine the effect of the relationship between interest rates and exchange rates on macroeconomic variables in Turkey in the period from January 1995 to September 2008. The findings of the study show that for the real sector a change in short-term interest rates has an impact on private investments through exchange rates whereas it has no effect on public investment, foreign direct investment, and foreign trade balance. Interestingly, the relationship between interest rates and exchange rates has no impact on growth rate. However, it is worth noting that private investment is one of the determinants of economic growth and therefore a change in interest rates has an indirect impact on economic growth.

The evidence from this study suggests that in the financial sector, the relationship between interest rates and exchange rates has an impact on debt stock. It may be in part due to foreign currency-denominated debt securities. However, the relationship between interest rates and exchange rates has no effect on portfolio movements and public sector borrowing requirements whereas it puts upward pressure on inflation.

As noted earlier, policymakers should pay attention to the effect of a change in short-term interest rates through exchange rates on other macroeconomic variables. In the countries that have a high level of debt stock, an attempt to stimulate economic growth performance is crucial for the ability to repay debts. An increase in debt service cost or poor performance in economic growth has an adverse effect on expectations.

## TABLES

**Table 1: ADF Test Results**

	<b>ADF TEST (LEVEL)</b>		
<b>Variables</b>	Test statistics	Critical Value (%1)	Critical Value (%5)
<b>Real GDP Growth Rate</b>	-10.02452	-4.015700	-3.437801
<b>Total Debt Stock</b>	<b>-0.423233</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Foreign Trade Balance</b>	-4.215834	-4.015700	-3.437801
<b>Foreign Direct Investment</b>	<b>-1.807549</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Inflation</b>	<b>-0.375399</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Nominal Interest Rate</b>	-5.439383	-4.015700	-3.437801
<b>Public Investment</b>	<b>-2.074052</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Public Sector Borrowing Requirement</b>	<b>-2.006490</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Real Exchange Rate</b>	-4.485190	-4.015700	-3.437801
<b>Private Investment</b>	<b>-1.560136</b>	<b>-4.015700</b>	<b>-3.437801</b>
<b>Net Portfolio Movements</b>	-11.36108	-4.015700	-3.437801
	<b>ADF TEST (FIRST DIFFERENCE)</b>		
<b>Variables</b>	Test statistics	Critical Value (%1)	Critical Value (%5)
<b>Total Debt Stock</b>	-10.00908	-2.579870	-1.942883
<b>Foreign Direct Investment</b>	-13.68552	-2.579495	-1.942830
<b>Inflation</b>	-4.331275	-2.579315	-1.942805
<b>Public Investment</b>	-11.31637	-2.579967	-1.942896
<b>Public Sector Borrowing Requirement</b>	-4.416573	-2.580366	-1.942952
<b>Private Investment</b>	-11.15769	-2.579226	-1.942793

Source: Authors' calculations



**Table 2: LR Test Results for Real Sector**

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-404.4330	NA	2.56e-08	5.220671	5.375739	5.283646
1	-125.8066	525.5105	1.69e-09	2.503881	3.899494*	3.070657
2	-17.63497	193.0658	9.72e-10	1.944746	4.580904	3.015323
3	97.60303	194.0083	5.16e-10	1.296164	5.172867	2.870542*
<b>4</b>	<b>175.8114</b>	<b>123.7474</b>	<b>4.43e-10*</b>	<b>1.116312*</b>	<b>6.233559</b>	<b>3.194490</b>
5	236.4318	89.77958*	4.85e-10	1.159091	7.516884	3.741071
6	293.7959	79.14794	5.67e-10	1.243090	8.841427	4.328871
LR: Likelihood Ratio Test (at the 5% significance level)						
FPE: Final Prediction Error						
AIC: Akaike Information Criterion						
SC: Schwarz Information Criterion						
HQ: Hannan-Quinn Information Criterion						

Source: Authors' calculations

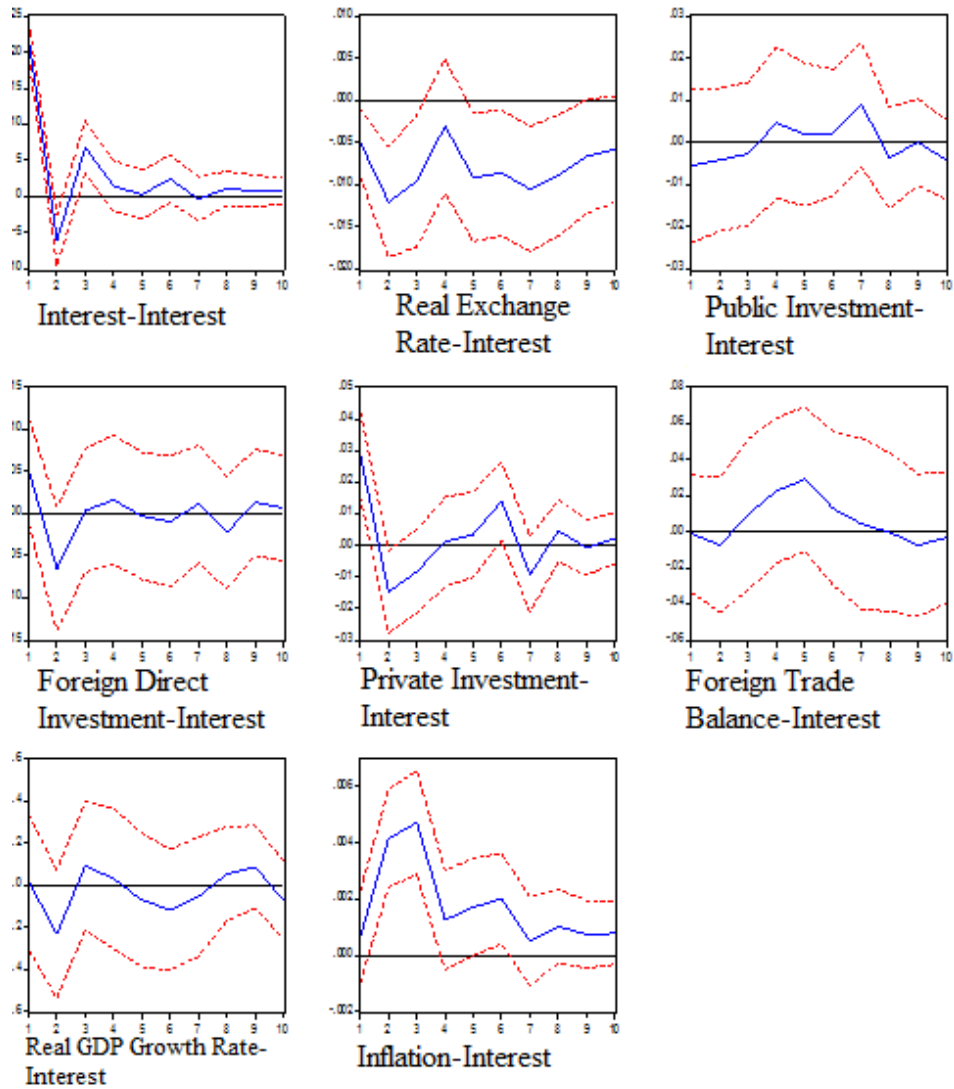
**Table 3: LR Test Results for Financial Sector**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	442.8602	NA	2.69e-09	-5.542534	-5.445616	-5.503174
1	711.5422	516.9579	1.23e-10	-8.627117	-8.045612*	-8.390960
2	752.4671	76.15139	1.01e-10	-8.828698	-7.762605	-8.395744
3	797.9344	81.72598	7.80e-11	-9.087777	-7.537096	-8.458026*
4	827.1095	50.59480	7.44e-11	-9.140627	-7.105358	-8.314078
<b>5</b>	<b>854.4526</b>	<b>45.68719*</b>	<b>7.27e-11*</b>	<b>-9.170286*</b>	<b>-6.650429</b>	<b>-8.146941</b>
6	877.5287	37.09705	7.53e-11	-9.145933	-6.141489	-7.925790
LR: Likelihood Ratio Test (at the 5% significance level)						
FPE: Final Prediction Error						
AIC: Akaike Information Criterion						
SC: Schwarz Information Criterion						
HQ: Hannan-Quinn Information Criterion						

Source: Authors' calculations

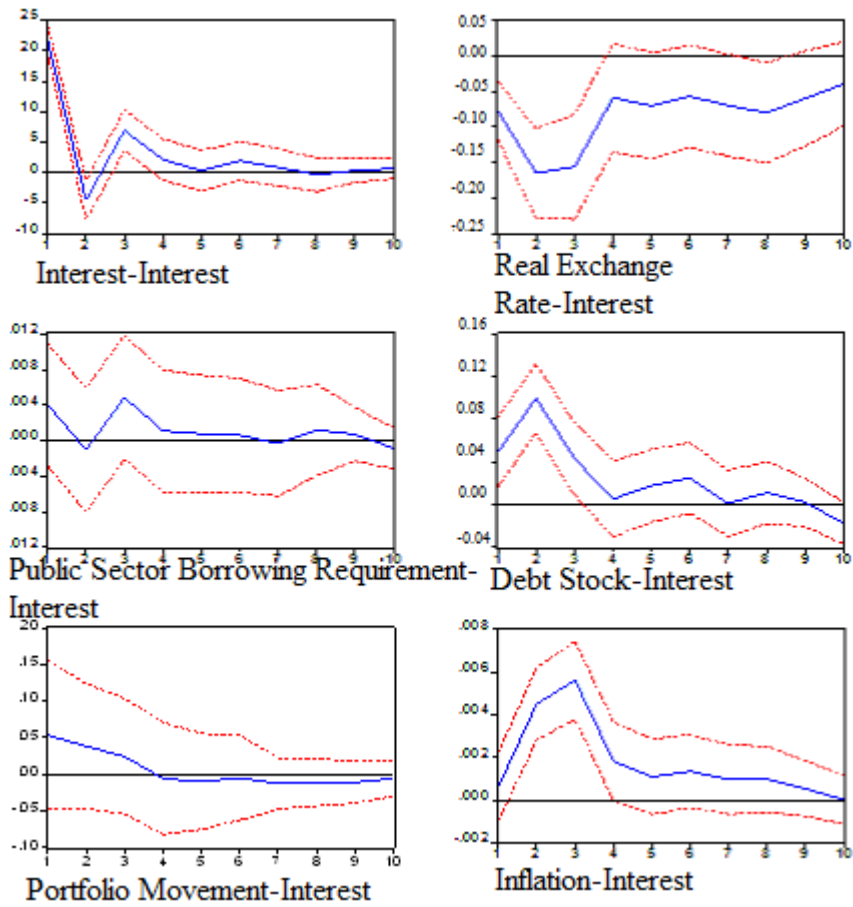
## FIGURES

**Figure 1:** Impulse Response Analysis for Real Sector



Source: Authors' calculations

**Figure 2:** Impulse Response Analysis for Financial Sector



Source: Authors' calculations

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