Interest Rate Pass Through in Turkey: The Measurement of the Monetary Transmission Mechanism Dynamics

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Abstract

In this study it is aimed to investigate the transmission mechanism of monetary policy interest rate to personal consumer loans interest rate, deposit interest rate, GDP and prices in Turkey. In order to investigate the possible effects of changes in policy rates stemming from financial market conditions and monetary policy applications on transmission via interest rate channel, the ARDL methodology is used. The results obtained show that the level of pass-through effect of policy rate to retail interest rates of the banking sector is greater than the policy rate's effect on GDP and prices. Although the existence of high pass-through effect to retail interest rates, since it represents an uncompleted characteristic, the effect of policy rate on GDP and prices remains low. However, the effects of policy rate on GDP and prices are positive and negative, respectively.

Keywords: Interest Rate Pass-Through, Monetary Transmission Mechanism, ARDL

1. Introduction

Interest rate transmission mechanism is one of the most important economic phenomena in pursuing an effective monetary policy. In its simplest sense, the interest rate transmission effect is "the rate and degree of affecting the rates of retail interests in banking sector" (Yüksel and Özcan, 2013). A full transmission effect will be present if the change in the rates of interest in money market causes changes in the same direction and amount as the rates of retail interest. In the event of full transmission from the policy interest and market interest to the rate of retail interest, it is fair to say that monetary policy get stronger in terms of its impacts on the economy. The first step in the effect of monetary policy on economy is the change that arises in the rate of short-term interest. When banks and other financial intermediaries change the rate of interest they implement, households and companies change their consumption and investment decisions accordingly.

As stated by Bredini et al. (2001) and DeBondt (2005), the success of monetary policy depends on the speed of the effect of transmission and the margin between the retail interest rate and short-term interest rate. According to Manna et al. (2001), fluctuations in the rate of interest during this period of transmission represent a significant indication for the monetary policy. This study evaluates the effectiveness of the transmission mechanism of monetary policy in Turkey in the context of the rates of banking interest, size and speed of the reaction of GDP and inflation in the face of the changes in monetary policy. Recent significant changes in regulation of the monetary policy and in financial infrastructure in Turkey have caused significant improvements in the effectiveness of the banking sector and contributed to the size and speed of the transmission effect of interest rates (Şıklar et al., 2013). This makes it necessary to study the effect of transmission of interest rates. The global financial crisis that broke out and created a strong financial pressure in 2008 also had an adverse effect on Turkish economy, which lead to a serious economic recession in 2009 when GDP decreased by about 5%.

In 2009, the Central Bank of the Republic of Turkey (CBRT) took down the rates of interest from 16.75% to 8.75% through consecutive cutbacks, allowing the domestic currency to lose its value. This was intended to alleviate the adversities to be caused by the economic recession. However, only when the mechanisms of transfer to the real economy function effectively such policy changes may achieve their objectives. As stated by Haughton and Iglesias (2012), when the central bank changes the policy interest rates, commercial banks have to respond by reflecting the cost caused by this change to their loan and deposit interest rates. If all costs brought about by the increase in the rate of interest by the central bank are transferred to the rates of retail interest, it would be possible to talk about the effect of full transmission. In addition, if there is a long-term correlation between the rate of interest controlled by the central bank and retail rates, whether it is complete or incomplete, monetary policy would gain effectiveness. It is argued that the adjustment process is asymmetric if the same adjustment process is experienced in returning to the long-term equilibrium value in the face of increases and decreases in interest rate and it is symmetric otherwise (Haughton and Iglesias, 2012).

In the current literature, there are a small number of empirical studies that analyze the transmission effect of monetary policies in Turkey. This study analyzes the speed and impact of transmission of changes in the interest rate of the monetary policy to consumer loan interest rate, deposit interest rate, GDP and inflation in Turkey from 2003 onwards. In order to analyze the transmission of the changes in the interest rates of the monetary policy to banking interest rates and economic activities through the interest rate transmission mechanism, the Autoregressive Distributed Lag Model (ARDL) Bound Test developed by Pesaran et al. (2001) is employed. The most important advantage of the ARDL model is that it enables the use of stationary variables of different degrees while all variables have to be of the same degree in co integration approach. The dataset to be used in the study includes the period from 2003 to 2013, which allows seeing the effects of the global crisis of 2008. In this respect, the current study will help the monetary policy decision makers by measuring the effects of policy shocks created via interest rates through transmission mechanism. The study is made up of four parts. While the first part is related with a short literature review, the second part contains the explanation of the dataset used in the study and the ARDL model. The third and fourth parts include and evaluate the empirical findings and conclude the paper, respectively.

2. A Short Literature Review

There is a wide range of literature on the effect of transmission of interest rates. A considerable part of the studies conducted so far focuses on the speed and size of transmission of the changes in policy interest rates to deposit and loan interest rates of commercial banks. It is found in these studies conducted from mid-1990s that the effect of transition from policy and market interest rates to retail interest rates is usually slow and incomplete. Egert et al. (2007), Horvath et al. (2004), Ehrmann et al. (2003), Toolsema et al. (2002), Hofmann (2002), Mojon (2000), DeBondt (2005), Donnay and Degryse (2001), Kleimer and Sender (2000), Cotarelli and Kourelies (1994), Borio and Fritz (1995) and BIS (1994) can be considered examples of such studies. Slow and incomplete transmission effect is majorly the result of rigidity of the adjustment process observed in the interest rates. The rigidity experienced in retail interest rates in the form of bank deposit and loan interest rates in an economy emerges depending on several factors. Among such factors are structure of financial markets, economic policies that are pursued, degree of financial development of the country, level of competition in the banking system and the ownership structure of financial intermediaries (Agenor and Montiel, 2008). Such factors are generally classified under the titles of fixed menu costs, conditions of imperfect competition, changing market structure and costs of asymmetric information.

According to the hypothesis of menu costs, if the changes observed in prices are considered trivial or temporary changes by companies, they would be reluctant to reprice their products. This is the most frequently used approach in accounting for the rigidities mentioned above (Yu et al., 2013). Uncompetitive market structure is another reason for slow adjustment of directed interest rates. Hannan and Berger (1991) show that companies represent higher price rigidity in a market where concentration is high. It is shown in studies conducted by Lowe and Rohling (1992), Wang and Lee (2009), Aziakpono and Wilson (2006) that loan interest rates show rigidity in the direction of increase when the policy interest rate increases, and deposit interest rates show rigidity in the direction of decreasing when the policy interest rates decrease. These results are called reverse consumer reaction and are generally the most preferred approach in explaining the rigidity in interest rates. Stiglitz and Weiss (1981) use asymmetric information phenomenon to state that information gaps and project risks between banks and companies give rise to moral hazard and adverse selection problems.

The problem of adverse selection emerges as the risk of applicants for loan increases, which leads to withdrawal from the market of those with low risk who are willing to borrow. As high risk means high income, the projects that imply a high degree of risk are matched with expectation of high income. This encourages projects that are likely to fail, causing adverse selection and moral hazard problems to emerge (Agenor and Montiel, 2008). Examination of the literature reveals that assumption of linearity (symmetry) is used while the transmission mechanism of interest rate is discussed in most of prominent (traditional) studies. According to Wang and Lee (2009), the linear model used by many researchers for testing the transmission effect of the rate of interest generate results that are biased to rejection of the effect of full transmission as it does not take asymmetries into consideration in the process of adjustment. The study conducted by Toolsema et al. (2002) analyzes similarities in the transmission mechanism of the rate of interest in 6 countries that are members of the European Monetary Union (EMU), using the data on monthly basis and fully-modified OLS method and explores the co integration between the money market interest rate and retail interest rates. The study, in which an error correction model that is made up of sequential regression to estimate short-term dynamics in the sampling period, reveals the differences of speed and size in transmission mechanisms. In the study conducted by Angeloni and Ehrmann (2003), the mechanism of interest rate transmission before and after the European Monetary Union is examined using the VAR methodology and whether there is a difference in the transmission process of monetary policies among countries after accession to the Union is inquired. Mamingi et al. (2008) examines the effect of variability of the interest rate in the Carribean Region on the interest rates of retail deposit and loans using the partial adjustment error correction model. Asymmetric adjustment process is ignored in all these studies cited as example.

Many researchers use the method suggested by Wang and Lee (2009) to overcome this issue and take into consideration the asymmetries in the interest transmission mechanism. Haughton and Iglesias (2012) analyze the transmission effect of interest in the Caribbean Region using TAR and MTAR co integration models and evaluate the asymmetric effects using the EGARCH method. According to the results of that study, while a full transmission effect is present in two countries (Trinidad-Tobago and St. Lucia), in only three out of these 6 countries (Jamaica, Guyana and St. Lucia) there is an asymmetric co integration between loan and deposit interest rates according to the results of TAR and MTAR models. These results reveal that loan and deposit interest rates show a rigid adjustment process in the direction of increase in Jamaica while they show a rigid adjustment process in the direction of decrease in Guyana and St. Lucia.

On the other hand, Wang and Thi (2010) study the interest rate transmission mechanism in Taiwan and Hong Kong using the asymmetric co integration method. According to the results of the study, an incomplete transmission effect is present in both of these countries. The results reveal presence of symmetric co integration between retail interest rates and market interest rates in both countries. In these countries, adjustment rigidities are present in increasing direction for deposit interest rates, and in decreasing direction for loan interest rates. The study conducted by Fadiran and Ezeoha (2012) examines the interest rate transmission mechanism in South Africa using the error correction model and EGARCH methodology. According to the results of the study, a symmetric adjustment mechanism is present in the direction of increase for deposit interest rates, and in the direction of decrease for loan interest rates.

Yüksel and Özcan (2013) investigate the effect of transmission from policy interest rate to banking sector interest rates in Turkey using the TAR and MTAR methods developed by Enders and Siklon (2010). The results of this study suggest that changes in policy interest rates have serious effect on the loan interest rates. The results obtained with regard to the adjustment process reveal that all retail interest rates implemented by the banking sector are adjusted asymmetrically to the changes in the policy interest rates. On the other hand, it is emphasized in this study that the size and the speed of the interest rate transmission effect do not show a significant change at the times of financial crisis.

3. Dataset and Methodology

The time series data to be used in the study is retrieved from the databank published by CBRT the electronic data distribution system (EVDS) and the Ministry of Development, and includes monthly observations for the period of 2003 to 2013. As a significant effect of seasonality is observed in the time series of industrial production index (as a proxy for monthly GDP) and inflation in the model, the data were seasonally adjusted with the method of ratio to moving average before they are included in the model.

The variables used in the model are compound interest rate of domestic government bond (*dibs*); consumer loan interest rate (*cash*); deposit interest rate (*deposit*); industrial production index (*gdp*); consumer price index (*inf*) and a dummy variable to see the effect of 2008 global financial turmoil (*dummy*).

The process of transmission of changes in the interest rate of monetary policy to retail rates and economic activities by means of the transmission mechanism of the interest rate in Turkey will be estimated using the Autoregressive Distributed Lag Model (ARDL) with the Bound Test developed by Pesaran et al. (2001). The model to be estimated for this purpose tests the co integration among the monetary policy interest rate, consumer loan interest rate, deposit interest rate, and output level and inflation variables as given in equation (1) below:

$$\Delta dibs = \beta_0 + \sum_{i=1}^{p} \beta_1 \Delta dibs_{t-p} + \sum_{i=1}^{p} \beta_2 \Delta cash_{t-p} + \sum_{i=1}^{p} \beta_3 \Delta deposit_{t-p} + \sum_{i=1}^{p} \beta_4 \Delta gdp_{t-p} + \sum_{i=1}^{p} \beta_5 \Delta inf_{t-p} + \beta_6 dibs_{t-1} + \beta_7 cash_{t-1} + \beta_8 \Delta deposit_{t-1} + \beta_9 \Delta gdp_{t-1} + \beta_{10} \Delta inf_{t-1} + \beta_{11} dummy + \varepsilon_t$$

The lag length represented by p has to be determined to implement the bound test approach in equation (1). At the next stage, F statistics should be implemented on the first lags of dependent and independent variables in inquiring the presence of co integration. The hypotheses necessary for this test are given below:

$$H_0: \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$$
$$H_1: \beta_6 \neq \beta_7 \neq \beta_8 \neq \beta_9 \neq \beta_{10} \neq 0$$

For co integration, the value of F statistics calculated is compared to upper and lower critical values in the table presented in Peseran et al. (2001). If the F value is smaller than the lower critical value, it is decided that there is no co integrating relationship among series. If the calculated F statistic is between the upper and lower critical values, a final comment cannot be made, and other co integration tests are required. On the other hand, if the calculated F statistic is higher than the upper critical value, it is concluded that there is a co integrating relationship among series. Once a co integrating relationship is found among the series, ARDL models are established to identify short- and long-term dynamics.

4. Empirical Results

Granger and New bold (1974) state that it is possible to encounter spurious regression problem if non-stationary time series are used. Therefore, non-stationary time series in analyses would cause unreliable results among variables. For this reason, Augmented Dickey- Fuller (ADF) and Phillips-Peron (PP) unit root tests which are among the most frequently used methods in testing the stationary properties of series are employed in this study. The test results are given in tables 1 and 2 below.

Table 1: Results of ADF Unit Root Test Statistics

Variables	With Intercept	1% Critical Value	5% Critical Value	10% Critical Value	With Intercept and Trend	1% Critical Value	5% Critical Value	10% Critical Value
Dibs	-4.60	-3.48	-2.88	-2.57	-3.84	-4.02	-3.44	-3.14
Cash	-2.86	-3.48	-2.88	-2.57	-2.59	-4.02	-3.44	-3.14
Δcash	-9.55	-3.48	-2.88	-2.57	-9.68	-4.03	-3.44	-3.14
Deposit	-4.93	-3.48	-2.88	-2.57	-4.64	-4.03	-3.44	-3.14
loggdp	-2.65	-4.02	-3.44	-3.14	-2.65	-4.02	-3.44	-3.14
Δloggdp	-10.47	-4.03	-3.44	-3.14	-10.47	-4.03	-3.44	-3.14
loginf	-2.58	-3.48	-2.88	-2.57	-4.32	-4.03	-3.44	-3.14
Δloginf	-7.46	-3.48	-2.88	-2.57	-7.59	-4.03	-3.44	-3.14

Table 2: Results of PP Unit Root Test Statistics

Variables	With Intercept	1% Critical Value	5% Critical Value	10% Critical Value	With Intercept and Trend	1% Critical Value	5% Critical Value	10% Critical Value
dibs	-4.49	-3.48	-2.88	-2.57	-3.82	-4.02	-3.44	-3.14
cash	-2.80	-3.48	-2.88	-2.57	-2.66	-4.02	-3.44	-3.14
Δcash	-9.50	-3.48	-2.88	-2.57	-9.69	-4.03	-3.44	-3.14
deposit	-4.72	-3.48	-2.88	-2.57	-3.92	-4.03	-3.44	-3.14
loggdp	-1.65	-3.48	-2.88	-2.57	-2.83	-4.02	-3.44	-3.14
Δloggdp	-10.42	-3.48	-2.88	-2.57	-10.56	-4.03	-3.44	-3.14
loginf	-2.60	-3.48	-2.88	-2.57	-5.97	-4.02	-3.44	-3.14
Δloginf	-29.53	-3.48	-2.88	-2.57	-31.98	-4.03	-3.44	-3.14

According to the test results, the variables *dibs* and *deposit* are taken *I(0)* as they are stationary at their levels while the variables cash, *loggdp* and *loginf* are made stationary by taking their first differences as they are not stationary at their levels, These later variables therefore present *I(1)* characteristic. The fact that series are stationary at different levels shows that the series can be co integrated at different degrees. Therefore, short and long term relations can be estimated with ARDL Bound test approach, which makes it possible to implement the co integration method on the series with different degrees of stationary levels. The appropriate number of lags in the model was determined by giving maximum 8 lags according to Schwartz Information Criteria (SIC). In order to see the possible effects of 2008 global financial turmoil we used a dummy variable for the period May 2008 – May 2009. Table 3 contains results of Pesaran's Bound Test.

Table 3: Bound Test Results

k	F-Statistic	5% Lower Bound	5% Upper Bound
4	5.30	2.86	4.01

Considering the results given in Table 3 the F value exceeds the upper critical value cited in Peseran et al. (2001). This result verifies that there is a co integrating relationship among variables. Therefore, an ARDL model may be established to identify short and long term relations. Therefore it will be possible to estimate short-term relations among variables by using error correction methodology. The empirical model regarding the short-term dynamics is given in equation (2).

$$\Delta dibs = \beta_0 + \sum_{i=1}^{p} \beta_{1i}\, \Delta dibs_{t-p} + \sum_{i=1}^{p} \beta_{2i}\, \Delta cash_{t-p} + \sum_{i=1}^{p} \beta_{3i}\, \Delta deposit_{t-p} + \sum_{i=1}^{p} \beta_{4i}\, \Delta gdp_{t-p} + \sum_{i=1}^{p} \beta_{5i} \Delta inf_{t-p} + \beta_6 ECT_{t-1} + \beta_7 dummy \quad (2)$$

Table 4: contains the estimation results of the error correction model with appropriate lags obtained through SIC.

Table 4: Test Results of Error Correction Model

Variables	Coefficient	t statistic	p value
DDIBS(-1)	-0.161207	-1.023781	0.3083
DCASH	0.403668	3.922833	0.0002
DDEPOSIT	0.440082	1.794647	0.0756
DDEPOSIT(-1)	-0.111226	-0.415090	0.6789
DDEPOSIT(-2)	0.179241	0.955475	0.3416
DLOGGDP	0.420876	1.949442	0.0539
DLOGINF	0.006175	0.351473	0.7259
DLOGINF(-1)	0.005375	0.279074	0.7807
DLOGINF(-2)	0.004703	0.242559	0.8088
DLOGINF(-3)	-0.030538	-1.568737	0.1197
DLOGINF(-4)	-0.048208	-2.319957	0.0223
DLOGINF(-5)	-0.018601	-0.940834	0.3490
DLOGINF(-6)	-0.023241	-1.229078	0.2218
DLOGINF(-7)	-0.020955	-1.111269	0.2690
DLOGINF(-8)	-0.007924	-0.469656	0.6396
C	-0.002005	-1.041522	0.3000
DUMMY	-0.021458	-2.863748	0.0051
ECT(-1)	-0.392821	-2.080539	0.0399

According to Table 4, the error correction term (ECT) has a negative sign as expected and is statistically significant showing a strong dynamic adjustment process to deviations from equilibrium. The value of the error correction term shows us that the model returns to equilibrium or stability in almost 2½ months. Table 5, on the other hand, presents the estimated short term coefficients of the ARDL error correction model.

Table 5: Short-Term Coefficients Based on the ARDL Model

Variable	Coefficient	P Value	Transmission Speed (months)
Dcash	0,34	0.00	2,0
Ddeposit	0.43	0.02	1,7
Dloggdp	0.04	0.06	24,0
Dloginf	-0.01	0.19	25,0

Considering Table 5, the transmission speed of policy interest is found to be 2 months for the of consumer loan interest rates, 1,7 months for deposit interest rate, and 24 months for GDP. On the other hand, even though the transmission speed is found negative and 25 months for inflation, contrary to expectations, the result of the short-term coefficient is insignificant.

These results suggest that if changes occur in policy interest rate in Turkey, the speed of transmission to deposit interest rates is higher; the transmission is reflected to consumer loan interest rates and GDP later. Table 6 contains long-term coefficient findings based on the ARDL model.

Table 6: Long-Term Coefficients Based on the ARDL Model

Variable	Coefficient	P Value
Constant	-0.001	0.387
Dcash	0,25	0.001
Ddeposit	0.62	0.000
Dloggdp	0.029	0.062
Dloginf	-0.014	0.037
Dummy	-0.014	0.006

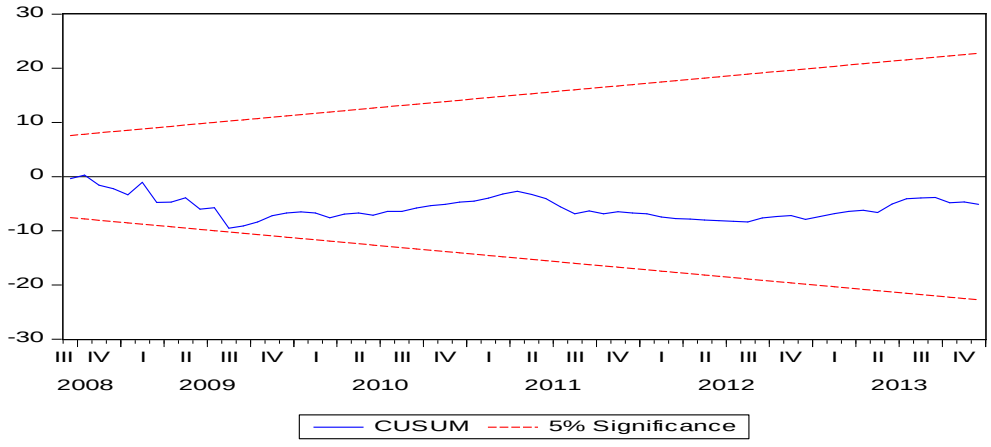
These results suggest that the effect of transmission of change in the policy interest rate in Turkey to deposit and consumer loan interest rates in the long run is higher than other variables. The primary factor in higher effect of transmission in such variables can be considered to be the fact that changes in the policy interest rate primarily affect the banking interest rate in the monetary transmission mechanism. Transmission of the change in the policy interest rate to the GDP is found to be 0.03 and it is seen that it occurs more slowly compared to banking interest rates. The primary reason for such a result is the structure of monetary transmission mechanism and it shows us that output level is affected through interest rate channel. It can be said that the reason for the low ratio of 0.014 for the coefficient that indicates the effect of transmission of the policy interest rate on inflation is that a change in the policy interest rate does first effect level of output and then inflation through the level of output. In addition, another point to be emphasized at this point is the inverse relationship between the policy interest rate and inflation. This relationship shows that the increase in the interest rate reduces the rate of inflation.

Some diagnostic tests related to autocorrelation, heteroscedasticity, and whether the model is stable are also conducted. Diagnostic test results are given in the Table 7 and Figure 1. According to these test results, it is found by the Breush-Godfrey LM and ARCH tests that problems of autocorrelation and heteroscedasticity are not present, respectively. CUSUM test also shows that the model is stable.

Table 7: Diagnostic Test Results

R^2	0.46	AIC	-5.91
Log likelihood	380.58	SIC	-5.52
Breusch-Godfrey LM	1.50 (0.13)	ARCH	0.29 (0.58)
F statistic	5.75 (0.00)		

Figure 1: CUSUM Test



5. Conclusion

Effects of interest rate changes in conducting the monetary policy on market and retail bank interest rates are very important for the effectiveness of monetary policy transmission. This study inquires the speed and effect of transmission of the monetary policy interest rate to consumer loan interest rate, deposit interest rate, output and inflation using the monthly data of the period from 2003:1 to 2013:12 in Turkey employing the ARDL methodology. While the tests conducted verify the co integration relationship, they also show that the effect of transmission from policy interest to deposit interest is high but not complete in the long term. On the other hand, the fact that transmission effect of policy rate on loan interest rate is higher and more incomplete compared to deposit interest rate can be explained by the presence of a strong demand for loans in the economy during the period under investigation. The existence of incomplete transmission effect in terms of both deposit and loan interest rate restricts policy interest rate's effect on output and inflation. It should be noted however that the low level of adjustment speed given by the estimated error correction model is a natural outcome of incomplete transmission effect of monetary policy. The other possible factor that produces such a result is the high level of concentration ratio in Turkish banking system. The other interesting point obtained empirically by this study is that the adjustment is considerably low while the error correction term of ARDL model has the correct negative sign and is statistically significant. This point out the fact that the adjustment cost in the banking is considerably high. The existence of incomplete transmission effect and high level of stickiness in loan rates reflect the fundamental characteristics of market structure of Turkish banking system. In this context, lower speed and higher costs of adjustment require more attention for further studies.

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