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*UDK: 336.748.12(560)*
*DOI: 10.2478/jcbtp-2018-0024*

*Journal of Central Banking Theory and Practice, 2018, 3, pp. 73-90*
*Received: 18 October 2017; accepted: 29 December 2017*

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# Inflation Expectations in Turkey: Determinants and Roles in Missing Inflation Targets

**Abstract**: This paper aims at specifying the determinants of 12-month ahead and 24-month ahead inflation expectations in Turkey by using monthly data from April 2006 to December 2016. Put differently, this paper tries to shed light on how inflation expectations respond to changes in past inflation rate, inflation target, output gap, USD/TL exchange rate, oil price, and EMBI in Turkey. To this end, the paper first conducts unit root tests in order to detect the order of integration of the variables. Then, the paper employs the autoregressive distributed lag approach to examine whether there is a cointegration relationship among variables and to estimate long-run parameters. According to the findings, 12-month ahead expected inflation rate is positively related to past inflation rate, inflation target, output gap, USD/TL exchange rate, and oil price and is negatively related to EMBI. Besides, 24-month ahead expected inflation rate is positively related to past inflation rate and USD/TL exchange rate and is negatively related to inflation target and EMBI. Upon its findings, the paper makes some inferences about the success of inflation targeting strategy in Turkey.

**Keywords**: the Central Bank of the Republic of Turkey, inflation targeting, inflation expectations, decision makers and experts, autoregressive distributed lag approach.

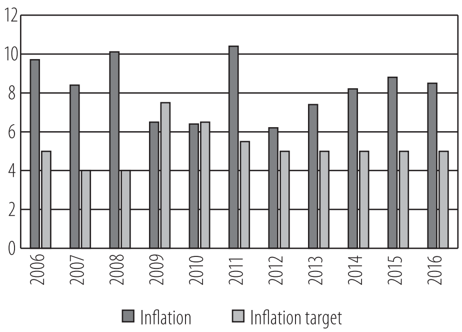
**JEL Codes**: C22, E52, E58

## 1. Introduction

A central bank which adopts a monetary policy strategy selects a nominal anchor that is publicly presented (Lakic, Sehovic & Draskovic, 2016). Inflation targeting is a monetary policy strategy that uses inflation expectation as the nominal anchor. A central bank which follows inflation targeting strategy tries to achieve inflation target using all available information and conducts monetary policy by steering short-term (overnight) interest rates. Given the lagged effect of monetary policy on inflation and the high correlation between inflation expectations and inflation (Bofinger, Reischle & Schachter, 2001; Mehra & Herrington, 2008; Mishkin, 2012; Turguttopbas, 2017), a central bank that adopts inflation targeting strategy tries to affect public's inflation expectation. When a central bank is transparent, reliable, and reputable, it is able to shape public's inflation expectation. Put differently, the expectation management of the central bank can ensure that the public's inflation expectation will be equal to inflation target. This means the anchoring of inflation expectations. Hence, the central bank must manage and anchor inflation expectations for the successful conduct of monetary policy (Wong, 2015). The central bank, therefore, adjusts short-term interest rates so that inflation expectation is equal to inflation target (see e.g., Svensson, 1997; Clarida, Gali & Gertler, 1998, 1999, 2000).

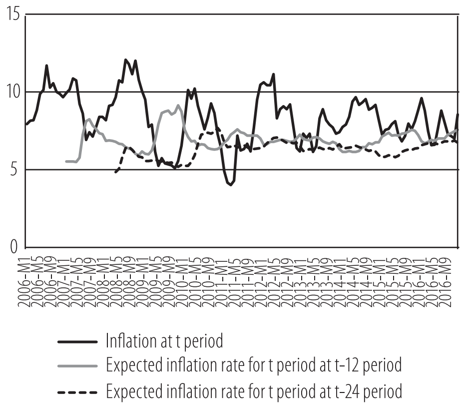
The Central Bank of the Republic of Turkey (CBRT) adopted inflation targeting in 2006. Like other central banks following inflation targeting strategy, the main policy instrument of the CBRT to achieve inflation targets became short-term interest rate and the CBRT focused on expected inflation rates as it was clearly specified in the inflation reports of the CBRT. As a central bank adopting inflation targeting strategy, the CBRT announces not only its own inflation forecasts but also those obtained from the inflation survey, which is carried out by the CBRT. The survey of expectations is conducted in order to follow the expectations of the decision makers and experts in financial and real sectors regarding macroeconomic variables. One of these macroeconomic variables is inflation. Therefore, one can follow inflation expectations of the decision makers and experts in Turkey through the survey of inflation expectations.

**Graph 1: Inflation and inflation targets in Turkey (%)**



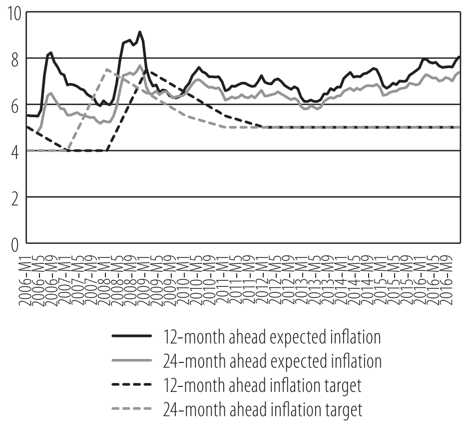

Source: CBRT

**Graph 2: Inflation and inflation expectations in Turkey (%)**




Source: CBRT

**Graph 3: Inflation expectations and inflation targets in Turkey (%)**




Source: CBRT

Using consumer price index (CPI) data, Graphs 1-3 depict the actual inflation rates, inflation targets, and inflation expectations in Turkey. Inflation data in Graphs 2-3 are calculated on yearly basis. As seen in Graph 1, the actual inflation rates deviated considerably from inflation targets in 2006, 2007, 2008, 2011, 2012, 2013, 2014, 2015, and 2016. The actual inflation rates were lower than inflation targets only in 2009 and 2010 when the CBRT revised inflation targets upward. Even though inflation is also affected by some other factors along with monetary policy and so central banks have imperfect control over inflation (Svensson, 1997), one can argue that the CBRT, which adopts inflation targeting, is not successful at achieving inflation targets. Graph 2 depicts actual inflation rates and inflation expectations during the period 2006-2016. As seen, the inflation rate fluctuated around 8% during the period 2006-2016 in Turkey. Hence, one can argue that inflation is downwardly strict in Turkey. Expected inflation rate for t period at t-12 period means 12-month ahead expected inflation rate at t-12 period. Similarly, expected inflation rate for t period at t-24 period means 24-month ahead expected inflation rate at t-24 period. To keep it simple, these data might be demonstrated. For instance, 24-month ahead expected inflation rate was 4.82% in April 2006 while 12-month ahead expected inflation rate was 6.77% in April 2007. Then, the actual inflation rate was 9.66% in April 2008. This graph therefore reveals actual inflation rates and inflation expectations in Turkey and shows whether the decision makers and experts could forecast future inflation in Turkey. As seen from the graph, the actual inflation rates were usually higher than inflation expectations in Turkey. For this reason, one might argue that the decision makers and experts could not forecast future inflation in Turkey. Put differently, the decision makers and experts were extremely optimistic about future inflation in Turkey. Another important finding indicated in Graph 2 is that forecasts increased over time since expected inflation rate for t period at t-12 period was usually greater than expected inflation rate for t period at t-24 period. Put differently, the decision makers and experts could not forecast future inflation in Turkey though their levels of optimism decreased and they upwardly revised their inflation expectations over time. Similarly, a recently produced paper by Soybilgen and Yazgan (2017) finds that forecast performances of the decision makers and experts for inflation are very poor by employing some econometric methods. Graph 3 presents expected inflation rates and inflation targets. As is depicted in the graph, inflation expectations were greater than inflation targets in most of the periods in Turkey. Therefore, one might argue that inflation expectations were not anchored well in Turkey. Graph 3 also shows that 12-month ahead expected inflation rate was greater than 24-month ahead expected inflation rate. This evidence indicates that the decision makers and experts were optimistic regarding inflation in the following periods.

In sum, the findings exhibited in Graphs 1-3 are that (i) inflation expectations were not well anchored in Turkey, (iii) the decision makers and experts were not successful in terms of forecasting future inflation, and (iii) the CBRT was not successful in terms of achieving inflation targets. As a recently published paper by Bulut (2016) remarks, long monetary transmission lags, depreciation of the Turkish Lira (TL), and increases in the prices of food and non-alcoholic beverages have roles in missing inflation targets in Turkey. In addition to these events, one of the reasons of missing inflation targets might be related to inflation expectations that are considerable for the success of monetary policy. This is because inflation expectations in Turkey are usually low compared to actual inflation rates and high as compared to inflation targets. Then, some questions appear to be important for Turkey: what determines and does not determine inflation expectations in Turkey? Do decision makers and experts in Turkey consider all available and necessary information when forming their inflation expectations? The answers of these questions help researchers and policy makers to find out the reasons for low inflation expectations and are very considerable in terms of success of the monetary policy in Turkey. This paper focuses on these questions. In other words, this paper analyses the determinants of 12-month ahead and 24-month ahead inflation expectations in Turkey by using monthly data from April 2006 to December 2016.

How this paper contributes to the monetary economics literature lies in the following three points: i) One can observe that there is an extending empirical literature on the determinants of inflation expectations (see e.g., Mehra & Herrington, 2008; Gerlach, Hordahl & Moessner, 2011; Celasun, Mihet & Ratnovski, 2012; Coibion & Gorodhichenko, 2015; Wong, 2015). Therefore, one may argue that this topic is worth examining. ii) To the best of the author's knowledge, there are a few papers examining the determinants of inflation expectations in Turkey (see e.g., Baskaya, Kara & Mutluer, 2008; Baskaya, Gulsen & Orak, 2010, 2012). These papers employ similar models to find out the determinants of inflation expectations and yield comparable findings. Accordingly, they examine whether inflation expectations are related to past inflation rate, inflation target, exchange rates, oil prices, embi+Turkey (EMBI), and industrial production gap. While all variables have statistically significant and positive impacts on inflation expectations in the papers of Baskaya et al. (2008, 2010), all variables, except EMBI and industrial production gap, have statistically significant and positive effects on inflation expectations in the paper of Baskaya et al. (2012). Therefore, there seems to be a research gap for Turkey in this regard. iii) Baskaya et al. (2008, 2010, 2012) estimate the coefficients of independent variables through ordinary least squares (OLS) without examining variables' time-series properties, such as unit root and cointegration. Put differently, they ignore the order of integration of variables. However, researchers should examine stationarity of variables in order to avoid spurious regression problem in time series analyses. Hence this paper, instead of employing OLS, conducts unit root and cointegration tests to estimate the responses of inflation expectations to changes in some macroeconomic variables.

The rest of the paper is organized as follows: The following section presents model and data. Section 3 gives estimation methodology. Findings are reported in Section 4. Section 5 concludes the paper with a summary of main findings and some implications.

## 2. Model and data

This paper performs time series analysis to specify the determinants of inflation expectations in Turkey. The study uses 12-month ahead and 24-month ahead annual CPI inflation expectations. The data are monthly and cover the period from April 2006 to December 2016 since the CBRT has announced 24-month ahead inflation expectations since April 2006.

Following Baskaya et al. (2008, 2010, 2012), this paper establishes the following empirical model:

$$\pi^{e}_{t+k/t} = \beta_0 + \beta_1\pi_{t-1} + \beta_2\pi^{t}_{t+k/t} + \beta_3 Y^{gap}_{t-2} + \beta_4 USD_t + \beta_5 P^{oil}_t + \beta_6 EMBI_t + \varepsilon_t \quad (1)$$

k = 12, 24

where

$\pi^{e}_{t+k/t}$ - 12/24-month ahead expected annual inflation rate at t period,
$\pi_{t-1}$ - inflation rate at the previous period,
$\pi^{t}_{t+k/t}$ - 12/24-month ahead annual inflation target at t period,
$Y^{gap}_{t-2}$ - industrial production index gap (%) at t-2 period,
$USD_t$ - TL per unit of US Dollar at t period (direct quotation, USD/TL),
$P^{oil}_{t}$ - oil price (Europe Brent Spot Price FOB (Dollars per Barrel)) at t period,
$EMBI_t$ - embi+Turkey at t period,
$\varepsilon_t$ - error term.

The model includes past inflation rate as public closely follows past inflation rates (Baskaya et al., 2010). Inflation target is included in the model in accordance with the essence of inflation targeting strategy as it was denoted in the first section. Inflation targets in interim periods are calculated through the linear interpolation method. The model also includes output gap defined as the difference between seasonally adjusted industrial production index (2010=100) and potential industrial production index and calculated through the filter developed by Hodrick and Prescott (1997). Because, output gap warns central banks and public about inflationary pressures and they can use output gap to forecast future inflation (Kara, Ogunc, Ozlale & Sarikaya, 2007; CBRT, 2011). Two-period lagged value of output gap is added to the empirical model as industrial production index data are announced in about two months in Turkey. The exchange rate channel is one of the most considerable monetary transmission channels and indicates the effects of changes in exchange rates on aggregate demand and inflation (Kruskovic, 2017). Besides, a considerable part of Turkey's imports are priced in USD. The model therefore contains TL per unit of US Dollar. Hence, an increase in USD indicates depreciation of TL. the The model involves oil prices since oil is a considerable input for economic activities and changes in oil prices can affect inflation in Turkey (Berument & Tasci, 2002; Catik & Onder, 2011). Finally, embi+Turkey (Emerging Markets Bond Index Plus, EMBI) is included in the empirical model to observe the effects of macroeconomic fragility on inflation expectations in Turkey (Baskaya et al., 2010). All variables' coefficients are expected to be statistically significant and positive.

While inflation, inflation expectations, inflation target, industrial production index, and USD/TL data are obtained from the CBRT, data for oil prices are extracted from US Energy Information Administration (EIA). Besides, EMBI data are taken from JP Morgan through Datastream.

## 3. Estimation methodology

### 3.1. Unit root tests

Specifying the order of integration of variables is the first step in time series analyses to avoid spurious regression problem. Unit root tests produced by Dickey and Fuller (1981, henceforth ADF) and by Phillips and Perron (1988, henceforth PP) are commonly performed in econometric analyses. However these tests do not consider possible breaks in series and this is a principal shortcoming for these tests. Researchers therefore should regard the possibility of breaks in series to obtain efficient output.

Narayan and Popp (2010) develop a unit root test with two structural breaks that are endogenously determined. They suggest two models allowing for two structural breaks. The first model, namely M1, allows for two structural breaks in intercept while the second model, namely M2, allows for two structural breaks in intercept as well as trend.

The data-generating process of a time series $y_t=d_t+u_t$ that Narayan and Popp (2010) describe has two components, a deterministic component ($d_t$) and a stochastic component ($u_t$) where $u_t$ presents an AR (1) process. Models are demonstrated as follows:

$$d_t^{M1} = \alpha + \beta t + \Psi^*(L)\left(\theta_1 DU'_{1,t} + \theta_2 DU'_{2,t}\right) \tag{2}$$

$$d_t^{M2} = \alpha + \beta t + \Psi^*(L)\left(\theta_1 DU'_{1,t} + \theta_2 DU'_{2,t} + \gamma_1 DT'_{1,t} + \gamma_2 DT'_{2,t}\right) \tag{3}$$

where $DU'_{i,t} = 1\left(t > T'_{B,i}\right)$, $DT'_{i,t} = 1\left(t > T'_{B,i}\right)\left(t - T'_{B,i}\right)$, i=1,2.

Here, $T'_{B,i}$, i=1,2 stands for the true break dates. The parameters $\theta_i$ and $\gamma_i$ denote the magnitude of the intercept and trend breaks, respectively. Narayan and Popp (2010) express that the inclusion of $\Psi^*(L)$ allows breaks to happen slowly over time. Therefore, the proposed model is an innovative outlier class of models as it is based on the idea that the series responds to shocks to the trend function in a similar way as it responds to shocks to the innovation process, $e_t$.

The test regressions are the reduced forms of the corresponding structural model. They are showed as

$$y_t^{M1} = \rho y_{t-1} + \alpha_1 + \beta^* t + \theta_1 D(T_B')_{1,t} + \theta_2 D(T_B')_{2,t} + \delta_1 DU'_{1,t-1} + \delta_2 DU'_{2,t-1} + \sum_{j=1}^{k} \beta_j \Delta y_{t-j} + e_t \qquad (4)$$

$$y_t^{M2} = \rho y_{t-1} + \alpha^* + \beta^* t + \Omega_1 D(T_B')_{1,t} + \Omega_2 D(T_B')_{2,t} + \delta_1^* DU'_{1,t-1} + \delta_2^* DU'_{2,t-1} + \gamma_1^* DT'_{1,t-1} + \gamma_2^* DT'_{2,t-1} \sum_{j=1}^{k} \beta_j \Delta y_{t-j} + e_t \quad (5)$$

The break dates are determined using a sequential procedure (see Narayan & Popp (2010) for the details of this procedure). The null hypothesis of a unit root of $\rho=1$ is tested against the alternative hypothesis of $\rho<1$, and t-statistics of $\hat{\rho}$ in (4) and (5) are used. Critical values are generated through Monte Carlo simulations and depicted in Table 3 in Narayan and Popp (2010). If calculated test statistics are greater than critical values, the null hypothesis of a unit root is rejected.

## 3.2. Cointegration test

In a time series analysis, if one determines the series are not stationary, he/she must employ cointegration methods to examine the long-run relationships among series in order to avoid spurious regression problem. If the order of integration of series is different, the long-run relationship among series must be investigated through the bounds test and the autoregressive distributed lag (ARDL) approach. The main advantage of the ARDL method is that it can be employed irrespective of whether regressors are purely I(0), purely I(1) or mutually cointegrated (Pesaran & Shin, 1999). Another great advantage of the ARDL method is that it can present effective estimations in small samples (Narayan and Narayan, 2004). Accordingly, first, whether there is a cointegration relationship among series is examined through the bounds testing approach produced by Pesaran, Shin and Smith (2001), and second, if this relationship exists, short-run and long-run parameters are estimated through the ARDL method propounded by Pesaran and Shin (1999).

For an empirical model in which Y is dependent and X is independent variables, the models that are established to test whether there is a cointegration relationship between variables are as follows:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \beta_3 trend + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta X_{t-i} + \varepsilon_t \qquad (6)$$

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \sum_{i=0}^{p} \lambda_i \Delta X_{t-i} + \varepsilon_t \quad (7)$$

To test (6), $F_{IV}$, $F_V$, and $t_V$ statistics are utilized. $F_{IV}$ statistic tests the null hypothesis of no cointegration denoted as H0: $\beta_1=\beta_2=\beta_3=0$ while $F_V$ statistic tests the null hypothesis of no cointegration stated as H0: $\beta_1=\beta_2=0$. Besides, $t_V$ statistic tests the null hypothesis of no cointegration defined as H0: $\beta_1=0$. $F_{III}$ and $t_{III}$ statistics are used in order to test (7). $F_{III}$ statistic tests the null hypothesis of cointegration defined as H0: $\beta_1=\beta_2=0$ while $t_{III}$ statistic tests the null hypothesis of cointegration stated as H0: $\beta_1=0$. While the lag length is being determined for the bounds test, SBC (Schwarz Bayesian Criterion) can be used. Among the lag lengths without serial correlation, the lag length that presents the lowest SBC is used. Pesaran et al. (2001) present lower and upper bounds critical values (I(0) and I(1), respectively). If test statistics are greater than the upper bound critical values, then the null hypothesis of no cointegration is rejected. After determining there is a long-run relationship between series, the ARDL model is established to estimate short-run and long-run parameters.

The optimal lag length can determined using SBC for the ARDL (p,q) model specified as

$$Y_t = \alpha + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{i=0}^{q} \beta_i X_{t-i} + u_t \quad (8)$$

Using this model, long-run parameters can be calculated as

$$\alpha^* = {}^{\alpha}\!\Big/\!\left(1-\sum_{i=1}^{p} \alpha_i\right) \quad (9)$$

$$\beta^* = {\left(\sum_{i=0}^{q} \beta_i\right)}\Big/{\left(1-\sum_{i=1}^{p} \alpha_i\right)} \quad (10)$$

The cointegration model depending on these calculations is as follows:

$$\widehat{Y}_t = \alpha^* + \beta^* X_t \quad (11)$$

After estimating long-run parameters, the short-run relationship between variables can be obtained through the error correction model based on the ARDL approach. This model is as

$$\Delta Y_t = \theta_0 + \theta_1 EC_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-i} + \sum_{i=0}^{q} \lambda_i \Delta X_{t-i} + u_t \quad (12)$$

In (12), the one-period lagged error correction term, namely $EC_{t-1}$, shows how much deviation in the short run is corrected in the long run. The coefficient of $EC_{t-1}$ is expected to be negative and statistically significant.

## 4. Estimation results

Table 1 depicts the results of the ADF and PP unit root tests. As seen, the null hypothesis of a unit root can be rejected at level for output gap. Put differently, output gap is stationary. Besides, the null hypothesis of a unit root can be rejected at first differences for other variables with regard to the unit root tests. Hence these unit root tests indicate that these variables are integrated of order one.

**Table 1: ADF and PP unit root tests**

| Variable | ADF test statistic | | PP test statistic | |
|---|---|---|---|---|
| | Level | 1st difference | Level | 1st difference |
| $\pi^e_{t+12/t}$ | -0.013 | -6.352[a] | 0.250 | -6.027[a] |
| $\pi^e_{t+24/t}$ | 0.298 | -6.497[a] | 0.644 | -6.109[a] |
| $\pi_{t-1}$ | -0.849 | -8.009[a] | -0.723 | -9.621[a] |
| $\pi^t_{t+12/t}$ | -0.255 | -2.554[b] | -0.200 | -2.683[a] |
| $\pi^t_{t+24/t}$ | -1.140 | -3.649[a] | -0.168 | -3.654[a] |
| $Y^{gap}_{t-2}$ | -2.978[a] | -5.441[a] | -2.695[a] | -11.830[a] |
| $USD_t$ | 2.470 | -7.067[a] | 3.136 | -6.900[a] |
| $P^{oil}_t$ | -0.758 | -7.036[a] | -0.717 | -7.063[a] |
| $EMBI_t$ | 1.566 | -10.754[a] | 1.545 | -10.743[a] |

Notes:

[a] Indicates 1% statistical significance.

[b] Indicates 5% statistical significance.

Table 2 reports the results of the Narayan and Popp (2010) unit root tests. As is seen from the table, the null hypothesis of a unit root can be rejected at level for past inflation rate. In other words, past inflation rate is stationary. Additionally, the null hypothesis of a unit root can be rejected at first differences for 12-month ahead expected inflation rate, 24-month ahead expected inflation rate, 12-month ahead inflation target, output gap, and EMBI. Therefore, the Narayan and Popp

(2010) unit root test yields that these variables are integrated of order one. Besides these findings, the Narayan and Popp (2010) unit root test indicates mixed findings for 24-month ahead inflation target, USD/TL exchange rate, and oil price. These findings indicate that the ARDL approach should be employed to determine whether there is a cointegration relationship in the models and to estimate long-run parameters.

**Table 2: Narayan and Popp (2010) unit root test[a,b]**

| Variable | M1 test statistic | | M2 test statistic | |
|---|---|---|---|---|
| | Level | 1st difference | Level | 1st difference |
| $\pi^e_{t+12/t}$ | -3.135 (Oct. 2008, Dec. 2008) | -7.598[c] | -4.507 (Dec. 2008, Dec. 2013) | -8.293[c] |
| $\pi^e_{t+24/t}$ | -2.610 (Dec. 2008, Dec. 2011) | -4.982[c] | -0.932 (Jun. 2008, Dec. 2008) | -5.758[c] |
| $\pi_{t-1}$ | -4.396[d] (May 2011, May 2012) | -6.712[c] | -5.400[d] (May 2011, May 2012) | -6.766[c] |
| $\pi^t_{t+12/t}$ | -0.172 (Jan. 2009, Jan. 2011) | -6.116[c] | -2.288 (Jan. 2009, Jan. 2012) | -37.26[c] |
| $\pi^t_{t+24/t}$ | -3.027 (Jun. 2008, Jan. 2010) | -7.073[c] | -11.03[c] (Jul. 2009, Jan. 2010) | -6.091[c] |
| $Y^{gap}_{t-2}$ | -2.254 (Jan. 2009, Sep. 2013) | -5.970[c] | -2.357 (Jan. 2009, Feb. 2010) | -13.16[c] |
| $USD_t$ | -1.285 (Sep. 2008, Mar. 2009) | -8.327[c] | -4.724[e] (Sep. 2008, Dec. 2008) | -8.669[c] |
| $P^{oil}_t$ | -1.705 (Jul. 2008, Dec. 2008) | -8.672[c] | -5.684[c] (Jul. 2008, May 2012) | -8.770[c] |
| $EMBI_t$ | -2.902 (Sep. 2008, May 2013) | -13.06[c] | -4.160 (Sep. 2008, May 2013) | -12.96[c] |

Notes:

[a] For M1, critical values for 1%, 5%, and 10% levels of significance are -4.958, -4.316, and -3.980, respectively. For M2, critical values for 1%, 5%, and 10% levels of significance are -5.576, -4.937, -4.596, respectively.

[b] Break dates are reported in parentheses.

[c] Indicates 1% statistical significance.

[d] Indicates 5% statistical significance.

[e] Indicates 10% statistical significance.

Prior to presenting the results of the ARDL test, the paper focuses on the break dates that the Narayan and Popp (2010) unit root indicates. Because, one may argue that these break dates correspond to the considerable periods for the Turkish economy. Accordingly, the 2008-2009 global crisis may account for the breaks detected in 2008 and 2009. The remarkable growth performance of the Turkish economy may account for the breaks detected in 2010 and 2011. Finally, the breaks discovered in 2012 and 2013 may be accounted for by the quantitative easing program of the FED.

**Table 3: ARDL models**

ARDL cointegration test for k=12 (first model)

Panel A: Determination of the lag length for the bounds test

| Lag length | SBC | LM[a] |
|---|---|---|
| 1 | 0.208 | 36.696 |
| 2 | 0.070 | 1.329 |
| 3 | 0.152 | 7.570 |
| 4 | 0.292 | 0.373 |

Panel B: Results of the bounds test

| Test statistics | | | | |
|---|---|---|---|---|
| $F_{III}$ | $t_{III}$ | $F_{IV}$ | $F_V$ | $t_V$ |
| 5.179[b] | -5.761[b] | 5.580[b] | 6.187[b] | -6.310[b] |

| 5% critical values[c] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I(0) | I(1) | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| 2.45 | 3.61 | -2.86 | -4.38 | 2.63 | 3.62 | 2.87 | 4.00 | -3.41 | -4.69 |

Panel C: Long-run parameters

| Variable | Coefficient | Prob. value |
|---|---|---|
| $\pi_{t-1}$ | 0.158[d] | 0.000 |
| $\pi^{t}_{t+12/t}$ | 0.674[d] | 0.000 |
| $Y^{gap}_{t-2}$ | 0.120[d] | 0.000 |
| $USD_t$ | 1.964[d] | 0.000 |
| $P^{oil}_t$ | 0.009[e] | 0.022 |
| $EMBI_t$ | -0.722[d] | 0.000 |

Panel D: Diagnostic tests

| Test | F-statistic | Prob. value |
|---|---|---|
| $\chi^2_{BG}$ | 0.198 | 0.820 |
| $\chi^2_{ARCH}$ | 0.001 | 0.987 |

ARDL cointegration test for k=24 (second model)

Panel E: Determination of the lag length for the bounds test

| Lag length | SBC | LM[a] |
|---|---|---|
| 1 | -0.650 | 22.607 |
| 2 | -0.687 | 2.724 |
| 3 | -0.497 | 1.085 |
| 4 | -0.296 | 0.001 |

Panel F: Results of the bounds test

| Test statistic | | | | |
|---|---|---|---|---|
| $F_{III}$ | $t_{III}$ | $F_{IV}$ | $F_V$ | $t_V$ |
| 3.809[b] | -4.674[b] | 3.312 | 3.605 | -4.462 |

| 5% critical values[c] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I(0) | I(1) | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) | I(0) | I(1) |
| 2.45 | 3.61 | -2.86 | -4.38 | 2.63 | 3.62 | 2.87 | 4.00 | -3.41 | -4.69 |

| Panel G: Long-run parameters | | |
|---|---|---|
| Variable | Coefficient | Prob. value |
| $\pi_{t-1}$ | 0.091[f] | 0.076 |
| $\pi^{t}_{t+24/t}$ | -0.892[d] | 0.000 |
| $Y^{gap}_{t-2}$ | 0.036 | 0.233 |
| $USD_t$ | 1.783[d] | 0.001 |
| $P^{oil}_{t}$ | 0.007 | 0.269 |
| $EMBI_t$ | -1.145[d] | 0.000 |
| Panel H: Diagnostic tests | | |
| Test | F-statistic | Prob. value |
| $\chi^2_{BG}$ | 2.273 | 0.107 |
| $\chi^2_{ARCH}$ | 2.241 | 0.137 |

Notes:

[a] LM is the Breusch-Godfrey LM test statistic used to test serial correlation.
[b] Indicates the rejection of the null hypothesis of no cointegration.
[c] Critical values are obtained from Pesaran et al. (2001).
[d] Illustrates 1% statistical significance.
[e] Illustrates 5% statistical significance.
[f] Illustrates 10% statistical significance.
$\chi^2_{BG}$: Breusch-Godfrey serial correlation LM test
$\chi^2_{ARCH}$: ARCH heteroscedasticity test

Table 3 shows the results of the ARDL cointegration test. Accordingly, the optimal length is 2 in the bounds tests for both models since this lag length provides the lowest SBC without serial correlation. After determining the optimal length for the models, the existence of a cointegration relationship in the models is examined. According to results of the bounds test, all tests statistics are greater than the upper bound critical values in the first model. Table 3 also shows that two out of five test statistics are greater than the upper bound critical values in the second model. Therefore, the bounds test shows that there is a cointegration relationship among variables and that parameters of independent variables can be estimated for both models. Hence the ARDL model can be employed to estimate long-run and short-run relationships among variables.[1] As is seen from the table, in the first model, past inflation rate, inflation target, output gap, USD/TL exchange

[1] In order to save space, long-run and short-run ARDL models and the results of CUSUM and CUSUM-Q tests are not presented in the paper. Findings obtained from the ARDL models show that the coefficient of the one-period lagged error correction term is statistically significant and negative, as expected. Besides, CUSUM and CUSUM-Q tests indicate that short-run and long-run parameters are stable. These models and findings are available upon request.

rate, oil price, and EMBI have the estimations of 0.158, 0.674, 0.120, 1.964, 0.009, and -0.722, respectively. Additionally, all variables' coefficients are statistically significant. Then, 12-month ahead expected inflation rate is positively related to past inflation rate, inflation target, output gap, USD/TL exchange rate, and oil price and is negatively related to EMBI. In the second model, past inflation rate, inflation target, output gap, USD/TL exchange rate, oil price, and EMBI have the estimations of 0.091, -0.892, 0.036, 1.783, 0.007, and -1.145, respectively. Besides, it can be observed from the table that the coefficients of output gap and oil price are not statistically significant. Then, 24-month ahead expected inflation rate is positively related to past inflation rate and USD/TL exchange rate and is negatively related to inflation target and EMBI.

The findings for 12-month ahead expected inflation rate majorly concur with those of Baskaya et al. (2008, 2010, 2012). On the other hand, the findings for 24-month ahead expected inflation rate contradict with those of Baskaya et al. (2008, 2010, 2012) since the findings of the paper indicate that only past inflation rate and USD/TL exchange rate have statistically significant and positive effects on 24-month ahead expected inflation rate.

## 5. Conclusion

After the explicit inflation targeting experience during 2002-2005, the CBRT adopted inflation targeting in 2006. Inflation targeting is a monetary policy strategy which uses inflation expectation, which is strongly correlated with inflation theoretically, as the intermediate target. Besides, a central bank adopting inflation targeting strategy tries to achieve inflation target using all available information. During the period 2006-2016, (i) the CBRT usually missed inflation targets, (ii) actual inflation rates were usually higher than inflation expectations, and (iii) inflation expectations obtained from the survey of expectations were usually greater than inflation targets. Therefore, one can argue that (i) the CBRT is not successful at achieving inflation targets, (ii) the decision makers and experts are not successful at forecasting future inflation, and (iii) inflation expectations are not well anchored in Turkey. Then, it seems to be worthwhile to examine the determinants of inflation expectations in Turkey. Put differently, one may argue that whether the decision makers and experts consider all available information while they are forming inflation expectations should be investigated in Turkey.

This paper tries to specify the determinants of 12-month ahead and 24-month ahead inflation expectations obtained from the survey of expectations in Turkey using monthly data from April 2006 to December 2016 by employing the ARDL method. According to the findings, 12-month ahead expected inflation rate is positively related to past inflation rate, inflation target, output gap, USD/TL exchange rate, and oil price and is negatively related to EMBI. Besides, 24-month ahead expected inflation rate is positively related to past inflation rate and USD/TL exchange rate and is negatively related to inflation target and EMBI.

These findings have considerable implications. First, more variables have statistically significant and positive impacts on 12-month ahead expected inflation rate compared to 24-month ahead expected inflation rate. These findings support Graph 3 which presents 12-month ahead inflation expectations were greater than 24-month ahead inflation expectations. Besides, the coefficient of inflation target is negative in the second model. This is a serious problem for the success of monetary policy in Turkey that essentially aims at shaping inflation expectations of the decision makers and experts to achieve inflation targets. Second, all independent variables in the models can affect future inflation and so should be considered by the decision makers and experts while they are forming their inflation expectations. Thus inflation expectations of the decision makers and experts can rise if they consider all variables.[2] Third, the CBRT may increase interest rates and achieve inflation target as a result of more precise inflation forecasts in the surveys. Otherwise, the CBRT may have to increase inflation targets in the following years in order to achieve inflation targets.

2 According to Soybilgen and Yazgan (2017), the current survey can be reconsidered by the CBRT to improve forecast precision of the survey.

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