# INTEREST RATES, FISHER EFFECT AND ECONOMIC DEVELOPMENT IN TURKEY, 1989-2011

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**Abstract:** This paper investigates the validity of the Fisher Hypothesis in Turkey covering the period 2003 – 2012. To test validity of Fisher Hypothesis, this paper uses an Autoregressive Distributed Lag test for threshold cointegration recently introduced in the literature by Li and Lee (2010). The empirical results which are obtained from this paper indicate that Fisher hypothesis is valid for Turkey, meaning nominal interest rates would be an important leading indicator for inflation.
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## 1. Introduction

A linkage between nominal interest rate and inflation, known as the Fisher hypothesis, has attracted the attention of both economists and policy makers. The Fisher hypothesis, introduced by Fisher (1930), states that the expected nominal asset returns should move one for one with expected inflation. If the hypothesis holds in the long-run, the monetary policy will have no influence on the real interest rate, since, in this case, any change in expected inflation will be offset by a change in the nominal rate of interest, leaving the ex ante real interest rate unchanged (Nusair 2008).

In empirical studies, validity of Fisher Hypothesis is tested for cointegration between nominal interest rate and inflation rate. The presence of cointegration would imply that Fisher hypothesis hold. The standard cointegration tests require that all variables to be integrated of the same order. Based on this assumption, before testing cointegration, the unit root tests are used to assess the nature of the data generating process of the series.

It is well known that standard unit root and cointegration test results can be affected by structural breaks and nonlinearity. This may explain the conflicting results on the validity of the Fisher hypothesis in the literature. To avoid this conflicting results, this paper uses an Autoregressive Distributed Lag (ADL) test for threshold cointegration recently introduced in the literature by Li and Lee (2010). This approach tests the cointegration relationship without requiring the same order of integration of all variables (Chang and Xu 2012).

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The issue of the validity of Fisher hypothesis has attracted substantial attention in the empirical literature. Kıran (2013) examines the validity of Fisher hypothesis in Turkey over the period from 1990:01 through 2010:03 by using cointegration and fractional cointegration approaches. Findings of this paper support the validity of the Fisher hypothesis in Turkey. Incekara et.al. (2012) use quarterly data over the period from 1989:Q1 to 2011:Q4 for Turkey to examine the Fisher hypothesis. Using Johansen cointegration analysis, they found that in the long term, Fisher impact is valid for Turkish economy. Gül and Acıkalin (2008) investigates the fisher effect of Turkey. They use Johansen cointegration analysis. Their findings suggest that there is a very powerful Fisher effect in the case of Turkey from 1990 to 2003. Christopoulos and Ledesma (2007) present evidence that, for the U.S. during the 1960–2004 period, the Fisher relation presents important non-linearities. Panel cointegration tests are applied to a panel of quarterly data covering 20 OECD countries between 1980 and 2004 by Westerlund (2008). The evidence of this paper suggest that the Fisher effect cannot be rejected once the panel evidence on cointegration has been taken into account. Atkins and Coe (2002) investigate the empirical validity of the long-run Fisher effect in the United States and Canada cover the period 1953 to 1999. Using ARDL bounds test approach they reject the null hypothesis of no long-run relationship between nominal interest rates and inflation in post-war Canadian and US data.

The purpose of this paper is to re-examine the Fisher Hypothesis for Turkey using recently developed econometric techniques testing threshold cointegration relationship without requiring the same order of integration of all variables. According to our best knowledge, there is no previous study examining validity of Fisher hypothesis by using this approach.

This paper is organized as follows: Section 2 discusses theoretical model and methodology. Section 4 describes data and empirical results. Some conclusions are offered in Section 5.

## 2. Theoretical Model and Econometric Methodology

Fisher (1930) suggests that the nominal interest rate is equal to sum of the real interest rate and expected inflation. Under the rational expectation assumption, the Fisher hypothesis equation can be written in a regression framework as follows,

$$i_t = \alpha + \beta\pi_t + \varepsilon_t \tag{1}$$

where $i_t$ is the nominal interest rate and $\pi_t$ is the observed inflation. Validity of Fisher effect requires that the inflation and nominal interest rates should be cointegrated with a unit slope on inflation. In other words, if $\beta$ coefficient in equation 1 is equal to one, this implies that Fisher hypothesis hold. The Fisher effect would imply that market interest rates are good indicators of inflationary expectations (Christopoulos and Ledesma, 2007)

To test validity of Fisher Hypothesis, many researchers rely on evidence from cointegration tests regarding the relationship between nominal interest rate and inflation

rate. From a statistical point of view, the presence of cointegration would imply that Fisher hypothesis hold. The application of standard cointegration techniques requires that the nominal interest rate and the inflation rate are integrated of order one, I(1). It is well known that standard unit root and cointegration test results can be affected by structural breaks and nonlinearity. To avoid this, this paper uses an Autoregressive Distributed Lag (ADL) test for threshold cointegration recently introduced in the literature by Li and Lee (2010). This approach tests the cointegration relationship without requiring the same order of integration of all variables (Chang and Xu 2012). Thanks to this approach, we can avoid poor size and power properties of the conventional unit root tests as indicated Harris (1995).

Threshold ADL model of Fisher hypothesis described as follows

$$\Delta i_t = \beta_0 + \beta_1\, i_{t-1}\, I_t + \beta_2\, i_{t-1}(1-I_t) + \beta_3\, \pi_{t-1}\, I_t + \beta_4\, \pi_{t-1}(1-I_t) + \beta_5 \Delta\pi_t + \beta_6 \Delta i_t + \beta_7 \Delta\pi_{t-1} + \varepsilon_t$$

$I_t$ denotes the indicator function. Li and Lee (2010) suggest two indicators; Indicator A with $I_t^a = I\big(u_{t-1} < u_{t-1}^*(\tau)\big)$ and Indicator B with $I_t^b = I\big(\Delta u_{t-1} < \Delta u_{t-1}^*(\tau)\big)$ are considered.

Here only one lag of $\Delta i_t$, $\Delta\pi_t$ is included in the regression following the parsimony principle (Liu et. al. 2012)

Li and Lee (2010) proposed two test for threshold cointegration. The first, the BO type test, is attributable to Boswijk (1994) who suggests testing the coefficients of both $i_{t-1}$ and $\pi_{t-1}$ in the test regression.

The null hypothesis of the threshold BO test given by

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

In contrast, the second the BDM type test of Benerjee et al. (1998), is concerned only with the coefficient of $i_{t-1}$. Benerjee et al. (1998) suggest adding leads of $\Delta\pi_t$ to their regression so that the asymptotic results are valid in absence of strict exogeneity.

The threshold BDM Test is based on testing following null hypothesis,

$$H_0: \beta_1 = \beta_2 = 0$$

Li and Lee (2010), based on their Monte Carlo Experiment, also report that the BO test performs better than any of other test in term of size and power.

## 3. Data and Empirical Results

The data used in this study are monthly, covering the period 2003:1 – 2012:12 and are obtained from the Central Bank of the Republic of Turkey.  The interest rate is the three-

month time deposit rate and the inflation rate is calculated by using consumer price index (CPI) as $[\ln(CPI_t/CPI_{t-1})]$. Figure 1 plots the two time series over the stated period.

Figure 1: Interest Rate and Inflation Rate of Turkey
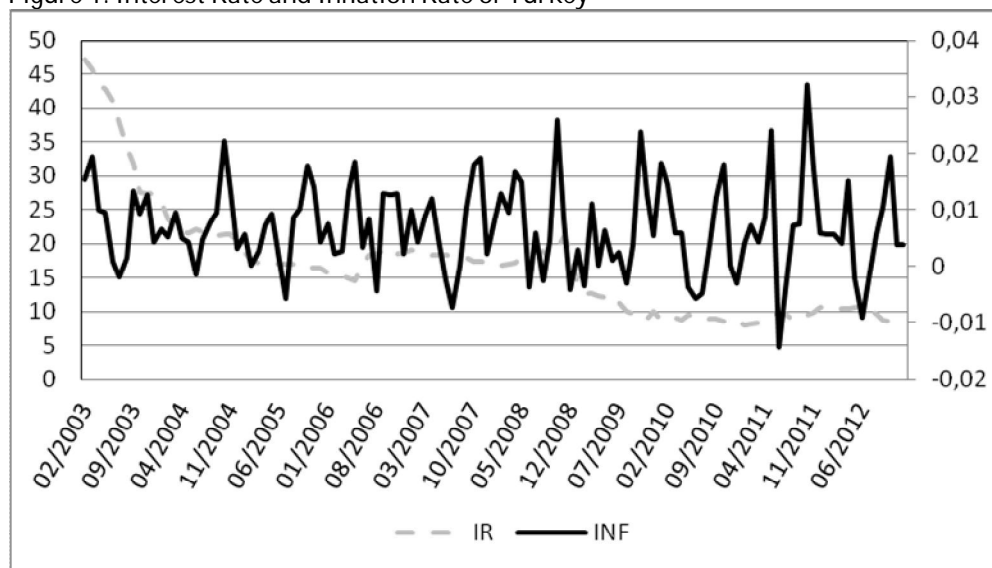


To test validity of Fisher Hypothesis we use ADL threshold cointegration test. Table 1 reports the results from ADL test for threshold cointegration using both indicator A and indicator B functions, respectively.

Table 1: ADL Threshold Cointegration Test Results

Part A: Indicator A

|  | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $\beta_7$ |
|---|---|---|---|---|---|---|---|---|
| $I_t^a$ | -0.32359 | 0.004189 | -0.05351 | 38.0018 | 83.1381 | 3.32733 | 0.191388 | -7.9926 |
|  | (-0.93) | (0.19) | (-4.92) | (2.88) | (2.20) | (0.39) | (2.26) | (-0.64) |
|  | BO = | 44.4007 *** | $E_t^*(\tau)=$ | 3.4657 | $\tau$ = | 0.2083 | AIC= | 2.379012 |

Part B: Indicator B

|  | $\beta_0$ | $\beta_1$ | $\beta_2$ | $\beta_3$ | $\beta_4$ | $\beta_5$ | $\beta_6$ | $\beta_7$ |
|---|---|---|---|---|---|---|---|---|
| $I_t^b$ | 0.272489 | -0.05681 | -0.04508 | 28.84745 | 47.86711 | 7.033638 | 0.219463 | 0.334123 |
|  | (1.90) | (-3.55) | (-3.40) | (1.59) | (2.77) | (0.72) | (1.78) | (0.02) |
|  | BO= | 28.9847*** | $E_t^*(\tau)=$ | -1.0609 | $\tau$ = | 0.756303 | AIC= | 2.48436 |

The critical values for BO statistic are tabulated at Li and Lee (2010). For Indicator A, the critical values of BO test for 1%, 5% and 10% are 24.00, 19.04 and 16.90, respectively. For Indicator B, the critical values of BO test for 1%, 5% and 10% are 23.88, 18.66 and 16.36, respectively. The number in parenthesis indicates the robust t-statistic. *** indicates significance at 1% level.

The BO tests in Table 1 clearly reject the null of no long run relationship between nominal interest rates and inflation rate. In other words, there is a cointegration relationship between these series. This findings indicate that Fisher hypothesis is valid for Turkey.

## 4. Conclusion

The validity of Fisher hypothesis has been widely studied in recent years. In this paper, we present new evidence on this ongoing solvency debate. To test validity of Fisher Hypothesis in Turkey covering the period 2003:1 – 2012:12 we use ADL threshold cointegration test. This approach tests the cointegration relationship without requiring the same order of integration of all variables. The findings which are obtained from this paper indicate that Fisher hypothesis is valid for Turkey, meaning nominal interest rates would be an important leading indicator for inflation.

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