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PSYCHOLOGICAL DOMINANCE, MARKET DOMINANCE AND THEIR IMPACTS IN TURKEY

Abstract: *The study focuses on analyzing an economy that applies an inflation-targeting rule in which the policy interest rate is determined actively by the Taylor rule, and the policy maker involuntarily becomes the affirmant of inflation. In an economy that applies inflation-targeting policy where interest rates are determined in light of the Taylor rule, as the Central Bank tries to establish price stability and financial stability by determining policy interest rates, the Central Bank might fall into a position to do nothing but to assent inflation. In the empirical section, two new indices, the psychological dominance (pdi) and market dominance indices (mdi) are developed based on the difference between the policy rates. The band within which the indices follow random walk processes are determined with Band-TAR models. The CB policy is additionally modeled with a nonlinear Taylor rule with TVEC models. The most significant point of the process is its inflation-creating effect. By moving from the Turkey example, the main problem in the policies of Central Bank of Turkey is the difference between the borrowing and lending rates and its inflationary effect.*

Keywords: *Price Stability, Monetary Policy, Central Bank, Taylor Rule, Nonlinear econometrics.*

JEL Classification: E31, E58, C50

1. Introduction

If the literature regarding the monetary policy and its applications vis-à-vis inflation is investigated, the striking feature is that they constitute a recognizable amount of studies within this area. In the post-1990 period, inflation targeting, Taylor rule, and the Fiscal Theory of Price Level[1] have significant place in this field. These approaches, which focus on the causes of inflation or on producing policy suggestions on lowering inflation rates, are investigated both separately and together in many studies.

This study focuses on an economy that follows inflation targeting in which policy interest rate is determined in accordance with the Taylor rule to obtain price stability and financial stability and in which the LM curve is flattened by the monetary policies without money. Accordingly, the study aims to analyze how under the above-mentioned economy, the price stability policies end up in unexpected inflation, in the sense that monetary authority unwillingly affirms inflation. The most prominent feature of this process is in regard to its inflationary effects. The main problem that leads to this phenomenon is the inflationary effect that is caused by both the difference between the lending and borrowing rates, and simultaneously, targeting the quantities[2].

The study focuses on two subjects. The first is the development of the psychological and market dominance indices, and the second is the analysis of inflationary effects of policy interest rates. Two separate indices are developed to find the inflationist effect of the difference between CB's borrowing (BR) and lending (LR) interest rate. Psychological dominance index (PDI) is determined by LR/BR rate, where LR and BR denote the lending rate and the borrowing rate, respectively. The market dominance index (MDI) was based on the ratio between the lending and borrowing rates divided to their average as ((*LR-BR*)/*AVG)*.

[1]Among these approaches, the Fiscal Theory of Price Level (FTPL) links the causes of inflation to fiscal dominance. In the development process of the FTPL, many studies have made significant contributions to the theory. Among these, the study of Barro (1979) is one of the cornerstones. In one of the early studies on FTPL, Martins (1980) discusses that the price of bond is analogous to the price level, thus the nominal rate of interest is determined by the bond/money ratio and has no close relationship to the changes in the price level. Further, Aiyagari and Gertler (1985), Sargent (1982), Sargent and Wallace (1981), Woodford (1991, 1996, 1998, 2001), Sims (1991, 1993), Leeper (1991) and Cochrane (1998) are the papers which focus on the Ricardian and Non-Ricardian interactions between monetary and fiscal policies. Cochrane (2007) shows that the success in controlling inflation in the 1980s in the USA cannot be attributed to a Taylor-type interest rate rule linking the interest rates to inflation and other variables constituting regime switches between active and passive monetary policy regimes.

[2]In accordance with the Economics Theory it is known that if the price is determined, quantity should be left to the market mechanism. On the other hand, as it will be explained in detail in the following, the Central Bank of the Republic of Turkey determines both price and quantity. This situation is unattainable in light of Economic Theory.

In the upcoming sections, using the BAND-TAR model, the threshold effects under error correction mechanisms will be evaluated for the PDI and MDI indices.The interrelation between PDI and MDI indices and inflation will be analyzed with TAR-VECmodels.The interrelations between the interest rates, output gap and inflation rates will be evaluated with TAR-VECmodels.

The second part of the study focuseson the psychological and market dominance measures. The third part investigates the econometric methodology. The econometric results are discussed in Part 4. The conclusions are given in Part 5.

2. Inflationary Effect in Accordance with the Psychological and Market Dominance

In order to see the effect of the policy of the Central Bank of the Republic of Turkey (CB) clearly, first the constraints should be clearly defined. CB tries to establish price stability and inflation stability by determining policy interest rates in an economy in which inflation-targeting policy is followed so that simultaneously the interest rates are determined with Taylor rule (Bildirici et al., 2014). Accordingly, giving up controlling of the money supply and determining the interest rate causes horizontal LM curve and money policy without money (Parasız, 2011). Thus, the most critical point of this type of policy is its inflationary effects[3].

In accordance with the interest rate determination policy of the Central Bank, which aimed at representing the stress and the conditions in the financial markets, the purpose of an interest- smoothing model in its interest rate policy is to lower the upward and downward breaks in the markets. By aiming at decreasing the number of the breaks and their magnitudes, Central Bank creates an interest rate series to affect the expectations of the actors within the market and to alter the expectations by correcting it towards a positive path. Once this measure is taken, the financial stability could be achieved and maintained. The policy interest rate rule followed by the Central Bank supports the financial system on one hand and is seen as an important tool in maintaining the financial stability. In situations where the policy interest rates are determined by the application of the Taylor rule, the aim is to control extreme volatility.

The CB could not directly finance the budget deficits by buying the government bonds. Consequently, it could affect this process indirectly. In that manner, it could procure the banks to buy government bonds indirectly. However, if

[3]As the CB alters the LM curve by making it horizontal, it also achieves the determination of the price level. As a result of this policy, the quantity should be left to the market as suggested by the Economics Theory. On the other hand, CB targets the determination of the quantity at the same time and the simultaneous targeting of both the price and the quantity causes inflationary effects in return (Bildiriciet.al., 2014).

the interest rates rise above the lending rate of the CB, banks borrow from the CB. Since the interest rate on borrowing is below the market interest rate, the CB ends up financing the budget deficits indirectly. The most critical point of this policy structure is that by making money abundant in the market, the Central Bank falls into a situation in which it comes to support the inflation, which it was at the beginning trying to control.

2.1. Developments in Turkish Economy

After the crisis of 2000-2001, implicit inflation targeting has been implemented as of 2002-2005. Since its adaptation, the Central Bank has begun to use the policy tools that allowed Woodford's Neo-Wicksellian monetary policy or monetary policy without money. The first two are applications of an inflation-targeting regime. The second phase is the application of Taylor rule. The third method is the usage of short-term interest rates as basic policy tools. These decisions, in a sense, showed that Neo-Wicksellian monetary policy was being performed. As of 2006, when inflation targeting was adopted, evidences of a full Neo-Wicksellian monetary policy became highly obvious[4].

After 2010, CB adopted policy interest rate application. With this policy, Central Bank can have a structure that supports inflation. Indeed, CB did not change its policy interest rate of 5.75. It also set its borrowing interest rate as 5. In return, it raised its lending interest rate from 9% to 12.5%. Although CB kept its policy interest rate at 5.75, it has been observed that the interest rates kept rising with time. What is very important for this study are the reasons why interest rates kept rising and created inflation while Central Bank kept its policy interest rate at 5.75. CB needs to provide high amounts of liquidity to the market by making weekly repos (repurchase agreements). This way, banks receiving cash are expected to sell these funds in the money market. If there are those who cannot sell these funds in the money market, CB repurchases these funds at 5%. So, the banks that were funded with 5.75, sell these funds as loans or provide these to each other; and if there is a portion of funds they could not sell, they sell it back to CB at 5% interest. Meanwhile, they face a loss of 0.75 points for the funds they couldn't sell. However, since they receive an interest income from the funds they sold, the loss of 0.75 points is deducted from this income. As a result, they still have a profit. If banks had needed domestic funds, they used to become indebted to CB with a 9% interest. After CB raised the indebtedness interest from 9% to 12.5%, the market could not be funded with the 5.75% policy interest as

[4]The most significant evidence of Neo-Wicksellian monetary policy in inflation targeting was having all interest rate determination responsibility left to a monetary policy board. Another significant evidence was the declaration of the usage of short-term interest rates as basic monetary policy tools. On the other hand, the declaration that long-term inflation predictions would be made and the commitment of accountability in major deviations from the goal is a strong evidence of Neo-Wicksellian monetary policy, due to accepting the management of expectations as a priority (Bildirici et al., 2014).

much as desired, up until now. When the market is funded as much as desired, it will set the money amount. Consequently, CB has a passive role. However, now, CB does not provide funds as much as desired by the market, and provides as much as it desires, at 5.75. In other words, CB is active in setting the money amount instead of being passive, and it doesn't provide the market as much liquidity as the market desires. Because the liquidity demand of the markets exceeds the liquidity supply, the banks have the opportunity to supply this money over CB's lending interest rate. Lending interest rate was 9%, now it is 12.5%. This has raised banks' borrowing costs from CB. However, banks' borrowing interest range is from 5.75% to 12.5%. This rate can vary every day. However, since lending interest rate is now 12.5% and MB does not fund the market sufficiently over its policy interest rate of 5.75, interest rates increase implicitly (Parasız İ., 2011 and Bildirici et. al. 2014).

CB can imply for the markets that it will increase the policy interest rate, by increasing borrowing interest rates. Thus it has widened the gap between two interests without changing the policy interest rates but increasing lending interest rate. Because it would look weird when CB brings the lending interest rate, which it had increased from 9% to 12.5% in its former decision, back to its previous rate again; a decision to increase signal policy interest rate towards lending interest rate, has given the signal that the policy interest rate over the market is to be potentially increased without increasing the policy interest rate (Bildirici et. al. 2014). The other effect emerging with the rise of interest rate is the increase in inflation. Behind the inflation increases are the terms brought by inflation targeting.

Two separate indexes are developed to find the inflationist effect of the difference between CB's borrowing and lending interest rate. Psychological dominance index is determined by LR/BR rate, where LR and BR denote the lending rate and the borrowing rate, respectively. The market dominance index (mdi_t) was based on the difference between the lending and borrowing rates and is calculated as (LR-BR). Therefore, both indices are based on the spread between the two policy interest rates According to psychological dominance index, the area that shows a decrease after a certain point is the point where inflation decreases, and excessive decline in the decrease rate brings an inflationist effect.

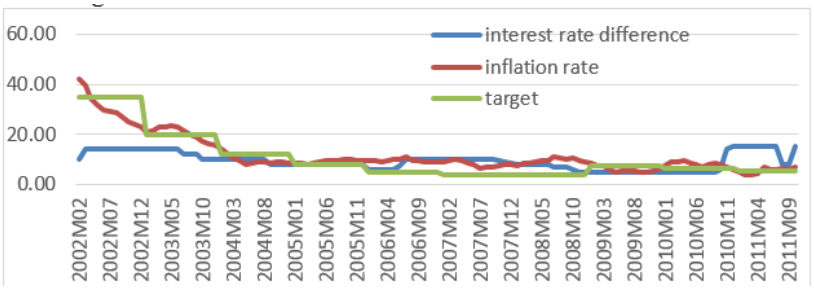


Figure 1. Inflation, policy interest rate difference and the inflation target: 2002.01-2011.10

Source: Central Bank of Republic of Turkey, EVDS Database.Notes. Red line shows the monthly inflation rates and blue line shows the difference in the policy interest rates. To match the data range on the left axis, the difference is multiplied by two.

As can be seen in Figure 1, when the difference in two rates remains in the strip and the rate is decreased, the inflation decreases; however, when the rate remains under or over a certain strip, the inflation rises. In the upcoming sections, using the BAND-TAR model, the strip will be improved for both psychological dominance and market dominance indexes.

3. Econometric Theory

Psychological and market dominance indexes are defined and modelled with BAND-TAR and the relationship between inflation and these indexes are modelled with TAR-VEC. The aim at estimating TAR-VEC models is to determine the thresholds to display the Central Bank's use of the Taylor rule against inflation with policy interest rate. The use of the BAND-TAR models is to determine the nonlinear cointegration and the band of thresholds for the psychological market dominance indices to evaluate the thresholds between which the series are subject to random walk processes. We also used Kapetanioset. al. (2003) nonlinear KSS unit root and TAR unit root tests to determine then onlinear unit root structure for the series analyzed.

3.1.BAND-TAR model

In the Obstfeld and Taylor (1997) Band-TAR model, the time series is allowed to follow stationary process in between symmetrical thresholds; whereas, the outer regimes correspond to the upper and lower regimes' convergence towards the band neighborhood. A three-regime Obstfeld and Taylor (1997) Band-TAR model with the upper, middle, and lower regimes is,

$$\begin{aligned}
&\Delta q_t = \lambda_{out}\,(q_{t-1} - c) + \varepsilon_t^{out} \quad if \quad q_{t-1} > c;\\
&\Delta q_t = \varepsilon_t^{in} \quad if \quad c \geq q_{t-1} \geq -c;\\
&\Delta q_t = \lambda_{out}.(q_{t-1} + c) + \varepsilon_t^{out} \quad if \quad q_{t-1} < -c
\end{aligned} \tag{1}$$

where, Δ is the first difference, y_t is the dependent variable, c is the threshold parameter and $\varepsilon_t^{out} \sim iid\left(0, \sigma_{out}^2\right)$ and $\varepsilon_t^{in} \sim iid\left(0, \sigma_{in}^2\right)$ are white noise processes. In the equation, within the band that corresponds to the range of [-c,+c] thresholds the *PDI* and *MDI* indices follow random walk processes. In the outer regimes, if the error correction term is significantly negative $\lambda_{out} < 0$, once the psychological limits are exceeded, the correction occurs towards the edges of the band[5].

3.2. TAR unit root analysis

The C-H test contains three types of tests. The first one gives information about the nonlinearity of data. The second and third give information about unit root process of data and regimes separately. For two-regime threshold autoregressive model at first stage is testing the nonlinearity of the data. For this purpose, standard Wald statistic is used. The second part of C-H procedure is testing for the stationarity. In this case the null hypothesis is stated as, $H_0 : \rho_1 = \rho_2 = 0$ .If H_0 holds then the model can be defined as a stationary TAR process for Δy_t . When $\rho_1 < 0$, $\rho_2 < 0$ and $(1+\rho_1)(1+\rho_2) < 1$ the process is stationary and the alternative of the null hypothesis is $H_1 : \rho_1 < 0$ and $\rho_2 < 0$. Another case of interest is partial unit root case with the following hypothesis,

$$H_2 : \begin{cases} \rho_1 < 0 & and \quad \rho_2 = 0, \\ & or \\ \rho_1 = 0 & and \quad \rho_2 < 0. \end{cases} \tag{2}$$

If H_2 holds, then the process y_t will be nonstationary but not a classic unit root case.

In the second part of the C-H test one of the test statistics they apply is R_{1T} which is a one-sided Wald test statistic and tests the alternative hypothesis $\rho_1 < 0$ or $\rho_2 < 0$

[5]The Obstfeld and Taylor (1997) Band-TAR model is estimated with maximum likelihood as is done by Rapach and Wohar (2003, 2006), the thresholds *c* are calculated with grid search. In order to accept the model, Rapach and Wohar (2003) suggest that the minimum number of observations should be at least 30, or as stated by Rapach and Wohar (2006), the observations falling to the outer regimes should correspond to at least 15 % of the total number of observations.

against H_0. Another type of test is two-sided Wald test statistic tests $\rho_1 \neq 0$ or $\rho_2 \neq 0$ against H_0. These two tests help to decide if the process has a unit root or is stationary[6].

3.3. TAR cointegration

Hansen and Seo (2002) extended this literature by examining the case of unknown cointegrating vector.The two-regime threshold model where the γ is the threshold parameter takes the following form in the Hansen and Seo (2002) study[7],

$$\Delta x_t = \begin{cases} A_1' x_{t-1}(\beta) + u_t, & w_{t-1}(\beta) \leq \gamma \\ A_2' x_{t-1}(\beta) + u_t, & w_{t-1}(\beta) > \gamma \end{cases} \quad (3)$$

There are two regimes defined by the error correction term's value. As described in Hansen and Seo (2002) the parameters A_1 and A_2 are coefficient matrices and require the dynamics in these regimes. If $P(w_{t-1} \leq \gamma)$ has the relation $0 < P(w_{t-1} \leq \gamma) < 1$ this shows threshold effect, otherwise the model characterizes linear cointegration. And also they form the following constraint,

$$\pi_0 \leq P(w_{t-1} \leq \gamma) \leq 1 - \pi_0 \quad (4)$$

where the trimming parameter $\pi_0 > 0$.

4. Data and the Econometric Results

4.1. Data

Data are taken from the Central Bank Electronic Data Delivery System (EVDS) of the Central Bank of Turkey and covers the period between 2002:01-2011:10.The data contains the central bank the borrowing interest rate (br_t) and the lending interest rates (lr_t). The ir_t shows the nominal interest rates in the economy. The consumer price index (cpi_t) is utilized to calculate the inflation rate by using natural logarithms and first differences as inf_t=ln(cpi_t) and after taking the first differences, the inflation rate is calculated as Δinf_t=ln(cpi_t)-ln(cpi_{t-1}) following the usual approach in the literature. The data also includes the inflation targets announced by the Central Bank to evaluate the Taylor rule under threshold effects. The psychological dominance

[6]In the third part of the C-H test there is an alternative unit root testing procedure for each regime. The first test statistic in this part is one-sided Wald test statistic t_1 which tests the alternative hypothesis $\rho_1 < 0$ and $\rho_2 = 0$ against H_0. This test helps to decide if the process is not stationary or stationarity is only in the first regime. The last test statistic is another one- sided Wald test statistic t_2 which tests the alternative hypothesis $\rho_1 = 0$ and $\rho_2 < 0$ against H_0. t_2 and also helps to decide if the process is a partial unit root process.

[7] $\Delta x_t = A_1' x_{t-1}(\beta) d_{1t}(\beta,\gamma) + A_2' x_{t-1}(\beta) d_{2t}(\beta,\gamma) + u_t$ where I(.) denotes the indicator function, and this model can be writen as $d_{1t}(\beta,\gamma) = I(w_{t-1}(\beta) \leq \gamma)$ and $d_{2t}(\beta,\gamma) = I(w_{t-1}(\beta) > \gamma)$.

index(pdi_t) is calculated as (pdi_t)=(lr_t/br_t) and is in natural logarithms.The market dominance index(mdi_t) is calculated as (mdi_t)=(lr_t-br_t)/avg, where the avg_t is the average of the lr_t/br_t . Further, the indices are in natural logarithms. The output gap is denoted as og_t and is calculated with taking natural logarithms of the real GDP per capita realizations and their deviations from the trend. The trend real GDP per capita is calculated with the Hodrick-Prescott filter.

4.2. Unit root and nonlinearity test results

Firstly, time series are tested with conventional unit root tests NG-Perron and the KPSS test known as having good properties for nonlinear series. The nonlinear unit root in series isanalyzed with Kapetanioset. al. (2003) (KSS) and Caner and Hansen (2001) (C-H). Main reason for not using the ADF and PP conventional unit root tests is that they fail to provide sufficient power for nonlinear series.

The results are given in Table 1. The results indicate that the null hypothesis of unit root cannot be rejected at 5% level of significance for the series in levels and the first differences of inf_t, pdi_t, mdi_t, og_t and ir_tappearto be stationary. It can be concluded that the variables are integrated of order one, I(1). Kapetanios et al. (2003) KSS test and C-H tests are nonlinear unit root teststo be performed at the second stage.

TABLE 1 – Conventional and nonlinear unit root tests

	NG-Perron				KPSS	KSS
	MZa	MZt	MSB	MPT		
inf	-6.41829	-1.78594	0.27826	3.83622	1.17 (9)	1.49 (4)
Δ***inf***	-52.5366	-5.11859	0.09743	0.48318	0.37* (54)	-5.48***(3)
pdi	32.4247	3.54776	0.10942	12.9049	0.82 (5)	-0.91 (1)
Δ***pdi***	-47.1594	-4.67985	0.09923	0.97619	0.08*** (4)	-4.05*** (0)
mdi	25.5763	3.28684	0.12851	13.6021	0.32 (9)	-1.60 (3)
Δ***mdi***	-49.6102	-4.94504	0.09968	0.58516	0.14*** (4)	-5.51***(2)
og	-6.75238	-1.73980	0.25766	3.97076	-0.72 (5)	-0.97(2)
Δ***og***	-53.9502	-5.19305	0.09626	0.45587	0.21*** (10)	-9.57***(1)
ir	-2.20064	-0.79980	0.36344	30.1348	0.42 (22)	-2.41 (4)
Δ***ir***	-87.9613	-6.63179	0.07539	1.03597	0.05 (16)***	-9.09*** (3)

Caner and Hansen Unit Root Test Results					
C-H	INF(5)	PDI (5)	MDI (6)	OG (1)	IR(5)
Wald Stat – (Asimp. p-val.)					
BTT	27.018 (0.00)	29881.58(0.0)	64.43 (0.0)	6286 (0.0)	22.24 (0.0)
R_2	11.82 (0.08)	0.00256 (0.99)	0.43 (0.99)	1314 (0.98)	6.09 (0.48)
R_1	11.82 (0.07)	0.0026 (0.99)	0.43 (0.99)	0.001 (0.99)	6.09 (0.43)
t_1	2.83 (0.13)	0.05 (0.96)	0.62 (0.93)	-1.032 (0.86)	1.37 (0.75)
t_2	1.95 (0.49)	0.000005(0.96)	0.23 (0.96)	-0.498 (0.95)	2.05 (0.44)

* %10, ** %5, ***%1 show the significance levels. Lag length selected is given in ( ). For Ng-Perron tests, the MZa critical values for significance levels %10, %5 and %1 are, -5.7, -8.1, -13.8. MZt critical values for significance levels

%10, %5 and %1 are, -1.62, -1.98, -2.58. MSB critical values for significance levels %10, %5 and %1 are, 0.275, 0.233, 0.174. MPT critical values for significance levels %10, %5 and %1 are, 4.45, 3.17, 1.78. the critical values for KPSS test for significance level %10, %5 and %1 are, 0.347, 0.463, 0.739. Newey West Bartlett Kernel are used for selecting the lag length in KPSS test. The critical value for KSS test *t* value α=0.01;0.05;0.1(with drift and no trend) -3.48, -2.93 ve -2.66 (Kapetanios et. al. 2003; Table 1). Bootstrap Threshold Test (BTT), Two – Sided Wald Test for UR (R_2), One – Sided Wald Test for UR (R_1), Test for Stationary t_1, Test for stationary t_2.

The results confirmed the findings that the analyzed variables are integrated of order 1. C-H test results show that the data used in the analysis are not stationary but their first differences are stationary. The t1 and t2 tests show that each regime has unit roots. The results suggest that the same degree of stationarity is inherent for the series analyzed, the series are subject to nonlinearity, and each series are inherently subject to threshold type asymmetry between regimes.

4.3. Psychological dominance analysis with the Band-TAR model

We aim to test if keeping the *pdi* within the band allows the monetary policy efficiency, which shows the effectiveness in coping with the inflation shocks that divert the price stability away from the target level. As a result, Band-TAR approach aims to test possible inflationary effects of the disinflationary monetary policy. Further, the Band-TAR model allows us to model the error correction mechanism and the rate of convergence to the band within which the policy is more effective in controlling inflation in light of the psychological dominance index suggested. The psychological dominance index is modelled as a Band-TAR process as shown below,

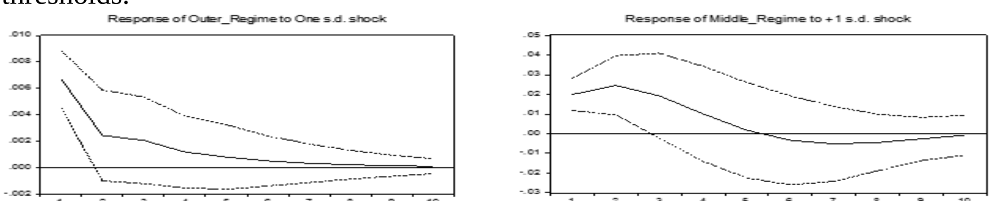
$$\Delta pdi_t = \begin{cases} \underset{(0.023)}{-0.1175} \times \underset{(0.014)}{\left(pdi_{t-1} - 0.033 \right)} + \varepsilon_t^{out} & if \quad pdi_{t-1} > -0.033 \\ \varepsilon_t^{in} & if \quad 0.033 \geq pdi_{t-1} \geq -0.033 \\ \underset{(0.023)}{-0.1175} \times \underset{(0.014)}{\left(pdi_{t-1} + 0.033 \right)} + \varepsilon_t^{out} & if \quad pdi_{t-1} < +0.033 \end{cases} \tag{5}$$

LL=279.76,AIC=-5.45,dw=1.63,ARCH(1)=0.00000226(0.99),ARCH(12)=1.39(0.19) $\hat{\sigma}_{e,Band-TAR}$ =0.04024, Q(1)=2.81(0.094), Q(2)=4.55(0.10), Q(12)=14.16(0.29),

If the band thresholds were to be taken into account, the borrowing lending ratio, *br*, follows random walk process in the middle regime with *n*=67 observations. These observations account for 65.69 % of the total number of observations. The lower and upper thresholds are estimated as -0.033 and +0.033, therefore, the 35 observations correspond to 34.31% of the sample outside of the band. The lambda parameter is estimated negative and is -0.1175, further, the error correction mechanism is statistically significant. We conclude that error correction in the outer regimes takes place towards the band neighborhood according to the model estimated.

In the figure below, generalized impulse response functions are evaluated. The response following a one-standard deviation positive shock in the borrowing lending

rate variable is calculated for the middle and upper/lower regimes separately. The left-hand side (Figure 2.a) corresponds to the response of the *pdi* calculated for the borrowing lending rate, *pdi* in the outer regimes in which the error correction takes place towards the edges of the band defined with the negative and positive thresholds. The figure given on the right-hand side (Figure 2.b) corresponds to the response of the *pdi* in the inner regime (middle regime) that lies within the band for the estimated thresholds.



a. Response to Positive 1 std. dev. Shock, Outer Regimes **b. Response to Positive 1 std. dev. Shock, Inner Regime**

Figure 2. Generalized Impulse Response Functions,
Band-TAR Model for Psychological Dominance

In Figure 2.a, the response following a positive shock is positive and the confidence intervals cut the zero horizontal line after two lags.We can conclude that the *pdi* follows a positive path following a positive innovation that is significant for two periods. In Figure 2.b, the response following a positive shock in the inner regime dies out after the 3rd lag where the 95% confidence interval cuts the zero line, however, the response follows a cycling path so that after the 5th period, it becomes negative. Further, if panel a. and b. are compared, we noted that the response starts at comparatively higher values, +0.02 in the inner regime and 0.0063 in the outer regime. According to the results obtained, we conclude that the error correction towards the equilibrium occurs in the outer regime and the positive monetary policy shocks have significant impacts, however, the response to a policy shock lasts longer in the inner regimes.

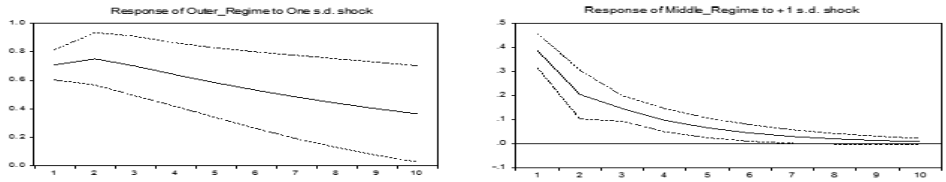
4.4. Market dominance analysis with the Band-TAR model

The suggested Band-TAR to evaluate the market dominance index (*mdi*) is estimated as follows,

$$\Delta mdi_t = \begin{cases} \underset{(0.05)}{-0.084} \times \left(mdi_{t-1} - \underset{(0.068)}{0.428} \right) + \varepsilon_t^{out} & if \quad mdi_{t-1} > -0.428 \\ \varepsilon_t^{in} & if \quad 0.428 \geq mdi_{t-1} \geq -0.428 \\ \underset{(0.05)}{-0.084} \times \left(mdi_{t-1} + \underset{(0.068)}{0.428} \right) + \varepsilon_t^{out} & if \quad mdi_{t-1} < +0.428 \end{cases} \tag{6}$$

LL=-102.85, AIC=1.90, dw=1.87, ARCH(1)=0.0004(0.98), $\hat{\sigma}$ =0.65, Q(1)=0.002(0.98), Q(2)=0.00014(0.99), Q(12)=14.36(0.27).

The lower and upper thresholds are estimated as -0.428 and +0.428. Outside of the band, 74.58% of the observations are located, which amount to 88 observations. The lambda parameter is estimated as negative showing that the error correction mechanism occurs and is calculated as -0.084. According to the results, we conclude that error correction in the outer regimes takes place towards the band neighborhood defined with the -0.428, +0.428 thresholds. Generalized impulse response functions calculated for the market dominance Band-TAR model are given in the figure below. The response following one standard deviation positive shock in the market dominance index calculated for the middle is given in Figure 3.b and upper/lower regimes (outer regimes) in Figure 3.a.



a.Response to Positive 1 Std.Dev. Shock,Outer Regimes **b.Response to Positive 1 Std.Dev. Shock, Inner Regimes**

Figure 3. Generalized impulse response functions, Band-TAR model for *mdi* index

The error correction parameter is estimated negative -0.08, therefore only 8% of the deviations from the long-run equilibrium are corrected. Accordingly, the response in the outer regimes follows a similar path so that the convergence towards the equilibrium lasts more than 10 periods. The figure given on the right-hand side (Figure 3.b) shows the response of *mdi* in the inner regime within the thresholds. Though the impact of a positive shock is positive, it dies out after the 7th period in which the 95% confidence interval reaches zero line.

If panel a. and b. are compared, it is observed that a positive shock has a twice-higher impact on the dependent variable in the outer regime as expected. We conclude that the error correction towards the equilibrium occurs in the outer regime though the positive monetary policy shocks which have higher impacts compared to the inner regime.

4.5. Relation between PDI and inflation in the context of TVEC analysis

The relation between inflation and *pdi* is estimated within the TVEC approach. The results suggest that the *pdi* has a positive impact on inflation and the inflation recovery speed after a shock is 84%, which is faster in the first regime.

First Regime (typical regime): $inf \leq 0.39 pdi + 0.8$ (7)

Second Regime (extreme regime): $inf > 0.39 pdi + 0.8$ (8)

$$\Delta inf_t = \begin{cases} \underset{(0.357)}{0.756} - \underset{(0.447)}{0.85} v_{t-1} - \underset{(0.25)}{0.129} \Delta \inf_{t-1} - \underset{(0.094)}{0.84} \Delta \inf_{t-2} - \underset{(0.3273)}{0.37} \Delta pdi_{t-1} - \underset{(0.327)}{1.13} \Delta pdi_{t-2} + u_{1t} & v_{t-1} \le 0.84 \\ \underset{(0.118)}{0.194} - \underset{(0.118)}{0.199} v_{t-1} - \underset{(0.136)}{0.517} \Delta \inf_{t-1} - \underset{(0.05)}{0.026} \Delta \inf_{t-2} - \underset{(0.11)}{0.092} \Delta pdi_{t-1} - \underset{(0.09)}{0.011} \Delta pdi_{t-2} + u_{1t} & v_{t-1} > 0.84 \end{cases} \quad (9)$$

$$\Delta pdi_t = \begin{cases} \underset{(0.182)}{-0.065} + \underset{(0.243)}{0.083} v_{t-1} + \underset{(0.129)}{0.033} \Delta \inf_{t-1} + \underset{(0.069)}{4.366} \Delta \inf_{t-2} - \underset{(0.018)}{0.065} \Delta pdi_{t-1} - \underset{(0.24)}{5.13} \Delta pdi_{t-2} + u_{2t} & v_{t-1} \le 0.84 \\ \underset{(0.068)}{0.154} - \underset{(0.067)}{0.16} v_{t-1} + \underset{(0.0795)}{0.83} \Delta \inf_{t-1} + \underset{(0.072)}{0.154} \Delta \inf_{t-2} + \underset{(0.072)}{0.109} \Delta pdi_{t-1} - \underset{(0.055)}{0.062} \Delta pdi_{t-2} + u_{2t} & v_{t-1} > 0.84 \end{cases} \quad (10)$$

The cointegration relation is obtained as, $v_t = \inf_t - 0.39\, pdi_t$ following the minimization of the Likelihood function. The estimated threshold value is $\hat{\gamma} = 0.84$. As a result, the first regime obtained in the analysis dominated a major part (typical regime); 91 % of the whole period while the second regime corresponds only to 9% of the time period. The first regime is achieved so that, (typical regime) $inf \le 0.39 pdi + 0.84$ whereas the second regime, (extreme regime) is dominant if $inf > 0.39 pdi + 0.84$.

4.6. Relation between MDI and inflation in the context of TVEC analysis

The Eicker-White standard errors are given in parentheses for the estimated Threshold VEC model. The results are given below.

First Regime (typical regime): $inf \le 0.81 mdi + 0.25$ (11)

Second Regime (extreme regime): $inf > 0.81 mdi + 0.25$ (12)

$$\Delta inf_t = \begin{cases} \underset{(0.007)}{0.0063} - \underset{(0.149)}{0.28} v_{t-1} - \underset{(0.091)}{0.39} \Delta \inf_{t-1} + \underset{(0.092)}{0.21} \Delta mdi_{t-1} + u_{1t} & v_{t-1} \le 0.25 \\ \underset{(0.023)}{-0.012} - \underset{(0.53)}{0.036} v_{t-1} + \underset{(0.36)}{1.43} \Delta \inf_{t-1} - \underset{(1.78)}{4.96} \Delta mdi_{t-1} + u_{1t} & v_{t-1} > 0.25 \end{cases} \quad (13)$$

$$\Delta mdi_t = \begin{cases} \underset{(0.0064)}{0.002} + \underset{(0.14)}{0.06} v_{t-1} - \underset{(0.09)}{0.029} \Delta \inf_{t-1} + \underset{(0.09)}{0.085} \Delta mdi_{t-1} + u_{2t} & v_{t-1} \le 0.25 \\ \underset{(0.23)}{-0.355} - \underset{(0.087)}{0.604} v_{t-1} - \underset{(0.094)}{0.64} \Delta \inf_{t-1} + \underset{(0.58)}{19.27} \Delta mdi_{t-1} + u_{2t} & v_{t-1} > 0.25 \end{cases} \quad (14)$$

Cointegration relation $v_t = inf_t - 0.81 mdi_t$ is obtained, following the minimization of the Likelihood function. The estimated threshold value is $\hat{\gamma} = 0.25$. As a result, the first regime is accepted to be prevailing, where the interest rate is at least 25 percent higher than the inflation. As a result of this, the first regime obtained in the analysis

dominated a major part (typical regime); 93 % of the whole period while the second regime corresponds only to 7 % of the time period. The first regime is achieved so that, (typical regime) $\imath nf \leq 0.8\,1md\dot{\imath} + 0.2\,\dot{}$ whereas the second regime, (extreme regime) is dominant if $\imath nf > 0.8\,1md\dot{\imath} + 0.2\,\dot{}$.

4.7. TVEC Results in context of Taylor rules

In this section, since the Central Bank sets the policy interest rates under a Taylor type rule, a TVEC type nonlinear model is estimated to evaluate the interrelations of the interest rate, the output gap and the inflation rate. In the literature, various approaches are derived to define the variables under the Taylor rule. In this study, HP filter method is taken to estimate the trend production and the consumer price index is used to calculate the inflation rates[8].

Following Bildiriciet. al. (2014), the following model is reported. The model aimed at evaluating the interrelations between ir_t, $og_t$and inf_t. The long run cointegration model is estimated as,

$$ir_t \leq -0.25inf_t + 4.05og_t + 0.25 \tag{15}$$

$$ir_t > -0.23inf_t + 3.84og_t + 0.25 \tag{16}$$

The short run vectors with threshold type nonlinearity with error correction mechanisms are estimated as,

$$\Delta ir_t = \begin{cases} \underset{(0.036)}{-0.13}v_{t-1} + \underset{(0.33)}{2.056}\Delta ir_{t-1} + \underset{(0.25)}{0.35}\Delta og_{t-1} - \underset{(0.015)}{0.03}\Delta \inf_{t-1} + u_{1t} & v_{t-1} \leq 0.25 \\ \underset{(0.015)}{-0.035}v_{t-1} + \underset{(0.12)}{0.14}\Delta ir_{t-1} - \underset{(0.09)}{0.17}\Delta og_{t-1} + \underset{(0.01)}{0.009}\Delta \inf_{t-1} + u_{1t} & v_{t-1} > 0.25 \end{cases} \tag{17}$$

[8]Taylor (1993) used the annual change of Gross National Product (GNP) deflator while measuring the inflation. Kozicki (1999) applied Taylor's rule for the USA by using four different inflation variables. In the study, the Consumer Price Index (CPI) is used to calculate the inflation rate and the Central Bank's inflation targets are taken to obtain the deviations of inflation rate from the inflation target. In light of the production variable, Taylor (1993) estimated the *potential production*, applied a time-based trend equation on the actual production. The other methods in the literature are the linear and parabolic trend equations, HP filters, and various structural approaches. There are various approaches to equilibrium real interest rate calculations.The studies of Kozicki (1999:14) and Judd and Rudebusch (1998) have calculated equilibrium real interest rate as difference from the average federal fund rate's average inflation. Rudebusch (2001), to estimate equilibrium real interest rate (r*), used IS slope equation, and similar to Taylor's rule, found r* as 2.2%. Although Kozicki's (1999:10-13) equilibrium real interest rate estimates displaying varieties according to estimation periods increased the discussions on whether equilibrium real interest rate can be stable; in this study, it is taken as 2.2, just as in Taylor's rule and Kozicki's study.

$$\Delta og_t = \begin{cases} \underset{(0.044)}{0.009} v_{t-1} - \underset{(0.38)}{0.79}\Delta ir_{t-1} - \underset{(0.28)}{0.44}\Delta og_{t-1} + \underset{(0.017)}{0.015}\Delta \inf_{t-1} + u_{2t} & v_{t-1} \le 0.25 \\ \underset{(0.02)}{0.009} v_{t-1} + \underset{(0.18)}{0.17}\Delta ir_{t-1} - \underset{(0.13)}{0.20}\Delta og_{t-1} - \underset{(0.20)}{0.003}\Delta \inf_{t-1} + u_{2t} & v_{t-1} > 0.25 \end{cases} \quad (18)$$

$$\Delta \inf_t = \begin{cases} \underset{(0.48)}{-1.45} v_{t-1} + \underset{(4.54)}{1.38}\Delta ir_{t-1} - \underset{(3.34)}{4.586}\Delta og_{t-1} - \underset{(0.20)}{0.20}\Delta \inf_{t-1} + u_{2t} & v_{t-1} > 0.25 \\ \underset{(0.17)}{-0.57} v_{t-1} + \underset{(1.46)}{0.93}\Delta ir_{t-1} - \underset{(1.05)}{0.74}\Delta og_{t-1} - \underset{(0.13)}{0.016}\Delta \inf_{t-1} + u_{3t} & v_{t-1} > 0.25 \end{cases} \quad (19)$$

The cointegration relation for the first regime is estimated as $v_t = ir_t + 0.25 inf_t - 4.05 og_t$ whereas, for the second regime, the obtained relation is given as $v_t = ir_t + 0.23 inf_t - 3.84 og_t$. The estimated threshold value is $\hat{\gamma} = 0.25$. Further, the first regime obtained in the analysis corresponds toa smaller percentage of the total observations and denoted as the extreme regime (33% of the whole period) while the second regime corresponds to the majority (67%) of the observations. Additionally, the first regimes achieved if $ir_t \le -0.25 inf_t + 4.05 og_t + 0.25$ whereas the second regime is achieved if $ir_t > -0.23 inf_t + 3.84 og_t + 0.25$ .The long run equations represent a Taylor type interest rate rule that provided significant findings. Firstly, for both of the regimes, the parameter estimates of inflation have negative signs and are less than 1 in absolute terms. Secondly, the parameter estimates of output gap are positive as expected, but are significantly large. This finding contrasts the Taylor (1993)'s proposal that coincides with active monetary policies aiming at coping with inflation since Taylor's (1993) proposal focuses on increasing the policy interest rate with a larger proportion vis-à-vis an increase in inflation: a 1.5% increase in the interest rates as a response to a 1% increase in the inflation rates. Considering the results, the dynamics worked in away that hinted passive monetary policies since the parameter estimates of the inflation rates unexpectedly negative. Further, in contrast to the second policy recommendation of the Taylor rule that suggested the output gap to have a coefficient around +0.5 so that the Central Bank focuses largely on price stability, the parameter estimates of the output gap is significantly large suggesting that the monetary policies had been largely responsive to output shocks instead of inflation shocks in the determination of policy interest rates. If the second regime is analyzed, similar findings apply for the parameter estimates of inflation rates. The parameter estimates of og_t are even larger in the positive direction than those obtained for the first regime.

The vectors with statistically significant *ec* mechanisms will be evaluated[9]. We will focus on the Δir_t vector since it represents the Taylor rule type specification where the interest rates are determined by the inflation rates and the output gap within a nonlinear framework. In the first regime, the inflation rate coefficients are significantly negative and are estimated as -0.03. Similar to the long-run equation, the parameter estimate of inflation has opposite signs of those expected for the Taylor (1993) specification. In the second regime, the *ec* term is statistically significant and suggests 3.5% of the deviations are corrected within one period. The parameter of inflation is statistically insignificant. Further, the parameter of og_t is estimated as -0.17 however it is statistically significant at 10% significant level. The results suggest that in the second short-run regime, inflation has no impact on the policy interest rates and the output gap has significant effects but this impact operates at the opposite direction.

For the estimated TVEC model, Generalized Impulse Response Functions (GIRFs) are calculated. The results are given in Figure 4a and 4b. The responses given in Figure 4ashow the results for the first regime, and responses in the second regime are given in Figure 4b. In both groups, the first figure shows the response of the system to the interest rate, when one-standard deviation shock is faced by the output gap variable. When the figures are examined, as expected, we see that different regimes have different responses. In the first regime (where the threshold is less than 25%), a shock to the system shows that the output gap responses to the interest rate are positive, and the 5th period response in deficit shows that the effect of the shock disappeared. Interest rate response is the same in both regimes but the amount of the response differs.

[9]If the short-run models are evaluated, the error correction (*ec*) term of the Δir_t vector is estimated as -0.13 and as -0.035 for the first and second regimes. Both *ec* terms are statistically significant at 5% significance level. In the Δogtvector, none of the *ec* terms are statistically significant. Further, in the $\Delta inft$vector, the *ec*term in the first and second regimes are -1.45 and -0.57 and both are statistically significant. However, in the first regime, -1.45 in absolute terms is larger than 1 suggesting that the deviations from the long run equilibrium is diverging. In the second regime, 57% of the deviations from the long run equilibrium is corrected within one period.

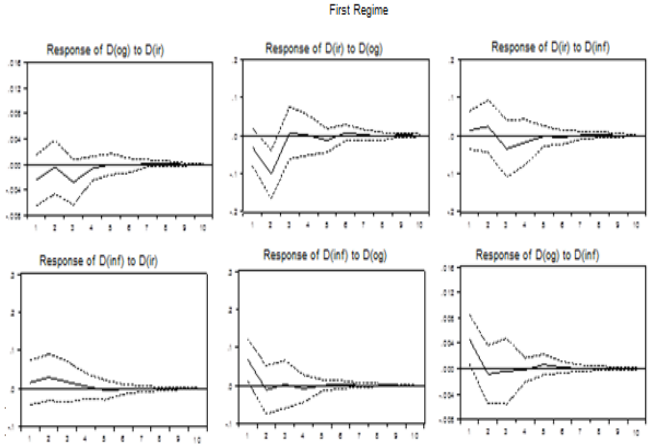


Figure 4a. GIRFfunctions in the first regime

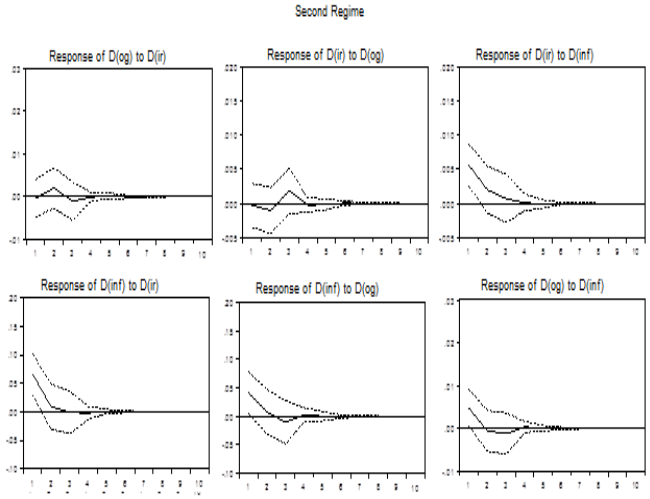


Figure 4b. GIRFfunctions in the second regime

Interest rate response tends to decline in the first stage, reaches a minimum in the 2nd period, and the shock dies in the 3rd period. Interest rate's response against the inflation deficit is in a positive direction at the beginning of the first regime, declines in the 2nd period, second regime effect is negative, and disappears in the 4th period. Inflation deficit's response against interest rate is the same in both regimes but the effects of the shock differ according to regimes.

As policy implications, the results showed an important deviation from the positive sign and more than 1 to 1 increase in the interest rate suggestion of the Taylor (1993).Since the error correction is statistically significant in both regimes of the Δir_t vector, the results suggest strong nonlinearity and regime dependency in the short-run. The reason is, the coefficients of Δog_{t-1}have opposite signs if the regime are compared. The coefficients of Δinf_{t-1} possess a similar characteristic. However, the parameter of inflation is statistically significant only in the first regime and the parameter of output gap is statistically significant only in the second regime. The results suggest that the Taylor rule based monetary policy is a long run phenomenon and in the short run, the policy interest rates are influenced by the variations in the output gap and in the inflation depending on the specific regime the Economy is in. Therefore, the policy results show that in the long run, the policy interest rates are more likely to be under the effect of output gap since it has a significantly larger and positive parameter estimate. Further, in the long run, the effect of inflation rates is minor in addition to the sign of its parameter estimate being negative[10].

The overall policy results for the Δog_t and Δinf_t vectors suggested similar results so that the interest rate rule followed in Turkey for the sample analyzed. The very low and sustainable inflation rates as those obtained by many countries that applied inflation targeting in the past, had been successful in applying inflation targeting policies. Further, it should be noted that, by assuming the quantity of money exogenous and by assuming that the main policy tool is the policy interest rates, the models estimated for the *mdi-inf* and *pdi-inf* variables in the previous sections also provided imported insights regarding the response of inflation rates in Turkey to the indices proposed based on the lending and borrowing policy interest rates. An overall result is that, as the CB tried to cope with increases in the inflation rates by increasing the spread (or based on the *mdi* index, the ratio of the two policy rates), the results suggested that, the anti-inflationary policy resulted in even higher inflation rates in Turkey.

5. Conclusions

The study focuses on analyzing an economy that applies inflation targeting rule where the policy interest rates i.e. the lending and the borrowing rates are determined actively by the CB, the LM curve became horizontal. Simultaneously, the policy maker also tries to control the quantity of money in addition to policy rates. The policy application within this context contrasts with the economic theory since the policy maker tries to control both a price (i.e. the interest rates) and the quantity (the money

[10]It should also be noted that, compared to the Taylor (1993) that utilized yearly data, the data used in the study is monthly, therefore, the findings with monthly data should require care in investigation in addition to the enriched information such as regime specific behavior provided with the estimated nonlinear models.

supply) simultaneously. Hence the CB involuntarily becomes the affirmer of inflation and the anti-inflationary policy results in increases in the inflation rates. To evaluate the CB policy, two separate indices are introduced: the market dominance and the psychological dominance indices. The indices are based on the ratio and the spread of the main policy rates. The aim is to capture the inflationist effect of following this type of policy.

The study followed various nonlinear econometric techniques, namely, the Band-TAR and the TVEC models, respectively. The purpose of this approach is as follows: the Band-TAR model aims at determining the thresholds for the two indices within a nonlinear cointegration framework. Accordingly, error correction occurs only in the outer regimes for the evaluated indices that consist of the main policy tools of the CB. Nevertheless the two policy indices follow a random walk process within the band defined with the threshold showing without passing a band of thresholds, the PDI and MDI indices follow mean reverting behavior. Additionally, the parameter estimates of the PDI and MDI indices are positive showing that within each regime, the policy rates have unexpectedly positive effects on inflation. It should be noted that, by increasing the spread or the ratio of two policy rates, the CB tries to cope with inflation by introducing contractionary monetary policy. At the last stage, the TVEC analysis is conducted within the multivariate Taylor rule. The TVEC model is used to determine the thresholds and the dominance of regimes. Even by assuming that the CB uses the policy interest rates only, by keeping the money supply out of the models, the results suggest that the increase in the spread between the lending (LR) and borrowing rates (BR) is inflation-creating. As policy implications, significant findings are obtained to evaluate the importance of the proposed PDI and MDI indices on the inflation rates. Within a political perspective, the results overall suggested findings in favor of inadequate inflation targeting in the Turkish Economy that deviates from the examples from many countries that succeeded to bring the inflation down to very low levels.

The findings of the paper will be summarized for policy implication purposes. According to the results obtained in terms of the PDI index, once a certain threshold is reached, the deflationary policies fail to provide expected results and excessive decline in the policy rate brings on an inflationary result. Both of the PDI and MDI indices are modelled with the BAND-TAR model showing error correction occuring only to the estimated bands.Ifthe relationship between inflation and these indices are evaluatedthe following conclusions are reached for the economies thatfollow inflation targeting policies. The indices evaluated in the study and the nonlinear responses of inflation to these indices showed that, above and below the thresholds, the policy follows differentiated patterns to achieve price stability. As the price stability or instability is

under the influence of dominant fiscal policies and considering the regime switching characteristics, the anti-inflation policy could result in deviations from the inflation targets. Accordingly, the Central Bank policy could result in an unexpected inflationary process so that the Central Bank could affirm inflation. As policy recommendations, the monetary and fiscal policies should consider nonlinearity, threshold effectsin light of suggested market dominance and psychological dominance indices and their impact on the inflation rates.

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