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# THE TURKISH EXPERIENCE IN INFLATION TARGETING: UNCERTAINTIES AND THE EFFICIENCY OF MONETARY POLICY

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**ABSTRACT.** In January 2002, Turkey adopted implicit inflation targeting as monetary policy. The short-term interest rate of the Central Bank of the Republic of Turkey would serve as instrument and should influence the secondary market interest rate. Using a Vector Error Correction Model, we analyze the joint dynamics of these two rates. We show that the political or geopolitical uncertainties of the 2002 and 2003 (early elections, discussions on the opening of negotiations to joint the European Union and conflict in Iraq) have not affected the dynamics of the two rates. However, there has been a structural change in their long term dynamics at the end of 2004 because of the opening of negotiation Turkey to join the European Union. This event has temporarily reinforced the efficiency of the monetary policy.

*JEL* Classification: C32; E52; E58.
Keywords: Monetary Policy; Inflation Targeting; Interest Rate; Structural Change; VECM.

**RÉSUMÉ.** En janvier 2002, la Turquie adopte une politique monétaire de ciblage de l'inflation implicite. C'est le taux d'intérêt directeur de la banque centrale qui sert d'instrument, et qui doit influencer le taux d'intérêt du second marché. Au moyen d'un modèle vectoriel à correction d'erreur, nous analysons la dynamique jointe de ces deux taux. Nous montrons que les incertitudes géopolitiques de 2002 et 2003 (élections législatives anticipées, discussions sur l'ouverture des négociations d'adhésion à l'Union européenne et conflit en Irak) n'ont pas affecté la dynamique des deux taux. Mais, il y a eu un changement de structure dans leur dynamique de long terme à la fin de l'année 2004, à cause de l'ouverture des négociations sur l'adhésion de la Turquie à l'Union européenne. Cet événement a temporairement renforcé l'efficacité de la politique monétaire.

Classification *JEL* : C32 ; E52 ; E58.
Mots-clefs : Politique monétaire ; ciblage de l'inflation ; taux d'intérêt ; changement structurel ; VECM.

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## 1. Introduction

Following the failure of disinflationary policies of the 1980's and 1990's based on nominal anchoring (monetary targeting or exchange rate anchoring), inflation targeting has since become the dominant framework of monetary policy.

Economists' approaches differ upon the definition of the inflation targeting regime. Bernanke *et al.* (1999) consider inflation targeting as a "discretionary constraint" combining the advantages of rules with those of discretionary measures. Mishkin and Schmidt-Hebbel (2001) give a more advanced interpretation and define inflation targeting as a set of specific elements, like an institutional commitment for price stability, the absence of fiscal dominance and other nominal anchors, independence from political instruments and the transparency and responsibility of the political process. The IMF (2005) defined the institutions (central banks) that adopt inflation targeting as institutions having an official inflation target and publishing their inflation forecasts.

The countries that adopted inflation targeting the earliest were New Zealand in 1990, Chili and Canada in 1991. As of today, 24 countries have adopted inflation targeting, with different experience. However, the short term interest rate of the central bank is the essential instrument of monetary policy. All countries which adopt the inflation targeting regime have the short term interest rate as an instrument of monetary policy.[2]

There are two principal approaches in the empirical literature on inflation targeting, both of which stress international comparative studies. The first initiated by Mishkin and Posen (1997) and followed by Neumann and Von Hagen (2002) question the efficiency of this policy as an instrument in combating inflation. The second, proposed by Ball and Sheridan (2003), uses the method of "difference- in- difference estimation" on the problem of the efficiency of this policy in terms of employment and growth.

We propose an original approach, radically different, permitting us to analyze a very peculiar aspect of inflation targeting. For this policy to be efficient, the interest rate of the central bank should influence the secondary market interest rate. Our aim is to see whether political or geopolitical shocks can perturb this transition mechanism of monetary policy in the long term and question its efficiency. This question is of primordial importance in Turkey, taking into account the political and geopolitical context in which this experience has been made since 2002. In addition, this country presents unique characteristics. On the one hand, high inflation was chronic during the last two decades of the 20th Century, on the other hand there was a manifest ambition to combat it and above all this policy has been successful. Since 2002, Turkey has not only succeeded in reducing its inflation rate (from more than 70% to 8%) but has also experienced a phase of exceptional economic expansion with growth rates of the order of 7% per annum until 2006. Thus there is no doubt that the monetary policy of inflation targeting has been largely efficient. However, the first 18 months of this new policy were marked by

2. Except Mexico that had chosen the liquidty of the bank system as instrument.

strong political and geopolitical uncertainties. Among them are a political crisis due to the state of health of the Prime Minister, holding early elections, the coming to power of AKP (the pro-Islamist conservative party) with an absolute majority in parliament, starting negotiations to join the EU and war in Iraq.[3]

Our aim in this study is to determine whether political and geopolitical uncertainties have had an effect on the efficiency of monetary policy. As the short-term interest rate has been the principal instrument of the central bank to implement its disinflation policy, the success of such a policy necessitates that the short-term interest rate can influence the secondary market interest rate. Thus we analyze the joint dynamics of the short-term interest rate and the secondary market interest rate, using a Vector Error Correction Model (VECM). More specifically, we are looking for a deformation in the long term structure linking these two rates, or a modification in the speed of convergence of these rates to equilibrium levels, using a test of structural change proposed by Seo (1998).

In the Section 2, we dwell on the details of the inflation targeting policy by examining the dynamics of the interest rate of the central bank and that of the secondary market in the light of political and geopolitical events. The Section 3 is consecrated to the dynamic analysis of a bivariate system constituted by the two interest rates. We propose several tests enabling us to see whether the necessary conditions for the success of the program were met. Then we show, using the method proposed by Seo (1998), that the political and geopolitical uncertainties of 2002 and 2003 have not influenced the dynamics of the two rates but that there has been a structural change in the long term dynamics of these rates at the end of the year 2004 because of the opening of negotiations for Turkey to join the EU. The Section 4 is on interpreting this structural change and we find that the most probable cause is the opening of negotiations in December 2004, for Turkey to join the European Union.

## 2. Inflation targeting in Turkey

Thanks to its strategy of export led economic expansion, adopted in 1980 and to various structural reforms, Turkey has experienced strong growth between 1980 and 1993. However, macroeconomic disequilibria have got keener since 1988. Financing the chronic budget deficit through monetary expansion generated an inflation rate superior to 50% as well as a deteriorating external position, culminating in the first monetary crisis in 1994. A fine analysis can be found in Ozatay (1997). Chronic inflation persisted[4] and a program to combat inflation was adopted in 1999 with the collaboration of the IMF. Despite the adoption of several stabilization programs, monetary financing of the chronic budget deficit has generated rates of inflation above 50% and deteriorated the

3. Turkey is a member of NATO and has a common frontier with Iraq. The Americans planned to open a second front, in southern Turkey.

4. Insel (2003) give the causes of chronic inflation and the reasons for which this inflation isn't transformed on hyper-inflation.

external position. In December 1999, to stabilize the economy, a program of disinflation was implemented with the financial support of the IMF. This program leaned notably on a restrictive monetary policy, based partly on the principles of a currency board and a system of nominal anchoring of the exchange rate aiming at stabilizing the real exchange rate (soft-peg regime). With this monetary policy, it is the market which determines the interest rate, the central bank aligning *ex-post* its short-term interest rate to that of the market. In February 2001, this policy led Turkey to one of the most severe crises of its history. Akyüz and Boratav (2002), Alper (2001), Ertugrul *et al*. (2005), Hericourt and Reynaud (2007) propose differing analyses. Yet it is clear that the disfunctioning of the banking sector stressed by Yeldan and Boratav (2002) and the OECD report (2002) has played a central role.

### 2.1. Specifics of the inflation targeting policy

After the February 2001 financial crisis, a stand by program with IMF was implemented in May 2001 for the period 2002-2004. The aims were reducing the inflation rate to 35% as soon as fall 2002, ensuring growth based on exports and to realize a better allocation of resources. The program also envisaged realizing structural reforms aiming at augmenting the growth potential of Turkey.

In the beginning of 2002, the Central Bank of the Republic of Turkey (CBRT), having just become independent, announced the passage to inflation targeting as the final objective of monetary policy and the adoption of the implicit inflation targeting regime until 2005. The adoption of this regime was necessary because of the weakness of the financial sector. In the period 2001-2005, some reforms were realized. Thus the role of the CBRT was redefined, giving it a more active role. Its main objective has become ensuring price stability. The CBRT can reserve the right to intervene in order to avoid dramatic fluctuations of the exchange rate. In 2001, inflation targets were announced for the 3 following years (35%, 20% and 12%) in agreement with the government. During these three years CBRT has ameliorated its communication policy and sources of information and developed new instruments and methods of forecasting inflation. 2005 was the last year before the passage to the inflation targeting regime. The meetings of the monetary council were held at dates announced in advance. Decisions on the level of interest rates are made following these meetings and the central bank publishes a release. During this period, monetary policy became more and more predictable.

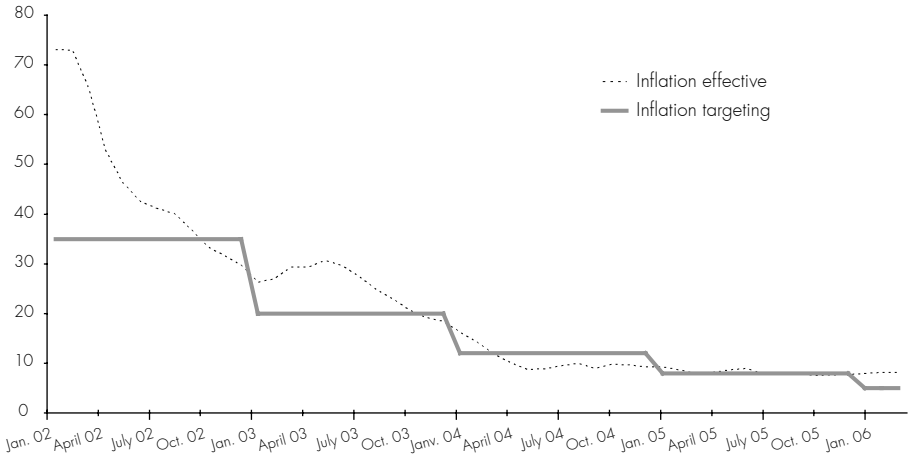
In 2006, with the "official" adoption of the inflation targeting policy, the CBRT has taken the following decisions:

- the consumer price index was chosen to measure inflation since it is this index which is the easiest to follow for the public and since it is an indicator which measures the cost of living;
- target rates for 2006, 2007 and 2008 are 5%, 4% and 4%;

- a target zone (a zone with predetermined tolerance) was set, bounded by around 2% of the target rate. The central bank undertook to give explanations in case the effective inflation rate left this interval;
- a horizon in which inflation would reach its optimal value was set, representing an engagement to a medium term policy.

Graph 1 shows the evolution of actual inflation rates in the years under the implicit inflation targeting regime and in the first months under the inflation targeting regime. One can observe that as soon as the new monetary regime was implemented, the inflation rate has rapidly come down. In fact, in January 2002, the CBRT has benefited from a favorable climate: relations with the EU were good, the IMF supported the program, and inflationary expectations were low. In the first three years of the program, inflation targets were reached before the programmed dates. In 2004, the actual inflation rate got below the target value in March, even if the two rates remained close. This situation increased the confidence of economic agents in monetary policy and led expected inflation downwards. However, in the beginning of 2006, inflationary pressures resurfaced.

**Graph 1** - Evolution of effective inflation rates and inflation targeting




Source: Central Bank of Turkey and the Treasury.

## 2.2. The data and their evolution

Graph 2 shows that the evolution of the short term interest rate of the CBRT and the secondary market interest rate evolved in a parallel way in the period January 2002 - March 23, 2006. This is the period in which the implicit inflation targetging policy was adopted, ending before the rise of oil prices.

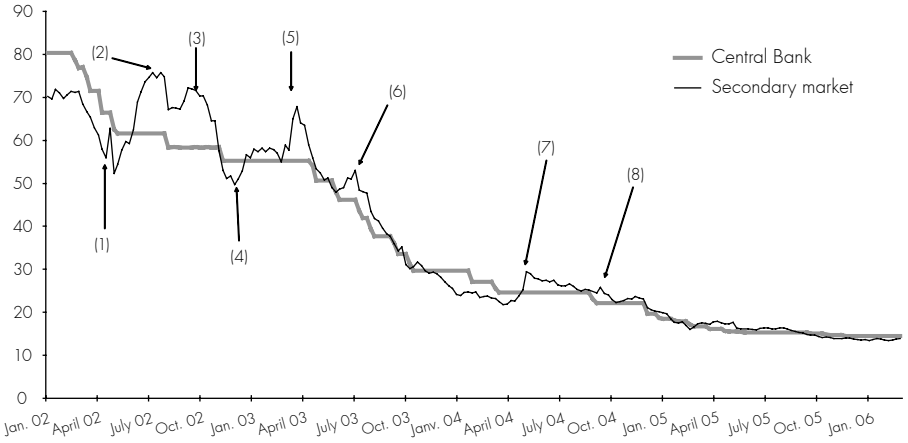
We have constructed these two series using the same method and the same sources as the CBRT. Our short term interest rate is the daily interest rate of the CBRT. The secondary

market interest rate is based on the daily rate of yield of the most traded asset at the IMKB, the Istanbul stock exchange.

The data are daily. However to avoid complications linked to micro events, daily data have been transformed to weekly data taking the average rate. The data used for the empirical analysis are thus weekly over the period January 2002 - March 2006 so that we have 215 observations for each series.

Graph 2 shows that the short-term interest rate of the CBRT and the secondary market interest rate evolved in a parallel way during the sample period. However, as the short-term interest rate of the CBRT falls monotonically, that of the secondary market is much more volatile and has risen over certain periods. The graph also shows that the secondary market interest rate was quite volatile at least until June 2004. This volatility can be explained taking into account the political and geopolitical tensions of that period. What matters is to understand whether these tensions and the resulting volatility have had an impact on the efficiency of monetary policy.

**Graph 2 -** Evolution of interest rates




(1) April 2002: Illness of the Prime minister and speculation on early general elections.

(2) July 2002: Uncertainty about early general elections and debates in parliament on harmonizing Turkish legislation with that of the EU and the Copenhagen criteria.

(3) October 2002: Tension between The U.S.A. and Irak.

(4) November 2002: Victory of the AKP at the general elections ensuring political stability.

(5) March 2003: Beginning of the conflict in Irak.

(6) June 2003: Summit of the Council of Europe where heads of government affirm that negotiations will commence only if Turkey would satisfy the Copenhagen criteria.

(7) May 2004: The FED decides to raise its interest rate.

(8) September 2004: Discussions on the new Turkish penal code.

Sources: Central Bank of the Republic of Turkey and Istanbul Stock Exchange (IMKB).

## 3. Empirical analysis of the joint dynamics of the rates

A necessary condition for the efficiency of inflation targeting is that the short term interest rate, chosen as the instrument of monetary policy, can influence the secondary market interest rate. Thus the central bank should not only have perfect control on its short term interest rate but also this rate should influence the dynamics of the secondary market interest rate.

We propose an original approach based on the analysis of the long term joint dynamics of these rates. This approach permits us to test not only the potential efficiency of the inflation targeting policy but also to investigate whether political and geopolitical events have perturbed this efficiency.

### 3.1. The model

To analyze the effect of geopolitical shocks on the efficiency of the inflation targeting policy we use a VECM as an unconstrained reduced form. So that the joint dynamics of the two rates is modeled as follows:

$$\begin{cases} \Delta CB_t = \Gamma_{11}(L)\Delta CB_{t-1} + \Gamma_{12}(L)\Delta SM_{t-1} + \alpha_1(\beta_1 CB_{t-1} + \beta_2 SM_{t-1}) + c_1 + u_{1t} \\ \Delta SM_t = \Gamma_{21}(L)\Delta CB_{t-1} + \Gamma_{22}(L)\Delta SM_{t-1} + \alpha_2(\beta_2 CB_{t-1} + \beta_2 SM_{t-1}) + c_2 + u_{2t} \end{cases} \quad (1)$$

The variable $\Delta CB_t$ is the variation of the short-term interest rate of the central bank. $\Delta SM_t$ the variation of the secondary market interest rate, and the parameters $\Gamma_{ij}(L)$ ($i = 1,2$ et $j = 1,2$) model the short term dynamics. In the case where the two variables are cointegrated, the parameters $\beta_1$ and $\beta_2$ are the cointegration coefficients $\alpha_1$ and $\alpha_2$ represent the weight of this cointegration relation in each of the equations (error correction terms).

We focus on the long term relation and the constraints that can be associated with it. If a cointegration relation exists between these two variables it will signify that in the long term these two rates can not diverge. The constraint $\beta_1 = -\beta_2$ is interpreted as the differential of the rates. The difference between the leading interest rate and the rate in the secondary market is stationary. This result indicates that there exists a long term economic equilibrium which stipulates that the two rates are equal to the equilibrium rate. An absence of a cointegration relation between the variables puts in doubt the efficiency of monetary policy itself, the secondary market rate being independent in the long term of the short-term rate of the central bank. Conversely, the stationary of the differential of the rates is a necessary condition of the full efficiency of monetary policy.[5]

The constraints on the parameters $\alpha$ can be interpreted in terms of the capacity to restore long run equilibrium. That is to say in terms of the adjustment speed of the rate towards the long term equilibrium. The constraint $\alpha_1 = 0$ signifies that the long term dynamics of the short-term rate of the central bank is independent of that the secondary market rate. The case most favorable to the efficiency of the monetary policy of the central bank is that where the differential of the rates is stationary ($\beta_1 = -\beta_2$) and the short-term rate of the central bank is

5. We suppose that $\beta_1 \geq |\beta_2|$ in the equation $\beta_1 CB_{t-1} + \beta_2 SM_{t-1}$.

weakly exogenous ($\alpha_1 = 0$). In this configuration, the value of the coefficient $1/\alpha_2$ measures the adjustment speed of the secondary market rate towards the equilibrium rate which is fixed by the short-term rate.

Seo's structural change tests will enable us to verify the stability of the long term equilibrium as well as that of the speed of convergence, searching for an endogeneous structural change.

### 3.2. Estimation of the model and first results

Before estimating model (1) we analyzed the univariate properties of the interest rate series to determine their order of integration. To do this we have used several unit root tests. The results of the stationarity tests like Dickey-Fuller, Phillips-Perron and Kwiatkowsky, Phillips, Schmidt and Shin (KPSS) indicate that the series have unit roots, are integrated of order one, having deterministic trends.[6]

The method of Johansen (1991) and Johansen and Juselius (1991) is quite appropriate to estimate model 1 and test the constraints on parameters of the long term. The AIC criterion indicates that we should keep 14 lags. The Hannan-Quinn criterion gives the same result and likelihood ratio tests reject models more parsimonious.

Several tests have been made on the errors to detect phenomena like ARCH: Ljung-Box tests on the autocorrelation of errors up to 16 lags and normality tests like that of Jarque-Bera. These tests enable us to see whether our estimation conforms to the assumptions underlying the techniques we use. To save space, we haven't presented the results of these tests. They indicate that the assumptions are satisfied. TABLE 1 shows that there exists a cointegration relation at the 5% threshold between these variables.

**Table 1- Cointegration tests**

| Eigenvalues | $H_0$ : r = | Trace | Lambda max | Critical values at 5 % | |
|---|---|---|---|---|---|
| | | | | Trace | Lambda max |
| **0.1213** | 0 | **29.54** | **26.51** | 15.41 | 14.07 |
| 0.0147 | 1 | 3.03 | 3.03 | 3.76 | 3.76 |

Thus the estimated model is a VECM with the following long term parameters:

$$\begin{cases} \Delta CB_t = \Gamma_{11}(L)\Delta CB_{t-1} + \Gamma_{12}(L)\Delta SM_{t-1} + 0.008_{(0.49)} * (CB_{t-1} - 0.928 * SM_{t-1}) + c_1 + u_{1t} \\ \Delta SM_t = \Gamma_{21}(L)\Delta CB_{t-1} + \Gamma_{22}(L)\Delta SM_{t-1} + 0.195_{(4.96)} * (CB_{t-1} - 0.928 * SM_{t-1}) + c_2 + u_{2t} \end{cases}$$

where Student statistics are given in parentheses.

We focus our analysis on the parameters of the long term relation. The restriction $\beta_2 = 0$, if it is accepted, will indicate that the interest rate of the CBRT is stationary whereas $\beta_1 = 0$ will indicate that the interest rate of the secondary market is stationary. TABLE 2 shows that these two restrictions are clearly rejected.

6. The results of these tests are available on request sent to the corresponding author.

**Table 2 - Tests of restrictions on the long term parameters**

| Type of constraint | Restrictions | P-values |
|---|---|---|
| Stationarity test for the interest rate of the central bank | $\beta_2 = 0$ | 0.00 |
| Stationarity test for the interest rate of the secondary market | $\beta_1 = 0$ | 0.00 |
| Stationarity test for the differential of the interest rates | $\beta_1 = -\beta_2$ | **0.07** |
| Weak exogeneity test for the interest rate of the central bank | $\alpha_1 = 0$ | **0.64** |
| Weak exogeneity test for the interest rate of the secondary market | $\alpha_2 = 0$ | 0.00 |
| Joint stationarity test for the differential of the interest rates and weak exogeneity test for the interest rate of the central banks | $\beta_1 = -\beta_2$ and $\alpha_1 = 0$ | **0.10** |

The stationarity of the differential of the rates is tested for the constraint $\beta_1 = -\beta_2$. Although the coefficients are very close to the constraint (1 and –0.928) the null hypothesis is not rejected at the 5% level but it is rejected at levels superior to 7%. This statistical result confirms the intuitive reading of GRAPH 2 representing the evolution of the rates.

The tests for $\alpha_i$, $i = 1,2$ show very clearly that the short-term interest rate of the CBRT is independent of the long term equilibrium ($\alpha_1 = 0$), while that of the secondary market is influenced by the long term relation.

The value of $\hat{\alpha}_2 = 0.195$ indicates that the speed of return to equilibrium is around five weeks. This signifies that if the CBRT lowers its short-term rate, in a month, the secondary market will be perfectly aligned with the new rate. The confidence interval at the 5% threshold for the coefficient is [0,117 ; 0,273] which indicates that the confidence interval in terms of weeks is [3,66 ; 8,54].

Finally, the joint test of stationarity for the differential of the rates and the weak exogeneity test of the interest rate of the CBRT show that these two hypotheses can not be rejected.

The results of these tests give three essential messages:
- the dynamics of the short-term rate of the CBRT is independent of the cointegration relation, that is to say that in the long term the CBRT keeps control of the short-term rate;
- the secondary market rate is influenced by the equilibrium interest rate fixed by the CBRT and a mean delay of one month is needed for the secondary market rate to join the equilibrium rate;
- there exists a long term equilibrium opposing the interest rates with coefficients very close to 1 and –1.

However, the GRAPH 2 suggests the possibility of a structural change during the first 18 months of the implementation of the inflation targeting policy. This structural change would be explained by the presence of several non-economic shocks linked to the political and geopolitical context the geopolitical situation which created uncertainty affecting the efficiency of monetary policy.

### 3.3. Seo's tests for structural change (1998)

"The oil shock in 1973 and the change in American monetary policy in 1979 have motivated the development of econometric techniques permitting us to catch the non-linearity linked to a non-stochastic exogeneous change".[7] Testing for structural change was hampered by the fact that the structural change parameters do not appear in the null hypothesis of no structural change and appear only in the alternative hypothesis. This problem has been resolved by Andrews (1993) and Andrews and Ploberger (1994). They have used an orthogonal projection of the null hypothesis using an inner product containing the structural change parameter. To do this they have used an inner product containing a structural change parameter and obtained statistics for asymptotic tests.

Seo (1998) has extended the results of Andrews and Ploberger (1994) to structural change in cointegration or for non-stationary processes. Tests for endogeneously detecting the structural change of the cointegration vector and the vector of adjustment at unknown dates have been formulated in the context of an error correction model (ECM). A VECM is estimated by the technique of Johansen (1991). The VECM is transformed to a triangular form for identification purposes. First Lagrange Multiplier (or score) tests are calculated as if the time of structural change is known i.e. exogenous. Then the time of change is randomized. The AVE, Exp and Sup tests of Andrews and Ploberger (1994) are formulated and their asymptotic distributions obtained. These tests have the same asymptotic optimality properties as those of Andrews and Ploberger (1994).

Tests for structural change in the cointegration parameters and those for change in the adjustment parameter are formulated separately. However, testing for structural change in both the cointegration parameters and the adjustment parameters is easy since their statistic is just the sum of those for change in each case.

### 3.4. Results and comments

Seo (1998) tests, permitting us to endogenously detect structural change, have been conducted on a sample of which we have excluded 15% of the data at both ends of the sample period. Thus they cover a period form October 2002 to September 2005.

The global values of these statistics given in TABLE 3, show that the stability of the parameters of the long term, can not be rejected at the 5% threshold no matter which test is used. On the other hand, the stability of the $\alpha$ coefficients is rejected by two tests (Exp-LM and Sup-LM) over three.

7. Baldi-Delatte, 2006, p. 790.

**Table 3 -** Stability tests

| | | Ave-LM* | Exp-LM** | Sup-LM*** |
|---|---|---|---|---|
| Tests on $\beta$ | Statistic | 0.34 | 0.89 | 2.02 |
| | 5 % Critical value | 2.71 | 2.02 | 9.09 |
| Tests on $\alpha$ | Statistic | 1.16 | **5.04** | **6.17** |
| | 5 % Critical value | 3.37 | 2.23 | 5.14 |

* Critical value for Ave – $LM_2^{\beta}$ and Ave – $LM_2^{\alpha}$, Seo (1998) Table 1, page 238.

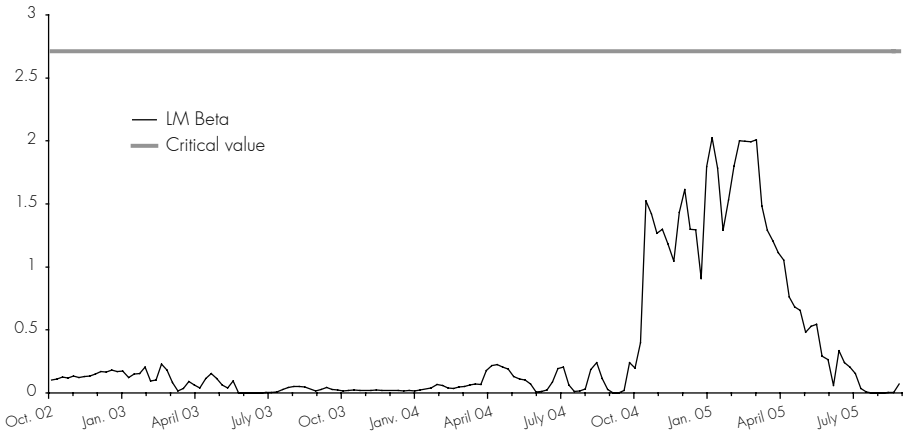
** Critical value for Exp – $LM_2^{\beta}$ and Exp – $LM_2^{\alpha}$, Seo (1998) Table 2, page 241.

*** Critical value for Sup – $LM_2^{\beta}$ and Sup – $LM_2^{\alpha}$, Seo (1998) Table 3, page 243.

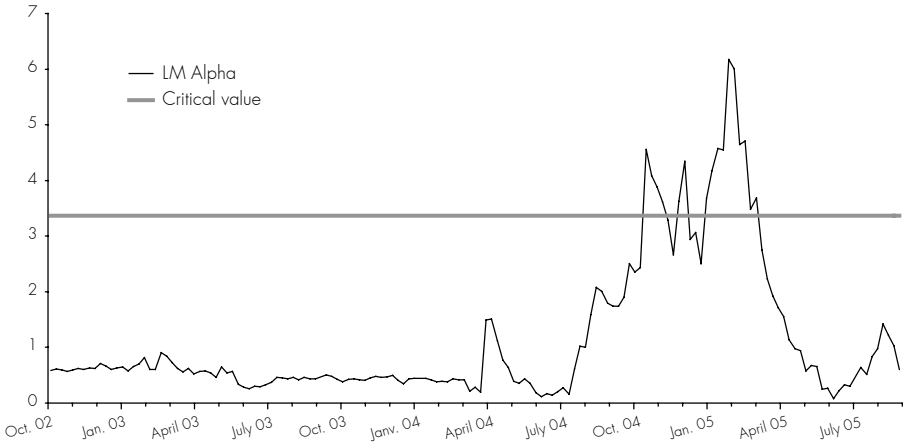
At this stage of the analysis, we know that there has been a structural change that has modified the values of the error correction terms $\alpha$. However, we are incapable of determining the period in which this structural change has occurred. The statistics $LM_{\tau}$, where $\tau$ represents the different periods at which these statistics are calculated, will permit us to determine endogenously the period in which structural change has occurred.

Graph 3.a shows the values taken by the test $LM_{\tau}^{\beta}$ at different dates. It shows that the statistics calculated are always inferior to the statistic tabulated at the 5% threshold, which confirms that the coefficients of the long term relation are stable. The values taken by the test $LM_{\tau}^{\alpha}$ (Graph 3.b) show that the calculated statistic is superior to the tabulated value in the period mid October 2004 to end of March 2005.

**Graph 3.a -** Stability test on $\beta$ parameters



**Graph 3.b -** Stability test on $\alpha$ parameters




## 4. Economic interpretation of the structural change

Seo tests made on the bivariate model indicate that there has been a structural change in the period October 2004 to March 2005. This structural change has not appeared in the coefficients of the long term relation. However the weights of this relation in each of the two equations have changed. In other words, the differential of the rates has remained invariant and the speed of convergence has been modified.

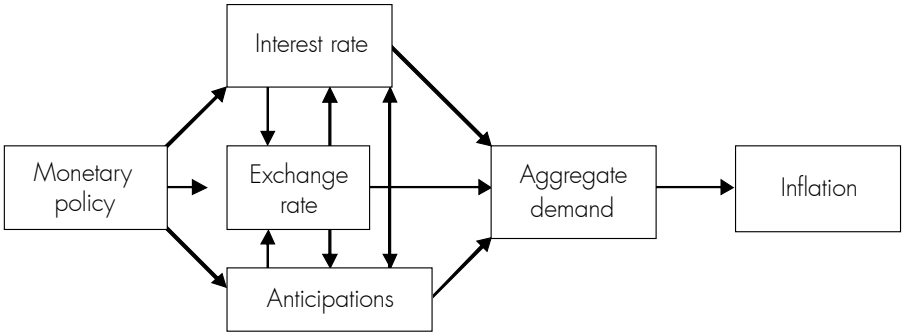
This result is surprising at first sight in that one would expect the parameters to be unstable in the beginning of the period when there was strong political and geopolitical uncertainty. It signifies that the various political and geopolitical shocks that have shaken Turkey between 2002 and 2003 have not altered the speed of convergence of the secondary market interest rate to its equilibrium value. It remains to explain the reasons why Turkey has had a structural change between October 2004 and March 2005.

To answer this question, we will follow two paths. The first one supposes that this result is due to the misspecification of the model caused by omitted variables. Since this approach has been fruitless, we will try to find an economic justification for the structural change at the last quarter of 2004.

### 4.1. The influence of exchange rates on the long term dynamics of the interest rate

The SCHEME 1 summarises the transmission mechanisms of monetary policy. In our case the instrument of monetary policy is the interest rate of the central bank. The scheme shows the possibility that exchange rates can influence the long term dynamics of the interest rate. If this is true, the bivariate model that we have estimated is subject to a specification error and the structural change shown by the Seo tests is just the result of omitting a key variable.

**Scheme 1 -** The transmission mechanisms of monetary policy




We have thus estimated a VECM with three variables: the interest rate of the Turkish central bank, the interest rate in the secondary market and the exchange rate. The estimation has been made using the same interest rate data in the same period.

Unit root tests show that the exchange rate is integrated of order 1. TABLE 4 shows that the dimension of the cointegration space is not modified by adding the exchange rate to the VECM. We then focus on the modifications of the long term relation caused by introducing the exchange rate series.

**Table 4 -** Cointegration test

| Eigenvalues | $H_0$ : r = | Trace | Lambda max | Critical values at 5 % | |
|---|---|---|---|---|---|
| | | | | Trace | Lambda max |
| **0.1144** | **0** | **45.09** | **24.90** | 29.68 | 20.97 |
| 0.0651 | 1 | 13.79 | 11.06 | 15.41 | 14.07 |
| 0.0308 | 2 | 2.40 | 2.40 | 3.76 | 3.76 |

As TABLE 5 shows, we start by testing for the exclusion of the exchange rate in the long term relation. This hypothesis is accepted up to the 44% threshold. Joint tests of the stationarity of the differential of the interest rates and of the weak exogeneity of the interest rate of the central bank show that the introduction of the exchange rate does not modify the long term dynamics of the interest rates. These results seem to indicate that the exchange rate does not play a part in the long term dynamics of the interest rates.

Table 5 - Tests of restrictions on the long term parameters

| Type of constraint | Restrictions | P-values |
|---|---|---|
| Exclusion test for the exchange rate | $\beta_3 = 0$ | **0.44** |
| Joint exclusion test for the exchange rate and stationarity test for the differential of the interest rates | $\beta_3 = 0$ and $\beta_1 = -\beta_2$ | **0.31** |
| Joint exclusion test for the exchange rate, stationarity test for the differential of the interest rates and weak exogeneity test for the interest rate of the central banks | $\beta_3 = 0$, $\beta_1 = -\beta_2$ and $\alpha_1 = 0$ | **0.27** |

Expected inflation can also be an omitted variable. Unfortunately, weekly data do not exist. The polls on expected inflation conducted by the central bank are made twice a month. In addition to that, numerous studies, like that of Kara and Tuger (2005), on the quality of these polls on expectations of economic agents, conclude that they are irrational.

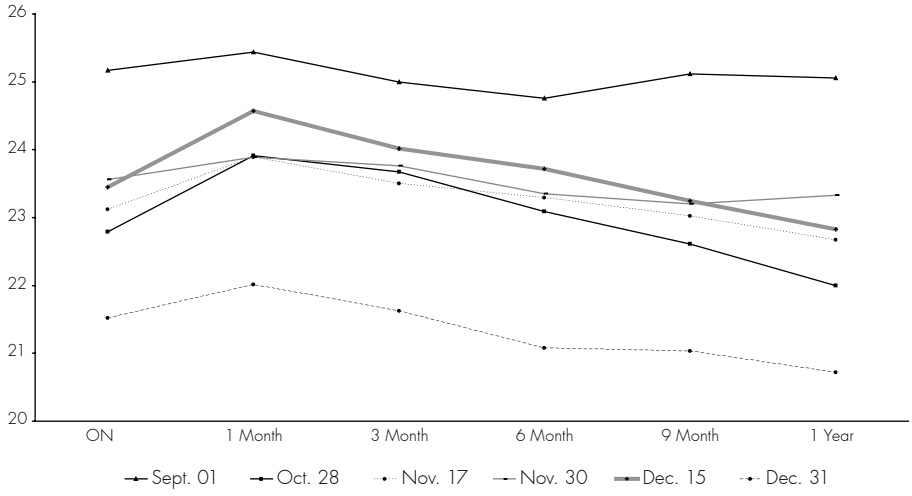
## 4.2. Opening accession negotiations with the European union

Seo tests have detected a structural change at the end of 2004, affecting the speed of convergence of the interest rates. The only striking event in Turkey at that time that we have identified is the opening of negotiations on joining the European Community. In 2004, the annual report of the European Commission recognized that Turkey "satisfied sufficiently the political criteria of Copenhagen" permitting the Council of Europe of December 16 to decide on the opening of negotiations for joining the E.U.

We think that this decision has lifted strong uncertainty and strengthened the credibility of the economic program. It is necessary to remind that the government formed by the AKP, following its victory in the elections of 2002, considered Turkey's joining the E.U. as an absolute priority. Important legislative reforms have been made to conform to the political Copenhagen criteria. Yet in December 2004 there was still doubt on the decision that the E.U. Heads of state and government would take. Thus the decision to open negotiations has lifted an extremely strong uncertainty. In addition, the decision has strengthened the credibility of the program based on fighting inflation and keeping public finance under control.

A first evidence is given by the yield curves of the last quarter of 2004 (GRAPH 4). Notice that the yield curves are inverted, short term assets yielding more than long term ones (for example, at December 31 the daily interest rate was 21.2% while the annual interest rate was just 20.70%). This shows that the markets anticipated a fall in inflation and preferred focusing on short term assets. However we notice a downward parallel shift. Thus between the yield curve in December 15 (before the opening of negotiations) and that of December 31, there is a difference of 2 points. One can thus say that the decision in December 16 has pushed all the marker interest rates downwards while the interest rate of the central bank has remained unchanged.

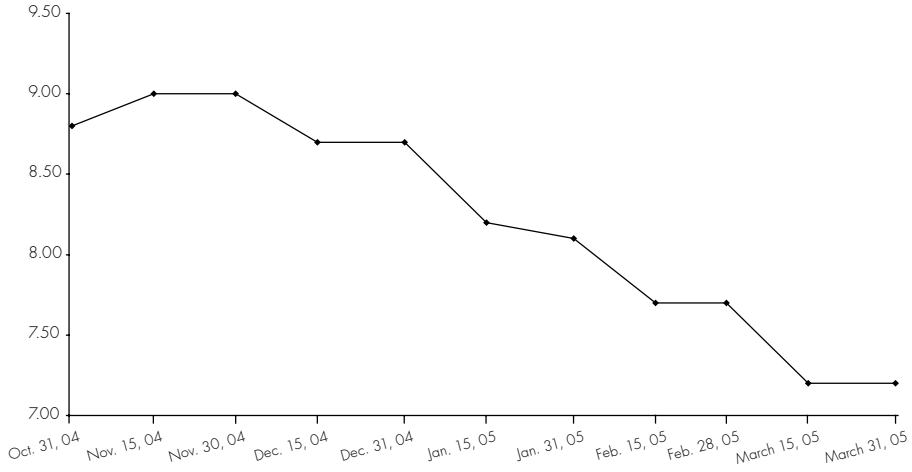
**Graph 4 -** Yield curves




Source: Reuters.

A second evidence of the effect of the decision in December 16 is given by the study of the expected inflation rate polls conducted by the CBRT. Graph 5 shows clearly that until December expected inflation rates were in the 8.5% - 9% range. Then they fall steadily to 7.25%, indicating that the credibility of the disinflationary policy has been strengthened.

**Graph 5 -** Annual expected inflation




Source: Central Bank of the Republic of Turkey.

A third evidence is given by our empirical study. If our explanation is the right one, the effectiveness of monetary policy should be increased and the speed of convergence of the secondary market to the equilibrium rate should have increased. Unfortunately Seo's method is based on the properties of estimated residuals of the VECM and does not permit us to estimate the parameters of the model in the period October 2004 - March 2005.

We have thus estimated the VECM for the period from October 2004 to March 2005. We know that the limited number of observations (28) puts in question the robustness of the estimation and that the results obtained have to be treated with caution. In order to lose the minimum number of observations and keep a maximum degree of liberty, we estimate the VECM with one lag.

Table 6 shows that there exists a cointegration relation at the 5%[8] significance level. We obtain the following estimates for the long term parameters. We see that the interest rate of the central bank remains weakly exogeneous. The joint stationarity test of the interest rate differential and the weak exogeneity of the interest rate of the central bank show that these two hypotheses can not be rejected at the 18% level. Thus we find the same results as the tests made on the whole period. These results show that structural change has not modified the dynamic properties of the two series. On the other hand, the adjustment coefficient in the equation for the interest rate in the secondary market is much greater. Its estimated value is 0.509 in the subperiod while it is 0.195 for the whole period. It seems that the speed of convergence of the rate in the secondary market has increased in this period since it is about two weeks.

**Table 6 - Cointegration tests, October 2004-Mars 2005**

| Eigenvalues | $H_0$ : r = | Trace | Lambda max | Critical values at 5 % | |
|---|---|---|---|---|---|
| | | | | Trace | Lambda max |
| **0.4417** | 0 | **15.59** | **15.15** | 15.41 | 14.07 |
| 0.001 | 1 | 0.04 | 0.04 | 3.76 | 3.76 |

8. Reinsel and Ahn (1992) proposed to correct the bias due to a small sample by multiplying the statistic trace and the eigenvalue ($T–pk$) where $T$ is the number of observations, $p$ the number of lags and $k$ the dimension of VECM. With this correction, the statistic of trace (13,36) and the statistic of eigenvalues (12,98) are inferiors to critical values at 5% but are still significant at 10% (for the critical values of 13,33 and 12,07).

## 5. Conclusions

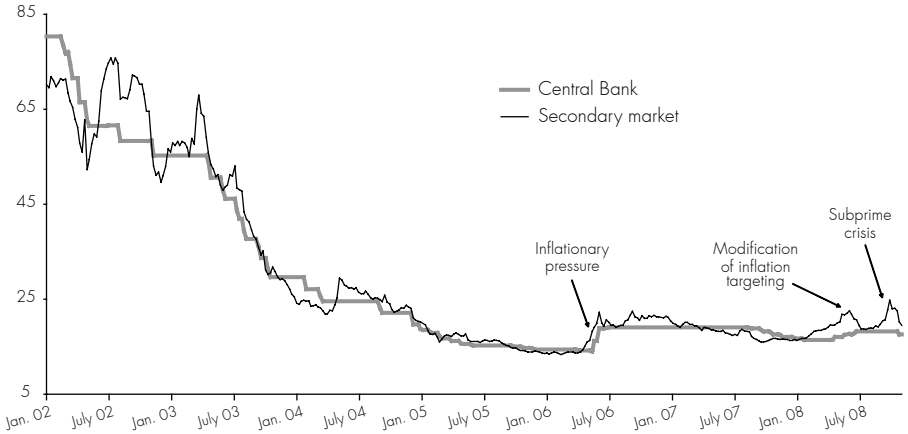
The original approach that we have proposed has shown that the important political and geopolitical uncertainties present at the beginning of the inflation targeting program have not had any influence on the long term dynamics of the interest rates of the CBRT and of the secondary market. On the other hand, the opening of negotiations with Turkey to join the EU has increased the speed of convergence of the secondary market rate to its equilibrium value fixed by the CBRT.

This point is essential given the fact that debate has been ongoing on the monetary policy conducted by the CBRT. Since 2004, economists have been criticizing the medium term objectives of the CBRT, arguing that passing from an inflation target of 8% in 2005 to a target of 5% in 2006 was too ambitious. In fact, these medium term objectives necessitated a very restrictive monetary policy and have pushed real interest rates to very high levels. The Turkish Lira was overvalued due to massive capital entry (6% of the GDP in 2004 and 13% in 2005) penalizing exports, favoring imports giving rise to a current account deficit (5% of the GDP in 2004 and 7% in 2005). The decision taken at 17 December 2004 to open negotiations with the EU, combined with very high interest rates have given rise to a massive influx of capital, obliging the CBRT to buy foreign exchange massively to prevent the appreciation of the national currency (1,350 millions of dollars in January 2005 and 2,361 millions in March 2006).

In the light of our results, it seems that the CBRT had the possibility of lowering its short-term rate which would have permitted a readjustment of the external account, without endangering the objectives of monetary policy; rather than intervening massively in the currency market putting in question even the principle of flexible exchange rates.

Since March 2006 the world economy has been influenced by two major developments: the rise of oil prices attaining their summit in July 2008 and the subprime lending crisis which started in summer 2007 but whose devastating effects were felt in autumn 2008. These developments have influenced the Turkish economy and the monetary policy of the CBRT. The rise of oil prices in summer has been one of the reasons given by the CBRT to explain the rise in inflation in 2006 (9.6%). Graph 6 shows that the CBRT tightened its monetary policy since spring 2006 by adjusting upwards the short term interest rate. Despite these measures, inflation targets for 2006 and 2007 were not attained. It was necessary to wait until summer 2008 for the CBRT to confess that the targets set for 2008, 2009 and 2010 were no longer realistic and had to be modified. The new targets are 7.5% for 2009, 6.5% for 2010 and 5.5% for 2011.

**Graph 6 -** Interest rates 2002-2008




The bankruptcy of the investment bank Lehman Brothers in September 2008 has perturbed financial markets throughout the world. The GRAPH 6 shows that the Turkish secondary market has also been shocked. However the differential between the rates is being absorbed. Slowing world growth and the emerging recession in Europe is likely to have consequences on the growth of the Turkish economy. In 2007 the economy grew 4.5% yet a net slowing of the economy is forecast with 2.3% growth in 2008 and 1.7% in 2009.

Z.Y. G., T. J. & R. T.[9]

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