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Taylor Rule and Monetary Policy in Tunisia

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***A*bstract:** This paper estimates the forward-looking monetary policy reaction function of the Central Bank of Tunisia (CBT) using quarterly data from 1993:Q2 to 2011:Q4. Policies which the CBT applied are analyzed according to the Taylor rule. The empirical results indicate that the CBT followed the Taylor rule in its interest setting behaviour. In forward-looking models, the response coefficient of expected inflation is greater than the output gap, which is consistent with the fact that inflation is the primary objective of monetary policy. The results of forward-looking models reflect the policies conducted in Tunisia.

JEL Classifications: E52, E43, E58

Keywords: Taylor rule, Monetary policy, Reaction function, GMM

1. Introduction

Following the seminal work by Taylor (1993), considerable research has been done to establish the extent to which a monetary policy rule can explain the dynamics of policy rates. Taylor-type rules have become the standard by which monetary policy is introduced in macroeconomic models both small and large. They have been used to explain how policy has been set in the past and how policy should be set in the future. Indeed, they serve as references for policymakers in assessing the current stance of monetary policy and in determining a future policy path.

Since the end of the 1990s, the analysis of monetary policy rules in developing countries has become increasingly important after economic reforms and subsequent transitions to new policy regimes. However, these countries have specific characteristics that differ from those of developed countries.

Monetary policies in developing countries are influenced by the world's major central banks, i.e., the Federal Reserve Bank, the European Central Bank and the Bank of Japan. Due to the existence of external constraints, central banks in developing countries stabilize exchange rates. Hence, the analysis of monetary policy rules in these countries requires a model specification different from that of developed countries.

Previous empirical studies concerning monetary policy rules used headline inflation to examine the interest rate setting behaviour of central banks. According to these policy rules, a central bank that seeks to stabilize inflation will increase its policy rate in response to a rise in inflation regardless of whether this rise is temporary or permanent.

Since the ending of 1986, the CBT has undergone various reforms. In the post-reform period, the monetary policy framework was characterized by a transition from direct instruments to indirect instruments. These changes altered the conduct of the Tunisian monetary policy. The stability-

oriented monetary policy strategy is the framework adopted by the CBT to achieve price stability. This paper estimates forward-looking monetary policy rules to examine the interest rate setting behavior of the CBT.

The paper is organized as follows. We review the previous work on monetary policy rules in the next section. In section 3, we present a brief history of the monetary policy in Tunisia. We describe the estimation methodology of forward-looking reaction function in section 4 and present our data and results in Section 5. We set out our conclusions in section 6.

2. Previous Studies of Monetary Policy Rules for Developed and Developing Countries

The expression «Taylor Rule» comes from the seminal work of Taylor (1993). The author showed that US monetary policy, covering a brief period of only 5 years (1987 - 1992), is well described by movements in the federal funds rate that respond to deviations of inflation and real GDP from their target and potential levels, respectively. This result led to a plethora of papers on interest rule models and central bank behaviour. Studies were generally applied to industrial countries, and many evaluate monetary policy using the *Taylor principle*: central banks facing higher expected inflation should raise nominal interest rates by more than the rise in expected inflation, in order to stabilize inflation.

After Taylor (1993), a stream of empirical literature studied and tested Taylor rule and its extensions. McCallum (2000) adopted historical analysis to test Taylor rule using the economic data of U.S. and U.K. during the period from 1962 to 1999, and Japan from 1972 to 1998. He suggested that rules' messages are more dependent upon which instrument rather than which target variable is used. In order to study the behaviour of central banks in the United States, Japan and some European countries, Clarida, Gali, and Gertler (1998) estimated forward-looking monetary policy rules by using the Generalized Method of Moments (GMM). They found that the central banks in the United States, Germany and Japan have pursued an implicit form of inflation targeting. The United Kingdom, France and Italy were constrained by their European Monetary System commitments and the Bundesbank had a strong influence on monetary management within these countries.

Clarida, Gali, and Gertler (2000) found that central banks in developed countries followed the Taylor rule (1993) in their interest setting behavior. The authors estimated a forward-looking monetary policy rule for United States pre - and post - October 1979, the beginning of Paul Volcker's tenure as Fed chairman. They found that the Taylor rule interest rate coefficients followed the *Taylor principle* during the Volcker-Greenspan term but not before 1979. According to them, this result may explain the inflation stability in the United States in the early 1980s.

Following Clarida *et al.* (1998; 2000), the GMM has widely been used to examine the central bank behaviour in developed countries. Chadha, Sarno, and Valente (2004) examined empirically whether asset prices and exchange rates may be admitted into a standard interest rate rule, using data for the United States, the United Kingdom, and Japan since 1979. They showed that asset prices and exchange rates can be employed as information variables for a standard «Taylor-type» rule.

By using the GMM and cointegration techniques, Mésonnier and Renne (2004) estimated the reaction function of monetary policy in the Euro area and derive the Taylor-type policy rule that a would-be ECB would have followed since the beginning of the European Monetary System (1979-2003). They found the presence of a systematic element in the monetary policy that prevailed in the euro area over the last two decades. Auray and Fève (2003) examined the behavior of the nominal interest rate and inflation in a sticky prices model with an exogenous money growth rule in the

United States. They found a relationship between the nominal interest rate and inflation similar to that described by the Taylor rule.

Gorter, Jacobs, and De Haan (2008) estimated Taylor rules for the euro area using Consensus Economics data for expected inflation and output growth, and compare these estimates with more conventional specifications in which actual outcomes are used. They showed that the ECB takes expected inflation and expected output growth into account in setting interest rates, while in the more conventional model specification; the coefficient of realized inflation is not significantly different from zero. Consequently, they found that the indications of accommodating behavior by the ECB implied by contemporaneous Taylor rules seem to be mainly driven by the lack of a forward-looking perspective.

Licheron (2009) investigated two hypotheses regarding the influence of national consideration in the ECB interest rate setting. The first hypothesis is related to the institutional framework of the Eurosystem, with a predominance of national representatives in the ECB Governing Council. The second hypothesis is more strategic: the ECB may be careful not to push one or several countries into deflation when raising its interest rates. He found that national consideration matter in the ECB decision-making, especially due to the fear of pushing individual countries toward deflation. Interestingly, inflation dispersion among EMU countries also seems to provide an explanation for the high inertia in euro area interest rates.

A limited number of empirical studies have estimated monetary policy rules for emerging and developing countries. Most of them focused on countries having an inflation-targeting framework. Torres (2003) examined Taylor-type monetary policy rules for Mexico and found that its monetary policy had been consistent with that of an inflation-targeting regime. Some studies found a high responsiveness of policy rates to changes in the exchange rate and the foreign interest rate. Using a standard open economy reaction function, Mohanty and Klau (2005) showed that in most emerging economies the interest rate responds strongly to exchange rate, in some, response is higher than that to changes in the inflation rate or the output gap.

By taking into consideration variable inflation targets, Yazgan and Yilmazkuday (2007) estimated forward-looking monetary policy rules for Israel and Turkey. They found that forward-looking Taylor rules seem to provide reasonable description of central bank behaviour, in both countries, even with only two response variables such as deviation from targets and output gap.

Aklan and Nargelecekenler (2008) estimated the backward-looking and forward-looking monetary policy reaction functions of the Central Bank of the Republic of Turkey (CBRT) by considering the post-crisis period from August 2001 to September 2006, with a special emphasis on inflation targeting. They indicated that the CBRT followed the Taylor rule in its interest setting behaviour. In forward-looking models, the response coefficient of inflation and the output gap is greater than that of backward-looking models. The results of forward-looking models reflect, the policies conducted in Turkey. In the post-crisis period, expected inflation has been the main reaction variable for the CBRT.

Moura and De Carvalho (2010) examined the way monetary policy has been conducted recently in the seven largest Latin American economies. They run 16 alternative specifications for the Taylor rule and select the most appropriate functional form through out-of-sample measures of forecasting performance. They found strong empirical support for endogenous monetary policy reacting. Empirical evidence indicates that Mexico and Brazil pursues a «tough» monetary policy, whereas Chile and Peru appear to pursue «mild» monetary policy against inflation. Apparently, Argentina, Colombia and Venezuela do not change nominal interest rates to tackle inflation fluctuations and adopt «lax» monetary policies. Exchange rate change seems to be a relevant variable for interest rate decisions only for Mexico, whereas the output gap only appears to matter to Chile, Colombia and Venezuela.

Aleem and Lahiani (2011) estimated forward-looking monetary policy rules to examine the interest rate setting behaviour of the State Bank of Pakistan. Considering the external constraints on monetary policy, core inflation and a country-specific measure of the output gap, they demonstrated that the State Bank of Pakistan reacts to changes in inflation, the output gap and the federal funds rate.

De Carvalho (2012) estimated Taylor rules using the Consensus Economic Forecasts database for Argentina, Brazil, Chile and Mexico, the four largest Latin American economies, aiming to verify whether financial market analysts incorporate Taylor rules at the time of forecasting interest rates. He applied the GMM and used real-time data of the output gap for Brazil and Mexico. Her findings indicate that, except for Mexico, interest rates market forecasts can be explained by Taylor rules. Financial analysts in Brazil and Chile expect the Taylor principle to be respected, but with a lower level of confidence than found in previous works, a result consistent with the tougher monetary policy trade-offs these countries have faced in recent years.

3. Brief History of the Monetary Policy in Tunisia

Over the last three decades, Tunisia has undertaken economic reforms which have allowed access to international capital markets on favorable terms: a good macroeconomic policy track record was established, the prudential framework for the financial sector was strengthened, the foreign exchange system was liberalized, and the CBT has developed monetary instruments in line with best practices. Building on these achievements the authorities wish to strengthen Tunisia's integration into the global economy and the CBT is contemplating a move to an inflation targeting framework in the medium term.

In the early 1980, the CBT undertook to define a strategy aiming at the preservation of the value of the currency and the support of the economic policies of the government. However, although this strategy has more than one objective, price stability remains the primary (implicit) objective of monetary policy.

Indeed, since 1987, the Tunisian monetary authorities have had as an intermediary objective the targeting of M2 aggregate. This is determined according to the quantitative theory of money. In fact, the CBT fix a growth of M2 at 2% below the projected growth of nominal GDP.[1] Then, under the assumption of a roughly constant multiplier, the amount of base money supply consistent with the target growth of M2 is calculated. Finally, taking into account projected net international reserves and the credit requirement of the agricultural sector, the CBT determines the quantity of liquidity to be distributed through the refinancing facilities. On a weekly basis, these amounts are fine-tuned taking into account the perceived financing needs of the commercial banks (Treichel, 1997). In particular, the deviation of current M2 growth from a reference value is interpreted as an indicator of the risk to price stability.

To attain its intermediary objective, the CBT acts on the amount of liquidity. Until 1996, this amount was regulated from the restrictions imposed to the commercial banks. These banks are in fact submitted to constraints such as the obligation to finance priority sectors as well as the fixation of debtors' interest rates.

Furthermore, from 1997, after the removal of these restrictions, the principal instrument became that of money market interventions (International Monetary Fund [IMF], 2004). The CBT inject or withdraw liquidity through the refinancing facilities (repurchase agreements and bid techniques). These techniques are completed with standing facilities and weekly fine-tuned operations in light of

[1] The CBT inserts in the definition of M2 the anticipation of prices, products and the velocity of this aggregate.

the financing needs of the commercial banks. As regards reserve requirement techniques, this was not actively used during the last two decades. In October 1989, the reserve requirement rate rose from zero to 2%. From that date to the early 2000s, banks had to deposit on non remunerated accounts, at the central bank, all deposits which were above a certain rate determined monthly by the emission institute.

Since 1999, the CBT has modified the quantitative approach the targeting of M3 instead of M2. The final aim being to attain an inflation objective close to the one observed in partner and competitive countries. However, in reality, the formulation of the monetary policy has not really changed and the Central Bank has continued to act on the level of banking liquidity through many operations, notably call for tender, allowance uptake[2] as well as weekly fine tuned operations. The reserve requirement technique was also reactivated and differentiated according to the duration of deposits in 2002.[3]

Moreover, under Article 33 of the May 2006 central bank law, the main assignment of the monetary policy consists in preserving price stability. This amendment removed the ambiguity regarding whether the domestic stability of the currency had priority over its external stability.[4] The May 2006 CBT law amendments' also eliminated all forms of monetary financing. These changes laid two key features of an inflation targeting framework. The CBT also intends to adopt interest rates as the operational target of monetary policy. In the interim, monetary policy has been anchored on a monetary program (Chailloux, Durré, & Laurens, 2009): the CBT derives annual targets for M3 from the government's financial program, as well as monthly targets for M3 and base money growth. Finally, it calibrates monetary operations based on liquidity forecasts, and aims at keeping short-term interbank rates within a desired range.

Concerning the exchange policy, the aim of establishing prudent monetary policy following the recession and the balance of payment problems of the middle 1980s - combined with the start of an openness and a liberalization process of the economy - urged the monetary authorities to target the real exchange rate (after having devaluated the dinar).

During the past decade or so, monetary policy in Tunisia has been implemented in the context of a managed floating exchange regime whereby the CBT intervenes in the market with a view to achieve a slight pace of depreciation of the real exchange rate against a basket of currencies weighted according to the country's main trading partners and competitors. This policy aimed at adjusting periodically the nominal exchange rate so as to support the competitiveness of the Tunisian economy. This approach has allowed the main exporting sectors to record good performances. More recently (the beginning of 2000s), the monetary authorities have been more flexible in the application of this rule by basing themselves on a series of indicators to ensure the competitive position of producers and guide its exchange rate policy.[5]

Tunisia operates monetary policy in the context of a managed float based on an undisclosed basket of currencies with no preannounced path for the exchange rate. The value of the dinar is determined on the interbank market which, in turn, is guided by daily indicative buying and selling exchange

[2] The 3 months allowance uptake of treasury bonds was introduced in 2001.

[3] It is useful to note that the CBT continue his rising of the reserve requirement rate given the prevailing situation of excess of liquidity of the Tunisian money market (Central Bank of Tunisia [CBT], 2011).

[4] The former Article 33 stated that: *«The ultimate objective of monetary policy is to safeguard the value of the currency by keeping inflation down to a rate close to the rate observed in partner and competitor countries».*

[5] For a review of Tunisia's experience with real exchange rate targeting, see Fanizza, Laframboise, Martin, Sab, and Karpowicz (2002).

rates against major currencies in a 1 percent range. The CBT also publishes the weighted-average rate for interbank transactions for the previous day, and it may intervene in the spot foreign exchange market at levels that do not necessarily correspond to the published mid-point range.[6]

It seems then that monetary authorities sometimes use the nominal exchange rate to correct shocks on domestic prices. Such a practice can lead to hyper inflation. However, the depreciation of the nominal exchange rate could lead to an increase in the price of foreign goods (and/or a revision in the increase of the inflation expectations concerning the price of domestic goods), which can feed inflationary pressures.

Boughrara (2006) indicated that, in the case of Tunisia, this exchange rate policy has been quite successful and facilitated by the fact that tourism has become increasingly important, while dependence on agriculture has declined. The absence of major terms of trade shocks and capital controls for non-residents obviously facilitated this success. It should be noted that capital transactions in Tunisia are still subject to a strong restrictions, both on the inward and outward directions. Indeed, extensive restrictions on capital inflows and outflows were maintained, allowing the authorities to pursue an independent monetary policy that has been prudent over the period. The CBT focused on setting the target rate of expansion in credit to the economy around the rate of nominal GDP growth, in effect targeting growth in broad money. Capital controls were utilized to ensure that domestic savings would be used to finance domestic investment (rather than the acquisition of foreign assets), and to limit reliance on short-term external financing.

4. Methodology

How a central bank reacts to changes in economic conditions is of crucial importance in both policy-making and to academics. Attempts to describe a systematic process by which the central bank adjusts a variable that it has control over, such as an interest rate, to changes in economic conditions give rise to the reaction function approach. There are many ways that one can specify monetary policy reaction functions or rules. Several variables have been thought to significantly affect the setting of monetary policy instruments, including monetary aggregates and the exchange rate. In recent years, however, Taylor-type rules have become the most popular way of summarizing how central banks conduct monetary policy.

The best-known simple instrument rule is the Taylor rule, where the instrument - the nominal short-term interest rate - responds only to inflation and to the output gap. Taylor (1993) suggested this rule as an explanation of the monetary policy setting for the early years of Alan Greenspan's chairmanship of the Board of Governors of the U.S. Federal Reserve System, thereafter «the Fed» (1987 - 1992). Since the rule described a complicated process in very simple terms and fitted the data very well, it quickly became very popular. We start by describing the original Taylor rule (1993) and present the modifications it has since undergone.

The Taylor (1993) rule prescribes the adjustment of interest rate policy instrument in a systematic manner in response to developments in inflation and macroeconomic activity. It can be written as:

$$i_t^* = \bar{r} + \pi_t^* + \beta(\pi_t - \pi_t^*) + \gamma x_t \quad (1)$$

[6]The intervention policy is guided by the behaviour of the real effective exchange rate. Since 2001, the CBT has been targeting a depreciation of the real effective exchange rate in order to support export competitiveness and growth.

where i_t^* is the target rate for the nominal interest rate, π_t is the percentage change in the price level, π_t^* is the variable target for inflation, $\bar{r}$ is the long-run equilibrium real interest rate, x_t is the measure of the output gap in period t. The output gap defined as the percentage deviation of actual output from its potential level. The parameters β and γ measure the sensitivity of the interest rate to variations in inflation and the output gap, respectively.

In Taylor (1993), $\bar{r}$ and π_t^* are both set equal to 2, and a weight of 0, 5 is assigned to both β and γ. Stability implies that a $\beta>0$, which means that the response of the monetary authorities to an inflation shock translates into a higher real federal funds rate. Otherwise, the central bank cannot convince markets that it prefers lower future inflation.

In practice, there seems to be a common belief that central banks aim to smooth interest rates.[7] This is modeled by adding an interest rate smoothing term in Eq. 1. The actual interest rate i_t, partially adjusts to the target i_t^* according to Eq. 2. Sack and Wieland (1999) show evidence that interest rate smoothing is a common practice of central banks in developed economies, and explains such behaviour by (i) forward-looking expectations; (ii) uncertainty concerning data on output and inflation and (iii) uncertainty about the monetary policy transmission mechanism. The signalling of further adjustments in the short-term rate moves future short-term rates and market long-term rates, powering the effects of monetary policy. Frequent revisions on output and inflation data may induce milder reactions at the time data are released, and uncertainty about the transmission mechanism can make the gradual adjustment of short-term rates desirable to avoid unnecessary movements in output and inflation. In addition, fear of reputation losses caused by interest rate reversals can also lead to gradualism.

Interest rate smoothing can be introduced into the model via the following partial adjustment mechanism:

$$i_t=(1-\rho)i_t^*+\rho i_{t-1}+v_t \tag{2}$$

where $\rho \in [0,1]$ is the smoothing parameter, v_t is a random disturbance term caused by the central bank's control of interest rate. According to this partial adjustment behavior, the central bank at each period adjusts its instrument in order to eliminate only a fraction $(1-\rho)$ of the gap between its current target level and some linear combination of its past values. Therefore, the parameter ρ can be considered as an index which captures the degree of interest rate smoothing.

Clarida *et al.* (1998) calculated the following estimation formula for the Taylor rule. First, the target rate (i_t^*) is expressed as a linear combination of the long-term equilibrium bank rate $\bar{r}$, the deviation of the inflation rate ($E\left[\pi_{t+n}\middle|\Omega_t\right]$) until after period *n*, which is expected based on information Ω_t at point in time *t*, from the target inflation rate (π^*), and the deviation between the GDP ($E\left[y_t\middle|\Omega_t\right]$) expected based on information Ω_t at point in time *t*, and target GDP (y_t^*):

$$i_t^*=\bar{r}+\beta(E\left[\pi_{t+n}\middle|\Omega_t\right]-\pi^*)+\gamma(E\left[y_t\middle|\Omega_t\right]-y_t^*)=\alpha+\beta\left[\pi_{t+n}\middle|\Omega_t\right]+\gamma E\left[x_t\middle|\Omega_t\right] \tag{3}$$

However, $\alpha=\bar{r}-\beta\pi^*$ and $x_t \equiv y_t-y_t^*$. If Eq. 2 and Eq. 3 are combined, the result is as follows:

[7] See for example Orphanides (2001) and Rudebusch (2002).

$$i_t = (1-\rho)\{\alpha + \beta E[\pi_{t+n}|\Omega_t] + \gamma E[x_t|\Omega_t]\} + \rho i_{t-1} + v_t \quad (4)$$

If the expected value expression is excluded, the result is as follows:

$$i_t = (1-\rho)\alpha + (1-\rho)\beta\pi_{t+n} + (1-\rho)\gamma x_t + \rho i_{t-1} + \mu_t \quad (5)$$

where, $\mu_t = -(1-\rho)\{\beta(\pi_{t+n} - E[\pi_{t+n}|\Omega_t]) + \gamma(x_t - E[x_t|\Omega_t])\} + v_t$, and μ_t is an error term that does not correlate with the information at time *t*.

In the existing literature, Eq. 5 is usually estimated by the GMM. According to Clarida *et al.* (1998, 2000), this estimation method is well suited for the econometric analysis of interest rate rules when the regressions are made on that are not known by the central bank at the decision-making moment.

Levin, Wieland, & Williams (2003) argued that the behaviuor depicted in Eq. 5 could be an optimal response for a central bank. Such interest rate smoothing has been employed in the empirical work of Clarida *et al.* (1998, 2000), Gerlach and Schnabel (2000), and Doménech, Ledo, and Taguas (2002). For the case of CBT, we assume that the onset of action of monetary policy is one year (n = 4 quarters).

This study estimates reaction the forward-looking monetary policy reaction function of the CBT. Eq. 5 is to be estimated for Tunisia in the following paper.

5. Data and Results

In Tunisia, the money market rate was used a proxy for the short-run money market rate. The target for the inflation rate is 2%. The seasonally adjusted industrial production series (IPS) was used for the measure of output gap. The definition of the output gap is a detrended IPS by Hodrick and Prescott (1997) filtering (with the smoothing parameter set at λ = 1600). The output gap is calculated as the percentage deviation of actual output from trend output.

Taking into account the availability and reliability of consumer price index (CPI) and GDP deflator, we choose the CPI as a measure of inflation rate. In our study, the annualized quarterly inflation rate is calculated according to the data of quarterly year-on-year growth rate of CPI. These variables are available from the International Monetary Fund (International Financial Statistics, IMF CD-ROM, 2012). We use quarterly data from 1993:Q2 to 2011:Q4.

In order to estimate a forward-looking reaction function, we used expected Inflation. The standard rule considers the interest rate react to contemporary variables. However, since monetary policy affects the real economy with a lag (European Central Bank [ECB], 2002), we substituted in our reaction function, expected inflation to actual inflation.

Before going on to look at the results, two points must be emphasized; first, in the expected results in Tables 1, the errors were corrected for heteroscedasticity and serial correlation using the Newey and West (1987) procedure. The estimation was obtained by the quadratic spectral kernel and Andrews (1991) bandwidth in E-Views.

Second, according to Clarida *et al.* (1998), we employ the GMM to estimate the unknown parameters in the forward-looking monetary policy rules described by Eq. 5. The forward-looking horizon for expected inflation is four quarters. Given that the instruments are correlated with the endogenous variables and uncorrelated with the error term, GMM estimators are strongly consistent and asymptotically normal. Accordingly, the instruments used were as follows: lags of interest rate, lags of inflation rate, and lags of output gap.

GMM requires that all the variables used in the estimation should be stationary. Therefore, we used the Phillips and Perron (PP) tests to determine if the variables were stationary, and it was found that the null of the unit root was rejected in all variables (interest rate, inflation rate and output gap) at the 5% significance levels, when tests were applied using the Schwarz Information Criteria (SIC) and the Lagrange Multiplier (LM) test. PP test statistics in the presence of intercept as well as intercept and trend are presented in Table 1. All of the series are found stationary in the level form.

Table 1. Phillips and Perron Test Statistics

Level Stationary		
Variable	Intercept	Trend and Intercept
Interest rate	-3.15**	-3.89**
Inflation rate	-6.16**	-6.11**
Output gap	-8.67**	-8.55**

** indicates significant at 5% level of significance.

Table 2 reports the results for the GMM estimation of our forward-looking specification with a lag of 4 quarters for inflation rate, the output gap and the interest rate.

Table 2. Estimation Results of Eq. 5

Constant	0.085
	(0.9)
Lagged interest rate	0.958
	(57.89)***
Expected inflation rate (t+4)	0.151
	(3.49)***
Output gap	0.056
	(1.82)*
Structural parameters	
ρ	0.958
β	3.595
γ	1.33
Adjusted R^2	0.96
$J-Stat$	5.16
$P-Value$	0.74
Number of instruments	12
Number of observations	67

Notes: *(resp.**,***): rejection of the null hypothesis at the 10% (resp. 5%, 1%) significance level

The results are shown in Table 2. The structural parameter β associated with the stabilization of inflation is greater than 3, then the *Taylor principle* is accepted and the CBT reacts strongly to a deviation of expected inflation from the target of 2%. Similarly, the cumulative reaction (i.e. long term) interest rate to the output gap is very significant, since the structural parameter γ is greater

than 1: the CBT is very attentive to changes in the cyclical position and seems to have a secondary objective of stabilizing output. However, the response coefficient of the lagged interest rate is much more moderate, since the interest rate smoothing parameter ρ is very high (0,958). The estimated values of the smoothing parameter imply that the CBT puts significant effort on smoothing interest rates. This high level of smoothing parameter has been demonstrated in several empirical studies in the case of the ECB (Fourçan & Vranceanu, 2007; Licheron, 2009) and has often been interpreted as a sign of a great «preference of gradualism» on the part of Central banks.

All coefficients are statistically significant at the 1% and 10% levels. Hansen's (1982) J-statistics in Table 2 indicates that the validity of the instruments is not rejected by the data. J-statistics, which test the overidentification restrictions, appear to be satisfactory. Hence, the overidentifying restrictions cannot be rejected.

Based on these results, we conclude that the Eq. 5 is the optimal reaction function of the CBT as part of its new policy. In other words, we obtain a first result is that the Tunisian monetary authorities target their actions on future inflation, not current or past inflation. The rule that reflects their behaviour is a rule of the forward-looking. We also conclude that the Tunisian monetary authorities are more concerned with the objective of price stability as one of economic stability. In addition, they adopted a policy of partial adjustment of the interest rate.

Even if a configuration taking into account expected inflation is probably more realistic, it is still necessary to ensure the quality of the model. A control chart can be seen by comparing the effective interest rate with that calculated from the estimated coefficients.

Figure 1 shows that the reaction function of the CBT according to a Taylor rule type forward-looking illustrate a fairly respectable dynamic real interest rates observed. In this respect, there is no longer the divergence between the two curves. The following figure shows the graphical representation of historical rates and those estimated.

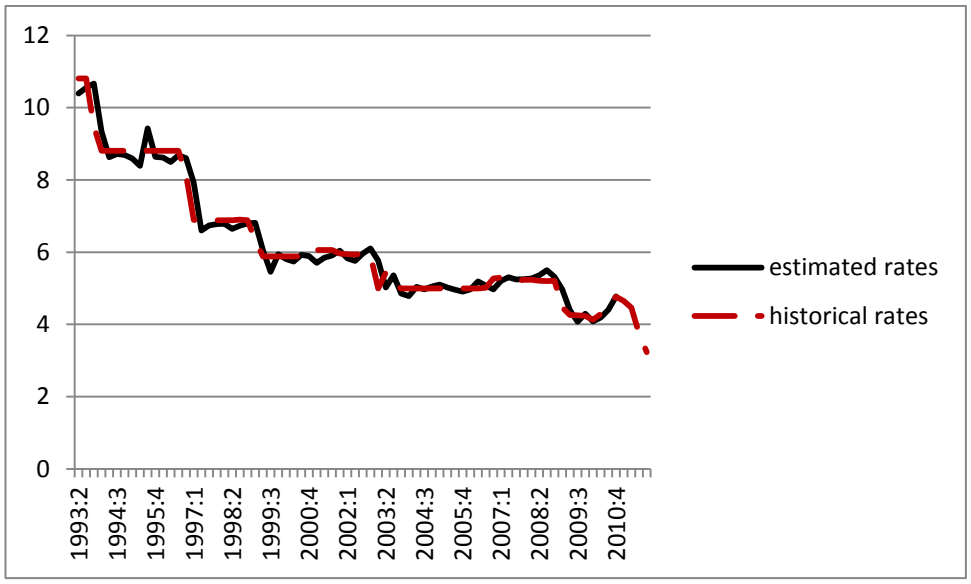

Figure 1. Historical rates and estimated rates

6. Conclusion

This paper, estimated the reaction function of the CBT using quarterly data from 1993:Q2 to 2011:Q4. Over the investigation period, it was observed that Taylor rule based monetary policy was

conducted to set interest rates in Tunisia. According to empirical results, the forward-looking equation explains the policy rate. Indeed, the response coefficient of expected inflation is greater than the output gap. The empirical evidence shows that the CBT responds to expected inflation deviations from its target value and positive output gap by increasing real interest rates. In terms of the main variables of change to the policy rate, expected inflation tends to dominate the output gap in the reaction function. The forward-looking Taylor rule appears to provide a reasonable description of the CBT.

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