THE MONETARY POLICY OF THE CENTRAL BANK OF TUNISIA : AN ASSESSMENT

By

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Abstract

Tunisia has been undertaking reforms of its financial sector as part of broader macroeconomic adjustment program and structural reform since 1987. The main objectives of the reforms are (i) to curb inflation, (ii) to make real interest rates positive and (iii) then to lower them so as to stimulate the investment and to promote savings. In order to reach these goals, Tunisian monetary authorities decided to adopt a monetary targeting strategy. First, it seeks to provide a description of the central characteristics of the Tunisian monetary policy. Second, it examines the relevance of the preconditions of the implementation of the monetary targeting strategy in the light of the recent developments of time series econometrics. Third, it seeks to check if the Central Bank of Tunisia succeeded in orienting the expectations of the public. It has been found using causality, cointegration and exogeneity tests that the monetary targeting preconditions are not gathered yet. Our analysis highlighted the difficulties of implementing a base regime especially under the financial stability restriction; it casts serious doubts on the feasibility of such regime. It is found also that the official target announcements did not provide optimal guidance to economic agents regarding the future course of the money supply. Finally our paper concludes that the Central Bank of Tunisia that regards itself as a monetary targeter should instead be seen as having followed a discretionary monetary policy with a focus on price stability.

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1. Introduction

Financial sector reforms are usually one component of broader structural adjustment programs and in a synergetic relationship with other elements of the reform program. The effectiveness of these reforms on growth may be undermined if they are undertaken in an environment of high inflation and unsustainable fiscal balances. A stable macroeconomic framework characterized by low inflation and fiscal sustainability is generally viewed as a desirable, albeit not an indispensable precondition of financial sector reform. On the other hand, a low inflation rate based on a sustainable fiscal policy clearly increases the likelihood of achieving positive but moderate real interest rates, reduces risk premia on holding financial assets and increases the information content of financial variables. Nevertheless, the presence of an unstable macroeconomic environment of high inflation and unsustainable fiscal balances need not rule out indefinitely the launching of financial sector reforms. Such an environment might create pressures to revert to financial repression and undermine the credibility, and thus the impact of the reforms (time-consistency). That is why a clear priority is assigned to the maintenance of price stability. Actually, this reflects the deep conviction that an environment of stable prices[1] creates the economic conditions that foster sustainable output growth, a high level of employment creation and better living standards. Through the pursuit of price stability, in a manner that is consistent with the others financial structure reform objectives, it becomes possible for country to fulfill the other part of its mandate.

Rules and targets play a central role in the debate on the conduct of monetary policy. Monetary authorities should follow a simple growth rule[2] that is officially stated as a target (Friedman,1968). Once these targets are announced, economic agents have to decide whether to rely on these official projections or whether to form their own expectations. Thus, decision to rely on monetary target announcements depends on the accuracy of the stated targets compared to available alternatives for generating expectations.

Tunisia has been undertaking reforms of its financial sector as a part of broad macroeconomic adjustment program and structural reforms since the ending of 1986. This program[3] aimed mainly at liberalizing interest rates, improving banking supervision and introducing more market-based instruments of monetary policy. To encourage direct financing through financial markets and to enhance the effectiveness of indirect monetary instruments, the Government introduced indeed new financial instruments and made them more flexible[4]. These changes altered the conduct of the Tunisian monetary policy. The stability-oriented monetary policy strategy is the framework adopted by the Central Bank of Tunisia (CBT) to achieve price stability. The selection of a strategy is of great importance for a central bank, because it represents a structure for the filtering and the processing of information; it constitutes also a guide for external communication with the public. The CBT decided to carry on a monetary

[1] Academic research strongly supports the view that the best contribution that monetary policy can give to the efficient functioning of monetary economies is to ensure price stability. There is consensus among researches that high rates of inflation are costly for the society (Fischer,1994) and plenty of evidence of the negative impact of inflation on economic activity (Barro,1996).

[2] The major modern argument in favor of monetary targeting comes from (Barro and Gordon, 1983), who have shown that the problem of dynamic inconsistency is liable to a non-inflationary stance. If there is no such commitment, the outcome in terms of inflation and unemployment will be worse than if there was a commitment.

[3] An entire description of the program is beyond the scope of this paper.

[4] These instruments consist of mainly treasury bills, certificates of deposit and commercial papers.

targeting strategy (MTS); since the beginning of the reform the M2 aggregate is considered as the intermediate target of the Tunisian monetary policy.

The purpose of this paper is threefold. First, it seeks to provide a description of the central characteristics of the Tunisian monetary policy. Second, it examines the relevance of the preconditions of the implementation of the MTS in the light of the recent developments of time series econometrics. Third, it seeks to check if the CBT succeeded in orienting the expectations of the public. The plan of the paper is as follows. Section 2 starts with a description of the Tunisian financial structure. In section 3, a special emphasis is given to the contribution of the preconditions in the success of a monetary targeting strategy. Section 4 opens with the description of the non-stationary features of the individual time series. Then the econometric methodology is presented.. All the focus of section 5 is on the checking of the preconditions of the success of a MTS. The assessment of the impact of the CBT announcements on the expectations generating process of economic agents is mainly emphasized. Finally, section 6 summarizes the main findings, draws some policy implications and reports the concluding remarks.

2. Financial Structure and Monetary Policy

Following a balance of payments crisis in 1985-86 Tunisia started a stabilization program, as well as a structural adjustment program of economic and financial liberalization. The objective was to move from controlled economy and an administratively managed financial system towards an open and market oriented system with a reduced direct involvement of the state. Measures taken to reform the financial and banking systems since 1987 included eliminating progressively credit allocation controls by abolishing credit ceilings and preferential interest rates. Interest rates were progressively freed, but the CBT maintained a strong involvement in their determination. Reforms of the financial system included the development of non bank financial institutions and the capital market. Like many other developing countries, Tunisia has a dual financial system : a legal financial system and an illegal financial one. What we are more interested in here is the legal financial system, which covers the financial markets and financial institutions. Prior to 1987, Tunisia's financial markets were rather incomplete and simple. Since that time, after the beginning of the reform era, Tunisia has been gradually trying to establish complete financial markets in order to meet the demands of the liberalization and of the sustained growth.

2.1. Financial Structure

The Tunisian financial system consists of the Central Bank (CBT) and many other financial institutions which are by 2001 : 13 deposit money banks, 8 development banks of which 2 are state-owned and 6 are joint ventures between Tunisian and other Arab states, 7 off-shore banks, 8 private leasing companies and 1 saving institution. Commercial banks are allowed to collect deposits of any maturity, provide short- and medium-term credit, and may engage in long-term credit operations for up to 3% of their deposit basis. Other financial institutions include: 2 merchant banks and 2 factoring companies, 20 mutual funds, 19 capital risk companies, 16 insurance companies; the stock exchange, brokerage houses, and the central depository for securities.

Despite the gradual development of the other financial institutions such as the stock market, mutual funds and leasing companies, the intermediation of saving and the financing of economic activity in Tunisia remain dominated by the banking system. Following a gradually evolving financial liberalization, interest rates on several loans were deregulated since 1987. They were liberalized in 1987, 1994 and 1996. Nevertheless, some deposit rates remained regulated. In deed, interest rates on sight deposits (up to 3 months) must not exceed a ceiling of 2%, and those on special savings deposits, which accounted for about 40% of total deposits of the public in the banking system at the end of 1998, are set at 2% below the money market rate. Saving accounts dedicated to housing financing have a fixed credit rate of 5.25%.

The banking law of 1994 allowed credit institutions to expand into previously forbidden financial activities (leasing, credit institutions and foreign exchange loans), and established the Stock Exchange Commission to supervise the Tunisian Stock Exchange. Money market interventions by the CBT were facilitated via the buying and selling of government bonds between the CBT and credit institutions. This measure reflects the need to switch to indirect instruments of monetary policy in the new deregulated environment. The new banking of July 2001 instituted further important reforms of the financial sector ; more specifically, it covers two main aspects : the first focuses on the liberalization of the banking sector, which will put an end to present system of specialization of the banking entities[5] while the second, will serve to consolidate the protection of the depositors. The introduction of the new law of a legal mechanism to guarantee deposits represents a small revolution on the Tunisian banking scene in that it creates confidence in the country's banking system, which now needs to open up to exterior following the signing of the agreement of free exchange with the EU and the World Trade organization's GATT trade agreement. In sum, the recent banking law introduced the principal of a sole banking entity, thus opening the way to what could conveniently be called a universal bank (general bank), a designation which signifies the end of specialization within the banking sector. Translated into practical terms, it means there will no longer be a separation between deposit banks, investment banks and merchant banks[6]. The new banking law aimed at further strengthening competition between development banks and commercial banks, effectively crating a unified legal basis of universal banking.

It must be kept in mind that up to 1986 the available financial options on investors were really very limited and included only time deposits and real estate. The financial deregulation expanded the range of available options by including the stock market, investment in foreign currency and various other products such treasury bills. These instruments were introduced basically to drain out excess of liquidity inside the monetary market and to dampen the demand for money. Better still, additional efforts to prevent the creation of excess liquidity continued outside the money market.

Reserve requirement which has remained unchanged for the last two decades has not been actively used as an instrument of monetary policy. In June 1989, the CBT raised the general reserve requirement from zero to 2% of deposits. From October 1989 to the end of 1990, banks were required to deposit in non-interest-bearing account at the Central Bank all deposits growing in excess of a given rate, determined on a monthly basis by the CBT.

[5] According the banking law of 1994, credit entities include banks, which offer a full range of financial operations, and financial companies, which do not have the right to undertake deposit operations.

[6] Nevertheless, deposit taking by development banks and long-term lending by commercial banks continue to be restricted.

The main financial instruments available to individuals since 1990 are bank deposits, shares and promissory notes by the finance and securities companies. On the borrowing side, the primary sources of finance are loans from various financial institutions, shares issues, and for larger companies, foreign borrowing. Though other financial instruments, such as commercial paper or certificates of deposit play only minor, they continue evolving over years. The debt instrument markets, such as the short-term money market and long-term non-equity bond market are not well developed. The treasury bills, which were introduced mainly to finance the budget deficit, were issued until March 1989, in two different forms. The transferable treasury bills, which were introduced in 1989 with maturities ranging from 13 weeks to 7 years, and have been sold to the public through the banks, are highly liquid instruments. Banks are indeed required to buy them back from their clients at face values (with only a small discount for operation costs). The second type of bills are the negotiable treasury bills; they were introduced in 1993 with the view to supply a long-term financial instrument and fostering the development of a secondary market. The are auctioned to stock exchange intermediaries and listed on the stock exchange. Despite all these efforts, a liquid secondary market did not develop for many reasons. The CBT essentially determined the money market rate through auctions and repurchase facility. The money market exhibited, however, some rigidities, as evinced by the fact that the rate at auctions did not clear the market and remained fairly stable. But after 1990, the repurchase facility was the most important source of refinancing.

2.2. The Current Regime of Monetary Policy

The primary objectives of monetary policy in legislation include preserving the value of the currency and to support the economic policies of the government. The main purpose of the monetary policy, as further explained on the website of the CBT[7], is to preserve the (internal and external) value of the currency. Nevertheless, the institutional responsibility for foreign exchange policy is not clearly defined and publicly disclosed. Also it should be noted that the CBT is entrusted with several missions in its charter, in particular supporting the government's economic policy, in addition to its general mission of defending the value of the currency and ensuring its stability. While the law does not explicitly state that price stability takes precedence over the responsibility to support the economic objectives of the government, the monetary authorities see price stability as the primary objective of the CBT.

The monetary policy strategy of the CBT assigned a prominent role to money growth. In particular, the deviations of current M2 growth from a reference value is interpreted as an indicator of the risk to price stability. Currently, the CBT develops a notion of the appropriate growth of the money supply and the amount of refinancing according the following three steps procedure. First, the growth of M2 is set at 2% below the projected growth of nominal GDP. Second, under the assumption of a roughly constant multiplier, the amount of base money supply consistent with the target growth of M2 is calculated. Third, 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[8]. On a weekly basis, these amounts are fine-tuned taking into account the perceived financing needs of the commercial banks. While the CBT monitors a number of other indicators, such as the level of net international reserves and the monthly inflation rate to assess the appropriateness of its monetary policy, monetary aggregate M2 appears to be the Tunisian Central Bank's leading indicator of monetary policy.

[7] <http://www.bct.gov.tn>
[8] Tunisia maintains relatively strict controls on capital account transactions.

The stability-oriented monetary policy strategy is the framework adopted by the Central Bank of Tunisia since 1987 to achieve price stability. The selection of a strategy is of great importance for the CBT, because it represents not only a structure that allows the institution to filter the information but also a guide for external communication with the public. It decided to carry on a MTS on the M2 aggregate. Since the beginning of the reform the M2 aggregate[9] was considered as the intermediate target of the Tunisian monetary policy. At the operational level, the monetary program prepared by the CBT at the beginning of each year t defines the monetary policy for the year t+1. Till recently, its formulation focused on the determination of the appropriate growth of M2 on the basis of projections for real output growth, inflation, interest rates, and the desired external balances. From the projected path of M2, an estimate of the required increases in net domestic credit was calculated given a separate assessment of the credit needs of the private sector, the Bank could derive the credit expansion to the public sector was consistent with these projections (Treichel,1997). But one should wonder if the technical conditions are met or not yet ?

3. Monetary Targeting Prerequisites

The adopted reforms led the CBT to alter its conduct of the monetary policy. The selection of an appropriate monetary strategy has become of great importance for the CBT since it represents a structure for the filtering and the processing of information and a guide for external communication with the public (Svensson,1996a, 1996b ; Issing,1996). The CBT decided to carry on a MTS focused on controlling inflation[10]. Such strategy comprises the following elements : first, a reliance on information conveyed by a monetary aggregate to conduct monetary policy. In the process of monetary policy, some measure of money is often served as an intermediary target, standing between the Central Bank's ultimate policy goals of sustainable economic growth with price stability and the operating targets used for day-to-day (or week-to-week) policy to attain the ultimate goals, the Central Bank may aim at money as an intermediate target as if achieving its target is achieve the final policy objectives. Second, an announcement of targets on a monetary aggregate to guide the public's inflation expectations; a prominent role ought to be assigned to money, in relation to which a quantitative reference value for the rate growth of that aggregate has to be announced at the end of each year t for the year t+1. Third, an accountability mechanism that precludes large and systematic deviations from the monetary targets[11].

Economists concur (Issing,1996; Mishkin,1999a,1999b; Mishkin and Savastano,2001) in the belief that a MTS has at least the following advantages. It enables to the Bank to adjust its monetary policy to deal with domestic considerations; it allows, indeed, some scope for monetary policy to deal with transitory output fluctuations and even certain external shocks. It enables also the Bank to choose goals for inflation that may not be necessary similar to those of other countries. Moreover, such a strategy is easy to monitor since information on whether the Central Bank is complying its targets is readily known and available almost immediately.

[9] See section 4.1 for a definition of the M2 aggregate.

[10]There are four broad monetary policy strategies that can produce a nominal anchor that credibility constraints the discretion of the Central bank over the medium term (Mishkin and Savastano,2001).

[11]The stability of the demand for money function is another necessary condition that ought to be checked; in addition, the strategy presupposes that monetary policy is not dictate by fiscal considerations (lack of fiscal dominance) and that exchange rate is “flexible”. To conserve space, the present paper does not focus on these conditions; they will make the subject of a future paper.

Therefore, when compared to the targets announced by the Central Bank, the actual figures for monetary aggregates that are typically reported within few weeks generate informative signals. These signals enlighten the public and markets about not only the stance of the monetary policy but also the intentions of the authorities to keep inflation in cheek; they can consequently help fix inflation expectations and produce less inflation. Monetary targets have also the advantage of being able to promote almost immediate accountability for monetary policy makers to keep inflation low and so help constrain the monetary policy maker from falling into the time-inconsistency trap. A monetary aggregate targeting strategy is said to be successful if it shows that it is able to exhibit these advantages; and for that to be a set of conditions ought to be fulfilled.

In what follows, we will explain with some details how and to what extent the above mentioned preconditions are useful to the conduct of the monetary policy.

3.1. The Controllability

The first one is that the target monetary aggregate must be well controlled by the Central Bank. Otherwise, the monetary aggregate may not provide clear signals about the intentions of the policy makers and thereby make it harder to hold them accountable. The controllability necessitates, in turn, the followings : First, in order to regulate the liquidity in the economy, the monetary authority must choose a monetary aggregate which incorporates the instruments the monetary authority uses to implement its policy. Second, the relationship between the monetary aggregate and the money supply (the money multiplier) must be stable and predictable. Provided that the monetary base B is under the control of the monetary authority, the determination of the reasons behind the changes in the money multiplier becomes important in the implementation of the monetary policy. Given that B is under the control of the Central Bank, it could only achieve its primary objective of providing the price stability by controlling the money multiplier as much as possible.

Evidence from the past periods suggests that there is a high degree of association between the monetary B and the money supply. The monetary authority can in principal control a larger portion of the changes in the money supply by controlling the size of changes in B. Nevertheless, there are some other factors, on the one hand, such as changes in the composition of deposits between demand and time deposits and commercial bank's behavior in holding excess reserves which are all said to be outside the control of the monetary authority. All theses factors are included in the money multiplier[12]. Therefore, the predictability of the money multiplier and the degree of control of the monetary authority over B gain importance in determining the money supply.

3.2. Linkage with the Ultimate Goal

The second condition is that there must be a strong and reliable relationship between the goal variable (inflation or nominal income) and the target aggregate. The relationship between monetary aggregates and the prices may become weak and instable especially when it comes to an economic environment characterized by a low inflation and an increasing financial integration[13]. If there is velocity instability, so that the relationship between the monetary

[12] The relationship among the money supply, the money multiplier can be written as follows: M2=k.B

[13] This was the main problem with the MTS in industrialized countries.

aggregate and the goal variable is weak, then monetary aggregate targeting will strongly lack precision and hence often will not work. More precisely, the weak relationship implies that hitting the target will not produce the desired outcome on the goal variable and thus the monetary aggregate will no longer provide an adequate signal about the stance of monetary policy. Thus, monetary targeting will not help fix inflation expectations and be a good guide for assessing the accountably of the Central Bank. Better still, a weak relationship between the target monetary aggregate and inflation will make it difficult for the CBT to be transparent and accountable to the public. Nevertheless, this does not necessarily imply that monetary policy will be expansionary or irresponsible; rather, it will complicate greatly the central bank's communication with the public and the markets, and impair its credibility. So in order to check if the intermediary target is linked to the price variable, cointegration aspect should be emphasized. The monetarist theory of inflation (Barro,1987) mentioned indeed that the inflation is closely linked to money growth primarily in the long-run, and in the short-run the relationship between the two variables could be somewhat fragile without seriously undermining the theory.

3.3 Announcements and Public's Expectations

One of the most important necessary conditions for the success of a monetary targeting strategy is the announcement of the targets on the intermediary aggregate. The basic idea behind these announcement is to guide the public's expectations. The announcement procedure allows in principal the Central Bank to anchor the expectations and produce less inflation. The information signals produced, when the targets announced are compared to the actual monetary aggregate, enlighten economic agents about the intentions of the CBT. Therefore, the assessment of the announcements effect on the public's expectations formation is necessary. Indeed for a Central bank like the CBT applying monetary targeting it is useful and important to know and to assess if its announcements are credible. As a consequence, the assessment process should rest on the models of expectations. The methodology proposed in this paper consists of comparing two models. In the first, we consider the forecast of individuals based on monetary target information. This forecast consists of two components : the target value of the money stock (the first component) and a term representing the persistence of the lagged target deviations (the second component). This latter component is motivated by the CBT's announcements that deviations from target are possible for the sake of peripheral system safety and economic stabilization. The second model is an ARIMA model; our methodology suppose that this model do not rely on the CBT announcement. These models should be compared.

3.4. Previous Empirical Works

A great number of studies (Svensson,2000; Cukierman,1996 ; Friedman,1968 and 1995; Friedman and Kutner,1993 and 1996; Issing,1996 and 1997; Mishkin,1999; Mishkin and Savastano, 2001; Ford and Morris,1996) have shown on theoretical and empirical grounds that for a monetary targeting strategy to be effective and sound, the above preconditions must be fulfilled. Some of these focussed on the controllability aspect and nothing is said the money-prices link (Ford,1996); conversely, others have emphasized the money-prices relationship and they neglected the controllability condition analysis (Friedman and Kutner,1993 ; Mishkin and Savastano,2001). On the whole, sum, two main conclusions could be drawn from these studies : First, the experiences of industrialized countries have shown that when inflation falls to single digit levels (as is the case of Tunisia), money growth rates will be likely to lose informational content and become less useful indicators of monetary

policy. Second, these studies have pointed out that changes in the financial system, including the growth of finance companies and permanent building societies, may have altered the time series properties of the monetary aggregates and may have changed the observed relationship between monetary targets and money base. For these reasons and seeing that Tunisia knows all these changes (as explained in section 2), it seems judicious and reasonable to examine the MTS's preconditions.

In the particular case of Tunisia, our current bibliographical research reveals that no serious empirical assessment or analysis has been devoted to check whether the prerequisites of the MTS are gathered or not yet. For instance, Najeh and Bouaziz (1990) have used a very simplistic analysis to show that M2 is not controllable; the authors pointed out, using monthly data during the period 1978-1990, that the multiplier was instable. In a more recent paper, Treichel(1997) has examined, using cointegration tests, the relationship between the monetary base and the money supply (M2); and he concluded that M2 is controllable and could be considered as a sensible intermediate target.

The above mentioned pervious studies have some caveats. They are methodologically unsounded ; a study like that of Najeh and Bouaziz (1990) used some descriptive statistics without taking into account the non-stationary nature of the date; the authors did not exploit the long-run information contained in the data. Treichel's work has emphasized the long-run relationship between money base and prices and nothing was said about the short-run dynamics. The inspection of the short-run dynamics is mandatory especially when it comes to the controllability issue. Moreover, all these studies share the same drawback : they did not examine the money-prices relationship; according our knowledge, no research has been devoted to seriously analyze the linkage between the intermediate target and prices in Tunisia.

It is therefore judicious and reasonable to examine simultaneously the main prerequisites of the MTS in an emerging country like Tunisia. Unlike these studies, our research uses advanced econometric techniques (especially, stationary tests, cointegration tests, short and long-run causality tests, exogeneity tests, error correction models and expectation models) to assess not only the controllability of the M2 aggregate but also its link with prices. These advanced econometric tools will allow us to appraise the prerequisites of the implementation of the MTS and to draw robust policy implications about the monetary policy of the CBT. Also, our research proposes and applies an assessment methodology of the impact of the CBT'announcements of the monetary targets on the expectations generating process of economic agents. In what follows, we will explain how we will assess the CBT's monetary strategy.

4. Data Description and Econometric Methodology

4.1. Data Description

The quarterly data used in this paper cover the period 1987:Q1 to 2000:Q1. The monetary aggregate variable employed is broad money M2 which is the sum of narrow money and quasi-money : M2 = M1+Quasi-money, where M1=Fiduciary money + Credit balance of checking accounts + Current accounts opened next to the CCP and next to registered intermediaries and Quasi-money = Forward deposits + Certificates of deposit + Foreign accounts in foreign currencies opened by residents and non-residents + Sight investments which could not be used directly as a settlement. The price variable is the Consumer price

index (CPI). Several sources of these data are available : the National institute of Statistic (INS), Central Bank of Tunisia, International Financial Statistics (IMF, various issues), International Financial Statistics (IMF, CD-ROM, 2001). Our data have been collected from the quarterly Financial Statistics Bulletin (various issues) for M2, and from the National Institute of Statistics for the CPI. These variable are seasonally adjusted. The annual targets are announced in the Central bank web site and in the *Budget Economique* (various issues).

4.2. Unit roots tests

We start by establishing the time-series properties of the individual variables. The aim here is simply to show that the variables are integrated of the same order. An integrated variable is a variable which is not stationary that is, which exhibits no tendency return to its original value following a disturbance. The existence of non-stationarity in a time series does not inevitably imply that the time series has a unit root. A non-stationary series having a unit root is called Difference Stationary series. If the non-stationary series does not have a unit root it is instead called a trend Stationary series (Nelson and Plosser, 1982). Our focus here is on the DS series. The tests for unit roots are performed sequentially using Perron-Phillips and Dickey-Fuller tests.

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The results point out that the null hypothesis of integrated series of order one is not rejected by the data as shown by the statistics (t_μ and t_τ). When the series in their first differences are considered, both tests reject the null hypothesis as shown in the third and the sixth column of table 1 Given these results, one can conclude that all the variables are integrated of order one, I(1).

4.2. The VAR Methodology

In order to characterize the long-run equilibrium relations between the variables mentioned, we start with the following basic closed VAR model with Gaussian errors

$$\Delta X_t = \sum_{i=1}^{k} A_i \Delta X_{t-i} + \Phi_t + U_t \qquad (2)$$

where X is the vector of the p variables of the system, assuming X to be I(d) with $d \leq 1$, such that ($p \times p$) coefficient matrices, Φ_t a vector of deterministic terms and exogenous variables and U_t residuals following a normal distribution $N(0,\Sigma)$. A reparametrisation of this VAR(k) results in an error-correction form :

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \Phi_t + U_t \qquad (2)$$

Here Π is an ($p \times p$) coefficients matrix which contains information about long-run relationships between the variables in the data vector. Π can be factorized according to the number r ($0 \leq r \leq p$) of linear independent cointegration vectors : $\Pi = \alpha\beta'$ where α is the ($p \times r$)-matrix of adjustment coefficient and β the ($r \times p$)-matrix of cointegration vectors (Johansen (1988)).

The multivariate tests to be performed on the data depend on how potentially significant deterministic trends are modeled. The technical framework for this analysis is the p-dimensional vector error correction model that allow for quadratic deterministic trends in the (data generating process) DGP and linear trends in cointegrating vectors. This general VECM can be expressed as :

$$\Delta X_t = \alpha \begin{pmatrix} \beta \\ \mu_1 \\ \delta_1 \end{pmatrix}' X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \alpha_\perp \mu_2 + \alpha_\perp \delta_2 . \text{time} + U_t \qquad (2)$$

The parameters $\alpha\mu_1$ and $\alpha\delta_1$ measure the effect of the deterministic components on the long-run properties of the model, while $\alpha_\perp\mu_2$ and $\alpha_\perp\delta_2$ measure the effect on the common-trends, or growth-rate, components. Five alternative specifications of the deterministic components of the model are embedded in Eq.(3), depending on the values of μ_i and δ_i. These specifications give rise to the following models :

Model 1: δ_i and μ_i (where i=1,2) are unrestricted so that there may be linear trends in the growth rate (that is $\delta_2 \neq 0$) which implies that there are quadratic trends in the levels of the vector X ; this is the most general specification.

Model 2 : $\delta_2=0$ which excludes quadratic trends from the DGP but allows for the possibility of a deterministic drift in the cointegrating vector(s) and in the data as well.

Model 3: $\delta_1=\delta_2=0$ which implies no linear trend in the cointegrating relationships but allows for linear trends in the level of the data itself (through $\mu_2 \neq 0$ operating on ΔX), and non-zero intercepts in the cointegrating vector;

Model 4: $\delta_1=\delta_2=0$ and $\mu_2=0$ which implies that the only deterministic components in the data are the intercepts in the cointegrating relationship.

Model 5: $\delta_1=\delta_2=\mu_1=\mu_2=0$ which assumes no deterministic components in the model, that is all stationary components have mean zero.

Obviously, one could not test all these specifications. It would be more judicious to discard the ones deemed to be the most unlikely. With regard to data at hand, Model 1 should be discarded since none of the series depict a quadratic trend. Similarly, Model 5 has to be ignored because it is with little interest in practice. It remains to be seen which among the remaining specifications is the most appropriate facing the data at hand.

When implementing the Johansen method cointegration technique a number of crucial empirical decisions have to be made. The first decision concerns the lag-length in the VAR, for which we used the Schwartz Bayesian Information Criterion as an a priori sign and a check on normality and autoregressive properties of the estimated residuals ex post. Secondly, in order to determine the appropriate specification of the deterministic components in the VAR model, one can proceed as in Johansen (1992) by recoursing to the so called Pantula principle. We remind that the Pantula principle suggests to test the rank of the long-run model by estimating the three model versions sequentially from the most restricted to the less restricted. The model is not valid until the null hypothesis Rank(Π)=r ceases to be rejected using the Trace test. Better still, it is also possible to test for the rank condition along with

determining the right deterministic components in the cointegration space and/or short-run model.

4.3. Causality Analysis

Since the greatest part of the empirical work focuses on the causality analysis, we will expose the methodology adopted by the paper in the context of the VAR model. By definition, a variable x Granger-causes another one, say y, if the knowledge of the past of x helps to get better forecasts of y. Tests can be performed in a reduced form model, such as the VAR representation. Since we are dealing with (potentially) cointegrated I(1) variables, we will use the VAR in its ECM representation following Engle and Granger(1987). In such representation, at least one of the variables is caused by the long-run residuals, therefore by the levels of the others variables. This is the well known property of causality within a system of cointegrated variables (Granger,1988). When testing causality between variables that are cointegrated without taking into account the long-run relationship between them, its then possible to find no causal relationship (Granger,1988 ; Hunter,1990 and 1992). Nevertheless, considering the error correction terms ($\hat{z}_{t-1}$) into the equation reintroduces the information lost in the differencing process, thereby allowing for long-run as well short-run dynamics. Moreover, by including $\hat{z}_{t-1}$ in the equations, a second channel is introduced through which Granger causality can be detected[14]. In order to show how causality tests should be implemented, it would be sensitive to consider a bivariate VECM model :

$$\Delta x_t = a_1 + \lambda_1 \hat{z}_{t-1} + \sum_{i=1}^{s} \psi_{1i} \Delta x_{t-I} + \sum_{i=1}^{s} \phi_{1i} \Delta y_{t-i} + u_{1t} \quad (4)$$

$$\Delta y_t = a_2 + \lambda_2 \hat{z}_{t-1} + \sum_{i=1}^{s} \phi_{2i} \Delta x_{t-I} + \sum_{i=1}^{s} \psi_{1i} \Delta y_{t-i} + u_{2t} \quad (5)$$

When there is no long-run relationship between the variables of interest or when a such relationship exists but not accounted for, that is when the error correction terms ($\hat{z}_{t-1}$) are omitted, the causality test reduces to the following null hypothesis[15]:

$$H^{\Delta}_{Eq2,0} : \phi_{2i} = 0, \quad i \in \{1,2,\ldots,s\} \quad (6)$$

Eq.(6) represents the usual way to test if x Granger-Causes y. Economists refer to this kind of causality by short-run causality or Δ-causality (Hunter,1992 ; Toda and Phillips,1993,1994). In contrast, when the long-run information is reintroduced(via the error correction terms $\hat{z}_{t-1}$), one opens up an additional channel of Granger-causality so far ignored by standard tests. This type of causality is known as long-run cointegrating causality (LR-causality); the corresponding null hypothesis is:

$$H^{LR}_{Eq2,0} : \lambda_2 = 0 \quad (7)$$

---

[14] Granger (1988) notes that cointegration between two or more variables is already sufficient to indicate the presence of causality at least in one direction .

[15] The exponent Δ means that the null hypothesis concerns the short-run causality; for reasons of simplicity and to conserve space, throughout this section, we suppose that the interest of the modeler is emphasized on testing if x Granger-cause y (and not the converse).

The concept of long-run or cointegration causality is somewhat related to weak exogeneity. One find no difficulty to see that the two concepts are indeed strongly linked (Urbain,1992 ; Johansen,1992). Empirically, when it is found that λ_2 is not statistically different from zero (when the null $H^{LR}_{Eq2,0}$ is not rejected), y is said to be weakly exogenous for long-run parameters. In such case x will not thought to cause y in the long-run. In the converse case, one can conclude that x Granger-cause y in the long-run. When the two feedback coefficients, λ_1 and λ_2, are negative and statistically different from zero, one can say that there is a long-run bi-directional relationship between the two variables. In sum, one should consider the following null hypothesis when it comes to test if x Granger-causes y:

$$H_0 : \quad H^{LR}_{Eq2,0} \cap H^{\Delta}_{Eq2,0} \tag{8}$$

It is pointed out that under some regularity conditions (Toda and Phillips, 1993, Theorem 2) the distribution of the Wald statistics associated to the null hypothesis represented by Eq.(8) is $\chi^2(n_1 n_2 k)$; n_1 stands for the rank of adjustment coefficients matrix, n_2 for the rank of cointegration vector and k for the VAR model order.

5. Empirical Assessment

5.1. Controllability of M2.

A convenient way to gauge controllability of a monetary aggregate is to examine the statistical association between the aggregate in question and the monetary base, the latter is being a major policy instrument which is commonly considered under the effective control of policymakers. Therefore, one may regress the M2 aggregate against the monetary base (B). When the aggregate exhibits a high correlation then it could be judged policy controllable since its movements are more closely associated with similar changes in the policy instrument. When the non-stationary nature of the monetary aggregates is taken into account, it will be of course more suitable to address this question by having recourse to the cointegration theory. Therefore, policy controllability should be based on cointegration and error-correction modeling. If a reliable long-run relationship exists, that is if the two variables are cointegrated, the intermediary aggregate will be deemed controllable in the long-run. And an error-correction model should be elaborated. Short-run dynamics may be more relevant from the policy perspective, and studying such dynamics requires the estimation an error correction model.

In order to assess of the link between the monetary base and the money supply, the hypothesis of cointegration between them is addressed based on the Johansen procedure described above. Tests of the number of cointegration relationships consist of the maximal eigenvalue ($\hat{\lambda}_{max}$) and trace statistics, where $\hat{\lambda}_{max}$ tests for at most r cointegrating vectors against an alternative of exactly r+1 cointegration relationships; while Trace tests for at most r cointegrating vectors against an alternative of at least r+1 vectors. The test statistics are $-T.\ln(1-\hat{\lambda}_{max})$ and $-T\sum_{i=r+1}^{n}\left(1-\hat{\lambda}_i\right)$, respectively. Johansen and Juselius (1990) suggested that the maximal eigenvalue test has greater power than Trace test, so we use both tests to check for consistency. Before reporting the results, it should be noted that some preliminary

estimations[16] allowed us to choose the right specification of the deterministic component. With this preferred specification which corresponds to *MODEL 4* (see section 4.2), the optimal lag order is k=2. This lag structure allows the model to bend a lot of hypothesis and specifically the normality hypothesis. This latter hypothesis justifies the use of the asymptotic critical values[17].

The results (see table 2, Panel A) show that the data reject the null hypothesis of zero cointegration vector between the two variables whatever the specification of the alternative: the two tests reject the null hypothesis. But, when the null is that there is at most one long-run relationship between the variables, our results show that both trace and the maximum eigenvalue test statistics are less than the 5% critical values given in Johansen and Juselius (1990,Table 2A) suggesting the presence of a cointegrating vector between M2 and B.

<INSERT TB2 HERE>

The above results are confined to the long-run horizon; short-run dynamics may be more relevant from the policy perspective, and studying such dynamics requires the estimation of regression equations linking monetary base to the M2 intermediary aggregate. Since B exhibits a significant cointegrating relationship with M2, the proper regression is to estimate the error correction model VECM :

$$\Delta \hat{m}_t = c_1 - \underset{(4.498)}{0.035}\, \hat{z}_{t-1} + \underset{(2.622)}{0.371}\, \Delta m_{t-1} + \underset{(-1.681)}{0.065}\, \Delta b_{t-1} \qquad (9)$$

adj R^2=0.695 Nor = 3.175 Q(4) =1.781

$$\Delta \hat{b}_t = c_2 - \underset{(0.009)}{0.348}\, \hat{z}_{t-1} + \underset{(2.150)}{1.036}\, \Delta m_{t-1} - \underset{(-1.640)}{0.216}\, \Delta b_{t-1} \qquad (10)$$

adj R^2=0.378 Nor = 1.727 Q(4) =1.457

Seeing that there is a potent long-run relationship binding the two variables and in order to get an idea about the direction of long-run causality, we decide to test the weak exogeneity of the two variables. In fact, the failure to reject the weak exogeneity of B (B is not weakly exogenous) implies that the hypothesis : *M2 Granger-causes B in the long-run*, cannot be rejected. Conversely, if the weak exogeneity of B is rejected, then it can be thought that the hypothesis: *"M2 Granger-causes B in the long-run"* should be rejected. The results reported (see table 3) indicate that B is weakly exogenous (*p-value=77%*) with respect to long-run parameters; therefore one can conclude that the hypothesis "*B Granger-causes M2 in the long-run"* is a likely hypothesis. More important, the data also rejected the weak hypothesis of M2 (*p-value=0%*), pointing out that the hypothesis : *"M2 Granger-causes B in the long-run"* ought to be rejected. Actually, these findings are not surprising since Granger (1988) proved that if two variables are cointegrated, there should be causality between them at least in one direction. The most importing question for us now is the following : to what extend do the dynamics of M2 depend on those of B ? In other words, to what extent is M2 controllable via B and how can we measure the statistical adequation between these two variables ?

<INSERT TB3 HERE>

[16] These estimations are not reported.

[17] Whatever the critical values (asymptotic or corrected for finite-sample biases), the results of the cointegration test are unchanged.

According to the above estimations results, Eq.(9) could be used in order to forecast the dynamics of M2 conditional on those of B since the latter is *strongly exogenous*. Nevertheless, one cannot pretend that M2 is controllable. A (state) variable may judged more controllable than another variable if two conditions are gathered. First, the state variable has to exhibit the highest correlation with the control variable[18]. Second, the CBT should not lack tools to control the behavior of the state variable with the supposed control variable (for instance in the case at hand, B is the control variable and M2 is the state variable). In other words, the movements of the state variable have to be more closely associated with similar changes in the policy instrument (the variable B). On the empirical front, Eq.(9) implies that growth in the base money explains about 70% of the total variations in the M2 growth; besides, the degree of responsiveness of the M2 aggregate to the changes in the monetary base (elasticity) is moderate : every 10% increase in the growth rate of the monetary base leads to a almost 0.65% increase in the growth of the money stock.

On the whole, the direction of the long-run causality and the gigh value of the adjusted R^2 highlight the explanatory power of the money base with regards to M2 aggregate. More precisely, evidence from cointegration between M2 and B implies that there is a strong long-run relationship binding the two variables, a finding that supports the controllability of the monetary base in the long-run. There is much to be ignored, so it would seem, from being able to explain movements in the level of, and the changes to M2. These results suggest that the control of the base might provide sufficient information about the M2 aggregate to permit them to be utilized within their cointegrating and ECM/causality equation in the conduct of economic policy.

In the light of these findings, one can conclude that Eq.(9) could be used for inference about the supply of money. It could be also utilized to forecast the dynamics of M2 supply seeing that B is weakly exogenous with respect to interest parameters on the one hand, and M2 does not Granger-cause B on the other hand. These two findings imply that B is *strongly exogenous* (Engle et al.,1983). Hence, it appears then that a base regime would be a feasible operating regime for the control of the money supply in Tunisia. As a consequence, Eq.(9) could be used, by the CBT, to derive a volume of the injection of the high-powered money consistent with the target monetary aggregate. Nevertheless, the CBT should be careful when using Eq.(9) since the magnitude of the coefficient of Δb_{t-1} is moderate and may weakens the effectiveness that equation. Besides, one objection that has been raised against a reserve targeting regime, where interest rates are fully endogenous, is the risk of excessive volatility of interest rates (Treichel,1993).

5.2. Money-Inflation Relationship

In Tunisia and as explained by the CBT, the price stability represents a fundamental aspiration of monetary policy. Such thinking is predicted on the well-known monetarist theory of inflation which assigns a prominent causal role for money growth in the inflationary process. A weak or a missing relationship between M2 and prices imply that the information variable, an intermediate or when possible an instrument of monetary policy. A Looser relationship may, nevertheless, suffice for money to be used as an information variable rather than as a

[18] The correlation is measured by the adjusted R^2 statistics which measures the fraction of the variation in M2 that can be accounted for by variations on money growth. For instance, an adjusted R^2 of 1 means that monetary base (B) accounts for all of the variation in M2 while an adjusted R^2 of 0 says that B accounts for none of the variation in M2.

causal variable in achieving the ultimate policy objectives[19]. It should be noted also that the presence of predictive content does not necessarily imply that M2 would make a good intermediate target. For that to be the case, M2 must be controllable and must have an effect on economic variables that the CBT ultimately wish to influence. Since the intermediate target should, among other things, be ultimately related to the final target in the long run, we start by analyzing the potentially long-run equilibrium relationship between M2 and inflation.

As seen from (Table 4, Panel B), the data suggest that there is a long-run relationship between money and prices. Therefore, controlling the growth of money supply (money stock) seems necessary to stave off inflation at least in the long-run horizon. However, These results do not tell us anything about the presence of any reliable linkage between money and prices in the short-run. To address this possibility, we recourse to the VECM modeling since the presence of the cointegration requires the estimation of a such model. The results are the following:

$$\Delta\hat{p}_t = c_1 \underset{(-1.919)}{-0.0002}\ \hat{z}_{t-1} + \underset{(1.755)}{0.269}\ \Delta p_{t-1} \underset{(-0.727)}{-0.103}\ \Delta p_{t-2} + \underset{(0.816)}{0.034}\Delta m_{t-1} + \underset{(2.345)}{0.08}\Delta m_{t-2} \qquad (11)$$

adj R^2=0.345 Nor = 2.01 Q(4) = 3.457

$$\Delta\hat{m}_t = c_2 \underset{(-2.252)}{-0.0004}\ \hat{z}_{t-1} \underset{(-4.852)}{-1.388}\ \Delta p_{t-1} + \underset{(2.186)}{1.083}\ \Delta p_{t-2} \underset{(-0.273)}{-0.043}\Delta m_{t-1} + \underset{(2.947)}{0.452}\Delta m_{t-2} \qquad (12)$$

adj R^2=0.10 Nor = 3.175 Q(4) = 4.191

If statistical reliability is measured by the size and significance of the adjusted R^2, it can be hardly argued that growth in M2 provides a sensitive reliable link between money stock and the policy maker's goal of price stability in the long-run. The inflation model (Eq.(11)) representing the monetary aggregate exhibits indeed a moderate adjusted R^2. But, an all cases, before getting carried out with this apparently interesting finding, it should be noted that the coefficients on ECM terms (associated with Eq.(11) and Eq.(12)) are statistically significant and have theoretically correct (negative) signs. Nevertheless, they have very weak magnitudes. For instance, if we consider coefficient feedback of the inflation model represented (see Eq.(11)), one can conclude that only 0.02% of any desequilibrium between actual inflation and the long-run inflation in any quarter is made up within the next quarter. This reflects the presumption that the linkage between money and prices is weak and that actual inflation does not adjust instantaneously to its long-run determinant. Moreover, in the short-run, it appears from Eq.(11) that the growth rate of M2 has no impact on inflation. But, in order to confirm these findings, we turn Granger-causality tests.

<INSERT TB4 HERE>

The causality tests between money supply and prices can also provide evidence on the validity of the monetarist hypothesis. Specifically, empirical support for the monetarist position will be indicated only if changes in the money supply cause price changes and no reverse changes exists. On the other hand, if only a strict reverse relationship is found, then the monetarist hypothesis will be contradicted in favor of some alternative hypothesis (Darrat,2000). Specifically and as seen from table 4, the null hypothesis that money supply do

[19] An information variable is one that provides information about future economic activity and in particular about variables in the objective function of the CBT; the information on money is required to adjust monetary policy operations during some time interval in response to the actual money growth that departs from the intermediate target, but not necessarily to restore the target itself.

not Granger-cause prices at the conventional risk level of 5% (p-value=5.4%), but it is rejected at a larger risk level. More interestingly, in the short-run the data fail to reject the same null hypothesis (p-value=12.8%). This latter finding confirms our initial presumption that the growth rate M2 has no impact on inflation. More interestingly, the reverse null hypotheses that prices do not Granger-cause money supply in the long-run as well as in the short-run are rejected (all the p-values are less than 5%, see the second row of table 4). The above results of money supply-prices suggest that, on the whole, money supply growth has no significant impact upon inflation; as a consequence, a such relationship cannot be considered as reliable for monetary targeting strategy. Furthermore, reductions in the excessive M2 growth could not be considered as an appropriate anti-inflation policies in Tunisia. The M2-prices relationship could be at best qualified by a looser relationship and consequently M2 aggregate cannot be used as a causal variable in achieving the ultimate policy objective. Therefore the growth in M2 stock is far from being reliably linked to the policy maker's goal of price stability in the short-run (as measured from the ECM) as well as in the long-run (as seen from cointegration and Granger-causality tests). Thus, restrictive monetary policy would be somewhat fruitless to bring in their effects on inflation. Better still, our findings do not provide any testimony in support of the policy usefulness of M2 aggregate in Tunisia.

5.3. Announcements and the Expectations Assessment

The main finding that one can draw from the above empirical results is that money-prices linkage is very weak. An obvious and a logical consequence of such finding is the fact that the CBT's monetary targets will not anchor inflation expectations. In the light of this information and knowing that that the Bank is still following up the same strategy, one would wonder, if the CBT could be transparent and credible. In principal, if the Central Bank is credible, economic agents would rely on the information published on the monetary targets when forming their expectations about the future dynamics of prices. The question that one should ask is the following : How can we know whether the announcements of CBT are accounted for by the agents ? To answer this question, we elaborate two models; in the first one (called M_{CBT}), we suppose that agents take into account the Bank's announcements and in the second one (that we called M_{PUBLIC}), we assume that they do not. But before elaborating these models, we should have at one's disposal the following variables : m_t, m_t^T, $\tilde{m}_t$ and $\tilde{m}_t^T$. The first variable is the log of the stock money ; the second one is the log of money target stock. In principal, these variables are computed as quarterly average but when they bring the tilde symbol this signifies that they were generated from the last month of the quarter. Therefore, the most up-to-date information on target deviations is obviously the deviation from the last month of the current quarter namely $(\tilde{m}_t - \tilde{m}_t^T)$. Once all these series were computed, one will be able to formulate the model M_{CBT} based on monetary target information as :

$$\hat{m}_t = \alpha + m_t^T + \beta(\tilde{m}_{t-1} - \tilde{m}_{t-1}^T) \qquad (13)$$

The estimating Eq.(13), gives the following results:

$$\hat{m}_t = \underset{}{0.02} + m_t^T + \underset{(13.709)}{0.941}\,(\tilde{m}_{t-1} - \tilde{m}_{t-1}^T) \qquad (14)$$
$$\qquad\quad (0.661)$$

The implications that can be drawn from the above results are the following: first, the α-parameter is not statistically significant which points out that monetary target variable is an unbiased predictor of the money supply when the one period lagged deviation is taken into

account. Second, the β-estimate points out that, on average, 94% of a quarter's target deviation is carried over to the next quarter.

The next step consists of recoursing to the Box Jenkins methodology in order to elaborate a forecasting model for the intermediary target M2. During the identification stage, we carried out a lot of time series forecasting models, but two of them seemed the most suitable : ARIMA(0,1,1) and ARIMA(0,1,0). These two specifications were estimated and only the results concerning the preferred model (that we call M_{PUBLIC}) are reported:

$$\Delta \hat{m}_t = 0.023 + 0.303\ \varepsilon_{t-1} \qquad (15)$$
$$(0.317)\quad (1.91)$$
$$R2=0.993 \quad DW = 1.85 \quad Q(4)=6.75$$

The diagnostic checking shows that the residuals are not different from white noise series; the Durbin-Watson and the Q-statistics for four lags point out that there is no significant autocorrelation in the residual from this equation. The constant indicates that, on average, the money stock grows about 2.3% per quarter during the estimation period. The significantly positive parameter of the lagged error term indicates that a deviation of money from mean growth rate typically gives rise to a deviation of the same sign and of roughly a third (about 30%) of the size in the following quarter.

Finally, we compared the expectation model (M_{CBT}) to the preferred one chosen in the second step according to the RMSE and MAE statistics in an out-of-sample experiment. The comparison exercise will have in principal two issues : if (M_{CBT}) is preferred to (M_{PUBLIC}), then it will be said that the CBT succeeded in orienting the public's expectations; otherwise, one can conclude that the Bank failed.

<INSERT TB5 HERE>

Its was found (see table 5) that according to the one-step-ahead predictions results M_{PUBLIC} performs a robust forecasting; its accuracy is greater than the M_{CBT}. The conclusion to be drawn from these findings is strong : the BCT failed to guide the public's expectations. The reasons that explain this failure are advanced in the next section.

6. Main findings, Policy Implications and Concluding Remarks

The paper's results showed that the preferred monetary aggregate has not the good characteristics. While it is seen that it is controllable in the long-run, the data at hand indicated that M2 stock is not perfectly controllable in the short-run. The lack of controllability (or the imperfect controllability) may indicate that the latter does not provide clear signals about the intentions of the policy makers and thereby makes it harder to hold them accountable. The imperfect controllability could be explained by the fact that during some episodes, the money stock was primarily determined by private sector money demand and not directly by the CBT (Boughrara and Smida,2002). For these reasons, the CBT has not complete control over M2 and hence MTS will be tainted with errors.

Besides, another finding of this paper concerns the money-prices relationships. It is shown that the M2 aggregate is still far from being reliably linked to the policy maker's goal of price stability in the short-run (as measured from the ECM) as well as in the long-run (as

seen from cointegration and Granger-causality tests). This lack of reliability could be explained by the low inflation environment. When inflation falls to single digit levels as is the case of Tunisia, money growth rates are indeed likely to lose informational content and become less useful indicators of monetary policy, as occurred in many industrial countries. Thus, restrictive monetary policy would be somewhat fruitless to bring in their effects on inflation.

It is found also that the official target announcements did not provide optimal guidance to the public regarding the future course of the money supply. More precisely, our results showed that the preferred model (according to the RMSE criterion) among many time series models that do not rely on the target announcements, is the ARIMA(0,1,1). At first glance this finding seems somewhat surprising; can economic agent without use of econometric techniques elaborate expectations corresponding to a moving average of order one ? The answer is yes since, as demonstrated by Muth(1960), that adaptive expectations can provide the optimal forecast of a series that follows a moving average process of order one. We believe that the CBT's failure to guide the public expectations is mainly due to the fact that the monetary target announcements do not happen usually the right time, that is not at the end of year t for the year t+1; they are rather announced (published) at the end of the first quarter of the year t+1 (for the same year). We deeply believe that even when these announcements are published at the right time, they would not be taken into account by economic agents. These agents are indeed aware that every time the goals of the Bank conflict, the institution would favor the financial stability.

In the light of the above empirical findings, one would wonder if a MTS is yet a sound choice in the case of Tunisia ? we recall that in the context of a MTS, two operating regimes for the control of the money supply can be distinguished, namely a base regime and a price regime; so which of them should or could the CBT follow ?

In a price regime short-run interest rates are targeted so as to be consistent with the desired growth rate of the money supply. Since in this regime the base money supply is endogenous, then the estimated money demand function has to be solved for the interest rate in order to define a proper and suitable operating target interest rate. Obviously, some preconditions ought to be fulfilled so as to make the price regime relevant. There should be a stable long-run money demand function. The demand for M2 function ought to be elastic with respect to the short-run interest rates in the short-run[20]. In sum, the estimations of the demand for M2 function reported in Boughrara(2001,2002) pointed out that this regime is not relevant[21].

In the base regime, after the prediction of a money multiplier, the monetary base is manipulated so as to achieve a desired growth of the money supply. In this regime, the interest rate on the money market is endogenous. Consequently, the major drawback of a such regime is the risk of an excessive volatility of interest rates. This means that the interest rates dynamics should be smooth enough so as to avoid the crisis risks of the banking system. We believe that the base regime would be irrelevant and in contradiction with the reform goals if

[20] This condition was not fulfilled nor in Triechel (1997), neither in Boughrara (2001,2002).

[21] For instance, the semi-elasticity reported in Boughrara(2001) is too low (-0.011); as a consequence, to decrease the demand for money by 11%, the CBT has to raise the rate by 100% which is questionable in view of the financial reform requirements.

adopted by the CBT without taking into account the financial stability constraint. Further constraints or caveats make this strategy fruitless.

We cannot argue that Tunisia's Central Bank pursued any regime belonging to the MTS : it did not make its monetary targets for M2 public at the beginning of the year because it is not aware of the uncertainties surrounding the banking system situation, nor is it accountable for meeting its targets. Instead, the CBT used the information contained in M2 aggregate to guide the setting of its policy instruments. On the whole, our findings do not provide any testimony in support of the usefulness of M2 aggregate in Tunisian MTS. The CBT that regards itself as a monetary targeter should instead be seen as having followed a discretionary monetary policy with a focus on price stability. Such an approach presents two main caveats : the first one is that it depends too much on the preferences, skills and credibility of the individuals running the CBT; the second one is that it does not lend itself to make monetary policy transparent and accountable

The policy implications to be drawn from the findings of this paper seems to be important for the future. The framework for implementing monetary policy should be defined more precisely. The adoption of price stability as the main objective means that the credit policy considerations in the implementation of monetary policy must be completely abandoned. In order to better control the monetary supply process, the CBT must be aware that policies that improve and strengthen the financial and monetary markets should be pursued. It should be also aware that the weakness of the banking system almost brought down its MTS; consequently,. further efforts should be done in order to improve the present situation of the banking system. Effectively, the Tunisian financial system globally is in need of further reforms and Tunisia is about to reach that objective especially when it comes to achieve the dual objective of price stability and financial development. Monetary policy must take into account the weak magnitude of interest rate semi-elasticities especially when choosing the monetary instruments.

All these recommendations are seen as long-run ones. In the short-run and seeing that M2 is no longer an appropriate intermediary target, the choice of a either a new intermediary monetary target or a different monetary strategy must be established. In the first case, the CBT could select and announce the rate of expansion of M3 as its new intermediary monetary target. Better still, in order to improve the accuracy of its MTS, the CBT ought to define monetary growth targets in a more convenient way. For instance, it could derive target ranges for the growth of the money supply from a money demand function. If the new aggregate is found to be hardly controllable, the CBT could introduce some modifications when formulating the targets : instead of announcing a single value target, the Bank should announce a target corridor, say of 2 to 5%, which can be interpreted as a 95% confidence interval. By the same way, in so doing the CBT could gain greater discretion to respond to extraneous developments. Furthermore, these measures would undoubtfully enhance the credibility and accountability[22].

[22] Its monetary targeting framework is rather viewed as a mechanism used by the CBT to communicate with much transparency the way the monetary policy is directed to achieve its inflation goal and as a means for increasing the accountability. The experience of some countries proved indeed that targeting regime permits substantial target misses and, as a consequence, the adherence to a rigid policy rule has not been found to be necessary to obtain good inflation outcomes.

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Appendix

Table 1 : *Unit Roots tests*

	Dickey-Fuller			Phillips-Perron		
	H_0:I(1)		H_0:I(2)	H_0:I(1)		H_0:I(2)
Variable	t_μ	t_τ	t_μ	t_μ	t_τ	t_μ
b	-0.362	-3.47	-9.364°	-1.053	-2.7	-3.708*
m_2	-0.512	-1.777	-9.198°	-0.958	-2.454	-3.907*
p	-5.884	-0.668	-5.287°	-2.474	-0.703	-2.967*

Table 2 : *Johansen Tests for cointegration*

H0	H1	Trace	H0	H1	λmax
PANEL A : Tests for B and M2					
r=0	r ≥1	39.75*°	r=0	r=1	32.72*°
r≤1	r ≥2	7.03	r≤1	r=2	7.03
PANEL B : Tests for P and M2					
r=0	r ≥1	54.92*°	r=0	r=1	52.303*°
r≤1	r ≥2	2.617	r≤1	r=2	2.617

*Note : * signifies that the null is rejected at a risk of 1% and °means that it is rejected at a risk 5%.*

Table 3: *Long-run Exogeneity Test*

Null hypothesis	LR (λ_i=0)	P-value	Decision	Conclusion
$H_{WE}(m)$: λ_1=0	10.88	0%	Reject H0	M2 is not WE
$H_{WE}(b)$: λ_2=0	0.08	77%	Do not reject H0	B is WE

Note : WE signifies weakly exogenous. The null hypothesis is rejected at a risk of ρ% if the reported *p-value* is lower than ρ.

Table 4 : *P-value of Granger-causality and Long-Run Exogeneity*

Eq.(i)	$H^{LR}_{Eqi,0}$ or H_{WE}	$H^{A}_{Eqi,0}$	$H^{LR}_{Eqi,0} \cap H^{A}_{Eqi,0}$
Eq.(11)	{λ_1=0}	{ϕ_{1i}=0}	{λ_1=0}∩ {ϕ_{1i}=0}
	5.4%	*12.8%*	*1%*
Eq.(12)	{λ_2=0}	{ϕ_{2i}=0}	{λ_2=0}∩{ϕ_{2i}=0}
	2.4%	*12.8%*	*0%*

Note : The null hypothesis is rejected at a risk of ρ% if the reported p-value is lower than ρ.

Table 5 : *Results of out-of-sample forecasting*

Model	RMSE	MAE
M_{PUBLIC}	0.041	0.037
M_{CBT}	0.049	0.046