Macrothink Institute™

Business and Economic Research
ISSN 2162-4860
2023, Vol. 13, No. 3

The Determinants of Central Bank Efficiency Scores: The Case of Tunisia

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Received: February 17, 2023 Accepted: July 24, 2023 Published: August 7, 2023

doi:10.5296/ber.v13i3.20749 URL: https://doi.org/10.5296/ber.v13i3.20749

Abstract

The global financial crisis of 2007 and the recent health crisis of 2019 revealed the inefficiency of the pure status of central banks. They have also prompted reflection on the question of a new "central banking". If the challenge for academic work is to redraw the theoretical contours, it is rather a question for central bankers to redefine the new framework of their action. In this sense, abundant literature has emerged examining the institutional arrangements most likely to make central banks effective. On the other hand, and to our knowledge, few analyses have focused on delineating a new intermediate status that would allow central banks to be more efficient.

It is in this perspective of research on the efficiency of central banks that our article is written. The latter is an evaluation of the evolution of the efficiency scores of the Central Bank of Tunisia (BCT) with the change of its status, over the period from 2000 to 2020. The first part of the paper is a review of the theoretical and empirical literature on the issue of measuring central bank efficiency. In the second part, we propose to calculate and interpret the evolution of the BCT's efficiency, with its change of status.

The calculation of the efficiency scores leads to an average score of 0.765 and also reveals frequent changes in scores and alternating periods of increase and decrease. Our economic analysis, split into two periods before and after the BCT's independence, allows us to show that the efficiency scores recorded are not linked to its status, but rather are explained by macroeconomic, financial, monetary, and institutional variables.

Keywords: Efficiency, Banking efficiency, Crisis, Central banks

JEL code: A10, A19, D61, G01, H21

1. Introduction

Subprime crisis (2007) and the recent COVID crisis (2019) have put the ineffectiveness of pure central bank statutes into perspective and fueled debates by central banking theorists on the role, status, and objectives of these monetary authorities. While many studies have attempted to judge the effectiveness of new central bank instruments, few studies have focused on the issue of efficiency.

Interest in the issue of central bank efficiency is indeed relatively recent and dates back to the beginning of the 21st century, with the publication of the work of Cecchetti and Krause (Cecchetti and Krause, 2002). The Bank for International Settlements (BIS) subsequently organized, in Stockholm on 23 and 24 May 2003, the first workshop on the theme of the efficiency of central banks, which was unfortunately not followed by other events.

However, the question of the efficiency of this institution, with its dual public and monetary identity, is of great importance because, as Heikenstein points out, “Central banks are not subject to the pressure of competition. Therefore, we must work hard on these issues and invite external evaluation. Cost consciousness is particularly important in cases where a central bank determines its budget, as hard-earned legitimacy can be quickly lost" (Heikenstein, 2003).

As part of this work, we subscribe to this approach by evaluating the performance of central banks through efficiency. Our choice is justified by the fact that the concept of efficiency crystallizes the various components of global performance, in the sense of effective achievement of the objectives with a minimum of costs. As such, we retain the definition proposed by Mester which is “Efficiency is whether the central bank creates production (output) in the most efficient way in the sense of the cost of resources (inputs)” (Mester, 2003).

Applied to the case of the BCT, this meaning authorizes an evaluation of its efficiency with its status, through a calculation of its efficiency scores, over the period 2000-2020. The question is whether the change of status of the BCT, from dependent to independent in 2016, improves its efficiency. Such an undertaking recommends that, in the first part, we undertake a review of the theoretical and empirical literature relating to the question of measuring the efficiency of central banks. In the second part, we first try to measure the efficiency of the BCT, by calculating its efficiency scores. We then propose an economic interpretation of the evolution of these scores, with the change of status of the BCT. Also, we proceed beforehand to the selection of the inputs and outputs necessary for the estimation of a cost function of the said central bank, using the non-parametric method SFA.

2. Literature Paper

Since the second half of the 20th century, economic literature has refocused its assessment of performance, on the efficient and effective achievement of assigned objectives. This led to the development of several methods for estimating efficiency scores applied in the fields of health, finance, and sport. In doing so, and as evidenced by the review of the literature, the majority of themes relating to central banks have been the subject of in-depth analysis. However, few works have dealt with the question of the efficiency of these institutions because the definition of the efficiency of central banks is a difficult and complicated exercise (Blix et al., 2003; Mester, 2003; Davies & Green, 2010).

In what follows, we first propose to present, according to the chronological order of their publication, the works which endeavored to measure the efficiency of the central banks of certain countries. We then proceed to a review of the literature on methods for estimating efficiency frontiers.

2.1 Review of the Empirical Literature

It is to Mc Kinley and Banaian (Mc Kinley and Babaian, 2005) that the credit for producing the first estimates of cost efficiency scores for a sample of 32 central banks using the SFA method is due. The results indicate that the highest inefficiency scores were found in the Czech Republic, Iceland, and the United States and that the best efficiency scores are, for the most part, recorded in the countries of Eastern Europe. East (Bulgaria, Romania, Austria…).

Ihaddaden (Ihaddaden, 2019) takes up the cited work of Mc Kinley and Banaian to calculate the efficiency scores on a sample of 19 European national central banks for the year 2017. Applying the DEA method, the estimates indicate that only half of the said central banks are efficient (51.25%). The central banks of Spain, Finland, Lithuania, and the Netherlands are the most efficient. Greece and Malta are the least efficient.

El Farooq et al. (El Farooq et al., 2021-1), on a sample of 17 Asian central banks between 2016 and 2018, calculate (using the SFA method) efficiency scores varying between 0.2368 and 0.821864 with an average of 0.82186. The authors enrich their study by looking for the effects of international trade and growth on efficiency scores. They conclude that: (i) Foreign trade and GDP have a positive and significant effect on efficiency scores, (ii) The effect of trade is larger than that of GDP, and (iii) The exchange rate hurts efficiency scores. These same authors extend their research in another paper (El Farooq et al., 2021-2) where they proceed, on the same sample and during the same period, to a classification of the 17 central banks according to their level of efficiency. It shows that the central banks of Hong Kong and Taiwan are the most efficient and that those of Pakistan and Sri Lanka are the least efficient.

Table 1. Review of previous work

Publication	Object	Method	Inputs	outputs
McKinley and Banaian (2005)	Calculation of cost efficiency scores for 32 central banks for the year 2001	SFA	1. Physical capital (fixed assets) 2. Labor (Wage costs)	1. Monetary Policy Index (Heritage Foundation and Wall street journal) 2. Banking supervision indices in quantity and quality
Ihaddaden (2019)	Calculation of cost efficiency scores for 19 European central banks for the year 2017	DEA	**1.** Physical capital (fixed assets) **2.** Labor (wage costs/GDP)	Monetary policy index (Monetary freedom from Heritage Foundation).
Farooq Dar et al. (2021)	Calculation of the efficiency scores of 17 Asian central banks (2016-2018)	SFA	1. Exploitation charges 2. Total investment 3. Total deposits	Net income
Farooq Dar et al. (2021)	Calculation of the efficiency scores of 17 Asian central banks (2016-2018)	DEA	**1.** Exploitation charges **2.** Total investment **3.** Total deposits	**1.** Net profit **2.** Total assets
	Ranking of efficiency scores of 17 Asian central banks (2016-2018)	SBM (super efficiency model)		

Summary by the authors

2.2 Methods for Estimating Efficiency Frontiers

The estimation of efficiency frontiers is based on two approaches whose main difference lies in the assumptions concerning the residuals, namely: the parametric approach and the non-parametric approach (see Table 2) (Daly, 2010).

The two types of parametric models encountered in the literature are deterministic parametric frontiers and stochastic parametric frontiers. The former attribute the deviation of the production unit from the production frontier exclusively to factors that are under the control of the firm (the inefficiency is due exclusively to the producer). The latter assumes that other factors alter the efficiency and which are beyond the producer's control, thus allowing a more precise measure of inefficiency. They were extended by thick borders *(Thick Frontier Approach, TFA)*, the recursive approach to the thick border *(Recursive Thick Frontier Approach, RTFA),* and the Distribution Free *Approach, DFA*.

Non-parametric approaches have the particularity of not imposing any pre-established shape on the boundaries and are based on linear programming for the envelopment of data and the construction of production boundaries. The two most popular non-parametric methods are extensions of Farrell's model (Farell, 1957). This is the Data Envelopment *method. Analysis, DEA*) and that of the hypothesis of free availability *(Free Disposal Hull, FDH)*.

Table 2. Parametric and non-parametric approaches

	Parametric Approaches	*Non-parametric approaches*
Benefits	• Reduced inefficiencies can have statistical properties • Take into account hazards other than inefficiency (stochastic frontiers	• No particular functional relationship specification for the production boundary • Easy decomposition of inefficiencies into technical, allocative, and scale inefficiencies
Disadvantages	• Need to represent the technology by a particular parametric form • The decomposition of different components of inefficiency is not always possible, especially for multi-product technologies.	• Reduced inefficiencies have no statistical properties • Large measurement errors and/or omission of variables can affect measures of inefficiency.

Source: Chaffai ME Estimation of efficiency frontiers: an overview of recent developments in the literature. Review of development economics. p.p. 33-67, (p 41).

At the end of this review of the literature, it should be emphasized that previous work, although rare, has provided relevant results on the efficiency of certain central banks. However, all of these studies only concerned the central banks of developed or emerging countries. Hence, the interest in our analysis of the central bank of Tunisia.

Referring to the pioneering work of McKinley and Banaian (2005) and that of Farooq et al. (2021, 1 and 2), we propose, in what follows, to evaluate the efficiency of the BCT considering the institutional entity of a central bank as an independent unit in charge of accomplishing its strategic mission of price stability. We will estimate the cost efficiency of the Tunisian central bank defined by Blix et al. (Blix et al., 2003) as " the concept of central bank efficiency involves considerations of what services are appropriate to that institution as well as how they can be produced at least cost "

The choice of the estimate of a cost function is not random. It is based on the methodology for measuring central bank output, as defined by the 2008 System of National Accounts (SNA)(Note 1), invites experts to estimate central bank output as non-market output, which is important to measure by costs.

3. Calculation and Economic Interpretation of Bct Efficiency Scores

The calculation of BCT efficiency scores presupposes the prior definition of inputs and outputs as well as the choice of an appropriate estimation method.

3.1 The Definition of Inputs and Outputs

Regarding the balance sheets and the income statement of central banks, we propose to define the production of the central bank by the sum of:

1. Total revenue from central bank intervention operations on the money market: this item mainly includes interest received from central bank interventions on the money market during refinancing operations, interest received on foreign currency deposits, and income recognized on the occasion of operations carried out with the IMF.

2. Portfolio of equity securities: this is made up of shares that the central bank has subscribed to and which represent its shares in the capital of certain non-resident organizations and companies as well as resident companies whose purpose is the management of common banking services. These shares are accounted for at their acquisition price.

This production requires the combination of a set of inputs, namely:

1. Human capital: it is all the knowledge, experience, and physical skills accumulated by a person and which determine their ability to work or produce. This factor of production is evaluated by the cost of personnel hired by the central bank (composed essentially of salaries, bonuses, and social charges) divided by the workforce.
2. Financial capital: it is made up of assets in the form of financial assets, mainly shares, bonds, or claims. It is calculated by total interest expense divided by total deposits.
3. Physical capital: this includes goods or services that can be used during the production cycle (machines, tools, transport equipment, etc.). It is measured by the ratio between operating expenses and fixed assets.

Table 3. The list of variables

	Variable name	Rating	Definition
outputs	Total products	Y1 _	Total revenue from central bank intervention operations on the money market transcribed to the income statement
	Securities portfolio	Y2 _	The total portfolio of equity securities transcribed to the assets of the central bank's balance sheet
Inputs	Human capital	x1 _	Personnel load/ headcount
	Financial capital	x2 _	Interest expense/total deposits
	Physical capital	x3 _	Operating expenses/fixed assets

Summary by the authors

3.2 The Choice of Method: Stochastic Frontiers (SFA)

The choice of an appropriate estimation method is not an easy task since, in the empirical literature cited above, there is no consensus on it. In the context of this work, the DEA and FDH methods cannot be used, since they do not take into consideration the random error due to measurement error and chance, which makes it difficult to compare the scores of efficiency. Moreover, the TFA cannot provide an exact measure of efficiency; it limits itself to defining its general level by using quartiles in its estimation. Consequently, it does not meet the requirements of our research, just like the DFA method, which offers a measure of average efficiency for each firm (constant over time), rather than an evaluation of efficiency at any given time. an instant of the period.

Because of all these arguments, it appears that the most appropriate estimation method for calculating BCT efficiency scores is the SFA approach. The latter has the advantage of deriving efficiency estimates using these own random costs, without assuming a common boundary.

In the approach developed by Aigner et al. (Aigner, Lovell, and Schmidt, 1977) and Meeusen et al. (Meeusen and Van den Broeck, 1977), a frontier is qualified as stochastic if it is estimated that the differences between the observed production and the maximum production are explained by two independent error terms. The first represents the uncontrollable random effects and misspecification errors of the production process. It follows a symmetric normal distribution. The second term, which reflects the degree of technical inefficiency endogenous to the firm, follows an asymmetric distribution defined positively for a cost function and negatively for a production and profit function. The stochastic production frontier is represented as follows:

$$Y_i = \beta X_i' + \varepsilon_i \quad \text{Or} \quad \varepsilon_i = v_i - u_i \tag{1}$$

Yi: observed production, β: a vector of parameters to be estimated, X_i' the vector of inputs and ε_i: the error term composed of $u_i \geq 0$ the component representing productive inefficiency, and v_i ($-\infty \leq v_i \leq +\infty$) the stochastic random component.

The estimation of the stochastic frontier by the maximum likelihood method requires the determination of the probability density function of the variable ε_i of the Cobb-Douglas function below:

$$\log Y_i = \beta_0 + \sum_j \beta_{ij}\ Log\ x_{ij} + \varepsilon_i\ avec\ \varepsilon_i = v_i + u_i \tag{2}$$

The density is the product of the densities of u_i and v_i. The v_i follows a normal distribution N(0.σ ^{2}υ) while the u_i follows a semi-normal distribution $|N\ (0,\ \sigma^2 u)|$. It is written:

$$f(u,v) = \frac{1}{\pi\sigma_u\sigma_v}\exp\left[-\left(\frac{u^2}{2\sigma_u^2}\right) - \left(\frac{v^2}{2\sigma_v^2}\right)\right] \tag{3}$$

Substituting v as a function of u, we get:

$$f(u,\varepsilon) = \frac{1}{\pi\sigma_u\sigma_v}\exp\left[-\left(\frac{u^2}{2\sigma_u^2}\right) - \left(\frac{\varepsilon^2+u^2+2u\varepsilon}{2\sigma_v^2}\right)\right] \tag{4}$$

The density ε is determined by integrating the relation (12) for u, we have:

$$f(\varepsilon) = \left(2/_{\sigma}\right)\varphi\left(\varepsilon/_{\sigma}\right)\left[1 - \Phi\left(\varepsilon\lambda/_{\sigma}\right)\right] \tag{5}$$

with $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and $\lambda = \sigma_u/_{\sigma_v}$

Φ denotes the distribution function of a reduced centered normal distribution and φ its density.

Knowing (13), and assuming that we have T observations, the logarithm of the likelihood of the model (10) is written:

$$\log L = T\log\left(\sqrt{2}/_{\sqrt{\pi}}\right) - T\log\sigma - 1/_{2\sigma^2}\sum_{i=1}^{T}\varepsilon_i^2 + \sum_{i=1}^{T}\log\left(1 - \Phi\left(\varepsilon_i\lambda/_{\sigma}\right)\right) \tag{6}$$

Maximizing the likelihood amounts to finding the parameters β, λ and σ ^{2} which constitute the solution of the optimization system of (6):

$$\begin{cases} \partial \log L /_{\partial\beta} = \left(\frac{1}{\sigma^2}\right) \sum_{i=1}^{T} (y_i - x_i' \beta) x_j + \lambda/_{\sigma} \sum_{i=1}^{T} \left(\varepsilon_i /_{1-\Phi_i}\right) x_i = 0 \\ \partial \log L /_{\partial\lambda} = \left(\frac{-1}{\sigma}\right) \sum_{i=1}^{T} \left(\varepsilon_i /_{1-\Phi_i}\right) (y_{i-} x'_i \beta) = 0 \\ \partial \log L /_{\partial\sigma^2} = \left(\frac{T}{2\sigma^2}\right) + \left(\frac{1}{2\sigma^4}\right) \sum_{i=1}^{T} (y_i - x_i'^2) + \left(\lambda/_{2\sigma^3}\right) \sum_{i=1}^{T} \left(\varepsilon_i /_{1-\Phi_i}\right) (y_{i-} x'_i \beta) = 0 \end{cases} \quad (7)$$

Let Θ = (β, λ, σ^2), be the vector of parameters that maximizes (14). To have the standard deviations of the coefficients estimated by the maximum likelihood, we will take the inverse of the quantity:

$$E\left[\frac{\partial^2 logL}{\partial\Theta\Theta'}\right] \quad (8)$$

3.3 Calculation of BCT Efficiency Scores

In the case of a stochastic frontier, we assume that the technology is specified. Therefore we will use a cost function, whose form is known. The efficient cost frontier is defined as follows:

CTi i = + ε F Yi P, i , with i i i ε = v + u (9)

Where CT represents the total cost of firm i, Yi the level of outputs, Wi the prices of inputs, ui the inefficiency, and vi the random shock. The function F (.) will take the functional form of Cobb Douglas. By adopting an intermediation approach, the stochastic cost frontier which will be estimated econometrically takes the following logarithmic form:

$$Ln\, CT_t = \alpha_0 + \alpha_1 Lny_{1t} + \alpha_2 Lny_{2t} + \beta_L Ln(w_{Lt}) + \beta_k Ln(w_{Ft}) + \beta_f Ln(w_{ct}) + v_t + u_t \quad (10)$$

WL, WF, and WK: the price of labor (L) and the price of financial capital (F), the prices of physical capital (C). Y1 and Y2 represent the two banking outputs, namely, products and securities portfolios. CT: the total cost. α , α , α , β 1 , β and β : the coefficients to be estimated. vi : random error term distributed independently according to the normal law N(0, σ^2v). u_i: term measuring inefficiency and which are positively defined with a semi-normal distribution N(0, σ^{2u}).

The efficiency frontier is calculated using the STATA21 software, the results of which are reported in the appendices1. The period considered extends from 2000 to 2020. The estimated parameters of the Cobb-Douglass function for the BCT are summarized in the following table:

Table 4. The estimated parameters of the Cobb-Douglass function

Setting	Coefficient	Standard deviation	Probability
α_1	0.1031253	0.0000929	0.000
α_2	-0.5120803	0.0003703	0.000
$\beta L_{\_}$	-1.008878	0.0005349	0.000
$\beta f_{\_}$	0.0771803	0.0001229	0.000
$\beta k_{\_}$	2.747757	0.000765	0.000
$\sigma 2 = \sigma u^2 + \sigma_v^2$	0.21.35546	0.004657653	0.3274591
$\gamma = \sigma_u^2 / \sigma_u^2 + \sigma_v^2$	0.4378888	0.0389389	0.04378888
Log likelihood = 17.521302		Prob > chi2 = 0.000	

Source: the authors

This table indicates that the coefficients β_F, β_L, and β_k are significantly different from zero. Human and physical factors act positively on the BCT cost function. Moreover, the value of σ^2 (0.21) is statistically significant which confirms the results of Jondrow et al. (Jondrow et al., 1982); this value is interpreted as being the approximate value of the average inefficiency of the sample because it integrates the effects of white noise V_i which are not taken into consideration in the determination of the efficiency term.

The value of γ (0.437) ∈ [0.1] is consistent with the statistical property mentioned above, statistically, this term is significant at the 10% level. The log-likelihood value (17.52) indicates that the model in question has good explanatory power. The estimated parameters of the frontier cost function allow us to calculate the distance of each observation from the efficient frontier. The degree of efficiency is represented by the second error term U_i and varies between zero and infinity. Efficiency is measured by its inverse which varies between zero and unity.

The results obtained from the efficiency score suggest that the BCT displays a relatively inconsistent degree of efficiency between 2000 and 2020 varying between 0.91 and 0.99. The results reveal that the BCT displays, on average, a degree of efficiency of 0.765. This average score is comparable to those found by Farooq Dar et al. (Farooq Dar et al., 2021-1 and 2021-2), for the central banks of Thailand (0.79773) and Kazakhstan (0.76452), over the years 2016-2018, using the SFA technique. Moreover, it is very satisfactory compared to the almost zero scores obtained by Olusola and Oluwatobi (Olusola and Oluwatobi, 20017) for Nigeria, between 1980 and 2015 (SFA). Finally, if we compare it to the results obtained by Ihadidden (Ihadidden, 2019), Tunisia's score is comparable to that of Cyprus (0.7885), higher than that of Italy (0.5876) or France (0.5128) and significantly lower than that of Lithuania and Germany.

Table 5. BCT efficiency scores from 2000 to 2020

Year	BCT efficiency score
2000	0.716
2001	0.511
2002	0.545
2003	0.905
2004	0.946
2005	0.914
2006	0.932
2007	0.999
2008	0.722
2009	0.8155
2010	0.695
2011	0.997
2012	0.969
2013	0.997
2014	0.949
2015	0.999
2016	0.949
2017	0.907
2018	0.965
2019	0.825
2020	0.706
Mean	***0.765***

Source: the authors

Figure 1 shows that the efficiency levels of the Tunisian central bank are fluctuating. The evolution of the scores shows that the phases of trend reversal are very short periods. Such an observation, pushes us, in what follows, to wonder about the reasons which underlie such a situation, through an economic interpretation of the evolution of the scores of efficiency of the BCT.

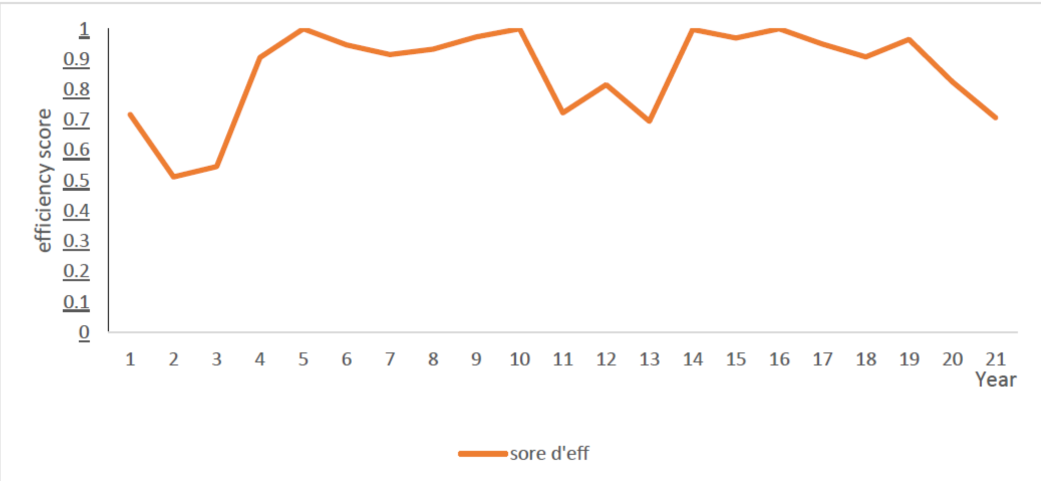

Figure 1. Evolution of BCT efficiency scores between 2000 and 2020

Source: the authors

3.4 Analysis of BCT Efficiency Scores

To conduct an economic interpretation of the evolution of the efficiency scores of the Tunisian central bank, it is necessary, first of all, to specify certain methodological elements that would guide this interpretative component.

First, it is a question of making a breakdown by reference to the change in the status of the central bank, that is to say before and after 2016 and the entry into force of the article of law number 2016-35, of April 25, 2016 (Official Journal of the Republic of Tunisia, 2016) determining the status of the central bank of Tunisia (Official Journal of the Republic of Tunisia, Number 35, April 29, 2016). Such a breakdown thus makes it possible to know whether the status of the BCT conditions its efficiency. Then, the evolution of such scores reveals that the phases of trend reversal are very short periods, the interpretations will then favor a short-term analysis. To this end, four types of conjunctures, both national and international, will serve as a frame of reference. These are monetary, financial, economic, and institutional conditions.

3.4.1 The Pre-independence Period (2000-2015)

The first phase of the decline in the efficiency of the BCT lasted from 2001 to 2002. Such a decline can be explained, on an international scale, by the slowdown in world growth (Due in particular to higher oil prices, the rise in short-term interest rates to control inflationary pressures specific to certain countries), and the attacks of September 11, 2001. These considerations resulted in a deterioration of the BCT's production and an increase in the cost of its inputs (rise in the interest rate, drop in tourism receipts, drop in savings, etc.).

At the national level and during this period, the growth rate in Tunisia fell to 1.7% in 2002, while it reached 4.9% in 2001 and 4.3% in 2000 (ITCEQ, 2017). This deterioration was also accentuated by the terrorist attacks which targeted the first tourist destination in Tunisia, the island of Djerba, in April 2002. They strongly affected the tourist season of 2002 and thus caused Tunisia's foreign exchange earnings to fall. The tourism sector has recorded a decline of 4.5% during this period, against a growth of 2.5% in 2001 (ADB/OECD, African Economic Outlook, 2004).

The year 2003 marks the reversal of the downward trend in the efficiency of the BCT. This improvement in efficiency is the result of a higher growth rate which stood at 4.5%, on average between 2003 and 2009 (ADB/OECD, African Economic Outlook, 2008).

Moreover, the Tunisian economy has shown strong resilience to the international financial crisis of 2008, thanks in particular to a financial and monetary regime that imposes control of capital movements, a regulated banking system, and a weak articulation financial with the international, especially since the Tunisian financial system is banking oriented. This situation was favorable to the achievement of the main objective of the BCT, that of preserving the internal and external value of the Tunisian dinar, by maintaining a low level of inflation and guaranteeing the external balance.

This stability of efficiency at high scores and a record level in 2009, was made possible thanks to a regulation of the financial and monetary system, to the resilience of Tunisian industry to its greatest shock. These performances are also attributable to the actions of the BCT, which continued its restrictive monetary policy by maintaining the growth rate of money in the broad sense (M2), to control inflation and keep it at a low level, despite a depreciation of the dinar of nearly 6% against the dollar and 5.1% against the euro and the risk of imported inflation. The latter was thwarted through a policy of increasing flexibility of the exchange rate, which allowed a deceleration of the rise in prices from August 2006 until 2011.

However, the years 2010-2012 were marked by a new downward trend in the efficiency of the BCT, fundamentally resulting from a political revolution in 2011, which led to a reversal of the institutional environment. The resulting instability notably affected the various economic aggregates, notably a sharp fall in growth (-1.9%) and record inflation levels (6.1%). Such levels forced the BCT to intensify its interventions to contain the rise in prices. However, the effects of these interventions were limited and the monetary policy instrument became almost ineffective. The inefficiency of the intervention of the BCT as regards the control of the general level of prices is also explained by a considerable imported inflation (Note 2), following the strong depreciation of the dinar observed since 2011 (the dinar has indeed lost 15% against the dollar and 10% against the euro, between 2011 and 2013(Note 3)). This depreciation was all the more violent as the central bank decided to limit its interventions on the foreign exchange market and favor the objective of inflation targeting. This new orientation had the expected effects, neither on controlling inflation nor on the competitiveness of the Tunisian economy and even less on the attractiveness of a foreign direct investment. The central bank thus saw its outputs lose value and its costs increase, hence the drop in efficiency scores recorded over this period.

The 2013-2015 period corresponds to a period of the relative stability of the BCT's efficiency at high rates. It would seem that the 2014 elections and the new political recomposition were harbingers of a better business environment. Its positive signals were comforted by strong growth rates recorded in the agricultural, industrial, and service sectors, despite the 2015 attacks, the fall in tourist (Note 4) receipts, the decline in phosphate production, the multiplication of movements, and the consequent decline in growth. This trend of stability and then a decline in efficiency scores will continue after the change in the status of the BCT and the entry into force of its independence in 2016.

3.4.2 The Era of BCT Independence (2016-2020)

During the post-independence period, the evolution of efficiency was ordered by the evolution of the main social and economic indicators. This is how the maintenance of efficiency during the years 2015 and 2018 was at a high level before starting a downward trend in 2019.

These relative performances were achieved despite political factors which constituted a burden on the business environment, thus hampering the improvement of the main economic aggregates. Indeed, the conflicts between the two heads of the executive, the parliamentary performance, and the death of President Mohamed Béji Caïd Essebsi overwhelmed investment and exports which did not increase, as expected, by 5% and 2, 7% (African Economic Outlook, 2019), when they are expected to pull economic stimulus.

The investment rate remained below the "psychological threshold" of 20%, due to the decline in foreign direct investment (FDI) (-25.4% during the first half of 2016) and financing constraints (African Economic Outlook, 2017). This context turned out to be more unfavorable, especially since at the regional level, political instability and the war in Libya weighed on our economy. This has increased debt, the rate of which concerning gross national disposable income has increased from 53.2% in 2016 to 71.3% in 2020 (ITCEQ, 2020).

In addition to this political, economic, and social instability that has persisted since the 2011 revolution, this period was also marred by the COVID-19 health crisis. The year 2020 was marked by an unprecedented drop in economic activity, due to the pandemic and the repercussions of the strict restriction measures, both nationally and internationally.

This exceptional situation resulted in a sharp decline in growth, a decline in investment, and job losses. The unemployment rate thus recorded a considerable increase in 2020, since it rose from an average of 15%, over the period 2016-2019, to 18% in 2020 (ITCEQ, 2020).

The budget deficit also worsened from -6.1% in 2016 to -11.4% in 2020 (ITEQ, 2020). In terms of current account balances, 2018 saw the highest current account deficit rate in recent decades, reaching a level of 11% of GDP. Such a level is in fact due to the accumulation of the trade deficit which rose from 7.5% in 2011 to 13.1% of GDP in 2018 (ITCEQ, 2020). Along the same lines, and apart from 2018, gross national savings experienced a particularly pronounced downward trend between 2019 and 2020. The corollary was a sharp drop in investment, which fell from 19.3% in 2016 to 13% in 2020 (ITCEQ, 2020).

4. Conclusion

In the context of this article, we have proposed to study the evolution of the efficiency scores of the Central Bank of Tunisia (BCT) concerning the change of its status, over the period from 2000 to 2020.

At the end of this research, it appears that the efficiency scores recorded over the period considered are constantly changing, alternating phases of increase and decrease.

Moreover, the explanations of the evolution of the said scores revealed that the status of the BCT does not impact its efficiency; Its change of status in 2016 did not positively affect its efficiency. Such explanations rather showed that it was both national and international conjunctures that conditioned the rises and falls of the BCT's efficiency scores, as well as their stability. In particular, the analysis of the economic situation has taught us that the evolution observed in efficiency scores at each period is attributable to economic, monetary, political, and institutional factors.

These conclusions recommend we identify the real determinants of the efficiency of the BCT, such an enterprise will be the subject of later research work.

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Notes

Note 1. The System of National Accounts 2008 (SNA 2008) is a statistical framework that provides a detailed, consistent, and flexible set of macroeconomic accounts for decision-making, analysis, and research purposes. It has been prepared and published under the auspices of five international organizations: the United Nations, the European Commission, the OECD, the IMF, and the World Bank.

Note 2. See Kawther Alimi, Essays on monetary policy in Tunisia in a dynamic stochastic general equilibrium framework, Co-supervised thesis, University of Orléans and the University of Sfax, July 2019, P.46.

Note 3. See Sami Moulay, Why is the galloping depreciation of the Tunisian dinar causing so much panic? leaders.com.tn

Note 4. These are the attack at the Bardo Museum (March 18, 2015), the attack in Sousse (June 26, 2015), and the attack in Tunis (November 24, 2015).

Appendix

ANNEX 1

Stoc. frontier normal/truncated-normal model   Number of obs = 21
Wald chi2(5) = 86.39
Log likelihood = 15.091653   Prob > chi2 = 0.0000

LnCT	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
LnX1	-0.0191462	.0284964	-0.67	0.050	-.0749982	.0367057
LnX2	0.895595	.1854328	4.83	0.000	.5321533	1.259037
LnX3	-0.3618683	.4474446	-0.81	0.041	-1.238844	.515107
LnY1	0.1937038	.1086731	1.78	0.075	-.0192916	.4066991
LnY2	0.200424	.0777921	2.58	0.010	.0479542	.3528938
_cons	12.87576	3.079396	4.18	0.000	6.840255	18.91126
/mu	-.1152787	60.45465	-0.00	0.998	-118.6042	118.3737

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