

Competition and Banking Efficiency: Evidence from Tunisian Banking Industry

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Abstract

A growing body of literature argues that competition increases banking efficiency. Using large datasets for Tunisian banks, we offer new empirical evidence of this causal relationship over the period 1990 to 2009. We use a three pronged approach. First, we use concentration tests to assess the level of competition in the Tunisian banking industry. Second, we estimate the level of efficiency of these banks using the stochastic frontier approach. Building on these results, and to check for robustness of our findings, we estimate several specifications to examine the relationship between competition and efficiency. The Tunisian banking system shows a high competition with an increasing tendency for all specifications and approaches. The study also provides evidence for an increasing efficiency mainly for private banks. The empirical results show that efficiency and competition go hand in hand within the Tunisian banking industry. Finally, the study findings show robust support to suggest that private banks display a better efficiency than state owned ones.

Key Words: Bank competition, Efficiency, Stochastic Frontier Approach

1. Introduction

There is considerable evidence now that weak and inefficient financial systems can be a significant obstacle to economic growth. By weakening the process of channelling saving into productive investment, an inefficient banking sector, with limited competition can slow down optimal allocation of credit, thus hindering investment and economic growth. In this regard, competition is generally considered a positive force in most industries supposed to foster efficiency and stimulate innovation (Casu and Girardone, 2009). By reducing monopoly rents and cost inefficiencies, favoring the reduction of loan rates and then accelerating investment, banking competition is expected to provide economic growth and therefore welfare gains.

Banking competition and its effects are regarded as a subject of particular interest in developing countries, since investment is particularly sensitive to banking credits considered by far the largest source of external finance for enterprises (Caviglia *et al.*, 2002). However, one can not neglect the potential negative effects of banking

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competition through excessive risk-taking by banks, which may impede financial stability (Allen and Gale, 2004; Carletti and Hartmann, 2002).

To improve banking efficiency, governments both in developing and developed countries have recently undertaken several financial sector reforms. Against this background, our current study intends to shed light on the current state of the Tunisian banking sector, particularly with respect to the degree of competition among banks and their relative efficiency.

Until the mid 80's, the Tunisian economy and the banking system were heavily state regulated. The scope for manoeuvre for the banking institutions was narrow as all core banking policies were directed by the Central Bank of Tunisia. As a result, a competitive banking sector was absent in the economy. Besides, the Tunisian financial sector has the main function of collecting savings at low cost and redirecting them to government and public enterprises as well as to priority business sectors. We have also to mention that Banks needed the approval of the Central Bank for any credit decision, with highly dissuasive bank-to-bank refinancing quotas, with a fixed percentage of their deposits for lending at preferential interest rates to government priority sectors. Banking supervision and prudential regulation were also limited since the central bank played an important role in all core banking policies. All these state regulated policies have led to many banking inefficiencies that contributed to the existence of public non-performing loans mainly in the agricultural and mining sectors and a weak competition among banks (Ben Ali and Changuel, 2009).

Since the adoption of the *Structural Adjustment Plan*, with the support of the International Monetary Fund, the Tunisian banking sector has undergone a substantial amount of restructuring. In fact, in 1987 and also reinforced in the mid 90's, many regulations began with banking liberalization measures pushing banks to be more competitive and also to enhance their responsibility. As a result, several public banking institutions have been privatized, the problem of non-performing loans has been addressed, and the legal and a prudential regulatory framework have been reinforced. State intervention in this sector was reduced. The requirement for prior authorization by the central bank for credit decisions was lifted and bank financing for some public enterprises at preferential rates ceased. Many other measures were established such as opening banks' capital to foreign participation and allowing foreign banks to open branches and operate on-shore activities. The development bank category was eliminated in 2004. The institutions that used to fall under that category were authorized to engage in all banking activities (Ben Ali and Changuel, 2009). These various liberalization measures were expected to create competition and to enhance efficiency within the Tunisian banking environment.

In this regard, this study intends to assess the correlation between competition and efficiency in the Tunisian banking sector. We conduct our analysis in three steps. First, we provide evidence on the level and evolution of the Tunisian banking competition between 1990 and 2009. Second, we assess the efficiency of Tunisian banks of our sample banks over the same period. In the third step, using several specifications we investigate the relationship and the causality between competition and efficiency. Studies focusing on the causal relationship between competition and efficiency in developing countries are still relatively little. To our knowledge, this is the first paper that addresses an empirical analysis of such relationship for the Tunisian banking industry. To our knowledge, this is the first paper that addresses an empirical analysis of such relationship for the Tunisian banking industry. The results of this study are particularly important as far as Tunisia is concerned with Islamic banking activities in the near future. Islamic banking in Tunisia is still in its "infancy" since Zitouna Bank is, since May 2010, the only fully fledged Islamic bank. However, interest in Islamic finance and banking is now grown considerably in Tunisia. This study can serve as a background for future studies since Tunisian banking industry have started incorporating Islamic finance along side conventional banking practices. Our study provides empirical analysis regarding the key factors driving competition and efficiency in the Tunisian banking system.

The rest of the paper is organised as follows: Section 2 provides a concise literature review on efficiency and competition concepts. Section 3 presents the methodology: the models and the data sources, and describes the variables used. Section 4 presents the empirical results. Finally, section 5 presents some concluding comments.

2. Competition and efficiency in banking Literature

An intuitive common thought, suggests rather a positive relationship between competition and efficiency in banking economics. That is, the more competitive is the banking sector, the more it is efficient. In this regard, Claessens and Laeven (2004) argue that the view that competition is good is more naïve in banking than in other industries, and empirical literature on this topic supports rather a negative link (Goldberg and Rai, 1996; Weill, 2004) as the most efficient banks would benefit from lower costs and therefore higher market shares (Demsetz, 1973). Besides, recent banking literature indicate that the relationship between competition and banking system efficiency is rather complex.

In its broad meaning, efficiency is a concept which indicates the ability to transform inputs into outputs according to a given production process. Efficiency makes it then possible to appreciate the performances as well as the potential of development of an

entity and to locate it compared to its competitors. Competition is a central concept in economics encompassing the notion of individuals and firms striving for a greater share of a market and therefore acting both as an organizing principle of economic reasoning and as a market phenomenon.

Studies focusing on competition and efficiency in firms' framework originated mainly with Leibenstein (1966), and after was addressed by Demsetz (1973) and Peltzman (1977) for the banking industry. Leibenstein's (1966) findings suggest that inefficiencies inside firms (the 'X-inefficiencies') are reduced by the degree of market competition. He highlighted the fact that the main determinant of a reduction in inefficiencies is an increase in competitive pressures. The main reasons for such a difference are that competition provides incentives to managers to exert more effort. As they are aware of the increase in competition, and afraid that their firm will leave the market, these latter entities tend to improve their performance. Thus, managers are motivated to carry out a better managerial performance and consequently to make changes in management if necessary. Being informed about the comparative possibilities of competition, managers are inclined to exert more effort (Pruteanu-Podpiera, Weill, and Schobert, 2008).

Leibenstein's X-efficiency theory lies within the scope of the 'Structure-Conduct-Performance' theory proposed by Bain (1951) where market structures influence firm behaviour in terms of quantities and prices, and therefore firms' profits. An alternative assumption on the 'Structure-Conduct-Performance' theory was later on supported by Demsetz (1973) asserting a negative link between competition and cost efficiency. His study provides evidence suggesting that the best-managed firms have the lowest costs and consequently the largest market shares leading to a higher level of concentration. Demsetz's (1973) viewpoint thus provides further support to the argument that efficiency determines competition.

It is worth noting that this strand of literature on efficiency and competition is confined to the study of such concepts but in a general firm framework which is not necessarily specific to the banking industry that has some specific characteristics compared to other markets. Due to these specific characteristics, another causal relationship between competition and efficiency may arise for the banking industry. The main feature characterizing the banking industry is that it acts in an information asymmetry framework. Information asymmetry between lender and borrower in credit activity may lead banks to resolve the consequent adverse selection and moral hazard problems. In this regard, banks in developing countries may suffer more from information asymmetry problems due mainly to lack and uncertainties of accounting information, but also due to the absence or insufficiency of any risk analysis due to the insufficient bank employees' lack of know-how.

Studies focusing only on the banking competition-efficiency nexus are still not copious. While numerous of these studies have confirmed the negative association between bank's efficiency and competition, others support the literature predictions as for a positive link between these two variables. In fact, two main strands of research can be highlighted when dealing with this rather causal relationship:

In a typical strand adapted from the efficient structure hypothesis proposed by Demsetz (1973), increases in competition produce increases in profit efficiency. For instance, an exogenous shock that forces banks to minimize costs, offer services at lower prices and at the same time forces them to increase profits may lead to higher market concentration. Indeed, efficient banks with superior production and technologies management that translate into higher profits will increase in size and market share at the expense of less efficient banks (Vander, 2002). Conversely, uncompetitive markets allow bank managers to enjoy a 'quiet life' without keeping costs under control, leading to lower levels of efficiency (Berger and Hannah, 1998). Under this assumption, we expect that competition causes efficiency. Another line of thought focuses on the pertinence of screening and monitoring in explaining this positive relationship. In particular, Petersen and Rajan (1995) provides support to the argument that institutions exposed to more intensive competition, use more sophisticated screening and monitoring procedures whereas banks in monopolistic markets spend less on monitoring. This argument is supported by Chen's (2007) study arguing that competitive banks have better screening and monitoring procedures and are therefore, less likely to suffer from nonperforming loans and therefore will be more efficient. This result is also consistent with the documented evidence in Wheelock and Wilson (1995), Berger and DeYoung (1997), Kwan and Eisenbeis (1997), and Williams (2004).

A second strand of research suggests that competition leads to a decline in banks' efficiency. The study which has been the cornerstone of this negative relationship relies on Diamond's (1984) research. According to Diamond's (1984), the specificities of the banking industry show a negative causal relationship between competition and cost efficiency. Three main arguments support this thought. First, higher competition is likely to be associated with shorter and less stable customers-banks relationships (Boot and Schmeits, 2005) as customers' willingness to switch to other banks increases in more competitive environments. This phenomenon may amplify information asymmetries that require additional resources for screening and monitoring borrowers decreasing by the same way banking efficiency. Second, since banks can expect less stable customers-banks relationships in a competitive environment, they are likely to reduce relationship-building activities, which hinder the value of information (Chan, Greenbaum, and Thakor, 1986). Third, taken

together, these two arguments suggest a reduction in the information' proprietary value held by banks, leading to greater expenses in retaining old and attracting new customers through aggressive marketing strategies which will cause an adverse effect on bank efficiency. This result is consistent with the documented evidence in DeYoung, Hasan, and Kirchhoff (1998). In the same line of thought, when banking efficiency declines, such banks are preoccupied with retaining old and attracting new customers. To resolve this problem, insufficient resources are generally allocated to screening and monitoring borrowers and to underwriting standards (Dell'Ariscia and Marquez, 2006). These insufficient resources and inadequate underwriting standards result in increased inefficiencies. Under this assumption, we expect that competition cause decreases in bank efficiency.

3. Methodology

Our objective in this study is to investigate, empirically, the relationship between competition and efficiency within the Tunisian banking system. We explain in this section how we estimate both variables (a) separately and (b) in a linear relationship. We also describe the data and the variables used.

3.1. Measuring competition

Empirical research on the measurement of banking competition can be divided into two main bodies of research approaches: the traditional industrial organization approach and the new empirical approach. The traditional approach proposes different market structure tests to assess banking competition based on the SCP model suggested by Bain (1956). This theory claims that the structure of an industry, or the degree of its concentration determines its degree of collusion which in turn drives performance. The ability to collude is assumed to be inversely related to the number of firms and their market shares in a given industry, and thus is positively correlated with concentration. Successful banks would be able to extort monopolistic rents in concentrated markets by their ability to offer lower deposit rates and higher loan rates. The most commonly applied tests in this theory are concentration ratio or the Hirschman-Herfindahl index (Nauenberg, Basu and Chand, 1997).

The new empirical approach provides non-structural tests to outwit the problems in measuring competition provided by the traditional approach. Contrary to the latter, this approach measures banks' conduct directly and does not infer the competitive conduct of banks through the analysis of market structure. The most commonly applied tests to assess competition with the new empirical approach are the Rosse-Panzar model (Panzar and Rosse, 1987) and Bresnahan-Lau test (Bresnahan, 1982; Lau, 1982). The Rosse-Panzar model provides a characterization of the degree of

competition for the banking industry as a whole. It is based on the estimation of the H-statistic, which aggregates the elasticities of total revenues to input prices. Bresnahan-Lau test is based on the estimation of a structural model with separate supply and demand equations.

Our research considers individual measures of competition for each bank of our sample through the period of study instead of aggregate measures for the full sample. Therefore, we compute the Hirschman-Herfindahl's index and the concentration ratio for each bank of the sample instead of estimating the Rosse-Panzar model or using the Bresnahan Lau test.

Hirschman-Herfindahl index can give us a first look to the degree of concentration of a market of a given industry. Concentration is inversely linked to competition. The more is the concentration in banking, the less is the competition. It can be written as follows:

$$HHI = \sum_{i=1}^n S_i^2 ,$$

where S_i : the market share of the bank i .

The value of HHI lies between two extreme values, 0 and 1. $HHI = 1$ is the maximum value where market structure is a monopoly. Conversely, $HHI = 1/n$ is the minimal value showing that the market is in a perfect competition structure.

As for the ratio of concentration, it is defined as follows:

$$CRK = \sum (P_K / T)$$

where, P_K is the market share of the "K" main large banks of a given industry.

T: is represented by the total assets, total deposits, or total credits of a given bank. Given the size of our sample (10 banks), we choose the three main banks of the Tunisian banking system ($K=3$).

3.2. Measuring Efficiency

Assessing the efficiency of a given bank, is measuring how close a bank is to what a best-situation bank would be for producing a given amount of outputs. This gives information on how the production process is managed, and mainly the optimality of the chosen mix of inputs.

To estimate the level of efficiency, two main methods are proposed in the literature: parametric methods and non-parametric methods. Data Envelopment Analysis (DEA) is a non-parametric linear programming method used to measure best practice

technology and relative technical efficiency of decision making units (in this case banks), using the same inputs and outputs. In this regard, DEA can determine the efficient set of banks that are below (above) the efficient production frontier and which are inefficient (efficient). Stochastic frontier approach (SFA) and the distribution-free approach (DFA) are parametric approaches, that apply econometric tools to estimate the efficiency frontier.

In this study, we adopt a stochastic frontier approach. SFA rely on distributional assumptions. It considers the cost function $TC = f(Y, P) + \varepsilon$, where TC represents total cost, Y is the outputs' vector; P is the input prices' vector and ε is the error term. Two main assumptions are embedded in SFA. First, it assumes that the error term is the sum of two components, u and v , where u is a one-sided component representing cost inefficiencies, reflecting the degree of weaknesses in managerial performance, and v is a two-sided component representing random disturbances, assumed to have a normal distribution.

3.3. Measuring the link between Competition and Efficiency

To examine the impact of competition on efficiency in the Tunisian banking industry, we estimate several model specifications. HHI index and CR3 ratio are the two dependent variables used in these regressions. Both variables are expressed in terms of total deposits, total credits, and total assets. Average cost efficiency is the independent variable. Formally, our models are specified in equations (1) and (2).

$$Eff_t = \alpha_0 + \alpha_1 HHI_t + \varepsilon_t (1)$$

$$Eff_t = \alpha_0 + \alpha_1 CR_{3t} + \varepsilon_t (2)$$

where,

Eff_t : corresponds to the level of efficiency at the date t;

HHI and CR3 are represented in terms of total assets, total deposits or total credits. ε_t is the error term.

3.4. Data and Variables used in the study

Two approaches are proposed in the banking literature to model bank behavior: the intermediation and the production approaches. The production approach views the bank as using labor and capital to produce deposits and loans. The intermediation approach assumes that banks collect deposits and purchase funds using labor and capital, and intermediate these sources of funds into loans and other assets. Output is measured by both operating and interest costs that are included in the total cost. We adopt in this the intermediation approach in this paper.

Our study is conducted in a panel data analysis. It uses annual observations of accounting data for a sample of Tunisian Banks. Our sample extends from 1990 up to 2009. This period corresponds to the various reforms undertaken in the banking sector in Tunisia. The sample covers the 10 main Tunisian Banks: BNA (Banque Nationale Agricole), STB (Société Tunisienne de Banques), UIB (Union Internationale de Banques), AB (ATTIJARI BANK), BIAT (Banque Internationale Arabe de Tunisie), BT (Banque de Tunisie), UBCI (Union Bancaire pour le Commerce et l'Industrie), ATB (Arab Tunisian Bank), AMB (Amen Bank), BH (Banque de l'Habitat). These banks play a very important role in financing the Tunisian economy. Indeed, more than 90 percent of credits supply is provided by these Banks. Moreover, these banks collect 90 percent of banking deposits. The sources of the data were drawn from annual reports published by Central Bank of Tunisia. We also use the annual report of the Tunisian's Professional Association of Banks and financial institutions. All variables are expressed in million Tunisian dinars (TND).

One output – loans – is adopted in the cost function and the cost efficiency frontier. The price of loans is computed using the ratio of interest received on loans to loans. The inputs include labor, physical capital, and borrowed funds. The price of labor is measured by the ratio of personnel expenses to the number of employees. The price of physical capital is defined as the ratio of expenses for physical capital to fixed assets. The price of borrowed funds is measured by the ratio of expenses for borrowed funds to borrowed funds. Total costs are the sum of expenses for personnel, physical capital, and borrowed funds. Estimations are carried out using the Frontier software (version 4.1).

4. Results and discussion

This section discusses the empirical results. It is subdivided in three subsections. The first subsection discusses the trends in banking competition. The second assesses the evolution of banking efficiency. In the third subsection, we investigate the relationship between competition and efficiency.

4.1. Evolution of Banking Competition

Table 1 provides the empirical results of competition in the Tunisian banking system according to Hirschman-Herfindahl index. Column 1 concentrates on the results of Hirschman-Herfindahl' total assets specification, while the second and the third columns display the results of Hirschman-Herfindahl' total credits and total deposits specifications, respectively. Table 2 provides the market share of each bank of our sample over the period of study. Table 3 displays evolution of competition according

to the concentration index (CR_3) in terms of total assets, total deposits and total credits.

Table 1. Evolution of Hirschman-Herfindahl index

Year	Total assets			Total credits			Total deposits		
	HHI	N = 1/HHI	Banks in competition	HHI	N = 1/HHI	Banks in competition	HHI	N = 1/H.H.I	Banks in competition
1990	0,140	7,13	7	0,14	6,45	6	0,124	8,05	8
1991	0,142	7,01	7	0,15	6,44	6	0,119	8,37	8
1992	0,141	7,04	7	0,15	6,45	6	0,117	8,50	8
1993	0,138	7,20	7	0,15	6,55	6	0,115	8,45	8
1994	0,136	7,32	7	0,14	6,39	6	0,131	7,58	8
1995	0,131	7,58	8	0,13	7,15	7	0,116	8,39	8
1996	0,129	7,71	8	0,13	7,34	7	0,115	8,67	9
1997	0,120	8,30	8	0,13	7,49	7	0,114	8,72	9
1998	0,120	8,32	8	0,13	7,67	8	0,113	8,78	9
1999	0,117	8,40	8	0,11	8,53	8	0,113	8,78	9
2000	0,120	8,30	8	0,11	8,36	8	0,115	8,68	9
2001	0,118	8,41	8	0,11	8,43	8	0,115	8,62	9
2002	0,120	8,30	8	0,11	8,38	8	0,117	8,54	9
2003	0,118	8,54	9	0,11	8,34	8	0,116	8,56	9
2004	0,118	8,54	9	0,12	8,32	8	0,115	8,62	9
2005	0,116	8,58	9	0,11	8,46	8	0,113	8,78	9
2006	0,116	8,56	9	0,11	8,38	8	0,114	8,75	9
2007	0,117	8,56	9	0,11	8,38	8	0,114	8,72	9
2008	0,116	8,57	9	0,11	8,41	8	0,114	8,75	9
2009	0,116	8,56	9	0,11	8,39	8	0,114	8,74	9

At first glance, Hirschman-Herfindahl index show a clear-cut trend regarding the evolution of the competition in the Tunisian banking system with an obvious weak concentration (hence a high competition). All model specifications, in terms of total assets, total credits and total deposits show an increasing number of banks in competition. For instance, our results show that the number of competing banks is 7 (out of 10 banks of our sample) from 1990 to 1994, 8 banks from 1995 to 2002, and 9 banks from 2003 to 2009. As regards total credits and total deposits specifications, our findings confirm this trend with an increasing number of competing of banks from 6 banks in 1990 to 8 banks in 2009 (total credits) and from 8 banks in 1990 to 9 banks in 2009 (total deposits), as reported in table 1.

This result suggests the existence of a high competition among Tunisian banking system. As regards the highest concentration, our results show that it is observed in 2005 (competition index equal to 8, 58). In terms of total credit, one notices that since

1998, there are only 8 banks which compete in granting credits (with a degree of concentration $HHI = 0,13$). Between 1996 and 2009, the number of banks in direct competition is 9 out of 10 as shown in the third column of Table 1.

Table 2. Evolution of Banks' Market Share

	<i>AB</i>	<i>ATB</i>	<i>AMB</i>	<i>BH</i>	<i>BIAT</i>	<i>BNA</i>	<i>BT</i>	<i>STB</i>	<i>UBCI</i>	<i>UIB</i>
1990	0,058	0,033	0,070	0,077	0,117	0,243	0,067	0,192	0,067	0,071
1991	0,058	0,034	0,064	0,075	0,116	0,254	0,071	0,188	0,068	0,068
1992	0,057	0,038	0,070	0,080	0,121	0,263	0,068	0,166	0,060	0,072
1993	0,052	0,057	0,076	0,071	0,121	0,263	0,069	0,154	0,057	0,075
1994	0,054	0,047	0,080	0,076	0,120	0,246	0,068	0,173	0,052	0,080
1995	0,058	0,049	0,663	0,081	0,124	0,234	0,071	0,168	0,0582	0,078
1996	0,064	0,055	0,070	0,084	0,123	0,228	0,070	0,168	0,0538	0,079
1997	0,072	0,051	0,071	0,092	0,126	0,183	0,073	0,179	0,0586	0,089
1998	0,081	0,050	0,070	0,096	0,127	0,181	0,073	0,179	0,059	0,079
1999	0,089	0,057	0,075	0,127	0,127	0,167	0,068	0,154	0,059	0,088
2000	0,083	0,051	0,075	0,113	0,120	0,152	0,066	0,201	0,054	0,081
2001	0,086	0,048	0,074	0,128	0,125	0,155	0,065	0,184	0,051	0,079
2002	0,087	0,046	0,075	0,123	0,128	0,149	0,069	0,193	0,0458	0,080
2003	0,087	0,053	0,076	0,126	0,135	0,153	0,068	0,177	0,0456	0,074
2004	0,097	0,072	0,093	0,145	0,159	0,160	0,077	0,205	0,0522	0,080
2005	0,080	0,068	0,087	0,124	0,138	0,157	0,064	0,165	0,045	0,067
2006	0,083	0,074	0,075	0,129	0,143	0,155	0,062	0,163	0,047	0,064
2007	0,083	0,075	0,079	0,128	0,148	0,156	0,061	0,161	0,048	0,063
2008	0,082	0,079	0,073	0,129	0,158	0,153	0,058	0,171	0,051	0,061
2009	0,070	0,080	0,072	0,132	0,162	0,149	0,052	0,178	0,056	0,069

As regards market share, except the BIAT, ATB and AB (three private banks) and STB (a state owned bank), all banks show a decreasing market share over the period. Meanwhile, in 1993 the BNA display the highest market share with 26, 33 % of the whole banking system credit (table 2). Between 1996 and 1997, the BNA have lost 4,5% of its market share mainly to the profit of the UIB, BH, STB and AB.

Evolution of competition in the Tunisian banking industry as proxied by CR3 index as reported in Table 3, also provides evidence of an increasing competition within the Tunisian banking industry. For instance, market share of the three main banks STB, BNA and BIAT, decreased from 0,554 in 1990 to 0,45 in 2009 (Table 3). These findings show a decreasing market power of these banks on the Tunisian banking system as a result of the restructuring operations undertaken in the 1990's which led to a lesser concentration and to higher degree of competition. The highest concentration is recorded in 1991 (total assets), 1994 (total deposits) and 1990 (total

credits). We also find that the weakest banking concentration is displayed in 1999 (total assets), 2005 (total deposits) and in 1998 (total credits). This result indicates the existence of a high competition between banks.

Table 3: Evolution of CR₃ index

Year	CR ₃ (Total assets)	CR ₃ (Total deposit)	CR ₃ (Total credit)
1990	0,554	0,481	0,867
1991	0,558	0,466	0,474
1992	0,551	0,461	0,471
1993	0,539	0,465	0,456
1994	0,539	0,502	0,821
1995	0,528	0,466	0,421
1996	0,520	0,463	0,403
1997	0,494	0,446	0,399
1998	0,497	0,439	0,396
1999	0,449	0,457	0,427
2000	0,474	0,459	0,455
2001	0,464	0,454	0,449
2002	0,471	0,464	0,449
2003	0,466	0,469	0,452
2004	0,471	0,464	0,454
2005	0,461	0,451	0,447
2006	0,462	0,457	0,462
2007	0,462	0,457	0,462
2008	0,452	0,457	0,463
2009	0,450	0,458	0,463

Overall, the analysis of Tunisian banking competition reveals a relatively high competition between the Tunisian banks during the period 1990-2009 with both approaches, Hirschman-Herfindahl index and concentration ratio. This provides further support to the effect of the banking system restructuring and liberalization process established as part of the *Structural Adjustment Program*. The liberalization attempt was expected to create a competitive business environment within the sector by allowing them to make their own credit allocation decisions, diversifying their activities and to set their own interest rates. This resulted in a greater competition (Ben Ali and Changuel, 2009).

4.2. Evolution of Banking Efficiency

Estimation outcomes of the efficiency function are shown in Table 4 and Table 5. The first table provides the empirical results of our banks' average cost efficiency,

maximum and minimum coefficients for this variable. As shown in Table 4, the coefficient of Log-Probability indicates that the model has a good explanatory power (64, 93).

Our results show that both coefficients of inputs (labor and capital) are not statistically significant with a negative sign for labor. This suggests that variation in total cost cannot be explained by variation of the level of output but rather by a misuse of banks inputs. This provides evidence of cost inefficiencies in the Tunisian banking system.

The estimated parameters of the cost function allow us to compute the banks' X-efficiency scores (Table 5). These results show that the average efficiencies by bank vary between 66,48 and 91, 43. Our findings also suggest rather weak disparities in efficiency between Tunisian banks (84. 38 %). So, Tunisian banks display an average inefficiency of about 16 %. This means that reduction of 16% of production capacities would make it possible to the banking system to restore their long-term profitability (Dietsch 1996).

Table 4: Banks' Efficiencies

<i>Banks</i>	<i>Average Cost efficiency (%)</i>	<i>Max efficiency (%)</i>	<i>Min efficiency (%)</i>
AB	80,95	89,42	69,66
ATB	85,09	91,84	75,92
Attijari Bank	90,26	94,77	84,01
BH	91, 27	95,33	85,62
BIAT	81,11	89,52	69,90
BNA	66,48	80,34	49,33
BT	94,30	96,98	90,52
STB	73,34	84,78	58,67
UBCI	91,43	95,42	85,87
UIB	89,53	94,36	82,84
Mean	<u>84,381</u>	<u>91,279</u>	<u>75,238</u>

Average efficiency by bank, although weak, reflects the differences which exist between the Tunisian banks, as regards cost control or management and allocation of resources. Moreover, the results show that over the period of study the two private banks, BT (94, 30), and UBCI (91,43%) followed by the state owned bank BH (91, 27%) displayed the best scores of efficiency. This finding suggests that these three banks have the best managerial practices of the banking sector since they are closest to the efficiency frontier. In this regard, BT recorded the best efficiency score with 90,52% in 1990 and 96,98 % in 2009.

As regards the third state owned efficient bank of our sample, BH recorded an efficiency score of about 85, 62% at the beginning of our period of study to reach an efficiency of about 91, 27%.

Table 5. Evolution of X-Efficiency and X-Inefficiency

Year	X-Efficiency (%)	X-Inefficiency (%)
1990	72,73	27,26
1991	74,48	25,51
1992	76,13	23,86
1993	77,69	22,30
1994	79,15	20,84
1995	80,53	19,46
1996	81,82	18,17
1997	83,03	16,96
1998	84,16	15,83
1999	85,23	14,76
2000	86,22	13,77
2001	87,16	12,83
2002	88,03	11,96
2003	88,84	11,15
2004	89,60	10,39
2005	90,31	9,68
2006	90,45	9,54
2007	90,58	9,41
2008	90,87	9,12
2009	90,98	9,017

We have to mention that the financial liberalization process launched in Tunisia as part of the *Structural Adjustment Plan* has been designed to enhance the operational autonomy of the banking sector. However, private banks seem to have well benefited from these liberalization measures by restructuring a better framework for their activities leading to a better efficiency. This supports the evidence argued in *Standard and Poor's* report that states that Tunisian private banks are the most efficient compared to state-owned banks that exhibit a low quality of credits and a high amount of nonperforming loans.

It is worth noting that BNA and STB are the more inefficient banks all over the period of study, recording the weakest efficiency scores of 66,48% and 73,34%, respectively. These inefficiencies are a result of the presence of bad and nonperforming loans in public enterprises and in the agricultural and mining sectors supported by these two state owned banks through government funded credit allocation programs with the Central Bank of Tunisia's refinancing guarantees.

Empirical results show a continuous increase in the efficiency from 72,73% in 1990 to 90,98% in 2009. The results presented in Table 5 also show that cost efficiency of

our sample' banks is, on average, of 83, 30% over the period of study. This means that for the same level of activity, these banks could reduce their costs of 16, 69 % in average.

An important finding of this study is an overall increasing efficiency over the period of study. This result is due to the restructuring plans, based on external consultant audits, which were conducted with an emphasis on the recapitalization and clean up of bad loans. After a heavily state regulated banking system, the reforms introduced to the banking system in Tunisia helped its restructuring so as to enables it facing new competitive environment.

4.3. Competition and efficiency: Causal Relationship

As discussed above, analyzing the dynamics of competition and efficiency variables of the Tunisian commercial banks separately showed that the efficiency and degrees of concentration act in opposite directions. Indeed, as the concentration measured by both concentration indices decreases, average efficiency scores increase. The results show a negative relationship between the average cost efficiency and the concentration levels in the Tunisian banking system. That is, the more the concentration is higher, the less is the banking efficiency. To check for robustness of our results and to examine this relationship, we estimate linear regressions in the following forms specified in Equations (1) and (2), defined previously.

Both HHI and CR3 in these equations are expressed in terms of total assets, total deposit or total credit and. Therefore, we estimate six different specifications: Efficiency as a function of Hirschman-Herfindahl index (total assets, total credit and total deposits), and as a function of CR₃ index (total assets, total credit and total deposits). The regression results are shown in Table 6. This table provides the empirical results of the effects of competition on banks' average cost efficiency (*Eff*).

Our results show a strong negative relationship between the average cost efficiency and the level of concentration of the Tunisian banking system in the HHI specification in terms of total assets and total credits (but in terms of total deposits the correlation coefficient is rather weak). That is, efficiency and Hirschman-Herfindahl index go in opposite directions.

CR₃ specifications also display a negative relationship between competition and efficiency but only in terms of total credits. The coefficient α_1 relative to HHI index is negative, significant and equal to -4.45, -2.40, respectively, for total assets, and total credits specifications (Equation 1). The same coefficient is also negative and equal to -0.10 for the concentration ratio specification in terms of total credits (Equation 2). This suggests that an increase in the concentration of the Tunisian banks over the

period of study involved a significant reduction in average cost efficiency. This finding suggests that a decrease in banking concentration generated by an increase in the Tunisian banks' competition induces a positive impact on its efficiency. Estimation outcome shows that the more the market share of the three main banks of our sample increases (so the completion decreases), the less is the average cost efficiency. Conversely, the more the market share of these three banks increases, the more the competition decreases, which will in turn decrease the average cost efficiency.

Table 6. Evolution of efficiency in terms of competition

	Equation (1)						Equation (2)					
	I.H.H (T. assets)		I.H.H (T. deposits)		I.H.H (T. credits)		CR ₃ (T. assets)		CR ₃ (T. deposits)		CR ₃ (T. credits)	
	a_0	a_1	a_0	a_1	a_0	a_1	a_0	a_1	a_0	a_1	a_0	a_1
Coef	1.41	-4.45	1.14	-2.50	1.16	-2.40	1.22	-0.81	1.39	-1.08	0.90	-0.10
SD	0.20	1.60	0.26	2.26	0.14	1.11	0.39	0.84	0.19	0.39	0.04	0.07
Prob.	0.002		0.285		0.045		0.006		0.014		0.000	
R ²	0.645		0.768		0.679		0.774		0.778		0.789	

5. Concluding comments

Until the mid 1980's, the Tunisian economy was heavily state regulated, affecting the financial system with heavy control. The scope for manoeuvre for banks was narrow as the products which they were authorized to offer, interest rates, credit management as well as core banking policies were directed by Central Bank of Tunisia. In 1986, with the support of the International Monetary Fund, Tunisia had undertaken a *Structural Adjustment Plan*, aimed at re-orientation of the economic policies towards more competition within the banking sector.

This paper assesses the impact of competition on the efficiency of the Tunisian commercial banks over the period 1990 - 2009. We use a three pronged approach. First, we assess the level of competition in the Tunisian banking industry over this period. Second, we estimated the level of efficiency of these banks using the stochastic frontier analysis approach. Third, we estimate several specifications to examine empirically the relationship between competition and efficiency.

The empirical findings of this study suggest that efficiency and competition are positively correlated. That is, increasing concentration (so a decrease in competition) within the Tunisian banking industry over the period of study has negatively affected

its efficiency. Besides, and all things being equal, private banks show a better efficiency than state owned ones.

Such results are helpful to provide the normative implications of competition policy in the Tunisian banking industry. Specifically, a negative relationship between competition and efficiency would imply a trade-off between these two objectives.

Drawing on the empirical research, it is necessary to reinforce the governorship of the banks and the management and of mainly state owned ones. State owned banks' managers are particularly concerned in order to making them as efficient as private banks. This is particularly important insofar as Tunisia will issue in the immediate future the total convertibility of the Tunisian Dinar and the liberalization of its capital account (Ben Ali, 2007). The Tunisian banking system has also to make important progress to improve and reinforce its stability.

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