

The Extent of Competition and Its Impact on Bank Efficiency: Case of the Tunisian Commercial Banks

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Abstract

The increasing of banking competition has pushed worldwide banks to improve their resource allocations in order to become more competitive and efficient. The purpose of this article is to measure the level of banking competition and its impact on Tunisian banks. Our empirical investigation is based on a sample of ten Tunisian banks during the period from 1998 to 2013. Its purpose is to measure their competition by using the Herfindahl index and the concentration ratio as structural approach and the model Panzar and Rosse as non-structural approach. We found that Tunisian banks are in intense competitive situation. Similarly, we found that more concentration decreases, more the competition between banks increases.

Keywords: Banking competition, efficiency, structural approaches, non-structural approaches, Herfindahl - Hirschman index, concentration indices.

1. Introduction

Faced to macroeconomic imbalances, most industrialized countries are engaged in a change process of their financial systems. Financial liberalization is the main mutation which marked the end of the twentieth century.

The phenomenon of liberalization is mainly rooted by deregulation and. It is characterized by the reducing of the state role in the economy through the privatization of public enterprises, reduction of tax rates and encouragement of exports to international markets.

Tunisia has been engaged in a liberal direction by adopting the Structural Adjustment Programmer of the World Bank (SAP) in 1986. This program involved the increasing of competition among financial institutions, including banks, which are encouraged to achieve better efficiency by strengthening their market position.

Indeed, the intensification of banking competition has pushed banks to improve their resource allocations to become more competitive and efficient. This issue was studied by several researchers in order to reach a consensus about the methods used to estimate competition and efficiency. This being one of the factors that motivated our research, particular in the Tunisian context.

Through this study, we will try to answer the following question: How is the level of banking competition and the impact assessment of Tunisian commercial banks?

The main concern of this article is to underline the methods for estimating the extent of the Tunisian banking sector and their impact.

Our empirical investigation is based on a sample of ten Tunisian commercial banks over the period from 1998 to 2013. Its purpose is to measure their competition by using the Herfindahl index and the concentration ratio as structural approach and the model Panzar Rosse and as non-structural approach. Finally, we will evaluate the impact of competition on efficiency of Tunisian commercial banks.

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2. Literature Review

Since 1973, the international financial system has experienced several crisis, particularly during the last decade.

The following table shows the history of crises since 1973.

Table 1: History crises after 1973

Year	Crisis	Financial markets in question
<u>1974</u>	Herstatt Bank (Germany)	Bank, Forex, systemic risk
<u>1979</u>	Fed Funds rising	US money market
<u>1982</u>	Bank debt of developing countries	Bank, interest rate, systemic risk
<u>1985</u>	<u>Bank of New York</u>	<u>Bank</u> , systemic risk
<u>1987</u>	Krach bond market and equity market	Interest rates, equities, systemic risk
<u>1989</u>	<u>Junk bonds</u>	<u>Bank</u> , interest rates
<u>1989</u>	Japanese bubble	Shares market, real estate, banks
<u>1992-1993</u>	European Monetary System	Forex, interest rates
<u>1994</u>	Mexican peso crisis	Forex, interest rate, Systemic risk
<u>1997</u>	Asian economic crisis	Forex, bank
<u>1997-1998</u>	Brazil	<u>Forex</u>
<u>2000</u>	Turkey	<u>Bank</u> , interest rate, <u>Forex</u>
<u>2001</u>	Attacks of September 11, 2001	Systemic risk
<u>2001</u>	<u>Junk bonds</u>	Interest rate
<u>2007</u>	<u>financial crisis : 2007-2009</u>	Real estate market, bank, shares, systemic risk

• The Banking Competition

Alain Bienaymé (1998)² defines competition as "a confrontation of companies each of which seeks to increase its market share." Krafft (1999)³ consider that competition is "a set of actions that are undertaken in order to achieve the objectives of a firm at the expense of others."

The free banking competition is considered by many experts as the best way to organize the banking system and maximize efficiency and stability, between the three actors of competition which are : producers, traders and customers.

Banking competition is mainly due to the diversity of banking products (market competition) and on the other, with the structural changes in the financial and banking environment (non-market competition).

The concept of efficiency is related to transformation of inputs into outputs according to the strategy adopted by the company. This concept also allows us to appreciate the performance and the development potential of an entity where it focuses on the quality of organization and decisions on the market. In the

² : Bienayme. A (1998): «Competition principles». Paris, Economica 1998, pp 1-29

³ : Krafft. J (1999): «The Competition Process». Economica, Paris, 1999

banking sector, the notion of efficiency allows to study the inner workings of the credit institutions applying different perspectives to analyze their performance.

- **Efficiency Concepts**

Thierry and Tulkens (1998) defines efficiency as "the ability to achieve the objectives for a given decision unit".

Efficiency can be defined in different ways and according to the objective of the study. That's why we distinguish several types of efficiency: cost efficiency, revenue efficiency, effectiveness profit, technical efficiency, allocative efficiency, ... etc.

The cost efficiency is the ability of a firm to minimize costs. It takes into account two types of efficiency: Technical and allocative. The technical efficiency measures the ability to generate maximum outputs for a given basket of inputs. In another way, it is the ability to minimize the inputs used to produce a given basket of outputs. The allocative efficiency measures the ability to choose optimal combinations of inputs, given their prices. Efficiency-income is the ability to maximize income. The efficiency gain measures the ability to maximize profit. Compared to the cost efficiency, profit efficiency offers two inputs information on bank performance. The first is allocative efficiency in output and the second concerns the banks' market power. In markets with imperfect competition, efficiency advantage can measure (1) the difference in term of market power between banks and (2) the banks' ability to use it.

3. Models

There are several methods for measuring banking competition, divided into two main classes:

- Structural approaches
- Non-structural approaches

- **Structural Approaches**

To assess the degree of competition in a well-defined market, we must adapt the analysis in terms of market share. Among the formal approaches studying the relationship between competition and concentration, we mention the Lerner index, the Herfindahl-Hirschman and the ratio of bank concentration CR_k ...

➤ **The Lerner Index (L_{it})**

The estimation of Lerner indices has been widely used in the banking sector as an indicator of the degree of market power. Among the most important studies in this area, we mention Shaffer (1990)⁴ for Canadian banks; Cetorelli Angelini (2000) for Italian banks; Maudos and Pérez (2001) for Spanish banking; and Fernández de Guevara & al. (2005)⁵ for a sample of countries in the studies European Union.

For banks, the most used reference model, from which the Lerner index is obtained, is the imperfect competition model Monti-Klein (1972) which examines the behavior of monopolistic banks.

According to Carbó (2009)⁶, the Lerner index is calculated using the following formula:

$$L_{it} = \frac{P_{it} - C_{m_{it}}}{P_{it}}$$

⁴ : Sherrill. S (1990): « A test of competition in Canadian banking ». Journal of Money, Credit and Banking, 1993, vol. 25, no 1, pp 49-61

⁵ : Fernandez. G & al (2005): « Market Power in European Banking Sectors ». Journal of Financial Services Research, Springer, vol. 27(2), pp 109-137, April

⁶ : Carbo. S, Humphrey. D, Muados. J & Molyneux. Ph (2009): « Cross-country comparisons of competition and pricing power in European banking ». Journal of International Money and Finance 28, pp 115- 134.

with

L_{it} : the Lerner index

P_{it} : The average price calculated as the ratio between total income and total assets

C_{mit} : The marginal cost

➤ **Herfindahl –Hirschman Index (HHI)**

The HHI is extracted from the name of two American economists Orris C. Herfindahl and Albert Otto Hirschman. This index mainly uses the term market share. It is defined as the sum of squares of the share of each company in a very specific market.

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

With :

P_i : The market share of the bank i

The HHI is an indicator of the market power that measures the increase or decrease in the degree of concentration of a financial institution in a very specific market. It takes account of all market participants and risks of coordination of behavior.

The Herfindahl index expanded (H_α) are the most used in the measurement of banking concentration.

$$(H_\alpha)^{\alpha-1} = \sum_{i=1}^n P_i^\alpha$$

➤ **The Concentration Index (CR_k)**

In order to measure banking concentration, the CR_k is the most used in empirical studies because it takes into consideration the market share of (k) first banks to the same sector.

$$CR_k = \sum \left(\frac{S_k}{TB}\right)^2$$

with

CR_k : concentration index

S_k : The market share of (k) first largest banks

TB : The balance sheet total (it can be reported to the other size as total deposit, total credit ...).

To have a good measure of bank concentration, it is necessary that the concentration should be lower in case of bank mergers, and its measure must be a decreasing function for banks of similar size, and also the transfer of the market share of a bank in another must be reflected in the value of the index.

• **Non-Structural Approaches**

There are two non-formal approaches to measure banking competition:

- Approach "Structure-Conduct-Performance" (SCP approach).
- Approach. "Structure-Efficient" (HE approach).

➤ **The SCP Approach**

The first empirical studies on the extent of bank competition were based on the identification of an inverse relationship between market concentration and intensity of competition, in the case of the SCP approach.

The model behavior-Structure-Performance was elaborated in the industrial economy by the American economist Edward S. Mason (1899-1992). It was widely applied during the decade (1960-1970) to the banking industry.

This model provides a general framework for analyzing the performance of markets such as behavior and conflicts in an industry determined by its structures. The SCP paradigm describes a positive causal link between the concentration of a market and the profitability of banks that compose it. It examines how a highly concentrated market causes collusive behavior for large banks because of increased market power and high profits.

This paradigm suggests that the degree of market concentration is inversely proportional to the intensity of competition. There is a direct relationship between the degree of market concentration and the degree of competition among banks. It also examines the behavior of industrial firms and compares their performance.

Indeed, according to Rainelli (1998), "the higher the concentration, the larger firms have significant monopoly power and they tend to adopt a collusive behavior. If firms are in perfect collusion, they maximize profits seals and behave like a monopoly".

In this approach, companies can have monopoly profits if they manage to coordinate their activities. But when it comes to an agreement, the companies have an interest in not respecting the terms of the agreement by increasing prices in order to increase their market share.

On the other hand, the absence of "barriers to entering" reduces the ability of companies to maintain a monopoly: If prices are too high, new businesses can enter the market by obtaining positive margins. These companies must cut prices so as to make the entrance of potential competitors unprofitable and keep prices and margins monopolies.

In the structure-conduct-performance model business results are determined by market structures.

➤ **The "Structure-Efficient" Approach**

In the "Structure-Efficient" approach elaborated by Demsetz (1973). The banks can not generate high profits if they do not increase their size and market share.

This theory, which "justifies the concentration and profitability of a sector by the efficient behavior of some of its components with respect to their rivals" leads to a high concentration in the banking market.

The theoretical work of Hicks (1935) seems to be the first to analyze the relationship between competition and efficiency. Hicks focused on causality from market structure to efficiency. Unlike the work of Demsetz (1973) and Peltzman (1977) who studied the causality from efficiency to power the market.

Empirically, the work of Berger and Hannan (1998)⁷ is according to Boone (2008)⁸ the first to study the effect of the concentration on efficiency cost using the Herfindahl Index. This measure reflects moderately the power of individual market. Other authors, such as Koetter and al. (2011)⁹ have used another measurement indicator : the Lerner index adjusted

Several other studies have been conducted in the same context such as Turk Ariss (2010) based on a sample of 821 banks spread over 60 developed countries and studies Maudos and De Guevara (2007) based on a sample of 15 countries in the European Union (EU) during the period 1993-2002 using IHH and the Lerner index. These authors have shown the existence of a positive relationship between market power and cost efficiency.

⁷ : Berger. N & Hannan. T (1998) « The efficiency cost of market power in the banking industry: A test of the "quiet life" and related hypotheses ». Review of Economics and Statistics, August 1998, Vol. 80, No. 3, pp 454-465.

⁸ : Boone. J (2008): « A new way to measure competition ». The Economic Journal, 118 pp 1245-1261.

⁹ : Koetter. M, Kolari. J & Spierdijk. L (2011): « Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for us banks ». Review of Economics and Statistics, 94(2), pp 462-480.

Similarly, Delis and Tsionas (2009) studied a sample of 11 EU countries using the Lerner index during the period (2000- 2007). They identified a negative relationship between the level of market power and efficiency of different banks. Casu and Girardone (2009) applied the Lerner index to measure the concentration of banks in 5 European countries. They found a positive causality between market power and efficiency. The same result is also found by Lapteacru and Emmanuelle (2011). Coccoresse and Pellecchia (2010) studied the Italian banking sector by applying the Lerner index during the period (1992-2007). They found a very significant negative relationship between efficiency and provide cost market.

For the Africa continent, we mention the studies of Hauner and Peiris (2006) and Mlambo and Ncube (2011) in Uganda. They found that the level of competition has significantly increased and has been associated with an increased efficiency resulting in a positive relationship that has developed between competition and efficiency.

Florian Léon (2012) studied a sample of seven African countries during the period (2002 – 2007) using the Lerner index. He found that the power of the market has a positive effect on the cost efficiency. This effect is not significant on the efficiency gain. Another study in the land of Egypt led by Poshakwale and Qian (2011) who measured competition IHH CRk. They reported the presence of a positive effect between competition and bank efficiency.

For the Tunisia case, Chaffai and Sellami (2008)¹⁰ estimated the relationship between efficiency and competition measured by the Lerner index. The results show that an increase in market power improved cost efficiency. Ben Ali and Sghaier (2012)¹¹, who measured the concentration competition indicators during the period (1990 – 2009), found a positive impact on the level of competition on the level banking efficiency.

➤ **Model Panzar and Rosse (1987)**

The model of Panzar and Rosse (1987) assesses the degree of competition prevailing in the banking market, based on the estimation of a revenue function that calculates the H-statistical index which is defined as the sum of the elasticities of bank revenues to changes in price and is as follows:

$$H = \sum_{i=1}^n \frac{W_i / \partial W_i}{R / \partial R} = \sum_{i=1}^n \frac{W_i}{R} \times \frac{\partial R}{\partial W_i}$$

with:

W_j : the price of production factors to the bank (i).

A : The function returned to the bank (i).

H : Degree of banking competition

If $H = 1$: The market is in a situation of pure and perfect competition;

If $H \leq 0$: Existence of a market monopoly;

If $0 < H \leq 1$: The market in monopolistic competition.

This model has been applied by different authors that are presented in the following table:

¹⁰ : Chaffai. M & Sellami. S (2008) « Banking competition and efficiency: The Case of the Tunisian commercial banks ». Research Unit on Production Econometrics, Sfax University, Sfax -Tunisia.

¹¹ : Ben Ali. M-S & Sghaier. A (2012) « Competition and Banking Efficiency: Evidence from Tunisian Banking Industry ». Journal of Islamic Economics, Banking and Finance, Vol. 8 No. 1, Jan - Mar 2012.

Table 2: Studies based on the model of Panzar and Rosse (1987)

Author	Countries covered	period
Stavarek. D & Repkova. I (2011)	Czech Republic	2001 - 2009
Semih.H & George. C (2007)	Argentina, Brazil, Chile, Colombia, Costa Rica, Equadore, Mexico, Peru, Paraguay, Uruguay, Venezuela.	1993 - 2000
Mamatzakis. E, Staikouras.C & Koutsomanoli . N (2005)	Albani, Bosnia, Bulgaria, Croatia, Macedonia, Romania and Serbia.	1998 - 2002
Bikker. J-A & K. Haaf. K (2002)	23 countries (including 17 European)	1988 - 1998
De Bandt. O & Davis. F (2000)	Germany, France and Italy	1992 - 1996

Presentation of the sample

The sample of our empirical study consists of 10 Tunisian commercial banks. It is an observation panel during a period of twelve years (1998 to 2013).

To measure the level of competition of Tunisian commercial banks, we will use two concentration indicators : the Herfindahl Index (HHI) and the concentration index of top three banks CR3 defined as the total assets of 3 largest banks reported total assets of all banks.

4. Results

• Total Assets

Table 3: Evolution of market share of Tunisian banks 1998-2013

	1998	1999	2000	2001	2002	2003	2004	2005
BNA	18,15%	16,79%	15,27%	15,45%	14,92%	15,35%	15,93%	15,65%
STB	17,98%	15,47%	20,13%	18,74%	19,40%	18,15%	17,45%	16,58%
BIAT	12,71%	12,72%	12,03%	12,48%	12,84%	13,44%	13,66%	13,89%
UIB	7,99%	8,83%	8,12%	8,02%	8,01%	7,38%	6,89%	6,55%
BH	9,61%	11,16%	11,35%	12,78%	12,31%	12,58%	12,35%	12,24%
Attijari.B	7,10%	7,52%	7,56%	7,41%	7,56%	7,68%	8,02%	8,56%
BT	7,37%	6,84%	6,62%	6,51%	6,96%	6,83%	6,62%	6,44%
UBCI	5,92%	5,95%	5,45%	5,13%	4,58%	4,53%	4,49%	4,85%
ATB	5,02%	5,78%	5,11%	4,88%	4,63%	5,35%	6,32%	7,13%
AB	8,15%	8,93%	8,36%	8,61%	8,78%	8,70%	8,27%	8,11%

	2006	2007	2008	2009	2010	2011	2012	2013
BNA	15,36%	15,56%	15,12%	13,72%	13,28%	14,10%	14,30%	13,05%
STB	16,13%	15,79%	15,26%	14,54%	14,34%	13,83%	13,20%	13,18%
BIAT	14,51%	15,12%	15,31%	15,20%	15,47%	15,73%	14,39%	14,97%
UIB	6,47%	5,51%	5,79%	5,85%	6,02%	5,82%	6,15%	6,20%
BH	12,87%	12,29%	11,98%	12,63%	11,25%	10,70%	10,46%	10,12%
Attijari.B	7,48%	7,35%	7,79%	8,49%	8,21%	8,15%	8,11%	9,03%
BT	6,27%	6,39%	6,72%	6,35%	6,67%	6,62%	6,84%	6,55%
UBCI	4,89%	4,71%	4,58%	4,32%	6,04%	5,82%	6,15%	6,20%
ATB	7,56%	8,57%	8,63%	9,13%	8,53%	8,43%	8,40%	8,33%
AB	8,46%	8,71%	8,82%	9,77%	10,21%	10,79%	11,99%	12,37%

We will present the evolution of the assets of Tunisian banks by calculating the market share of each bank in our sample during the period from (1998 to 2013).

From the above table, we can see that addition, the concentration is, the more competition is strong. We find that:

- For 1998, the market concentration is owned by a group of 3 banks : BNA, STB and BIAT. In 2013, this market share declined and the composition of the group was modified by adding the AB.

- The decline in the share of the first group is mainly due to the increase in market share of other banks in our sample.

- Throughout the period, we notice a change in market shares of ATB and BH. Quotas market share among banks are becoming balanced.

• **The Index IHH**

In the following table, we present the evolution of the Herfindahl index and concentration to a bank group during the period 1998-2013.

Table 4: Evolution of the Herfindahl index and concentration for the Bank Group (BNA, STB and BIAT) during the period 1998-2013.

year	IHH	1/IHH	CR3	year	IHH	1/IHH	CR3
1998	0,120	8	0,488	2006	0,116	9	0,460
1999	0,114	9	0,450	2007	0,117	9	0,465
2000	0,120	8	0,474	2008	0,115	9	0,457
2001	0,119	8	0,467	2009	0,113	9	0,435
2002	0,120	8	0,472	2010	0,111	9	0,431
2003	0,119	8	0,469	2011	0,112	9	0,437
2004	0,118	8	0,470	2012	0,110	9	0,419
2005	0,116	9	0,461	2013	0,109	9	0,412

The Herfindahl index tends to 10% (1/n) which leads us to conclude that the Tunisian banking sector is in competition. The concentration ratio shows that the market share was 49% in 1998 saw a decline of 41% to pass. This decrease is due to changes in the share of other banks market. This confirms the result reached above concerning the evolution of the market shares of ATB and BH. Thus the degree of banking competition has increased.

The table also shows a low concentration (8 banks) during the period (1998-2004). The situation has improved to 9 banks of the same size in terms of total assets since 2005, following the reforms introduced on Tunisian banking sector. This leads us to conclude that the Tunisian banks are in intense competitive situation as 9 out of 10 banks in the sample have almost the same size.

• **Model Panzar and Rosse (1987)**

Estimated Total Income Function

Using the same sample consisting of ten commercial banks in the same period from (1998 to 2013). The revenue function can be written as follows:

$$\text{Log}(RT_{it}) = \alpha_0 + \sum_{j=1}^n \alpha_j \log(X_{it}^j) + \sum_{k=1}^n \beta_j \log(P_{it}^k) + \varepsilon_{it}$$

with:

RT: Total Income

α, β : Parameters to estimate

Y_{it}: Control variables

P_{it} : Prices of factors of production (labor, capital expenditures and financial)

ε_{it}: Error Term

i = 1, 2, 3 ... 10 (Banks)

t = 1, 2, 3 ... 12 (years).

The degree of banking competition can be written as follows:

$$H = \sum_{k=1}^n B_k$$

The variables are represented as follows:

Table 5: Presentation of variables

Variable	Title	Notation	Formula	
endogenous	Total income	RT	$\frac{\text{Net banking income}}{\text{Total Assets}}$	
	Return on assets	ROA	$\frac{\text{Net Income}}{\text{Total Assets}}$	
exogenous	Work price	PI	$\frac{\text{Salary mass}}{\text{Total Assets}}$	
	Financial capital price	P _{cf}	$\frac{\text{Interest expense}}{\text{Total Assets}}$	
	Prices of other expenses	P _{ad}	$\frac{\text{General operating expenses}}{\text{Total Assets}}$	
	Control variables	X ₁		$\frac{\text{Total crédits}}{\text{Total Assets}}$
				$\frac{\text{Social capital}}{\text{Total Assets}}$
				$\frac{\text{Net banking income}}{\text{Total Assets}}$

Return on assets can be measured according to the following pattern:

$$\text{Log (ROA)} = \alpha_0 + \alpha_1 \log(X_{it}^1) + \alpha_2 \log(X_{it}^2) + \alpha_3 \log(X_{it}^3) + \beta_L \log(Y_{it}^{Pl}) + \beta_{CF} \log(Y_{it}^{PCF}) + \beta_{Pad} \log(Y_{it}^{Pad}) + \epsilon_{it}$$

According to Claessens and Laeven (2004), the measure of profitability is adjusted in order to avoid negative values. So the balance equation is written as:

$$\text{Log (1 + ROA)} = \alpha_0 + \alpha_1 \log(X_{it}^1) + \alpha_2 \log(X_{it}^2) + \alpha_3 \log(X_{it}^3) + \beta_L \log(Y_{it}^{Pl}) + \beta_{CF} \log(Y_{it}^{PCF}) + \beta_{Pad} \log(Y_{it}^{Pad}) + \epsilon_{it}$$

Variables can be estimated by:

The fixed effects model assumes that (u_i and v_i) are not random. The appropriate method is the Ordinary Least Square (OLS).

The random effects model assumes that (u_i and v_i) are random. The appropriate method is the Generalized Least Square (GLS).

After estimating the parameters with the fixed effect model and random effect, proceed to Hausman test which is used to discriminate these two non-biased effects.

If P < 0.05 then, one must choose the fixed effect where:

- H0: rejected (estimators are obtained by the CWM method).
- H1: accepted (the existence of a correlation between the specific effect and the explanatory variables).

Table 6: The Parameters Estimated by the Fixed Effects Model

R² (Within) = 0.2481 Prob > F = 0.0188			
Variables	Coefficients	Std. Err	t- Student
Constant	+ 0,0358	0,01951	- 1,32
log(X _{it} ¹)	+ 0,0559	0,02254	+ 2,62 **
log(X _{it} ²)	- 0,0629	0,05289	- 1,85 ***
log(X _{it} ³)	+ 0,0176	0,01987	+ 0,96
log(Y _{it} ^{P1})	- 0,0684	0,03458	- 2,84 *
log(Y _{it} ^{PcF})	- 0,0095	0,00756	- 1,82 ***
log(Y _{it} ^{Pad})	- 0,3253	0,02546	- 0,53
* Parameters are significant at the 1% level.			
** Parameters are significant at the 5% level.			
*** Parameters are significant at the 10% level.			
F (9, 144) = 1,35 Prob > F = 0,3891			

According to the estimated parameters, using the software STATA12, the explanatory variables explain 24.81% variable "return on assets (ROA)" because the R is on the order of 0.2481. The probability of F = 0.0188 < 0.05 where the model is globally significant but the specific effect of the test shows the absence of fixed effect in this case because the probability of F is 0.3891 > 0.05 we therefore turn to estimate the parameters by the random effects model.

Table 7: The Parameters Estimated By the Random Effects Model

R² (Within) = 0.8925 Prob > F = 0.0006				
parameter	Variables	Coefficients	Std. Err	t- Student
α ₀	Constante	+ 0,0372	0,01992	- 1,98 **
α ₁	log(X _{it} ¹)	- 0,0092	0,00872	+ 0,86
α ₂	log(X _{it} ²)	- 0,0713	0,03283	- 2,79 *
α ₃	log(X _{it} ³)	+ 0,0208	0,03584	- 0,92
β _L	log(Y _{it} ^{P1})	- 0,0722	0,05587	- 3,82 *
β _{cF}	log(Y _{it} ^{PcF})	+ 0,0238	0,01249	+ 2,02 **
β _{Pad}	log(Y _{it} ^{Pad})	- 0,0982	0,02722	- 2,15 **
* Parameters are significant at the 1% level.				
** Parameters are significant at the 5% level				
F (9, 144) = 1.21 Prob > F = 0,3891				

The endogenous variables explain 89.25% of the variable return on assets. The likelihood of Chi2 = 0.0006 < 0.05 where the model is globally significant. Following Hausman test P-value = 0.0952 > 0.05, then we must choose the random effects model estimated by the method of Generalized Least Square.

$$E = \sum \beta_i = P1 + \beta_{PcF} + \beta_{Pad} = - 0,0722 + 0,0238 - 0,0982 = - 0,1466 \neq 0$$

From this result, we can see that the assumption of competitive equilibrium of Panzar and Rosse model is not checked. Hence, we can say that the Tunisian banking system is not in long-term equilibrium.

5. Conclusion

Worldwide banks have experienced major changes in the regulatory environment, such as the development of financial instruments, the introduction of e-commerce and online banking and a significant consolidation of the highly competitive financial industry.

In such environment where structures of financial industries are in permanent change, it is important to study banking competition that pushed banks to improve their resource allocations to become more competitive and efficient.

To conduct our research, we studied the different methods and estimation approaches of bank competition which are structural approaches (the indicators of concentrations such as the Herfindahl index, concentration ratio and the Lerner index) and non structural approaches such as the model Panzar and Ross).

We found that the Tunisian banking sector is in competition. The concentration ratio CR3 shows that the market share was 49% in 1998 and decline to 41% in 2013. This decrease is due to changes in the share of other banks market.

We can also see that the Tunisian banks are intense competitive situation since 9 out of 10 banks in the our sample have almost the same size. The conclusion is that more concentration decreases, more the competition between banks increases.

According to the two estimation approaches of competition mentioned above, it is concluded that the Tunisian banking system is not in long-term equilibrium.

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