Efficient Structure versus Market Power: Theories and Empirical Evidence

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Abstract

In this paper, we investigate the market structure-performance relationship within the Tunisian banking system during the period 1990-2005. We attempt to distinguish between two theories, namely the Efficient Structure Theory and Market Power Theory. Using the Data Envelopment Analysis Method, we estimate efficiency measures under X-efficiency, Technical Efficiency, Scale Efficiency and Allocative Efficiency. By incorporating into our analyses these forms of efficiencies, this study allowed us to test for the validity of new hypotheses. The empirical investigation is conducted on profit and price regressions for a sample of 10 commercial banks. The results reject the SCP and Quite life hypotheses under the market power theory but retain the RMP hypotheses. Also, all the hypotheses under Efficient Structure theory are rejected. This result suggests that Tunisian banks do not exert a monopole power entailing the exploitation of customers, yet they are able to extend their market share and generate profits thanks to a diversification of products.

Keywords: Market Structure, Banking, Efficiency, Market Power, Tunisia

Jel Classification: D21, D61, G21, L11

1. Introduction

Within the framework of the restructuring efforts and the increasing openness of the Tunisian banking sector over a challenging environment marked by its quick mutations, several incentives have been undertaken in view of implementing a competitive bond between operators as well as improving the products and services offered. Banks found themselves in the obligation of seeking the most efficient organisational solutions, a diversification of the offer and the exploitation of the most advanced economies of scale. It is generally accepted that this latter might be achieved by the means of a partial or complete acquisition of national or foreign credit institutions. Bringing together banks might as well bring about similar effects but which are accompanied by a decrease in the number of banks thus leading to an increase at the level of market concentration. The change at the level of the banking sector which streams from the restructuring efforts might ultimately bring implications on the national level if they allow banks a market power likely to be socially ill-fated reducing thus the consumer's well-being. This justifies the extreme caution practiced by the authorities at the level of competition between firms. These fundamental changes have completely overturned the banking scene and have put this sector into a very serious situation characterized by a strong rivalry, in which competition became a very essential objective, yet, difficult to achieve. Such a situation forces banks to react in order to harmonize their procedures in a way to adjust themselves to the current events and to the requirements of this situation. Being thus, and to justify their existence and to strengthen their insertion into the international arena, banks should have the resources such that they challenge and win challenges at the level of efficiency research.

The relationship between market structure and performance has been treated within the framework of Structure-Conduct-Performance (SCP) paradigm. The original model SCP interprets performance as a result of the exogenous structure of the market which influences banks' conduct. The SCP paradigm assumes that a higher bank concentration allows a higher degree of cooperation between them. These banks might set higher prices and consequently gain substantial profits (Mason, 1939; Bain, 1951; Stigler, 1964; Heggested, 1977; Clark, 1986; Ahmed and Khababa, 1999; Sathye, 2005; Samad, 2008; Alzaidanin, 2003; Pilloff and Rhoades, 2002; Farooq, 2003; Maudos and Fernandez de Guevara, 2007; Al-Muharrami and Matthews, 2009).

Demsetz (1973) was the first to formulate an alternative explanation on market structure-performance relationship and proposes the Efficiency Hypothesis. Applied to banking sector, this hypothesis stipulates that a bank which operates more efficiently than its competitors gains higher profits resulting from low operational costs. The same bank holds an important share of the market. Consequently, differences at the level of efficiency create an unequal distribution of positions within the market and an intense concentration. Since efficiency determines market structure and performance, the positive relationship between these two seems superficial.

Efficiency, as a key factor of competitiveness, nowadays receives a multidimensional interest justified by the coexistence of well-defined capacities and skills making up an entangled and inter-related set which we cannot minimise nor neglect the value of one over the other. Among these capacities, the bank should be skilled in the five knowledge sets, have the talent to reinforce the training process and the relational network. It should as well master the sense of prediction and selection and rely on human capital. It goes without saying then that cost shrinking is no more the objective itself, in that institutions are seeking the adjustment of costs to quality and to products volumes in order to be efficient.

Two classic functional forms have dominated banking efficiency analysis; these are the parametric and non-parametric methods. The parametric method presents an econometric estimation of costs' parameters and includes three approaches; the Stochastic Frontier Approach (SFP), the Thick Frontier Approach (TFA) and the Distribution-Free Approach (DFA). The non-parametric approach is a programming technique which presents a linear frontier known as the Data Envelopment Approach. This method consists in searching whether there exists for each producer or a Decision-Making Unit (DMU) another entity which produces a higher quantity of output with a given data input or which entity with a given quantity of output uses less quantity of inputs. The whole set of entities which responds to this constrained optimisation program makes up what is called data envelopment frontier or better practices (Jemrić and Vujčić, 2002; Avkiran, 2006; Ariff and Can, 2008; Fu and Heffernan, 2007). A particular interest is devoted to the notion of efficiency, which notion has polarised the concern of several researchers given its distinguished contribution in explaining the market structure-performance paradigm.

The rest of the paper is organized as follows. Section 2 introduces the theories of Efficient Structure and Market Power and presents the different derived hypotheses. Section 3 presents the Data Envelopment Analysis methodology, and section 4 discusses the data and variables used. Results are presented in section 5. Section 6 draws some conclusions.

2. Efficient Structure vs Market Power: Theories and Emergence of New Hypotheses

An exhaustive review of the theoretical and empirical literature reveals that the Efficient Structure hypothesis is explored following a number of serious modelling attempts under the two versions of implicit and explicit measurements of Efficient Structure. Shepherd (1986), Schmalensee (1987), Timme and Yang (1991), Berger (1995), Sathye (2005), Park and Weber (2006), Byeongyong (2002), Byeongyong and Welss (2008), Chortareas et.Al (2009), Seelanatha, (2010), strongly contest employing market share as a proxy for efficiency and strongly recommend the employment of a direct measure of efficiency given that market share captures the effect of other variables other than efficiency.

Smirlok (1985), subscribing to the efficiency hypothesis, considers market share as a proxy for efficiency. The efficiency hypothesis prevails when a significant positive correlation between market share and profitability is signalled. This method implicitly assumes that a higher market concentration is the main source of market power. Shepherd (1986) criticizes this method by considering that the direct source of market power is the domination of participants over the individual market, independently of the ultimate sources of such a domination, hence the emergence of the Relative Market power (RMP) hypothesis. It is uniquely the banks with a large market share and diversified products that might exert their market power to determine prices and make profits. Consequently, under the RMP hypothesis, individual market shares accurately determine market power and market imperfections.

The RMP hypothesis is empirically proved when concentration introduced in the explanatory equations of performance is found non-significant in contrast to market share which should be positively and significantly correlated with price and/or profitability. Nevertheless, it is not obvious that employing market structure in these equations produces unambiguous results. A bank with a strong position in the market may either reinforce its domination over the market or achieve a higher efficiency.

Some empirical studies test the SCP and RMP hypotheses by analyzing the profit-concentration relationship (market share). However, these studies are incapable of favouring one of the two hypotheses. The reason is that the effects of market power and efficiency might be simultaneously present in the variables describing market structure and they are neutralized at the level of the concentration coefficient (market share). Another problem might arise, inconsistently with the theory; efficiency and concentration are negatively correlated. In this case, a significant and positive coefficient of market structure might be fallacious. These studies cannot confirm either of the SCP and RMP hypotheses without ambiguity, due to the combined effect of market power and inefficiency.

A particular case of market power hypothesis should be mentioned. It is the Quite Life (Hicks, 1935) hypothesis according to which a bank management unit with a large market share is less centred on efficiency as the exploitation of market power in terms of fixing prices allows deriving automatically benefits. An increase in market power comes with a deterioration of efficiency which makes banks unable of earning higher profitability. The Quite

Life hypothesis puts forward an explanation in the case of the absence of a presumed relationship between profitability and market structure.

Aware of the fact that neither the SCP model nor the efficiency model is important in explaining banking profitability and in order to resolve these methodological problems, Berger and Hannan (1993) were the first to think about explicitly integrating efficiency variables in the equations. They were followed by the works of Berg and Kim (1994), Maudos (1998), Berger (1995), Berger and Hannan (1997), Goldberg and Rai (1996), Papadoplous (2004), Byeongyong (2002), Park and Weber (2006), Samad (2008), Al-Obaidan (2008), Fu and Heffernan (2009), Chortareas et. Al (2009), Al-Muharrami and Matthews (2009), Seelanatha, (2010). Once the notion of efficiency is explored, different versions of efficiency are highlighted. Thus, the Efficient Structure hypothesis includes a production technique dimension, a production scale dimension and finally a resources allocation dimension.

Berger (1995) divides the efficiency hypothesis into x-efficiency (XE) and scale efficiency (SE) hypotheses. According to the x-efficiency hypothesis, the costs incurred by banks with efficient management and/or technologies are lower resulting in higher profitability. The better banks' x-efficiency is, larger are market shares and higher is concentration. Under the efficiency hypothesis, the difference in performance between two firms is not due to differences in management quality, but to differences at the level of scale efficiency. Banks' costs lower than their competitors result in higher profitability. These banks may acquire extended market shares which increases market concentration.

Besides the two types of efficiencies traditionally employed in the literature, Fiordelisi (2004) develops three measures of efficiency which are technical efficiency, allocative efficiency and scale efficiency. All these measures have been treated according to the DEA method over the Italian manufacturing industry during the period 1993-1997. The introduction of allocative efficiency constitutes the first innovation of the author (Note 1) It is particularly interesting in the sense that it allows situating ourselves under a new version of relative market power hypothesis and extending the Efficient Structure hypothesis under the Allocative Efficient Structure (AE).

Recently, Al-Obaidan (2008), presents a general composite model. Estimating technical efficiency using deterministic and stochastic functions, empirical results confirm the efficiency hypothesis in the Commercial Banking Industry of the Gulf Cooperation Council (GCC) Emerging Markets over the (1996-2005) period. Surprisingly, Al-Muharrami and Mattews (2009), who differentiate between bank fixed effects and country fixed effects, find out that over the period 1993-2002, the banking industry in the Arab GCC countries is best explained by the SCP hypothesis, but they fail to provide proof for the quiet life Hypothesis. Fu and Heffernan (2009) study the relationship between market structure and performance within the Chinese banking sector during the period 1985-2002. Using panel-based data and a random-effects estimation procedure, the market power and efficient structure hypotheses are tested. The obtained results suggest that the gradual reforms strategy affects Chinese banking market structure and recommend orienting the new policies towards enlarging the market shares of the most efficient banks. Fu and Heffernan (2009) propose a simultaneous application of market structure (concentration and market share) and efficiency (x-efficiency and scale efficiency) which allow retaining or rejecting the hypotheses. The SCP (RMP) hypothesis might be tested if the correlation between concentration (market share) and profit is positive. In this case, the rest of the structural variables and efficiency variables are irrelevant. Likewise, the x-efficiency hypothesis (scale efficiency) might be tested when there is a positive correlation between x-efficiency (scale efficiency) and profit. The rest of the efficiency variables and market structure variables are irrelevant. However, in order for the efficiency hypothesis to be confirmed, there should exist a positive correlation between market structure variables (concentration and market share) and efficiency (Berger and Hannan (1997)). Likewise, Chortareas et. Al (2009), produce evidence supporting the efficient structure hypotheses for nine Latin American countries between 1997-2005. The authors test the competition hypothesis mainly the market power hypotheses which includes SCP and RMP in the one hand, and on the other hand the efficient structure hypotheses which includes x and scale efficiency. Recently, Seelanatha (2010) reviews how the banks' efficiency and market structure affect the overall performance of banking firms measured in terms of profitability and net interest margin using structure conduct performance literature. Applied to a Sri Lankan banks sample, findings of the empirical analysis show that over the period 1977-2005, banks performance does not depend on either market concentration or market power of individual firms but on the level of efficiency of the banking units.

To our knowledge, this paper is among the rarest which attempts to investigate of explanatory models of profit generation sources within bank firms. The two dimensions of banking efficiency and social well being are strongly present, an aspect which makes of this paper a document that draws the interest of bank firms as much as the government and the consumer.

In the following we provide the formal representation of the two competing theories. Note that we retain all the forms of efficiency and we generate approaches in terms of x-efficiency, technical efficiency, scale efficiency and

allocative efficiency. Accordingly, all the variables are related to their expected sign. The Efficient Structure theory of profits may be characterized as follows:

$$\pi_{i,t} = f_1 \begin{pmatrix} \overset{\geq 0}{XE_{i,t}}, \overset{\geq 0}{TE_{i,t}}, \overset{\geq 0}{SE_{i,t}}, \overset{\geq 0}{AE_{i,t}} \overset{0}{CONC_{m,t}}, \overset{0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{1i,t} \qquad (1)$$

Necessary Conditions are:

$$MS_{i,t} = f_2 \begin{pmatrix} \overset{\geq 0}{XE_{i,t}}, \overset{\geq 0}{TE_{i,t}}, \overset{\geq 0}{SE_{i,t}}, \overset{\geq 0}{AE_{i,t}}, Z_{i,t} \end{pmatrix} + V_{2i,t} \qquad (2)$$

$$CONC_{m,t} = f_3 \begin{pmatrix} \overset{\geq 0}{XE_{i,t}}, \overset{\geq 0}{TE_{i,t}}, \overset{\geq 0}{SE_{i,t}}, \overset{\geq 0}{AE_{i,t}}, Z_{i,t} \end{pmatrix} + V_{3i,t} \qquad (3)$$

The Market Power Theory of profits may be characterised as follows

$$\pi_{i,t} = f_{1*} \begin{pmatrix} \overset{\geq 0}{XE_{i,t}}, \overset{\geq 0}{TE_{i,t}}, \overset{\geq 0}{SE_{i,t}}, \overset{\geq 0}{AE_{i,t}}, \overset{\geq 0}{CONC_{m,t}}, \overset{\geq 0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{1i,t} \qquad (4)$$

Quite Life effect is:

$$XE_{i,t} = f_{2*} \begin{pmatrix} \overset{\leq 0}{CONC_{m,t}}, \overset{\leq 0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{2i,t} \qquad (5)$$

$$TE_{i,t} = f_{3*} \begin{pmatrix} \overset{\leq 0}{CONC_{m,t}}, \overset{\leq 0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{3i,t} \qquad (6)$$

$$SE_{i,t} = f_{3*} \begin{pmatrix} \overset{\leq 0}{CONC_{m,t}}, \overset{\leq 0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{3i,t} \qquad (7)$$

$$AE_{i,t} = f_{4*} \begin{pmatrix} \overset{\leq 0}{CONC_{m,t}}, \overset{\leq 0}{MS_{i,t}}, Z_{i,t} \end{pmatrix} + V_{4i,t} \qquad (8)$$

3. The DEA methodology

The theoretical foundation of non-parametric estimations is developed for the first time by Farrell (1957). Charnes et al (1978) have put into focus a technique using programming methods which they call « Data Envelopment Analysis (DEA) ».

We consider a number of N banks or Decision-Making Units (DMUs), each of them produces "m" inputs by means of an "n" input. Each DMU measures its efficiency through the following ratio:

$$Hs = \frac{\sum U_i Y_{is}}{\sum V_j X_{js}} \qquad \begin{matrix} i = 1, \ldots \ldots \ldots \ldots .., m \\ j = 1, \ldots \ldots \ldots \ldots .., n \end{matrix} \qquad (9)$$

Where:

Y_{is}: is the quantity of the ith output produced by the Sth DMU.

X_{is}: is the quantity of the ith input used by the Sth DMU.

U_i : is the weight of the output i

V_i : is the weight of the output j

The ratio Hs represents the objective measure to be maximised under the following constraints:

$$\begin{matrix} 1) & \dfrac{\sum U_i Y_{ir}}{\sum V_j X_{jr}} \leq 1 & r = 1, \ldots \ldots \ldots ., N & (10) \\ \\ 2) & U_i \geq 0 \text{ et } V_j \geq 0 & & \end{matrix}$$

The first constraint signifies that efficiency ratios should not exceed 1. The second constraint represents the positiveness of the Ui and Vj weights. The mathematical formulation of the total technical efficiency of an entity "s" might be presented by the following linear program:

$$
\begin{aligned}
&\textit{Minimise} \quad \beta s \\
&\quad \text{Under the constraint s} \\
&\qquad 1)\ \sum \lambda r Yir \ \geq\ Yis \qquad\qquad i = 1,........\ ....\ , m \\
&\qquad 2)\ \sum \lambda s Xjr\ -\ \beta s Xjs\ \leq\ 0 \qquad j = 1,........\ ....\ ., n \\
&\qquad 3)\ \lambda r \geq 0 \qquad\qquad\qquad\qquad r = 1,........\ ....\ , N \\
&\qquad \text{any } \beta s
\end{aligned}
\tag{11}
$$

The variable βs represents the contraction factor and corresponds to the level of technical efficiency of the DMU under consideration. The interpretation of this linear program is simple. For an efficient bank, the coefficient βs equals 1, whatever "j" is different from "s". According to the first constraint, it is impossible to find in the set of references another bank which produces as much (or more) of each product.   According to the second constraint, it is impossible to find in the set of references another bank which uses a less important quantity of inputs. The coefficient βs applies to the set of vectors of input and is assimilated to a coefficient of use of resources.

After imposing variable scales' operations to the production frontier, it is possible to measure pure technical efficiency of the entity "s". To this effect, we should insert in the linear program (11) the following constraint: ∑λr = 1. Indeed, the linear program (12) is represented as follows:

$$
\begin{aligned}
&\textit{Minimise} \quad \Omega s \\
&\quad \text{Under the constraint s} \\
&\qquad 1 - \sum \lambda r Yir\ \geq\ Yis \qquad\qquad i = 1,........\ ....\ , m \\
&\qquad 2 - \sum \lambda r Xjr\ -\ \beta s Xjs\ \leq\ 0 \qquad j = 1,........\ ....\ ., n \\
&\qquad 3 - \lambda r \geq 0 \qquad\qquad\qquad\qquad r = 1,........\ ....\ , N \\
&\qquad 4 - \sum \lambda r = 1
\end{aligned}
\tag{12}
$$

To estimate scale efficiency of the firm i, efficiency is estimated under the constant returns scale (CRS) and variable returns scale (VRS) hypotheses. The ratio of technical efficiency measures obtained through the CRS and VRS models is the scale efficiency of each firm. $SE_i = TE/PTE$. Thanks to the successive resolutions of linear programs, the diagnosis allows measuring the scale efficiency score. The latter is equal to β_s / Ω_s. Scale efficiency measure gives us an idea about the excessive use of inputs associated with a non-optimal output level. If SEi =1, the firm operates at constant returns scale, which is economically and socially optimal (Charnes et. al, 1978). If SEi < 1, scale returns are increasing and if SEi >1, scale returns are decreasing. It is worth noting that scale efficiency cannot be negative, since technical efficiency and pure technical efficiency are often positive.

To estimate cost efficiency, we should take into account inputs prices. Indeed, we establish this measure by the following linear program:

$$
\begin{aligned}
&\textit{Min} \quad C = \sum PjsX^{*}js \\
&\quad \textit{U}\text{nder constraint s} \\
&\qquad 1 - \sum \lambda r Yir\ \geq\ Yis \\
&\qquad 2 - \sum \lambda r Xjr\ \leq\ X^{*}js \\
&\qquad 3 - \lambda r \geq 0 \\
&\qquad 4 - \sum \lambda r = 1
\end{aligned}
\tag{13}
$$

The allocations which minimise the production cost of an entity "S" given the observed prices of these inputs are obtained by les X^{*}js solutions of this linear program. Thus, cost efficiency score corresponds to the ratio minimum cost and weighted input quantities by their prices and reflected in $Ks = \dfrac{Cs^{\min}}{Cs}$, yet allocative efficiency score corresponds to the ratio cost efficiency and total technical efficiency $Ws = \dfrac{Ks}{Bs}$.

4. Data and Variables

4.1. Sample and Period

The Professional Association of the Banks of Tunisia is our main source of data published in their annual reports. We have as well used balance sheets and accounts' results available in the banks' activity reports. Data concerns the period 1990-2005. The choice of the period depended on the availability of necessary information. The year 1990 coincides with the introduction of a number of financial reforms attempting at boosting progressive monetary and financial systems openness by authorizing foreign participation in banks capital, liberalizing interest rates and the dinar's exchange rates and a gradual openness of the capital account (Note 2).

The sample includes 10 banks. We retained the commercial banks having a regular activity over the period under consideration. Banks whose data do not cover the studied period or those recently set up are eliminated from our sample (Note 3). The sample of banks retained includes three public banks, three private banks and four foreign banks. The public banks are; the Tunisian Banking Company (STB), Bank of Housing (BH), the National Agricultural Bank (BNA).   The private banks are; Arab International Bank of Tunisia (BIAT), Bank of Tunisia (BT), and Amen Bank (A. Bank). The banks with foreign participations are; the Banking Union for Trade and Industry (UBCI) and the Arab Tunisian Bank (ATB), ATTIJARI Bank of Tunisia, and the International Banking Union (UIB).

4.2. Input and output vectors and selected input prices

The choice of a behavioural model describing the attitude of the bank towards its production and activity dynamics imposes itself in the economics literature concerned with banking. We remind you that economics literature which describes banks' behaviour in terms of banking activities is divided into two schools: the first school adopts an intermediation approach according to which deposits are converted into credits (Mester 1987). The second school, on the other hand, adopts the production approach according to which the bank employs production and capital factors to generate deposits and credits. Ferrier and Lovell (1990) and Fried et al (1993) favour the production approach in so far as research is concerned with cost efficiency since this approach is centred on operational costs. Elyasiani and Mehdian (1990) favour the intermediation approach which includes interest expenses which constitute a large proportion of expenses of all banks. The intermediation approach fits perfectly our research interest, given the fact this latter is focused on the study of the bank's total costs. It is thus the approach which we favour in order to analyse the economic validity of the bank.

We take as banking outputs claims on clients (CC), inter-banks loans (IBL) and investment portfolio (IP) (Note 4). We retain as well three inputs as necessary requirements for production: the labor factor (L), the physical capital factor (K) and the financial capital factor (F). Claims on clients are generated from discounted portfolio, debit accounts, special resources-based credits and other clients-oriented credits. Inter-bank loans include specialised banks and institutions-oriented loans, cash, and Central Bank of Tunisia, deposits certificates, acquired treasury bills and postal cheques. The investment portfolio value is directly derived from balance assets.

In so far as inputs are concerned, these latter are measured by the global effect of the personnel for the labor factor. The physical capital factor or production equipments includes leasing operations, fixed assets and the net non-value of paying-offs and other assets. The last input, i.e. the financial capital, is essentially derived from deposits in the way the intermediation approach stipulates. Thus, financial capital includes loans given by the central bank, loans from specialised banks and institutions, clients' deposits, savings deposits, bonds, term accounts, other financial products, other clients-derived amounts, special resources and engagements and other loans.

As far as production factors are concerned, they are respectively cost of labour factor (LC), physical capital cost (KC) and financial factor cost (FC). Cost of work factor is estimated by the sum of salaries. The cost of physical capital is given by the charges on diverse operations, by the general operating charges and Endowments for amortization and for provisions on fixed assets. The financial cost supported by the bank is defined by charges on treasury operations and inter-bank operations, interests on client deposits, charges on obligatory, budget-related and external loans and diverse losses.

Data in terms of costs are very useful, if not necessary to compute different inputs prices in order to estimate total efficiency under these two disassociated forms, i.e. technical efficiency and allocative efficiency. Total cost (TC) is derived from the sum of labour factor cost, physical factor cost and financial factor cost. The operating cost (OC) is represented by the sum of labour factor cost and physical capital factor cost. Inputs prices are computed as the respective ratios of cost and quantity of production factor. Thus, we note (W_L) as the price of labour factor, (W_K), as the price of physical capital factor and (W_F), as the price of the financial factor.

5. Empirical Findings

5.1. Efficiency results

Table 1 shows that decomposing total efficiency into technical and allocative efficiencies bespeaks a big difference between these two. Technical efficiency seems to summarize the level of the bank's efficiency. This latter however suffers from deficiency in terms of efficient allocation of production resources knowing the inputs prices. A problem of better allocation of resources is detected at the level for each bank, despite the fact that UIB and the BS are the least exposed to this anomaly.

The disturbances observed at the level of cost efficiency are rather highly influenced by quasi-similar disturbances at the level of allocative efficiency. This is explained by the fact that technical efficiency shows a relative stability of its coefficients all along the period which ends by a convergence of scores of the two efficiency notions.

5.2. Regression of market structure-performance and efficiency: x-efficiency and scale efficiency

We introduce the variable efficiency under its decomposed forms of x-efficiency and scale efficiency. We test the different hypotheses according the variables concentration ratio of the three biggest firms (CR_3) and The Herfindhal-Hirschman index (HERF) (Note 5) and the variables market share MSI_1 and MSI_2. MSI_1 measures the deposits of the studied banks in relation to the deposits of all banks, whereas MSI_2 is expressed in terms of assets. Control variables account for firm specific and market specific characteristics. These characteristics are inherent to the size, risk, cost and ownership (See Table 2). They are supposed to affect bank's profitability as already proved by previous studies. (Ahmed and Khababa, 1999; Pilloff and Rhoades, 2002; Samad, 2008; Fu and Heffernan, 2009; Chortareas et. Al, 2009, Seelanatha, 2010).

In table 3, the estimations show very interesting results which are reported in table1. In relation to the variables profit, namely Return on Assets (ROA) and Return on Equity (ROE) (Note 6), the variables concentration are significant but with negative signs. In so far as the regression retaining the variable price (the net interest margin (NIM) (Note 7) as the dependent variable is concerned, the coefficients related to the variables concentration are positive but non-significant. These results allow us to reject the first classic hypothesis SCP.

As for the RMP, the results are sensitive to the to-be selected dependent variables. In so far as the variable profit is concerned, we detect positive and significant coefficients for the variable ROA regressed on MSI_1 and this holds whatever the variable concentration is CR_3 or HERF. Likewise, the results on price support the RMP hypothesis for regression relative to MSI_1 as market share variable and this holds whatever the variable concentration is CR_3 or HERF. The second definition of market share (MSI_2) shows the expected signs but with low significance.

The results show as well that the efficient structure hypothesis might be retained under its version Scale Efficiency. The second version x-efficiency is rejected because of the counterintuitive signs, despite the fact that the non rejection of the two versions might be the case of other studies and none of the hypotheses excludes the other. Scale efficiency is uniquely confirmed in profit regressions and this within six of the eight specifications.

At this level the results seem mitigated and in favour of the RMP hypothesis or the scale efficiency hypothesis applying the used variables. However, all the results reject the collusion and x-efficiency hypotheses. These results are in line with the work of Goldberg and Rai (1996). According to Berger and Hannan (1997), these results cannot be retained only after controlling for the necessary conditions.

The regression of the necessary conditions reveals an interest towards the robustness of the given conclusions according to which we assume that within the Tunisian banking sector the most scale-efficient banks produce at a minimum cost (See table 4). The results show that the variables concentration (CR_3 and HERF) are related to coefficients which do not confirm our conclusions. It is with the variable market share and under the definition MSI_1 that the results show a positive and significant relationship with scale efficiency. Despite this observation in favour of scale efficiency hypothesis, this latter cannot be adopted in the absence of a positive and significant relationship with the variable concentration.

5.3. Regression of market structure-performance and efficiency: technical efficiency and scale efficiency

Moving to estimations including technical efficiency instead of x-efficiency has allowed us to reduce ambiguity. Indeed, the results show some support to the RMP hypothesis over six of the twelve regressions. Price regressions totally support this hypothesis. Thus, the SCP, XE and SE hypotheses are rejected. Once the efficient structure hypotheses are rejected, the work on the necessary conditions seems senseless. (See table 5).

5.4. Regression of market structure-performance and efficiency: technical efficiency, scale efficiency and allocative efficiency

We thought that adding allocative efficiency variable in the set of regressions by comparison to the preceding specifications would allow a better representation of efficiency as a key variable in the model under its three components; technical efficiency, scale efficiency and allocative efficiency. The explanatory power confirms our intuition. It records a remarkable increase which moves from 0.21 to 0.40 for the first regression. (See table 6).

The Berger and Hannan's (1997) innovation in terms of analysis under the terms of price variables have been very useful to us. In fact, and similar to the previous results, all regressions are conclusive in favour of the RMP hypothesis in contrast to profit regressions which seem highly irrelevant. Two out of eight regressions are valid. They are in favour of the RMP hypothesis.

The allocative efficiency variable, despite being neatly significant (the most significant of all the variables in the regressions), shows a sign different from the theoretical expectations. The other efficiency variables: technical efficiency and scale efficiency are for for most of the estimations consistent with the theoretical approach but not significant. Thus, they do not explain the efficient structure-market power paradigm.

5.5. Testing the Quite Life Hypothesis

Our empirical study relative to the Quite Life hypothesis has been conducted using sixteen different regressions. (See table 7). The idea was to test the relationship between the variable efficiency, on the one hand, and market share and concentration variables, on the other hand. However, we would like to reiterate that with reference to the literature (Note 8), this hypothesis is retained only when the coefficients associated to market share and concentration variables are negative and significant for the same regression, a fact which was not proved in any of the investigated regressions.

In so far as the x-efficiency variable, this latter shows results disfavouring the Quite Life hypothesis because of signs inconsistent with those of the literature; the signs of the coefficients associated with market share and concentration are positive on the whole. Our research on the validity of the Quite Life hypothesis touches as well on the other versions of efficiency of which technical efficiency, scale efficiency and allocative efficiency. The same observations hold and consequently the same conclusions are forwarded, of which the non-validity of the Quite Life hypothesis.

6. Conclusion

This paper attempts to distinguish between two competing theories; the efficient structure theory and market power theory. We set to assess whether Tunisian deposit banks, which pretend profitability, show a collusive behaviour in terms of exploiting consumers and of fixing higher prices.

We explore the relationship between market structure and performance by incorporating different forms of efficiency computed by means of the Data Envelopment Analysis. It is worth noting that efficiency measurement highlights the way banks allocate their resources. It is in a way an appreciation of the banks' degree of adjustment between incurred costs and the quality of the offered services. Accordingly, efficiency relates to the two inputs-outputs poles, which implies that efficiency refers to the capacity of the bank to conveniently align the used resources to the products.

Over a sample of ten Tunisian banks, we used data over the period 1990-2005 to test the three hypotheses which emerge from market power theory i.e. the SCP hypothesis, the RMP hypothesis and the Quite Life hypothesis. Likewise, four hypotheses are related to the efficient structure theory, i.e. x-efficiency hypothesis, technical efficiency hypothesis, scale efficiency hypothesis and allocative efficiency hypothesis.

Our study reveals that, in the main, Tunisian banks are efficient at 67.13 per cent. By decomposing the total efficiency, we reach the conclusion that the origin of inefficiency resides mainly in allocative efficiency, whereas banks are technically and scale-level efficient. Yet, consistent with Al-Obaidan (2008), Chortareas et. Al (2009) and Seelanatha (2010), our empirical investigations in terms of profit and price regressions show results disfavouring the SCP hypothesis and reject consequently any possibility of market power exertion at the expense of consumers. Equally noted, whereas the Quite Life hypothesis is not retained, we confirm the validity of the RMP hypothesis. In so far as efficient structure hypothesis is concerned, none of its versions seem to support the market structure-performance model, although the efficient structure hypothesis is defendable on the ground of significant positive signs; this latter fails the necessary conditions. The obtained results allow us to conclude that Tunisian deposit banks have market shares explained essentially by an expertise in the field of product differentiation policies, naturally known for generation of profits without harming social structure.

This study provides some insights in terms of financial and economic implications. The earlier reforms characterizing the legislative and the legal frameworks have favoured banking sector efficiency. Therefore, these

results suggest that policy makers should focus on policy reforms that enhance banks' efficiency and mainly solve allocative inefficiency. In line with shepherd (1986), the Relative Market Power hypothesis confirmed in this study assumes that only firms with important market shares and diversified products have the power to fix prices and gain abnormal returns. Therefore, it is advisable that policy makers should be aware of practices which tend to fix prices of credits-related products and which eventually harm consumers' well being. Economic policies favoring financial innovation and products differentiation may improve market contestability, where continually improving the sector's efficiency and competition is very important.

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Notes

Note 1. The three innovation provided by Berger and Hannan (1997) are (1) the use of a direct measure of efficiency in profits-based regressions and price-based regressions, (2) a comparison between profit and price analyses using data for the same banking firms and during the same period. Finally, (3) the authors were the first to undertake an analysis of the effects of market structure on efficiency (the Quiet Life hypothesis).

Note 2. The Tunisian authorities adjourn to 2014 the date of the liberalization of the exchange rate of the dinar and the capital account. This decision is justified in light of the recent crises. Despite controls on capital movements, this country risks a "real" crisis, provided that it liberalized its business with the outside.

Note 3. In 2005, the banking sector included 20 banks, of which; the newly-operational as from March 2005 the "Financing Bank of Small and Mid-sized Companies" (BFPME). We signal the reconversion of the Tuniso-Saoudi Investment and Development Company (STUSID Bank) and Tuniso-Libyan Bank (BTL) into universal banks respectively in April and October 2005 and the privatisation of the bank of the South in November 2005.

Note 4. In order to measure banking activity, some authors retain the aggregated banking output computed by adopting the aggregation method proposed by Benston, Hanweck and Humphrey (1982).

Note 5. The Herfindhal-Hirschman HERF index is the sum of squares of market share and individual banks.

Note 6. Return on Assets (ROA) will be measured by the ratio the bank's net result and its total assets. Return on Equity (ROE) is the ratio between net result and total capital.

Note 7. NIM is the net interest margin, it measures the differential interest added to total assets.

Note 8. See the work of Berger and Hannan (1997).

Table 1. Efficiency results by bank

Banques	Total Efficiency	Scale Efficiency	Technical Efficiency	Allocative Efficiency
BNA	0.723	0.968	0.965	0.748
STB	0.769	0.993	0.993	0.773
BIAT	0.647	0.995	0.961	0.677
UIB	0.945	0.985	0.984	0.959
BH	0.760	0.995	0.985	0.768
Attijari Bank	0.924	0.984	0.97	0.944
BT	0.516	0.989	0.989	0.524
UBCI	0.492	0.989	0.989	0.501
A,BANK	0.362	0.981	0.969	0.374
ATB	0.628	0.916	0.899	0.676

Table 2. Definition of Variables

Dependant Variable		
Profit Variables	ROA: Return on Assets = net results of the bank/total assets	
	ROE :Return on Equity = net results of the bank / total capital	
Price Variable	NIM: Net Interest Margin = differential interest / total assets	
Explanatory Variables		
	Concentration Variables	HERF: Herfindhal-Hirschman Index: Sum of Squares of individual banks' market share
		CR3: Concentration ratio of the three largest banks
Market Specific Variables	Market Share	MSI $_1$: bank deposits i/ total deposits
		MSI $_2$: bank assets i/ total assets
	Macroeconomic variable	PCI: per capita income
	Risk Variables	CAPAST : Capital/ total assets of the bank i
		BR: Total credit/ total deposits of the bank i
Bank specific Variables	Scale Variable	DB: Volume of deposits of the bank i
	Price of Labour	WAGE: personnel expenses to staff number
	Ownership Variable	OWNER: it is equal to the unit when the bank is privately owned; equal to zero if it is state owned
		THREE: is equal to the unit when the bank belongs to the three largest banks, equal to zero elsewhere.

Table 3. Regression of the variables profit and price over concentration, market share, x-efficiency and scale efficiency variables

	ROA (1)	ROE (1)	NIM (1)	ROA (2)	ROE (2)	NIM (2)
Intercept	0.1043*** (3.27)	1.5318*** (4.69)	-0.3560*** (-4.49)	0.10437*** (3.88)	0.9631*** (3.47)	-0.2546*** (-3.74)
CR3	-0.0993*** (-3.74)	-1.0113*** (-3.72)	0.0895 (1.36)	-0.1001*** (-4.21)	-0.7161** (-2.91)	0.0179 (0.30)
HERF						
MSI 1	-0.0039 (-0.14)	0.5577** (1.98)	-0.1908*** (-2.79)			
MSI 2				-0.0043 (-0.24)	-0.1811 (-0.96)	-0.0684 (-1.48)
XE	-0.0089*** (-6.56)	-0.0654*** (-4.71)	-0.0042 (-1.25)	-0.0088*** (-6.41)	-0.0640*** (-4.49)	-0.00287 (-0.82)
SE	0.0133** (2.33)	0.0715 (1.22)	0.0584*** (4.10)	0.0131** (2.35)	0.0959* (1.66)	0.0485*** (3.43)
DB	-0.0036** (-1.96)	-0.0642*** (-3.34)	0.0235*** (5.04)	-0.0036** (-2.28)	-0.0261 (-1.58)	0.0175*** (4.33)
CAPAST	0.0229 (0.93)	-1.0358*** (-4.10)	0.0125 (0.20)	0.0217 (0.86)	-1.0942 *** (-4.19)	-0.0049 (-0.08)
BR	-0.0014* (-1.80)	-0.0335*** (-3.95)	0.0087*** (4.23)	-0.0013 (-1.35)	-0.0304*** (-2.96)	0.0116*** (4.63)
PCI	-1.09e-06 (-0.84)	-0.00001 (-1.40)	-0.00001*** (-3.94)	-1.09e-06 (-0.88)	-0.00003** (-2.43)	-0.00001*** (-3.32)
WAGE	-0.00002 (-0.27)	-0.00051 (-0.57)	-0.00028 (-1.30)	-0.00002 (-0.30)	-0.0014* (-1.66)	-0.00017 (-0.77)
OWNER	-0.00143 (-1.34)	-0.01098 (-1.00)	0.00924*** (3.48)	-0.00142 (-1.40)	-0.02085** (-1.99)	0.01125*** (4.38)
THREE	0.00043 (0.29)	-0.02548 (-1.64)	-0.00014 (-0.04)	0.00047 (0.36)	0.00460 (0.33)	-0.00458 (-1.34)
R^2	0.394	0.484	0.315	0.394	0.473	0.289

Notes: Two empirical models are considered: fixed effect models and random effect models.   Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1% .

Table 3 (Continued): Regression of the variables profit and price over concentration, market share, x-efficiency and scale efficiency variables

	ROA (3)	ROE (3)	NIM (3)	ROA (4)	ROE (4)	NIM (4)
Intercept	0.1373*** (3.91)	1.7918*** (4.95)	-0.3743*** (-4.23)	0.1280*** (4.45)	1.0941*** (3.64)	-0.2531*** (-3.42)
CR3						
HERF	-0.5577*** (-4.34)	-5.3542*** (-4.05)	0.4539 (1.40)	-0.5349*** (-4.75)	-3.6339*** (-3.09)	0.0672 (0.23)
MSI 1	0.0086 (0.31)	0.6501** (2.28)	-0.1967*** (-2.82)			
MSI 2				-0.0023 (-0.13)	-0.1720 (-0.91)	-0.0679 (-1.46)
XE	-0.0088*** (-6.63)	-0.0653*** (-4.74)	-0.0042 (-1.25)	-0.0088*** (-6.51)	-0.0642*** (-4.52)	-0.0028 (-0.82)
SE	0.0138** (2.47)	0.0785 (1.36)	0.0577*** (4.07)	0.0142*** (2.58)	0.1038* (1.81)	0.0483*** (3.42)
DB	-0.0047** (-2.49)	-0.0725*** (-3.66)	0.0241*** (4.98)	-0.0041*** (-2.62)	-0.0289* (-1.73)	0.0175*** (4.26)
CAPAST	0.0153 (0.63)	-1.1090*** (-4.41)	0.0187 (0.30)	0.0148 (0.60)	-1.1420 (-4.39)	-0.0039 (-0.06)
BR	-0.0014* (-1.80)	-0.0335*** (-3.97)	0.0087*** (4.24)	-0.0014 (-1.46)	-0.0309*** (-3.02)	0.0116*** (4.62)
PCI	-1.27e-06 (-0.99)	-0.00001 (-1.49)	-0.00001*** (-3.92)	-1.44e-06 (-1.17)	-0.00003** (-2.54)	-0.00001*** (-3.31)
WAGE	-0.00002 (-0.30)	-0.00057 (-0.64)	-0.00027 (-1.28)	-0.00003 (-0.46)	-0.0015* (-1.77)	-0.00016 (-0.76)
OWNER	-0.00132 (-1.25)	-0.010099 (-0.93)	0.00918*** (3.45)	-0.0014 (-1.47)	-0.0210** (-2.01)	0.0112*** (4.38)
THREE	0.00021 (0.14)	-0.0269* (-1.75)	-0.00006 (-0.02)	0.00065 (0.49)	0.0056 (0.40)	-0.0045 (-1.34)
R^2	0.412	0.492	0.315	0.412	0.477	0.289

Notes: Two empirical models are considered: fixed effect models and random effect models.   Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1% .

Table 4. Results of the necessary conditions related to the validity of the scale efficiency hypothesis

	CR3	HERF	MSI 1	MSI 2
Intercept	0.7713*** (14.77)	0.1867*** (17.15)	-0.4211*** (-6.95)	-0.5814*** (-7.96)
XE	0.0053 (1.13)	0.0010 (1.05)	-0.0041 (-0.71)	0.0128* (1.91)
SE	-0.0127 (-0.65)	-0.00037 (-0.09)	0.0431** (2.23)	0.0024 (0.10)
DB	-0.0165*** (-3.97)	-0.0039*** (-4.51)	0.0417*** (9.12)	0.0520*** (9.16)
CAPAST	-0.0107 (-0.12)	-0.01597 (-0.89)	-0.1616* (-1.73)	-0.3359*** (-2.91)
BR	0.0009 (0.33)	0.00012 (0.21)	0.00011 (0.03)	0.0345*** (8.69)
PCI	-0.000025*** (-6.78)	-5.41e-06*** (-7.04)	-0.000027*** (-7.65)	-0.00002*** (-4.71)
WAGE	0.000096 (0.34)	-0.000011 (-0.20)	-0.00097** (-3.56)	-0.0014*** (-3.90)
OWNER	-0.00428 (-1.24)	-0.00092 (-1.28)	-0.0153* (-1.78)	-0.01001* (-1.79)
THREE	0.0109*** (3.03)	0.0025*** (3.38)	0.0450*** (5.16)	0.0463*** (8.02)
R^2	0.821	0.849	0.926	0.900

Notes: Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Regression of the variables profit and price over concentration, market share, technical efficiency and scale efficiency variables

	ROA$_{(1)}$	ROE$_{(1)}$	NIM$_{(1)}$	ROA$_{(2)}$	ROE$_{(2)}$	NIM$_{(2)}$
Intercept	0.1340*** (3.70)	1.7559*** (5.01)	-0.3514*** (-4.41)	0.1115*** (3.62)	1.0154*** (3.38)	-0.2625*** (-3.81)
CR3	-0.1183*** (-3.92)	-1.1549*** (-3.96)	0.0870 (1.31)	-0.1099*** (-4.07)	-0.7870*** (-2.99)	0.0211 (0.35)
HERF						
MSI 1	0.0040 (0.13)	0.6178** (2.05)	-0.1892*** (-2.76)			
MSI 2				-0.0252 (-1.24)	-0.3323* (-1.67)	-0.0786* (-1.72)
TE	-0.0033 (-0.45)	-0.0345 (-0.47)	0.0130 (0.79)	-0.0025 (-0.34)	-0.0186 (-0.25)	0.0138 (0.82)
SE	0.0082 (0.74)	0.0464 (0.43)	0.0381 (1.56)	0.0074 (0.68)	0.0556 (0.51)	0.0286 (1.15)
DB	-0.0053** (-2.48)	-0.0768*** (-3.70)	0.0235*** (4.98)	-0.0036** (-1.98)	-0.0263 (-1.45)	0.0184*** (4.42)
CAPAST	-0.0079 (-0.29)	-1.2625*** (-4.75)	-0.0027 (-0.05)	-0.0141 (-0.51)	-1.3541*** (-4.99)	-0.0180 (-0.29)
BR	-0.00063 (-0.69)	-0.0273*** (-3.04)	0.0091*** (4.49)	0.000084 (0.08)	-0.0201* (-1.88)	0.0122*** (5.00)
PCI	-5.73e-07 (-0.38)	-0.000014 (-0.99)	-0.000013*** (-3.95)	-1.05e-06 (-0.74)	-0.000030** (-2.21)	-0.000010*** (-3.42)
WAGE	0.000038 (0.38)	-0.000080 (-0.08)	-.00022 (-1.01)	-9.25e-06 (-0.09)	-0.0013 (-1.41)	-0.00013 (-0.61)
OWNER	-0.00047 (-0.39)	-0.00409 (-0.35)	0.0099*** (3.75)	-0.00081 (-0.71)	-0.0164 (-1.47)	0.0117*** (4.56)
THREE	0.00090 (0.52)	-0.0219 (-1.31)	-0.00013 (-0.04)	0.0021 (1.44)	0.0167 (1.15)	-0.0041 (-1.25)
R^2	0.219	0.407	0.310	0.227	0.402	0.289

Notes: Two empirical models are considered: fixed effect models and random effect models.   Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. (Continued): Regression of the variables profit and price over concentration, market share, technical efficiency and scale efficiency variables

	ROA(3)	ROE(3)	NIM(3)	ROA(4)	ROE(4)	NIM(4)
Intercept	0.1693*** (4.23)	2.0343*** (5.24)	-0.3700*** (-4.16)	0.1357*** (4.10)	1.1488*** (3.53)	-0.2617*** (-3.49)
CR3						
HERF	-0.6472*** (-4.42)	-6.0334*** (-4.25)	0.4449 (1.37)	-0.5773*** (-4.50)	-3.9393*** (-3.12)	0.0844 (0.29)
MSI 1	0.01710 (0.54)	0.7143** (2.33)	-0.1954*** (-2.79)			
MSI 2				-0.0232 (-1.15)	-0.3243 (-1.63)	-0.0781** (-1.71)
TE	-0.0038 (-0.51)	-0.0374 (-0.52)	0.0131 (0.80)	-0.0029 (-0.39)	-0.020006 (-0.27)	0.0137 (0.82)
SE	0.0096 (0.87)	0.0584 (0.55)	0.0373 (1.52)	0.0091 (0.83)	0.0657 (0.61)	0.0285 (1.15)
DB	-0.0064*** (-2.94)	-0.0857*** (-4.00)	0.0241*** (4.91)	-0.0042** (-2.28)	-0.0292 (-1.60)	0.0183*** (4.34)
CAPAST	-0.0166 (-0.61)	-1.3446*** (-5.09)	0.0032 (0.05)	-0.0216 (-0.79)	-1.4071*** (-5.21)	-0.0167 (-0.27)
BR	-0.00062 (-0.68)	-0.0273*** (-3.06)	0.0092*** (4.50)	-8.77e-06 (-0.01)	-0.0206* (-1.93)	0.01228*** (4.99)
PCI	-7.25e-07 (-0.49)	-0.000015 (-1.06)	-0.000013*** (-3.94)	-1.37e-06 (-0.97)	-0.000032** (-2.31)	-0.000011*** (-3.41)
WAGE	0.000033 (0.33)	-0.00015 (-0.17)	-0.00021 (-0.98)	-0.000024 (-0.25)	-0.0014 (-1.53)	-0.00013 (-0.59)
OWNER	-0.00036 (-0.30)	-0.0032 (-0.28)	0.0099*** (3.73)	-0.00085 (-0.75)	-0.0165 (-1.49)	0.0117*** (4.55)
THREE	0.00068 (0.40)	-0.0234 (-1.41)	-0.000043 (-0.01)	0.0023 (1.58)	0.0178 (1.22)	-0.0041 (-1.25)
R²	0.239	0.416	0.311	0.244	0.405	0.289

Notes: Two empirical models are considered: fixed effect models and random effect models.   Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Regression of the variables profit and price over concentration, market share, technical efficiency, scale efficiency and allocative efficiency variables

	ROA(1)	ROE(1)	NIM(1)	ROA(2)	ROE(2)	NIM(2)
Intercept	0.1025*** (3.18)	1.5247*** (4.61)	-0.3677 *** (-4.58)	0.1028*** (3.77)	0.9515*** (3.37)	-0.2658*** (-3.85)
CR3	-0.0953*** (-3.56)	-0.9860*** (-3.59)	0.0990 (1.49)	-0.0966*** (-4.03)	-0.6897*** (-2.78)	0.0260 (0.43)
HERF						
MSI 1	-0.0059 (-0.22)	0.5445* (1.93)	-0.1944*** (-2.84)			
MSI 2				-0.0060 (-0.33)	-0.1920 (-1.02)	-0.0715 (-1.54)
TE	0.00024 (0.04)	-0.0079 (-0.12)	0.0149 (0.90)	0.00035 (0.05)	0.0025 (0.04)	0.0149 (0.88)
SE	0.0071 (0.73)	0.0380 (0.38)	0.0375 (1.54)	0.0067 (0.69)	0.050007 (0.49)	0.0283 (1.14)
AE	-0.0091*** (-6.65)	-0.0667*** (-4.76)	-0.0047 (-1.39)	-0.0090*** (-6.51)	-0.0659*** (-4.60)	-0.0033 (-0.95)
DB	-0.0032* (-1.67)	-0.0612*** (-3.11)	0.0246*** (5.15)	-0.0031* (-1.93)	-0.0226 (-1.33)	0.0185*** (4.45)
CAPAST	0.0236 (0.96)	-1.0307*** (-4.08)	0.0136 (0.22)	0.0219 (0.87)	-1.0902*** (-4.18)	-0.0047 (-0.07)
BR	-0.0014* (-1.76)	-0.0333*** (-3.92)	0.0087*** (4.25)	-0.0012 (-1.26)	-0.0298*** (-2.91)	0.0117*** (4.69)
PCI	-1.38e-06 (-1.04)	-0.000020 (-1.50)	-0.000013*** (-4.08)	-1.37e-06 (-1.08)	-0.00003** (-2.53)	-0.000011*** (-3.45)
WAGE	-9.05e-06 (-0.10)	-0.00042 (-0.47)	-0.00024 (-1.12)	-0.000012 (-0.14)	-0.0013 (-1.52)	-0.00013 (-0.61)
OWNER	-0.0013 (-1.22)	-0.0102 (-0.93)	0.0095*** (3.58)	-0.0012 (-1.26)	-0.0198* (-1.89)	0.0115*** (4.48)
THREE	0.00036 (0.24)	-0.0258* (-1.66)	-0.0004 (-0.11)	0.00040*** (0.30)	0.0039 (0.28)	-0.0048 (-1.41)
R²	0.400	0.486	0.319	0.400	0.477	0.293

Notes: Two empirical models are considered: fixed effect models and random effect models. Based on the results of the Haussman test, tests of conditions of

competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6 (Continued): Regression of the variables profit and price over concentration, market share, technical efficiency scale efficiency and allocative efficiency variables

	ROA(3)	ROE(3)	NIM(3)	ROA(4)	ROE(4)	NIM(4)
Intercept	0.1354*** (3.82)	1.7844*** (4.87)	-0.3877*** (-4.33)	0.1265*** (4.34)	1.0816*** (3.54)	-0.2651*** (-3.53)
CR3						
HERF	-0.5399*** (-4.17)	-5.2442*** (-3.92)	0.5009 (1.53)	-0.5197*** (-4.58)	-3.5168*** (-2.96)	0.1055 (0.36)
MSI 1	0.0066 (0.24)	0.6370** (2.23)	-0.2008*** (-2.87)			
MSI 2				-0.0039 (-0.22)	-0.1826 (-0.97)	-0.0710 (-1.53)
TE	-0.00025 (-0.04)	-0.0110 (-0.16)	0.0150 (0.91)	-0.000075 (-0.01)	0.00086 (0.01)	0.0148 (0.88)
SE	0.0082 (0.85)	0.0485 (0.49)	0.0366 (1.50)	0.0083 (0.86)	0.0594 (0.59)	0.0282 (1.13)
AE	-0.0090*** (-6.71)	-0.0665*** (-4.78)	-0.0047 (-1.39)	-0.0090*** (-6.61)	-0.0660*** (-4.63)	-0.0033 (-0.94)
DB	-0.0043** (-2.19)	-0.0696*** (-3.43)	0.0252*** (5.09)	-0.0037** (-2.28)	-0.0255 (-1.49)	0.0185*** (4.38)
CAPAST	0.0161 (0.66)	-1.1025*** (-4.38)	0.0204 (0.33)	0.0152 (0.62)	-1.1363*** (-4.37)	-0.0032 (-0.05)
BR	-0.0014* (-1.76)	-0.0332*** (-3.95)	0.0087*** (4.25)	-0.0013 (-1.37)	-0.0304*** (-2.97)	0.0117*** (4.68)
PCI	-1.53e-06 (-1.17)	-0.000021 (-1.58)	-0.000013*** (-4.06)	-1.70e-06 (-1.36)	-0.000034*** (-2.64)	-0.000011*** (-3.45)
WAGE	-0.000011 (-0.13)	-0.00048 (-0.54)	-0.00023 (-1.09)	-0.000025 (-0.29)	-0.0014 (-1.64)	-0.00013 (-0.59)
OWNER	-0.0012 (-1.13)	-0.0093 (-0.86)	0.0094*** (3.55)	-0.0013 (-1.33)	-0.0200* (-1.91)	0.0115*** (4.47)
THREE	0.00015 (0.10)	-0.0273* (-1.76)	-0.00032 (-0.08)	0.00058 (0.44)	0.0049 (0.36)	-0.0048 (-1.41)
R^2	0.417	0.494	0.320	0.417	0.480	0.293

Notes: Two empirical models are considered: fixed effect models and random effect models. Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Quiet Life hypothesis test

	XE(1)	XE(2)	XE(3)	XE(4)	TE(1)	TE(2)	TE(3)	TE(4)
Intercept	-1.4630 (-0.87)	-0.3364 (-0.22)	-1.1414 (-0.59)	-0.1802 (-0.11)	2.5378*** (3.74)	2.2050*** (3.43)	2.5180*** (3.26)	2.0996*** (2.97)
CR3	1.0867 (0.86)	0.7936 (0.66)			-1.2810** (-2.26)	-0.8961* (-1.73)		
HERF			3.2533 (0.51)	2.6032 (0.44)			-5.2502* (-1.86)	-3.2554 (-1.29)
MSI1	-0.4120 (-0.31)		-0.2432 (-0.18)		1.5008*** (2.56)		1.4619** (2.42)	
MSI2		1.5046 (1.55)		1.5422 (1.58)		0.5447 (1.32)		0.5116 (1.23)
DB	0.1550 (1.51)	0.0625 (0.66)	0.1397 (1.27)	0.0563 (0.58)	-0.0890** (-2.15)	-0.0661* (-1.69)	-0.0860** (-1.98)	-0.0613 (-1.53)
CAPAST	-1.4720 (-1.05)	0.2982 (0.20)	-1.4334 (-1.00)	0.3421 (0.23)	0.3968 (0.73)	0.5254 (0.88)	0.3188 (0.58)	0.4685 (0.78)
BR	-0.0588 (-1.23)	-0.1173* (-1.94)	-0.0583 (-1.21)	-0.1183* (-1.95)	0.0204 (1.12)	-0.0088 (-0.36)	0.0202 (1.10)	-0.0079 (-0.32)
PCI	-0.000031 (-0.51)	-7.82e-07 (-0.01)	-0.000035 (-0.56)	-5.00e-06 (-0.08)	0.000056** (2.01)	0.000049* (1.82)	0.000059** (2.08)	0.000053* (1.93)
WAGE	-0.0102** (-2.36)	-0.0081* (-1.85)	-0.0098** (-2.25)	-0.0079* (-1.81)	-0.0039** (-2.08)	-0.0048** (-2.54)	-0.0042** (-2.23)	-0.00503*** (-2.65)
OWNER	-0.0674 (-0.37)	-0.0508 (-0.55)	-0.0677 (-0.37)	-0.0520 (-0.56)	0.0132 (0.54)	-0.0110 (-0.37)	0.0137 (0.56)	-0.01006 (-0.33)
THREE	-0.0778 (-0.41)	-0.1630 (-1.57)	-0.0803 (-0.43)	-0.1620 (-1.56)	-0.0434 (-1.29)	0.006006 (0.17)	-0.0426 (-1.25)	0.0055 (0.15)
R^2	0.100	0.159	0.099	0.159	0.130	0.083	0.121	0.078

Notes: Two empirical models are considered: fixed effect models and random effect models. Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7 (Continued): Quiet Life hypothesis test

	SE $_{(1)}$	SE $_{(2)}$	SE $_{(3)}$	SE $_{(4)}$	AE $_{(1)}$	AE $_{(2)}$	AE $_{(3)}$	AE $_{(4)}$
Intercept	1.6481***	1.0546**	1.5656***	0.8919*	-3.0557**	-1.5184	-2.8150	-1.2624
	(3.55)	(2.45)	(2.96)	(1.89)	(-1.99)	(-1.06)	(-1.58)	(-0.79)
CR3	-0.7292*	-0.3190			2.0960*	1.4470		
	(-1.92)	(-0.91)			(1.82)	(1.32)		
HERF			-2.6935	-0.5893			7.7367	4.8885
			(-1.42)	(-0.34)			(1.31)	(0.91)
MSI1	1.1407***		1.0854***		-1.3479		-1.1772	
	(2.89)		(2.66)		(-1.10)		(-0.93)	
MSI2		0.2468		0.2158		0.8706		0.9359
		(0.89)		(0.77)		(0.97)		(1.04)
DB	-0.03643	0.0040	-0.0318	0.0096	0.2509***	0.1356	0.2373**	0.1249
	(-1.28)	(0.16)	(-1.07)	(0.36)	(2.67)	(1.54)	(2.35)	(1.38)
CAPAST	0.3408	0.3940	0.2982	0.3834	-1.7477	-0.5769	-1.6095	-0.4908
	(0.91)	(0.98)	(0.79)	(0.95)	(-1.35)	(-0.43)	(-1.22)	(-0.36)
BR	0.0183	0.0065	0.0181	0.0074	-0.0562	-0.0929*	-0.0550	-0.0945*
	(1.44)	(0.40)	(1.42)	(0.46)	(-1.28)	(-1.65)	(-1.25)	(-1.67)
PCI	0.000019	5.24e-06	0.000020	8.79e-06	-0.000083	-0.000043	-0.000088	-0.000050
	(1.01)	(0.28)	(1.10)	(0.47)	(-1.46)	(-0.75)	(-1.54)	(-0.87)
WAGE	-0.0014	-0.0024*	-0.0016	-0.0026**	-0.0079**	-0.0053	-0.0073*	-0.0049
	(-1.10)	(-1.94)	(-1.25)	(-2.04)	(-2.00)	(-1.33)	(-1.84)	(-1.23)
OWNER	0.0251	0.0109	0.0253*	0.0118	-0.0561	-0.03564	-0.0564	-0.0377
	(1.41)	(0.57)	(1.42)	(0.61)	(-0.31)	(-0.35)	(-0.31)	(-0.37)
THREE	-0.0452*	-0.0081	-0.0441***	-0.8919	-0.0689	-0.1595	-0.0724	-0.1578
	(-1.90)	(-0.35)	(-1.85)	(-0.39)	(-1.99)	(-1.44)	(-1.58)	(-1.42)
R²	0.111	0.0565	0.103	0.0562	0.100	0.140	0.100	0.140

Notes: Two empirical models are considered: fixed effect models and random effect models.   Based on the results of the Haussman test, tests of conditions of competitions are run with random effects. Figures in parentheses are t- statistics. *significant at 10%; ** significant at 5%; *** significant at 1%.