A PERFORMANCE COMPARISON BETWEEN STATE-OWNED, MIXED AND PRIVATE BANKS IN ALGERIA

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ABSTRACT

While an important effort has been dedicated in explaining the differences in terms of performance between state-owned, mixed and private enterprises, some nuances still remain. In this study, we compare Algerian banks' performance according to their ownership structure using Data Envelopment Analysis (DEA).

We find that private banks in average perform more efficiently than their public and mixed counterparts. Furthermore, our results indicate that public and mixed banks have a weak ability in terms of resource usage while private banks mostly operate at a non-suitable size. Our aim is to contribute to the broader area of firms' performance while providing relevant insights to Algerian policy makers and regulators.

KEYWORDS:

Banking ownership; performance measurement; Data Envelopment Analysis, ownership structure.

JEL CLASSIFICATION: G21, H21, L33.

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ETUDE COMPARATIVE DE LA PERFORMANCE DES BANQUES PUBLIQUES, MIXTES ET PRIVÉES EN ALGÉRIE.

RÉSUMÉ :

Un effort important a été consacré pour expliquer les différences de performance entre les entreprises publiques, mixtes et privées, cependant, certaines nuances demeurent. Dans cette étude, nous comparons les performances des banques algériennes en fonction de leur structure de propriété à l'aide de l'Analyse par Enveloppement des Données, plus communément connue sous son appellation anglophone Data Enveloppement Analysis (DEA). Nous constatons que les banques privées sont en moyenne plus performantes que leurs homologues publics et mixtes. Additivement, nos résultats indiquent que les banques publiques et mixtes pâtissent d'une faible opacité d'optimisation de leurs ressources tandis que les banques privées opèrent généralement à une taille inappropriée. Notre objectif est de contribuer au domaine plus large de la théorie de la performance des entreprises tout en fournissant des informations pertinentes à disposition des décideurs politiques et des régulateurs Algériens.

MOTS CLÉS:

Actionnariat bancaire; mesure de la performance; Analyse par Enveloppement des Données, structure de propriété.

JEL CLASSIFICATION: G21, H21, L33.

دراسة مقارنة لأداء البنوك العامة، المختلطة والخاصة في الجزائر

ملخص

في حين تم تكريس جهد مهم لشرح الاختلافات من حيث الأداء بين الشركات العمومية، المختلطة والخاصة إلا أنها لا تزال بعض الفروق الدقيقة في هذه الدراسة، قارنا أداء البنوك الجزائرية وفقًا لهيكل ملكيتها باستخدام تحليل بيانات التغليف. نجد أن البنوك الخاصة فيا لمتوسط تؤدي أداء أكثر كفاءة من نظيراتها العمومية والمختلطة، علاوة على ذلك، تشير نتائجنا إلى أن البنوك العمومية والمختلطة لديهن قدرة ضعيفة من حيث استخدام الموارد بينما تعمل البنوك الخاصة في الغالب بحجم غير مناسب. هدفنا هو المساهمة في المجال الأوسع لنظرية أداء الشركات مع توفير أفكار مهمة للسياسيين والهيئات التنظيمية

كلمات مفتاحية:

الملكية المصرفية .مقياس الاداء؛ تحليل مغلف البيانات ، هيكل الملكية.

تصنيف جال: .G21, H21, L33

1- INTRODUCTION

While a large body of literature has examined the impact of equity structure on firm performance, the empirical evidence has provided mixed results. Although one may be skeptical about the performance of State-Owned Enterprises (SOEs) and their ability to achieve optimal economic results, evidence lends only limited support to the hypothesis that SOEs are inherently less efficient than their private counterparts (Boardman and Vining, 1989; Toninelli, 2000). Moreover, the recent financial crisis weakened this dogma (Mrad and Hallara, 2012).

On the one hand, it is widely admitted that state ownership may have a negative repercussion on performance. Toninelli (2000) shows that public ownership is often correlated with politicization, inefficiency and waste of resources. Wei and Varela (2003) provide evidence from China's newly privatized firms that state equity ownership has a negative effect on firms' value. Boardman and Vining (1989) compare the performance of the 500 largest mixed non-US industrial firms. They provide evidence that state-owned and *mixed* enterprises perform substantially worse than similar private companies. On the other hand, many researchers find government ownership to be beneficial. Lu and Yao (2006) show that state equity enhances group-affiliated companies' performance when they adopt higher degrees of diversification. Moreover, Sun Qian et al. (2003) point out that government ownership has a positive impact on partially privatized state-owned enterprises in China while Andersonet al., (2007) find the same evidence in Mongolia.

Furthermore, it is worth noting that several studies call for mixed results. Indeed, Zeitun and Tian (2007) show that even though reducing government ownership can increase performance, it may also cause some companies to go bankrupt, at least in the short term. Additionally, Ng et al. (2009) point out that there is no optimal balance between state and private ownership as they observe mixed controlled firms performing substantially poorer.

Consequently, although ownership is an important determinant of performance, regarding the conflicting results, the relationship between ownership structure and performance remains partially unclear. We

aim to contribute to this debate by comparing banks' performance in the Algerian Banking System (ABS) according to their ownership.

To the best of our knowledge, two recent studies investigated banks' efficiency within the Algerian Banking System. Hacini and Dahou (2018a) employed two radial DEA models (CCR and BCC) to compare the efficiency of foreign versus domestic banks in Algeria between 2000 and 2012. They find foreign banks to be more efficient than their domestic counterparts due to their superior scale efficiency. They also point out that the ABS could improve its technical efficiency by 23%. Benkheznadji (2018) used a BCC model to evaluate a sample of Algerian banks within the period 2012-2016. Although the period is large, she included only 07 banks with 02 input and 01 output factors in the analysis, which may considerably affect the accuracy of the model leading to an important number of efficient units. Our analysis expands the two previous applications by considering a relatively significant sample and by analyzing the efficiency of each bank.

2- METHODOLOGY

The financial system in Algeria is dominated by the Algerian Banking System which counts 20 banks – 6 SOBs, 13 private banks and only 1 bank with mixed capital. Despite the superiority of the private banks in the number, SOBs have the lion share in terms of banking activities due mainly to a favorable national legislation. Indeed, by the end of 2015 the public banks hold 87.2% of the total banking assets with a network composed of 1123 branches against only 346 private branches, mainly located in the north of the country (Hacini and Dahou, 2018b). Following the recent significant drawback of oil prices, Algerian banks encountered a tremendous pressure on their liquidity even though they remain adequately capitalized with an overall solvency ratio of 19.6%, and profitable with an overall return on assets of 2% (IMF, 2018).

In order to conduct our research, we employ a linear programming technique, the Data Envelopment Analysis (DEA). DEA is a non-parametric linear programing technique that measures the relative efficiency of a set of homogeneous Decision-Making Units (DMUs)

that use an identical variety of inputs to produce an identical variety of outputs. While the application of DEA is not limited to banking it is the most widely operational research technique used to assess banking performance(Fethi and Pasiouras, 2010). The DEA approach differs whether we're considering banking institutions or bank branches as DMUs. Due to an easier availability of data, the majority of studies focus on banks at the institutional level. Indeed, Paradi and Zhu (2013) observe that among 257 DEA applications in the banking industry between 1985 and 2011, 195 evaluated performance at the institutional level.

Several DEA models have been applied in the banking sector however three main approaches appear most often (Paradi et al., 2011):

- The production model,
- The profitability model,
- The intermediation model.

The production and the intermediation model capture the two banks' primary role in the financial system (Paradi et al., 2018). The production approach measures how a bank produces transactions and related services for customers based on the use of capital and labor while the intermediation approach is interested in the bank as a financial intermediary that transfers funds from savers with a surplus to investors requiring funds. In other words, the intermediation model measures how a bank makes loans and investments based on the monetary assets it gathers(Paradi et al., 2018, 2011). Finally, the profitability approach considers banks' efficiency in maximizing revenues and minimizing expenses. According to Berger et al. (1997), the production approach is better suited for measuring the efficiency of branches while the intermediation approach is more adapted for banks' comparison. Moreover, due to a greater difficulty in obtaining the transaction flow required to examine production efficiency, the intermediation approach has been more widely applied (Fethi and Pasiouras, 2010).

The Data Envelopment Analysis offers several interesting properties. First of all, unlike parametric models, DEA doesn't assume any production technology. It measures efficiency by estimating a

production technology from the observed historical or cross-sectional data on reel production activities(Bogetoft and Otto, 2010). Moreover, unlike regression, DEA optimizes on each individual DMU with an objective of calculating a discrete piecewise frontier determined by a set of Pareto-efficient DMUs (Charnes et al., 1994). DEA measures the efficiency of a DMU in comparison to other DMUs within an organization or in similar industry that's why the efficiency measure obtained is called a relative efficiency (Vafaee Najar et al., 2018). In addition, DEA determines a set of peer-units against which the inefficient DMUs can learn to improve. Therefore, it provides a coherent improvement target for each inefficient DMU. Finally, DEA enables the study of organizations with multidimensional processes which include several inputs against several outputs.

In our Study, we decided to employ the two most widely used DEA models. We rely on the work of Paradi et al. (2018) to describe the DEA mathematical formulation.

1.1- The CCR model

The CCR model initially developed by Charnes et al. (1978) considers the i-th DMU and seeks as much as possible to radially contract its inputs (in the case of an input-oriented model) or radially expand its outputs (output-oriented model) while still remaining within the feasible production set. Suppose we have m input variables with a marginal weights vector $v_i (i = 1, \dots, m)$, s output variables with a marginal weights vector $u_r\ (r = 1, \dots, s)$, and n DMUs, the envelopment form of the input-oriented model is as follow:

$$min_{\theta,\lambda}\theta \qquad (1)$$

Subject to

$$\theta x_o - X\lambda \geq 0$$
$$Y\lambda \geq y_o$$
$$\lambda \geq 0$$

where x_o and y_o the column vectors of inputs and outputs respectively for DMU_o. $X$and$Y$ are the matrices of input and output respectively for all DMUs. λ is the column vector of intensity variables denoting linear combinations of DMUs, and the objective function θ is a radial contraction factor that can be applied to DMU_o's inputs. We

measure the efficiency of each DMU once, thus we need n optimizations. The optimal value of θ, denoted θ^* is the efficiency score of the DMU in consideration. If θ^* is equal to 1, then the DMU_o is evaluated as fully efficient under the assumption of zero slacks.

1.2- The BCC model

Banker et al. (1984) developed a radial DEA model where the production technology exhibits Variable Returns to Scale (VRS). They introduced a new constraint in the CCR model that separated scale efficiency from technical efficiency. The envelopment for of the input-oriented version of the model is given as follow:

$$min_{\theta_B,\lambda}\theta_B \qquad (2)$$

Subject to

$$\theta_B x_o - X\lambda \geq 0$$
$$Y\lambda \geq y_o$$
$$e_n\lambda = 1$$
$$\lambda \geq 0$$

The $e_n\lambda = 1$ constraint ensures that an inefficient firm is only benchmarked against firms of a similar size.

In the CCR model, the DMUs are assumed to be operating at constant returns to scale (CRS), that is when inputs are increased, we observe a proportionate rise in outputs. In this case, the scale of operations does not influence the efficiency of the DMU. Conversely, VRS implies a disproportionate rise or fall in outputs when inputs are increased. Scale efficiency measures can be obtained for each DMU by conducting both a CCR and a BCC analysis and decomposing the Technical Efficiency (TE) scores obtained from the CCR into two components, one due to Scale Efficiency (SE) and one due to Pure Technical Efficiency (PTE) (i.e., VRS Technical Efficiency). Decomposing TE helps to determine whether a DMU is operating at Optimal Returns to Scale (ORS), Increasing Returns to Scale (IRS) or Decreasing Returns to Scale (DRS). This is done through an additional DEA problem with Non-Increasing Returns to Scale (NIRS) imposed. By substituting the $e_n\lambda = 1$ restriction with $e_n\lambda \leq 1$, for a particular DMU if the NIRS TE score equals the VRS TE score, then that DMU must be operating under DRS. Alternatively, if the NIRS TE differs from VRS TE, then the DMU

operates under IRS. Finally, When VRS TE equals CRS TE, the DMU operates at ORS (Avkiran, 1999; J. Coelli et al., 2005).

1.3- Banks' inputs and outputs determination

Our study includes 13 banks, 7 have a total private ownership, 5 are SOBs and 1 bank has a mixed ownership. Due to the limited number of DMUs available, we restricted the total number of input and output variables to conserve the discretionary power of the analysis. In this context, we follow a general rule widely employed in DEA research (Paradi et al., 2018):

$$n \geq max\{m \times s, 3(m + s)\} \quad (3)$$

Where m, s and n are the number of inputs, outputs and DMUs respectively. Hence, our model involves 02 inputs and 01 output. From the bank's 2015 financial reports, we extracted and structured the following factors:

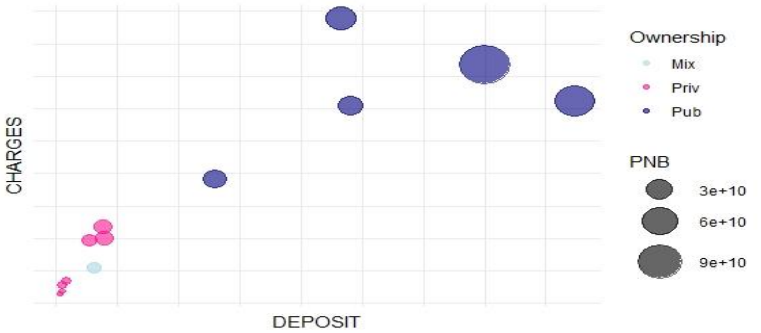
Table 1. **Input and output variables used in the analysis**

Output	Input
PNB: Net Banking Product	DEPOSIT: Total Customer Deposit
	CHARGES: General Operating Expenses (Including Salary Expenses)

Figure 1 exhibits the values of the variables used in our analysis. we observe that our banks form two distinct clusters. Private and mixed banks have a low volume of activity and a smaller size in comparison to their public counterparts which are significantly bigger. The BDL bank, located in the middle of Figure 1 could be apprehended as a middle-sized bank. Accordingly, the maximum of all our factors are attained by a public bank while all the minimums are observed at a private bank.

It is worth noting that the choice of the 2015 exercise is not random. Indeed, it is very hard to obtain the Algerian banks' financial report. Although the publication of their results is mandatory, few banks publish in a regular way. The 2015 exercise corresponds to the year when we find the greatest number of Algerian banks publishing their income statements and balance sheets.

Figure 1: **Three-dimensional representation of the banks' input and output factors according to their ownership structure**



Finally, we decided to employ an input-oriented model because we believe that Algerian banks have a better control over their resources. The DEA computations have been conducted using the *Benchmarking* package, developed by Bogetoft and Otto (2010) in the freeR software.

3- RESULTS AND DISCUSSION

Table 2 exhibits the Technical Efficiency (TE), the Pure Technical Efficiency (PTE), the Scale Efficiency (SE) and the Operating Scale (OS) for each bank under study. We observe that two banks are fully efficient: BNA and Trust Bank. They are efficient in managing their resources and operate at optimal scale. With a Technical Efficiency score of 33.22% the most inefficient bank is the CNEP bank which is a public bank. It operates under a Scale Efficiency of 99.96%, thus the source of its inefficiency lies in its weak ability in converting its inputs to outputs. Therefore, through a better resource management, CNEP Bank has a potential of improvement of 66.78% which is more than considerable.

Table 2. **Banks' TE, PTE, SE and OS.**

Bank	TE	PTE	SE	OS	Ownership Structure
Al Baraka	0.6351	0.6689	0.9495	IRS	Mixed
Al Salam	0.7940	1.0000	0.7940	IRS	Private
ABC	0.7563	0.7886	0.9591	IRS	Private
AGB	0.7145	0.9754	0.7325	DRS	Private
BADR	0.4448	0.5283	0.8420	DRS	Public
BDL	0.5226	0.5445	0.9597	DRS	Public
BEA	0.7038	0.7184	0.9797	IRS	Public
BNA	1.0000	1.0000	1.0000	CRS	Public
BNP	0.6901	0.9105	0.7579	DRS	Private
CNEP	0.3322	0.3323	0.9996	DRS	Public
FransaBank	0.6843	1.0000	0.6843	IRS	Private
SGA	0.8160	1.0000	0.8160	DRS	Private
Trust	1.0000	1.0000	1.0000	CRS	Private

The mixed bank – Al Baraka – is the fourth most inefficient bank with an overall TE of 63.51% and a PTE of 66.89%. In parallel, the most inefficient private bank is FransaBank which is mainly inefficient due to the loss incurred from not operating at the optimal scale size. In other words, FransaBank should increase its inputs and production scale in order to improve its overall efficiency.

Table 3. **Banks' mean TE, PTE and SE according to ownership.**

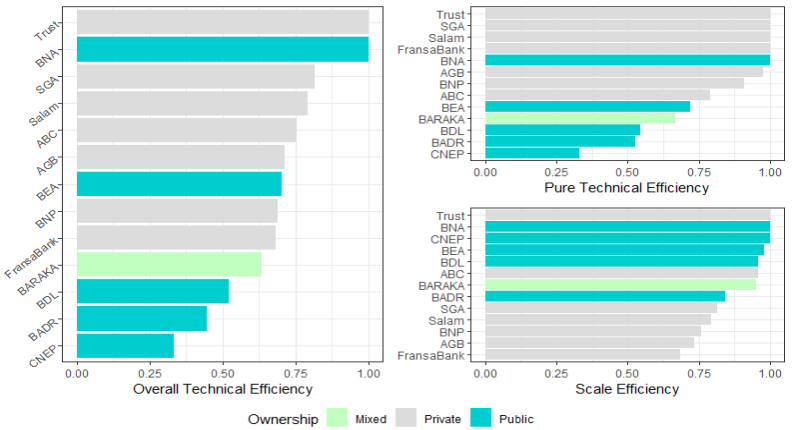
	TE	PTE	SE
Overall Mean	**0.699**	**0.805**	**0.883**
Public	0.600	0.625	0.957
Private	0.779	0.954	0.821
Mixed	0.635	0.669	0.949

From Figure 2 and Table 3, it's obvious that Private banks operate more efficiently. Indeed, with an average TE of 77.9% and PTE of 95.4%, they represent the most successful banks in terms of resource optimization. Nevertheless, they suffer from a lower scale efficiency in comparison to public and mixed banks. Therefore, private banks should consider rescaling their operational size. On the other hand, public and mixed banks operate in average almost at optimal scale, consequently they are mainly advised to focus on calibrating their inputs to the quantity of services provided. Finally, we observe that the ABS could improve its global technical efficiency by near 30% which is a significant improvement potential. Our results are close to

those obtained by Hacini and Dahou (2018a) who observe a potential of 20% in terms of technical efficiency's improvement.

The DEA methodology can be extremely beneficial for the Central Bank of Algeria as it represents the main governmental agency responsible for banking regulation. The Central Bank could use the DEA metrics in complementarity with other methodologies to monitor the efficiency's evolution among the ABS and intervene when things get critical. It is also an intuitive way to assess the impact of its regulation on the banking performance. Finally, it is also possible to manage banks' size by for example limiting the number of new branches opening when a bank operates at Decreasing Returns to Scale or conversely encouraging new branches establishment when a bank operates at Increasing Returns to Scale.

Figure 2. **Banks' TE, PTE and SE according to ownership**



4- CONCLUSION AND LIMITATIONS

In the present study we have employed an CCR and BBC models in order to compare Algerian banks' performance according to their equity structure. We have chosen to rely on the intermediation approach which assesses banks' performance according to the intermediation dimension. We find that private banks operate more efficiently in average than public and mixed banks. Decomposing the

Technical Efficiency into Pure Technical Efficiency and Scale Efficiency, we observe that the main source of inefficiency for private banks lie on their operating scale while the Public and Mixed banks are inefficient in converting their inputs to outputs. Our results are consistent with previous findings related to the specific aspect of public firms in terms of resource wasting, especially in developing countries. Due to the lack of data freely available, our analysis has some limitations. Firstly, we have considered one period of time – 2015 exercise. Further analysis could be conducted by incorporating several periods of time and analyzing performance evolution. In this context, the Malmquist Productivity Index in an interesting approach which can even disentangle the performance evolution from the technological shift and the efficiency improvement. Moreover, we have included 13 banks out of 21. A richer analysis would be obtained if all the banks operating in Algeria are within the scope of the DEA model. The regulator should encourage a more transparent financial disclosure's policy. Furthermore, other models such as the Stochastic Frontier Analysis (SFA) could have been employed in complementarity of the DEA technique. Finally, as mentioned above, DEA is a deterministic method in the way it doesn't assume any production technology. Nevertheless, this feature comes with a weakness. Indeed, DEA is highly sensitive to statistical noise such as measurement errors and sampling variation. In order"e to introduce a statistical consistency to the conventional DEA methodology, the Bootstrap DEA approach introduced by (Simar and Wilson, 1998)could be applied in order to obtain bias-corrected efficiency measures and confidence intervals.

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