Further Analysis of Bank Efficiency Correlates:

The   Nigerian Experience

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Abstract

All over the world, banks have been undergoing crisis, but the Nigerian experience has been hazardous to the country's financial sector stability. Against this scenery, this paper investigates some cost efficiency correlates of a set of fifteen deposit money banks in Nigeria over the period 2001-2008. Random effects Tobit regression was applied for estimating the correlates of cost efficiency obtained from Data Envelopment Analysis. The findings revealed net assets as a better index for measuring bank size-efficiency nexus other than total assets. Impacts of total assets, net assets, profitability, competition, indirect adoption of universal banking policy and non-listing of a bank on the stock exchange on bank's cost efficiency were non-linear at 95% confidence interval. Credit risk was found to be the most significant variable that negatively influenced efficiency in the model at 5% level, followed by foreign bank ownership that showed a positive effect on efficiency. Consequently, prompt oversight functions of the regulatory bodies, increased foreign banks participation, especially those that can bring international "best practices" to bear and good corporate governance are fundamental if an efficient banking system is to be attained in Nigeria.

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1 Introduction

Bank efficiency and its determinants are vital issues confronting the public and policy makers. The twin issues have become essential in transition countries that have been faced with one banking crisis or the other or incessantly faces crisis and those associated with frequent policy change and somersault. The regulatory authorities are often confronted with finding out whether inefficient banks operating in an economy will pose additional risks to the banking system and its safety net.

This is so because a key role of a country's bank regulators is to limit systemic risks, that is, the risk that the problem of a few banks could spread to many other banks that are otherwise liquid and solvent (Rao, 2002). When systemic risks are avoided or reduced, the money supply and the payment system are being protected from severe disruption thereby enhancing effectiveness of monetary policy. Stability in the financial sector and minimization of bank run tendencies are also achieved.

The lessons from the 2006-2010 global financial crises have reinforced the urgency for regulatory institutions to increase concerns over reduction or elimination of systemic risks in the financial sector. This, among other issues, has called for the need for regulations to be incentive compatible over time and across institutions, while balancing possible negative effects on innovation and efficiency.

In 2004, there was an onset of remarkable banking sector reforms in Nigeria. Arguably, the country's aim of becoming a financial hub in Africa; joining the league of top 20 economies in the world by the year 2020[3], providing one of the top 50 mega banks and developing a consistent strategy for the financial system are mirages if such mega banks are achieved by only consolidating the banks without addressing their efficiency level. Such policy could further lead to distress of inefficient and less productive banks irrespective of their status. Interestingly, since 2009, the Central Bank of Nigeria has continued to make emphasis on efficiency of the banking sector.

Common among some researchers and organizations is the adoption of accounting ratios for comparing efficiency of banks. Chen (2001) observed that such comparison is not appropriate unless the banks are nearly identical in term of product mix, bank size, market conditions, and other characteristics that can affect the costs of the banks. A major demerit of using financial ratios as performance evaluation index is its reliance on benchmark ratios and these benchmarks could be arbitrary and may mislead analysts (Yeh, 1996). Sherman and Gold (1985)

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[3] The Financial System Strategy (FSS 2020) or Vision 2020 is meant to achieve Goldman Sach's prediction that Nigeria and Egypt in Africa are among the next 11 countries that have the potential to be "BRIC like". The BRICs are the economies of Brazil, Russia, India and China.

noted that financial ratios do not capture the long- term performance, and it aggregates many aspects of performance such as operations, marketing and financing. Statistical based "efficient cost frontier" methods, either parametric or non-parametric have been adjudged to be a more appropriate technique (see for example, Berger et al., 2000, Jemric and Vujcic 2002, Coelli et al., 2005)[4].

This present study is peculiar to most previous studies in that it includes in its investigation, the impacts of stock exchange listing of banks and universal banking policy on cost efficiency. Research ground is also broadened in terms of comparing the role of net assets and total assets bank size yardsticks on efficiency. Following this introduction is the methodology in part two. Section three presents the econometric analysis and its interpretation. The policy implications are highlighted in the concluding remarks in section four.

2 Methodology

This paper adopts the two-stage method which involves solving a Data Envelopment Analysis (DEA) problem in a first-stage analysis, involving only the traditional inputs (x_i) and outputs (q_i). In the second stage, the efficiency scores (θ_i) for all banks i = 1,……..,n from the first stage are regressed upon the determining factors using censored (Tobit) regression. Simar and Wilson (2007) pointed out two major problems associated with estimates using this method.

First, θ_s are serially correlated in a complicated and unknown way, since they depend on the inputs and outputs of the first –stage analysis and also depend on the error term of the second stage regression. Thus, the error term depends on the first stage inputs and outputs of the intermediation process.

Second, this means that the error term of the censored regression is also correlated with the determining factors. In dealing with this problem, we applied the random effects Tobit regression based on maximum likelihood which makes correlation problems disappear asymptotically (see Delis and Papanikolaou, 2009).

The Tobit model or censored regression was first studied by Tobin (1958). Because he related his study to the literature on probit analysis, his model was nicknamed the tobit model (Tobin's probit) by Goldberger (1964). The merit of random effect model over fixed effect and between effect models is that its estimator is a weighted average of both fixed and between effects. If a researcher has reason to believe that some omitted independent variables may be constant overtime but vary between cases (that is, fixed effects) and others may be fixed

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[4] Coelli et al. (2005) gave a very robust explanation on frontier efficiency.

between cases but vary overtime (which is between effects), then he can include both types by using random effects (Princeton, 2007)[5]. The tobit model is stated as:

$$\theta_i = \beta' x + \mu_i, \quad \text{if} \quad \text{RHS} > 0 \quad \text{but not above 1}$$
$$\theta_i = 0, \qquad\qquad \text{otherwise} \tag{1}$$

where θ_i is efficiency score obtained by DEA analysis; β and x_i are vectors of unknown parameters and explanatory variables respectively μ_i are residuals that are independently and normally distributed with zero mean and common variance σ^2.

Explicitly, our tobit panel regression model is expressed as:

$$\theta_{it} = \beta_0 + \beta_1 TASSET_{it} + \beta_2 RISK_{it} + \beta_3 COMP_{it} + \beta_4 PBT_{it}$$
$$+ \beta_5 DUMFOR_{it} + \beta_6 DUMUNI_{it} + \beta_7 DUMNQ_{it} + \mu_{it} \tag{2}$$

and

$$\theta_{it} = \beta_0 + \beta_1 NASSET_{it} + \beta_2 RISK_{it} + \beta_3 COMP_{it} + \beta_4 PBT_{it}$$
$$+ \beta_5 DUMFOR_{it} + \beta_6 DUMUNI_{it} + \beta_7 DUMNQ_{it} + \mu_{it} \tag{3}$$

where
θ_{it} is the cost efficiency of the ith bank in period t obtained from DEA;
$TASSET_{it}$ is total assets of bank i in period t;
$RISK_{it}$ is credit risk (ratio of non-performing loans and advances to total loans and advances) of bank i in period t;
$COMP_{it}$ is competition (ratio of deposits of bank i in period t to total deposits of the sampled banks in period t);
PBT_{it} is profit before tax of bank i in period t;
$DUMFOR_{it}$ denotes dummy for foreign or domestic ownership of bank i in period t;
$DUMUNI_{it}$ is dummy for indirect or direct adoption of universal banking policy by bank i in period t;
$DUMNQ_{it}$ is dummy for non-listed or listed bank i in period t on the Nigerian Stock Exchange (NSE), and
$NASSET_{it}$ denotes net assets of bank i in period t.
All the data on these variables were obtained from the audited financial reports of 15 stable identity money deposits banks out of the 24 money deposit banks operating in the country as at the ending of year 2011. This selection was

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[5] Stata 9 software adopted for analysis in this paper is yet to have command for a conditional fixed-effect model, as there does not exist a sufficient statistic allowing the fixed effects to be conditioned out of the likelihood. However, the semi-parametric estimator for fixed effect tobit models developed by (Honore, 1993) gives unconditional fixed effects estimates that are biased.

necessary to allow for consistent analysis over the period 2001-2008 leading to a panel sample of 120 data points being analyzed[6].

Adopting the modified intermediation theory for identifying the preferred inputs and outputs, our input variables included deposits, fixed assets and number of employees while output variables were performing loans and advances, investments (short-term and long term) and liquid assets of the banks. The input prices included interest expenses, depreciation on fixed assets and personnel expenses. All the data that exceeded 12 months due to financial year alterations were prorated to 12 months except fixed assets and depreciation which are values as at the end of the bank's financial year.

3 Results and Discussion

The log likelihood of 6.7752 of model 2 on Table 1 and 7.3208 of model 3 on Table 2 show that both models are of good fit and that all the coefficients of the explanatory variables (total assets, net assets, profitability, competition, indirect adoption of universal banking policy and non-listing of a bank on the stock exchange) in the models are simultaneously different from zero at both 1% and 5% level. The Likelihood Ratio (LR) Chi-Square test is 24.17 for model 2 and 25.26 for model 3 with the p-value (i.e. probability of obtaining the chi-square statistic value) of 0.0005 and 0.0003 respectively, meaning that at least one of the regression coefficients in the model is significantly different from zero since both values are less than 0.05 or 0.01.

The Z-test shows that only the coefficient of risk (-0.4797) and foreign ownership dummy (0.0964) as well as constant term (0.9030) are statistically significant at 5% level. Given all the predictors in the model, the confidence interval provides an upper and lower range where the "true" coefficient may lie[7].

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[6] The sampled banks include Access Bank Plc, Afribank Plc, Diamond Bank Plc, Equitorial Trust Bank Plc, Fidelity Bank Plc, First Bank of Nigeria Plc, Guaranty Trust Bank Plc, Oceanic Bank International Plc, United Bank of Africa Plc, Union Bank of Nigeria Plc, Wema Bank Plc, Zenith International Bank Plc, Ecobank Nigeria Plc, Citibank Nigeria Limited and Standard Chartered Bank Nigeria Ltd. The last three were foreign banks while others were domestic. A bank is referred to as foreign bank if more than 50 per cent of its owners are foreigners; otherwise it is referred to as domestic. First City Monument Bank Plc and Intercontinental banks were dropped because they did not have accounting information for 2001 and 2004 respectively due to alteration in financial year.

[7] Since both models are fitted, either of them can be interpreted. But we adopted model 2 for interpreting all the predictors except net assets (in model 3).

Table 1: Estimated Random Effects Tobit Regression Coefficients of the
Efficiency Correlates (Model 2)

EFFI	Coefficient	Std. Error	Z	P>|Z|	[95% Conf. interval]
TASSET	-0.000000000026	0.000000000094	-0.28	0.779	-0.00000000021 0.00000000016
RISK	-0.4797	0.1506	-3.18	0.001	-0.7750 -0.1845
COMP.	0.1017	0.3638	0.28	0.780	-0.6114 0.8148
PBT	-0.0000000019	0.0000000029	-0.65	0.513	-0.0000000076 0.0000000038
DUMFOR	0.0964	0.0490	1.97	0.049	0.0004 0.1924
DUNUNI	0.0015	0.0504	0.03	0.977	-0.0973 0.1003
DUMNQ	0.0273	0.0478	0.57	0.567	-0.0663 0.1210
Constant	0.9030	0.0488	18.50	0.000	0.8073 0.9986

N = 120; Log Likelihood = 6.7752; LR Chi 2(6) = 24.17; Prob. > Chi 2 = 0.0005
Response Variable: Cost efficiency scores obtained using DEA.
Source: Author's Computation using STATA 9

Thus, we are 95% confident that the "true" coefficient of total assets lies between -0.00000000021 and 0.00000000016. This means that the relationship between total asset representing bank size and cost efficiency is very small and non-linear. That is, bank size increases efficiency to a certain point after which it decreases it. Similar findings have been obtained in the literature; for example, Fries and Taci (2005) for banks in 15 East European countries and Delis and Papanikolaou (2009) for banks in newly acceded European Union countries. This outcome can be traced to instability in the Nigerian system which has also extended to the banking sector. Largely, management of banks in Nigeria does not pursue stable policies. For example, they tend to cut costs in early period of reforms when bank sizes may be boosted and after some period they deviate to other ventures depending on the trend of the market and engage in "short cuts" to increase revenue and profits.

Table 2: Estimated Random Effects Tobit Regression Coefficients of the
Efficiency Correlates (Model 2)

EFFI	Coefficient	Std. Error	Z	P>|Z|	[95% Conf. interval]
NASSET	0.00000000052	0.00000000048	1.08	0.278	-0.00000000042 0.0000000015
RISK	-0.5330	0.1458	-3.66	0.000	-0.8187 -0.2473
COMP.	0.2236	0.3765	0.59	0.553	-0.5144 0.9616
PBT	-0.0000000049	0.0000000028	-1.76	0.079	-0.000000010 0.00000000057
DUMFOR	0.0957	0.0487	1.96	0.050	0.0002 0.1911
DUNUNI	-0.0119	0.0497	-0.24	0.812	-0.1093 0.0856
DUMNQ	0.0346	0.0472	0.73	0.463	-0.0579 0.1270
Constant	0.9017	0.0485	18.60	0.000	0.8067 0.9967

N = 120; Log Likelihood = 7.3208; LR Chi 2(6) = 25.26; Prob. > Chi 2 = 0.0003
Response Variable: Cost efficiency scores obtained using DEA.
Source: Author's Computation using STATA 9

So, they can grow bigger with increasing inefficiency. These findings are also true for net assets. On average, efficiency of the banks will lie between -0.00000000042 and 0.0000000015 due to a unit increase in net assets when other predictors are not on hold. Although, the impact of net asset on efficiency is also non-linear, the results show that net asset measurement of bank size may be a better index because its coefficient is more significant. Also, the insignificant infinitesimal negative impact of total assets and net assets on cost efficiency point to the fact that efficiency does not hinge on size but on some other factors such as operational structure, technology, quality of management (corporate governance and risk management) and staff quality.

Specifically, a unit increase in credit risk level reduces cost efficiency by 0.48 on average. This reduction in efficiency is significant and it is the most significant variable in the model. At 95% confidence interval, the "true" coefficient of credit risk lies in the range of -0.78 and -0.18 which connotes that

efficiency will fall within the range of 0.18 and 0.78 given the influence of other predictors. The negative impact of credit risk on efficiency and its high level of significance we found underscore the gravity of increasing credit risk contribution to bank failures in Nigeria. However, findings of past studies on this issue are mixed; for instance, while Hughes and Mester (1993) as well as Delis and Papanikolaou (2009) reported results similar to ours, Altunbas et al. (2000) suggest that efficiency is not very sensitive to credit risk. Findings will most likely be dependent on the nature of banking business in each country.

Given the other predictors, we are 95% confident that the "true" coefficient of competition lies within the range of -0.61 and 0.81. So, competition increases efficiency for a while after which it reduces it. That is, competition exhibits non-linear relationship with cost efficiency which negates our expectation. This can be attributed to unhealthy competition in deposit mobilization in the Nigerian banking market and instability of the banking market. The unhealthy competition brought about lip service to corporate governance, lapses in risk management, lack of professionalism and distortion of financial reports in the Nigerian banking market in the periods considered.

Similarly, at 95% confidence interval, the "true" coefficient of profit before tax lies within -0.0000000076 and 0.0000000038. It means that given other explanatory variables, the impact of profit before tax on efficiency is also non-linear and infinitesimal like the total assets and net assets. The non-linearity outcome contradicts our expectation and earlier findings of Sufian and Majid (2007) for Singaporean banks and Sufian and Noor (2009) for banks in Middle East/ North Africa and Asian countries that reveal a positive impact of profitability on efficiency. The reduction in efficiency as profit before tax increases outgrows the increase in efficiency. This may likely underscore the window dressing nature of annual reports of most banks in Nigeria. They often report bogus profits without necessarily being efficient.

Foreign ownership dummy is positive and significant at 5% level, confirming our expectation. An increase in foreign ownership by one unit raises cost efficiency from zero to 0.9994 whereas a unit increase in domestic ownership makes cost efficiency to be 0.9030 from zero. Therefore, foreign banks are more cost efficient than domestic banks. This finding is true for some developing countries and is consistent with numerous results of past studies such as Shanmugam and Das (2004) on banks in India, Manlagnit and Lamberte (2004) on Philippine commercial banking system, Jemric and Vujcic (2002) on banks in Croatia and Delis and Papanikolaou (2009) on newly acceded European Union banking markets. This can be alluded to by technological innovations and international best practices brought into developing countries' financial markets and newly developed financial markets by foreign owned institutions, which promote efficiency. However, some studies have shown that operations of foreign banks in some developed countries' banking industry are less cost efficient than domestic banks operations. Few among those studies are Berger et al. (2000), Hasan and Hunter (1996) and Chang, Hasan and Hunter (1998), all in US banking

industry. It seems that foreign banks in US are not first-tier foreign banks that would provide the reputation benefits, international best practice, and competitive edge needed to increase efficiency.

Without keeping other variables in abeyance, we are 95% confident that the "true" coefficient of indirect adoption of universal banking policy dummy and unquoted banking structure dummy lie within the range of -0.097 and 0.1003 and -0.066 and 0.121 respectively implying that they can shift the constant term upward or downward. Based on these results, universal banking policy and non-quotation of a bank on the stock market have non-linear effect on efficiency. Therefore, it is clumsy to state whether indirect adoption of universal banking policy promotes efficiency more than direct adoption of the policy and stating whether unquoted banks are more efficient than quoted banks. This is because indirect adoption of universal banking policy increases efficiency for sometimes and later reduces efficiency as observed for unquoted banks too. These findings point to the need for further studies. The outcomes could be attributed to contagion effects of universal banking policy and the fact that shareholders do not have interest in a quoted firm's efficiency or how profits are made but how much profits are made.

4 Conclusion

The results of this study have shown that effects of total assets, net assets, competition, profitability and non-listing of banks on the stock market on bank efficiency is non-linear. That is, they caused increase and decrease in efficiency. This may be attributed to aggressive innovation and service improvement during consolidation, quiet life pattern of board and management shortly after consolidation, ignoring disclosure requirement without facing stern penalty, unhealthy competition in the banking market, corrupt and sharp practices, constant changes in policies as well as dearth of clear-cut direction on the part of the board and management. Therefore, the regulators should be up and doing in conducting their oversight functions on the banks.

Several policies have been implemented in the past to promote quality banking, rising profitability, efficiency and financial stability. One of those policies was the universal banking policy which became operational in Nigeria in 2001. From the results obtained, impact of indirect or direct adoption of the policy on efficiency is a paradox and insignificant. Therefore, the repeal of the policy regime in Nigeria at the end of 2010 was long overdue. Policy makers should emphasize other policy measures that may have direct influence on efficiency in order to safeguard the sector from crisis and subsequent bank runs thereby protecting the money supply from falling and strengthening the effectiveness of monetary policy.

The policy implication of credit risk and foreign bank ownership statistically significant impact on cost efficiency in Nigeria is potentially germane. Thus,

regular risk supervision by the regulators and adoption of international "best practices" by the banks should be among the top banking policies.

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