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EFFICIENCY ANALYSIS IN THE GHANA'S BANKING INDUSTRY

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ABSTRACT

This study attempted to investigate the level of Bank efficiency in Ghana by using Data Envelope Analysis (DEA). The study revealed that bank efficiency in Ghana has improved after the introduction of financial sector reforms in 1988 which have led to more competitions among banks, increased financial innovation, strict regulatory regime and higher profitability. The operational, technical and management efficiencies of the Ghanaian banks have significantly trended up as a result of improved corporate governance, regulatory environment and state of the art banking infrastructure and sustained macroeconomic stability over the study period.

Keywords: Efficiency, Banks, Industry, Data envelope analysis

INTRODUCTION

The turmoil in the financial markets, coupled with the economic downturn, is fundamentally altering the financial services environment. In this new world, improving operating efficiency has become a competitive necessity. But while financial firms have typically moved quickly to reduce costs when the business cycle is contracting, far too often these efforts have been quickly forgotten when business picks back up. For banks to exceed their peers in improving efficiency, they have to be willing to implement a long-term, enterprise-wide approach that will require fundamental, and for some, cultural change.

Financial services firms are facing a much tougher operating environment as a result of the credit crisis. Higher funding costs, increased defaults, and limited opportunities for top line growth are all contributing to a more challenging situation for the industry. Combined with the likelihood of additional compliance obligations, financial institutions are facing a level of difficulty they have not seen for many years. As a result, many firms are being forced to place more emphasis on reducing costs. Improving efficiency has long been a challenge for the financial services industry, but cost management is not only about reducing expenses. It is about generating more revenue per

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unit of cost. Banks vary widely in their commitment to cost management, and their commitment tends to be more cyclical than sustaining. The benefits of a stronger focus on efficiency can be significant. According to empirical research, banks that generally maintained a consistent approach to efficiency improvement also enjoyed superior growth in addition to being better prepared to organically fund investments. Furthermore, banks that effectively manage their operating costs will likely have more room to manoeuvre during crisis than banks that do not. This may be particularly important for banks struggling to rebuild capital positions damaged by the crisis. In this environment, any contribution to the bottom line is important. With this in mind, many banks have announced cost-reduction programs to help improve damaged margins. However, how successful will these programs be? In down markets, the temptation is often to resort to short-term measures and reduce costs quickly wherever possible. But successful cost management requires a long-term and consistent focus across cycles instead of reactive responses to specific business cycles, such as the current downturn.

For banks to exceed their peers in improving efficiency, they have to be willing to implement a long-term, enterprise-wide approach that will require fundamental, and for some, cultural change. They want to go beyond simply reducing budgets and improving processes, cutting back on external contractors, and freezing headcount and expenses. Instead, they try to embed a commitment to efficiency into the firm's DNA, perhaps even making consistent quality and continuous performance improvements part of the enterprise identity. This study assesses the need for a sustained focus on efficiency (cost management) in the Ghanaian Banking industry, particularly at the present time, and provides suggestions on ways to sustain banking efficiency in the country.

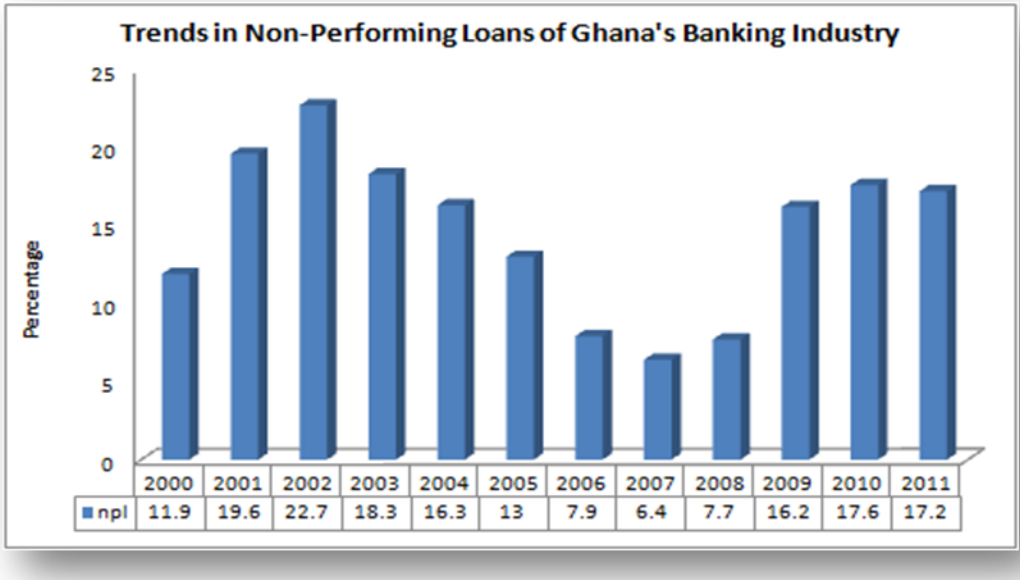
EFFICIENCY CHARACTERISTICS OF GHANAIAN BANKS

The financial reform was introduced after the inception of the Economic Recovery Program in 1983, a prescription of IMF for reversing the macroeconomic imbalances that characterized the Ghanaian economy in the early eighties. The Ghanaian economy was experiencing high inflation, high current account deficits, high fiscal deficits, slower pace in economic growth and some relative financial repression which impacted negatively on the financial sector. The financial reforms which was adopted by the country and introduced subsequently in 1988 brought about transformation of the Ghanaian banking sector in the form of financial innovations, increased competitions among banks and improved intermediation which hitherto was non-existing.

Non-performing loans

Before the financial sector reforms were introduced, the growth in Non-Performing Loans (NPL) of the banking sector was a major challenge and as a result various measures were instituted to truncate the surge in the NPL growth. The measures introduced impacted positively on the banking

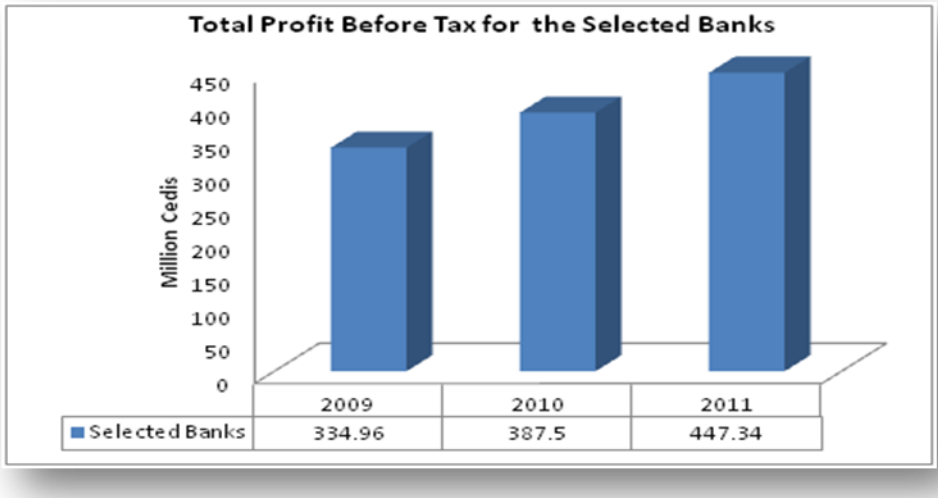
industry and the NPL levels dropped from as high as over 40 percent in the late eighties and early nineties to 22.7 percent in 2002. The NPL levels further declined from 18.3 percent in 2003 to 17.2 percent in 2011, suggesting a relative improvement over the years (**See Figure 1**). The reduction in the NPLs was as a result of increased management efficiency and improved prudential regulatory environment occasioned by the financial sector reforms which were implemented by the country.



Trends in profit before tax

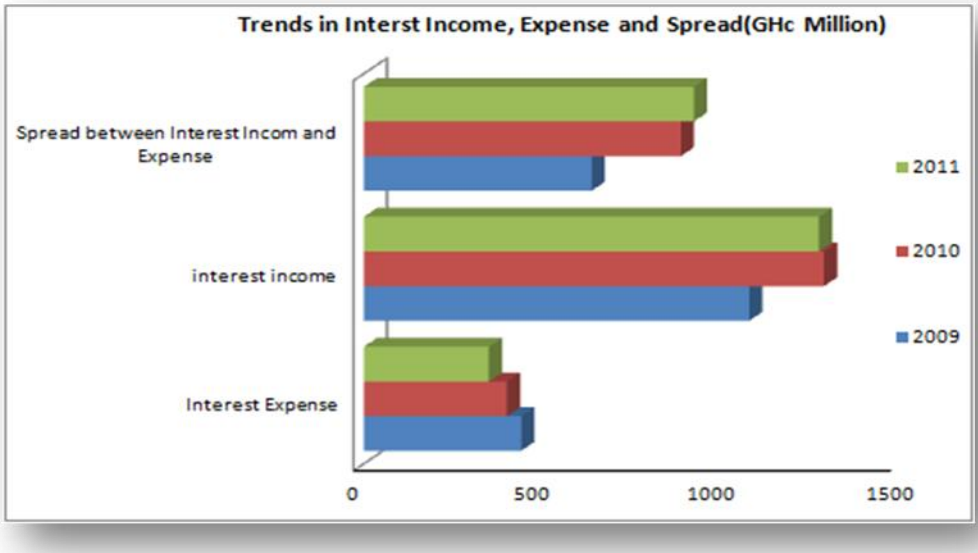
Profit creation remains one of the key determinants of operational and management efficiencies of all institutions including banks. Trends in profit before tax of Ghanaian Banks have improved tremendously in the post reformed period compared to pre-reform era. The Ghanaian banking sector remains liquid, solvent and profitable as profit levels of the banking system have firmed up significantly in the post reforms period due to enhanced operational and technical efficiencies. The adoption of risked-based banking supervision by the Central Bank, increased competition among players in the industry and improved intermediation function of the banks have contributed immensely to the success story of the lucrative banking sector in Ghana reflected in their reported yearly profits before tax.

The reported profit before tax of the selected banks for this study was GH¢334.96 million in 2009. The Industry's profit soared further from GH¢387.50 million in 2010 to GH¢447.34 million in 2011, suggesting a growth of 15.22 percent (**See Figure 2**).



Interest income and expense

Trends in interest income suggested that Ghana's banking industry has improved over the years. While interest income trended upwards, interest expense was on the declining side. Interest income firmed up by 19.4 percent to GH¢1,286.22 million in 2010 from GH¢1,077.15 recorded in 2009 where as interest expense for the same period went down by 9.8 percent to GH¢439.95 million from GH¢399.96 million. Interest income however declined marginally by 1.09 percent in 2011 to GH¢1,272.16 million whilst interest expense dipped by 12.57 percent to GH¢349.65 million in 2011. The spread between interest income and interest expense picked up from GH¢637.2 million in 2009 to GH¢886.26 million, suggesting a significant improvement of 39.08. The spread further trended up by 4.09 percent to 922.51 million in 2011, thus indicating increased operational efficiency in the Ghanaian banking sector (**See Figure 3**).



DATA ENVELOPE ANALYSIS

Some literature review

Data Envelopment Analysis (DEA) is a relatively new "data oriented" approach for evaluating the performance of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. The definition of a DMU is generic and flexible. Recent years have seen a great variety of applications of DEA for use in evaluating the performances of many different kinds of entities engaged in many different activities in many different contexts in many different countries. These DEA applications have used DMUs of various forms to evaluate the performance of entities, such as banks, hospitals, universities, cities, courts, business firms, and others, including the performance of countries, regions, etc. Because it requires very few assumptions, DEA has also opened up possibilities for use in cases which have been resistant to other approaches because of the complex (often unknown) nature of the relations between the multiple inputs and multiple outputs involved in DMUs. The Data Envelopment Analysis (DEA) method of measuring (in) efficiency is fundamentally based on the work by Farrell (1957) which was further elaborated by Charnes *et al.* (1978) and Banker *et al.* (1984). This approach (see e.g. Färe *et al.,* 1985) has been widely used in empirical efficiency (or productivity) analysis especially in cases where the units (DMUs) use multiple inputs to produce multiple outputs, and there are problems in defining weights and/or specifying functional forms to be employed in analysis. As DEA does not require input or output prices in determining empirical efficiency frontiers based on best practice technology and related measures of inefficiency, it has become especially popular in the study of public sector.

In the last few years several regional applications of DEA have emerged. Charnes *et al.* (1989) studied the economic performance of 28 China's cities in 1983 and 1984. Chang *et al.* (1995) use DEA and the Malmquist productivity index approach to study the economic performance of 23 regions in Taiwan in 1983 and 1990. Tong applied DEA to investigate the changes in production efficiency of 29 Chinese provinces in two papers with somewhat different emphasis (Tong 1996, 1997). Bernard and Cantner (1997) calculate the efficiency of the 21 French provinces in 1978-1989. In a recent study, Maudos, Pastor and Serrano (2000) analyse the relationship between efficiency and production structure in Spain 1964-93. Regional aspects are present also in several DEA studies, which concern agricultural productivity, see Weaver (1984), Mao and Koo (1997) or Millan and Aldaz (1998).

METHODOLOGY

In DEA models, we evaluate *n* productive units, DMUs, where each DMU takes *m* different inputs to produce *s* different outputs. The essence of DEA models in measuring the efficiency of productive unit DMU_q lies in maximizing its efficiency rate. However, subject to the condition that

the efficiency rate of any other units in the population must not be greater than 1. The models must include all characteristics considered, i.e. the weights of all inputs and outputs must be greater than zero. Such a model is defined as a linear divisive programming model:

Maximize $\frac{\sum_i u_i y_{iq}}{\sum_j v_j x_{jq}}$ subject to $\frac{\sum_i u_i y_{ik}}{\sum_j v_j x_{jk}} \leq 1 \quad k = 1,2 \ldots, n$ (1)

Where $u_i \geq \epsilon \quad i = 1,2 \ldots., s$ and $v_j \leq \epsilon \quad j = 1,2 \ldots., m$

This model can be converted into a linear programming model and transformed into a matrix:

Maximize $z = u^T Y_q$ subject to $v^T X_q = 1$ (2)

$u^T Y - v^T X \leq 0$ Where $u \geq \epsilon$ and $v \leq \epsilon$

Model(2) is often called primary CCR model (*Charnes, Cooper, Rhodes*). The dual model to this can be stated as follows:

Minimize $f = \theta - \epsilon (e^T s^+ + e^T s^-)$ subject to $Y\delta - s^+ = Y_q$ (3)

$X\delta + s^- = \theta X_q$

$\delta, s^+, s^- \geq 0$

where $\delta(\delta_1 \delta_2 \delta_3 \ldots \ldots \delta_n)$, $\delta \geq 0$ is a vector assigned to individual productive units, $s^+ \; and \; s^-$ are vectors of addition input and output variables, and, $e^T = (1,1,1 \ldots,1)$ and ϵ is a constant greater than zero, which is normally pitched at 10^{-6} or 10^{-8}. In evaluating the efficiency of unit DMU_q, model (3) seeks a virtual unit characterized by inputs $X\delta$ and outputs $Y\delta$, which are a linear combination of inputs and outputs of other units of the population and which are better that the

inputs and outputs of unit DMU_q which is being evaluated. For inputs of the virtual unit $X\delta \leq X_q$ and for outputs $Y\delta \geq Y_q$. Unit DMU_q is

rated efficient if no virtual unit with requested traits exists or if the virtual unit is identical with the unit evaluated, i.e. $X\delta = X_q$ and $Y\delta = Y_q$. If unit DMU is CCR efficient, then:

– the value of variable θ is zero,

– the values of all additional variables s^+ and s^- equal zero.

Consequently, unit DMU_q is CCR efficient if the optimum value of the model (3) objective function equals one. Otherwise, the unit is inefficient. The optimum value of the objective function *f** marks the efficiency rate of the unit concerned. The lower the rate, the less efficient the unit is compared to the rest of the population. In inefficient units θ is less than one. This value shows the need for a proportional reduction of inputs for unit DMU_q to become efficient. The advantage of the DEA model is that it advises how the unit evaluated should mend its behaviour to reach efficiency. Models (2) and (3) are Input-oriented, they try to find out how to improve the input characteristics of the unit concerned for it to become efficient. There are Output-oriented models as well. Such a model could be written as follows:

$$\text{maximize} g = \emptyset + \epsilon (e^T s^+ + e^T s^-) \quad \text{subject to} \quad Y\delta - s^+ = \emptyset Y_q \qquad (4)$$

$$X\delta + s^- = X_q$$

$$\delta, s^+, s^- \geq 0$$

This model can be interpreted as follows: unit DMU_q is CCR efficient if the optimal value of the objective function in model (4) equals one, *g** = 1. If the value of the function is greater than one, the unit is inefficient. The variable $\emptyset$ indicates the need for increased output to achieve efficiency. For the optimal solution to the CCR model, the values of objective functions should be inverted, i.e. *f** = 1/g*. Models (2), (3) and (4) assume constant returns to scale. However, in efficiency analysis, variable returns to scale can also be considered. In that case, models (3) and (4) need to be

rewritten to include a condition of convexity $e^T \delta = 1$. Afterwards, they are referred to as BCC (*Banker, Charnes, Cooper*) models.

The aim of DEA analysis is not only to determine the efficiency rate of the units reviewed, but in particular to find target values for inputs X_q and outputs Y_q for an inefficient unit. After reaching these values, the unit would arrive at the threshold of efficiency. Target values are calculated:

1. by means of productive unit vectors:

$$X'_q = X\delta*$$

$$Y'_q = Y\delta*$$

Where $\delta*$ is the vector of optimal variable values.

2. by means of the efficiency rate and values of additional variables $s^+ \; and \; s^-$:

Input-oriented CCR model:

$$X'_q = \theta X_q - s^- Y'_q = Y_q + s^+$$

Output-oriented CCR model:

$$X'_q = X_q - s^- Y'_q = \emptyset Y_q + s^+$$

Where θ is the efficiency rate in the Input-oriented model and $\emptyset$ is the efficiency rate in the Output-oriented model.

Inputs and output data selection

The measurement of efficiency in production units and the identification of sources of their inefficiency is a precondition to improve the performance of any productive unit in a competitive environment. Generally speaking, the term productive unit refers to a unit producing certain outputs by spending certain inputs. Banks, or bank branches, can be treated as production units too. In general, they are homogeneous units performing the same or similar activities. All inputs and outputs have an impact on efficient operation of such units, even though some are considered more or less important. In this research, bank deposits, operational expenses and interest expenses are utilized as the input factors because they represent the cost incurred by the banks. Loans, interest

income and profits are also treated as output factors The intermediation approach is adopted under this study whereby all items on which the banks incur cost are treated as inputs and all variables from which the banks derives revenue are treated as outputs. The data of DEA model are represented in the Appendix. Based on the proposed model, higher values of output and lower values of inputs are considered valuable.

ANALYSIS OF THE ESTIMATED DEA OUTPUT

The result of the DEA estimation suggested that banking sector efficiency in Ghana has improved over the study period. The banking sector efficiency was 0.78 in 2009 and further improved to 0.98 in 2010. The estimated results indicated that banking sector efficiency firmed up slightly again in 2011 to 0.99 close to 1(**See Table 1**). The banking sector in Ghana continues to make strides after the financial sector reforms which have brought innovations into the banking system. This might accounted for the improvement in bank efficiency in an environment of enhanced prudential regulation. The adoption of risked-based banking supervision framework and its subsequent implementation has made Ghanaian banks relatively more efficient over the years.

Table 1: Estimated efficiency levels for the banking industry and selected banks

2009 Data						
	dp	oex	intex	Lns	intln	Pr
Bank A	1259.47	140.19	134.31	1265.51	91.31	266.01
Bank B	833.08	83.71	36.07	408.53	83.71	36.07
Bank C	425.14	61.94	39.6	372.86	13.33	81.41
Bank D	922.07	77.68	48.92	456.15	72.68	131.37
Bank E	933.88	141.58	55.69	513.71	23.50	197.32
Bank F	277.6	25.45	41.62	214.71	10.51	64.25
Bank G	165.27	16.99	36.73	138.28	9.70	67.61
Bank I	295.14	21.07	36.19	176.50	3.32	51.43
Bank J	296.21	54.23	10.82	296.21	26.90	62.26
Industry	5407.86	622.84	439.95	3842.46	334.96	957.73

Efficiency Estimates for Selected Banks for 2009			
	Weighted output	Weighted input	Efficiency
Bank A	771.50	2307.60	0.33
Bank B	906.52	1598.78	0.57
Bank C	849.03	971.52	0.87
Bank D	1092.79	1747.31	0.63
Bank E	878.43	1435.35	0.61
Bank F	710.87	474.51	1.00
Bank G	592.51	633.44	0.94
Bank I	527.24	994.41	0.53
Bank J	215.59	696.85	0.31
Industry	5135.15	6339.23	0.81

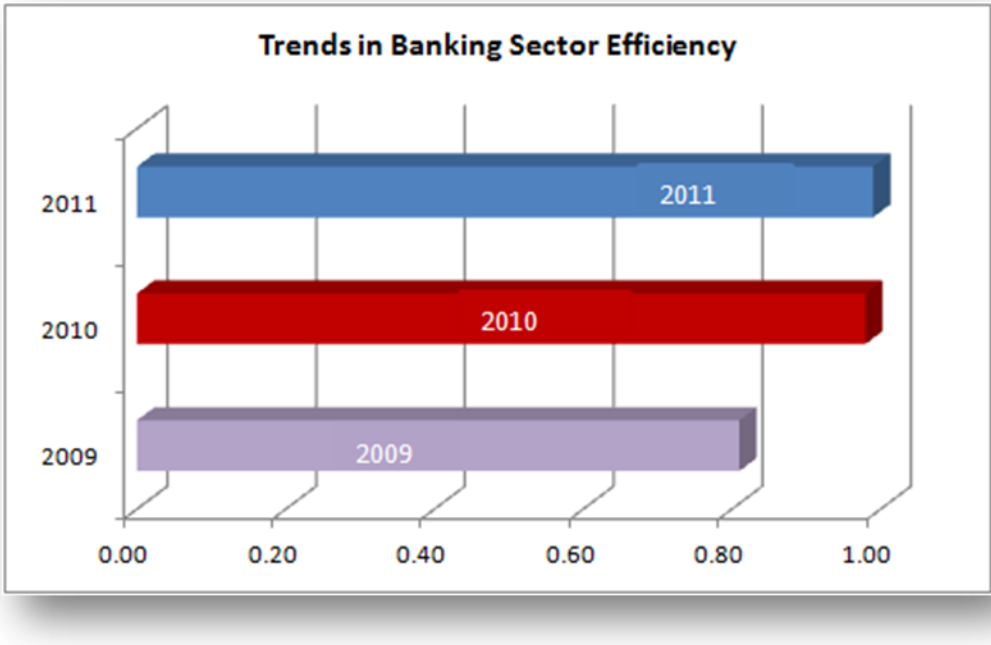
2010 Data						
	dp	oex	intex	Lns	intln	Pr
Bank A	1575.28	168.55	102.81	1003.68	68.61	389.03
Bank B	1092.44	102.93	45.37	467.15	101.51	213.94
Bank C	536	123	37.4	576.98	12.76	126.91
Bank D	1116.31	83.74	60.11	496.04	60.11	141.52
Bank E	1093.65	114.57	25.76	435.91	85.62	192.79
Bank F	256.63	28.32	32.67	296.62	12.59	69.15
Bank G	377.28	26.53	40.42	315.29	12.16	74.70
Bank I	548.02	33.48	45.23	212.04	6.83	45.23
Bank J	495.39	60	10.19	301.20	27.31	32.95
Industry	7091	741.12	399.96	4104.91	387.50	1286.22

Efficiency Estimates for Selected Banks for 2010			
	Weighted output	Weighted input	Efficiency
Bank A	765.17	2110.70	0.36
Bank B	882.20	1439.46	0.61
Bank C	838.13	899.43	0.93
Bank D	1077.35	1578.69	0.68
Bank E	853.81	1296.53	0.66
Bank F	705.89	432.33	1.00
Bank G	588.80	577.40	1.00
Bank I	524.20	897.24	0.58
Bank J	213.52	636.52	0.34
Industry	5695.98	5816.30	0.98

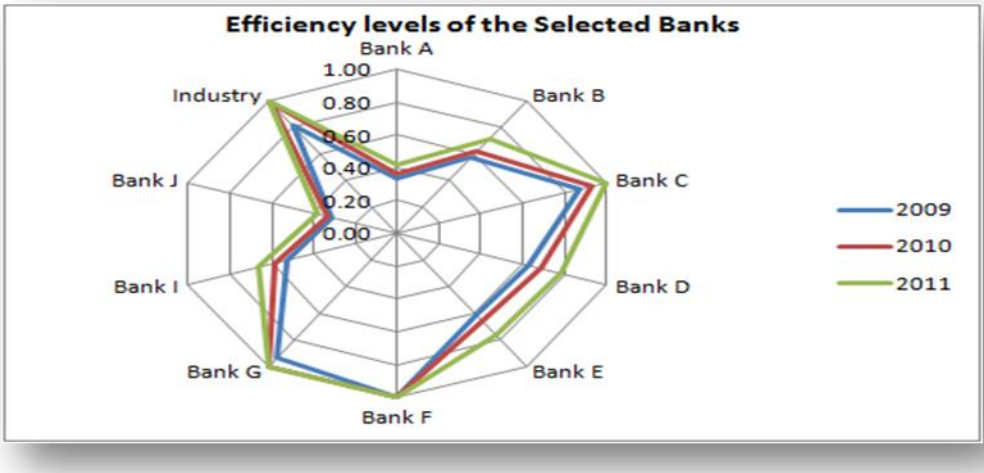
2011 Data						
	dp	oex	intex	Lns	intln	Pr
Bank A	2061.39	248.94	49.8	476.21	29.68	265.61
Bank B	1479.68	93.45	45.37	596.72	114.03	195.77
Bank C	827.71	132.98	38.89	678.74	51.11	119.18
Bank D	1608.25	123.12	41.92	849.89	72.38	170.52
Bank E	1331.78	105.85	20.05	588.63	115.44	174.36
Bank F	411.58	36.13	34.42	611.71	23.35	75.81
Bank G	545.8	47.41	50.23	475.23	17.38	99.90
Bank I	896.64	53.67	55.42	409.57	14.27	103.40
Bank J	625.77	72.92	13.55	138.28	9.70	67.61
Industry	9788.6	914.47	349.65	4824.98	447.34	1272.16

Efficiency Estimates for Selected Banks for 2011			
	Weighted output	Weighted input	Efficiency
Bank A	771.50	1855.69	0.42
Bank B	906.52	1273.50	0.71
Bank C	849.03	790.12	1.07
Bank D	1092.79	1394.06	0.78
Bank E	878.43	1143.05	0.77
Bank F	710.87	383.84	1.00
Bank G	592.51	513.13	1.00
Bank I	527.24	796.91	0.66
Bank J	215.59	559.66	0.39
Industry	8644.48	8709.96	0.99

The DEA analysis of the selected banks in this study suggested that while most of the banks have tremendously improved on the efficiency scale recently due to good management practices, improved corporate governance, increased competitions among banks and strict regulatory regime among other policies, few of the banks also continue to move from scale of inefficiencies (inside the production frontier) onto the efficiency frontier itself. If current policy momentum could be sustained it could create the necessary conditions for the few banks that are located inside the frontier to further shift onto the production frontier of the banking industry. Financial sector policies will continually play key role in revolutionalising the Ghana's banking system from rudimentarily stage into more technologically-driven heights and standards that could make it possible for Ghanaian banks to compete with ease against the more sophisticated international banks in the matured and emerging markets across the globe.



The usage of technology in the Ghana's banking sector has improved remarkably after the financial sector reforms which have brought financial innovation into the sector. The number of ATMs installed at various bank branches across the country has increased tremendously; branchless banking has taken a new turn; automated cheque clearing system and online cheque truncation platforms has commenced; improved Payment System architecture has been operationalized in the country; and finally, the establishment of Credit Reference Bureau and Collateral Registry have impacted positively on the banking system. All of these listed technology-based banking sector infrastructure and platforms have contributed to a larger extent to the efficiency improvement of the Ghanaian banks over the past years. These financial sector policies should be continued and sustained in order for banks operating in the country to continually choke more success now and in the future.



CONCLUDING REMARKS

This study attempted to investigate the level of Bank efficiency in Ghana by using Data Envelope Analysis (DEA). The study adopted the intermediation approach whereby all variables identified as incurring cost to the bank as input variables while variables identified as creating revenues to the bank as output variables in this instance. We identified six variables decomposed into three input variables (i.e. customers' deposits, operating expenses and interest payments) and three output variables (i.e. loans, profits and interest income). The paper revealed that bank efficiency in Ghana has improved after the introduction of financial sector reforms in 1988 which have led to more competitions among banks, increased financial innovation, strict regulatory regime and higher profitability. The operational, technical and management efficiencies of the Ghanaian banks have significantly trended up as a result of improved corporate governance, regulatory environment and state of the art banking infrastructure and sustained macroeconomic stability.

REFERENCE

Aldas, J. and Mahabub, H(2003). Can Hybrid Rice Technology Help Productivity Growth in Asian Tropics? Farmers' Experiences. *Economic and Political Weekly* Vol. 38, No. 25 (Jun. 21-27, 2003), pp. 2492-2501.

Färe, R., Grosskopf, S. and Lovell, C. A. K. (1985). The Measurement of Efficiency of Production. Boston: Kluwer-Nijhoff.

Farrell, M. J. (1957). Measurement of Productive Efficiency. *Journal of the Royal Statistical Society, Series A*, pp. 253-281.

Bernard, J. and Cantner, U. (1997). French Regional Performance and Variety. A Non-Parametric Frontier Approach. Paper Presented at the 37th Congress of the European Regional Science Association, Rome.

Chang, P. Hwang, S. and Cheng, W. (1995) Using Data Envelopment Analysis to Measure the Achievement and Change of Regional Development in Taiwan. *Journal of Environmental Management*, Vol. 43, pp.49-66.

Charnes, A. Cooper, and W. Li, S. (1989). Using Data Envelopment Analysis to Evaluate Efficiency in the Economic Performance of Chinese Cities. *Socio-Economic Planning Sciences,* Vol. 23, No. 6, pp. 325-344.

Charnes, A., Cooper, W. W. and Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, Vol. 2, pp. 429-444.

Maudos, Joaquin & Fernandez de Guevara, Juan, (2004). Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking & Finance, Elsevier,* Vol. 28, pp. 2259-2281.

Maudos, J. Pastor, J. and Serrano, L. (2000). Efficiency and Productive Specialisation: An Application to the Spanish Regions. *Regional Studies,* Vol. 34, No. 9, pp. 829-842.

Mao, W. and Koo, Won W. (1997). Productivity growth, technological process, and efficiency change in Chinese agriculture after rural economic reforms: a DEA approach. *China Economic Review*, Vol. 8, No. 2, pp. 157-174.

Tong & Chan (2003). Disparity in Production Efficiency of China's TVEs Across Regions: A Stochastic Frontier Production Function Approach. *Asia Pacific Journal of Management*, Vol. 20, pp. 113-131.

Tong, C. (1996). Industrial Production Efficiency and its Spatial Disparity among the TVEs of China: A DEA Analysis. *Singapore Economic Review,* Vol. 41, No. 1, pp. 85-101.

Tong, C. (1997). China's Spatial Disparity within the Context of Industrial Production Efficiency: A Macro Study By the Data Envelopment Analysis (DEA) System. *Asian Economic Journal*, Vol. 11, No. 21, pp. 207-217.

Appendices:

Table 2: Estimated Efficiency Outputs using DEA

	2009	2010	2011
Bank A	0.33	0.36	0.42
Bank B	0.57	0.61	0.71
Bank C	0.87	0.93	1.00
Bank D	0.63	0.68	0.78
Bank E	0.61	0.66	0.77
Bank F	1.00	1.00	1.00
Bank G	0.94	1.00	1.00
Bank I	0.53	0.58	0.66
Bank J	0.31	0.34	0.39
Industry	0.81	0.98	0.99