MALMQUIST INDEX OF NIGERIAN COMMERCIAL BANKS

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ABSTRACT

This work evaluated the efficiency change and productivity change of Nigerian commercial banks between 2002 and 2011. The study made use ofMalmquist Productivity Index (MPI) to measure productivity growth of banks in Nigeria.The results show that the average level of the Malmquist index (ΔTFP)had gone upsignificantly from 0.931 in year 2003 to 1.038 in year 2011, meaning that the TFP had gains over the study period. This was attributed to the significant increase experienced in the TFP-linked indices namely the technical efficiency index (ΔTE) and the technological change index (ΔTECH). The technical efficiency change index (ΔTE) maintained its status at 1.004 and technological change index (ΔTECH), increase from 0.928 to 1.034 in 2011 (or increase of 10.6%).

Key words:Malmquist index, efficiency change. Total factor productivity and Intermediation

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1.   INTRODUCTION

By the end of 2004, the then Nigerian CBN Governor, Charles Soludo believed that there were too many banks in the country compared to their real size and ability to perform with global perspective. The existing banks were encouraged to consolidate and recapitalize.There were about 89 commercial banks which later were shrunk to 24 with 25billions capital base. Efficiency monitoring of commercial banks in Nigeria became so tense especially by the central bank of Nigeria so as to realize the essence of the consolidation and recapitalization and as a result of that, many researchers have developed interest in the Nigerian banking sector by evaluating and appraising them in financial and non-financial status. Banks, as financial intermediaries, provide various services for depositors and borrowers. They provide liquidity and safekeeping for savings, which allows depositors to smooth consumption over time. They also conduct credit analysis, disburse loans and monitor outstanding credits for borrowers who require more financing than they can generate from internal sources or from alternative sources of finance such as financial markets (Berger & Humphrey, 1993). The roles played by these banks cannot be over-emphasized as they function as well in the following ways; they provide payment services, trade finance, leasing and factoring solutions thatfinance the inventory and fixed asset needs of borrowers. The efficiency of individual banks in providing these services and conditions in the external environment determine the efficiency of the overall banking sector, which influences the effectiveness of the domestic financial intermediation mechanism (Njuguna, 2007). (Sanusi, 2012) said generally that, the financial sector is more than just institutions that enhance payments andextend credit. He saidit encompasses all functions that direct real resources to their ultimate user. It mean, itis the central in a market economy and contains a number of separate, yet co-dependent, components of all which are essential to its effective and efficient functioning. These components include financial intermediaries such as banks and insurance companies which act as principal agents for assuming liabilities and acquiring claims. The second component is the markets in which financial assets are exchanged, while the third is the infrastructural component, which is necessary for the effective interaction of intermediaries and markets. He furthered highlighted some pertinent factors that called for the reforms in the country that there are eight interlocking factors responsible for what went wrong in Nigerian banking crisis in 2008 as found by Sanusi (2012) and these were macroeconomic

instability caused by large and sudden capital inflows, major failures in corporate governance at banks, lack of investor and consumer sophistication, inadequate disclosure and transparency about the financial position of banks, critical gaps in the regulatory framework and regulations, uneven supervision and enforcement, unstructured governance & management processes at the CBN and weaknesses in the business environment. All the aforementioned factors were responsible for the poor state of banking operations in Nigeria.

The concept being examined here is efficiency, to measure how this has been realizable   and its changes over time. Therefore it can be seen as "the maximizing of outputs in such a way the input resources are less utilized. Banking efficiency is defined as difference between observed quality of input and output variables with respect to optimal quality of input and output variables. The efficient banks can achieve a maximum value of ONE in comparison to inefficient banks can reduce to level of ZERO. HaseebShahid et al. (2010). The results of the study find out whether the recapitalization, technological advancement, merger and acquisition programmes were successful evenly among the Nigerian banks and if they have benefited mostly from expansion via economies of scale, while on the other hand, the results will also find out the inefficient banks, if shrinking them together with the efficient banks in order to benefit from scale advantages will be more beneficial.

2.   STATEMENT OF THE PROBLEM

In the several reforms banking sector has been experiencing in Nigeria, Nigerian economy faced with a myriad of economic problems. Some of these were high inflation, unemployment, increasing poverty, low economic growth rate, high fiscal deficits, huge balance of payments deficits, financial sector repression and worsening terms of trade. These economic crises have been attributed to two main factors, i.e. domestic policy failure and inadequate institutional capacity (Afolabi and Mamma 1994). From the past to the present banking dispensation, banking sector has been facing multiple challenges despite the technological gadget made-easy to assist the banking productivity, and as a result,myriad numbers of researchers have found that failing banks tend to be located far from the frontier i.e. the best practice.(e.g., Berger and Humphrey 1992, Barr and Siems 1994, DeYoung and Whalen 1994,Wheelock and Wilson 1994). Thus, in addition to having high ratios of problem loans, banks approachingfailure also tend to have low cost efficiency. A number of other studies have found negative relationshipsbetween efficiency

and problem loans even among banks that do not fail (Kwan and Eisenbeis 1994,Hughes and Moon 1995, Resti 1995). Cost-inefficient banks may tend to have loan performance problemsfor a number of reasons. For example, banks with poor senior management may have problems inmonitoring both their costs andtheir loan customers, with the losses of capital generated by thesephenomena potentially leading to failure. In instances where banks provide additional or higher quality services, costs rise but revenues may increase by more than the cost increase. Looking at efficiency fromeither the cost minimization or revenue maximization perspective fails to capture the goal of banks to maximize profits by raising revenues as well as reducing costs and does not account well for unmeasured changes in output quality (Berger &Mester, 1999).

3.   OBJECTIVE OF THE STUDY

- To evaluate the efficiency change of Nigerian banks
- To measure Total Factor Productivity of Nigerian banks

4. REVIEW OF EMPIRICAL LITERATURE

Tanko (2008) worked on a DEA Analysis of bank performance in Nigeria using Malmquist index examining some Nigerian commercial banks for 5 years under the Constant Return to Scale assumption. He found that the average efficiency of all the banks for five years was constantly improved except the efficiency improvement in the third year was found low. However, all the banks under consideration consistently showed improvements on the average. Berg *et al* (1992) found that the total productivity of the banks in Finland Norway and Sweden has significantly improved. Their results identified technological progress as a major contributing factor to the improved productivity of the large banks in those countries.

Selcuk and Tuba (2006) measured efficiency of commercial banks in Turkey through the use of Data Envelopment Analysis (DEA) between 2003 and 2004 and Malmquist Productivity Index (MPI) methodologies. He employed total loans and non-interest income as outputs and number of employees, physical capital, non-deposit funds and total deposits as inputs. 2003 16 out 31 banks of the banks sampled were efficient under CRS while 23 of them efficient under VRS assumption. Likewise in the year 2004, 11 out 31 banks were found to be efficient under CRS,

while 16 of them efficient under VRS assumption. It was also found that there is an increase in banks' efficiency changes over the time period of 2003- 2004.

Supachet (2008) evaluated the relative efficiency of Thai commercial banks in the year 2003 – 2006 by using Data Envelopment Analysis (DEA) with 13 commercial banks sampled. It was found that the efficiency of Thai commercial banks via operation approach is very high and stable while the efficiency via intermediation approach is moderately high and somehow unstable. The average efficiency via operation approach was 100%. However, small banks are the most efficient banks via intermediation approach. In addition, incumbents which are commercial banks originally competing in banking business and new entries which are commercial banks previously competing in finance and securities business are also efficient via operation approach with the average efficiencies of 100%. Nevertheless, incumbents, in average, are more efficient than new entries in perspective of intermediation approach.

Chansarn (2007) appraised the efficiency of Thailand's financial sector including banking sector after the financial crisis in 1997 by examining the total factor productivity (TFP) growth. He also investigated the efficiency of domestic and foreign commercial banks. Based on the 12 commercial banks sampled from the banks listed on the Stock Exchange of Thailand in the period 1998 – 2004, the study showed that the efficiency of commercial bank sector was diminishing in the period 1998 –2004. However, the sharp decrease in efficiency in banking sector occurred only in the period 1998 – 1999, while the efficiency was decreasing very slightly over the period of 1999 – 2004. The study also suggested that domestic and foreign commercial banks were not different in efficiency.

David (2011) studied scale economies in the Nigerian banks using Data Envelopment Analysis (DEA). He looked into scale economies scores before, during and after bank consolidation in the year 2001 – 2008. The findings showed that on average, more banks enjoyed economies of scale in the period of consolidation than in period of 3 years before the consolidation and 3 years immediately after consolidation. It was also found that more banks broke the frontiers in economies of scale in the pre-consolidation era than in post-consolidation period.

Santos (2007) examined Malmquist Index and Technical Efficiency of Philippine Commercial Banks in the post-Asian financial crisis period using data envelopment analysis (DEA) approach. 35 banks were sampled and result showed that banks improved their productivity by 4.6%

annually from 1998 to 2005. Likewise, the technological change frontier shift of 110% for the 8-year period is mostly driven by the innovativeness of the current banking system in accommodating e-banking, ATM and network infrastructure. It was also found that efficiency change has been decreasing by 5.6% annually, meaning that ability of management in influencing productivity is dwindling rather than catching up.

Laeven(1999) studied the risk and efficiency of banks in five East Asian countries including Philippines employing DEA for the pre-crisis period in 1992-1996. The evaluation in the study revealed that for all the five countries examined, banks efficiencydecreasedinsignificantly.

Mohd*e tal* (2006) investigated productivity change of banking industry during the period of 2000 to 2004 using Malmquist index of Data Envelopment Analysis (DEA) technique. It was found that Total Factor Productivity (TFP) has a little bit increased for the industry because efficiency change is found to be the super source of productivity growth to Malaysia's banking industry as compared to technical component that contributes a negative change to the overall TFP growth.

Sathye (2002), analyzed productivity change in Australian banks during the period of 1995 to 1999. The study found that technical efficiency of banks reduced by 3.1% and likewise, the Total Factor Productivity (TFP) also dwindled by 3.5%. And as a result of the findings, it was concluded that although the mean technical efficiency change and the mean of TFP stood positive, reduction in the productivity is still a matter of concern.

Njuguna (2007) examined The Empirical Analysis of the Commercial Banks' efficiency and Stock Returns in Kenya employing DEA methodology between 1998 and 2006   . The results of the findings revealed that the banks showed reducing cost efficiency over the sample period whereas the revenue efficiency was on an increase gradually. Total factor productivity (TFP) of the Malmquist index showed that technical efficiency and technological efficiency change were the main drivers of profit efficiency in the banking industry.

Jenifer and Kent (2009) examined post-crisis productivity for Jamaican banks between 1998 and 2007 by using Malmquist index. Having measured the technical progress and efficiency to foster bank productivity, the results showed an inconsistent growth pattern for banks between 1998 and 2007which is largely driven by efficiency gains in the immediate post-crisis period to 2002, it was also supported by technological progress towards the end of the sample period.   And

likewise, there was technological progress towards the end of the sample period in all the banks in the sample with modest growth

Don and Piyadasa (2003) investigated Performance of Indian commercial banks (1995-2002): an application of data envelopment analysis and Malmquist productivity index. It was deduced from the findings that there was no significant growth in productivity during the sampled period. The study showed a slight increase in technical efficiency due to enhanced scale efficiency caused by managerial efficiency. In the global view of the study, the smaller banks were found inefficient whereas the efficient banks were those with high equity to assets and high return to average equity ratios. The study also revealed that there has been no productivity growth in private sector banks although the public sector banks showed a remarkable change through 1995-2002. Technological change trend in the private sector banks has been a negative growth in almost the same manner, however, the public sector banks experienced a growth.

5.   METHOD OF DATA ANALYSIS

DEA is used as linear programming methods to construct a non-parametric frontier over the data, so as to be able to arrive at the efficiency scores relative to the frontier. Coelli (1996) developed a DEAP computer programming for performing DEA. The application of Malmquist DEA methods to panel data to arrive at the scores of total factor productivity (TFP) change; technological change; and technical efficiency change. The Malmquist index is the geometric mean of two productivity indices that use output distance functions for the alternative base periods t and (t + 1) as indicated by the D-superscripts in equation below

$$E = \frac{D^{t+1}(x_{i,t+1},y_{i,t+1})}{D^t(x_{i,t},y_{i,t})} \quad \dots\dots\dots\dots\dots\dots 1$$

$$M(x_{t+1},y_{t+1},x_t\,y_t) = \left[\frac{D^t(x_{i,t+1},y_{i,t+1})D^{t+1}(x_{i,t+1},y_{i,t+1})}{D^t(x_{i,t},y_{i,t})D^{t+1}(x_{i,t},y_{i,t})}\right]^{1/2} \quad \dots\dots\dots\dots\dots\dots\dots\dots 2$$

The first index relates the input - output combinations observed in the two time periods (*t* and *t + 1*) to the period *t* technology frontier, and the second index relates the same input - output combinations to the period *(t + 1)* technology frontier. The terms in the numerator are the inputs used and outputs generated by firms *i* in period *t + 1*, and those in the denominator represent the corresponding quantities observed for period *t*.

Following Fare et al. (1995), manipulation of the Malmquist index makes it possible to distinguish between efficiency changes and productivity changes:

$$M = \frac{D^{t+1}(x_{i,t+1},y_{i,t+1})}{D^t(x_{i,t},y_{i,t})}\left[\frac{D^t(x_{i,t+1},y_{i,t+1})D^{t+1}(x_{i,t+1},y_{i,t+1})}{D^t(x_{i,t},y_{i,t})D^{t+1}(x_{i,t},y_{i,t})}\right]^{1/2} = \Delta E \times \Delta T \cdots\cdots\cdots\cdots\cdots 3$$

The first term represents the change in technical efficiency (Δ*E)*, and the expression in square brackets represents technological change (Δ*T)*. Values that are greater than one for the Malmquist index indicate an improvement in productivity and values that are less than one signal deterioration. The same interpretation applies to the numerical values obtained for the efficiency and technology indices. Formally, there is no presumption that the three indices must always move in the same direction. For instance, animprovement in productivity is entirely compatible with opposite improvement in technical efficiency or technology, provided the deterioration in one component is more than offset by an improvement in the other to generate a value of M greater than1.

6.   DATA AND MODEL SPECIFICATION

The data for the research were obtained from the published financial statements of Nigerian banks from *2002-2011*. Informationrequired for the analysis was extracted for all the banks randomly sampled operating in Nigeria for the period often years. The banks include; first bank, Union bank, UBA, Zenith, GTbank, Diamond bank, Wema bank, Access bank, FCMB and Fidelity. All financial data are denominated in terms of Nigerian Naira(in thousands).Inputs used in the study are deposits (D), operating expenses (OE) and other assets (OA), while the outputs representloans and advances (L), investment (I), interest income (IY) and non-interest income (NIY). Deposits, one of the main inputs, arethe overall resources available to banks for carrying out their activities like lending and investment.Operating expenses is the cost incurred in the banking financial intermediation, this include the cost of labour and all other labour-related expenses. And other asset is in form of liquid assets made available for intermediation. The outputs chosen for the study constitute one of the major activities of banks, i.e. to channel their funds into investments, advancing loans for profits and provide miscellaneous services to generate significant amount of interest and non-interest revenues.

7.   RESULTS AND DISCUSSION

Table1.

	Malmquist Index Summary Of Annual Means		
	Technical efficiency change	Technology change	Total factor Productivity change
2003	1.004	0.928	0.931
2004	1.038	0.980	1.018
2005	0.987	1.032	1.019
2006	1.047	0.828	0.866
2007	0.998	1.027	1.025
2008	0.921	1.202	1.106
2009	0.987	1.219	1.204
2010	1.103	1.124	1.239
2011	0.965	1.029	0.992
Mean	1.004	1.034	1.038

Notes: all Malmquist index averages are geometric means

ΔTE = Technical Efficiency Change; $\Delta TECH$ = Technical or Technology change; and

ΔTFP = Total factor productivity change

Source: Field Data (2014)

Table2.

	Malmquist Index Summary Of Annual Means		
	ΔTechnical efficiency	ΔTechnology	ΔTotal factor Productivity
First bank	0.998	0.983	0.981
Union bank	1.041	1.065	1.109
UBA	1.024	1.100	1.127
Zenith	1.000	1.047	1.049
GTBank	1.000	1.055	1.055
Diamond	1.000	0.979	0.979
Wema	0.992	1.051	1.042

Access	1.000	1.031	1.031
FCMB	1.000	1.034	1.034
Fidelity	0.987	1.001	0.988
Mean	1.004	1.034	1.038

Notes: all Malmquist index averages are geometric means

ΔTE = Technical Efficiency Change; $\Delta TECH$ = Technical or Technology change; and

ΔTFP = Total factor productivity change

Source: Field Data (2014)

Figure1. Malmquist Index Curves for Annual Means
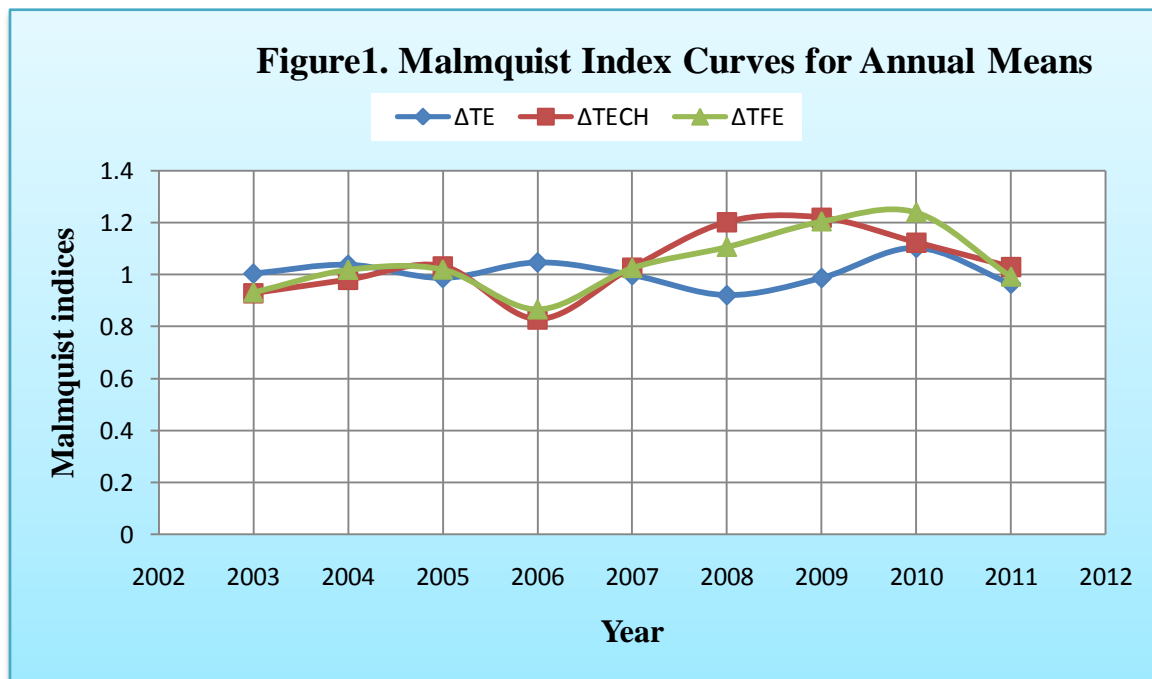
Notes: all Malmquist index averages are geometric means

ΔTE = Technical Efficiency Change**;** $\Delta TECH$ = Technical or Technology change**;**

ΔTFP = Total factor productivity change

Source: Field Data (2014)

The above results from table 1 and 2 indicate that the average level of the Malmquist index ($\Delta TFP)$ had gone up significantly from 0.931 in year 2003 to 1.038 in year 2011, meaning that the TFP had gains over the study period. This was attributed to the significant increase experienced in the TFP-linked indices namely the technical efficiency index ($\Delta TE)$ and the technological change index (ΔTECH$)$. The technical efficiency change index ($\Delta TE)$maintained

its status at 1.004 and technological change index (Δ*TECH)*, increase from 0.928to 1.034 in 2011 (or increase of 10.6%).

In general, the benefits realized via the technological progress by the banks under the study between the years 2007 to 2011 are just a little bit above the frontier (the best practice) contributed to an increase in TFP because of the improvement in the rate of mean technological progress by 10.6% over the study period. These results suggest that the total factor productivity change was more attributable to the technological change (Δ*TECH)* than technical efficiency change (ΔTE). Also, during the study period it was found that the Total factor productivity from years 2007 to 2010, respectively increased by 2.5%, 10.6%, 20.4% and 23.9% after a decline of 13.4% in 2006. However, there was decline of 0.8% from the frontier in 2011. This might suggest that the institutional reforms in banking system by the Central Bank of Nigeria were to certain extent successful. These developments occurred despite the technical efficiency change index (Δ*TECH)* zigzagging in a manner, where in 2003, 2004, 2006 and 2010 the (ΔTE) increased from the frontier by 0.4%, 3.8%, 4.6% and 10.3% respectively whereas (ΔTE) declined in years 2005, 2007, 2008,2009 and 2011 by 1.3%, 0.2%, 7.9%, 1.3% and 3.5% from the frontier respectively, though, the mean (ΔTE) was above the best practice in the 2010 by 0.4% increase resembling what was realized in 2003. The reason that was responsible for this might be inability of the banking system to cope with the economic meltdown. Theincrease in TFP from 2007 to 2010 were driven by technical efficiency (as a result of institutional reforms in the banking industry) and the technological efficiency realized after the banks adopted the modern core banking technologies that support internet banking, ATM network expansion and ATM service outsourcing; SMS-banking, and management of lending services.

The banks that were found below the frontier in their total factor productivity like First, Diamond and Fidelity Bank by 0.9%, 2.1% and 0.8% respectively, the decline was caused mostly by inability to change in their technical efficiency and technology status which invariably determine their total factor productivity.

From the figure 1 above, the responses of the Technical Efficiency Change, Technical or Technology change; andTotal factor productivity change were shown by the graph. The graph revealed that three changes rose between the years 2007 – 2010 but the year 2011 was a matter of concern when the three changes began to fall.

8.   GLOBAL MANAGERIAL IMPLICATIONS AND CONCLUSION

The study has established that the technical efficiency change and technological change of the banking sector operation has significant impact on its Total factor productivity. In addition, banks have put in place measures to clean their balance sheets of non-performing loans and advances net of provisions, growth of asset base, customer deposits, and technological innovations has further contributed to improved technical efficiency change in the sector and as a result, a bank which efficiently mobilizes its deposits, other funds and staff earns high profits. Technological change or the innovation component dominated and offset the negative efficiency change or the catch-up effect component of the index. Technological change improved in 1997 to 2010 period, which was driven by the massive innovation undertaken by banks to accommodate e-banking as well as build ATM and network infrastructure, both in-site and off-site locations signaling to the factthat on average the commercial banks in Nigeria had improved in terms of their technology which make some banks to break the frontier. Thescores analyzed above justify the fact that the commercial banks have improved in their general level of efficiency just a little bit above average because the difference in the scores has been proven to be statistically significant and positive. Again, the banks that have higher efficiency scores than the other banks were about 70% of the sample; this is attributed to improvement in technology (technical change) rather than efficiency change. Technological change or the catch-up component has been increasing annually, especially from2007 suggesting that banks have been actually forgingahead in management influencing productivity rather than catching-up.

REFERENCES

1. Berger, A.N. & Humphrey, D. B. (1993) "Bank scale economies, mergers, concentration and Efficiency: The U.S. experience". 27:123-154 Pennsylvania: Wharton Financial Institutions Centre.1.103 Berger, Allen N., and David B. Humphrey, (1992), "Measurement and Efficiency Issues in Commercial Banking," in Z. Griliches, ed., *Output Measurement in the Service Sectors*, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 56, (University of Chicago Press, Chicago) 245-79.

2. Berger, A.N. and Mester, L.J., (1997a), "Efficiency and Productivity Change in the U.S. Commercial Banking Industry: A Comparison of the 1980s and 1990s", Working Paper No. 97-5, A paper presented at the Conference on Service Sector Productivity and the

Productivity Paradox, Centre for the Study of Living Standards, Ottawa, Ontario, April 11-12, 1997.

3. Berg, S. A., Forsund, F. R., and Jansen, E. S. (1991): Malmquist Indices of Productivity Growth During The Deregulation of Norwegian Banking 1980 – 1989. Scandinavian Journal of Economics Vol. 94 pp 211-228 Barr, Richard, and Thomas Siems, (1994), "Predicting Bank Failure Using DEA to Quantify Management Quality," Federal Reserve Bank of Dallas, Financial Industry Studies Working Paper No. 1-94.

4. Chansarn S (2007). The Efficiency in Thai Financial Sector after the Financial Crisis, *EconomicAnalysis Working Paper*, Vol. 6, No. 10.

5. Coelli, T. (1996)."A Guide to DEAP® Version 2.1, A Data Envelopment Analysis (Computer) Program".CEPA Working Paper 96/08.

6. David M. (2011). Bank Consolidation and Scale Economies Trend of Banks in a Developing Country.MedwellJournal of Economics theory 5(1): 15-21, 2011DeYoung, Robert, and Gary Whalen, (1994), "Is a Consolidated Banking Industry a More Efficient Banking Industry?," Office of the Comptroller of the Currency, *Quarterly Journal*, volume 13, number 3.

7. Don U.A.G. and Piyadasa E. (2003) Performance of Indian commercial banks (1995-2002), Department of Econometrics and Business StatisticsMonash University, PO Box 197, Caulfield East, Victoria 3145, Australia. E-mail: Tissa.Galagedera@buseco.monash.edu.au and Department of Accounting and Finance Monash University, PO Box 197, Caulfield East, Victoria 3145, Australia. E-mail: Piyadasa.Edirisuriya@buseco.monash.edu.au Jenifer D. and Kent M. (2009), Measuring post-crisis productivity for Jamaican bank, Department of Management Studies, University of the West Indies, Mona, Kingston 7, Jamaica and Cardiff Business School, Cardiff University, Colum Drive, Cardiff, CF10 3EU, Wales, U.K.

8. HaseebShahid et al (2010), 'Efficiencies Comparison of Islamic and Conventional Banks of Pakistan', International Research Journal of Finance and Economics.

9. Jenifer D. and Kent M. (2009), Measuring post-crisis productivity for Jamaican bank, Department of Management Studies, University of the West Indies, Mona, Kingston 7,

Jamaica and Cardiff Business School, Cardiff University, Colum Drive, Cardiff, CF10 3EU, Wales, U.K.

10. Kwan, Simon, and Robert Eisenbeis, 1994, "An Analysis of Inefficiencies in Banking: A Stochastic Cost Frontier Approach," working paper.

11. Laeven, L. (1999). Risk and efficiency in East Asian banks.*World Bank Working Paper No.2255*. Washington, D.C.: The World Bank.

12. Muhammad H.A. (2010) *X-Efficiency Analysis of Pakistani Commercial Banks.* International Management Review Vol. 6 No. 1 2010 Njuguna C. K. (2007) '*The empirical analysis of the commercial banks' efficiency and stock returns in Kenya"* A research project report submitted in partial fulfillment of the requirements of the degree of master of business administration, school of business, university of Nairobi Abdul Rahim etal. (2006), Efficiency of Commercial Banks in Malaysia, AAMJAF, Vol. 2, No. 2,19–42, 2006 Santos J.D.(2007), Malmquist Index and Technical Efficiency of Philippine. Commercial Banks in the Post-Asian Financial Crisis Period.*Philippine Management Review*2007, Vol. 14, 93-114.

13. SanusiLamidoSanusi(2012): Banking reform and its impact on the Nigerian economy. A Lecture delivered by Governor of the Central Bank of Nigeria, at theUniversity of Warwick's Economic Summit, Warwick, 17 February 2012.

14. Sathye, M. (2002). Measuring productivity changes in Australian banking: An application of Malmquist indices. *Managerial Finance, 28,* 48–59.

15. Selcuk P. and Tuba Y.A. (2006) Measuring Efficiency of Commercial Banks In A Developing Economy:

16. The Case of Turkey Investment Management and Financial Innovations, Volume 3, Issue 2, 2006. Pg. 217- 231 Supachet C. (2008).The Relative Efficiency of Commercial Banks in Thailand: DEA Approach,International Research Journal of Finance and EconomicsISSN 1450-2887 Issue 18 (2008)EuroJournals Publishing, Inc. 2008 pg. 53-68.

17. Tanko M. (2008) A DEA Analysis of Bank Performance in Nigeria, MPRA Paper No. 33560, posted 20.

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