Productivity and Efficiency of Banking Sector in Nepal

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Abstract

The paper aims to analyze the productivity and efficiency of banking sector in Nepal. Using systematic random sampling, 20 banks including both commercial and development are selected. The 180 observations of nine year's panel data from FY 2006/07 to FY 2014/15 has been used. Stochastic Frontier Approach is used taking three input variables i.e. capital, deposit and human resource cost, and one output variable i.e. loans and advance of sampled banks for analysis. The study found that the productivity of human resource, deposit and capital is significant. The joint venture banks are the most efficient than private and Government owned banks. The commercial banks are more efficient than development banks. The study has important implications for the policy makers to take corrective actions for improving the productivity and efficiency of banking sector in Nepal.

Keywords: Productivity, Efficiency, Stochastic frontier approach, Panel data, Banking sector

1. Introduction

The banking sector plays a vital role in the economic development of a country through the efficient intermediation of funds. The efficient intermediation of funds from savers to users enables the application of available resources to their most productive uses. A strong banking sector effectively channels funds and financial products in such a way as to strengthen the financial and economic system of any nation (Sharma, Sharma & Barua, 2012). Therefore, the sound performance of the banking sector has always been a key issue for ensuring development of nation.

The performance of banking sector is measured by financial ratios, but this approach has a major demerit in terms of its subjectivity and reliance on benchmarking ratios (Yeh, 1996). Sherman and Gold (1985) initiated the frontier analysis approach to bank performance assessment and they argued for the application of frontier analysis techniques in bank performance evaluation instead of financial ratios and other traditional financial measures. The frontier analysis technique handles multiple inputs-outputs.

The formal banking system was started in Nepal with the establishment of Nepal Bank Limited. in 1937/11/15 A.D. After its establishment other various types like commercial banks, development banks, finance companies and micro finance limited with the various

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ownership status all over Nepal operating at various levels of business and various levels of profit.

Nepalese banking sector has delivered a significant role in facilitating for economic growth of Nepal. There is an increasing concern to know the productivity and efficiency of banks in Nepal. Therefore, the present study aims to analyse the productivity and efficiency with the inclusion of the commercial as well as development banks including government, joint venture, and other banks established at different places and times in Nepal applying frontier analysis.

2. Literature Review

Wei and Wang (2000) studied the technical efficiency of the commercial banks in China and found that on an average, the newly established banks were relatively more technically efficient than the state-owned commercial banks. Yao et al. (2007) found that Chinese joint-stock banks were more efficient than their state-owned counterparts.

Athanasoglou, Georgiou and Staikouras (2008) assessed the productivity in the Greek banking industry for the period 1990-2006 using the estimation of productivity (partial and total factor) on the index number method (Tornqvist index). They found that the bank output and labor productivity increased considerably during the period under examination, outpacing the respective GDP growth and labor productivity of the Greek economy. Capital productivity and TFP of the Greek banking industry also improved remarkably mainly since 1999, as a result of the structural changes that took place within the industry, capital investments (mainly in IT equipment) as well as improvement in the quality of human capital.

Tahir and Haron (2008) examined the technical efficiency of the Malaysian commercial banks over the period of 2000-2006, using the stochastic frontier approach (SFA). They showed that the average overall efficiency of Malaysian commercial banks was 81 percent implying an input waste of 19 percent. They also found that the level of efficiency increased during the period of study and domestic banks were found to be more efficient relative to foreign banks.

Using the stochastic frontier production function model and the time invariant cross-sectional data, Samad (2009) examined inefficiencies of Bangladesh banking industry. The measure of technical efficiency indicates that the efficiency of Bangladesh commercial banks lies between 12.7 and 94.7 percent; the industry average rated at 69.5 percent. He also found that about 30 percent of the commercial banks in Bangladesh fell below the industry average. Baten and Kamil (2010) investigated the online bank specific deposits efficiency using stochastic frontier technique to determine factors affecting the efficiency level of banks for the period 2001 - 2007. They used a panel of 20 banks divided into four groups namely, NBs (National Banks), ISBs (Islamic Banks), FBs (Foreign Banks), and PBs (Private Banks) in Bangladesh. They showed that the estimated year-wise average online banks deposits efficiency was 73.8% while group-wise average deposits efficiency was 77.7%. At the bank group level, Nationalized Commercial Banks (NBs) and Islamic Banks (ISBS) were more efficient by 90.9% and 86.8% respectively, followed by Private Banks (PBs) which had 63.4% and Foreign Banks (FBs), 62.7%. They also observed that the foreign banks were less efficient in producing deposits. The most efficient bank was found to be Islami Bank Ltd. and the most inefficient bank was Pubali Bank with efficiency scores of 0.96 and 0.52 respectively.

Gajurel (2010) reported that there was a considerable level of cost inefficiency due to technical inefficiency and there existed comparatively low level of external (particularly regulatory) influences on input mix as indicated by a very low level of allocative inefficiency. The study reported growth of productivity to be negative mostly resulting from lack of technological progress. The study also found that State-owned banks appeared with less cost efficiency than private banks (domestic and foreign). The study also showed consistently inverse impact of size of the firm on cost efficiency; banks with higher financial capital, larger loan ratio and higher profit tended to be more cost efficient, however banks with higher credit risk tended to be less cost efficient.

Sanyal and Shankar (2011) estimated the productivity of Indian banks. Taking loans plus deposits as output and labor (number of employees), capital (fixed capital) and an intermediate input (expenditures on communication) as an input they found that the total factor productivity (TFP) of the old Indian private banks showed 52.6 percent higher than the foreign banks. However, on the productivity growth side the new Indian private banks led to the change of their productivity growth to 6 percent higher than that of their foreign counter parts. They also found the Indian private bank's productivity demonstrated a growing trend in the post-1998 period than the public and foreign banks. They also showed both old and new Indian private banks with better performance than their foreign counterparts, the latter might close the gap in the future. However, public bank productivity stills lagged far behind than that of private banks.

Kamau (2011) examined the trends in efficiency and productivity changes of the banking industry during the post liberalization period in Kenya. Efficiency scores and total factor productivity growth were estimated using the output oriented DEA model. Three inputs and two outputs specifications were made to represent efficiency and productivity gains in the intermediation process. A general remarkable observation on estimated commercial banks efficiency scores was that banks in Kenya performed fairly well during the period. The commercial banks' efficiency score was not less than 40 percent at any one point. In terms of foreign and local banks, foreign banks were found to be more efficient than local banks. And in the local category local private banks were found to be more efficient than local public banks. Large sized banks appeared to be more efficient than medium and small banks might be due to economies of scale.

Using the total deposits, interest expenses, and other operating expenses as inputs while total loans, interest income, and other operating revenues as output, Suzuki and Sastrosuwito (2011) found that the efficiency of the Indonesian banking sector during the period of 1994-2008 was relatively high, with the mean of overall industry 0.866. They also found that the government owned banks were most efficient than joint venture and foreign owned bank, private owned banks. Bhattacharyya and Pal (2011) estimated technical efficiency of Indian commercial banks from 1989-2009 using a multiple-output generalized stochastic production frontier. The study showed 64% efficiency on an average during the sample period, and that efficiency declined in both public and private banks during most parts of the post-reform period.

Rajan, Reddy and Pandit (2011) measured productivity and thereby efficiency of Indian scheduled commercial banks for the period 1979 through 2008 using the asset approach. The study found that the public sector banks (PSB) i.e. the nationalized banks (NB) and state bank of India were more efficient compared to domestic private banks and foreign banks. Taking

the loans, investments as outputs and deposits, labour and capital as inputs, they also found the foreign banks performed with higher efficiency compared to the domestic private banks.

Hasan et al. (2012) examined the technical efficiency of the Malaysian domestic banks listed in the Kuala Lumpur Stock Exchange (KLSE) market over the period 2005–2010. A parametric approach, Stochastic Frontier Approach (SFA), was used in this analysis. They found that Malaysian domestic banks exhibited an average overall efficiency of 94 percent, implying that sample banks wasted an average of 6 percent of their inputs. Among the banks, RHBCAP was found to be highly efficient with a score of 0.986 and PBBANK with the lowest efficiency score of 0.918. They also showed that the level of efficiency increased during the period of study, and that the technical efficiency effect fluctuated considerably over time.

Jha and Hui (2012) compared the financial performance of different ownership structured eighteen commercial banks in Nepal for the period 2005 to 2010 using econometric model (Multivariate regression analysis). They showed that the public sector banks were significantly less efficient than their counterpart are; however domestic private banks were equally efficient to foreign-owned (joint venture) banks. Furthermore, the estimation results revealed that return on assets was significantly influenced by capital adequacy ratio, interest expenses to total loan and net interest margin, while capital adequacy ratio had considerable effect on return on equity.

Poudel and Hovey (2013) investigated the impact of corporate governance on efficiency of 29 Nepalese commercial banks from the 2005-2011 time spans. Using the non-performing loan as variable for bank's efficiency, they found that bigger board and audit committee size and lower frequency of board meeting and lower proportion of institutional ownership led to better efficiency in the commercial banks. Thagunna and Poudel (2013), using Data Envelopment Analysis (DEA), studied on Measuring Bank Performance of Nepali Banks: A Data Envelopment Analysis (DEA) perspective during 2007-08 to 2010-11. They revealed that efficiency level was reported relatively stable and increased on overall. They also found no significant relationship with efficiency level and ownership structure of banks and there were no notable differences in the efficiency levels of banks according to their asset size.

Neupane (2013) studied the change in efficiency and productivity of banking industry during the period of 2007/08 to 2011/12 and analyzed the effects of various indicators on the efficiency of the twenty-two commercial banks in Nepal. Malmquist Index was used to measure the efficiency and productivity whereas Tobit regression was used to analyze the determinants of efficiency. He showed that the productivity changes of commercial banks in Nepal improved over the sample period and that the increase in productivity change in Nepalese commercial banks was due to the technical progress rather than efficiency components. He also reported that the decline in efficiency change was due to decline in both pure efficiency change and scale efficiency change. With the use of Tobit regression model the study found positive relationship between debt to equity ratio and efficiency as well as between capital adequacy and efficiency. Further, profitable banks with lower leverage and higher capital adequacy ratio were found to be more efficient and bank loans seemed to be more highly valued than alternative bank outputs i.e., investments and securities.

Gayval and Bajaj (2015) estimated the efficiency of 19 nationalized Indian commercial banks using DEA and stochastic production frontier. They found moderate consistency between

parametric and nonparametric frontier methods in efficiency scores rankings, identification of best and worst performing banks, the stability of efficiency scores over time and correlation between frontier efficiency and accounting based performance measures.

Panta and Bedari (2015) examined the level of cost efficiency of 18 "A" class commercial banks during the period of 2005/06 to 2011/12 by using stochastic frontier analysis. Their result indicated that the level of cost efficiency increased substantially over the period of time with small size banks exhibiting a higher cost efficiency as compared to the medium size ones. Similarly, the result also showed that change in the regulation after 2008 even though it was positively related with the cost, was not statistically significant.

Garamu (2016) evaluated the relative technical efficiency and productivity change of Ethiopian commercial banks during the period 2007 to 2011. Using Intermediation approach two input variables - fixed asset and labor, and two output variables- total deposits and net loans & advances were selected. The study adopted DEA to measure effici3ency of banks and MPI to measure the productivity gains of banks over time. Using a panel data of ten commercial banks operating in Ethiopia from 2007 – 2011, they found that, on average, Ethiopian commercial banks were relatively technically inefficient. Scale inefficiency takes the leading contribution for source of inefficiency. The study also revealed that the average TFP change is 0.965 during the study period.

Luintel, Selim and Bajracharya (2017) found that financial liberalization has made Nepalese bankers more effort oriented – evidence shows a clear rise in the level of bankers' efforts following liberalization. Nepalese bankers' optimal level of effort has increased considerably (by 43% during the period under analysis) and appears on an upward trajectory, albeit at a slower pace. Likewise, the banking sector's effort (incentive) driven productivity has also risen by 1% a year, on an average, post-liberalization (2003–2012). The association between the optimal levels of effort and optimal productivity seemed very close in the early years of liberalization but appeared somewhat opaque in later years. They also found that effort-driven productivity accounts for slightly over 40% of banking sector TFP (measured by Solow Residuals) in Nepal. Remarkably, the overall proportion of performing loans to total loans has increased from 76% in 2003 to over 96% in 2012. Nepalese banks earned an average bank spread (profit per unit of bank output) of 3.25 percent points during the sample period but this has slightly declined in recent years (3.17 percent points), perhaps reflecting the competitive pressure.

Hada, Zhu and Tamang (2017) studied the frontier analysis of operational efficiency (including technical, pure technical and scale efficiencies) between Nepalese and Chinese commercial banks over the period of 2012 and 2013 using data envelopment analysis (DEA) approach. The study showed that the mean operational efficiency score of Chinese banking industry is higher than that of Nepalese banking industry except pure technical efficiency score in 2013. In terms of technical and pure technical efficiencies, the performance of China's 5 state-owned banks was better than that of Nepal's 3 state-owned banks, and China's other banks, respectively; however, in term of scale efficiency, the performance of China's 5 state-owned banks were worse than that of Nepal's 3 state owned banks, and China's other banks, respectively.

Osuagwu, Isola and Nwaogwugwu (2018) estimated technical efficiency and total factor

productivity change in the Nigerian banking sector for the period 2005–14. They applied both non-parametric Data Envelopment Analysis (DEA) and parametric Stochastic Frontier Approach (SFA), using the Malmquist Productivity Index, and error component production function respectively, to ascertain if any significant variation in efficiency exists on a sample of 12 banks covering over 80 percent of total bank assets in Nigeria. The theoretical intermediation approach was applied for selection of input and output variables. The input variables considered were total deposits, total equity and operating expenses including staff costs, and output variables were loans and operating income, which accounts for off-balance-sheet items such as non-interest or fee-based income. They revealed that the mean technical efficiency under SFA and total factor productivity change in DEA decreases as bank output moves toward non-interest or fee-based income. Although the magnitude differs, both SFA and DEA follow a similar direction for technical efficiency and total factor productivity change. Grmanova and Ivanova (2018) measured the efficiency of banks in the Slovak Republic in 2009 and 2013 using DEA. The study found that the largest banks in the Slovak national banking market were more efficient than other banks.

Shah, Wu and Korotkov (2019) evaluated the performance and productivity of sustainable banks. A two-stage performance evaluation was employed with the integration of data envelopment analysis (DEA) and Malmquist productivity index (MPI) to evaluate sustainable bank performance and productivity for 9 years (2010–2018) in comparison with non-sustainable banks. DEA was used to define dynamic benchmarking, and MPI builds on time-series analysis. The study revealed that sustainable banks are more efficient and productive. The productivity of sustainable banks and non-sustainable banks was influenced by external and internal factors, respectively.

Fatema, Siddik, and Ibrahim (2019) investigated the relative technical efficiency and productivity change of Bangladeshi commercial banks during the period 2013 to 2017. They utilized the Data Envelopment Analysis (DEA) technique to evaluate the efficiency of sample banks and The Malmquist productivity index (MPI) to assess the productivity expands of banks over time. The study found that listed commercial banks in Bangladesh were technically inefficient. They also revealed that there are only six banks which have been technically efficient and rests were classified as technically inefficient. The study also found that only 3 among the 19 banks employed in the study were displayed an overall improvement in productivity and sixteen banks presented an overall decline in productivity.

3. Research Methodology

3.1 Research Design

The basic framework involves measuring input output, their relation and testing various hypotheses relating to productivity and efficiency. The population of banks includes both commercial and development banks established before 2005 A.D. The systematic random sampling has been used for the selection of banks. To test and analyze the hypothesis, human resource cost, deposit, capital considered as independent (input) variables and loans and advances has been considered dependent (output) variable. The stochastic production frontier model has been used as tools for analysis. The 180 observations of nine year's panel data from FY 2006/07 to FY 2014/15 has been used and data were collected from the audited annual reports of sampled banks.

3.2 Population and Sample size

The commercial and development banks established before 2005 A.D. has been considered as the population of the study. Out of twenty seven commercial banks, only 15 banks have recorded their establishment before 2005 A.D. Similarly, out of twenty four development banks, only 10 banks have found their establishment before 2005 A.D. So, the population of the study constituted 25 banks scattered in different places of the country.

In determining the sample size, there is no clear explanatory variable that reflect the banking characteristics and situations. Therefore, the growth of banks till 2005 A.D. is considered as a basis for determining sample size. The growth rate of bank from 1937 A.D. to 2005 A.D. comes 5.65%. Assuming the probability, p = 0.0565, the expected growth, q = 1-p within a couple of year is 0.9435, the reason for taking growth rate is that even if there is sharp fluctuation in the bank establishment it does not affect in the sample size determined.

Setting confidence level $(\mathbf{Z^a/_2})$ at 95% and precision also at 95%, the sample size as per $\mathbf{n} = \frac{(Za)^2 * p * q}{d^2}$ comes 81. As the finite population is 25, it requires adjustment for correcting the population. Therefore, using the correcting factor as per $\mathbf{s} = \frac{n}{1+\frac{n}{N}}$ the sample size is determined at 20 banks.

In the process of preparing the sampling frame of banks, Nepal Rastra Bank source which provides a list of all commercial and development banks was tapped to select the banks with systematic random sampling. After obtaining a list of commercial banks and development banks with their establishment date, a sampling frame was prepared in the order of the date of establishment. After the process, a systematic random sampling was used to pick up the banks for study. First, a sample unit was selected using the lottery technique and after the first selection, a sample interval was used to select other sample units. The sample interval is calculated with $^N/_s$ where, N is population and S represents the sample size.

3.3 Model Specification

Model Specification for Measuring Productivity

The regression equation for productivity taking loans and advance as output variable and capital, deposit and human resource cost as input variables can be expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 X1_{it} + \beta_2 X2_{it} + \beta_3 X3_{it} + \ldots\ldots\ldots\ldots + u_{it}$$

Where;

β_0 = Intercept

Y_{it} = Natural logarithm of Loans and advances for sample banks *i* at time *t*

$X1_{it}$ = Natural logarithm of Capital for sample banks *i* at time *t*

$X2_{it}$ = Natural logarithm of Deposit for sample banks *i* at time *t*

$X3_{it}$ = Natural logarithm of Human Resource Cost for sample banks *i* at time *t*

i = 1 to 20 banks

t = 2006/07 A.D. to 2014/15 A.D.

u_{it} = Error term.

$\beta_1, \beta_2, \beta_3$ are coefficients of X1, X2 and X3 respectively.

3.4 Model Specification for Efficiency Measurement

Stochastic Frontier Approach (a parametric approach) was used to compute the technical efficiency of sampled banks. For a parametric approach, technical efficiency is derived from a frontier production function which considers production possibility. The production function describes the relationship between the output variable with quantities of input variables plus the inefficiency and random error (Mokhtar, Abdullah & Habshi, 2006).

Technical efficiency (TE) has two types of measure. If it is an output-oriented measure, TE is a bank's ability to achieve maximum output given its sets of inputs. An input-oriented TE measure, however, reflects the degree to which a bank could minimize its inputs used in the production of given outputs. A value of 1 indicates full efficiency and operations on the production frontier. A value of less than 1 reflects operations below the frontier. The wedge between 1 and the value observed measures the technical efficiency (Mokhtar, Abdullah & Habshi, 2006).

The production function which was proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and Broeck (1977) can be written in a natural logarithm form as follows:

$$\text{Iny} = f(x) + \text{In } U_t - \text{In } V_t$$

Where ln y represents observed outputs, f denotes some functional form, x is the vectors of inputs, is the inefficiency error term and is the random error term which accounts for measurement error or other errors such as effect of weather, strike or luck on the value of output.

For a parametric technique, the inefficiency and random error components of the composite error term are disentangled by making explicit assumptions about their distribution. Following Aigner, Lovell and Schmidt (1977), this study assumes the distribution of the error term or statistical noise, , to be a two-sided normal distribution while the inefficiency term, is assumed to be one sided (half normal distribution).

This study used the truncated normal distribution for estimating inefficiency which was also used by Cebenoyan, Cooperman, Register and Hudgins (1993) and Berger and DeYoung (1997). This study also used the translog functional form as described by Mester (1993); Bauer et al. (1998). It does not impose any restrictions on the first and second order effects (Kaparakis et al., 1994). This flexibility serves as an advantage for banking efficiency studies because it is difficult to identify exactly the functional form that fit the production function (Kaparakis et al., 1994). The translog model allows homogeneity of degree one by simply imposing restrictions on the translog model parameter (McAllisster & McManus, 1993). The translog functional form of technical efficiency can be written as follows:

$$\ln y_i = \alpha_o + \sum_{i=1}^{n} a_i \ln x_i + E_i$$

where y_i is the output variable for the production function, X_i is the vector of quantities of i variable inputs, Y_i is the vector of quantities of variable outputs, E_i is the stochastic error term where $E_t = U_t - V_t$ is for the production function.

Variables Used

To analyze the productivity and efficiency of Nepalese banking sector, three input variables i.e. capital, deposit and human resource cost, and one output variable i.e. loans and advance of sampled banks were specified for the model. Brief descriptions of the variables are as follows:

- **Capital:** It is the fixed asset which includes all tangible long term assets such as land, buildings, furniture and equipment. Capital is here considered as an input following Tahir & Haron (2008), Baten & Kamil (2010).
- **Deposit:** It includes total deposits collected by bank through different type's depositors including interest bearing and non-interest bearing accounts like fixed deposits, savings deposits and call deposits as well as current accounts from individuals and corporations. Deposits are considered as an input following Mester (1993), Grmanova and Ivanova (2018), Osuagwu, Isola and Nwaogwugwu (2018).
- **Human resource costs:** Human resource costs include various expenses made for the betterment of employees of the banks such as salary, allowance, contribution to provident fund, training expenses, uniform expenses, medical expenses, pension and gratuity, staff bonus and other staff expenses. Labour (human resource) expenses are commonly used in the literature as the inputs (Kenjegalieva, et al., 2009, Luo, 2003) for obtaining output.
- **Loans and advance:** It includes the loans and advances provided by sample banks to their customers in various sectors. Loans and advance are considered here as an output following Sealey & Lindley (1977), Rajan, Reddy and Pandit (2011), Tahir & Haron (2008), Samad (2009).

3.5 Productivity and Efficiency

Productivity of Capital, Deposit and Human Resource Cost

The productivity of capital, deposit and human resource cost of sampled banks were determined using time-invariant inefficiency model in STATA (Statistics/Data Analysis) program. To run the stochastic frontier model for panel data in STATA (Statistics/Data Analysis) version 12, natural logarithm of loans and advance, capital, deposit and human resource cost were included in the model. Bank was taken as Panel ID variable and year as time variable for data set. Panel data of 20 groups (banks) of 9 years with 180 observations from excel sheet was imported in STATA software. After iteration 9, the value of log likelihood is -98.601465 and wald $\chi^2(3)$ is 1271.19 ($\chi^2(3) > 0.0000$) which indicates that the model is fitted (see table 2).

The relationship between inputs and output (Kumbhakar, Wang and Horncastle, 2015) in this study can be expressed as:

$$y = f(\boldsymbol{x})$$

Where y represents the output i.e. loans and advance and f(x) represents the inputs i.e. capital, deposit and human resource cost. Therefore, loans and advance is the function of capital, deposit and human resource cost. Theoretically, capital, deposit and human resource cost are positively related with loans and advance (output). The regression result also confirms the relationship as it was expected. The computed wald $\chi^2(3)$ is 1271.19 is higher than table value indicating an evidence of presence of regression. The coefficients of all variables are

jointly simultaneously not equal to zero. The coefficient of all the variables included as independent variables are positively affecting the output. Therefore, it can be concluded that the productivity of human resource cost, capital and deposit are significant.

Other things remaining the same, 1 percent change in capital leads to the increment of 0.16 percent in loans and advance (see table 2). The z value of capital is 2.57 and p value is 0.006 which indicates that the capital is positively significant at 5 percent level of significance. Similarly, other things remaining the same, 1 percent change in deposit, leads to the increment of 0.54 percent in loans and advance. The deposit is also positively significant at 5 percent level of significance ($P > |z|$ i.e. $9.69 > 0.000$). In the case of human resource cost, 1 percent raise in human resource cost leads to 0.24 percent increase in loans and advance. The z value and p value of human resource cost is 4.56 and 0.000 respectively i.e. $P > |z|$ which indicates that the human resource cost is confirmed with positive relation of significant at 5 percent level. Therefore, the alternative hypothesis is accepted all variable inputs capital, deposit and human resource cost have significant impact on loans and advance of Nepalese banking sector.

3.6 Efficiency of Banks in Individual and Various Group Level

The technical efficiency of all banks have been measured by using stochastic production frontier. The average technical efficiency of sampled banks is 73.95 percent. The highest efficient bank is Everest bank limited with technical efficiency score 93.99 percent and the least efficient bank is NIDC development bank limited with technical efficiency score 32.11 percent (see table 3).

The average technical efficiency of commercial banks and development banks is 78.14 percent and 68.82 percent respectively (see table 4). Two government owned banks i.e. Nepal bank limited and Rastriya Banijya bank limited are running at only 58 percent efficiency level while Everest bank limited and Laxmi bank limited are running at 93.99 percent and 92.73 percent efficiency level (see table 3). Likewise, the Siddhartha development bank and Excel development bank are running at 90 percent efficiency level and NIDC development bank and Gorkha development bank (Nepal) limited are running at only near about 33 percent efficiency level. All the government owned banks' technical efficiency is less than the average efficiency of Nepalese banking sector. Among the joint venture banks, the efficiency score of Standard Chartered bank Nepal limited and Nepal Bangaladesh bank limited is less than the average efficiency.

Based on ownership structure, joint venture banks are more efficient than other groups of banks. The average technical efficiency of joint venture banks is the highest i.e. 82.98 percent and followed by Nepalese private banks (76.22 percent) and government owned banks (54.71 percent) that indicates most of the joint venture banks are running more efficiently (see table 4). Agriculture development bank limited (69.80 percent technical efficiency), Everest bank limited (93.99 percent technical efficiency) and Laxmi bank limited (92.73 percent technical efficiency) are the banks with higher efficiency in their respective ownership structure.

4. Discussion and Conclusion

The capital, deposit and human resource cost as independent variables are positively affecting the output variable i.e. loans and advances. The productivity of human resource cost, capital and deposit are satisfactory as their coefficients are statistically significant. The loans and

advance is influenced by deposits (0.54) followed by human resource cost (0.25) and capital (0.16) which indicates that the human resource cost is more productive than capital but less productive than deposits. Productivity of deposits explains the productivity of loans and advances most in Nepalese setting with a score of 0.54 as is to be expected because efficient collection and use of deposits will lead to loans and advances in a banking system. This factor has come out strongly in Nepalese perspective too that banks should accord the highest attention to deposit mobilization and utilization in the form of loan to enhance the overall productivity and the efficiency of the banking sector. The impact of human resource cost on productivity is moderate because the main source of loans and advance of banking sector is their deposit collection from different types of accounts and their utilization. But the influence of human resource cost is particularly important as the value is above that of capital indicating the 'used to focus on human resource management of the banks'.

The average technical efficiency of sampled banks is 73.95 percent which indicates the Nepalese banking sector is running at near about 74 percent level of efficiency. This level of efficiency is lower than the study results of Suzuki and Sastrosuwito (2011), but higher than the study results of Yao et al. (2007). However, the variables and methodology used in their study is different from the present study.

The average technical efficiency of commercial banks and development banks is 78.14 percent and 68.82 percent respectively which indicates that commercial banks are more efficient than development banks in Nepal. Similarly, the average technical efficiency of joint venture banks is the highest 82.98 percent as against 70.08 percent of non-joint venture bank which in the case of category by ownership, it is 54.71 percent in government owned banks as against 76.22 percent in other type of ownership. This indicates that the joint venture banks and other category of Nepalese banks are more efficient than government owned banks. Similar results found in the study of Yao et al. (2007), but opposite with the results of Tahir and Haron (2008), Sanyal and Shankar (2008), Baten and kamil (2010), Suzuki and Sastrosuwito (2011), Rajan, Reddy and Pandit (2011) who found domestic banks are more efficient than foreign banks.

The average technical efficiency by nature of banks provide commercial banks as the more efficient than and development banks. It is also confirmed by the previous studies indicates that the commercial banks have utilized their resources more effectively than development banks because most of the employees of banking sector starts their career in development banks shift their job in commercial banks after gaining skills and knowledge of banking job. Besides this, the fresh, capable and talented persons' put the first priority to join the commercial bank which helps in getting more capable and talented human resources as employees of banks.

4.1 Limitations

The study has included altogether 25 banks established before 2005 A.D. as a population of the study. The study employed stochastic production frontier analysis.The study has included financial data of the audited balance sheets of the banks starting from the fiscal year 2006/2007 A.D. to 2014/2015 A.D.

4.2 Implications

The central bank of Nepal (Nepal Rastra Bank) should take corrective actions to improve productivity and efficiency of Nepalese banking sector with respect to policy regarding

resources mobilization of banks. The government owned banks should be improved in terms of productivity and efficiency in order for them to be able to sustain, compete and grow in the market.

4.3 Further Research

This study is conducted to analyze productivity and efficiency in the Nepalese banking sector using stochastic frontier model taking loans and advance as output variable and human resource cost, deposit and capital as input variables. Further study can be done taking other variables such as operating expenses, investment, operating income, operating profit, interest income, interest expenses etc.

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Annex

Table 1

List of Sampled Commercial and Development Banks

Nature of Banks	
Commercial Banks	**Development Banks**
Nepal Bank Limited	NIDC Development Bank Limited
Rastriya Banijya Bank Limited	Siddhartha Development Bank Limited
Agriculture Development Bank Limited	Gorkha Develpoment Bank (Nepal) Limited
Nabil Bank Limited	Sahayogi Bikas Bank Limited
Standard Chartered Bank Nepal Limited	Karnali Bikash Bank Limited
Himalayan Bank Limited	Shubhechchha Bikas Bank Limited
Nepal SBI Bank Limited	Gandaki Development Bank Limited
Nepal Bangladesh Bank Limited	Excel Development Bank Limited
Everest Bank Limited	Western Development Bank Limited
Nepal Credit and Commerce Bank Limited	
Laxmi Bank Limited	

Table 2

Regression Results

Time-invariant inefficiency model Group variable: Bank Dependent Variable: log likelihood = -98.601465					Number of obs = 180 Number of groups = 20 Obs per group: min = 9 avg = 9 max = 9 Wald chi2(3) = 1271.19 Prob > chi2 = 0.0000	
	Coeff.	Std. Err.	z	P > |z|	[95% conf.	Interval]
Ln(Capital)	0.1623582	0.0591	2.75	0.006	0.046524	0.278192
Ln(Deposit)	0.5412514	0.0558526	9.69	0.000	0.431782	0.650721
Ln(Human Resource Cost)	0.2493491	0.0546877	4.56	0.000	0.142163	0.356535
Constant	2.444654	0.6195048	3.95	0.000	1.230447	3.658861
/mu	-2.687842	13.31202	-0.20	0.840	-28.7789	23.40323
/lnsigma2	0.2595042	3.473647	0.07	0.940	-6.54872	7.067726
/ilgtgamma	2.078621	3.906866	0.53	0.595	-5.5787	9.735938
Sigma2	1.296287	4.502844			0.001432	1173.477
Gamma	0.888079	0.3861095			0.003763	0.999941
Sigma_u2	1.15215	4.502438			-7.67247	9.976767
Sigma_v2	0.1441369	0.0162161			0.112354	0.17592

Table 3

Efficiency of Individual Bank

Name of Banks	Technical Efficiency in percentage
Nepal Bank Limited	58.21
NIDC Development Bank Limited	32.11
Rastriya Banijya Bank Limited	58.74
Agriculture Development Bank Limited	69.8
Nabil Bank Limited	86.95
Standard Chartered Bank Nepal Limited	69.19
Himalayan Bank Limited	89.03
Nepal SBI Bank Limited	88.11
Nepal Bangladesh Bank Limited	70.62
Everest Bank Limited	93.99
Nepal Credit and Commerce Bank Limited	82.16
Siddhartha Development Bank Limited	90.97
Laxmi Bank Limited.	92.73
Sahayogi Bikas Bank Limited	76.03
Karnali Bikash Bank Limited	60.49
Shubhechchha Bikas Bank Limited	83.59
Gorkha Develpoment Bank (Nepal) Limited	33.57
Gandaki Development Bank Limited	85.46
Excel Development Bank Limited	90.88
Western Development Bank Limited	66.31
Average of Sampled Banks	73.95

Table 4

Efficiency of Various Groups of Banks

Bases of bank categorization		Average TE in %
Nature of Banks	Commercial Banks	78.14
	Development Banks	68.82
Ownership Structure	Government Banks	54.71
	Joint Venture Banks	82.98
	Other Groups of Banks*	76.22

**Includes the banks which do not come under government and joint venture banks.*