Efficiency Analysis of Commercial Bank Branches: The Case of Berhan Bank Sh. Co.

Getnet Zemene Muche*
Financial sector Consultant and Head of Research and Business Intelligence, Berhan Bank Sh. Co., Addis Ababa, Ethiopia

Abstract

Ensuring efficiency is critical for banks to continually play their role of financial intermediary in mobilizing financial resources and channeling towards productive investment ventures. Thus, this study investigates and discusses on the operating efficiency of 61 branches in Berhan bank between years 2015 and 2020. Secondary data from the internal reports of the Bank were used. A non-parametric linear programing model Data Envelop Analysis (DEA) was employed on input variables (personnel expense and other operating expense) and output variables (annual deposit collected) focusing on output-oriented comparison to estimate the operating efficiency of branches. The finding indicates that both technical and scale efficiency of the branches were very low, with an average 31% and 71 %, respectively and it's below the best practice frontier of 1 (100%). Meanwhile, 99 percent of the branches operating at an increasing economy of scale. Therefore, most of the branches are operating below the best practice production frontiers and they have the capacity to improve productivity by 29 percent. By geographic location, Addis Ababa city branches have relatively better efficiency compared to branches located in other regions. Looking at the seasonality of branches, the seasoned ones have better average efficiency than their newest counterparts. Therefore, it is recommended that the Bank should design effective deposit mobilization strategy that networks potential market segments, implement branch standardization by focusing on selection of appropriate benchmarks, attain the branches' most productive scale size through the elimination of scale inefficiencies ,with minimal changes to branches 'scale size (revise overall planning process), on branch level resource allocation, invest on managerial skill of personnel to improve branch level leadership and launch technology banking.

Keywords: Efficiency, data envelop analysis, output oriented, scale efficiency, Berhan Bank, Ethiopia

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* The author can be reached through getumuche020@gmail.com

INTRODUCTION

Ensuring efficiency is critical for banks to continually play their core role of financial intermediary in mobilizing financial resources and channeling them towards productive investment ventures. The socio-economic environment wherein banks are operating in Ethiopia is characterized by the existence of multitudes of unbanked population, continuously growing national economy and expanding infrastructure necessary for banks to operate more at branch level. In particular, as NBE directed banks to address unbanked population, the banking industry has been competing in branch networking over the last five years. In the study period, one way through which the banks compete and try to maintain or increase the market share was through the branch network. NBE report, in 2018 demonstrated that a private bank branches, on average, has increased from 1,164 in 2014 to 3,159 in 2018[1].

Nowadays, it is common to find two banks sharing one building or working next door to each other, and it clearly indicates how they are fragmented and competing for unnecessary cost of office rent (Abebe, 2020). Besides, Berhanu (2015) noted that an internal report of banks revealed that many of the branches failed to mobilize the required level of resource and negatively contributed towards the bank's performance as opposed to others which used the same amount of input; other branches are recording below average and serving as cost center of the bank. Therefore, unless they allocate the scarce resources efficiently by applying the art of technology and leadership in their daily activity as they employ high skilled human capital their inefficient intermediation will crowd out the use of productive factors in other sectors that can potentially foster economic growth. Thus, inefficient branches must be closed while new ones will be opened in an effort to have a better geographic

[1]Internal report of Private bank's

allocation of branches. If a reconstruction of the branch network is about to take place, it is imperative for a bank to know the efficiency of its branches. Once the efficiency of each branch is known, the management of the bank is in a position first, to rank the branches, second to see where the inefficiency is coming from and third to suggest ways of improving the performance (Noulas, 1994) Thus, the main objectives of this study are to measure the operating efficiency of 61 branches of Berhan Bank in Ethiopia.

LITRATURE REVIEW

2.1. Bank Efficiency Measurement

According to Noulas (1994) the measurement of efficiency has been approached from a variety of dimensions. The traditional approach has used a variant of ratio analysis using a number of financial ratios (e.g., ROA, ROE). Financial ratios can measure the overall financial soundness of a bank or branch and the operational efficiency of its management. Furthermore, it is a short run analysis that may be inappropriate for describing the actual efficiency of the bank in the long-run since it fails to consider the value of management actions and investment decisions that will affect future performance. Hence, limited choice of a benchmark against which to compare a univariate or multivariate score from ratio analysis, ratios fail to consider multiple outputs (services and/or transactions) provided with multiple inputs. The problems in financial ratio analysis have prompted researchers to new ways of measuring efficiency in the banking sector, in order to minimize the above-mentioned limitations of Ratio analysis method. This study used the Data Envelopment (DEA) approach developed by Charnes *et al.* (1978).

2.1.1. Measuring Technical Efficiency and Scale Efficiency

The knowledge of technical efficiency was first proposed by Farrell (1957) based on the works of Debreu (1951) and Koopmans (1951). In the study, he identified two forms of efficiency: technical efficiency and allocative efficiency. Technical efficiency mirrors the ability of a firm to obtain maximum output based on a given set of inputs. Besides, allocative efficiency measures the ability to use the optimal input set based on available prices and production techniques. Technical efficiency and allocative efficiency can be combined to measure the economic efficiency (or overall cost efficiency) of a firm.

2.1.2 Overview of Data Envelope Analysis (DEA)

It is a non-parametric method that utilizes linear programming to measure the level efficiency of comparable decision-making units (DMU) by employing multiple inputs and outputs. DEA, occasionally called frontier analysis, is a performance measurement technique which can be used for analyzing the relative efficiency of productive units. In the case of banks, these are branches having the same multiple inputs and multiple outputs.

2.1.2.1 Basic Types of DEA Model

The two basic assumptions are production at constant return to scale (CRS) and Variable return to scale (VRS). The envelopment surface will differ depending on the scale assumptions that underpin the model. Two scale assumptions are generally employed: constant returns to scale (CRS), and the BCC model by bankers. Charnes-Cooper altered the Constant Return to Scale (CRS) notion to Variable Return to Scale (VRS). The latter encompasses both increasing and decreasing returns to scale. CRS reflects the fact that output will change by the same proportion as inputs are changed (e.g. a doubling of all inputs will double output); VRS reflects the fact that production technology may exhibit increasing, constant and decreasing returns to scale.

2.1.2.2 Input and Output Orientation

The difference between the output- and input-orientated measures can be illustrated using a simple example involving one input and one output. This is depicted in Figure 1 (a) where we have a decreasing return to scale technology represented by f(x), and an inefficient firm operating at the point P. The Farrell input- orientated measure of TE would be equal to the ratio AB/AP, while the output- orientated measure of TE would be CP/CD. The output- and input-orientated measures will only provide equivalent measures of technical efficiency when constant returns to scale exist, but will be unequal when increasing or decreasing returns to scale are present (Fare and Lovell, 1978). The constant returns to scale case are depicted in Figure 1(b) where we observe that AB/AP=CP/CD, for any inefficient point P we care to choose.

One can consider output-orientated measures further by considering the case where production involves two outputs (y1 and y2) and a single input (x1). Again, if we assume constant returns to scale, we can represent the technology by a unit production possibility curve in two dimensions. This example is depicted in Figure 2 where the line ZZ' is the unit production possibility curve and the point A corresponds to an inefficient firm. Note that the inefficient point, A, lies below the curve in this case because ZZ' represents the upper bound of production possibilities.

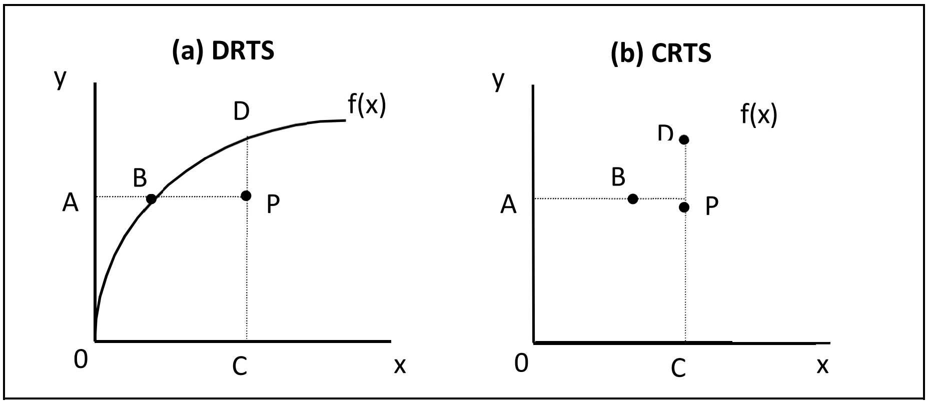

Figure 1: Input- and Output-Orientated Technical Efficiency Measures and Returns to Scale

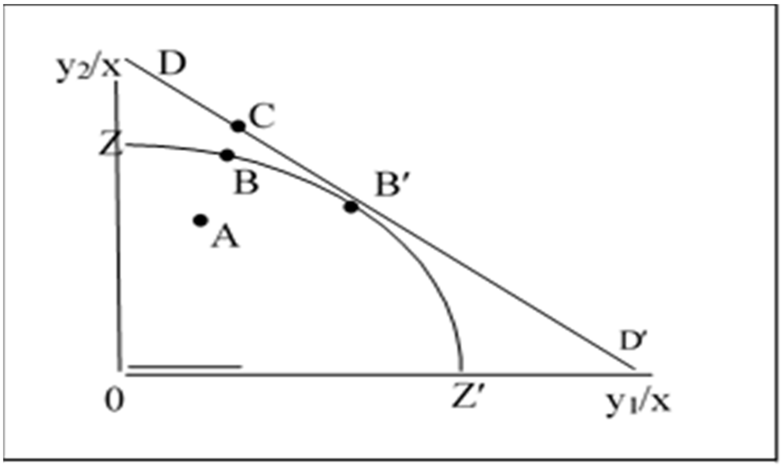

Figure 2: Technical and Allocative Efficiencies from an Output Orientation

The Farrell output-orientated efficiency measures would be defined as follows. In Figure 2 the distance AB represents technical inefficiency. That is, the amount by which outputs could be increased without requiring extra inputs. Hence a measure of output-orientated technical efficiency is the ratio

$TE_O = 0A/0B$……………………………………………………………...(1)

If we have price information then we can draw the iso revenue line DD′, and define the allocative efficiency to be

AE_O = 0B/0C……………………………………………………………(2)

Which has a revenue increasing interpretation (similar to the cost reducing interpretation of allocative inefficiency in the input-orientated case). Furthermore, one can define overall economic efficiency as the product of these two measures

EE_O = (0A/0C) = (0A/0B)(0B/0C) = (TEO)(AEO)………………………(3)

Again, all of these three measures are bounded by zero and one. Thus, in contrast, with input DEA, the linear program is configured to determine a firm's potential output, given its inputs, if it operated efficiently as firms along the best practice frontier. Output-oriented models are "...very much in the spirit of neo-classical production functions defined as the maximum achievable output given input quantities" (Färe *et al.*, 1994, p. 95)

2.1. Empirical Review

During the late 1980s and particularly in the 1990s, the DEA method has been used extensively to evaluate banking institutions. Violeta and Gordana (2017) assess the relative efficiency of the branches in Komercijalna Banka AD Skopje in Macedonia during a three-year period (from2009 to 2011). Output-oriented DEA window analysis model with VRS assumption obtained results interpreted in the bank and they correspond to the factual situation and the perceptions of the respondents, with the exception of one of the branches which, according to the results, show high inefficiency. For the validation of these unexpected results, the use of AHP-DEA validation model was suggested. The results of

AHP are used for ratio-cone weights restriction in the DEA model. The obtained result by this AHP-DEA validation model is used as more valid.

Majid (2012) studied the efficiency of Indian commercial banks for the sample of 8 commercial banks during 2000 – 2010. Using inputs and outputs analysed based on intermediation DEA approach, the findings revealed that the mean of economic efficiency, technical efficiency, and allocative efficiency are 0.991, 0.995, and 0.991 in VRS model and 0.936. 0.969 and 0.958 in CRR model, respectively. Moreover, the results suggest that Bank of India and ICICI bank are more efficient as compared to other banks in India, and the result confirmed that selected public sector banks are more efficient than private sectors during the study period in India.

Empirical evidence on performance evaluation and efficiency of the banking industry is much researched globally. However, there is dearth of research in Ethiopia and only two studies have been conducted at bank level efficiency. Tadesse (2017) conducted a study to identify the determinants of commercial banks technical efficiency in Ethiopia in the years 2011 to 2014. To estimate the technical efficiency score, DEA was employed on input variables (interest expense, operating expense and deposit) and output variables (interest income, non-interest income and loan). The finding revealed that banks had different levels of efficiency result under constant and variable return to scale. A Tobit model is used to examine the determinants of technical efficiency. It is found that level of capitalization, liquidity risk, return on asset and market share have positive and significant effect on the technical efficiency score.

Tesfaye (2014) assessed the efficiency level of Ethiopian banks for the period 2008-2012 by using DEA approach. The result has shown that the industry efficiency level is at modest level but the technical and scale efficiency of banks is characterized by group variations across different ownership and size; it causes efficiency variances across various groups such as banks, public banks that gain favourable support from the government in creating easy market for deposit, loans and forex. The study recommended that banks need to improve their efficiency to ensure equalization of banks in technical efficiency and increase their competitiveness at international level, and call the government's support to enhance their capacity to compete.

Literature gap: There was not empirical research done on bank branch efficiency in Ethiopia because branching data generally are confidential and not required by regulators. This paper tries to add to the limited information available about bank branch efficiency. It specifies the Fourier-Flexible nonparametric form for the cost function to characterize the efficient frontier for bank branches, the first application of the form in a frontier efficiency context.

3. RESEARCH METHODOLOGY

3.1 Mathematical Model Specification

The literature distinguishes different approaches in measuring banking efficiency: a traditional approach with simple ratio measurement, parametric and a non-parametric approach in which the specification of a production cost function is required in both approaches. The non - parametric method offers a linear boundary by enveloping the experimental data points known as" Data Envelopment Analysis" (DEA).

In this paper, we have used the output-oriented DEA window analysis model with the variable returns to scale (VRS) assumption for measuring the relative efficiency of the bank branches of Berhan Bank.

Technically speaking, DEA is an approach rather than a model. Unlike the stochastic production frontier (SPF) model where the parameter estimates represent the production elasticity, the resultant weights associated with the input variables have no economic interpretation. Models can be developed, however, to assess allocative and scale efficiencies, congestion, and overall economic efficiency (Färe *et al.*, 2000). Linear programming (LP) models are developed to undertake the DEA, and for the purposes of simplicity, these can be referred to as DEA LP models. An output-oriented approach is generally more appropriate for the estimation of capacity and capacity utilization. Following Färe *et al.* (1989), and Färe *et al.* (1994), the output-oriented DEA LP model of capacity output, given current use of inputs, is shown as:

$Max\ \emptyset_1$

S.t

$$\emptyset_1\, u\, j.m \ \le \sum_j z\, ju\, \jmath.m^{\cdot} \qquad \forall\, m$$

$$\sum_j z\, jx\, \jmath.n \ \le x\, \jmath.\dot{n} \qquad n \in \ \alpha$$

$$\sum_j z\, jx\, \jmath.n = \lambda\, x\ \ \jmath.\dot{n}^{x}\ \ \jmath.n \qquad n \in \ \tilde{\alpha}$$

$$\sum_j z\, j = 1$$

$$\lambda\, j.n \ \ge 0 \ \ n \in \ \tilde{\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Wherein a scalar showing by how much the production of each firm can increase output, $u_{j,m}$ is amount of output m by firm j, $x_{j,n}$ is amount of input n

used by boat *j* and z_j are weighting factors. Inputs are divided into fixed factors, defined by the set, and variable factors defined by the set $\hat{\alpha}$. To calculate the measure of capacity output, the bounds on the sub-vector of variable inputs, $x_{\hat{\alpha}}$, need to be relaxed. This is achieved by allowing these inputs to be unconstrained through introducing a measure of the input utilization rate ($\lambda_{j,n}$), itself estimated in the model for each boat *j* and variable input *n* (Färe *et al.*, 1994). The restriction $\sum_j z_j = 1$ allows for variable returns to scale.

Capacity output based on observed outputs (u^*) is defined as multiplied by observed output (u). Implicit in this value is the assumption that all inputs are used efficiently as well as at their optimal capacity. From this, technically efficient capacity utilization (TECU) based on observed output (u) is:

$$TECU = \frac{u}{u*} = \frac{u}{\emptyset_1 u} = \frac{1}{\emptyset_1} \qquad (2)$$

The measure of TECU ranges from zero to 1, with 1 being full capacity utilization (i.e. 100 percent of capacity). Values less than 1 indicate that the firm is operating at less than full capacity given the set of fixed inputs. Implicit in the above is a downwards bias because observed outputs are not necessarily being produced efficiently (Färe *et al.*, 1994). As with the SPF measure of capital utilization, an unbiased measure of capacity utilization is calculated as the ratio of technically efficient output to capacity output. The technically efficient level of output requires an estimate of technical efficiency of each boat, and requires both variable and fixed inputs to be considered. The output orientated DEA model for technically efficient measure of output is given as:

$Max\ \emptyset_1$

s.t.

$$\emptyset_2 u\, j.m\ \leq \sum_j z\, ju\, \jmath.m \qquad \forall\, m$$

$$\sum_j z\, jx\, \jmath.n\ \leq x\, \jmath.n \qquad \forall\, m$$

$\sum_j z\, j = 1$ ……………………………………………………………………………(3)

Where F2 is a scalar outcome showing how much the production of each firm can increase by using inputs (both fixed and variable) in a technically efficient configuration. In this case, both variable and fixed inputs are constrained to their current level (i.e. the equality constraint on the output orientated model of capacity has been relaxed). Again, the restriction $\sum_j z_j = 1$ is imposed to allow for variable returns to scale. In this case, F2 represents the extent to which output can increase through using all inputs efficiently. From this, technical efficiency is estimated as:

$TE = \frac{1}{\emptyset_2}$…………………………………………………………………(4)

The measure of technical efficiency ranges from one to infinity; F2 - 1.0 is the proportion by which outputs may be expanded. Some existing software and articles, however, report the value of TE as one over F2 (see for example, Coelli, Rao and Battese, 1998). Values of the ratio (Eq. 4) less than 1 indicate that, even if all current inputs (both variable and fixed) are used efficiently, output is less than potential output. That is, output could increase through efficiency gains, without changing the levels of the inputs. The unbiased estimate of capacity utilization is consequently estimated by:

$$CU = \frac{TECU}{TE} = \frac{\frac{1}{\emptyset_1}}{1}\frac{1}{\emptyset_2} = \frac{\emptyset_2}{\emptyset_1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(5)}$$

As, $\Phi_1 \leq 1$ the estimate of CU ^{3} TECU. Dividing the level of output by the corrected measure of capacity utilization produces lower but unbiased estimates of capacity output.

3.2 DATA and Variables

For the purpose of analyzing the trend of efficiency, annual performance report of 61 branches from years from 2015-2020 were used as secondary data to analyze their efficiency. DEA is a deterministic methodology for examining the relative efficiency, based on the data of selected inputs and outputs of branches. The first step in the analysis was selecting the production approach for measuring the relative efficiency of the branches. According to this approach, the bank branches use labor and capital in order to produce deposits and loans, as stated in Paradi *et al.* (2004, p. 355). Therefore, in the analysis, the following set of inputs and outputs were applied to quantify the efficiency of branches.

Outputs*:* Outstanding Deposit (branches are serving for deposit mobilization center)[2]but deposit balances excluding fixed time deposits of branches were also considered as an output. The fixed time deposit balances were excluded because in some cases fixed time deposits are mobilized at Head Office level without the involvement of branches. Unlike current and saving accounts, fixed

[2] According to Banks' performance evaluation criteria, deposit mobilization is the main factor while loan allocation is done at head office level.

time deposits are mobilized in large volume without requiring the commitment of proportionate resources. Inputs include salary and benefit, expense and other operating expense. The input excludes Interest expense since loan allocation is managed only at head office level.

4. RESULT AND DISCUSSION

In this study, Data Envelopment Analysis model was chosen to analyze technical and scale efficiency under the output-orientation model, with an aim of measuring the operating ability of the sample branches to maximize output. The study was meant to analyze the operating and technical efficiency of branches; however, the branches are limited in resource mobilization (deposit). What is more, this study used deposit mobilization as a primary target of branches, but not allowed to allocate loan and maximize profit.

Accordingly, the DEA model analyzed the technical and scale efficiency level of branches taking into account salaries and benefit and other operating expenses as an input, and the six - year data of branches' outstanding balances of deposits as an output for the years 2015 to 2020. The technical and scale efficiency level of branches under consideration is labeled as the respective efficiencies of branches between 0 and 1. i.e. efficiency score of 1 indicates that the particular branch is on the best practice production frontier; a score less than 1 shows that the branch is beneath the best practice production frontier.: Meanwhile, multi-stage DEA that enables to conduct sequence of projected points with mixed inputs and outputs that ultimately enables economies of scale registered by average increase return to scale (IR), constant return to scale (CRS) and decreasing return to scale (DRS) of the branches.

Technical efficiency of branches. Accordingly, in table 1 below each year values for technical efficiencies (VRS) were found to be in the low range, at about 25 % to 48 % with an average of 31 %. The mean technical efficiency (variable returns to scale) of branch production activities in the bank decreased, from 43 % in 2017 to 25 % in 2020 (figure 1). By geographic location, Addis Ababa city branches have relatively better technical efficiency compared to branches located in another region. In opening dates, the oldest branches have better average efficiency than the youngest branches of the Bank.

Scale efficiency: As mentioned above, scale efficiency is calculated by the ratio between technical efficiency under constant returns to scale and technical efficiency under variable returns to scale, which indicates how optimal a bank's scale is. In this study scale efficiencies were found to be relatively unstable - at around 72 % over the period 2015 to 2020. The mean scale efficiency scores, which is in the range of 61 % and 87 % which decreased from 85 % in 2015 to 71 % in 2020. In this case, the average efficiency scale value of 71% implies that the observed branch operation could have further increase their output by about 29 % if they had reached an optimal scale. However, one should ask: which scale is optimal? Efficiency scales have a relationship to the different forms of returns to scale. The results here show that increasing returns to scale was a dominant characteristic in all periods, reflecting the need to expand production scales in future years in order to attain greater efficiency. In all years, the proportion of increasing returns to scale was 99%, while the optimal scale accounts for only a small proportion, at 1%.

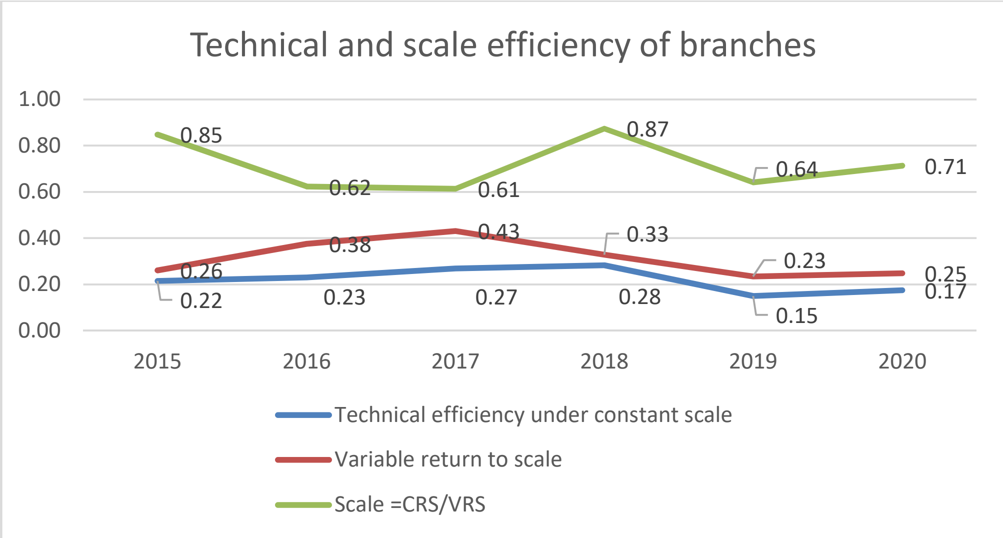

Figure 3: Technical and Scale efficiency of branches

The overall technical efficiency score ranges between technical efficiencies (VRS) were found to be in the low range, at about 25 % to 48 % with an average of 31 %. Similarly, scale efficiencies were found to be relatively unstable - at around 72 % over the study period. The mean scale efficiency scores, which is in the range of 61 % and 87 % which decreased from 85 % in 2015 to 71 % in 2019. In this case, the average efficiency scale value of 71% implies that the observed branch operation could have further increase their output by about 29 % if they had reached an optimal scale. Thus, the banks could improve its output by 29% on average. In other words, banks could have used only 71% of its capacity level of outputs. In all years, allocated inefficiency was higher than technical inefficiency. This problem of selecting the optimal mix of inputs given, the prices can be associated with the industry's aggressive movement in resource mobilizations. As shown in table 1, branches located in Addis Ababa region are more efficient under all the given scenarios (technical and Scale) as compared to other regions. Addis Ababa, however, has better output. On the other hand. The result indicated that branches opened earlier have better technical and scale efficiency compared to branches opened in the latter period (Table 1).

Table 1: Efficiency Result of branches

Branches	Technical and scale Efficiency under Output oriented		
	Constant to return to scale (CRS)	Variable return to scale (VRS)	Scale efficiency
Addis Ababa City	0.28	0.38	0.75
Regional branches	0.17	0.27	0.67
Amhara region	0.16	0.24	0.67
Oromia region	0.16	0.27	0.67
South Nations and Nationality	0.26	0.40	0.69
Tigray	0.13	0.18	0.74
Branch opened (2009-2012)	0.36	0.43	0.82
Branch opened (2013-2015)	0.17	0.28	0.66
Average	0.21	0.31	0.71

Source: Author's computation

5. CONCLUSION AND RECOMMENDATIONS

According to the DEA output-oriented production approach, the measure of efficiency ranges from 0 to 1, with 1 being full capacity utilization (i.e. 100 percent of capacity). Values less than 1 indicate that the branches are operating at less than full capacity, given the set of fixed inputs. The overall technical efficiency score ranges between technical efficiencies (VRS) were found to be in the low range. Similarly, scale efficiencies were found to be relatively low and unstable - at around 72 % over the period 2015 to 2020. The results suggest that most branches (99 percent) are experiencing increasing economies of scale by operating below the best practice production frontiers and they have the capacity to improve their productivity. Branches located in the capital city are more efficient as compared to branches located in another region. Furthermore, the sources of branches' inefficiency were contributed from both technical and scale operations where the former has contributed more. The sources of their inefficiency are due to lack of technological dynamism as and the pure technical inefficiency (i.e., managerial inefficiency)

The bank should design effective deposit mobilization strategies that direct sources of potential deposit market segment, include a profit target for branches in the performance management system, and design branch standardization. It should also invest in technology banking and managerial skill of personnel to improve its technical and scale efficiency of branches. Besides, the bank should increase its branch networking at the regions Addis Ababa with better efficiency. Finally, the bank is advised to improve its planning process, the target setting and performance management system of the branches.

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