Volume: 5 Issues: 28 [September, 2020] pp. 37 - 48]
International Journal of Accounting, Finance and Business (IJAFB)
eISSN: 0128-1844
Journal website: www.ijafb.com

ASSESSING THE PERFORMANCE OF COOPERATIVE BANKS IN THE PHILIPPINES: A DATA ENVELOPMENT ANALYSIS

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Article history
Received date : 28-8-2020
Revised date : 29-8-2020
Accepted date : 25-9-2020
Published date : 29-9-2020

To cite this document:
Mirasol, M.L.P. & Garcia, D.R. (2020). Assessing the Performance of Cooperative Banks in the Philippines: A Data Envelopment Analysis.. *International Journal of Accounting, Finance and Business (IJAFB)*, 5 (28), 37 - 48.

Abstract: *This paper assesses the performance of cooperative banks (CBs) in the Philippines for the period 2015-2018 by calculating their technical efficiencies. Slack-based data envelopment analysis (SBM-DEA) was applied in a dataset of 23 CBs provided by Bangko Sentral ng Pilipinas. Adopting the intermediation approach, total deposits and fixed assets were used as input variables and total loans and other earning assets were used as output variables. Results showed that three CBs were efficiently strong having operated at their most productive scale size (MPSS), seven CBs were efficiently weak, six were inefficient (without slacks), and seven were inefficient (with slacks). On the average, the overall technical efficiency is 64.1% implying that CBs need to reduce their inputs by 35.9% while producing the same amount of outputs. The sources of inefficiency were identified to be both from poor management of inputs and inappropriate scale of operations. The CBs should improve management competencies and practice rightsizing to achieve optimal scale of operations.*

Keywords: *Data Envelopment Analysis, Efficiency, Most Productive Scale Size*

Introduction

Cooperative banks (CBs) are integral part of the cooperative movement, particularly in the credit sector. They were first established in Europe in the 19th century to provide credit to small urban and rural enterprises that have little or no access to credit (Coccorese, Ferri & Spiniello, 2017). They have a peculiar business model because that their customers are their members (Clark, Mare & Radic, 2018). They operate not for profit but to improve the economic standing of their members. In return, their members are to patronize the CBs' financial services and not to gain dividends (Spulbar, Nitoi & Anghel, 2015). They tend to be traditional in their business dealings as compared to commercial banks as they are engrained in local economies (Stefancic, 2016). Their banking activities are primarily focused on deposit taking and granting

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of loans, hence, they are more connected to the real economy (Vozkova & Kuc, 2017). Because of these characteristics, CBs were able to weather the effect of a more stringent monetary policy in times of financial crunch such as the 1997 Asian Financial Crisis compared to savings banks (Ferri, Kalmi & Kerola, 2014).

In the Philippines, CBs are recognized by the government as significant segment of the rural banking system. They are the primary providers of financial services to hundreds of primary cooperatives, federations and their individual members who usually encounter difficulties in accessing banking services (Agcaoili, 2011). The report of the BSP shows that in spite of small share in the banking system's total loan portfolio, rural banks and CBs were able to provide the financial needs of agri-agra sector and micro, small and medium enterprises (MSMEs) that were considered underserved or unserved by larger commercial banks (The Philippine Banking System, 2014). Thus, the importance of CBs in the rural areas cannot be ignored. They need to be ever present in the countryside so that the agri-agra sector where cooperatives belong and the MSMEs can rely on them in times of financial needs. However, only a few were able to manage their resources to optimal use in order to attain efficiency. BSP records reveal that the number of operating CBs dropped from 40 in 2011 to 25 in 2018. In a span of eight years, 15 CBs ceased operations which significantly affected the provision of formal credit in the rural areas. In order to ensure their continued presence and provision of financial services, it is then vital that CBs have to keep track of their performance from time to time. Correspondingly, since CBs consider market competition as one of the major risks in their operations (Report on Philippine Financial System, 2018), they need to examine their performance on a regular basis all the more.

A very effective technique to help sustain the competitiveness, profitability and viability of banks is to regularly assess their level of efficiency (Jayaraman, et al., 2014). Efficiency indicates increased profitability, sufficient funds circulating in the system, higher prices and better-quality consumer services, and improved capital buffers to absorb risk (Popovici, 2013). A bank that is operating efficiently helps increase economic growth and financial stability (Banna & Koh, 2017). Besides, economists will agree that one of the most vital concerns in the financial market is the competence of the banking system inasmuch as the efficiency of banks can influence the stability of banking industry and the effectiveness of the monetary system as a whole (Yilmaz, 2013). The efficient working of the banking institution is an essential requirement for the growth of the country. It is then imperative that their efficiency is to be measured consistently to ensure that they are working at the optimum level (Trivedi, Mehta & Mehta, 2016). This is done by using well-defined efficiency indicators that would reflect the most relevant aspects of performance and serve as a basis of comparison (Székely, 2018). Thus, efficiency assessment is conducted to pinpoint weaknesses so that the appropriate measures can be done to improve the performance of the entire system (Liu, 2018).

Objectives of the Study

This paper generally aimed to assess the performance efficiency of CBs in the Philippines. In so doing, the efficient and inefficient CBs can be identified, the main causes of inefficiency can be determined, and measures on how to improve efficiency can be proposed. The results of this study will provide important insights to the CBs management, to the member cooperative-investors and to the government regulators.

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Literature Review

Technical Efficiency

An efficient firm is defined by Farrell (1957) as being able to produce the largest output possible out of a given set of inputs. He then explained that efficiency constitutes technical efficiency and allocative efficiency. Technical efficiency refers to the capability of a firm to achieve maximum output out of a particular group of inputs, while allocative efficiency is the capability of the firm to utilize the inputs in optimum extents, taking into consideration price and production technology. The combination of the two will result into overall economic efficiency, which can be examined from the perspective of input or output-based models. Similarly, Wahidudin (2010) opined that technical efficiency reveals the ability of the organization to attain maximum output out of a given set of inputs; while, allocative efficiency reflects its ability to utilize the inputs in optimal magnitudes, considering the input prices. The combination of these two is referred to as total economic efficiency (TEE) or cost efficiency (CE). Moreover, technical efficiency can be decomposed into scale efficiency (SE) and pure technical efficiency (PTE).

As illustrated by Coelli et al. (2005) and presented in the study of Emrouznejad & Cabanda (2015, pp. 3-4), "the unit isoquant of the fully efficient firm is represented by the curve SS' (see Figure 1), which enables the measurement of technical efficiency. If a firm uses quantities of inputs, defined by the point P, to produce a unit of output, then the distance QP represents the technical inefficiency of that firm, which is the amount by which all inputs can be proportionally reduced while the output remains constant. This is represented by the ratio of QP/0P by which all inputs can be reduced to achieve an efficient production. Thus, technical efficiency (TE) of a firm is expressed as the ratio TE = 0Q/0P, which is equal to one minus QP/0P. It takes an interval value between zero and one as an indicator of the degree of technical efficiency of a firm. A firm is fully technically efficient when a value of one is obtained. In Figure 1, point Q is technically efficient because it lies on the efficient frontier in which case TE = 1 and di (x, q) = 1. Thus, an input-oriented TE is expressed as TE = 1/ di (x, q) in terms of input-distance function di (x, q) (Coelli et al., 2005: 52-53). Whereas, allocative efficiency can be calculated if the input price ratio is also known, represented by the line AA' in Figure 1. The allocative efficiency (AE) is expressed as the ratio AE = 0R/0Q."

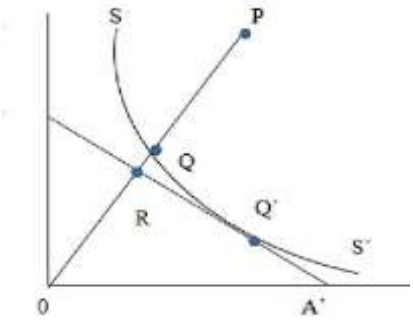

Figure 1. Technical and Allocative Efficiencies (Coelli et al., 2005)

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Related Studies

For the past decades, bank efficiency has been the subject of many studies among researchers, scholars and academicians in many countries using frontier analysis. In Europe, Ouenniche & Carrales (2018) employed the non-parametric data envelopment analysis (DEA) to assess the efficiency of UK commercial banks and found that the banks are yet to achieve acceptable levels of overall technical efficiency, pure technical efficiency and scale efficiency. Spulbar, Nitoi & Anghel (2015), on the other hand, used the parametric stochastic frontier analysis (SFA) to assess the cost efficiency of cooperative banks and savings banks of nine European countries. The results showed that smaller cooperative banks and savings banks are more efficient in managing costs than larger banks. In Asia, Safiullah and Shamsuddin (2018) compared the cost and profit efficiencies of conventional banks and Islamic banks of 28 countries using stochastic meta-frontier approach. They found that Islamic banks are 4% more cost efficient but 17% less profit efficient on a risk-adjusted basis and that higher bank risk reduces cost efficiency but increases profit efficiency. Sufian & Kamarudin (2014) assessed the level of profit efficiency of Bangladesh banks using DEA-slack based method and the findings revealed that most of the banks have been experiencing economies of scale due to being below the optimal size or diseconomies of scale for being more than the optimal size. The study of Kollapuri (2017) on the effects of bank consolidation to efficiency involving 16 consolidation deals in India concluded that pure technical efficiency scores improved in majority of the deals, while for overall and scale efficiency scores, majority did not register efficiency gains. In Southeast Asia, Wong & Deng (2014) studied the relative efficiency of 39 banks in four countries from Southeast Asia using DEA. The findings suggested that Malaysian banks are more efficient, large-sized banks in ASEAN are less cost efficient, and government banks showed substantial efficiency gain throughout the years.

As far as Philippine banks are concerned, only a handful of studies have focused on bank efficiency using frontier analysis. Montinola and Moreno (2001) were the first to use DEA in studying the effects of liberalization of foreign bank entry to the Philippines in 1994. The results indicated that there was a decline of domestic bank efficiency before the liberalization due to lack of competition but the effects of liberalization were minimal. In a subsequent study, Dacanay (2007) examined not only the effects of liberalization but also the effects of Asian financial crisis and consolidation to the profit and cost efficiencies of Philippines commercial banks from 1992-2004 using SFA. Results showed that there was a modest efficiency gain after liberalization, cost inefficiency of the sector increased after the crisis, and there was no efficiency improvement both for the acquired and surviving banks three years after merger. Also using SFA, Manlagñit (2010) examined the cost efficiency of Philippine commercial banks from 1990 to 2006 by incorporating risk and asset quality measures. The results showed substantial inefficiencies among domestic banks all throughout the study period and that risk and asset quality affect the efficiency of banks. In the study of Gordo (2013), the relative efficiencies of different bank groups in the Philippines were measured for the period 1999-2009 employing DEA-Malmquist Total Factor Productivity Index. Results showed that generally there was a declining trend in technical efficiency and that bigger banks are found not to be more efficient than smaller banks. Though the banks have undergone technological progress, there was no increase in total factor productivity due to decline in technical efficiency. However, the results are not conclusive since there was no statistical differences in the efficiency scores and efficiency changes throughout the study period. Later, Metica, et al. (2015) examined the overall technical efficiency and productivity level of twelve universal and three commercial banks in the Philippines using DEA-Malmquist Index and SFA from 2004 to

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2012. The findings revealed that efficiency change and technical change caused the improvement in the productivity of banks, while scale efficiency change and pure efficiency change caused the banks to be cost efficient. Also, findings showed that older and larger banks were more efficient than younger and smaller banks. None of these cited studies have particularly focused on the efficiency analysis of the Philippine cooperative banking sector. This gap is what the present study aimed to fill.

Methodology

Data and Sample

The study made use of secondary data provided by the Supervisory Insights Division, Department of Supervisory Analytics of the BSP. Specifically, the financial data were sourced from the published balance sheets of CBs which were submitted to the BSP for the period 2015-2018. Moreover, only the published balance sheets were provided by the BSP as the original requested information which includes income statements is covered by Section 27(c) of R.A. 7653 (The New Central Bank Act) as amended by R.A. 11211 (BSP Charter) which prohibits personnel of BSP from disclosing or revealing information relating to the condition or business of any institution subject to BSP supervision or examination. Since only 23 CBs out of the 25 operating CBs have published balance sheets for the said test period, these 23 CBs comprised the sample of this study.

Data Envelopment Analysis

Charnes, et al. (1978) made some advancements on Farrell's concept and came up with a non-parametric approach known as data envelopment analysis (DEA) to measure the relative efficiency of a similar set of decision-making units (DMUs) under investigation. It involves the nonparametric approximation of an efficiency frontier that envelops the group of entities in order to identify best practices (Fall, et al., 2018). The points on the frontier are the effective units with best practices. Those points that are below the border are the ineffective or under-effective units. (Yannick, et al, 2016). Compared to a simple efficiency ratio, DEA can accommodate multiple inputs and outputs and can locate where the improvements in efficiency should be and how extensive these improvements should be (Sherman & Zhu, 2006). Moreover, its most notable benefit in management is it can pinpoint the unit used as reference to locate the source of inefficiency (Wahyudi & Azizah, 2018). While the DEA frontier can, in some situations, be rightly viewed as a production frontier, it must be remembered that ultimately DEA is intended as a method for performance evaluation and benchmarking against best-practice. It is a type of "balanced benchmarking" that examines performance in multiple criteria and helps organizations to test their assumptions about performance, productivity, and efficiency (Cook, et al., 2013). Additional advantages of DEA were also noted in terms of (a) its ability to identify sources and amounts of inefficiency in each input and each output for each entity (hospital, store, furnace, etc.) and (b) its ability to identify the benchmark members of the efficient set used to effect these evaluations and identify these sources (and amounts) of inefficiency (Cooper, et al., 2007).

DEA has two main models: constant return to scale (CRS) and variable return to scale (VRS). CRS happens when the percentage change in output is equal to the percentage change in inputs. On the other hand, VRS may indicate increasing, decreasing, or constant returns to scale. According to Coelli, et al. (2005), increasing return to scale (IRS) happens when the percentage change in output is greater than the percentage change in inputs, whereas, decreasing return to

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scale (DRS) happens when the percentage change in output is less than the percentage change in inputs. The difference in efficacy ratios between these two types of DEA shows that the firm is not operating at an optimal scale. Scale inefficiency is then known by the difference between CRS technical inefficiency and VRS technical inefficiency. Through this model, the cause of efficiency/inefficiency level is revealed. Moreover, a bank under investigation is considered efficient when it is on the frontier with no input and output slack. Slacks represent potential improvements in the input and output variables of the inefficient CBs. The non-radial efficiency measure DEA-slack-based model (SBM) tackles input excesses and output shortages (Tone, 2002) known as slacks. With SBM, the best and least performers were identified using the standards of the most productive scale size (MPSS).

Data Analysis

This study employed the input-oriented slack-based model (SBM)-DEA to evaluate the efficiency of each CB using DEAP Version 2.1 software. In the input-oriented model, bank efficiency is centered on input variables. Accordingly, decreasing the inputs proportionately transforms an ineffective bank into an effective one (Balcerzak, Kliestik, Streimikiene, & Smrčka, 2017). A bank should have a total score of 100% in cost efficiency (CRSTE), managerial efficiency (VRSTE), and advantageous condition (SE) in order to be the best performers. Corollary, their operations should be in constant return to scale (Metica, Garcia, Bool & Sunga, 2015). In choosing the input and output variables, intermediation approach was used. This approach assumes that a bank's primary task is to take deposits and transform the same into loans and other earning assets (Popovici, 2013), which is the basic function of the CBs. With this, the CBs produce two outputs: total loans (y_1) and other earning assets (y_2) out of the inputs: total deposits (x_1) and fixed assets (x_1). Total loans represent the CBs' gross total loans portfolio and other earning assets represent dues from BSP and other banks, and financial assets. Whereas, total deposits represent the CBs' deposit liabilities, and fixed assets represent the CBs' premises, furniture, fixture and equipment (net). The descriptive statistics of the variables measured in millions of Philippine Peso (PhP) is presented in Table 1.

Table 1. The Descriptive Statistics of Variables.

	Min.	Max.	Mean	SD
Total loans (y_1)	21.33	3183.73	609.39	733.35
Other earning assets (y_2)	3.03	1085.55	215.97	247.63
Total deposits (x_1)	14.21	2530.97	520.97	564.04
Fixed assets (x_2)	0.03	160.59	32.47	37.36

Results and Discussion

Using DEAP v.2.1, the tables below show the technical efficiency from CRS DEA, pure technical efficiency from VRS DEA, and scale efficiency, including the presence or absence of slacks of the 23 cooperative banks. There were four (4) groups of CBs identified according to their levels of efficiency, namely: efficiently strong (100% in CRSTE, VRSTE and Scale), efficiently weak (100% efficient in either CRSTE, VRSTE and Scale), inefficient (without slacks), and inefficient (with slacks).

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The Efficiently Strong Cooperative Banks

Table 2 shows that the efficiently strong CBs were DMU 3, DMU 20 and DMU 36 which displayed the maximum (100%) efficient performance in cost or overall efficiency (CRSTE), management (VRSTE) and scale of operation. This is called the maximum productive scale size (MPSS) of a CB for the period 2015 to 2018. Cooper, Seiford & Tone (2006) mentioned that firms that achieved 100% maximum efficiency operated at their MPSS. It is likewise defined as a measurement that states how resources should be organized and utilized to achieve optimal results (Sari, et al., 2018). It is achieved if and only if it has pure technical efficiency and scale efficiency of 1. At MPSS, a CB is cost efficient in their operation, good in managing total deposits and fixed assets to generate the desired level of total loans and other earning assets, and is operating in the advantageous condition (constant returns to scale, CRS). As a result of efficient performance, there were no shortage in total loans and other earning assets nor excess use of total deposits and fixed assets from 2015 to 2018.

Table 2. The Efficiently Strong Cooperative Banks.

	Efficiency Summary				Slacks			
DMU	CRSTE	VRSTE	Scale	RTS	TL	OEA	TD	FA
Efficiently Strong								
DMU 3	1.000	1.000	1.000	CRS	0	0	0	0
DMU 20	1.000	1.000	1.000	CRS	0	0	0	0
DMU 21	1.000	1.000	1.000	CRS	0	0	0	0
Mean	1.000	1.000	1.000					

CRSTE – Constant return to scale technical efficiency; VRSTE – Variable Return to Scale Technical Efficiency; Scale – Scale Efficiency; RTS – Return to Scale; TL – Total Loans; OEA – Other Earning Assets; TD – Total Deposits; FA – Fixed Assets

The Efficiently Weak Cooperative Banks

Table 3 reveals that the efficiently weak CBs were DMU 12, DMU 17, DMU 9, DMU 6, DMU 4, DMU 19, and DMU 1. This group was efficiently weak because they have achieved below 100% performance in cost efficiency (CRSTE) and scale efficiency (SE). However, the group was efficient in administering the use of total deposits and fixed assets (VRSTE = 1.00). Except for DMU 1, the CBs operated at decreasing return to scale (DRS) implying that the CBs operated at higher scale sizes, i.e., they have exceeded their optimal size. DMU 1 was detected operating at lower scale size. This is a condition of increasing return to scale (IRS) or operating at small condition to achieve higher returns. However, there is a trade off in going small because of cost disadvantages (CRSTE < 1.00) resulting to an increase in organizational size of total loans and other earning assets at an increase of total deposits and fixed assets.

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Table 3. The Efficiently Weak Cooperative Banks.

	Efficiency Summary				Slacks			
DMU	CRSTE	VRSTE	Scale	RTS	TL	OEA	TD	FA
Efficiently Weak								
DMU 12	0.831	1.000	0.831	DRS	0	0	0	0
DMU 17	0.747	1.000	0.747	DRS	0	0	0	0
DMU 9	0.688	1.000	0.688	DRS	0	0	0	0
DMU 6	0.656	1.000	0.656	DRS	0	0	0	0
DMU 4	0.628	1.000	0.628	DRS	0	0	0	0
DMU 19	0.613	1.000	0.613	DRS	0	0	0	0
DMU 1	0.590	1.000	0.590	IRS	0	0	0	0
Mean	0.679	1.000	0.679					

CRSTE – Constant return to scale technical efficiency; VRSTE – Variable Return to Scale Technical Efficiency; Scale – Scale Efficiency; RTS – Return to Scale; TL – Total Loans; OEA – Other Earning Assets; TD – Total Deposits; FA – Fixed Assets

The Inefficient (without slacks) Cooperative Banks

Table 4 shows the inefficient CBs (without slacks) were DMU 7, DMU 23, DMU 10, DMU 18, DMU 14, and DMU 13. They seem to be a revelation. Although the six CBs were inefficient in their overall cost (CRSTE < 1.00, VRSTE < 1.00 and Scale < 1.00), they incurred no shortage in total loans and other earning assets nor excess in total deposits and fixed assets. All of the CBs operated at decreasing return to scale (DRS) implying that they opted to go "big" (higher scale of operation) but with decreasing total loans and other earning assets to sustain operation. This option made them cost inefficient because of inefficient management of inputs and bad scale condition (going big).

Table 4. The Inefficient (without slacks) Cooperative Banks.

	Efficiency Summary				Slacks			
DMU	CRSTE	VRSTE	Scale	RTS	TL	OEA	TD	FA
Inefficient (without slacks)								
DMU 7	0.481	0.538	0.894	DRS	0	0	0	0
DMU 23	0.537	0.639	0.840	DRS	0	0	0	0
DMU 10	0.684	0.900	0.760	DRS	0	0	0	0
DMU 18	0.675	0.902	0.748	DRS	0	0	0	0
DMU 14	0.604	0.825	0.733	DRS	0	0	0	0
DMU 13	0.389	0.543	0.716	DRS	0	0	0	0
Mean	0.562	0.725	0.782					

CRSTE – Constant return to scale technical efficiency; VRSTE – Variable Return to Scale Technical Efficiency; Scale – Scale Efficiency; RTS – Return to Scale; TL – Total Loans; OEA – Other Earning Assets; TD – Total Deposits; FA – Fixed Assets

The Inefficient (with slacks) Cooperative Banks

Table 5 shows the inefficient (with slacks) CBs. They were operationally inefficient with majority (N = 5) of them operating at increasing return to scale and few (N = 2) with decreasing return to scale (DRS). The five CBs at IRS were as follows: DMU 8, DMU 15, DMU 5, DMU 11 and DMU 22. The two cooperatives at DRS were DMU 2 and DMU 16. The CBs were not

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cost efficient (CRSTE = 0.516) because of poor management of inputs (VRSTE = 0.591) and disadvantageous scale condition (IRS or DRS). They suffered shortage in total loans and other earning assets or incurred excess in fixed assets. DMU 8 and DMU 15 experienced shortage in the desired level of total loans (PhP 17.332 million) and other earning assets (PhP 47.204 million). DMU 2 and DMU 5 have shortage in other earning assets in the amount of PhP 3.351 million and PhP 8.7 million, respectively. DMU 11, DMU 22 and DMU 16 have excesses in fixed asset in the amount of PhP 6.389 million, PhP 6.007 million and PhP 12.869 million, respectively. The excess in fixed assets implied less liquidity of the three CBs since these tangible/physical assets cannot be converted into cash in an instant. Excessive nonliquid assets could exacerbate their problem on decreasing output (total loans and other earning assets) that could be a cause of closure in the future.

Table 5. The Inefficient (with slacks) Cooperative Banks.

	Efficiency Summary				Slacks			
DMU	CRSTE	VRSTE	Scale	RTS	TL	OEA	TD	FA
Inefficient (with slacks)								
DMU 8	0.582	0.589	0.988	IRS	17.332	0	0	0
DMU 15	0.696	0.756	0.920	IRS	47.204	0	0	0
DMU 2	0.414	0.464	0.892	DRS	0	3.351	0	0
DMU 5	0.214	0.308	0.695	IRS	0	8.7	0	0
DMU 11	0.482	0.507	0.951	IRS	0	0	0	6.389
DMU 22	0.712	0.815	0.874	IRS	0	0	0	6.007
DMU 16	0.510	0.700	0.729	DRS	0	0	0	12.869
Mean	0.516	0.591	0.864		32.27	6.03		8.42

CRSTE – Constant return to scale technical efficiency; VRSTE – Variable Return to Scale Technical Efficiency; Scale – Scale Efficiency; RTS – Return to Scale; TL – Total Loans; OEA – Other Earning Assets; TD – Total Deposits; FA – Fixed Assets

Efficiency Summary

Table 6 shows the mean of each efficiency group of the CBs and the grand mean. Overall, the average CRSTE of the 23 CBs is 64.1%, VRSTE is 80.4%, and SE is 80.4%. This implies that generally, CBs may possibly decrease their inputs by 35.9% while producing the same amount of outputs, improvement in management would help decrease input utilization by 19.6%, and by correcting their scale, CBs could reduce their inputs by 19.6%.

Table 6. The Efficiency Summary of Cooperative Banks.

Efficiency Group	Mean		
	CRSTE	VRSTE	Scale
Efficiently Strong	1.000	1.000	1.000
Efficiently Weak	0.679	1.000	0.679
Inefficient (without slacks)	0.562	0.725	0.782
Inefficient (with slacks)	0.516	0.591	0.864
Grand Mean	0.641	0.804	0.804

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eISSN: 0128-1844
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Conclusion and Recommendation

The objective of this study is to assess the performance efficiency of cooperative banks in the Philippines in order to identify the efficient and inefficient CBs. For the analysis, SBM-DEA was employed. The results suggest that three CBs were efficiently strong having operated at MPSS, seven were efficiently weak, ten were inefficient (without slacks), and seven were inefficient (with slacks). On the average, sources of inefficiency were identified to be both from poor management of inputs and inappropriate scale of operations. The overall technical efficiency of the 23 CBs is 64.1% which implies that in order to reach optimal efficiency, the CBs need to reduce their total deposits and fixed assets by 35.9% while producing the same amount of total loans and other earning assets. Maintaining large amount of deposits and fixed assets do not readily translate into larger volume of loans and other earning assets as the expenses incurred in maintaining the same could weigh down the production of loans and other earning assets. In addition, CBs that are operating in IRS condition should increase the scale of their operations. This could be done through expansion of operations by recruiting new customers in their present market areas, putting up branches in other areas or entering into mergers with CBs that are also in IRS condition. In the case of CBs that are operating in DRS condition, they need to downsize their scale of operations. This could be done by focusing on a particular market segment, upgrading technology, or closing branches that are not doing well.

References

Agcaoili, L. (2011, September 19). BSP sets measures to boost co-op banking. *Philstar*. Retrieved https://www.philstar.com

Balcerzak, A., Kliestik, T., Streimikiene, D., & Smrčka, L. (2017). Non-parametric approach to measuring the efficiency of banking sectors in European Union countries. *Acta Polytechnica Hungarica*. *14*, 51-70. 10.12700/APH.14.7.2017.7.4. DOI: 10.12700/APH.14.7.2017.7.4

Bangko Sentral ng Pilipinas. (2014). *The Philippine banking system*. http://www.bsp.gov.ph/downloads/Publications/ 2014/FACTBOOK_2014V1.pdf

Bangko Sentral ng Pilipinas. (2018). *Report on Philippine Financial System Second Semester 2018.* http://www.bsp.gov.ph/banking/pub.asp

Banna, H., Ahmad, R., & Koh, E. H.Y., (2017). Determinants of commercial banks' efficiency in Bangladesh: Does crisis matter? *Journal of Asian Finance, Economics and Business, 4*(3), 19-26. doi:10.13106

Charnes, A., Cooper, W.W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research, 2*(6), 429-444

Clark, E., Mare, D. S., & Radic, N. (2018). Cooperative banks: What do we know about competition and risk preferences? *Journal of International Financial Markets, Institutions & Money*. Elsevier, 90-101

Coccorese, P., Ferri, G., & Spiniello, F. (2017). Are mergers among cooperative banks worth a dime? Evidence on post-M&A efficiency in Italy. *Center for Relationship Banking and Economics Working Paper Series*. Working Paper No. 18, March 2017, LUMSA University, Rome, Italy

Coelli, T.J., Rao, D.S.P., O'Donnel, C.J., & Battese, G.E. (2005). An Introduction to Efficiency and Productivity Analysis. Springer (2nd ed), 349

Cook, W.D., Tone, K., & Zhu, J. (2014). Data envelopment analysis: Prior to choosing a model, *Omega, 44*(C), 1-4

Cooper, W.W. & Seiford, L., & Tone, K. (2006). Introduction to data envelopment analysis and its uses: With DEA-solver software and references. *Introduction to Data Envelopment*

Analysis and Its Uses: With DEA-Solver Software and References. 1-354. Doi:10.1007/0-387-29122-9.

Dacanay, S. (2007). Profit and cost efficiency of Philippine commercial banks under periods of liberalization, crisis and consolidation. *The Business Review*, *72*, 315–322.

Emrouznejad, A., & Cabanda, E. (2015). Introduction to data envelopment analysis and its applications. Doi:10.4018/978-1-4666-4474-8.ch004.

Fall, F.S., Al-Mouksit, A., & Wassongma, H. (2018). The efficiency of microfinance institutions: A meta-analysis. *Elsevier*, 107, 176-188

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society*, Series A, *120*(III), 253-281.

Ferri, G., Kalmi,P., & Kerola, E. (2014). Does bank ownership affect lending behavior? Evidence from the Euro area. *Journal of Banking & Finance* Elsevier

Gordo, G.M. (2013). Estimating bank efficiencies using frontier analysis. *Philippine Management Review 2013*, 20, 17-36.

Jayaraman, A.R., Srinivasan, M.R., & Arunachalam, R. (2014) Impact of merger and acquisition on the efficiency of Indian banks: A pre-post analysis using data envelopment analysis, *Int. J. Financial Services Management*, *7*(1), 1–18

Kollapuri, M. (2017). Bank consolidation and efficiency: An empirical study from India. *Centre for International Trade and Development School of International Studies*, Discussion Paper 17-03. Jawaharlal Nehru University, India.

Liu, Y. (2018). Two-phase network data envelopment analysis: An example of bank performance assessment. 16. http://dx.doi.org/10,5772/intechopen.74933

Manlagñit, M. C. (2011). Cost efficiency, determinants and risk preferences in banking: A case of stochastic frontier analysis in the Philippines. *Journal of Asian Economics, 22*, 23-35.

Metica, M.A.G. P., Garcia, D. R., Bool, N. S., & Sunga, M. S. (2015). Performance analysis of universal and commercial banks in the Philippines from 2004 to 2012: DEA and SFA approach. *European Academic Research*, 2(12)

Montinola, G., & Moreno, R. (2001). *The political economy of foreign bank entry and its impact: Theory and a case study* (Pacific Basin Working Paper Series PB01-11). San Francisco, CA: Federal Reserve Bank of San Francisco.

Ouenniche, J., & Carrales, S. (2018). Assessing efficiency profiles of UK commercial banks: A DEA analysis with regression-based feedback. *Ann Oper Res* 266: 551. https://doi.org/10.1007/s10479-018-2797-z

Philippine Cooperative Code of 2008, Republic Act No. 9520 (2009). https://www.cda.gov.ph/resources/issuances/philippine-cooperative-code-of-2008/republic- act-9520

Popovici, M.-C. M. (2013), A survey on bank efficiency with data envelopment analysis and stochastic frontier analysis. *SEA Practical Application of Science, I*(1)

Safiullah, Md., & Shamsuddin, A. (2018) Risk-adjusted efficiency and corporate governance: Evidence from Islamic and conventional banks. *Journal of Corporate Finance*, https://doi.org/10.1016/j.jcorpfin.2018.08.009

Sari, Y.D., Angria, L.S., Efendi, S., & Zarlis, M. (2018). Estimating Most Productive Scale Size in Data Envelopment Analysis with Integer Value Data. *4th International Conference on Operational Research* (InteriOR), IOP Publishing.

Sherman, D. H., & Zhu, J. (2006). *Improving service performance using data envelopment analysis (DEA*). Service Productivity Management. Springer US. DOI 10.1007/0-387-33231-6

Spulbar, C., Nitoi, M., & Anghel, L. (2015). Efficiency of cooperative banks and savings banks: A stochastic frontier analysis. *Romanian Journal of Economic Forecasting* 6 *–XVIII (1)*

Stefancic, M. (2016). Are cooperative banks better equipped to weather financial crisis than their commercial counterparts? Evidence from the Italian banking sector before and during the credit crisis. *Organizacija*, *49*(2) DOI: 10.1515/orga-2016-0008

Sufian, F., & Kamarudin, F. (2014). Efficiency and returns to scale in the Bangladesh banking sector: empirical evidence from the slack-based DEA-method. *Economics of Engineering Decisions*, *5*(25), 549-557. doi.org/10.5755/j0l.ee.25.5.5035

Székely, B. (2018). Bank efficiency differences across central and eastern Europe. *Magyar Nemzeti Bank (MNB*) Working Papers 2018/3. Budapest, Hungary

Tone, K. (2002). A slack-based measure of efficiency in data envelopment analysis. *European Journal of Operational Research, 143*(1), 32-41. http://dx.doi.org/10.1016/S0377-2217(99)00407-5

Trivedi, H., Mehta, D., & Mehta, N. K. (2016). Banking efficiency: literature exposition for DEA approach. *Research Journal of Management Science. 5*(11) E-ISSN 2319–1171

Vozková K., & Kuc, M. (2017). Cost efficiency of European cooperative banks. *Journal of Economics and Management Engineering*, *11*(11)

Wahidudin, A. N. (2010). *Technical efficiency of commercial banks in Malaysia: an application of window data envelopment analysis. Journal of Technology and Commerce*. *5*(1), 58-70

Wahyudi, S.T., & Azizah (2018). A comparative study of banking efficiency in ASEAN-5: the data envelopment analysis (DEA) approach. *Journal of Indonesian Economy and Business*. *32*(2), 168-186

Wong, W.P. & Deng, Q. (2016). Efficiency analysis of banks in ASEAN countries, *Benchmarking: An International Journal*, *23*(7), 1798 – 1817 http://dx.doi.org/10.1108/BIJ-11-2013-0102

Yannick, G.Z.S., Hongzhong, Z., & Thierry, B. (2016). Technical efficiency assessment using data envelopment analysis: An application to the banking sector of Côte d'Ivoire. *Procedia - Social and Behavioral Sciences*, *235*, 198–207

Yilmaz, A. A. (2013). Bank efficiency analysis in Turkish banking system. *WEI International Academic Conference*, Antalya, Turkey