Acceptance Letter

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It`s our pleasure to inform you that the manuscript entitled 'Analysis of expenses quality of credit cooperatives of free admission of associates' is accepted for publication in Vol. 163, Issue. 12 of SYLWAN journal (ISSN: 0039-7660) based upon the reviewers` positive comments on this paper.
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Analysis of expenses quality of credit cooperatives of free admission of associates

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Abstract

This research aims to analyze the quality of expenses of credit unions of free admission of associates in Santa Catarina. We applied the non-parametric research method of Data Envelopment Analysis (DEA) and the statistical model Tobit regression. The sample of this research contemplated 46 cooperatives. We analyzed the following variables: total assets, equity, number of associates, credit operations, administrative expenses, expenses with the personnel, financial intermediation expenses and surpluses. Data were obtained through the profit and loss statement, balance sheet and explanatory notes. Results show an efficiency ranking in the expenses for each cooperative, and generation of the new statistical model, with the Tobit regression equation. As results, we also found that most of the analyzed credit unions do not reach the 50% of efficiency. Only 10, 87% of the cooperatives from this sample showed 100% efficiency.

Keywords: public governance; organizations; credit cooperative; data envelopment analysis; Tobit regression.

1 Introduction

This paper brings the performance of the credit unions of free admission of associated of Santa Catarina, taking as reference the managerial accounting and the analyze of the data collected by using the Data Envelopment Analysis (DEA). It is

important to study the credit union issue since it is a segment that has been showing positive results in the financial market growth and is also increasing its adherence in the population in general (Severgnini *et al.*, 2017). According to Vilela, Nagano and Merlo (2007) studies, credit unions are the group with the highest growth rate in the financial system.

Credit unions offer the same services as the other traditional financial institutions, however with a more flexible structure and many times with a more personalized service to their customers. This said, credit unions, generally, work with customers with a lower income when comparing to clients from traditional financial institutions and this fact entails the use of distinct procedures leading to a closer relationship with the client (Ferreira; Gonçalves; Braga, 2007).

Credit cooperatives are financial institutions formed through a cooperative society, with the purpose of providing financial services to its members, such as the collection of demand and time deposits, checks, crediting and provision of collection and custody services, among other services. So, studying credit unions contributes to cooperativism, contributes considerably to regional economic growth, and offers more viable alternatives to those agents who have less access to financial resources (Pinheiro, 2008).

Credit cooperativism is consolidated in the international scenario. From 2003 to 2013, there was an increase in membership from 1.9 to 7 million, respectively. In December 2013, a total of 1,154 credit cooperatives operating in Brazil were presented, of which 888 belonged to the systems of the largest Brazilian credit cooperatives, which are the System of Credit Cooperatives of Brazil (Sicoob), the Credit System Cooperative (Sicredi), the National Confederation of Unicredis Central Cooperatives (Unicred), the Cooperative Urban Credit System (Cecred), the Cooperative System of Solidarity Economy (Confesol) and Uniprime Norte do Paraná (Uniprime) (

These institutions are not intended to make a profit, but accountability and the provision of their information to regulators, such as the Central Bank of Brazil (Bacen) and central cooperatives, in the case of individual cooperatives are required. According to Maia, Bressan, Lamounier and Braga (2013), these obligations may pressure cooperatives to manage their results in order to minimize the effect of fluctuations, since results with high volatility may indicate a risk situation.

Credit unions were chosen for this study because of their importance in fostering the economic growth and social development of Brazil. In total, the cooperative service network in Brazil represents 18% of the country's banking branches and occupy the 6th position in the ranking of volume of assets. Therefore, credit unions are the largest retail financial institutions in Brazil. In this way, the audit mechanisms are used by the Credit Cooperatives aiming at maintaining integrity and image before the cooperative, clients and society, with the objective of obtaining greater reliability in the conduct of operations and processes.

Due to the reality of the Brazilian credit unions, the verification of the acting of those using the DEA has a great relevance since the growing of this segment in the financial market brings better opportunities to the population in general. And not only

creating new job opportunities, but as well as in the development of small businesses in the entire country.

This study aims to apply the data envelopment analysis to study the performance of 46 credit union of free admission of Santa Catarina associates in relation to the variables of the standardized financial statements of the year of 2017 of the credit unions.

The aforementioned study highlights the credit union, a very relevant topic in the financial market. Although credit unions still occupy a small space when comparing to the tradition financial institutions, credit unions are increasingly gaining and consolidating their place when the subject is how to retain new customers. Credit unions that better play their socioeconomic role are considered the most efficient, or even the ones with best performance. (Ferreira; Gonçalves; Braga, 2007).

Given this, the importance of this study of economic nature focus in the verification of performance of cooperatives using the analysis of variables *outputs* and *inputs* collected in the repository of Banco Central do Brasil (BACEN) and in the credit unions´ reports available on their websites, regarding their 2017 financial statements issued in this social year.

Regarding the academic nature, this study has a great importance since this topic still has not been studied considerably also because is relatively recent for the accounting world. To this end, there are many subtopics to be explained and discussed about credit unions in Brazil and their performance evaluation.

The study of Vilela, Nagano and Merlo (2007) also shows that through Data Envelopment Analysis it is possible not only verify strictly financial indexes by itself, but to verify information along the financial indexes that can give better explanations to the results.

2 Theoretical foundation

Credit unions are financial institutions with a different approach than the traditional financial institutions, the relationship of credit union with the associate´s money and the treatment given to the user are also a differential, starting with the denomination given to the client, instead of client the users are called associates or cooperative.

According to Etgeto *et al.* (2005), corporative organizations started due the needs of farmers, craftsman and workers whom decided to organize themselves as a form of defending their business when facing the financial market. This way, small groups of workers started to join those groups to solve or resolve financial problems between each other (Etgeto *et al.,* 2005).

Credit unions can be classified as cooperatives of free admission of associates, which means, any citizen can be an associate, and there are also the credit unions of specific labor classes, where only people from this specific class can be an associate. The demand for the services provided by credit unions has been increasing significantly, mainly because they offer lower service costs and fees than traditional financial institutions (Bressan, 2010).

To execute this study it was chosen the use of the quantitative method of DEA statistics in order to measure the performance of credit corporatives of free admission of associates in the state of Santa Catarina. This data analysis has been used in several research areas because it is able to measure the performance of several fields of knowledge. Many recent studies have paid attention to the evaluation of business performance with the use of data envelopment analysis in several branches, such as accounting, economics, psychology, law and others (Casa Nova, 2002).

3 Research Method

As research method, it was applied the non-parametric method of Data Envelopment Analysis (DEA) and the statistical model multi Tobit regression. The research sample included 46 credit unions. It was analyzed the following variables: total assets, equity, number of associates, credit operations, administrative expenses, expenses with the personnel, financial intermediation expenses and surpluses. Data were obtained through the profit and loss statement, balance sheet and explanatory notes.

The goal of this study is to verify the performance of 46 credit unions of free admission of associates in Santa Catarina, analyzing their results in the fiscal year of 2017. The first stage of this study consisted on verifying documents from credit unions, using the data published by them on their websites, as well as in the repository of BACEN. After collecting data, the same was treated using the data envelopment analysis by the Integrated System for Decision Support (ISYDS) software.

The research method of this research follows the stages of collecting variables from credit unions of this sample, analyzing the variables by the DEA, generation of expenses efficiency ranking by each credit union and generation of Tobit regression equation.

This study is a quantitative research, for that reason it aims to measure the performance of the credit unions by the statistical calculation of the DEA, for this will be used eight variables obtained from the balance sheet (PB), profit and loss statement (DRE) and explanatory note shown on table 1.

Table 1 - Variables used in the data collection to DEA analysis

Inputs	Outputs
Administrative expenses (DA)	Total assets (AT)
Number of associates (NC)	Surplus (SE)
Financial intermediation expenses (DIF)	Credit operations (OC)
Expenses with personnel (DCP)	Equity (PL)

Source: Own elaboration.

The choices of variables were given by previous studies that used the DEA to verify performance of credit unions. For the variables *input* that represents inputs or instruments that are able to operate the credit union service, are classified as inputs: administrative expenses, intermediary financial and personnel expenses and the number of associates that the company obtained in 2017.

The administrative expenses represent the expenses related to the company´s physical space such as maintenance, rent, and fixed expenses such as electricity, water,

sanitation and others. The expenses with personnel refer to the expenses with employer's paycheck, fees and other charges related to their staff.

The financial intermediation expenses refer to the operations to capture market, loans, expenses with credits granted and others. And last, the number of associates was picked as one of the variables in order to compare the size of the credit union by associate, consequently, the amount of input that it may have as a consequence of this comparison.

The variables *output*, which represent the final product after the variables *input* had been processed, were total assets, equity, surplus and credit operations. The total assets demonstrate all the assets, goods and rights belonging to the credit union that it owns, while the equity is related to the accounts that represent the book value of the credit union, meaning the amount invested by the members.

Surplus represents, for business purpose, a profit. Represents the result of all activities, otherwise, it there is no surplus there will be an impairment in the operation. As for credit operations, they are relate to interest revenue from loans, financing and other services that the credit union has to offer, the proceed acquired by the same in their activities.

Participated in this research the following credit unions: DMU1 - Vale do Itajaí credit union- Viacredi; DMU2 - Nossa Senhora do Desterro credit union - Sicoob CrediSC; DMU3 - credit union of free admission of Southern Santa Catarina - Acentra; DMU4 - credit union of free admission of associates- Sicoob Crediserra SC; DMU5 - credit union of free admission of associates of Midwest Santa Catarina – Sicoob Credimoc SC; DMU6 - vale do itajaí and vale do itapocú credit union - Sicoob Multicredi; DMU7 - credit union of free admission of associates of urubici - Sicoob crediaraucária/SC; DMU8 - credit union of free admission of associates of north and northeast of Santa Catarina - Sicredi norte SC; DMU9 - vale do vinho credit union of free admission of associates - Sicoob Vale do Vinho; DMU10 - urban credit cooperative - Cecred; DMU11 - credit union of free admission of the valley - Sicoob Credivale/SC; DMU12 - Maxi Alfa credit union of free admission of associates- Sicoob Maxicrédito; DMU13 - Campos Novos credit union of free admission of associates - Sicoob Campos Novos; DMU14 - Auriverde credit union of free admission of associates - Sicoob Credial/SC; DMU15 - credit union of free admission of associates of southern Santa Catarina - Sicoob Credisulca/SC; DMU16 - Itaipu credit union of free admission of associates - Sicoob - Creditaipu; DMU17 - Nova Trento credit union of free admission of associates - Sicoob Trentocredi/SC; DMU18 - Vale do Rio do Peixe credit union of free admission of associates - Sicoob Credirio/SC; DMU19 - credit union of free admission of associates of vale do Itajaí and coastal Santa Catarina - Sicredi vale litoral/SC; DMU20 - credit union of north Santa Catarina - Acredicoop; DMU21 - Vale do Chapecozinho credit union of free admission of associates - Sicoob Valcredi Sul ; DMU22 - credit union of free admission of associates - Viacredi alto vale; DMU 23 - credit union of free admission of associates of Jaraguá do Sul and area - Sicoob CejaSCred; DMU24 - credit union of free admission of associates - Sicoob Credicaru SC; DMU25 credit union of free admission of associates of Guaramirim - Crevi/SC; DMU26 - credit union - Credicomin; DMU27 - credit union of free admission of associates - Sicoob Crediplanalto/SC; DMU28 - credit union of free admission of associates - Sicoob Credisserrana; DMU29 credit union of free admission of associates of the vale of Canoinhas - Sicoob Credicanoinhas/SC; DMU30 -

São Miguel do Oeste credit union of free admission of associates - Sicoob São Miguel/SC; DMU31 - Caçador credit union of free admission of associates - Sicoob caçador SC; DMU32 - credit union of free admission of associates - Sicoob Credipérola; DMU33 - Itapiranga credit union of free admission of associates - Sicoob Creditapiranga SC; DMU34 - credit union of the valley of canoas - Sicoob/SC Credicanoas; DMU35 - credit union - Credifoz; DMU36 - credit union of the north of Santa Catarina and south of Parana - Sicoob Credinorte; DMU37 - credit union of Contestado area - Scrcred; DMU38 - credit union - Sicoob Alto Vale; DMU39 - credit union Unicred Desbravadora Ltda. - Unicred Desbravadora Sul; DMU40 - Litorânea credit union of free admission of associates; DMU41 - credit union of free admission of associates - Sicoob - Crediauc/SC; DMU42 - credit union Unicred of Greater Florianópolis Ltda. - Unicred Florianópolis; DMU43 - credit union of east Santa Catarina and Paraná Ltda. - Unicred União; DMU44 - corporative

of   Credit, savings and investment in the south of the stateof Santa Catarina   -   Sicredi Sul/SC; DMU45 - credit union Unicred south of Santa Catarina - Unicred Sul Catarinense; DMU46 - credit union of free admission of associates of west Santa Catarina

4 Analysis and results

In this section it will be discussed the results obtained in the study about the credit union of free admission of associates in the state of Santa Catarina using the DEA. The following table displays the result obtained by calculating the DEA in the eight selected variables, the DMU nomenclatures refer to the credit unions of this sample, which are identified by their name in the appendix of this work.

Table 2 - Analysis of performance of credit unions in the year of 2017 using DEA

DMU	DEA result.	DMU	DEA result.
DMU1	1	DMU23	0,016967
DMU2	1	DMU24	0,020059
DMU3	0,119994	DMU25	0,010055
DMU4	0,061845	DMU26	0,008735
DMU5	0,136916	DMU27	0,028975
DMU6	0,12514	DMU28	0,012873
DMU7	0,076003	DMU29	0,066086
DMU8	0,02196	DMU30	1
DMU9	0,145925	DMU31	0,013135
DMU10	0,041419	DMU32	0,009249
DMU11	0,064918	DMU33	0,008626
DMU12	1	DMU34	0,034571
DMU13	1	DMU35	0,009216

DMU14	0,808569	DMU36	0,015331
DMU15	0,520751	DMU37	0,008544
DMU16	0,023447	DMU38	0,007949
DMU17	0,008097	DMU39	0,044285
DMU18	0,043013	DMU40	0,067066
DMU19	0,023266	DMU41	0,026607
DMU20	0,010056	DMU42	0,066909
DMU21	0,018536	DMU43	0,095646
DMU22	0,081092	DMU44	0,023441
DMU23	0,016967	DMU45	0,050798
DMU24	0,020059	DMU46	0,012626

Source: Own elaboration.

According to Table 2, out of 46 credit unions studied only 5 of them, which represents 10,87% of the total sample, have shown an efficiency of 100%, of the remaining credit unions only 2 obtained an efficiency above 50%. The other 39 credit unions, which equals 84,70% of the sample analyzed, showed an efficiency below 50%, a result considered unsatisfactory.

On Table 3 are presented the 7 highest results and the 7 lowest results of efficiency in credit unions.

Table 3 – Comparison between the seven highest results and the seven lowest DEA results of credit

DMU	DEA result	DMU	DEA result
DMU1	1	DMU32	0,009249
DMU2	1	DMU35	0,009216
DMU12	1	DMU26	0,008735
DMU13	1	DMU33	0,008626
DMU30	1	DMU37	0,008544
DMU14	0,808569	DMU17	0,008097
DMU15	0,520751	DMU38	0,007949

Source: Own elaboration.

These comparative results can also be analyzed in Figure 1, which shows the comparative DEA scores between the seven highest results and the seven lowest results of credit union´s efficiency.

Figure 1 – Comparative DEA score graphic between the seven highest results and the seven lowest results of credit union
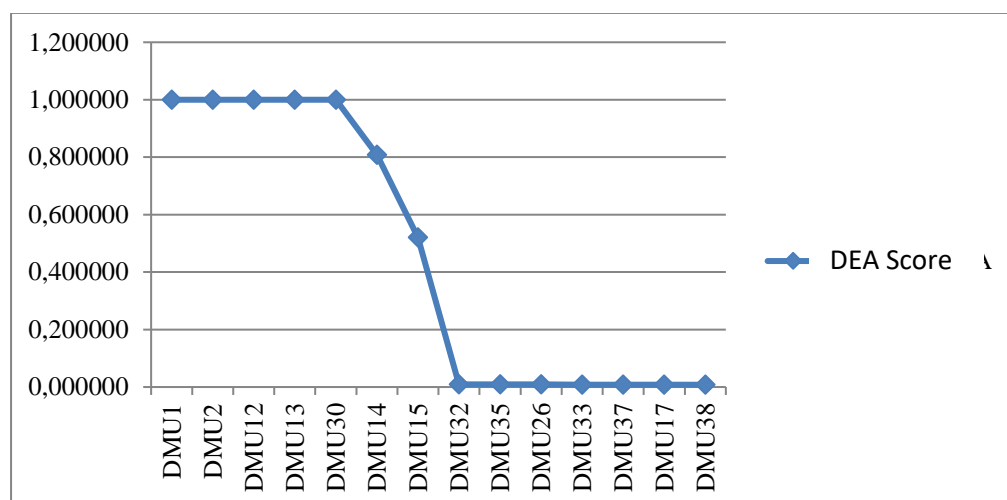
Source: Own elaboration.

As shown in Table 3 and Figure 1, the efficiency differences are quite significant, considering that the credit union named DMU 38 achieved the lowest score of the sample, a 0,79% efficiency, which means, it doesn´t reach even 1% of efficiency.

Table 4 presents the descriptive statistics for each *output* variable of the DEA model and collected from credit unions that compose this research sample.

Table 4 – Descriptive statistics of output variables applied in the efficiency model

	Total assets	Equity	Surplus	Credit operations
Standard deviation	13461512,97	2058036,24	7511480,7	357943,12
Average	2557684,68	395636,49	2274576,58	101043,09
Minimum	46984	7265	-635	2784
Maximum	92682701,35	14160368,6	35676896,47	2266344

Source: Own elaboration.

The descriptive statistics for each *input* variable of the DEA model applied in the sample for this research are presented in Table 5.

Table 5 – Descriptive statistics of input variables of the DEA efficiency model

	Financial intermediation expenses	Expenses with personnel	Administrative expenses	Number of associates
Standard deviation	861220,89	646107,07	721136,29	134433,89

Average	-147820,15	-102927,2	-113883,85	54803,43
Minimum	-5920589,88	-4436763,21	-4950880,91	1454
Maximum	-1271	-696	15028	616000

Source: Own elaboration.

Tables 4 and 5 demonstrate the results obtained in the descriptive statistical of the analyzed variables of credit unions. For this study, the analyzed credit unions were chosen for reason that they are free admission of associates and located in the state of Santa Catarina, therefore, this sample included small, medium and large size credit union.

The statistical results shows that the total assets and equity can explain differences in efficiency of credit unions. And considering this, their differences are very clear when analyzing their net equity when the smallest DMU is R$ 7.265 billion, while the largest DMU is R$ 2,058,036.24 million.

Another important detail in this result is that 39 of 46 credit unions studied did not reach 50% efficiency, and this is due the large variation of surplus which is equivalent to a 7522580,70 standard deviation. For this variable, it was found a minimum difference of R$-635 million and the maximum was over R$35676896.47 million reais.

Table 6 shows the variables of the five most efficient credit unions in this sample, these cooperatives reached 100% efficiency in the Data Envelopment Analysis model that was developed and applied.

Table 6 - Variables of the most efficient credit unions according to the DEA model applied in this research

	DMU1	DMU2	DMU12	DMU13	DMU30
Total assets (output)	4.703.048,00	92.682.701,35	1.857.119,00	216.635,00	1.070.186,00
Equity (output)	1.067.362,00	14.160.368,60	231.080,00	36.674,00	164.200,00
Surplus (output)	84.194,00	3.529.544,63	35.676.896,47	31.011.122,94	1.714,00
Credit operations (output)	2.266.344,00	63.563,00	1.049.246,00	127.075,00	4.233,00
Intermedia-tion expenses (input)	-193.083,00	-5.920.589,88	-90.169,00	-7.127,00	-1.271,00
Expenses with personnel (input)	-53.305,00	-4.436.763,21	-27.795,00	-2.750,00	-859,00

Administrative expenses (input)	-64.922,00	-4.950.880,91	-28.674,00	-3.509,00	-1.055,00
Number of associates (input)	432.000,00	7.169,00	151.808,00	1.454,00	68.077,00

Source: Own elaboration.

As shown in Table 7, it is possible to notice that by means of DEA modeling the efficiency of credit unions is measured regardless of the size of the same, which means credit unions, such as DMU 30, with a lower surplus and credit operation obtained maximum performance of efficiency, because DEA treats variables proportionally, according to each credit union.

Table 7 - Descriptive statistics of the DEA scores of credit unions analyzed

Statistic	Value
Average	0,173667304
Standard error	0,047477607
Median	0,037995
Mode	1
Standard deviation	0,322008795
Sample variance	0,103689664
Kurtosis	2,751842176
Asymmetry	2,095105236
Range	0,992051
Minimum	0,007949
Maximum	1
Sum	7,988696
Count data	46

Source: Own elaboration.

Following this, it was applied the Tobit regression model to verity the impact the variables of this research has in the DEA score of expenditures efficiency. The results of the iterations of Tobit regression model are listed in Table 8.

Table 8 – Iterations of the Tobit regression modeling

Iterations of the Tobit regression modeling

iteration 1: likelihood log = 41,3390809726 (step length = 1)

Parameters: -0,018970 7,6658e-007 2,3295e-005-1,5275e-005 2,5020e-008 4,5830e-007

-2,3228

Gradients: 1,1786e-012 -0,00011035 1,1814e-006-2,0128e-006 4,9178e-006 2,2615e-007

-6,0000 (norm 1,41e+000)

iteration 2: likelihood log = 41,3402904704 (step length = 1)

Parameters: -0,018970 7,6658e-007 2,3295e-005-1,5275e-005 2,5020e-008 4,5830e-007

-2,3177

Gradients: -2,9043e-013 1,7143e-005-7,4803e-008 4,4592e-007-1,4163e-006-1,0923e-007

0,47337 (norm 3,96e-001)

iteration 3: likelihood log = 41,3402905017 (step length = 1)

Parameters: -0,018970 7,6658e-007 2,3295e-005-1,5275e-005 2,5020e-008 4,5830e-007

-2,3176

Gradients: 3,5438e-013 3,0596e-005-1,9444e-006-1,4496e-006 1,6020e-006 6,4516e-008

0,0024027 (norm 2,82e-002)

Source: Own elaboration.

Table 9 shows the results of likelihood log of Tobit regression modeling.

Table 9 – Likelihood log of Tobit regression modeling

Likelihood log = 41,3402905017 (step length = 1)1)

Parameters: -0,018970 7,6658e-007 2,3295e-005-1,5275e-005 2,5020e-008 4,5830e-007

-2,3176

Gradients: 4,5208e-013 3,3549e-005-2,1397e-006-1,6008e-006 1,7720e-006 6,7610e-008

6,2744e-008 (norm 1,44e-004)

Successive criteria values within the tolerance (1e-007)

Source: Own elaboration.

The results of Tobit regression model, generated by using the stepwise procedure, of the variables that did not present statistical significance of 95% confidence and were eliminated are shown in Table 10.

Table 10 - Results of the Tobit regression modeling for efficiency of credit union expenditures

	coefficient	standard error	z	p-value	
Const	- 0,0189703	0,0174005	- 1,090	0,2756	
Total assets	7,66581e-07	1,67340e-07	4,581	4,63e-06	***
DIF	2,32949e-05	4,93814e-06	4,717	2,39e-06	***
DP	- 1,52749e-05	3,14686e-06	- 4,854	1,21e-06	***
SE	2,50196e-08	2,21719e-09	11,28	1,57e-029	***
OC	4,58297e-07	4,09828e-08	11,18	4,96e-029	***

Chi-square(5)	5608,768	p-value	0,000000
Likelihood log	41,34029	Akaike criterion	-68,68058
Schwarz criterion	-55,88009	Hannan-Quinn criterion	-63,88544

sigma = 0,0985057 (0,0177186)
Censored observation on the left: 0
Censored observation on the right: 0

Source: Own elaboration.

As can be seen in Table 10, the residues of the Tobit regression model present normal distribution, and also met the statistical assumption of 95% of confidence.

Table 11 - Test of normality of residues of Tobit regression model for efficiency of credit union expenditures

Test of normality of residues -
Null hypothesis: the error has normal distribution
Test statistic: chi-square(2) = 9,92362
p-value = 0,00700026

Source: Own elaboration.

Thus, the final Tobit regression statistical model is: spending score = - 0,0189703 + 7,66581e-07 total assets + 2,32949e-05DIF − 1,52749e-05 DP + 2,50196e-08 SE + 4,58297e-07 OC. This final regression equation allows estimate the main determinants of quality costs of credit unions analyzed in this research.

5 Final considerations

The general goal of this study was achieved, since it was possible to perform the envelopment analysis of the collected data, meaning, it was possible to verify the efficiency of 46 credit unions of free admission of associates in the state of Santa Catarina.

In this study it was also analyzed descriptive statistics given the variables of efficiency, with the purpose of giving more information about the variables of credit unions on topic.

It can be conclude with this study that most of the credit unions, around 84,79%, obtained an efficiency below 50%, which can be a sign that most of the credit unions should review their procedures so they can achieve a better level of efficiency, an option to increase their success is to use as *benchmarking* the five credit unions with 100% efficiency in the fiscal year of 2017, shown in this study.

The present work the importance of verifying the efficiency of credit unions due its importance in the current financial scenario and through studies like this, cooperatives that do not have a high efficiency can improve based in the ones with high efficiency. Corroborating, the studies of Ferreira, Gonçalves and Braga (2007) adds that based on results it is important to plan and promote actions to gain technical efficiency in the credit cooperative society.

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