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A RISK STUDY OF BRAZILIAN CREDIT UNIONS BASED ON ACCOUNTING BETA

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ABSTRACT

Credit unions are essential for many Brazilian municipalities with no access to bank credit. It is important to analyze how the PEARLS system's accounting indicators are related to the risk of cooperatives, directly impacting the development of deprived areas. This research aimed to investigate whether the accounting indicators proposed by the PEARLS system are related to the risk of Brazilian credit unions. If this hypothesis is confirmed, it can be said that the accounting information contained in these indicators is useful to assist its users in decision making. To this end, an econometric model was built using the cooperative accounting beta (risk) as the dependent variable explained by the PEARLS accounting indicators. The results indicate a positive and significant relationship between the risk and total deposits of a cooperative, its provision for the estimate of doubtful receivables (default), and its operating expenses. Furthermore, all variables were relevant to explain the risk of credit unions, suggesting that the accounting information present in the PEARLS indicators is useful to assist its users in decision-making regarding these entities' risk assessment. This finding is relevant because cooperatives' potential insolvency impacts not only the members but also their locations.

Keywords: Cooperativism. Credit Unions. Accounting Beta. Risk.

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1 INTRODUCTION

Credit unions are non-profit financial institutions that provide exclusive financial services to their members. Cooperative members (or associates) gain access to many products similar to those offered by banks, such as checking accounts, credit cards, loans, and financing. While the member owns the cooperative, he is also its client and participates in the distribution of any positive or negative results generated by the operations of the entity (Banco Central do Brasil, 2018).

In Brazil, credit unions' social importance lies in the fact that many municipalities are without access to traditional bank credit. Credit unions provide residents with alternative access to financial resources that can be used for consumption or small investments (Jacques & Gonçalves, 2016).

According to Bressan, Braga, Bressan, and Resende Filho (2011), one of the significant challenges facing credit unions today is the creation of management mechanisms that (a) are compatible with their administrative model; (b) meet the regulatory requirements of the Central Bank of Brazil (BACEN); and (c) are under their doctrinal principles.

In this context, the World Council of Credit Unions (WOCCU), an international agency for promoting credit unions, created the PEARLS system in the late 1980s. This system emerged as an adaptation to the US CAMELS, representing a set of performance indicators used in the United States to monitor financial institutions. PEARLS is the acronym for a group of financial indicators for evaluating credit unions' operational activities, namely Protection, Effective financial structure, Asset quality, Return and cost rates, Liquidity, and Signs of Growth (Bressan *et al*., 2011).

The PEARLS system seeks to (a) assist in the management analysis of credit unions, to mitigate serious institutional problems; (b) create a universal financial language between these institutions and their external public, enabling uniformity and comparability over time; and (c) facilitate the supervision of credit unions through their accounting data (WOCCU, 2019).

Thus, the PEARLS system is important for monitoring credit unions, mainly because of the damage represented by their potential insolvencies. These damages include its associates and a wide range of stakeholders, such as employees, service providers, suppliers, and the economy of the region. Even though the PEARLS system functions as a "flight panel", guiding managers, members, and supervisory bodies on the performance of the cooperatives (Kaplan and Norton, 1993), it is not known whether their financial indicators have enough accounting quality to predict credit risk.

Given the role of credit unions in many municipalities, it is important to analyze how the quality of the accounting indicators proposed by the PEARLS system impacts the risk of these institutions, which affects the lives of its members and the regions where they operate.

Thus, this paper aims to investigate whether the accounting indicators proposed by the PEARLS system are related to the risk of Brazilian credit unions. If this hypothesis is confirmed, the accounting information contained in the indicators is useful for its users' decision-making. To this end, the accounting beta (detailed in Section 2.3) will be used as a proxy for risk, as proposed by Beaver and Manegold (1975) and Damodaram (1997), given that cooperatives are privately held entities that do not trade on the stock exchange of values.

2 THEORETICAL FRAMEWORK

2.1 Credit Unions

Credit unions, regulated by Law no. 5,764, of December 16th, 1971, are defined as civil partnerships with their legal form and nature, not subject to bankruptcy, and constituted to provide services to its members (Law no. 5,764, 1971). These institutions' primary objective is to provide financial services to their members in an egalitarian and supportive manner (Pagnussatt, 2004).

Furthermore, they help to reduce social inequalities, facilitating access to credit and many services similar to banking, spreading the spirit of cooperation in favor of social well-being (Almada, Abreu, Cunha, Silva Filho, 2011).

Cooperativism refers to a movement aimed at people and not at a profit. In other words, its focus rests on providing services to its members. Thus, in the case of surplus resources (positive results between income and expenditure), these must be returned to the members in proportion to their operations with the cooperative in the financial year (Law no. 5,764, 1971).

Initially, at least 20 people were required for credit unions to be formed. However, with the Brazilian Civil Code of 2002, this amount has changed to only enough members to compose the board of directors, observing future renewals. Article 6 of Law no. 5,764 of 1971 shows cooperatives' classification, with their descriptions updated by the Brazilian Civil Code of 2002, as shown in Table 1.

Table 1
Classification of credit unions

Classification	Description
Single	Constituted by a minimum of twenty individuals. However, with the Brazilian Civil Code of 2002, this minimum ceased to exist, requiring only enough members to compose the board of directors, considering future renewals.
Central or cooperative federations	Constituted by a minimum of three individuals, permitting individual members in exceptional cases.
Cooperative confederations	Constituted by a minimum of three cooperative federations central cooperatives of the same or different modalities.

Source: Silva, Cardoso, Martins, Marena, and Oliveira (2018) and Law no. 5,764 (1971).

According to the Brazilian Cooperatives Organization (OCB) (2019), the principles of cooperativism are the voluntary and free membership, democratic management, economic participation of the members, autonomy and independence, education, training and information, inter-cooperation, and interest in the community.

According to Bressan, Braga, Bressan, and Resende Filho (2010), one of the significant challenges facing credit unions today is the creation of management models that respect their administrative characteristics and simultaneously meet the requirements of BACEN. In this sense, Bressan *et al*. (2010); Bressan *et al*. (2011), and Bressan, Bressan, Oliveira, and Braga (2014) propose that the PEARLS indicator system be adopted as an instrument for the operational evaluation of Brazilian cooperatives. This suggestion is mainly due to the possible negative impact of a poorly performed risk assessment of these entities on society and its members.

This system is nothing more than a set of financial indicators that allow one to identify when a credit union is in financial difficulties, showing the causes of this problem (Vasconcelos, 2006). Currently, the PEARLS system is used for the risk management of these institutions in 97 countries worldwide (Bressan *et al*., 2011).

2.2 Quality of the Accounting Information and Financial Indicators

The quality of accounting information refers to providing useful information on an entity to its external users (Paulo, 2007). According to Dechow, Ge, and Schrand (2010), for accounting information to be useful to its users, it must have three important quality characteristics, namely relevance, informativeness, and the ability to measure performance. The first evaluates whether the accounting information allows important decisions to be made. The second refers to the ability of accounting to report on the firm's performance. And the third implies the accounting system's ability to measure the entity's performance (Duarte & Lucena, 2018).

One of the forms to verify the quality of the accounting information reported by companies lies in the use of financial indicators constructed based on financial statements (Paulo, 2007). Thus,

if the financial indicators explain a specific phenomenon, accounting information can be considered good quality (Duarte & Lucena, 2018). In Brazil, research on the quality of accounting information still has great potential for development, as it focuses on companies listed on the stock exchange.

Gonçalves and Lemes (2018) recently verified the effect of recognizing expenses with research and development (R&D) on the quality of accounting information of Brazilian high-tech public companies between 2008 and 2015. The authors found that the expenditure on R&D, recognized as an expense, and costs activated provide useful information for investors.

Vallim, Macedo, and Kolozsvari (2019) assessed the quality of accounting information based on the differences in lengthening accruals in their ability to predict future cash flows of 168 publicly held, non-financial companies listed in [B]³ in 2017. The authors concluded that the predictive capacity of accruals is inversely related to their length. In other words, better quality accounting information is obtained with less lengthy accruals. The more elongated accruals result in lower quality accounting information.

Santos, Guimarães, and Macedo (2019) analyzed the impact of tax aggressiveness on the quality of accounting information in Brazil based on a sample of 727 observations from non-financial companies from 2010 to 2017. The results showed that higher Book-Tax Differences (BTD) and lower Effective Tax Rate (ETR) result in a lower informational capacity of Net Income per Share. Thus, the authors concluded that the tax aggressiveness captured by both BTD and ETR reduces the information capacity of profit, impairing the relevance of accounting information for the Brazilian capital market.

Bressan *et al*. (2010) built accounting indicators for Brazilian credit unions using the Accounting Plan for Financial Institutions of the National Financial System (COSIF). The study was the first in the country to use the system and aimed at assisting managers and other interested parties in obtaining managerial information on credit unions.

In turn, Bressan *et al*. (2011) applied the PEARLS system to Brazilian reality to analyze credit unions' insolvency affiliated to the Brazilian Credit Unions System (SICOOB). The authors prepared 39 financial indicators and concluded that the most related to insolvency are within the scope of protection, effective financial structure, asset quality, and return rates and cost.

Gozer, Gimenes, Menezes, Albuquerque, and Isotani (2014) diagnosed the insolvency of mutual credit unions in the state of Paraná through a mathematical model based on artificial neural networks (ANN) for groups of 10, 11, and 27 indicators of the PEARLS system. This model reproduced the functioning of the human brain and its ability to absorb information. As a result, the RNA network obtained the best performance with modeling for the 27 indicators.

Silva, Padilha, and Silva (2015) prepared a ranking of the 25 largest Brazilian credit unions between 2008 and 2012, based on the quality of assets and the PEARLS system's return rates and costs. The results showed that the return rate and cost group indicators impacted the ranking most. Thus, such cooperatives' economic and financial performance is related to the efficiency of the operating cost control management.

Based on previous papers and the recommendations of the World Council on Credit Unions, the PEARLS system indicators were used as risk-explanatory variables for credit unions, given by the beta accounting. The PEARLS system indicators are detailed in Tables 2 to 7, below.

Table 2
Protection Indicators

P-Protection
P1 = Provision for doubtful receivables under credit transactions/total classified portfolio **Objective**: To measure the provisions volume on doubtful receivables compared to the total portfolio.
P2 = Overdue credit transactions/total classified portfolio **Objective**: To verify the overdue credits compared to the total credit portfolio.
P3 = Risk transactions Level D to H/credit portfolio classification **Objective**: To show the portion of the credit portfolio with a delay of more than 61 days.
P4 = Percentage of estimated provision Level D to H/Adjusted Net Worth **Objective**: To show the portion of classified credit portfolio with a delay above 61 days compared to Adjusted Net Worth.

Source: Bressan *et al.* (2010; 2011).

Table 3
Effective financial structure indicators

E - Effective financial structure
E1 = Net credit transactions/total assets **Objective**: To measure the percentage of total assets invested in the credit portfolio.
E2 = Financial investments/Total assets **Objective**: To measure the percentage of the total assets invested in financial assets.
E3 = Share Capital/Total Assets **Objective**: To measure the percentage of the total assets financed by the members.
E4 = Institutional Capital/Total Assets **Objective**: To measure the percentage of total assets financed by institutional capital (cooperative capital, not considering the capital of the member).
E5 = Financial intermediation income/average total assets **Objective**: To measure the financial intermediation income compared to the average total asset.
E6 = Total assets/Adjusted net worth **Objective**: To measure the use of its own resources in financing the assets held by the cooperative.

Source: Bressan *et al.* (2010; 2011).

Table 4
Asset quality indicators

A - Asset quality
A1 = (Permanent assets + non-directed assets with the cooperative activity)/Adjusted net worth **Objective**: To measure the level of use and own resources with fixed assets and assets not directed to the activity of the cooperative.
A2 = Permanent asset/Adjusted Net Worth **Objective**: To measure the volume of permanent assets compared to adjusted net worth.
A3 = Undirected assets with cooperative activity/Total asset **Objective**: To show the ratio of other assets compared to total assets.
A4 = Total deposits/Total assets **Objective**: To show the total assets that derive from deposits.

Source: Bressan *et al.* (2010; 2011).

Table 5
Return rates and cost indicators

R - Return rates and cost indicators
R1 = Income from credit transactions/Average credit transactions **Objective**: To measure how much the credit portfolio yields.
R2 = Net income from financial investment/average financial investment **Objective**: To measure how much financial investments yield.
R3 = Term deposit expenses/Term Deposits **Objective**: To measure the cost of term deposits.
R4 = Expenditure on loan and transfer obligations/Average loan and transfer obligations **Objective**: To measure the cost of loan funds.
R5 = Gross margin/Average total asset **Objective**: To understand the relationship between the gross margin and average total asset.
R6 = Operating expenses/Average total assets **Objective**: To measure the cost associated with the management of credit union assets, indicating the degree of operational efficiency or inefficiency.
R7 = Scraps/Average total asset **Objective**: To measure the cooperative's earnings.
R8 = Scraps/Adjusted Net Worth **Objective**: To measure the return on equity.
R9 = Financial intermediation result/Operating revenue **Objective**: To measure the relationship between the result of financial intermediation and the operating revenue.
R10 = Scraps/operating revenue **Objective**: To measure the scraps compared to the operating revenue.
R11 = Income from the provision of services/administrative expenditure **Objective**: To show how much administrative expenses are covered by revenues from the provision of services.
R12 = Management expenditure administrative expenditure **Objective**: To understand the percentage of management expenses compared to the total administrative expenses.
R13 = Administrative expenditure/Average total assets **Objective**: To measure the percentage of administrative expenses compared to the total assets.

Source: Bressan *et al.* (2010; 2011).

Table 6
Liquidity indicators

L - Liquidity
L1 = Cash assets/Demand deposits **Objective**: Solvency indicator to measure the capacity of the cooperative to meet its immediate commitments.
L2 = Short-term assets/Total deposits **Objective**: Proxy for current liquidity.
L3 = Free Cash/Total Assets **Objective**: To Measure what is more liquid in the cooperative compared to the asset.

Source: Bressan *et al.* (2010; 2011).

Table 7
Signs of growth indicators

S - Signs of Growth
S1 = Operating revenue growth = (current month operating revenue/previous month operating revenue) - 1 **Objective**: To measure the growth rate of the operating revenue.
S2 = Total uptake growth = (current month's total uptake/previous month's total uptake) - 1 **Objective**: To measure the percentage of Growth of the total uptake.
S3 = Growth of credit transactions with Risk Level D-H = (credit transactions with risk level D-H of the current month/credit transactions with risk level D-H of the previous month) - 1 **Objective**: To measure the growth rate of credit transactions with D-H risk.
S4 = Growth of assets not directed at the cooperative's activity (Andaf) = (current month's Andaf/previous month's Andaf) - 1 **Objective**: To measure the rate of the Andafs.
S5 = Growth of the provision on doubtful liquidity credit transactions (PDLC) = (current month PDLC/previous month PDLC) - 1 **Objective**: To measure the growth rate of the PDLC.
S6 = Growth of the administrative expenditure = (current month administrative expenditure/previous month administrative expenditure) - 1 **Objective**: To measure the Growth of administrative expenditure. The smaller, the better.
S7 = Growth of the Adjusted Net Worth (ANW) = (current month ANW/previous month ANW) - 1 **Objective**: To measure the growth rate of the ANW.
S8 = Growth of the total assets (TA) = (current month TA/previous month TA) - 1 **Objective**: To measure the growth rate of the TA. It should be higher than the inflation rate according to the WOCCU.
S9 = Growth of the credit transactions = (current month Credit Transactions/previous month Credit Transactions) - 1 **Objective**: To measure the Growth of credit applications of the cooperative.

Source: Bressan *et al.* (2010; 2011).

Thus, if these indicators are suitable for credit unions, that is, constructed so that they capture the quality of accounting information, they are expected to be relevant to a certain extent to explain the risk of these entities.

2.3 CAPM and Accounting Beta

Risk is a commonly used term that remains undefined (Rodrigues, Silva, Libonati, & Pereira, 2008), and is considered a measure of uncertainty in which the possibilities of return are unknown. According to Securato (1993), it is the possibility of failure in already established objectives. For Edwards and Bowen (2005), the risk process involves predicting and impacting an event.

All the innumerable existing concepts concerning risk indicate the uncertainty of what may happen in a pre-established event. Based on this principle, Sharp (1964), Lintner (1965), and Mossin (1966) developed the CAPM (Capital Asset Pricing Model) based on the work of Markowitz (1952; 1959), adopting as assumptions that the market is perfect, the individuals are rational, and credit loan and supply take place at a risk-free rate. Thus, with such criteria in place, the expected return on an asset could be represented as the expected return on a risk-free asset plus a risk premium, according to Equation (1).

$$E(R_i) = E(R_{zm}) + [E(R_m) - E(R_{zm})]\beta_{im} \qquad (1)$$

While Lintner (1965) considers that the $E(R_{zm})$ portion deals simply with the risk-free rate, with $E(R_m) - E(R_{zm})$ capturing the premium per beta risk unit (β), Black (1972) believes that the first portion refers to the lower return expected by the market, while the second reflects the premium for the positive beta.

Otherwise, the CAPM also considers that an asset's total risk is given by the sum of its non-diversifiable (systemic) risk and its diversifiable (non-systemic) risk. In the view of Rodrigues *et*

al. (2008), the CAPM assumes that rational investors will be subject only to non-diversifiable risk since they will seek to diversify their portfolio by mitigating or eliminating diversifiable risk.

The non-diversifiable risk in the CAPM equation is represented in the beta and is positively and linearly related to the expected return. The beta coefficient, popularly known as market beta, can be expressed by Equation (2):

$$\beta_i = \frac{Cov\ (R_i,R_m)}{\sigma^2(R_m)} \qquad (2)$$

where $Cov\ (R_i, R_m)$ is the covariance between the return of the asset *i* and the return of the market portfolio *m*, and $\sigma^2(R_m)$ is the market variance.

The interpretation for β occurs as follows: if the risk of asset *i* is equal to that of market portfolio *m*, the return on its β will be equal to 1; if the risk of asset *i* is higher than that of market portfolio *m*, its β will be higher than 1, indicating a higher return; in turn, if the risk of asset *i* is lower than that of market portfolio *m*, its β will be lower than 1, indicating a lower return.

Analogously to the market beta, the so-called accounting beta uses accounting data to measure the variation in risk of companies whose shares have little liquidity or are not traded on the stock exchange. The basic hypothesis of this model is that, if accounting profits can predict future cash flows, the accounting beta is a good estimator for the market beta of a given company (Watts & Zimmerman, 1986).

Regarding the studies on the relationship between accounting information and the return on financial assets, the pioneering work of Ball and Brown (1969) analyzed 261 companies between the years 1946 and 1966, having observed a relationship between net profit, operating profit, and earnings per share using the market beta of these companies.

Beaver, Kettler, and Scholes (1970) identified significant correlations between accounting data by elaborating indices that could indicate the risk of bankruptcy of a specific company, noting that the accounting variables helped in the risk forecast.

Bowman (1979) showed the relationship between accounting variables and the measurement of market risk. His study analyzed the relationship between the financial variables leverage, risk of bankruptcy, interest, beta accounting, variation in profits, dividends, size, and Growth of the company and its relationship with the market's non-diversifiable risk. The author reported an association between non-diversifiable risk, leverage, and beta accounting.

On the other hand, many studies detected no significant relationships between accounting information and the market beta (Breen and Lerner, 1973; Gonedes, 1973; Lev and Kunitzky, 1974; and Elgers, 1980).

In Brazil, Rodrigues *et al*. (2008) suggested that the accounting beta should be calculated from profits and not returns, regressing each company's profit against the profits of the sector that best represented the company. Their results showed that the market beta does not differ statistically from the accounting beta.

Fernandes, Galdi, Teixeira, and Teixeira (2008) compared two accounting betas with the market beta, considering the shares of the 50 most liquid publicly held companies traded on the São Paulo Stock Exchange (Bovespa). For the first accounting beta, the covariance between each company's accounting return and the median accounting return of all companies in the sample was related, considering the denominator as the variance of the median accounting return of the entire sample. The second accounting beta related the covariance between each company's accounting return and the quarterly market return of the Bovespa index (Ibovespa), considering the variance of the Ibovespa quarterly return as a divisor. The authors concluded that the accounting beta could substitute the market beta.

Amorim, Lima, and Pimenta Junior (2014) selected 87 companies from 15 sectors listed on the BM & FBOVESPA, considering data for the 1995-2013 period. The regression of the return on the securities and Ibovespa were used to calculate the market betas, while 14 accounting

variables were used for the accounting betas. Pearson's correlation showed that accounting betas could be used as a proxy for market betas under certain conditions.

Antunes and Guedes (2006) investigated whether the leverage accounting indicator can be used to approximate market beta risk. Correlation tests, linear regression, and visual analysis of the dispersion between leverage (total and financial) and a beta of all companies listed on the Bovespa were conducted. All indicators were collected from Economática from 1995 to 2005, and the results indicated the absence of a relationship between the variables.

In other words, although several national and international studies have combined accounting information (accounting betas) and market betas, the data are inconclusive, and there is no consensus regarding this relationship (Amorim *et al*., 2014). However, because credit unions are entities with no shares traded on the stock exchange, the accounting beta will substitute the market beta, given that the accounting information of these entities is their only source of consistent data.

3 METHODOLOGY

The quarterly public data of credit unions present in the BACEN IF.data system between 2010 and 2018 were analyzed. Initially, the accounting beta, which is the risk indicator for these entities, was calculated. To this end, the quarterly revenue between 2010 and 2018 was used as a proxy for cooperatives' return. The market return was constructed based on all cooperatives' median quarterly revenue in each quarter, as proposed by Fernandes *et al*. (2008), resulting in 2,491 single credit unions with data for at least one quarter.

However, as not all cooperatives had observations between the 1st quarter of 2010 and the 4th quarter of 2018 (36 quarters), a cut was made in the data to exclude cooperatives that had less than 30 quarters with data. Such a procedure is recommended by authors such as Fávero (2015) and Gujarati and Porter (2011), for whom a regression must present at least 30 observations to maintain a minimum quality.

Thus, 496 cooperatives remained in the sample to estimate the model. Having defined the historical series of quarterly revenue for each of the cooperatives, the quarterly return of each of them was calculated using Equation (3):

$$Quarterly\ return = LN(Quarterly\ revenue / Quarterly\ revenue_{t-1}) \qquad (3)$$

In turn, the market return was calculated from the median of the cooperatives' quarterly returns, following the same formula. Having calculated the return series for each cooperative and the market, it was possible to prepare the accounting beta for each cooperative according to Equation (2) presented in Section 2.3.

All indicators from the PEARLS system for which the BACEN IF.data system contained information were selected. Furthermore, some of these indicators were adapted to reflect reality better. For example, indicators R1 and R4 had their original denominators replaced by total assets since credit unions have very "inflated" assets, which better captures profitability and expenses concerning investments.

The adapted indicators used in the survey correspond to 15 indicators, which are shown in Table 8, below.

Table 8
Indicators adapted from the PEARLS system

Indicators
P1 = Credit provision/Credit transactions
E1 = (Net credit transactions +Other net credits and provision) / Total asset
E5 = Financial intermediation revenue / Total asset
E6 = Total asset / Net equity
A4 = Total deposit / Total asset

R1 = Credit transaction income / Total asset
R4 = Expenses of loan and on-lending obligations / Total asset
R6 = Transaction expenses / Total asset
R7 = Scraps (result before taxing) / Total asset
R8 = Scraps (result before taxing) / Net equity
R9 = Resulto f financial intermediation / Transaction revenue
R10 = Scraps (result before taxing) / Transaction revenue
R11 = Service provision income / Administrative expenses
R12 = Personel expenses / Administrative expenses
R13 = Administrative expenses / Total asset

Source: The authors.

Before applying the econometric model, the descriptive statistics of the indicators were calculated. Furthermore, a correlation table was built for all variables used in the research. This correlation table sought to investigate two aspects of the data. First, the potential explanatory power of the independent variables; and second, a potential presence of multicollinearity between some of the variables. The econometric model was built according to Equation (4):

$$\beta contábil_{it} = \beta_0 + \sum_{n=1}^{15} B_n \, . \, Indicadores\ PEARLS_{it} + \varepsilon_i \qquad (4)$$

where $\beta contábil_{it}$ is the dependent variable, that is, the accounting beta of the cooperatives; $\sum_{n=1}^{15} B_n \, . \, PEARLS_{it} Indicators$ is each of the 15 PEARLS indicators for each cooperative; and ε_i is the random error with a zero mean and constant variance.

Thus, to determine whether the accounting indicators proposed by the PEARLS system are related to the risk of Brazilian credit unions, it is necessary to evaluate not only the quality of the independent variables individually but also the explanatory capacity of the variables together on the accounting beta, which means the rejection of the null hypothesis for the F statistic and the existence of explanatory power in the R^2 of the regression.

4 RESULTS AND DISCUSSION

Initially, descriptive statistics (mean, standard deviation, maximum, minimum, kurtosis, and asymmetry) were prepared for the 15 PEARLS system indicators and the accounting beta was calculated. Table 9 summarizes the results for descriptive statistics.

Table 9
Descriptive statistics

	Accounting Beta	**P1**	**E1**	**E5**	**E6**	**A4**	**R1**	**R4**
Mean	2.413	0.188	1.818	0.204	12.346	1.332	0.179	-0.005
Standard Deviation	7.042	0.261	1.073	0.144	11.163	1.274	0.143	0.009
Maximum	94.200	2.411	3.960	0.992	55.449	3.816	0.975	0.006
Minimum	-0.072	0.000	0.000	0.000	-0.004	0.000	0.000	-0.049
Kurtosis	92.284	26.343	-0.822	3.936	-0.078	-1.563	4.488	5.012
Assimetry	8.119	4.190	-0.510	1.123	0.793	0.232	1.478	-2.275
	R6	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**
Mean	-0.150	0.044	0.135	109.850	53.970	-0.886	3.956	-0.064
Standard Deviation	0.169	0.084	0.354	481.445	317.853	1.025	3.555	0.167
Maximum	0.000	0.541	4.136	5591.276	3954.381	1.252	30.168	2.372
Minimum	-1.243	-0.478	-3.404	-2.689	-215.202	-6.143	-16.623	-0.655
Kurtosis	10.467	12.705	81.328	79.644	103.081	1.707	13.212	142.050
Assimetry	-2.753	-0.827	1.397	8.392	9.651	-1.173	1.312	9.010

Source: The authors.

The first aspect highlighted concerns the beta accounting indicator, which revealed an average value of approximately 2.41. As this value ranges between –0.072 and 94.2, it is suggested that individual credit unions have a high level of risk. In comparison, even the riskiest publicly held companies tend to have betas with values not much higher than one.

Regarding the PEARLS system indicators, one stands out from each dimension:

a) The protection indicator (P1) showed that in each credit transaction conducted, credit cooperatives constituted, on average, almost 19% of provisions for loan losses, which indicates the tendency to have a high level of defaults when compared to banks, which recognize on average 5% of their provisions for loan losses, according to Dantas *et al*. (2017).
b) The financial structure indicator (E1) showed that all net credits added to their provisions corresponded to approximately 1.82 times the total assets of these entities.
c) The asset quality indicator (A4) revealed that total deposits represented approximately 1.33 times the cooperatives' volume of assets.
d) Finally, the return rate and cost indicator (R1) indicated that cooperatives' income with credit transactions represented almost 18% of their assets.

This analysis shows that credit plays a fundamental role in the financial and accounting structure of cooperatives. According to Sehn and Carlini Jr. (2007), one of the biggest concerns of organizations, regardless of size, is the issue of default. To reduce such risks, financial institutions develop risk mitigation policies to reinvest their capital in the future (Amaral Jr. & Távora Jr., 2010).

Another clear item of analyzing the distribution of the studied variables is that most have high kurtosis (leptokurtic distribution) and asymmetry, which suggests the non-normality of the distributions, as well as a high standard deviation concerning the mean, also observed by a range of distribution (the difference between the minimum and maximum values). Although they consist of concerning items in the estimation of the model, no adjustment was necessary regarding normality because of the sample size (larger than 400 observations) and the non-observance of impacts in the regression.

Subsequently, the correlation between the study variables was calculated to evaluate the independent variables' explanatory potential when preparing the regression for the accounting beta. The results are shown in Table 10.

Table 10
Correlation of the PEARLS indicators with the accounting beta

	Accounting Beta	**P1**	**E1**	**E5**	**E6**	**A4**	**R1**	**R4**
P1	0.009	1						
E1	-0.075	0.255	1					
E5	-0.096	0.568	0.722	1				
E6	0.108	0.176	0.298	0.130	1			
A4	0.189	0.268	0.213	0.233	0.800	1		
R1	-0.117	0.552	0.718	0.989	0.049	0.142	1	
R4	-0.042	-0.066	-0.338	0.016	-0.483	-0.205	0.022	1
R6	0.145	-0.558	-0.458	-0.825	-0.016	-0.062	-0.838	-0.093
R7	0.018	-0.361	0.230	0.015	-0.021	-0.120	-0.003	0.072
R8	0.071	-0.290	0.115	0.008	0.200	0.182	-0.016	-0.026
R9	-0.038	-0.043	0.142	0.058	-0.125	-0.150	0.052	0.101
R10	-0.021	-0.056	0.112	0.023	-0.102	-0.135	0.018	0.080
R11	-0.114	-0.130	-0.264	-0.073	-0.661	-0.543	-0.012	0.561
R12	-0.063	0.147	0.507	0.361	0.232	0.211	0.324	-0.100

R13	0.061	-0.312	-0.241	-0.472	0.118	-0.056	-0.473	-0.049

	R6	**R7**	**R8**	**R9**	**R10**	**R11**	**R12**	**R13**
R6	1							
R7	0.253	1						
R8	0.082	0.567	1					
R9	0.046	0.159	0.004	1				
R10	0.080	0.191	0.014	0.966	1			
R11	-0.058	-0.071	-0.162	0.160	0.121	1		
R12	-0.163	0.174	0.051	0.167	0.143	-0.225	1	
R13	0.455	0.458	0.612	0.018	0.040	-0.011	-0.056	1

Source: The authors.

The independent variables with the strongest correlations with the dependent variable, the accounting beta, were A4, R6, and R11. In turn, correlations between independent variables were evaluated to fight potential multicollinearity problems. Thus, some of the PEARLS system indicators were excluded, namely (a) R1 and E5, which showed strong correlations with E1 and R6, opting to maintain the last two given their higher correlation with the dependent variable; and (b) R10, which showed a high correlation with R9, the first being excluded because it had a weaker correlation with the accounting beta.

After the exclusions, 12 indicators remained and were used to explain the cooperative's accounting beta (risk). The results are shown in Table 11.

Table 11
Regression explaining the accounting beta with clean data

$$accountingβ = βo + \sum_{n=1}^{12} B_n . PEARLS_i Indicators + ε$$

Variable	**Estimator**	**Standard error**
Intercept	2.454	0.0002***
P1	2.392	1.419 *
E1	-0.296	0.332
E6	-0.105	0.075
A4	1.687	0.719 **
R4	-37.015	37.136
R6	6.793	2.471 ***
R7	3.917	4.212
R8	0.965	1.027
R9	0.00007	0.0001
R11	-0.195	0.689
R12	-0.150	0.204
R13	-0.762	1.531
F = 2.27 (0.0090)		
R^2 = 0.081		
R^2 ajust = 0.045		

Note. The standard error was re-estimated considering the HAC matrix. Significance * 10%, ** 5%, and *** 1%.
Source: The authors.

First, the regression database was evaluated for possible problems of heteroscedasticity and autocorrelation. The Breush-Pagan test was employed for the first, which presented $\chi^2 = 5.20$, with an associated probability of 0.951, which does not allow the rejection of the null hypothesis of homoscedasticity. Autocorrelation was determined using the Durbin-Watson test, which resulted in a DW = 1.91, with an associated probability of 0.188. It was impossible to reject the null hypothesis that the data have no autocorrelation over time.

In general, the independent variables analyzed together are relevant to the accounting beta of credit unions because the F statistic was significant at 1%, showing that the set of variables is important to explain the accounting beta. This is the first argument in favor of the quality of the accounting information in the PEARLS indicators. Moreover, the $R^2 = 0.081$ expresses that the proposed indicators can explain 8.1% of the accounting beta of credit unions, showing that the accounting information contained in the financial indicators contributes to explaining the risk of these entities, even if to a small extent.

It is possible to consider that low R^2 could pose a problem. However, many studies that built the accounting beta as a proxy for the market beta, considering different companies' samples in different countries, revealed a reduced value. For example, Breen and Lerner (1973) found values of R^2 ranging from 6% to 54%, with many coefficients not statistically different from zero. The various models developed by Lima, Ilha, and Galdi (2009) presented R^2 values between 6.1% and 59.5%. Amorim, Lima, and Murcia (2012) found R^2 values in the range of 6.2% to 39.46%, with many of the tested coefficients showing no statistical significance, which indicates that R^2 should not be analyzed in isolation but in conjunction with the other model statistics.

In turn, of the twelve PEARLS system indicators used to explain credit unions' risk, only P1, A4, and R6 were statistically significant. P1 showed that the percentage of funds provisioned regarding credit transactions is important to explain a cooperative's risk. The positive sign of the P1 coefficient indicates that the market understands that entities with higher provisions for doubtful receivables have higher risk levels than the others, as the expected default tends to be higher.

The coefficient of variable A4 (total deposits on total asset) showed a positive sign, as expected. This suggests that cooperatives with a high volume of deposits over their total assets tend to be riskier than the others, resulting in a higher market risk for the most leveraged cooperatives.

In turn, the coefficient of R6 (operating expenses on net equity) was also positive, which shows that credit unions with high operating expenses, that is, with greater inefficiency, generate higher risks for their members and their borrowers. In this regard, Ferreira, Gonçalves, and Braga (2007) argue that the decrease in operating expenses promotes the company's growth, reducing its risk, and, consequently, improving the services available to its members.

In other words, the results confirm that the accounting information used in the construction of the PEARLS indicators are generally useful, because, otherwise, such indicators would not be significant together to explain the credit beta of the credit unions, that is, its risk.

5 FINAL CONSIDERATIONS

The present study sought to investigate whether the accounting indicators proposed by the PEARLS system are effectively related to the risk of Brazilian credit unions. The application of the PEARLS system adapted to the Brazilian reality by Bressan *et al*. (2010), directed at the risk analysis of single credit unions, considers the protection, effective financial structure, quality of assets, return rate and costs, liquidity, and investment signs relevant to its members, borrowers, and regulatory and inspection bodies. Furthermore, this system was the most suitable for the cooperative market (WOCCU, 2019).

The results found in this study showed the importance of analyzing the provision for doubtful receivables or probability of default by customers (P1), the cash flow of deposits present in cooperatives (A4), and the operating expenses (R6). All coefficients of these variables showed positive signs, indicating that the probability of default, the volume of deposits, and the operating expenses influence these entities' increased risk.

Issues involving operating expense indicators, deposits, and, above all, customer default are relevant to financial institutions' success. Financial institutions' basic function is to provide medium to long-term resources for third parties (CMN Resolution 2,099, 1994). Regarding the

accounting model, such accumulated amounts of provision for credit and operating expenses may prove to be a serious problem for the cooperatives' continuity under the rules of BACEN. Therefore, they must be evaluated by managers and other users of accounting information. As for the deposits, higher volumes of monetary resources allow the cooperatives to invest with more capillarity in helping the members belonging to the most deprived populations in the national territory while increasing the credit risk.

This evidence shows that these three indicators are the most important for all those who demand credit unions' financial information. This perception is corroborated in part by the studies conducted by Bressan *et al*. (2014) concerning P1, Bressan, Lopes, and Menezes (2013) for A4, and Silva, Padilha, and Silva (2015) for R6. Therefore, these variables deserve greater attention from users of accounting information, given that they present greater risks to society. This is especially important for the population of low-income Brazilian municipalities, which often depend exclusively on credit unions to access financial resources in the form of loans.

Moreover, the model portrayed that all variables were relevant to explain the credit unions' accounting beta. This demonstrates the quality of the accounting information in the PEARLS indicators, which are useful for its users to assess the credit risk of a given cooperative.

During the study's development, it was possible to perceive the relevance of the financial statements as an analytical and managerial tool for cooperative managers, their members, and regulatory and inspection bodies. According to Fagundes *et al*. (2008), quality accounting information was proven to analyze future trends by assessing past events.

Future research should analyze the accounting beta of central credit cooperatives, considering that these institutions play a significant role in the entire cooperative financial system's strength through services such as financial centralization, supervision, legal and accounting advice, among others.

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