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Determinants of open membership in brazilian credit unions

Determinantes de la admisión libre de socios en cooperativas de crédito brasileñas

Determinantes da livre admissão de associados em cooperativas de crédito brasileiras

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Abstract

Purpose: To identify the determining factors of Open Membership in Brazilian credit unions between 2016 and 2020.

Methodology: A logistic regression model was used to estimate these factors. The analysis considered both specific internal variables of the cooperatives (age, asset size, number of members, and affiliation to systems) and variables representing the macroeconomic environment in which these institutions operate (municipal development index, population size in municipalities with service points (PACs) and cooperative headquarters).

Results: The main results indicate that a lower population size in the municipalities containing the cooperative headquarters and PACs increases the probability of Open Membership. Additionally, cooperatives with a larger number of members and assets also have a higher likelihood of adopting Open Membership.

Contributions of the Study: The study highlights the predominance of cooperatives with Open Membership in smaller and less developed municipalities, reinforcing the role of these cooperatives in social inclusion, reduction of inequalities, and provision of financial services and credit to the population in these locations. Moreover, the results provide valuable insights for policymakers, financial institutions, and cooperatives interested in promoting socio-economic development and equity in underserved communities by the financial system.

Keywords: Credit Unions. Open Membership. Logit.

Resumen

Objetivo: Identificar los factores determinantes de la Admisión Libre de asociados en cooperativas de crédito brasileñas entre 2016 y 2020.

Metodología: Se utilizó un modelo de regresión logística para estimar dichos factores. El análisis consideró tanto variables internas específicas de las cooperativas (edad, tamaño de activos, número de cooperados y afiliación a sistemas) como variables que representan el entorno macroeconómico en el cual estas instituciones se encuentran (índice de desarrollo municipal, número de habitantes en los municipios que cuentan con puntos de atención (PACs) y sede de las cooperativas).

Resultados: Los principales resultados señalan que a menor número de habitantes en los municipios sede y que contienen PACs, mayor es la probabilidad de que ocurra la Admisión Libre. Además, las cooperativas con un mayor número de cooperados y activos también tienen una mayor probabilidad de adoptar la Admisión Libre.

Contribuciones del Estudio: El estudio destaca la predominancia de cooperativas con Admisión Libre en municipios más pequeños y menos desarrollados, reforzando el papel de estas cooperativas en la inclusión social, reducción de desigualdades y oferta de servicios financieros y crédito a la población de estas localidades. Además, los resultados proporcionan información valiosa para los formuladores de políticas, instituciones financieras y cooperativas

interesadas en promover el desarrollo socioeconómico y la equidad en comunidades menos atendidas por el sistema financiero.

Palabras clave: Cooperativas de Crédito. Admisión Libre de Asociados. Logit.

Resumo

Objetivo: Identificar os fatores determinantes da Livre Admissão de associados em cooperativas de crédito brasileiras entre 2016 e 2020.

Metodologia: Utilizou-se um modelo de regressão logística para estimar tais fatores. A análise considerou tanto variáveis internas específicas das cooperativas (idade, tamanho do ativo, número de cooperados e filiação a sistemas) quanto variáveis que representam o ambiente macroeconômico no qual essas instituições estão inseridas (índice de desenvolvimento municipal, número de habitantes nos municípios que possuem postos de atendimento (PACs) e sede das cooperativas).

Resultados: Os principais resultados apontam que quanto menor o número de habitantes dos municípios sede e que contém PACs, maior a probabilidade de ocorrência de Livre Admissão. Além disso, cooperativas com maior número de cooperados e ativos também têm maior probabilidade de adotar a Livre Admissão.

Contribuições do Estudo: O estudo destaca a predominância de cooperativas com Livre Admissão em municípios menores e menos desenvolvidos, reforçando o papel dessas cooperativas na inclusão social, redução de desigualdades e oferta de serviços financeiros e de crédito para a população dessas localidades. Além disso, os resultados fornecem subsídios valiosos para formuladores de políticas, instituições financeiras e cooperativas interessadas em promover o desenvolvimento socioeconômico e a equidade em comunidades menos atendidas pelo sistema financeiro.

Palavras-chave: Cooperativas de Crédito. Livre Admissão de Associados. Logit.

1 Introduction

Credit unions, as financial institutions formed by associations of individuals to provide financial services, are integral to the National Financial System (SFN) and are authorized and supervised by the Central Bank of Brazil – BACEN (Banco Central do Brasil [BACEN], 2021a).

Cooperatives play a crucial role in economic development by targeting the financial and social inclusion of populations without access to traditional banking, thereby fostering increased competition in the credit system (BACEN, 2019).

Brazilian credit unions, prominently distributed across diverse municipalities, often in areas untouched by traditional banks, offer personalized services to members and provide products with attractive rates, significantly contributing to the SFN (Cunha, Oliveira & Gozer,

2016). Recognized by the regulatory body, National Congress, and Government, the promotion of credit unions is perceived as a guide for enhancing efficiency and competition in the credit market (Soares & Sobrinho, 2008).

Aligned with the objective of promoting and consolidating credit unions' growth and allowing association from diverse social activities, the National Monetary Council (CMN) introduced Resolution 3,106 on June 25, 2003. This resolution facilitated the establishment of Free Admission credit unions and the transformation of existing ones into this category, marking a departure from the previous requirement of a specific common bond for membership (CMN, 2003).

This regulatory shift broadened cooperative membership to include any natural or legal person, irrespective of economic potential or professional status, residing within the cooperative's operational area. This expansion in legislation not only marked an evolution in Brazilian cooperatives but also opened up extensive business possibilities, contributing to local development through increased access to credit and financial services (Cunha, Oliveira & Gozer, 2016).

Given the substantial growth in this type of association in recent years, it becomes pertinent to assess the determinants of Free Admission of members in Brazilian credit unions. The research question guiding this study is: **What are the determinants influencing the probability of Free Admission of members in Brazilian credit unions from 2016 to 2020?**

This study aims to contribute to regulatory bodies, especially BACEN, by analyzing the impacts of Free Admission regulation on Brazilian credit unions. The findings are expected to assist regulatory bodies, supervisors, and policymakers in monitoring and reflecting on the impact of Free Admission, providing a foundation for incentive actions for the efficient growth of credit unions. Moreover, this research offers valuable insights for users and members of Brazilian credit unions, aiding in making informed choices regarding membership in Free Admission or Restricted Admission cooperatives. Finally, it seeks to contribute to the field of Accounting, particularly in Controllership, by employing internal and external cooperative data to estimate the probability of Free Admission of members.

The article is organized as follows: Section 2 provides a literature review on the Free Admission of Members, focusing on the normative evolution of cooperativism in Brazil concerning the association modality. Section 3 elucidates the methodological procedures employed. Section 4 deliberates on the results obtained, and Section 5 offers concluding remarks and recommendations for future research.

2 Literature Review

2.1 Free Admission of Members

The Free Admission of Members entails the opportunity for individual credit unions to include any person, natural or legal, in their membership, provided statutory requirements are met. In contrast, credit unions with restricted admission, referred to here as restricted admission cooperatives, limit membership to specific segments, such as individuals with a "common bond" like rural producers in a specific region, businesspeople, public servants from a specific body, or a segment of employees from a particular company.

Internationally, the relaxation of the common bond is exemplified by the United States' experience, beginning in 1982 when the National Credit Union Administration (NCUA)

permitted the inclusion of SEGs (selected groups of employees), allowing multiple bonds as a common bond to expand cooperative membership (Burger and Dacin, 1991). This regulatory change aimed to preserve the mission and philosophy of credit unions in a competitive environment. Despite a 1998 Supreme Court ruling against the NCUA, the US Congress, through the Credit Union Member Access Act (1988), reinstated the multiple group membership provision, enhancing credit unions' operational scope and benefits (Frame, Karels, & McClatchey, 2002).

Frame et al. (2002) highlight that the expansion of members through SEGs significantly boosted credit union operations, illustrating a case where a credit union added 150 new SEGs during a legal battle, representing around 65% of its members. Loosening the common bond mitigated credit portfolio concentration risks, increased investment opportunities, and diluted informational advantages associated with a single common bond.

In Brazil, Free Admission of Associates was authorized on June 25, 2003, through Resolution No. 3,106 of the National Monetary Council (CMN) (Meinen, 2013). Meinen summarizes that free admission facilitated the amalgamation of diverse economic and social agents in a single entity, promoting efficiency in resource allocation resulting from the monetization of production and members' work. Initially considered a risk to the financial system's public interest, Free Admission gained acceptance through subsequent regulatory resolutions and sectoral maturation, leading to its authorization in 2003. This regulation fostered a more inclusive, fair, and competitive financial system, reducing seasonality and sectoral concentration risks within the cooperative segment (Meinen, 2013).

Höffling (2013) contends that the segmentation of credit unions is unjustified, as the bond that unites individuals, whether natural or legal, is their association with the cooperative, making them owners by contributing to the entity's capital. The author argues that the segmentation, with limitations on territorial bases to a single municipality, hinders development. CMN Resolutions No. 3,106 of 2003 and No. 3,859 of 2010 serve as a legal framework favoring the development and expansion of credit unions, promoting financial and economic inclusion in the Brazilian context.

Regulatory changes, such as the implementation of free admission of members to credit unions, can create opportunities for expansion and suggest future transformations (Canassa, Costa, & Bonacim, 2022). The adoption of free membership by credit unions broadens their reach, encompassing a larger, more diverse membership base, potentially leading to increased fundraising, transaction volumes, and business growth.

Neves, Amaral, and Braga (2012) analyzed the credit risk of 15 rural credit unions that adopted free admission found a reduction in risk and increases in economies of scale. However, the study noted an increase in the level of provisioning for the credit portfolio, indicating higher-risk credits being granted to members as cooperatives embraced free admission.

Abreu, Kimura, Araújo Neto, and Peng (2018) examined the efficiency of 880 credit unions regarding free admission and an increase in members. They found that larger cooperatives generally exhibit greater efficiency, and credit unions with free admission are, in general, less efficient compared to those with restricted admission.

Gonçalves and Bressan (2022) discussed the impact of free admission on the economic-financial performance of Brazilian credit unions, finding better performance for free admission cooperatives due to lower operating expenses and higher income from service provision. They highlighted better efficiency for credit unions with free admission compared to those with restricted admission.

Canassa, Costa, and Bonacim (2022) studie on changes in the ownership structure of cooperatives due to free admission argue for the dispersion of ownership and an increase in operational scale. The adoption of free admission may be driven by incentives such as reaching a larger population, achieving social objectives, potential gains in future cooperative performance, and other motivations, such as increased remuneration for directors or margins of managerial opportunism due to dispersed ownership.

The institution of legal guidelines for freely admitted credit unions aimed to expand the offer of financial services to different social and economic segments, reducing credit spread and service fees, thus playing a crucial role in banking competition and enhancing efficiency in the national financial system (Höffling, 2013).

2.2 Evolution of Normative Aspects and the Number of Cooperatives with Free Admission of Members in Brazil

The Free Admission of members, as previously mentioned, was instituted in Brazil following CMN Resolution No. 3,106 of 2003. From that year onward, the creation of Free Admission credit unions was permitted for locations with fewer than 100 thousand inhabitants or the transformation of individual credit unions into this modality, provided they are located in areas with less than 750 thousand inhabitants and meet specific requirements regarding reference assets (CMN, 2003).

In 2009, Complementary Law No. 130/2009 was enacted, considered a milestone in the regulation of Brazilian credit unions. This law, later amended, outlines the functioning of the National Cooperative Credit System, subjecting cooperatives to the aforementioned law, SFN legislation, and applicable determinations of CMN and BACEN (CMN, 2009).

In this context, CMN, through Resolution No. 3,859 of May 27, 2010, facilitated progress by allowing greater flexibility in the constitution and operation of free admission cooperatives. This resolution enabled the transformation of credit unions with restricted admission into those with free admission in municipalities with over two million inhabitants, and it also made the merger of smaller cooperatives into larger ones with free admission of members more flexible (CMN, 2010).

Several articles of CMN Resolution No. 3,859/2010 are noteworthy for illustrating the evolution of free admission in the Brazilian scenario. Article 14, items I and II, presented special conditions for cooperatives with free admission and established that BACEN would permit the creation of a single credit cooperative with free admission only if the population of the respective area of activity did not exceed three hundred thousand inhabitants. Alternatively, adoption of this admission regime by an existing cooperative, operational for more than three years, was allowed, with the limit for the area's population set at a maximum of three hundred thousand inhabitants (CMN, 2010).

The resolution stipulated that cooperatives covered in this article should include the expression "free admission" in their name from the first statutory change or from their constitution after the date of the BACEN circular's publication.

It is noteworthy that CMN Resolution No. 3,859 of 2010 was fully revoked and largely replaced by Resolution No. 4,434 of August 5, 2015, currently in force. This resolution addresses the constitution, authorization for operation, operation, statutory changes, and cancellation of authorization for the operation of credit unions (CMN, 2015).

Resolution No. 4,434 of 2015 classifies credit unions based on the types of operations they conduct rather than the characteristics of their membership. Chapter III of this resolution outlines the current classification of credit unions (full, classic, and capital and loan credit unions) and the statutory conditions for admitting members. It emphasizes that the conditions for admitting members and the area of activity of credit unions are defined by the general assembly and must be included in the cooperatives' bylaws.

Given the regulations on the free admission of members, cooperatives gained the ability to broaden their membership to include all natural and legal persons without a specific common bond. Consequently, credit unions expanded their operations to encompass various sectors of the economy, catering to self-employed professionals, rural producers, service providers, and others. This diversification allowed cooperatives to capture more resources from new members, offering collection and custody services, credit lines, and catering to diverse groups such as rural producers, employees, public servants, among others (Höffling, 2013).

The consequence of the Free Admission regulation is a significant increase in the number of Free Admission cooperatives, either newly formed or converted to this modality, concerning the total number of credit unions in Brazil. Between 2003 and 2007, 132 cooperatives embraced free admission, and from 2008 to 2018, this number rose to 267 (Canassa, Costa, & Bonacim, 2022). Notably, in 2020, Free Admission cooperatives surpassed the 50% mark of all cooperatives in this category, indicating the majority of credit unions operating in Brazil in 2020 adopted Free Admission.

Since the allowance for free admission of members, the representation of credit unions in this modality has been consistently increasing. This upward trend continues in 2022, where the free admission criterion represents 56.9% of the total number of individual credit unions (BACEN, 2022). Moreover, free admission cooperatives represented 88.5% of the total assets of individual credit unions in 2021, rising to 90.6% in 2022, emphasizing the substantial participation of cooperatives in this category (BACEN, 2021c, 2022).

The growing trend of adopting free admission aims to expand the associable public, increase membership, and optimize cooperative structures based on economies of scale (BACEN, 2020). This change aligns with the Central Bank's objectives of expanding the cooperative segment, particularly in more remote municipalities with limited access to financial services (BACEN, 2021c). The increase in free admission cooperatives has the potential to extend the segment's operations in these regions, particularly in small municipalities. Additionally, for the year 2022, credit unions with free admission exhibited higher average profitability compared to those with restricted membership (BACEN, 2022).

3 Methodological procedures

To accomplish the research objectives, a primary sample was utilized, comprising credit unions with free admission of members from 2016 to 2020, obtained from the BACEN website. Simultaneously, a secondary sample for the same period consisted of cooperatives that did not adopt Free Admission (referred to as restricted admission cooperatives) from 2016 to 2020. Cooperatives classified as capital and loan cooperatives were excluded due to the limitations on activities conducted by these cooperatives. The chosen initial period is justified by the enforcement of Resolution No. 4,434 of August 5, 2015, which, as previously mentioned, replaced the prior Resolution No. 3,859 of 2010.

The database spans 5 years, from 2016 to 2020, and credit unions lacking accounting information during this period were excluded from the samples. Additionally, a criterion was defined to exclude cooperatives that transformed into Free Admission in the current year from the Balance Sheet. This exclusion aimed to eliminate institutions from the sample that had not completed a full year of transformation to Free Admission, preventing potential bias in the performance analysis of these institutions. Table 1 provides details of the final composition of the sample.

Table 1
Sample Composition

	2016	**2017**	**2018**	**2019**	**2020**
Total of Single Cooperatives in operation	1019	969	927	875	847
(-) Capital and Loan Cooperatives	190	192	187	181	173
(-) Cooperatives with insuficiente data	12	8	14	14	12
(-) Cooperatives going Free Admission in the current year	21	24	21	51	34
Total Cooperatives after exclusions	**796**	**745**	**705**	**629**	**628**

Source: *Prepared based on data from BACEN (2021).*

To achieve the proposed objective, both internal and external variables were incorporated, aiming to capture the influence of internal factors and macroeconomic aspects that may determine the probability of Free Admission of members. Internal variables, established at the individual level of each cooperative in the samples and consistent with prior research (Frame et al., 2002; Jones & Kalmi, 2015; Santos & Braga, 2019), include: the age of the cooperative (in years); the size of the cooperative (represented by the natural logarithm of Total Assets); the number of cooperative members (represented by the total number of members); and a "System" dummy variable to ascertain whether the cooperative operates independently or is part of a system.

Consistent with previous studies (Emmons & Schimd, 1988; Frame et al., 2002; Jones & Kalmi, 2015; Santos & Braga, 2019), external variables in this research encompass: (a) the FIRJAN Municipal Development Index (IFDM); (b) the population size of the host municipality and municipalities with cooperative service points, obtained from the website of the Brazilian Institute of Geography and Statistics (IBGE). Both are municipality-level variables considered capable of influencing the occurrence of Free Admission of members.

Based on the determination of external and internal variables, the probability of Free Admission occurrence was estimated for each year "t" in the sample (2016 to 2020). The functional form of logistic regression (Equation 1) details how the probability of Free Admission was calculated for each cooperative "c," belonging to municipality "m," in each year "t," resulting in the probability (values between 0 and 1) of the occurrence of Free Admission.

$$E(Free\_Admission_{\,c,m,t}\,|X) = P(Free_{Admission_{c,m,t}}|X) = \phi\,(\beta_1\,HAB_{m,t} + \beta_2\,IFDM_{m,t} + \gamma_1 AGE_{c,m,t} + \gamma_2 SIZE_{c,m,t} + \gamma_3 NUMCOOP_{c,m,t} + \gamma_4 SYSTEM_{c,m,t}) \quad (1)$$

Which:

The dependent variable, "Free_Admission," is assigned the value 1 for instances of Free Admission adherence and 0 otherwise. In other words, if credit cooperative "c," situated in municipality "m" in year "t," operates as a Free Admission cooperative, the variable is assigned a value of 1; if the cooperative follows a restricted admission policy, the variable receives a value of 0.

The independent variable "HAB" is derived by summing the populations of the municipalities hosting the respective cooperatives' service stations (PACs) and the population of the municipality where the cooperative is headquartered. In cases where cooperatives lack a service point, only the population of the municipality where the headquarters is situated is considered. This variable serves as a proxy to capture characteristics of the municipalities where credit unions have service stations.

The independent variable "IFDM" signifies the IFDM of municipality "m" in year "t," with general index values ranging between 0 and 1. Higher values indicate a more developed municipality, while lower values signify lower development levels in the municipality.

β_1 and β_2 are coefficients of variables at the level of the municipalities in which the cooperatives have headquarters.

The independent variable "$\boldsymbol{AGE}$" represents the age (in years) of cooperative “c” in year “t”.

The independent variable **“SIZE”** reflects the size of cooperative “c” in year “t” and is measured by calculating the natural logarithm of the total assets of credit unions.

A The independent variable **“**$\boldsymbol{NUMCOOP}$" symbolizes the number of members of cooperative “c” in year “t”.

Finally, the independent variable **“**$\boldsymbol{SYSTEM}$" This is a dummy variable that takes the value 1 for cooperatives affiliated with a system and 0 for independent cooperatives. It serves as a proxy to indicate whether cooperative "c" in year "t" is affiliated with a system or operates independently.

γ_1 ,γ_2,γ_3 and γ_4: coefficients of variables at the cooperative level.

To validate the model, a statistical analysis of the significance of the parameters associated with the explanatory variables was conducted using the Hosmer-Lemeshow Goodness-of-fit test. This test evaluates the presence of significant differences between predicted and observed frequencies, with the model considered well-adjusted if an association is identified between the observed and predicted values (Fávero, Belfiore, Takamatsu, & Suzart, 2014). Another method to assess the model's fit is to examine the sensitivity, specificity, and overall accuracy percentage. Sensitivity is linked to the model's accuracy in predicting the event (i.e., correctly classifying a cooperative that is, in fact, Free Admission). Specificity represents the model's accuracy in predicting the control event (Fávero et al., 2014), correctly classifying a cooperative that is, in fact, Restricted Admission. Finally, the Receiver Operating Characteristic (ROC) curve was analyzed, a measure of the model's predictive capacity, relating sensitivity versus specificity. A greater area under the ROC curve indicates higher predictive power for the model.

4 Results and discussion

The general characterization of the sample data is presented separately for Free Admission cooperatives and Restricted Admission cooperatives for each year within the studied period (2016 to 2020). The variable data are presented by modality, including the size of the sample (N), maximum and minimum values, mean, standard deviation, coefficient of variation (CV), and median. Additionally, the Wilcoxon Mann-Whitney test was employed to verify the statistically significant difference in medians between the association modalities for each year (Table 2).

Considering a significance level of 5%, it can be inferred concerning the size variable (SIZE), measured by the natural logarithm of total assets, that throughout all years of analysis, Free Admission cooperatives are larger than Restricted Admission cooperatives in terms of asset size. The NUMCOOP variable, measuring the number of members, indicates that Free Admission cooperatives consistently have a greater number of members than Restricted Admission cooperatives throughout the period (Table 2).

The HAB variable reveals that in 2019 and 2020, Restricted Admission cooperatives are present in municipalities with a greater number of inhabitants than Free Admission, either due to more service points or their presence in more populous municipalities (Table 2).

In this sense, it can be inferred that Free Admission has service stations in less populated municipalities in 2019 and 2020, even with a lower IFDM rate, signifying municipalities considered less developed, as observed in the years 2016, 2019, and 2020 of the IFDM variable. Finally, using the AGE variable, representing the age of the cooperatives in years, it is observed that the Free Admission modality has, on average, older cooperatives than Restricted Admission cooperatives throughout the entire period (Table 2).

Additionally, from the visualization of the sample data (Table 2), heterogeneity in the data was identified, justifying the calculation of the natural logarithm of the following variables to be included in the logit model: the number of inhabitants of the host municipalities and municipalities where there are service stations (lnHAB), and the total number of members per cooperative (lnNUMCOOP). It is also worth highlighting that the SIZE variable is already the natural logarithm of the total assets of the cooperatives.

Table 2

Descriptive Statistics of the Variables used in the model to estimate the probability of Free Admission

Year	Type	Variable	N	Minimum	Maximum	Average	Standard Dev.	Median	CV
2016	F. Ad.	HAB	311	1807	1,74e+07	640778,7	1656663	244339	2,59
	F. Ad.	IFDM	311	0,4999	0,8806	0,7682	0,0683	0,7804*	0,09
	F. Ad.	AGE	311	1	114	25,5723	15,5833	24***	0,61
	F. Ad.	SIZE	311	16,4282	26,5296	20,2255	1,1528	20,3384***	0,06
	F. Ad.	NUMCOOP	311	476	393000	20119,75	31186,93	9380***	1,55
2017	F. Ad.	HAB	329	1799	1,78e+07	740970,9	1734029	287498	2,34
	F. Ad.	IFDM	329	0,4999	0,8806	0,7688	0,0688	0,7819	0,09
	F. Ad.	AGE	329	1	115	26,0638	15,4001	24***	0,59
	F. Ad.	SIZE	329	16,431	25,0676	20,3771	1,1635	20,4651***	0,06
	F. Ad.	NUMCOOP	329	219	433408	21474,38	33283,57	10246***	1,55
2018	F. Ad.	HAB	349	1905	1,79e+07	848117,9	1762375	368774	2,08
	F. Ad.	IFDM	349	0,499	0,8806	0,7717	0,0692	0,7886	0,09
	F. Ad.	AGE	349	2	116	26,5558	14,8558	25***	0,56
	F. Ad.	SIZE	349	17,6226	24,2249	20,4971	1,1289	20,6152***	0,06
	F. Ad.	NUMCOOP	349	413	472963	22930,21	35636,72	11315***	1,55
2019	F. Ad.	HAB	362	1908	1,99e+07	1285709	2793362	429439,5**	2,17
	F. Ad.	IFDM	362	0,499	0,8806	0,7727	0,06861	0,7886***	0,09
	F. Ad.	AGE	362	3	117	27,2734	14,6315	26***	0,54
	F. Ad.	SIZE	362	17,7209	24,2985	20,6634	1,1309	20,7562***	0,05
	F. Ad.	NUMCOOP	362	557	532528	25226,36	39476,59	12489,5***	1,56
2020	F. Ad.	HAB	403	1912	2,17e+07	1278522	2730716	418706***	2,14
	F. Ad.	IFDM	403	0,499	0,8806	0,7710	0,0677	0,7831***	0,09
	F. Ad.	AGE	403	4	118	27,2704	14,2685	26***	0,52
	F. Ad.	SIZE	403	17,644	24,5177	20,8120	1,1879	20,7895***	0,06
	F. Ad.	NUMCOOP	403	797	633889	26416,55	43832,5	13104****	1,66
2016	Rest. Ad.	HAB	485	1722	2,55e+07	1445854	3211637	259399	2,22
	Rest. Ad.	IFDM	485	0,4722	0,8789	0,7738	0,0717	0,7804*	0,09
	Rest. Ad.	AGE	485	1	111	18,4701	10,1977	17***	0,55
	Rest. Ad.	SIZE	485	13,2232	23,4592	17,9617	1,6141	17,9475***	0,09
	Rest. Ad.	NUMCOOP	485	200	139111	4036,891	8166,77	2119***	0,002
2017	Rest. Ad.	HAB	416	1722	2,57e+07	1793290	3826488	346069	2,13
	Rest. Ad.	IFDM	416	0,4722	0,8789	0,7734	0,0708	0,7804	0,09

Table 2

Descriptive Statistics of the Variables used in the model to estimate the probability of Free Admission

Year	Type	Variable	N	Minimum	Maximum	Average	Standard Dev.	Median	CV
2017	Rest. Ad.	AGE	416	1	112	19,6274	10,3996	18***	0,53
	Rest. Ad.	SIZE	416	13,0357	22,414	18,19462	1,5759	18,3082***	0,01
	Rest. Ad.	NUMCOOP	416	75	141092	4616,651	8813,449	2536***	1,91
2018	Rest. Ad.	HAB	356	1712	2,58e+07	2138263	4330551	378853	2,03
	Rest. Ad.	IFDM	356	0,4854	0,8789	0,7758	0,0703	0,785	0,09
	Rest. Ad.	AGE	356	1	113	20,8960	10,5813	19***	0,51
	Rest. Ad.	SIZE	356	13,6594	22,67	18,4095	1,5757	18,4584***	0,09
	Rest. Ad.	NUMCOOP	356	173	145847	5315,135	9821,98	2901,5***	0,00
2019	Rest. Ad.	HAB	267	1718	2,60e+07	2472216	4578183	705422**	1,85
	Rest. Ad.	IFDM	267	0,4854	0,8789	0,7854	0,06871	0,8029***	0,09
	Rest. Ad.	AGE	267	3	114	23,2059	11,2710	21***	0,49
	Rest. Ad.	SIZE	267	13,4511	22,8967	18,5789	1,6635	18,5229***	0,09
	Rest. Ad.	NUMCOOP	267	173	149586	5959,21	11535,53	2934***	1,94
2020	Rest. Ad.	HAB	225	1725	2,61e+07	2345092	4072989	794735***	1,74
	Rest. Ad.	IFDM	225	0,4854	0,8789	0,7843	0,0688	0,8017***	0,09
	Rest. Ad.	AGE	225	4	115	24,6133	11,6671	22***	0,47
	Rest. Ad.	SIZE	225	13,4203	23,2156	18,6848	1,7374	18,6621***	0,09
	Rest. Ad.	NUMCOOP	225	198	149355	6239,391	12513,06	2887***	0,002

Notes: *F. Ad.: Free Admission; Rest. Ad.: Restricted Admission. HAB.: total number of inhabitants of the municipalities headquarters; IFDM: IFDM index of the host municipality; AGE: age in years; SIZE.: natural logarithm of total assets; NUMCOOP: number of members. *, **, *** indicates that there is a statistically significant difference at levels of 10%, 5% and 1% respectively in relation to the previous year.*

Source*: Search results.*

The proposed logistic model was estimated separately for each year of the study horizon (2016 to 2020), and the results of the coefficients and the marginal effect of each variable are presented in Table 3. For the analysis of statistical significance, a level of 5% was considered. Thus, it is observed that all variables are statistically significant in all years of the period, except for the variable age (AGE), which showed statistical significance only in 2017 for the 5% level considered.

Furthermore, it is noteworthy that the dummy variable "System," initially included in the model, presented flaws in the estimation. For example, in 2016, all independent cooperatives (D_system = 0) are simultaneously in the Restricted Admission modality, causing the variable to fail in estimating the probability of Free Admission. Given this, and to maintain consistency across the variables for each year of analysis, it was decided to exclude the "System" dummy variable from the proposed logit model.

Table 3
Determinants of Free Admission of Credit Unions in the period from 2016 to 2020

	2016		2017		2018		2019		2020	
Variable	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**
lnHAB	-0,4424***	-0,0826***	-0,4118***	-0,0931***	-0,4182***	-0,1034***	-0,5041***	-0,1222***	-0,5634***	-0,1191***
IFDM	-8,8391***	-1,6513***	-8,2649***	-1,8696***	-5,0515***	-1,2495***	-5,6820***	-1,3773***	-4,3464**	-0,9194**
AGE	0,0216*	0,0040*	0,0261**	0,0059**	0,0159	0,0039	-0,0075	-0,0018	-0,0148	-0,0031
SIZE	1,4464***	0,2702***	1,3904***	0,3145***	1,1871***	0,2936***	1,0379***	0,2516***	0,9430***	0,1994***
lnNUMCOOP	0,3283**	0,0613**	0,3616**	0,0818**	0,4341***	0,1073***	0,7804***	0,1891***	0,8470***	0,1791***
constante	-19,2956***		-19,4322***		-18,2232***		-15,9670***		-14,6270***	
Number of observations	**796**		**744**		**705**		**629**		**628**	
R^2 McFaden	0,4638		0,4480		0,4148		0,4390		0,4395	
Count R^2	85,80%		83,20%		80,99%		83,62%		84,08%	
LR χ^2 (5)	494,04		457,65		405,39		376,45		360,12	
Prob > χ^2	0,000		0,000		0,000		0,000		0,000	
Hosmer-Lemeshow **Goodness-of-fit**	854,79**		661,18***		629,94***		582,41***		596,80***	
Sensitivity	80,06%		78,42%		80,80%		88,95%		91,81%	
Specificity	89,48%		86,99%		81,18%		76,40%		70,22%	
Area under ROC	0,9158		0,9070		0,8958		0,9030		0,8980	

Notes: **, **, *** indicates that the coefficient is statistically significant at the 10%, 5% and 1% levels respectively. Y=1: Free Admission Cooperatives; Y=0: Restricted Admission Cooperatives. lnHAB: natural logarithm of the number of inhabitants of the headquarters and municipalities that have service stations; IFDM: index; AGE: age in years; SIZE: natural logarithm of total assets; lnNUMCOOP: natural logarithm of the total number of members.*
Source: *Search results.*

It appears that the variables SIZE and lnNUMCOOP are positively related to the probability of Free Admission occurring. For example, the larger the size of the asset and the number of members, the greater the probability of Free Admission occurring. Such data are consistent with what was seen from the descriptive statistics that showed that Free Admission cooperatives have higher asset values (SIZE) and a greater number of members in relation to Restricted Admission.

On the other hand, the variables lnHAB and IFDM are negatively related to the probability of the occurrence of Free Admission. For example, the smaller the number of inhabitants of the municipalities that have service stations and headquarters municipalities, the greater the probability of the cooperative being Free Admission. This finding, as evidenced in the analysis of descriptive statistics, corroborates that Free Admission is more present in less populous municipalities than Restricted Admission cooperatives.

Furthermore, the negative coefficient for the IFDM index is consistent with the previous finding related to the number of inhabitants, since the lower the IFDM index, the greater the probability of Free Admission. It is understood that, in general, smaller municipalities are less developed than larger municipalities in terms of population. This result reinforces the social role of credit unions, especially Free Admission cooperatives, given the capillarity of this modality present in smaller and less developed municipalities.

To verify the quality of the logistic model, McFadden's R^2 was used, and the results indicate a good quality of the model, explaining at least 41% of the probability of Free Admission for the entire period. The Hosmer-Lemeshow Goodness-of-fit test also supports the well-adjusted nature of the model.

In evaluating the model's classification statistics for each year, considering measures of sensitivity, specificity, and Count R^2, it is observed that the model correctly classified Free Admission cooperatives in at least 78% of cases and Restricted Admission cooperatives in at least 70% of the observations. Count R^2 indicates that the proposed model correctly classified at least 80% of all observations for each year.

Finally, the ROC curve indicates that the model has excellent discriminatory power, with an area under the curve of at least 89% in all years. In summary, based on the results of the tests and validation regarding the adjustment and adequacy of the model, it can be concluded that the proposed logit model has high predictive power and validates the statements about the determinants of the probability of credit unions becoming freely admitted.

5 Final Considerations

In Brazil, two types of membership exist in credit unions: the Free Admission modality, where anyone within the cooperative's area of activity can become a member, and the Restricted Admission modality, where the cooperative determines a common bond that makes certain people eligible for membership. The authorization for the constitution or transformation of existing cooperatives into Free Admission resulted from Resolution No. 3,106 of the National Monetary Council (CMN) in 2003, but it was in 2015 that there was a refinement in the regulation of this authorization starting with Resolution No. 4,434, which eliminated some requirements that still limited cooperatives from transforming into Free Admission.

Given this scenario, a significant expansion of the Free Admission modality has been observed since 2015. Parallel to this expansion, an interest in evaluating the determining variables for the occurrence of Free Admission has emerged. Therefore, the general objective

of this work was to identify the determining factors that influence the probability of Free Admission of members to Brazilian credit unions from 2016 to 2020.

To achieve the proposed objective, a logit model was used based on internal variables (age of cooperatives, size of total assets, number of members, and affiliation to systems) and external variables (number of inhabitants of the municipalities served and the host municipality, and the IFDM municipal development index) of credit unions in the period between 2016 and 2020.

Based on the results of the sample analyzed between 2016 and 2020, it is noted that Free Admission cooperatives operate predominantly in less populous and less developed municipalities. This finding can be justified due to Resolution 3,859 of 2010, which limited the foundation or transformation to Free Admission according to the maximum number of inhabitants of the municipalities. As this limitation was fully revoked by Resolution 4,434 in 2015, it is understood that the Free Admission modality was predominant in smaller municipalities until 2015. However, even with the marked growth of the Free Admission modality from 2016 to 2020, its predominance in smaller municipalities persists.

On the other hand, cooperatives with greater assets and a larger number of members are more likely to be Free Admission. Furthermore, the significance of the variable age of cooperatives for the years 2016 and 2017 shows that older cooperatives are more likely to have Free Admission.

The observation of Free Admission in less developed cities highlights the social role in reducing inequalities and local development that this modality makes possible. Therefore, it is concluded that the expansion of Free Admission cooperatives represents an expansion of access to financial and credit services for less developed municipalities, contributing to the economic and social development of these locations.

As a contribution, this article reinforces the role of Free Admission cooperatives in social inclusion, given their performance in municipalities with lower IFDM. Additionally, it advises regulatory bodies not only regarding the expansion of the Free Admission modality in Brazil but also related to its presence in less developed locations, contributing to reducing inequality and promoting social and economic development.

The present study has limitations concerning the non-inclusion of unobservable characteristics in the logit model. Characteristics such as managerial skills, risk aversion of managers, among others, were not considered. For future studies, it is recommended to include variables of a social nature and other variables related to unobservable characteristics, such as the level of competitiveness of cooperatives, the life cycle, risk aversion of managers, and the level of governance.

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