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# Credit Union Life Cycle and Membership: Evidence from Brazilian Credit Unions

## ABSTRACT

**Objective:** This work explores the relationship between membership growth and Brazilian credit unions that cease operations according to the life cycle precepts proposed by Cook (1995) and Cook & Burress (2009).

**Method:** Kaplan-Meier estimators and duration models were applied to a sample of 253 credit unions founded between 2003 and 2018 to analyze the chances of survival for credit unions in relation to the size of their membership.

**Originality/Relevance:** In examining membership growth, this work differs from previous studies which have focused on financial performance.

**Results:** Credit unions with lower growth in terms of membership ceased operations soon after their founding without becoming established. A growth in membership in credit unions with a propensity for heterogeneity in terms of the members' interests, however, is positively associated with a risk of closing, possibly due to the influence costs and agency costs.

**Theoretical/Methodological contributions:** This study's findings reinforce the importance of considering member characteristics in examining credit union survival as well as policies that help credit unions become established and then adapt to the heterogeneity of their members' interests.

**Keywords:** Credit Unions; Membership; Life Cycle.

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## 1 INTRODUCTION

The decision to cease a credit union's operations is a member right which is guaranteed by (Law n. 5.764, 1971). However, little is known about what leads them to make this decision. Few studies have explored the previous characteristics of closed credit unions, and usually they have preferred to investigate their financial performance (Carvalho, Diaz, Bialoskorski & Kalatzis, 2015; Bressan, Braga, Bressan & Resende, 2011; Bauer, Miles, & Nishikawa, 2009; Ralston, Wright, & Garden, 2001). However, it is known that members do not care much about their credit union's financial performance, because they only need to invest a little capital to become customers of their financial services (Hart & Moore, 1998, 1996; Rasmusen, 1988). Competition with commercial banks is also not a very convincing motive given that small credit unions are able to provide satisfactory services to their members (Feinberg, 2001). That being so, what makes members close their credit unions?

Cook (1995) and Cook & Burress (2009)[1] propose a cooperative life cycle which, among other factors, is based on membership growth. To the authors, at first membership growth is essential to establish cooperatives and their services. After they have become established, however, problems related to the heterogeneity of their members' interests, such as the difficulty of making optimal decisions portfolio choices, and the increase in the costs of influence and agency make credit unions inefficient (Hart & Moore, 1998, 1996; Arrow & Raynaud, 1986). Without solutions to these problems, members end up having to close their credit unions.

Within this context, the objective of this work is to associate membership growth in Brazilian credit unions with the probability that they will cease their operations. We use duration estimators and models to investigate whether growth in equity capital, our measure for by membership growth, determined the longevity of 253 first-level Brazilian credit unions founded between 2003 and 2018, a period in which voluntary decisions to cease operations, mainly to be merged into another, became more common (BCB, 2020). Thus, we have verified that ceasing operations during their first few years of operation was more probable for credit unions with slower membership growth because they didn't manage to establish themselves. We have also tested whether membership growth is associated with open membership, which is a propitious environment for heterogeneous interests (Pinheiro, 2008) that may increase the probability of a credit union's closure.

The results indicate the importance of membership growth to credit unions in becoming established, but they also warn of the need to adapt to the extent that distinct interests begin to appear among their membership. In this manner, this work contributes to the literature by including membership as a determinant in credit union survival. The results also have important implications for policies which encourage capitalization and organizational adjustments once membership growth has been achieved.

## 2 LITERATURE REVIEW

Over the past 20 years, Brazilian credit unions have gone through a consolidation process similar to those that have taken place in countries like the United States and Australia in previous decades (Bauer *et al.*, 2009; Ralston *et al.*, 2001). Data from the Brazilian Central Bank and the Brazilian Treasury[2], indicate that of the 1,534 individual credit unions operating since 2000, 609 (approximately 40%) had ceased their operations by the end of 2018. Mergers were the main motive, which accounted for 398 of the 609 closures (65%) involving roughly 26% of these 1,534 credit unions. During this period, the number of credit unions registered with the Treasury even if they weren't necessarily operational, diminished from 1,545 in 2003

to 1,289 by the end of 2018. The number of branches, on the other hand, increased from 1,888 to 6,175 during this same period, reflecting the consolidation of Brazilian credit unions (BCB, 2020). While there are no records of whether this consolidation process was determined by external enforcement, these choices were made by the members who are the owners of these credit unions, and this became common just during the analyzed period.

Members are customers of credit union services and need to invest little capital to become members (Hansmann, 1996). The link to ownership of the credit union, however, does not impede members from seeking alternatives to obtain the financial services they desire: their credit union is just one option. Thus, it is common to attribute free rider behavior to these members, who are normally more concerned with the quality of the financial services they have at their disposition than the credit union's performance (Bauer, 2008; Hart & Moore, 1996; Banerjee, Besley, & Guinnane, 1994; Rasmusen, 1988).

The characterization of the member as a credit union customer reflects the origin of these organizations. Credit unions are founded by individuals who are discontent or excluded from the financial service markets in their regions (Besley, Coate, & Loury, 1993). The credit union is an organizational form which minimizes the costs of ownership, such as decision making or paying taxes, and at the same time it provides residual rights of control over the production of the desired financial services (Hansmann, 1996; Hart & Moore, 1990).

Residual rights of control allow members who are unsatisfied with the available services to request the return of their shares and they also have the right to vote in an assembly in which each person has just one vote, independent of the amount of capital owned by that individual (Hansmann, 1996; Hart & Moore, 1998, 1996). This right to make decisions in assemblies is guaranteed by Brazilian legislation (Law n. 5.764, 1971) and it involves the election of members for managerial posts, the approval of the credit union's financial statements, the destination of the surpluses, changes in the bylaw, and the voluntary closing of operations by liquidation, merger, split-up or acquisition. Thus, members maintain formal control over a credit union, and can determine structural changes whenever they deem necessary.

However, as free rider customers with little invested in the credit union, it is not expected that members will make the effort to discuss or approve structural changes if the credit union does not offer satisfactory financial services, nor will they approve changes or invest capital if the credit union is facing financial difficulties (Rasmusen, 1988; Fama & Jensen, 1983a, 1983b). These credit unions are usually closed voluntarily by their members due to merger or renunciation of ownership in the case of liquidation (Barron, West, & Hannan, 1994).[3]

The characteristics mentioned in the last few paragraphs are part of the cooperative life cycle proposed by Cook (1995) and Cook & Burress (2009), in which the three main factors which condition the longevity of credit unions are: membership; the financial health offered by the credit union to its members which is based on the services it offers; and the credit union's own financial health which it needs to remain active.

Five phases are presented in the life cycle. The first two phases contain a description of the economic justification for the existence of cooperatives and their organizational characteristics such as governance structures. These first two phases converge with articles about the motives for founding a credit union and their first years of operation, such as Besley, Coate and Loury (1993), Banerjee, Besley and Guinnane (1994), and Hansmann (1996). As pointed out above, cooperatives are founded by individuals in search of services who form a homogeneous group in terms of their preferences, which ends up minimizing the costs of group decision making and facilitating the choices of organizational characteristics (Banerjee, Mookherjee, Munshi, & Ray, 2001).

Credit unions like associations are open to any individual who meets the requisites for membership described in their bylaww, such as occupation or region of residence, and group together their shares, with the third phase of the life cycle being characterized by membership growth. Thus, in this phase that is characterized by more capital being added with the association of new members it is fundamental to provide resources so that the cooperative can continue to offer advantageous services and keep itself afloat. This is because studies by Hart and Moore (1998) and Rasmusen (1988) indicate that credit unions have difficulty in obtaining external funds for their operations. In Brazil, the addition of capital with new members is even more important because they are not permitted to raise funds from external sources to provide financial intermediation (Supplementary Law n. 130, 2009).

Cook (1995) and Cook & Burress (2009) indicates that after these organizations are established membership growth slowly makes these cooperatives less efficient. Increases in the number of members, which before were essential to provide funds, now increase the heterogeneity of member interests. A heterogeneity of interests gives these individuals different preferences and thus different utility curves (Arrow & Raynaud, 1986). In credit unions, heterogeneity can exist in the form of preferences for services, business models, and mere personal preferences among groups, among various other motives. Even though it is natural for humans to diverge in their preferences, it is understood that at their founding and early on in their lives, credit union members are homogeneous because they are composed of individuals with distinct preferences, but their preferences are similar in terms of the credit union. With the entrance of new members, many of them without any association with the founders, it is natural that the heterogeneity of interests increases when the requisites for association are less restrictive. Studies such as Ely (2014) and Leggett & Strand (2002) provide evidence of cooperatives losing efficiency to the extent that groups of new members with distinct interests join, which leads them to converge with the proposed cooperative life cycle.

Since credit unions seek to offer advantageous financial services and assembly decisions are taken with each member casting a single vote, the existence of more than two groups with distinct interests does not permit optimal decision making which will satisfy the entire membership (Arrow & Raynaud, 1986). Since it will be impossible to propose a portfolio of services that will please all of the members, it is common that the influence costs imposed by the management for electoral purposes are high (Hart & Moore, 1998, 1996). With free rider members, the agency costs for monitoring flawed management become greater as membership increases (Gorton & Schmid, 1999; Rasmusen, 1988). While credit unions flourish with membership growth and a homogeneity of interests, their financial health deteriorates when there is a heterogeneity of interests.

In the fourth phase of the life cycle, cooperative members seek solutions to correct their cooperative's inefficiency. Cook (1995) and Cook & Burress (2009) point out that members as owners get together to decide whether to make small organizational adjustments or cease their operations. Among the options involved in closing their operations are mergers, split-ups or liquidation, with decisions made by weighing the costs and benefits of each option. The enactment of the chosen alternative occurs in the fifth phase in which it ceases its operations or restarts the cooperative life cycle. Since the costs of collective decision making are higher with more members and there is little capital invested by each member, there is little incentive for them to reorganize the credit union and ceasing its operations becomes the most probable option. (Bauer, 2008; Hansmann, 1996; Barron *et al*., 1994).

### 2.1 Empirical literature about the motives for ceasing a credit union's operations

The empirical literature about closing credit unions consists of a few articles which are mainly focused on financial performance. Brazilian studies use financial indicators in duration and logit models (Carvalho *et al.*, 2015; Bressan *et al.*, 2011) with results that support the life cycle theory by demonstrating the deterioration of the financial health of the credit unions which cease their operations. Canassa and Costa (2018) add that these credit unions had capitalization problems which are related to the suggestion of the need for membership growth in the first few years after their founding. International studies present evidence of low efficiency in these credit unions and add that a small size is a determinant of their closure (Bauer *et al.*, 2009; Ralston *et al.*, 2001), even though this last point doesn't impede them from producing satisfactory services (Feinberg, 2001).

Studies about non-financial factors are even rarer. Canassa, Costa and Neves (2020) identify differences between several governance structures for closed and active credit unions such as the configuration of the Board of Directors and being located in the Southeast or the South. The results of Canassa *et al.* (2020) may suggest the need for adapting credit union structures as membership grows to maintain efficiency. Barron, West and Hannan (1994) meanwhile point out that old American credit unions whose assets grow little in comparison with their original assets are more likely to cease their operations, which is more evidence of the importance of membership growth in the first phases of the credit union life cycle.

## 3 METHODOLOGY

To accomplish our objective, we have employed estimators and duration models. Our sample is composed of 253 individual credit unions which were founded between 2003 and 2018, which enables us to accompany their life cycles from their foundation to the closing of their operations in some cases during a period in which the voluntary closing of operations by members became common. These 253 credit unions do not represent all of the credit unions founded during this period, and these organizations were selected because they charged a fixed value for becoming a member and did not have clauses requiring continuous capitalization by their members. As of the end of 2018, 116 of these credit unions were still active. Of the 137 that closed their operations during this period, 103 were merged into another, which reinforces the fact that these closures were voluntary and approved by their members. The 34 other closures, which included judicial closures, were grouped together because they were not large enough to be analyzed separately. The data utilized is available on the Brazilian Central Bank and Federal Treasury websites. All of the financial information was corrected by the IGP-M inflation index to yield 2019 figures to avoid measurement errors.

### 3.1 Membership growth

Membership growth was estimated from the growth rate of equity capital since the foundation of the credit union. It is assumed that the value in shares for membership was not altered during the period considered in this work. Even though this is a strong assumption, it is supported by the few incentives that free rider members have to make adjustments in their credit unions. There is also little incentive for investments above the bare minimum to become a member; members will always have just one vote and their benefits are linked to the use of the credit union services (Gorton & Schmid, 1999; Rasmusen, 1988). The selection of the sample is justified by these suppositions, given that those interested in becoming members of one of

the sample credit unions will make the same investment as any other member of the credit union.

Therefore, considering that the value needed to become a member of credit union *j* has been constant since its founding, the growth rate of the original credit union with equity capital $K_0$ can be calculated by (1).

$$GROWTH_{t^*j}=\left(K_{t^*j}/K_{0j}\right)^{\frac{1}{t^*}}-1 \quad (1)$$

Where $GROWTH_{t^*j}$ is the membership growth rate of credit union j until a given moment $t^*$ after its founding; $K_{0j}$ is the equity capital of j at its founding and $K_{t^*j}$ is the equity capital of j at time $t^*$. The effect of GROWTH on the probability of closing operations was tested using duration estimators and models, which will be presented in the following subsections.

In the life cycle theory, membership growth is important for cooperatives to establish themselves during the first few years after their founding (Cook & Burress, 2009; Cook, 1995). To investigate this assertion in terms of the duration estimators which are based on categories and not continuous variables like GROWTH (Wooldridge, 2010), each credit union j was categorized based on its average rate of GROWTH. The categorization considered terciles of lower growth (H=1), average growth (H=2) and higher growth (H=3), which is presented in (2).

$$H_j=\begin{cases} 3, \text{ if } \overline{GROWTH_j}>\sim 0{,}311 \\ 2, \text{ if } \sim 0{,}311\geq\overline{GROWTH_j}>\sim 0{,}165 \\ 1, \text{ if } \sim 0{,}165\geq\overline{GROWTH_j} \end{cases} \quad (2)$$

$H_j$ is the category which j is a part of, ~0.311 and ~0.165 are the approximate values which divide the terciles. H=3 and H=2 contain 81 credit unions, while H=1 contains 91.

### 3.2 Heterogeneity of interests among members

In the life cycle theory, cooperatives tend to have problems in selecting a portfolio and making collective decisions due to the influence of a heterogeneity of interests among its members. The greater heterogeneity there is, the greater these problems will be, and the worse the financial health of the members and the cooperative will be, which increases the likelihood that the cooperative will cease operations (Cook & Burress, 2009; Cook, 1995). As pointed out above, a heterogeneity of interests originates due to members with distinct preferences in terms of various possible factors, and therefore even though this is recognized within the membership, studies rarely measure this directly, as found in Pimentel (2008) and Nassar & Zylbersztajn (2004). Diverse origins can generate measurement errors, because cooperatives with heterogeneous members can be classified as homogeneous and vice versa, depending on the proxy selected.

It is natural to assume that the greater the number of individuals, the greater the heterogeneity of interests will be within this group (Arrow & Raynaud, 1986), however, this does not necessarily imply that a credit union that has more members has greater heterogeneity among its members. This depends on the members' objectives within the credit union which tend to converge when the requirements for membership are more restrictive. In this sense, Ely

(2014) and Leggett & Strand (2002) present evidence that credit unions that have less restrictive membership requirements are less efficient, which is justified by the existence of groups with distinct interests. In Brazil, this would be the case with credit unions which have open membership or credit unions with diverse classes of professionals among their members (Pinheiro, 2008).

That being so, the heterogeneity of member interests was considered to be the indicative variable L, which assumes a value of 1 if the credit union has open membership or its bylaw considers more than one class of professionals for those interested in becoming members, and a value of 0 if the credit union foresees just one class of professionals among its members (for example, rural production credit unions or a company's employees). It is assumed that in a credit union with L=1 heterogeneity of interests will be encouraged by the existence of diverse groups of individuals with distinct origins, and it will increase with the admission of new members. On the other hand, when L=0 the members will converge in terms of their interests, possibly due to personal and professional ties (Besley *et al*., 1993).

### 3.3 Duration estimators and models

The Kaplan-Meier estimator is a non-parametric estimate for the survival function in duration data. In this work, it indicates the probability of a credit union not ceasing its operations by time $t^*$ (Wooldridge, 2010), as estimated in (3).

$$\widehat{S}_j(t^*)=\prod_{t_0=0}^{t^*}\left([N_{t^*}-E_{t^*}]/N_{t^*}\right) \quad (3)$$

S is the probability that credit union j is operating from its foundation up until time $t^*$, which is estimated by the product of N credit unions which last until time $t^*$ minus E credit unions which have ceased their activities by time $t^*$ weighted by N. The founding of all credit unions is standardized as being $t_0=0$. The Kaplan-Meier estimator considers just the fixed characteristics of credit unions as determinants in the continuity of their operations, and therefore they are estimated for each H category.

To control for the other characteristics which can influence the credit union's ceasing of operations, we used linear duration models, which in this work are related to the credit union's financial health, for example (Wooldridge, 2010). Contrary to the Kaplan-Meier estimator which estimates the probability that the credit union will not cease its operations, linear duration models consider the risk of ceasing operations by time $t^*$. The based model for this study is presented in (4).

$$\lambda(t^*;GROWTH_{t^*j},L_j,L_j\times GROWTH_{t^*j},X_{t^*j})=\phi_1(GROWTH_{t^*j})\phi_2(L_j)\phi_3 (L_j\times GROWTH_{t^*j})\kappa(X_{t^*j})\lambda_0(t^*) \quad (4)$$

In which $\lambda$ is the risk of credit union j ceasing operations by time $t^*$ and is a function of GROWTH and the interaction between the indicative variable L with GROWTH in group X of controls with current values of the credit union's time $t^*$, and term $\lambda_0$ represents the closure risk of all of the credit unions with the passage of time. Since the credit unions were founded at a time in which it was common for credit unions to cease their operations, it is possible to argue that the term $\lambda_0$ is in fact homogeneous within the sample (Wooldridge, 2010). GROWTH estimates the effect of membership growth on the probability of the credit union ceasing operations, and the interaction between L and GROWTH captures the effect of growth on

membership within an environment in which heterogeneity in terms of member interests tends to be encouraged by multiple groups of members (Ely, 2014).

Since (4) is not linear, the natural logarithm is applied to both sides as shown in (4.1).

$$\mathrm{nl}\left(\lambda\left[t^{*};\mathrm{GROWTH}_{t^{*}j},\mathrm{L}_{j},\mathrm{L}_{j}\times\mathrm{GROWTH}_{t^{*}j},\mathrm{X}_{t^{*}j}\right]\right)=\beta_{1}\mathrm{GROWTH}_{t^{*}j}+\beta_{2}\left(\mathrm{L}_{j}\right)+\beta_{3}\left(\mathrm{L}_{j}\times\mathrm{GROWTH}_{t^{*}j}\right)+\gamma'\mathrm{X}_{t^{*}j}+\mathrm{nl}\left(\lambda_{0}\left[t^{*}\right]\right) \quad (4.1)$$

Parametric linear duration models are estimated by maximum likelihood and depend on the choice of the accumulated distribution function for time $t^{*}$. We considered the Exponential and Gompertz distributions, which are similar in assuming the disproportionality of the influence of time on the risk of ceasing operations, but they are different in terms of the intensity assumed by this influence. In the case of the Gompertz distribution, which assumes that the risk of ceasing operations is influenced (captured by the gamma variable) by previous closures which are not independent of time. It should be noted that (4) and (4.1) were elaborated using an Exponential distribution, which is considered standard. We also estimated Cox's proportional risk models. The Cox model is semi-parametric because it assumes that the probability of ceasing operations is conditioned by factors that vary over time, but not the influence of $\lambda_0$ at that time, which does not follow the accumulated distribution function as occurs in parametric models (Wooldridge, 2010).

### 3.3.1 Time variable and controls

Time $t^{*}$ is measured in semesters because credit unions present their books to the Central Bank of Brazil every semester and they are available to the public. Credit unions are considered to be operating when they send their balance sheets to the Central Bank; semester $t^{*}$ when operations cease is the last balance sheet available to the public.

The X controls in the linear models are based on previous studies (Canassa, Costa, & Neves, 2020; Carvalho *et al.*, 2015; Bressan *et al.*, 2011; Barron *et al.*, 1994). They are the risk of credit operations, measured by the ratio of credit operations classified between F and H compared to the entire credit portfolio, return on assets (ROA), measured by the surpluses after the statutory allocation on the credit union's size measured by the total assets, and the size itself measured by the natural logarithm of total assets, all with current values at time $t^{*}$. In terms of risk, we sought to control for the exposure of the credit union to bankruptcy, with ROA signifying the capacity to generate profits to be held in reserve or to compensate for losses, with the size and robustness of the assets taken into account based on the too big to fail principle. To control for unobservable regional effects, we used a dummy variable vector which identifies the state where the credit union's headquarters is located.

## 3.4 Descriptive statistics

Table 1 displays brief statistics for the sample. The median values of selected variables from Model 4 are presented, because tests of asymmetry and kurtosis rejected the null hypothesis of their similarity to a normal distribution for all of these variables (all with p-values<0.001). In fact, credit union samples are usually made up of organizations with heterogeneous characteristics which becomes clearer when we compare active credit unions with those which have ceased operations (Barron *et al.*, 1994). The results of the median tests ($\chi^{2}$[d.f.] for the active and closed groups are presented, whose null hypothesis suggests statistical equality. For *L*, which is indicative, we present the percentage of credit unions where

L = 1 in relation to their group as well as the results of the $\chi^2$[d.f.] independence tests among active and closed credit unions.

Table 1

**Descriptive Statistics for the Sample**

| Variable | Overall (253) | Active (116) | Closed (137) | $\chi$2 [d.f] |
|---|---|---|---|---|
| Semesters in Operation | 10 | 12 | 7 | 205.18*** [1] |
| Capital Growth Rate (GROWTH) | 0.203 | 0.195 | 0.220 | 20.05*** [1] |
| Risk of Credit Operations | 0.025 | 0.026 | 0.024 | 1.55 [1] |
| ROA | 0.006 | 0.008 | 0.001 | 114.43*** [1] |
| Size of Assets (nl) | 16.154 | 16.648 | 15.378 | 406.06*** [1] |
| L = 1 (open membership or more than one class of professional) | 32.81% | 21.90% | 45.69% | 16.13*** [1] |

**Note.** We considered the averages for each credit union in the sample during the semesters in which they were in operation to, then, reach the medians, considering for these statistics just one observation for each credit union. d.f. signifies degrees of freedom, which are the values in brackets below their respective figures for $\chi^2$.
*** indicates the rejection of the null hypothesis at 1%.

The median life cycle for credit unions that ceased their operations was 7 semesters, which was 5 semesters less than the median of those which were active at the end of 2018 (there is a statistical difference, with $\chi^2$[1] =205.18, p-value<0.01). There is also a statistical difference between the median growth rates of credit union capital ($\chi^2$[1] = 20.05, p-value<0.01), which suggests that closed credit unions had greater membership growth than those that remained active as of the end of 2018. However, greater inferences about the possible effect of the heterogeneity of interests depend on the results of the linear duration models. Closed credit unions had a lower ROA than those that remained active (0.001, versus 0.008; $\chi^2$[1] =114.43, p-value<0.01), which may suggest the difficulty in generating surpluses and the existence of losses within the group of closed credit unions. In addition, active credit unions are larger than those which have closed (the natural logarithm of total assets is 16.648, versus 15.378; $\chi^2$[1] = 406.06, p-value<0.01), which has also been observed in other studies such as Barron *et al.* (1994). It should be noted that the only variable which did not present a statistical difference between the medians was the risk of credit operations ($\chi^2$[1] = 1.55, p-value>0.10), which indicates that both groups of credit unions were operating with the same risk of bankruptcy for their members. You can also see that the percentage of credit unions where L = 1 is lower for the active credit unions than for the closed credit unions, with there being a statistical difference between the groups (21.90% and 45.69%; $\chi^2$[1] = 16.13, p-value<0.01).

## 4 RESULTS

Figure 1 contains Kaplan-Meier estimators for the H categories (given in [2]) of equity capital growth (GROWTH, calculated in [1]), for the entire sample. In the figure, each line represents a category and surrounding it are its intervals of confidence.

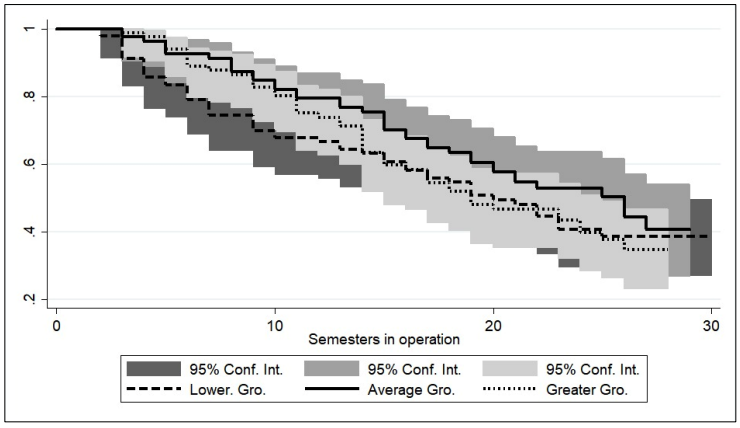


**Figure 1.** Kaplan-Meier Estimators for Capital Growth Categories

Note that by the tenth semester, there was a probability of just 70% that credit unions with lower membership growth would be operating, while the probabilities for the other two categories were greater than 80%. By the twelfth semester there is no clear distinction between the greater membership growth and average membership growth categories, given that even their intervals of confidence overlap. Beginning with the fifteenth semester there is a clear decrease in the probability of survival which goes from around 75% to little more than 60%. Around the fourteenth semester the probabilities that credit unions with greater and lesser membership growth are still active become similar and remain similar until the end of the analyzed period. In fact, beginning with the fifteenth semester the survival probabilities for credit unions with greater and lesser membership growth are similar, and both are lower than the survival rates for those with average growth.

In Figure 2 we see the Kaplan-Meier estimators for the credit unions grouped by those which were merged into another, which total 103 cases, and those which ceased operations for other reasons, which total 34 cases.

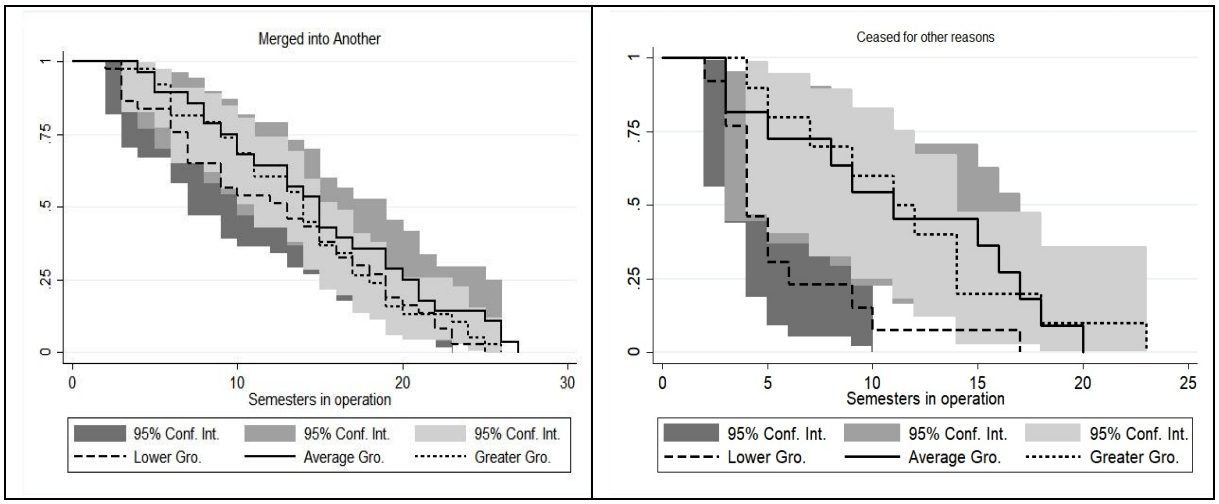


**Figure 2.** Kaplan-Meier Estimators for Closure Types

We can see similar behavior for the overall sample in Figure 1 when we consider just the credit unions which were merged. The analysis of the closures for other reasons, however, indicates that the survival rate for credit unions with lower growth is small (around 25%). No closed credit union with lower growth survived beyond the 17$^{th}$ semester.

Table 2 displays the results of the estimations of the regressions of Equation (4) for the Exponential (1), Gompertz (2) and Cox (3) models. The results of Table 3 contain the hazard ratio for each variable in the model, which indicates the positive influence of the variable (if it

is greater than 1) or its negative influence (if it is less than 1) on the probability of closing a credit union. Below the hazard ratios within the parentheses are their respective standard errors.

The verisimilitude ratio indicates the validity of the model under these three estimations, with values for $\chi^2$(d.f.) of 111.16(29) for the Exponential model (1), 126.53(29) for the Gompertz model (2) and 135.41(27) for the Cox model (3), all with p-values < 0.01. The Cox model (3) presented the smallest verisimilitude logarithm of 627.78, suggesting that this estimation has more robust results, which is why it will be the base for our discussion of the results. The gamma hazard ratio for Gompertz (2) was 0.087 (p-value < 0.01), which indicates that credit union closures are not independent of time. Since the hazard ratio is less than 1, the closure of a sample credit union diminished the risk of closure for the other credit unions.

The main results of Table 2, however, refer to the hazard ratios for GROWTH and the interaction between variable L, which indicates whether the credit union has open membership or includes more than one class of professional, and to GROWTH. For GROWTH, we identified a hazard ratio of 0.339 (p-value<0.01) for the Cox model (3). This indicates that the greater the growth rate of membership is, the lower the chances that it will cease operations. The result in the Cox model (3) for GROWTH is corroborated by the Exponential model (1), whose hazard ratio is 0.248 (p-value<0.01). However, GROWTH for the Gompertz model (2) was not significant.

Table 2

**Results of the Duration Model Estimations**

| | (1) Exponential | (2) Gompertz | (3) Cox |
|---|---|---|---|
| GROWTH | 0.248** | 0.401 | 0.339*** |
| | (0.143) | (0.242) | (0.125) |
| L (= 1 if there is open membership or more than one class of professional) | 1.226 | 1.135 | 0.951 |
| | (0.373) | (0.354) | (0.134) |
| L × GROWTH | 4.737** | 3.769** | 5.256*** |
| | (3.209) | (2.536) | (2.565) |
| Risk of Credit Operations | 36.662*** | 18.359*** | 3.309*** |
| | (16.622) | (8.767) | (0.815) |
| ROA | 1.065 | 1.095 | 1.040 |
| | (0.112) | (0.144) | (0.051) |
| Size of Assets (nl) | 0.955 | 0.775*** | 0.872*** |
| | (0.050) | (0.051) | (0.027) |
| *Dummies* for Headquarters' State | Yes | Yes | Yes |
| Constant | 0.073** | 0.868 | |
| | (0.076) | (0.990) | |
| Gamma | | 0.087*** | |
| | | (0.016) | |
| Observations | 4,302 | 4,302 | 4,302 |
| LR Test ($\chi^2$[d.f.]) | 111.16*** | 126.53*** | 135.41*** |
| | (29) | (29) | (27) |
| Log Likelihood | -230.81 | -216.39 | -627.78 |

**Note.** Below the hazard ratios listed between parentheses are the standard errors. The LR Test refers to the likelihood ratio test; below the $\chi^2$ values between the parentheses are the test's degrees of freedom.
*** indicates significance at 1%, ** indicates significance at 5% and * indicates significance at 10%.

On the other hand, the interaction between L and GROWTH was significant and greater than 1 in all of the estimations of the model (being 5.256, p-value<0.01, for Cox [3]; 4.737, p-value<0.05, for Exponential [1]; and 3.769, p-value<0.05, for Gompertz [2]). This implies that the greater the growth in membership in an environment which is propitious for a heterogeneity of interests, such as cases where L = 1, the greater the risk of the credit union's closure.

Finally, given the differences among the types of closure seen in Figure 2, the distinct regressions were estimated for merged credit unions and those which closed for other reasons. A summary of the results of the estimations of these regressions is displayed in Table 3, which contains the risk ratios for the GROWTH and L variables and their interaction, with the standard errors shown between parentheses.

Note in Table 3 that the results for the merged credit unions are similar to those for the overall sample in Table 2. Greater membership growth diminished the risk of closure (even though it was not significant in Gompertz [5] and neither was it in the sample as a whole), but this risk increased when there was interaction with L. On the other hand, in none of the regressions involving the credit unions which closed for other reasons was there significance for these variables.

In fact, the closure of these credit unions appears to have received greater influence from the factors represented in the controls, which are not presented in Table 3 for conciseness, such as the size of assets (a risk ratio of 0.460, p-value<0.01, the lowest ratio among all the regressions) and the headquarters' state.

Table 3

**Results of the Estimations of the Duration Models by Closure Type**

| Type | (4) Exponential Merged into Another | (5) Gompertz Merged into Another | (6) Cox Merged into Another | (7) Exponential Other Reasons | (8) Gompertz Other Reasons | (9) Cox Other Reasons |
|---|---|---|---|---|---|---|
| $GROWTH$ | 0.240** | 0.337 | 0.391** | 0.673 | 2.349 | 0.574 |
| | (0.173) | (0.248) | (0.162) | (0.659) | (2.322) | (0.501) |
| L (= 1) | 1.177 | 1.118 | 0.989 | 0.000 | 0.000 | 0.000 |
| | (0.394) | (0.382) | (0.150) | (0.004) | (0.001) | (0.001) |
| L × $GROWTH$ | 4.909** | 4.365* | 5.180*** | 1.965 | 1.031 | 1.928 |
| | (3.910) | (3.451) | (2.667) | (47.451) | (23.783) | (41.54) |
| Gamma | | 0.071*** | | | 0.183*** | |
| | | (0.019) | | | (0.426) | |
| Observations | 3,984 | 3,984 | 3,984 | 2,891 | 2,891 | 2,891 |
| LR Test ($\chi^2$[d.f.]) | 78.92*** | 76.09*** | 88.34*** | 121.44*** | 138.19*** | 145.94*** |
| | [29] | [29] | [29] | [27] | [27] | [26] |
| Log Logarithm | -185.99 | -178.43 | -466.38 | -55.56 | -45.92 | -90.99 |

**Note.** We used a group of controls presented for (4), which have not been reported for the sake of conciseness. Below the risk ratios are the standard errors. The LR test refers to the likelihood ratio test; below the $\chi^2$ values between parentheses are the test's degrees of freedom.

*** indicates significance at 1%, ** indicates significance at 5% and * indicates significance at 10%.

However, even though they were validated by the likelihood ratio test, it is important to emphasize that the regressions of the credit unions which closed for other reasons had the largest log likelihood among all the estimations, which suggests results that are less robust than the other regressions.

## 5 DISCUSSION

The results for the Kaplan-Meier estimators appear, for the overall sample, to converge with the proposed cooperative life cycle, because the probability of their ceasing their activities during the first few semesters after their founding is greater for credit unions that had less membership growth. To Cook (1995), Cook & Burress (2009) and Hart & Moore (1996), this is caused by capitalization problems due to too few new members. The estimators also make it possible to observe that credit unions with greater membership growth, which was essential to make them established, came to exhibit a similar survival rate as those with lower growth after

the fourteenth semester. However, using the estimators it is not possible to make inferences about this convergence in terms of the closure risk of these groups over time.

The Kaplan-Meier estimators for acquired credit unions are similar to those for the sample overall which is not the case when we consider just those that closed for other reasons. In this case, we can see that most credit unions with lower membership growth closed by the fifth semester, while those with greater and average growth followed a pattern similar to the overall sample. It is possible that credit unions with lower membership growth were not able to establish themselves in their markets, even though we cannot make inferences about the problems that they faced based on these estimators. They may have faced a lack of capitalization as suggested by Cook & Burress (2009) or competition as proposed by Barron *et al*. (1994).

The results for the regressions of the overall sample reinforce the importance of membership growth to establish credit unions, which has been pointed out by Cook (1995), Cook & Burress (2009), Hart & Moore (1996) and Besley *et al*. (1993). However, when they interact with the L variable which indicates open membership or more than one class of professional, a greater membership growth rate increases the risk of ceasing operations. Even though the results do not make it possible to identify the reason for this greater risk, we know that credit unions with multiple groups within their membership tend to suffer problems due to the heterogeneity of their interests. These problems tend to be greater to the extent that the number of members grows (Ely, 2014; Leggett & Strand, 2002). Given the evidence that closed Brazilian credit unions had poor performance (Carvalho *et al.*, 2015), it is possible that over time these problems diminished the performance of these credit unions which eventually ceased their operations.

If the regressions for the merged credit unions have results similar to the sample overall, the same cannot be said of those that closed for other reasons. For these credit unions the membership growth rate and their interaction with the indicative L variable were not significant. This may suggest that more than problems due to capitalization, these credit unions closed because they did not become large enough to compete with other credit unions in their region; their small size may have also made them unattractive in terms of acquisitions (Barron *et al*., 1994). In fact, the credit unions that closed for other reasons had lower risk ratios versus total assets among the performed regressions, or in other words the larger credit unions are, the lower the probability is that they will cease operations for reasons other than acquisition.

Finally, it should be emphasized that open membership or the existence of more than one class of professionals in the membership by itself does not have an effect on the probability of closure (there is no significance in all of the regressions and these credit unions represent a smaller proportion of those that ceased operations). Flexibility in terms of membership may have been a determinant in terms of the growth of credit unions after their founding because it enabled more interested people to become members (Ely, 2014; Leggett & Strand, 2002), even though it is possible that later this was the source of problems in terms of a heterogeneity of interests which led to an increased risk of closure (Cook, 1995).

## 6 CONCLUSION

This work uses the life cycle theory of cooperatives to investigate whether membership growth in Brazilian credit unions is associated with their risk of closure. To accomplish our objective, we have employed the equity capital growth rate and a variable indicative of open membership or more than one class of professionals to formulate Kaplan-Meier estimators and linear duration models. The results suggest that there is greater risk of closure for credit unions with less growth after their founding, and this growth can increase the risk of closure if it is associated with a membership characterized by a heterogeneity of interests. Therefore,

membership growth is a determinant factor in credit unions establishing themselves, but organizational adjustments are needed to the extent that the membership composition becomes more complex.

The results of this study have theoretical and practical implications. In terms of theory, this evidence reinforces the importance of the characteristics of a credit union's membership. In indicating the importance of membership growth, this work suggests the need to explore the interests of the membership. In terms of practice, the results point to the need for strategies to help credit unions become established after their founding and later adapt to possible problems due to the presence of groups with distinct interests within their membership. For example, credit unions can stipulate continuous capitalization clauses after their founding until they become established in the market. These clauses would avoid capitalization problems and would make it possible to invest in the entry of new members. After becoming established, incentives are needed to stimulate adjustments to their structures like corporate governance and control to deal with their complexity, given the entrance of groups with divergent interests.

Finally, a limitation of this study is the difficulty in obtaining or the lack of data to measure some key variables such as the heterogeneity of interests of credit union members. Even so, future studies can examine the credit unions which closed for other reasons which are numerous, as well as other problems which could be responsible for an increased risk of closure, such as the poor delineation of capitalization policies in their bylaws. Another possible avenue of research would be investigating the strategies used by credit unions to deal with the problems that can arise when they grow and become more complex as suggested by the life cycle theory.

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## NOTES

1 Cook (1995) and Cook & Burress (2009) deal with American farming credit unions, but the life cycle theory can be applied to any cooperative organization. Important topics in the life cycle theory, such as capitalization issues and collective and portfolio decision making, are cited in works regarding cooperatives in other sectors such as Gorton & Schmid (1999), Hart & Moore (1998, 1996) and Rasmusen (1988).

2 The Brazilian Central Bank and Treasury data used in this work come from the Registry of Financial Institutions and Financial Institution Balance Sheets from the Brazilian Central Bank and National Register of Legal Entities data from the Treasury.

3 Law n. 5.764 (1971) deals with judicial liquidation, which is determined outside of the credit union, but this type of closure is rare. Data from the Treasury indicates that there have only been 9 cases of this since 2003.

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# *Quadro Social e Ciclo de Vida de Cooperativas: Evidências em Cooperativas de Crédito Brasileiras*


## *RESUMO*

***Objetivo**: O trabalho explorou a relação entre o crescimento do quadro social e o encerramento de operações das cooperativas de crédito brasileiras, seguindo preceitos do ciclo de vida proposto por Cook (1995) e Cook e Burress (2009).*

***Método:** Estimadores de Kaplan-Meier e modelos de duração foram aplicados sobre uma amostra de 253 cooperativas de crédito singulares, fundadas entre 2003 e 2018, para analisar probabilidades de sobrevivência entre grupos de cooperativas de acordo com o crescimento de seu quadro social.*

***Originalidade/Relevância:** Ao se pautar no crescimento do quadro social, o trabalho se diferencia de anteriores que se basearam no desempenho financeiro.*

***Resultados:** As cooperativas de crédito com menor crescimento do quadro social encerraram suas atividades pouco após a fundação, sem nem ao menos se consolidarem. O crescimento do quadro social em cooperativas propícias à heterogeneidade de interesses nos membros, contudo, tem associação positiva com o risco de encerramento, possivelmente por problemas como custos de influência e de agência.*

***Contribuições teóricas/metodológicas**: Os achados desta pesquisa trazem reforçam a importância de se considerar características do quadro social nas pesquisas sobre sobrevivência de cooperativas de crédito, assim como sugerem políticas que auxiliem cooperativas a se consolidarem e se adaptarem a quadros sociais complexos.*


***Palavras-chave**: Cooperativas de crédito; Quadro social; Ciclo de vida.*

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