THE BIBLIOMETRIC LAWS AND THE SCIENTIFIC PRODUCTION ON CAPITAL STRUCTURE IN BRAZILIAN JOURNALS

AS LEIS BIBLIOMÉTRICAS E A PRODUÇÃO CIENTÍFICA SOBRE ESTRUTURA DE CAPITAL NAS REVISTAS BRASILEIRAS

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ABSTRACT

The maturation of scientific production on capital structure has enabled the development of a vast volume of scientific productions and theories. Since capital structure refers to the set of decisions made by an organization regarding the adjustment of the sources of financing of investment projects, the issue is relevant both on the corporate and academic sides. This academic interest has repercussions on the volume of publications on the subject, mainly on the empirical side. Despite the volume of articles on the subject, it has only recently been observed articles investigating how this production is being produced (on the spectrum of bibliography and bibliometrics). Thus, this paper intends to contribute to the theme by proposing to analyze the academic production on capital structure in Brazilian journals. Methodologically, this research is classified as quanli-quantitative and descriptive. The sample corresponds to 195 papers published between 1980 and 2018, produced by 412 authors (having an average of three authors per article) from 97 affiliation institutions, the researches were published in 66 journals. The analysis was done through the bibliometric (using descriptive statistics and the use of the Laws of Lotka and Bradford). The main findings of the research indicated that the interest in researching and publishing on the theme has been growing over the years; authors prefer to publish in partnership; we identified eight authors who stood out as the most prolific in the subject; although there are more authors publishing, Lotka's Law did not indicate that there is concentration of production in some authors; the works are being published in journals of the highest quality (evaluated by the QualisCapes system); five journals concentrate 29% of the scientific production, the Bradford Law pointed out that there is concentration of production in some journals (considered as 'core' or as 'important' in the thematic). It was verified that seven institutions are the main centers of provenance of authors in the thematic (47% concentrate of the authors of works), Lotka's Law indicated that there is concentration of production in some institutions. The Brazilian research on capital structure is proving to be promising, as well as the interest of more and more researchers in studying the thematic, emerging in the sense that knowledge about capital structure is increasingly being stoned in Brazil.

Keywords: Capital structure; Academic production; Lotka's Law; Bradford's Law.

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RESUMEN

La maduración de la producción científica sobre estructura de capital posibilitó el desarrollo de un vasto volumen de producciones científicas y de teorías. Hay que considerar que la estructura de capital se refiere al conjunto de decisiones, tomadas por una organización, en cuanto al ajuste de las fuentes de financiamiento de los proyectos de inversión, la temática es relevante tanto sobre el aspecto corporativo como el académico. Este interés académico repercute en el volumen de publicaciones sobre la temática, principalmente en el aspecto empírico. A pesar del volumen de artículos sobre la temática, sólo recientemente se observan artículos investigando cómo esta producción está siendo producida (sobre el espectro de la bibliografía y de la bibliometría). De esta forma, ese trabajo pretende contribuir con la temática al proponerse a analizar la producción académica sobre estructura de capital en los periódicos brasileños. Metodológicamente, esta investigación se clasifica como quanli-cuantitativa y descriptiva. La muestra corresponde a 195 documentos publicados entre 1980 y 2018, producidos por 412 autores (con un promedio de tres autores por artículo) provenientes de 97 instituciones de afiliación, las encuestas fueron publicadas en 66 journals. El análisis se dio a través de la bibliométrica (recurriendo a la estadística descriptiva y al empleo de las Leyes de Lotka y de Bradford). Los principales hallazgos de la investigación indicaron que el interés en investigar y publicar sobre la temática viene creciendo a lo largo de los años; los autores prefieren publicar en sociedad; se identificaron ocho autores que se destacaron como los más prolíficos de la temática; a pesar de haber autores publicando más, la Ley de Lotka no indicó que haya concentración de la producción en algunos autores; los trabajos se publican en revistas de más alta calidad (evaluadas por el sistema QualisCapes); los cinco periódicos concentran el 29% de la producción científica, la Ley de Bradford apuntó que hay concentración de la producción en algunos periódicos (considerados como 'núcleo' o como 'importantes' en la temática). Se verificó que siete instituciones son los principales centros de procedencia de autores en la temática (concentran el 47% de las autorías de trabajos), la Ley de Lotka indicó que hay concentración de producción en algunas instituciones. La investigación brasileña sobre estructura de capital se está mostrando prometedora, así como el interés de cada vez más investigadores en estudiar la temática, despunta en el sentido de que el conocimiento sobre estructura de capital sea cada vez más lapidado en Brasil.

Palabras clave: Estructura de capital; Producción académica; Ley de Lotka; Ley de Bradford.

RESUMO

O amadurecimento da produção científica sobre estrutura de capital possibilitou o desenvolvimento de um vasto volume de produções científicas e de teorias. Haja vista que estrutura de capital se refere ao conjunto de decisões, tomadas por uma organização, quanto ao ajuste das fontes de financiamentos dos projetos de investimento, a temática é relevante tanto sobre o aspecto corporativo quanto o acadêmico. Esse interesse acadêmico repercute no volume de publicações sobre a temática, principalmente no aspecto empírico. Apesar do volume de artigos sobre a temática, só recentemente que se observam artigos investigando como esta produção está sendo produzida (sobre o espectro da bibliografia e da bibliometria). Dessa forma, esse trabalho pretende contribuir com a temática ao se propor a analisar a produção acadêmica sobre estrutura de capital nos periódicos brasileiros. Metodologicamente, essa pesquisa é classificada como quanli-quantitativa e descritiva. A amostra corresponde a 195 papers publicados entre 1980 e 2018, produzidos por 412 autores (tendo uma média de três autores por artigo) provenientes de 97 instituições de afiliação, as pesquisas foram publicadas em 66 journals. A análise se deu através da bibliométrica (recorrendo a estatística descritiva e ao emprego das Leis de Lotka e de Bradford). Os principais achados da pesquisa indicaram que o interesse em se pesquisar e publicar sobre a temática vem crescendo ao longo

dos anos; os autores preferem publicar em parceria; identificaram-se oito autores que se destacaram como os mais prolíficos da temática; apesar de haver autores publicando mais, a Lei de Lotka não indicou que haja concentração da produção em alguns autores; os trabalhos estão sendo publicados em journals de mais elevada qualidade (avaliada pelo sistema QualisCapes); cinco journals concentram 29% da produção científica, a Lei de Bradford apontou que há concentração da produção em alguns periódicos (considerados como 'núcleo' ou como 'importantes' na temática). Verificou-se que sete instituições são os principais centros de proveniência de autores na temática (concentram 47% das autorias de trabalhos), a Lei de Lotka indicou que há concentração de produção em algumas instituições. A pesquisa brasileira sobre estrutura de capital está se mostrando promissora, bem como o interesse de cada vez mais pesquisadores em estudar a temática, desponta no sentido de que o conhecimento sobre estrutura de capital seja cada vez mais lapidado no Brasil.

Palavras-chave: Estrutura de capital; Produção acadêmica; Lei de Lotka; Lei de Bradford.

1 INTRODUCTION

The theme of capital structure is highlighted in Corporate Finance because it deals with the decisions related to the funding sources of investment projects, because they affect the value of the company and the financial commitment of the entity. Besides this interest in the business aspect, given these repercussions of decisions related to financing, the scientific academy has also been interested in investigating the behaviors, determinants and repercussions of these decisions. Therefore, this is a relevant issue both in the business and scientific aspects.

The maturation of the scientific production in the thematic allowed the development of a vast volume of scientific productions and theories, especially the theories of the irrelevance of the capital structure, in a point of balance between benefit and cost of the indebtedness (Trade-off), hierarchy of the sources of financing (Pecking order), opportunistic behavior of actions (Market timing) (Baker & Wurgler, 2002, 2007; Buettner, Overesch, Schreiber, & Wamser, 2012; Correa, Basso, & Nakamura, 2013; Lima, Lima, Lima, & Pereira, 2012; Modigliani & Miller, 1958, 1963; Myers, 1984; Padilha & Silva, 2016; Shyam-Sunder & Myers, 1999; Tsuji, 2011).

In spite of this volume of research developed over more than six decades, only recently that the works are analyzing the characteristics of this production. Even so, there are still few articles on this subject, with articles such as Alves and Crisóstomo (2018), Bittencourt and Albuquerque (2018), Nakamura, Jones and Nakamura (2017), Gomes *et al.* (2014), Coelho *et al.* (2013). Thus, this research intends to contribute to the theme by developing a bibliometric study that analyzes the production in capital structure up to the present time (2018).

Therefore, this paper intends to answer the following research question: **What are the characteristics of Brazilian scientific production on capital structure?** Therefore, the following general objective was defined: analyze the academic production on capital structure published in Brazilian periodicals.

A bibliometric study was developed with 195 articles on the subject resulting from the search in the databases Portal PeriódicosCapes, SciELO and SPELL. The authors analyze the production of the authors, the number of authors per article, the journals in which they were published, as well as the authors' regionality aspect. Including analyzes of the concentration of production through the Laws of Lotka and Bradford.

This article is divided into five sections. The first of these corresponds to this introduction. In the second section we present the theoretical reference guide of the research. The third section is dedicated to the presentation of methodological aspects. In section four, the main results are presented and discussed. The last section contains the conclusions of the study.

2 THEORETICAL REFERENCE

2.1 Capital structure

The capital structure, together with the investment and dividend policy, is one of the central themes in Corporate Finance. The capital structure deals with how organizations combine equity and third-party resources, so as to optimize the use of sources of finance

(Schroeder, Clark, & Cathey, 2005). Therefore, the financial decisions taken when adjusting the capital structure adopted by the company have repercussions on the value of the company and the relationship with shareholders and creditors (Alves & Crisóstomo, 2018).

The adjustment of the composition of the sources of financing is the object of analysis of the research on capital structure. Among these studies, there are those who have verified whether the capital structure of an organization influences the value of the firm or the researches that verify how this adjustment occurs - if there is any preference - and those that verify the factors that influence the capital structure. As a result of the range of research developed in these fields, theories have been proposed that seek to explain decisions about capital structure: such as the irrelevance of Modigliani and Miller's capital structure, Trade-off theory, Pecking Order theory, and Market Timing.

Modigliani and Miller (1958) concluded that the capital structure is irrelevant to the firm's value, given the existence of a perfect market (with no information asymmetry, no taxation and other theoretical assumptions). This argument bases the theory of the irrelevance of the capital structure. For Modigliani and Miller (1958), the company's value would be given by the rate of return that it could generate, depending on the risk class of the company, and not by the composition of the sources of financing that the entity adopted to generate such returns. In this way, what matters is the result obtained (returns) and not how this return was financed and obtained (capital structure). Subsequently, the authors themselves found some relevance to the capital structure when considering the influence of taxes on the market (Modigliani & Miller, 1963). Subsequent studies have found evidence in the opposite direction to the proposition of the irrelevance of the capital structure, giving scope for the development of new theories to explain decisions about the capital structure.

Among these theories, there is the Pecking Order, which predicts that firms adjust their capital structure according to a hierarchy of funding sources. This hierarchy is influenced by two issues: financial cost and informational level. Initially, the company will finance itself with internally generated funds, when these are not enough to finance the investment projects, the company will resort to debt, and when the debt is not sufficient, then it will issue shares (Cotei, Farhat, & Abugri, 2011; Henrique, Henrique, Soares, & Silva, 2018; Myers, 1984).

By resorting to internal funds, the company will have no additional financial cost, nor will it have to carry out further disclosure of information about the organization. When the company starts to claim debt, the financial cost becomes more prominent (since the company will have to pay interest on the indebtedness), in addition to having to disclose information to creditors. Finally, when the company uses the stock market, the informational cost stands out, because the entity must have a wide dissemination of information to meet the expectations of the market. In this way, the more profitable a company, the less it will resort to debt and the issuance of shares, since internally generated funds would be used to finance the entity (Henrique et al., 2018; Mantezelli, Nobre, Nobre, Sousa, & Calil, 2017; Myers, 1984; Shyam-Sunder & Myers, 1999).

Another theory is the Trade-off. This theory predicts that companies seek to reach an optimal point between equity and third-party capital, rather than following a hierarchy of financing preference. According to this theory, the company would prefer indebtedness (since interest paid on debt could be written off in corporate income tax, benefit from indebtedness) to the point where the cost and risk of new indebtedness would outweigh the benefit of indebtedness . The company will go into debt in order to enjoy the tax benefit of the indebtedness, but from a certain point the costs associated with the additional indebtedness would be greater than the benefit obtained. The Trade-off theory proposes that there is an

optimal point of indebtedness, in which the fiscal benefit and the costs of the indebtedness would balance (Buettner et al., 2012; Correa et al., 2013; Lima et al., 2012; Myers, 1984; Tsuji, 2011).

In turn, the Market Timing theory works with the idea of windows of opportunity. In this logic, the company would behave based on its knowledge about the real value of its own actions and the value that the market is valuing them, deals with opportunistic action in relation to the market. According to this proposition, the company will issue shares when it considers that the price is above its real value (overvalued shares) and will repurchase them when they are undervalued (Baker & Wurgler, 2002, 2007; Padilha & Silva, 2016).

The empirical studies have been using these theories to be based, although other, less used theories can be identified to explain the behavior of the capital structure. The theme itself, capital structure, and its macro area, Corporate Finance, are accompanied by a large volume of research at national (Brazil) and international level. It is now necessary to analyze this scientific production.

2.2 Bibliometric laws

Bibliometry analyzes the characteristics of scientific production through mathematical or statistical instruments (Pritchard, 1969). It refers to the tool that allows the mapping and creation of indicators for the treatment and administration of information, as well as the analysis of means of scientific dissemination and productivity of a given community and scientific network (Chueke & Amatucci, 2015). Therefore, bibliometrics is used to analyze the characteristics of scientific production (number of articles produced, gender of the authors, type of references used, quality of periodicals in which articles were published, authors' productivity, etc.) by theme, means of dissemination , period, authorship or other stratification.

According Ferreira (2010), the term 'bibliometry' was created by Paul Otlet in 1934 and was formerly known as 'scientific bibliography' (a term termed by Hulme in 1923). Although the popularization of the term bibliometry occurs with Pritchard (1969). Bibliometrics arises from the need to evaluate and study production and the scientific communities. Within the bibliometric studies three Laws were developed that were more prominent, according to Figure 1.

Figure 1: Featured Laws in Bibliometrics

Source: Prepared by the authors.

The Bradford Act (known as Productivity or Periodic Dispersion) analyzes the productivity of journals. According to this Law, few journals concentrate articles relevant to a certain area, and many journals have published articles. This Law makes it possible to determine the most relevant periodicals for a topic. The journals could be classified into three groups: the first would contain 33% of the production, composed of highly productive (essential) journals; the latter by the next 33%, composed of a larger group with less productive (important) journals and the last group would contain a much larger group of journals that have a lower contribution (noise) (Ferreira, 2010; Garcia, Merino, Domenech, Merino, & Pinto, 2016; Quevedo-Silva, Santos, Brandão, & Vils, 2016).

To check whether some journals are concentrating scientific production on a topic, Bradford's Law can be used through a manual and algebraic version. In the manual version, the data are arranged in a table so that one column has the name of the journal and another with the number of articles published by it. This table should be in descending order in relation to the number of articles published by the journals. Then a summary table is drawn up, in which in the first column (called column A) the number of journals with "n" publications is placed; in the second table (Column B) is put the contributions that the journals have, the "n". For example, if there is a journal with 27 articles and 3 articles with 15 articles, column A will be filled with numbers 1 and 3 (journals with "n" publications) and column B will contain the numbers 27 and 15 ("n"). After that, a third column (column C) will be filled in, which will contain the cumulative totals of the frequencies of Column A. Then the Ln of column C is calculated (the column Ln is created) and the column D (which shows the cumulative total of frequencies in column B). Finally, the column E (which results from the multiplication of columns A and B) is calculated. From the columns Ln and D a scatter plot is drawn, which the closer to the "S" form, the more concentrated the academic production is in a few journals. The journals that concentrate the first $(\frac{1}{3})$ of scientific production represent the 'core' of concentration, those of the second $(\frac{1}{3})$ represent the 'important' journals, and the other periodicals are the 'noise'. Manually it is necessary to divide the total articles by the total of zones (in our case, we are adopting three zones, $\frac{1}{3}$) to obtain the number of articles per zone. Since the journals are already in decreasing order, the first journals will be selected until the article quota is reached by zone, then the same procedure is done for the other journals until reaching the quota by zone, and then the others are selected. Once the zones have been defined, it must be verified that they follow the 1:n:n². The total journals of the second zone are divided by the total of the first zone and the one of the first zone has to be divided by the nucleus if the two divisions result in close numbers, that number is the Bradford multiplier, otherwise it should be divided in more areas than the initial quantity (Coutinho, 1991; Egghe & Rousseau, 1990; Ribeiro, 1983; Ribeiro, Chalhub, & Nisenbaum, 2016).

In the algebraic (or analytical) method it is possible, through formulas, the Bradford multiplier and the zones directly (Coutinho, 1991; Egghe & Rousseau, 1990; Ribeiro, 1983; Ribeiro et al., 2016). To calculate the Bradford multiplier, we follow Equation 1.

$$k = (1,781 * Ym)^{\frac{1}{P}} \qquad \text{Equation 1}$$

Where *Ym* refers to maximum productivity (1st value of column D of the manual method). *P* = number of zones to be worked on (three zones are usually used). The *k* will be the Bradford multiplier. To find out how many journals will be in the nucleus, calculate Equation 2.

$$r_0 = \frac{T*(k-1)}{(k^P-1)} \qquad \text{Equation 2}$$

On what r_0 represents the number of journals that will make up the nucleus. *T* refers to the total journals of the sample collected. The *k* is the multiplier of Bradford and *P* is the number of zones that one wants to work. In order to find the number of journals for Zone 1 one must multiply r_0 by *k*. For Zone 2, multiply r_0 by k^2. If there is a Zone 3, then multiply r_0 by k^3, and so on, for both k^i for how many *i* Zones there are.

How much Lotka's Law (or Law of the Inverse Square) analyzes the productivity of the authors. According to this Law, there is a quantitative relationship between the frequency of authors producing a number *x* of works. So few authors concentrate the largest share of

scientific output and a larger group of authors produce fewer articles. The number of authors who make 'n' contributions is equal to $\frac{1}{n^2}$ of those who made a contribution. For example, the number of authors who made two contributions is expected to be equal to $\frac{1}{4}$ of the number of authors who made a contribution; authors who have made three contributions, it is expected that they will be $\frac{1}{9}$ of those who made only one contribution. Another implication of Lotka's Law (in addition to measuring authors' productivity) would be tied to the 'Matthew Effect', in that the more it is published, the greater the stimulus and facility to publish a new paper and researchers who post more results gain more recognition and access to resources to improve your search (Garcia et al., 2016; Mello, Barbosa, Dantas, & Botelho, 2017; Quevedo-Silva et al., 2016). The Matthew Effect can be summed up in the statement that 'to those who have more will be given in abundance, and to those who have less, even what they have will be taken away', based on the biblical verse of Matthew 13:12 (Ferreira, 2010, p. 6).

When it comes to the Law of Zipf (or Law of the Lesser Effort), it analyzes the frequency of words and their meanings for determined area. According to this Law, researchers have a preference for using some words (especially shorter words and acronyms) than in other words. In this way, a small group of words is more recurring in articles than the other words within the publication. In addition, longer words such as 'deoxyribonucleic acid' are replaced by shorter words such as 'DNA' (Ferreira, 2010; Garcia et al., 2016; Quevedo-Silva et al., 2016). In addition to these Laws, other ways of analyzing scientific production have been proposed. Ferreira (2010) gathers some (See Figure 2).

Figure 2: Other instruments for verification of scientific production

Invisible Colleges	•Identifies the elite of researchers in a particular area of knowledge
Immediate or Impact Factor	•It estimates the degree of relevance of articles, scientific and scientific journals
Bibliographical coupling and co-citation	•Estimate the degree of connection between two or more articles
Literature obsolescence and half-life	•Estimated decline of scientific literature
Average life	•To estimate the average life of a literature unit
Law of elitism	•Estimates the size of the elite of a given author population
Goffman's Epidemic Theory	•Estimate the rate of growth and decline of a certain area of knowledge
Search Front	•Identifies a pattern of multiple relationships between cited authors

Source: Prepared by the author, based on Ferreira (2010)

Analyzing the scientific production makes it possible to develop policies and actions to know and preserve reference centers in scientific research in a given area and to stimulate and enable the development of other less productive centers. In addition, it is possible to know

how academic research is being developed and to identify the main difficulties for scientific production.

2.3 Previous studies

Research on capital structure focuses mostly on investigating the determining factors, whether or not to consider the macroeconomic, legal and sectorial characteristics of the companies present in the samples of these studies. Few papers have addressed the question of how this scientific production is being developed (Alves & Crisóstomo, 2018).

Despite the small number of bibliometric studies in capital structure, it is observed that the researches being developed to fill this gap are recent studies. As the work of Alves and Crisóstomo (2018), Bittencourt and Albuquerque (2018), Nakamura, Jones and Nakamura (2017), Gomes *et al.* (2014), Coelho *et al.* (2013). In Brazil, the publications that carry out bibliometric studies on capital structure are very recent and in smaller volume, compared to the international plane (Alves & Crisóstomo, 2018).

In his article, Alves and Crisóstomo (2018) have focused on the profile of scientific production on capital structure in Brazil. Through a bibliometric study, with a sample of 102 articles, published between 2001 and 2017, by 38 journals, the authors observed that the magazine that published the most articles on the subject was the Revista Contabilidade e Finanças (14 articles), concentrating 14% of production, has been confirmed from the application of Lotka's Law that there is a concentration of production in some magazines. The most published author was Prof. Wilson Toshiro Nakamura (13 articles). Although there is a more productive author, there is no evidence of concentration of production in authors. The papers are being published in higher quality journals (77% of them classified in the QualisCapes system as B1 or higher). The institutions of the South and Southeast regions of Brazil are the most representative, with a concentration of production in these institutions. The authors prefer to work in partnership (with two or three authors per article). Historically, the issue has been growing in publications, especially in the periods of the 2008 global financial crisis and the Brazilian crisis of 2015. In addition, the references used in the articles are mostly (64%), international works.

In its turn, Bittencourt and Albuquerque (2018) developed a bibliographical research on capital structure publications in Brazilian journals. The sample consisted of 80 articles, published between 1980 and 2016. The majority of authors have a PhD degree (45.32%). The studies are foundations by international articles (55.56%). They were published in journals of high classification in the system QualisCapes (45,10% in A2). The Journal of Accounting and Finance is the destination for greater publication of articles (20% of the sample). The most cited theories in the works were the classical structure of the irrelevance of Modigliani and Miller, the Trade-off and the Pecking order. Most research uses documentary bases (86.25%). The articles make mixed temporal cuts (71.25%), are quantitative (88.75%) and non-probabilistic (88.75%). The authors also verified the models, variables and metrics used in the sample studies. Finally, a summary of the main results of the studies analyzed was presented.

In their study, Nakamura, Jones and Nakamura (2017) produced a panorama of the research on capital structure and the theories used in articles published between 2009 and 2015 in the Brazilian journals classified in extract 'A' of the QualisCapes system, obtaining a sample of 16 papers. The results obtained indicated that the journal with the greatest number of articles was the Revista Contabilidade e Finanças (10 papers); the authors have a preference in publishing the studies in pairs; the author who produced more articles published in the subject was Prof. Wilson Toshiro Nakamura (3 articles). In terms of theories, the most recurrent ones were the irrelevance of the capital structure of Modigliani and Miller, the Trade-off and the Pecking order (all present in 81% jobs).

Gomes *et al.* (2014) investigated the use of quantitative research in capital structure papers published in the Encontro Nacional da Associação Nacional de Pós-Graduação e Pesquisa em Administração (EnAnpad), in the quadrennium 2006-2010. The research sample corresponds to 41 papers. Through the use of bibliometrics, the authors concluded that the analyzed research uses documentary sources for the collection of data (especially the financial statements); it was verified that 83% of the researches are quantitative, besides the researchers of the articles resort to databases already developed (71%). The main analysis technique employed in the sample articles was the multivariate analysis (present in 46% of the studies).

Coelho *et al.* (2013) analyzed the productions of Brazil and Abroad, published in journals classified in stratum 'A' of Qualis Capes, on capital structure, through bibliometry. The authors aimed to verify the theories most used by the researchers in the papers of the sample, published between 2000 and 2008. The results indicated patterns in the attributes of the works and the greater use of the Pecking Order Theory in the studies analyzed.

These papers provide information for the knowledge of how the scientific production in capital structure is being developed in Brazil. Although they are recent studies, the sample articles analyzed in these studies are limited to the year 2017 (study of ALVES; CRISÓSTOMO, (2018)) and 2016 (BITTECOURT; ALBUEQUERQUE, (2018)). In this research, we extended the time horizon, covering papper published until the month of November of 2018, in addition to the use of the Bibliometric Laws of Lotka and Bradford.

3 METHODOLOGY

3.1 Search Characterization

Regarding the objective, this research is descriptive. Descriptive studies aim to describe or register characteristics of a phenomenon, without interfering with it (Prodanov & Freitas, 2013). In this research, the characteristics of the academic production in capital structure, such as attributes relative to the authors, the geographic distribution of scientific production, the history analysis of the (in)evolution of this production, the analysis of the concentration of production according to the Laws of Lotka and Bradford.

In the case of the problem, this study is of the qualitative-quantitative type. Quantitative research is marked by the use of statistical techniques (from more basic techniques such as descriptive statistics, to more robust techniques such as regression models), in turn, qualitative research is recognized for performing readings and interpretations of social realities. The combination of these two types of research has the advantage of broadening the view on the problem investigated, allowing a deeper analysis (Souza & Kerbauy, 2017). For the analysis of Brazilian production on capital structure, this research uses descriptive statistics to quantify this production and also uses a description of the qualitative aspects, especially the implications of the concentration of production in some groups of authors, institutions and journals.

Regarding the research design (how the research design will be developed), this work is based on bibliographical research (Gil, 2014). In this work a survey of the scientific articles published in Brazilian journals on capital structure is carried out, in order to verify the characteristics of the production on the subject.

3.2 Characterization of the analysis

3.2.1 Data collection

The data were collected in the databases: Portal de Periodical Capes/MEC, SciELO and SPELL, and the collection was performed until 11/28/2018. We searched the articles on

the expression 'Capital structure', using two filters: search in the subject and title search, restricting the country of publication to Brazil. The choice of these databases was due to the fact that they are the main agglutinators of national scientific articles, besides allowing the use of filters to obtain the largest quantity of articles.

3.2.2 Sample

From the total of 404 results presented for the searches in the databases, a non-probabilistic sample of 195 scientific articles was obtained (excluding those materials that were not scientific articles, which were not published by national journals, those that did not referred to the theme of capital structure and repeated articles).

3.2.3 Analyze

The data of the articles were tabulated in the Excel 2010 software. After tabulation, the analyzes occurred in two phases: the first, through counts and averages of the information frequencies and the second through the use of the Lotka and Bradford Laws.

The following information was analyzed in the first phase: (i) (in) historical evolution of scientific production (ii) more productive authors; (iii) magazines that have published the most on the subject; (iv) concentration of production in some journals; (v) affiliation institutions of most representative authors; (vii) quality of journals evaluated by QualisCapes, (viii) the number of authors per article and the aspect of (ix) the regionality of the works. These analyzes were represented by graphs and tables.

In the second phase the (x) concentration of the production in some authors was analyzed; (xi) production concentration in some journals; (xii) concentration of production in institutions of authors. These analyzes were through the Lotka Law's for the concentration of production in authors and institutions, and the Bradford Law's for concentration on journals.

In order to verify the concentration of production according to Lotka's Law, the percentage of expected concentration was calculated according to the formula $\frac{1}{n^2}$ (presented and exemplified in subsection 2.2), each quantity of articles published by the same author. Subsequently, the authors' actual concentration ($\frac{Quantidade\ de\ autores\ que\ publicaram\ "X"\ artigos}{Total\ de\ artigos\ da\ amostra}$).
A line graph was drawn which presents the results of the two calculations in the form of two lines: one for the expected result (first calculation) and another for the result found (second calculation). For the Bradford Act, the manual methodology (presented and exemplified in subsection 2.2) was followed and revised through the calculations (subsection 2.2). So a line chart was drawn to see if the dispersion of results follows the behavior expected by the Bradford Act ("S" format). In the following section the results of the research are presented, besides presenting a discussion of them.

4 RESULTS

Aiming to analyze the scientific production on capital structure, this work was used bibliometric technique in a non-probabilistic sample of 195 articles. Although all the articles available in the databases have been scanned, it is not possible to generalize the results of this research to all the scientific production on capital structure in Brazil (since congress articles, conference materials and perhaps some article that was published by journal not indexed in the databases analyzed, even these bases being known in Brazil).

Resulting from the search in the three databases, a sample of 195 scientific articles, produced by 412 authors from 97 different affiliation institutions, was published and published in 66 journals. A total of 566 authors were identified. The difference between the

amount of authorship and authorship occurs as a result of the same author may have
participation in more than one article, therefore, he is counted as an author, but for each
participation in a paper will be counted as one authorship, each participation .

These articles were published in Brazilian journals classified in the QualisCapes
system, with the majority of these journals being classified in the highest strata of
QualisCapes: A2 with 54 articles or, in percentage, 28% of the sample; B1 with 62 articles or
32%; B2 with 39 articles or 20%; B3 with 35 articles. Periodicals with lower strata had few
publications on the subject (B4 with 4 articles or 2% and B5 with 1 article or 1%). The three
highest strata (A2, B1 and B2) accounted for 79% of all production on the theme, this
indicates that the theme is considered relevant to the journals considered of higher quality.
Graph 1 shows how scientific production has been behaving historically.

Graphs 1: Historical analysis of the academic production in the sample.
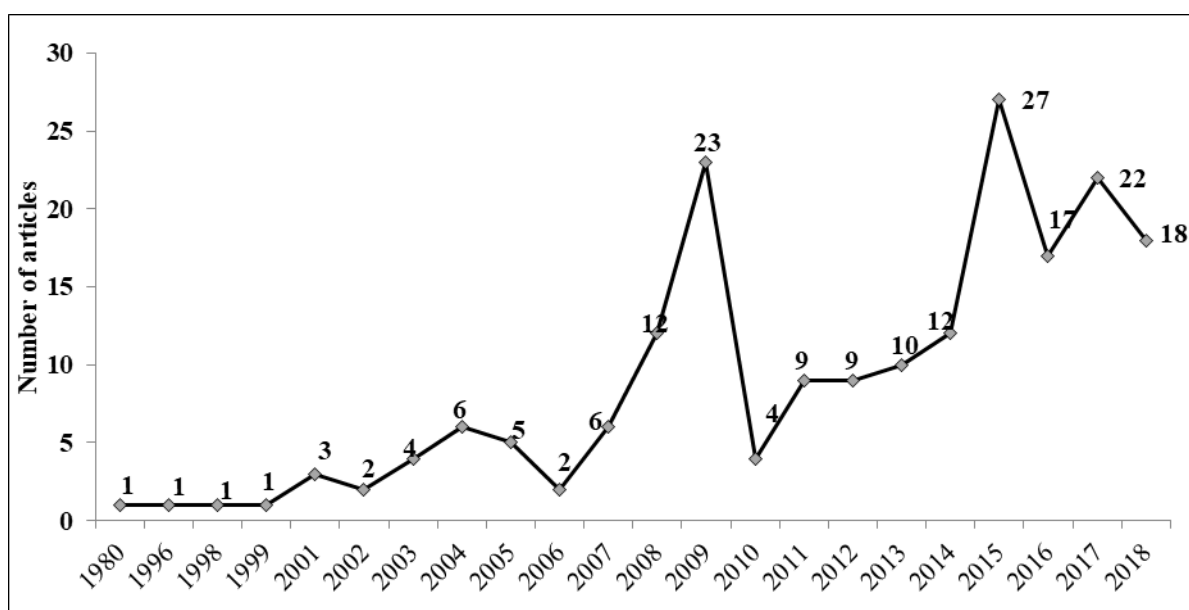
Source: Prepared by the author.

The search returned a horizon of 38 years (1980-2018) of articles published in Brazil.
Historically, academic production on the subject has been increasing, especially in the years
of 2009 and 2015 (in which peak production occurs, possibly attributable to the period
immediately post-crisis world (2008) and Brazil (2015) (Alves & Crisóstomo, 2018). It
should be noted that for the year 2018 data were collected until the month of November, and
it is possible that new articles could be published in the month of December / 2018. Then, the
number of authors per article was analyzed (Graph 2).

Graph 2: Number of authors per article
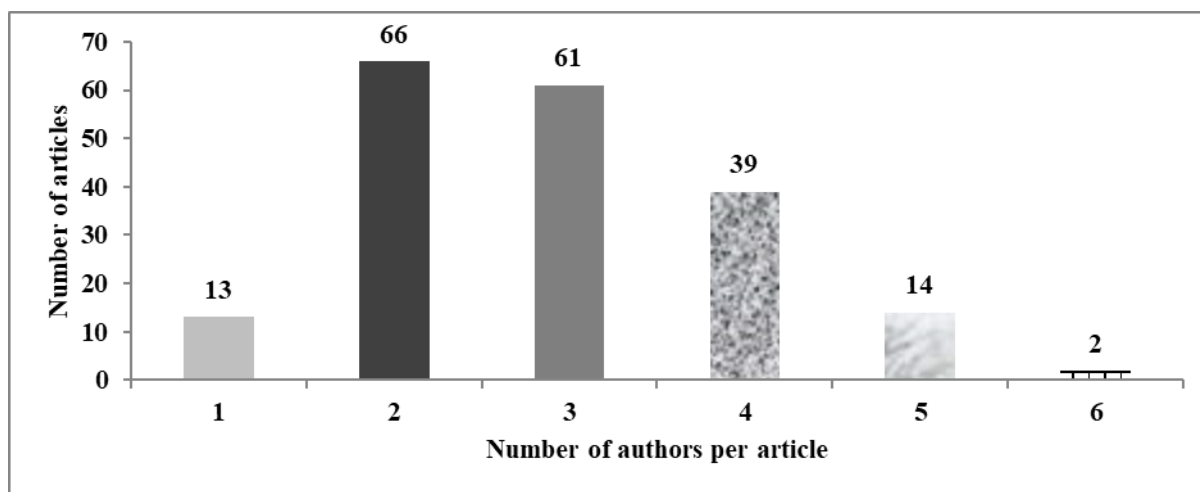
Source: Prepared by the author.

There is a preference for researchers to produce their articles in partnerships. From the sample, there is a preference for writing articles in pairs (66 articles) or in trio (61), few articles were written without partnerships (13). There were two articles that had six authors signing authorship. This finding points to the preference of the authors of the area for producing articles in partnership, which allows a better division of the research and revision phases, which may impact on the better quality of the papers. Given this framework of partnerships, it becomes relevant to investigate which authors stand out in this academic production in capital structure (Table 1).

Table 1: Most prolific authors

Authors	Sex	Number of articles
Wilson Toshiro Nakamura	Male	18
Eduardo Kazuo Kayo	Male	8
Tatiana Albanez	Female	8
Mauricio Ribeiro do Valle	Male	8
Joséte Florêncio dos Santos	Female	6
Fernanda Finotti Cordeiro Perobelli	Female	5
Leonardo Fernando Cruz Basso	Male	5
Paulo Renato Soares Terra	Male	5
TOTAL		63

Source: Prepared by the author.

The author who managed to publish more articles on the subject was Prof. Wilson Toshiro Nakamura (18 articles, being present in 9% of all articles produced on the subject), followed by teachers Eduardo Kazuo Kayo, Tatiana Albanez, Mauricio Ribeiro do Valle (both with 8 articles, or 4% of each production). Together, these four authors are present 22% of the works on the subject. This result corroborates the Nakamura, Jones and Nakamura (2017) and with Alves and Crisóstomo (2018).

By itself, this finding does not indicate that production is concentrated in few authors (even if one of them concentrates almost 10% of production). Thus, in Chart 3, Lotka's Law is evidenced as to the concentration aspect of the production in authors.

Graphs 3: Historical analysis of the academic production in the sample.
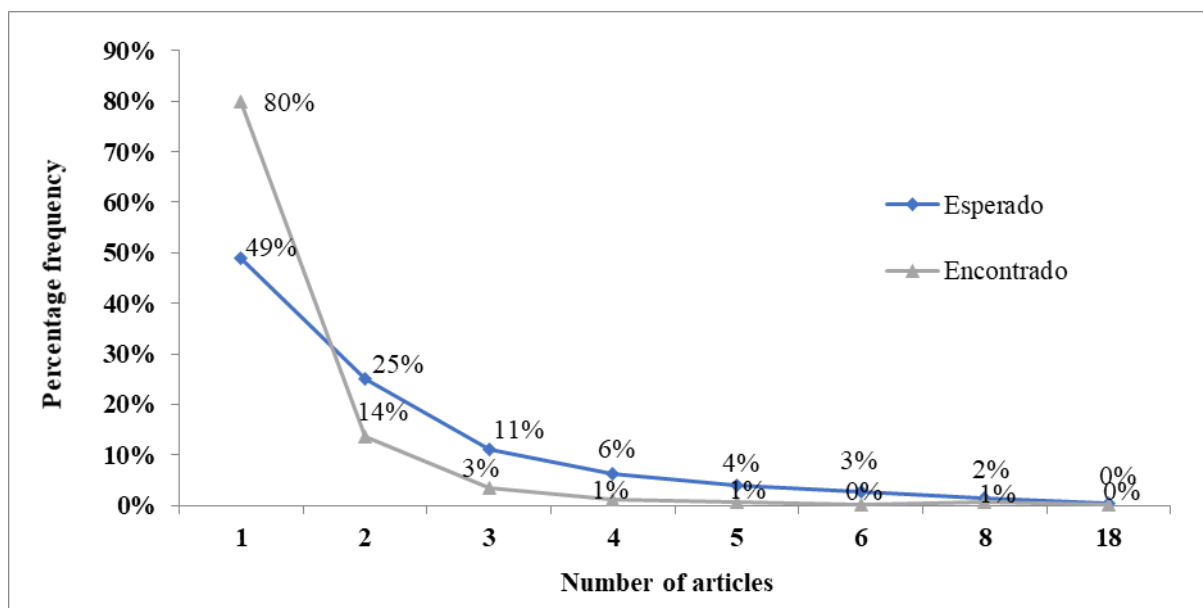
Fonte: Elaborado pelo autor.

It is identified that there is no concentration of the production in authors, because the blue line (expected) is above the green line (found) in all points of the axis of the abscissas of the graph (Quantity of articles published by the same author). This indicates that it was expected that, for example, authors who published two articles, represented 25% of authorship, but were identified as representing only 14%. On the other hand, authors who had a single contribution were expected to not exceed 49%, however, they represented 80%. Therefore, if one identifies there is a dispersion (since many authors are only having one contribution). This result is in line with that found by Alves and Crisóstomo (2018). This finding may indicate that several groups and research centers are publishing on capital structure, which is positive for the subject, however, they are limited to have only one contribution. Still, in relation to the attributes of the authors, the level of education (titration) of the authors was verified (Table 2).

Table: Author Titles

Titration	Total	%	% accumulated
Uninformed	165	29%	29%
Bachelors	9	2%	31%
Bachelor	23	4%	35%
Specialist	6	1%	36%
Master student	23	4%	40%
Master	74	13%	53%
Doctor student	70	12%	65%
Doctor	178	31%	97%
Pós-Doctor	18	3%	100%
Total	566	100%	

Source: Prepared by the authors.

The authors are highly qualified researchers, since most of them hold the title of Doctor (31%), in addition to the candidates for this degree (Doctors students with 2%). This predominance of authors of higher qualification allows the theme to be discussed on a sharper

look, generating research with significant contributions. Next, we analyzed which magazines served more articles (Graph 4).

Graph 4: Journals that most served articles.
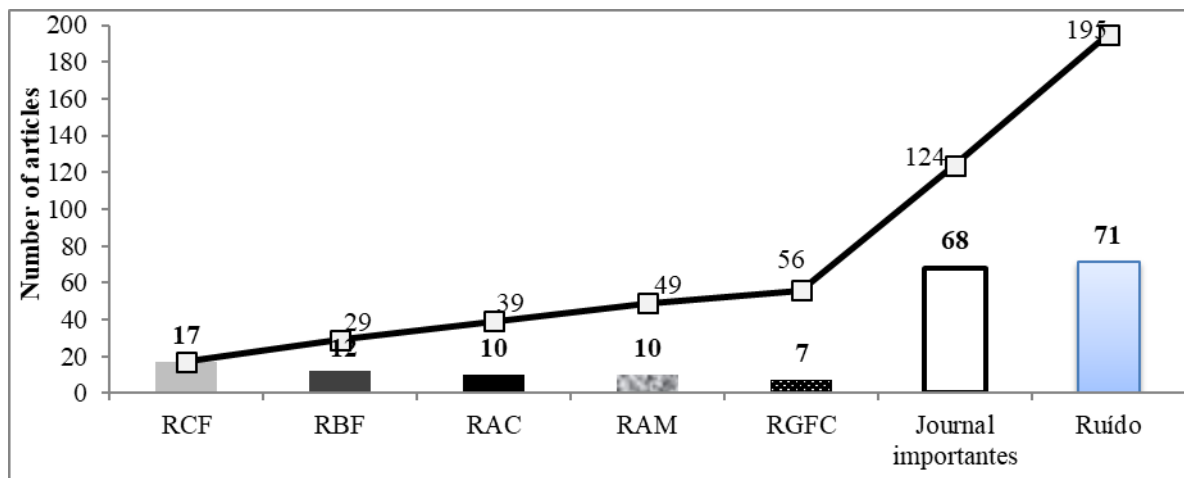
Source: Prepared by the author.

The journals in which there were more publications on capital structure was the Revista Contabilidade & Finanças with 17 articles (RCF, the acronyms of Graphic 4 are not necessarily the actual ones, only conventions for this article). The second most popular magazine was the Revista Brasileira de Finanças (RBF) with 12 articles, followed by the Revista de Administração Contemporânea (RAC) with 10 articles, the Revista de Administração Mackenzie (RAM) with 10 articles and the Revista de Gestão, Finanças e Contabilidade (RGFC) with 7 articles. Together, these five major journals concentrate 56 articles (see gray line in Graph 4), that is, 29% of Brazilian academic production on capital structure. The 14 magazines that accumulate the next $\frac{1}{3}$ of the production (called the important Journal) concentrate 68 articles (35% of the production). The last $\frac{1}{3}$ of the production was published by 46 magazines (Noise). Apparently, there is a concentration in scientific production in some journals, in order to verify this possibility, Graph 5, which presents the dispersion

Chart 5: Bradford's Law
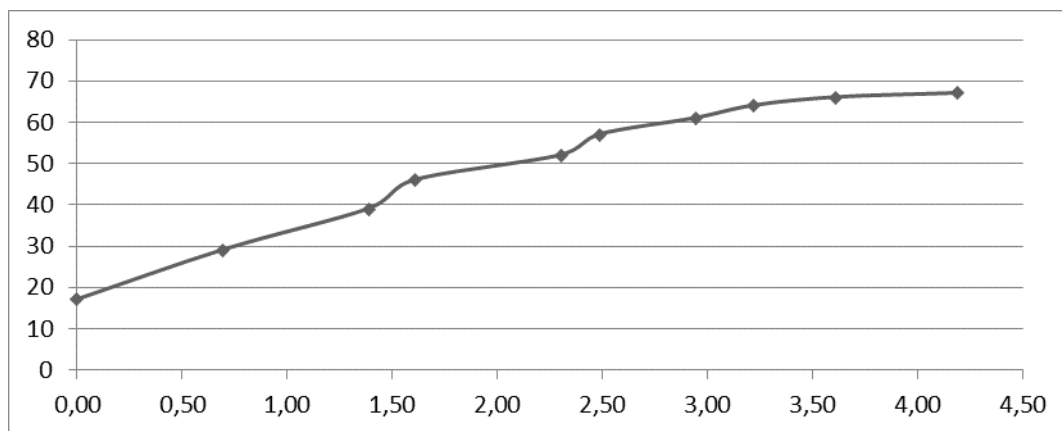
Source: Prepared by the author.

In the scatter plot, the closer to the 'S' format the graph has, the more closely complied with the Bradford Act the analyzed sample is. It is observed that Chart 5 has a format almost close to the one expected. This indicates that there is concentration in some journals. The

nucleus (first $\frac{1}{3}$) follows the expected periodicals for that zone (calculated nucleus was 4.77 journals; the nucleus checked was 5 journals). In turn, Zone 1 had 14 journals (approximately 15 was expected, one more newspaper). For the last zone (Zone 2) was found 46 journals (when the expected one was 46,35). The expected and found values (as well as the graph format near an 'S') indicate that, in fact, there is a concentration of publication of articles in some journals. This concentration can be explained because the most published journals on the subject are specialized in publishing on Finance. Then, in Graph 6, we analyze the academic production by institution of affiliation of the authors.

Graph 6: Most representative institutions
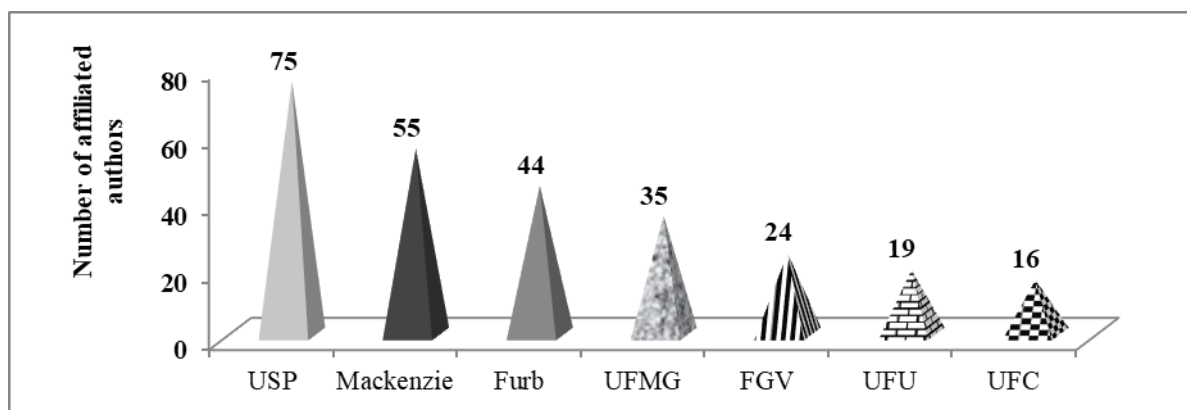
Source: Prepared by the author.

The three institutions of affiliation of authors of greater representativeness together, concentrate 31% of all authorship of the articles. Among the authors' affiliation institutions, the Universidade de São Paulo (USP) is the most prominent (with 75 authors in articles of the sample), followed by Universidade Presbiteriana Mackenzie (55) and FURB (44). Together, the seven most representative institutions account for 41% of authorship in sample work. This finding points to institutions that consolidate themselves as centers of reference in Brazil regarding academic production in capital structure. Lotka's Law (Figure 7) was applied to verify if there is actually a concentration of production in some institutions, mirrored in the idea applied by Alves and Crisóstomo (2018).

Chart 7: Lotka's Law for Authors Affiliation Institutions
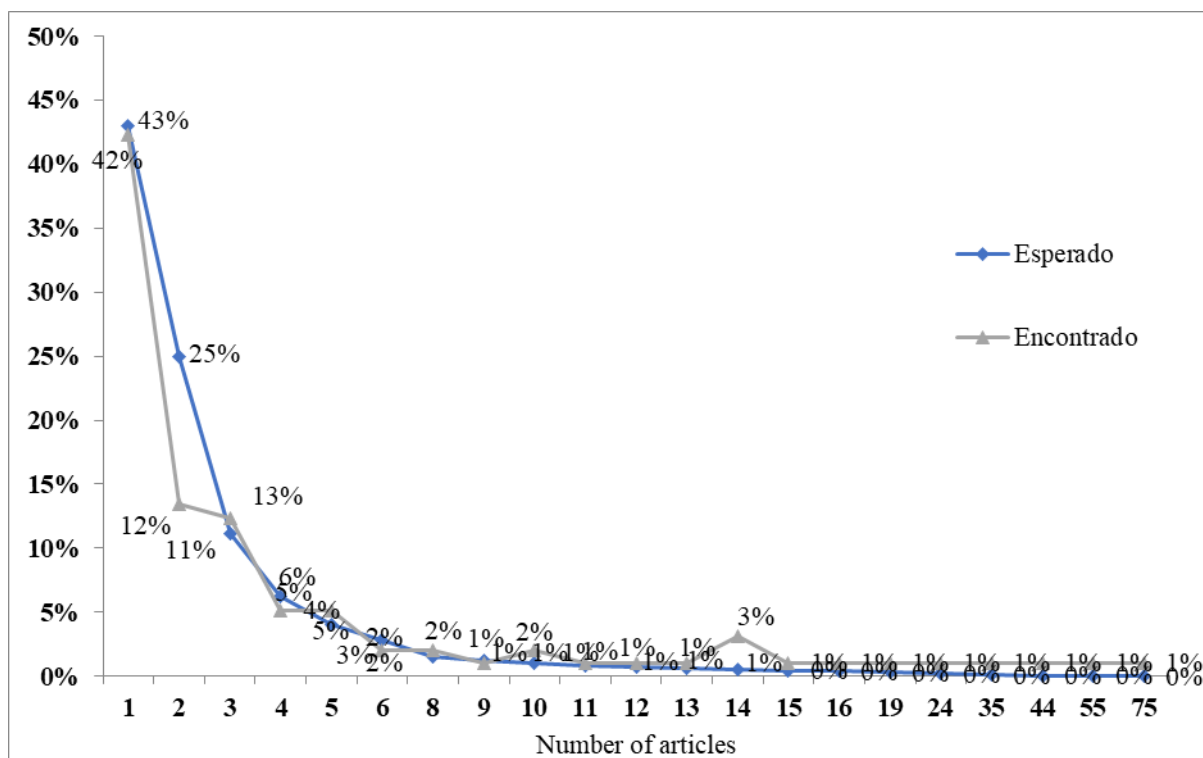
Source: Prepared by the author.

The concentration of scientific production in some institutions is confirmed, since the two curves (expected behavior and behavior found) are practically the same. That is, some institutions really consolidate and specialize in producing knowledge on the capital structure, corroborating with the finding of Alves and Crisóstomo (2018). This is positive in the aspect of improving the quality of Brazilian production vis-à-vis the world, at the point where more specialized institutions produce more and more unprecedented knowledge (correcting methodological flaws and including the current tendencies of Corporate Finance). However, it can negatively impact if the other institutions do not develop, restricting the knowledge to only some research centers. In Graph 8, we investigate the aspect of the regionality of academic production.

Graph 8: Authors' Regions
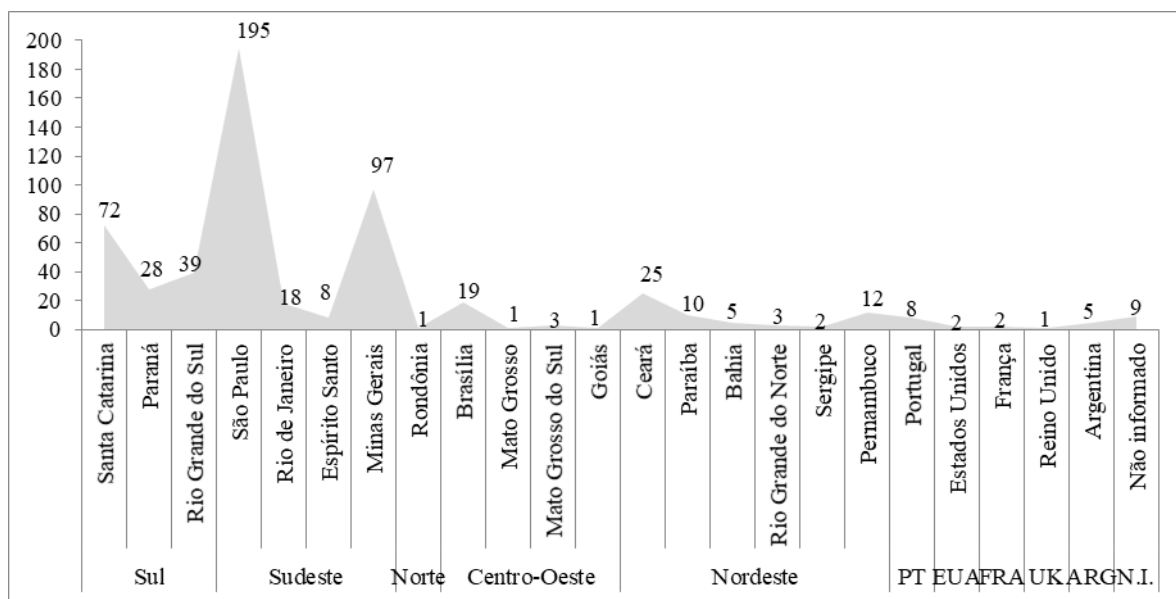
Note: PT refers to Portugal; EUA refers to the United States; FRA refers to France; UK refers to the United Kingdom; ARG refers to Argentina; N.I. refers to the authors that it was not possible to identify in the articles, the region of provenance.
Source: Prepared by the authors.

The regions that are polarizing, with greater emphasis, the scientific production of the sample are the South and Southeast regions of Brazil (largest area in the chart). The southern region is composed of three states: Santa Catarina (72 authors from this state, third largest participation in the sample), Paraná (28 authors) and Rio Grande do Sul (39). The Southeast region is made up of four states: São Paulo (195 authors, is the state with the largest participation in the sample), Rio de Janeiro (18), Espírito Santo (8) and Minas Gerais (97, second largest participation). Although the articles have been published only by Brazilian journals, it is observed that some foreign authors published their works in Brazilian journals, however, this participation of foreign authors is timid (3% of all authors) compared to the participation of Brazilian authors

In general, the academic production in capital structure is dispersed in several authors (although some have been highlighted by their high production), the production is concentrated in some journal and institutions of affiliation of authors, it has been published in journal of high quality in the QualisCapes system. In addition, production is historically growing. Despite this, there are some caveats about these attributes, especially regarding this monopolization of some institutions of affiliation of authors.

5 CONCLUSION

This paper aims to analyze the scientific production on capital structure in Brazilian periodicals. A bibliometric study of this participation was carried out in 195 scientific articles, written by 412 different authors, with an average of three authors per article, being published by 66 journals between 1980 and 2018. The bibliometric analysis verified characteristics of the works, the characteristics of the authors of these works, the historical analysis of this production, the most prolific authors, the institutions of affiliation of most representative authors, and the aspect of regionality.

The objective of the study was reached, since the findings of the research make it possible to investigate the production on capital structure. The main results pointed out that

the academic production on the theme has been increasing over the years (especially in the period immediately after the world and Brazilian crises), that the authors have a preference to publish in partnership (with two or three authors per article).

In addition, it was identified that eight authors gain prominence as they had participation in more articles in the subject. It was verified, through the application of Lotka's Law, that there is a scattering of authorships, that is, many authors produce few articles. Researchers on capital structure in Brazil are people of high academic qualification (majority are doctors or doctoral students). A repercussion of the quality of the works produced is that they were published in journals classified in higher strata (A2, B1 and B2) and concentrated 79% of production. The application of the Bradford Act indicated that there is concentration of production in some Brazilian journals (considered as the 'core' of the publication on capital structure).

Regarding educational institutions, three of them concentrate 31% of the participation in articles produced on capital structure. The application of Lotka's Law indicated that there is concentration of production in some institutions (which may characterize them as the main research centers in the subject). As for the geographic distribution, the regions that were most representative were the South and Southeast regions of Brazil, it was identified that some foreign authors published their researches in Brazilian journals.

As a suggestion for future works, it is indicated the enlargement of the sample, besides the articles of periodicals, for the works published in events and the works of conclusion of course. A paper comparing output on capital structure between countries can be developed. As the sample is expanded to other modes of publication of scientific papers, it is advisable to use more robust statistical techniques.

The findings of this article aim to contribute to the research on capital structure, in that it makes it possible to verify the characteristics of this scientific production. Understanding how the issue is being produced provides a foundation for a range of actions and policies, such as institutional and financial support for centers of reference in research, as well as support for emerging centers; encouragement to authors who find it more difficult to publish more than once; to provide a regional exchange, so that regions with greater representation can exchange knowledge and scientific expertise with researchers from less representative regions, among other actions.

The Brazilian research on capital structure is proving to be promising, as well as the interest of more and more researchers, which points out that knowledge about capital structure is increasingly being stoned in Brazil. Allied to this, the theme is still relevant, both in business and academic. New research must be developed and new bibliometric studies must be produced to verify whether or not there is a metamorphosis of Brazilian research on capital structure.

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