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Regional resilience: a bibliometric study from the Web of Science

Resiliência regional: um estudo bibliométrico a partir da Web of Science

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Abstract
This study presents the main topics and subtopics of the literature on resilience under a regional approach. A cocitation network was created by the CiteSpace scientometry program from the integral base, formed by 829 articles, indexed in the Web of Science. The study also presents the demographics of theoretical and empirical production, published in the period from 2010 to 2017, through the bibliometric method and based on the 61 articles belonging to the business economics knowledge area. In addition: methodological typification is discussed based on theoretical and empirical articles found in this area of knowledge; and the factors and variables commonly associated by empirical articles with the resilience of regions are listed. Since dealing with resilience implies, in many cases, assuming the occurrence of a shock, the results found in this study indicate that studies focused on the regional scope of resilience mainly referred to the 2008-2009 global economic and financial crisis.

Keywords: Regional Resilience. Regional Economic Resilience. Bibliometric study.

Resumo
Este estudo apresenta os principais tópicos e subtópicos da literatura acerca resiliência sob enfoque regional. Para esse fim, recorreu-se à rede de cocitações criada pelo programa de cientometria CiteSpace a partir da base integral de 829 artigos extraídos da *Web of Science*. Com base no método bibliométrico e delimitado a 61 artigos inseridos na área de conhecimento *business economics*, publicados no período de 2010 a 2017, o estudo apresenta também a demografia da produção teórica e empírica. Em adição, com base nos 50 artigos empíricos dessa área de conhecimento traçada, discute-se a tipificação metodológica e listam-se os fatores e variáveis comumente associados na literatura com a resiliência de regiões. Uma vez que tratar de resiliência implica, em muitos casos, assumir a ocorrência de um choque, constatou-se que os estudos voltados ao âmbito regional de resiliência referiram-se, majoritariamente, à crise econômico-financeira mundial de 2008-2009.

Palavras-chave: Resiliência Regional. Resiliência Regional Econômica. Bibliometria.

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INTRODUCTION

The idea of resilience is not new. The original conception of this term comes from studies of material sciences, focused on elastic properties of bodies (MARTIN-BREEN; ANDERIES, 2011) that allow them to store deformation energy without, however, causing damage or collapse in their structures (GORDON, 1978). In parallel with the dissemination of systemic thinking - in the mid-1960s, the term resilience was inserted in the field of natural sciences, and, therefore, new concepts of the term have emerged (DAVOUDI et al., 2012).

From the perspective of ecological systems, Holling (1973) defined resilience as the capacity of systems to absorb changes and still persist. In the early 1990s, authors, such as Masten, Best, and Garmezy (1990, p.426), addressed resilience at the level of individuals under the concept "process of, capacity for, or outcome of successful adaptation despite challenging or threatening circumstances". In the mid-1990s, resilience also began to be used in the sense of capacity or ability of communities to adjust to prolonged stresses (BROWN; KULIG, 1996).

In addition to these fields, resilience has entered, especially over the 2010s, areas focused on the study of geographic space, under the understanding that geographic space can also show resilient behavior in facing disturbances (CELLINI; CUCCIA, 2015). Especially after the global financial crisis of 2008-2009, one of the greatest economic shocks since last century (DUBÉ; POLÈSE, 2015), economic geography has investigated factors related to territory as a source of resilience for regions (BOSCHMA; MARTIN, 2010), once this global crisis exposed the vulnerability of regions (DAVIES, 2011).

From this perspective, resilience in the regional dimension can be understood as resilience capacity or recovery capacity of economies in facing disturbances that impact growth trajectory and/or development trajectory of regions (MARTIN; SUNLEY, 2015). In general, economic and financial crises are, commonly, in the core of studies inserted in the regional dimension of resilience.

Knowing that reviews of previous studies in a knowledge area contribute to its advancement by signaling the evolution process of its concepts and theories (LI; MA; QU, 2017), the present study aimed to identify the main discussion topics and subtopics present in the literature on regional resilience and to verify their evolution over time. Scientometry program CiteSpace was used for these purposes, based on 829 articles published between 1993 and 2017, extracted from the academic database Web of Science (WoS).

In addition, WoS Business Economics area was selected, in order to carry out a bibliometric literature review on regional economic resilience. This selection returned 61 theoretical and empirical articles published in the period from 2010 to 2017 in journals from the areas of Economics, Administration, and Geography. In this stage of the study, metrics of production demography were investigated, such as: time distribution, most cited articles, productivity by authors, and productivity by journals and their respective impact factors.

In the second stage of the bibliometric review, carried out with 50 empirical articles among those previously found, the objective was to verify, over time, metrics about methodological typification of the empirical scientific production, such as: research approach, type, design, data collection strategies, analysis techniques, regions covered, and study objectives. Furthermore, given the lack of studies on determinants of regional resilience, as highlighted by Martin and Sunley (2015), it was aimed to identify - based on these authors' model - factors associated by empirical literature with resilience capacity of regions. Achieving

this objective has contributed, especially, to corroborate and expand the theoretical framework of Martin and Sunley (2015) on regional resilience subsystems.

The article is structured as follows: the theoretical framework briefly discusses the three main research approaches on resilience (engineering, ecological system, and evolutionary), in order to guide readers with respect to discussions present in the literature. In the methodology section, procedures for carrying out the scientometry and criteria used to select articles for the bibliometric review are informed. In the results section, in addition to the citation network and bibliometric analysis, determinants of regional economic resilience are highlighted. At last, conclusions reflect on findings and describe contributions of the study.

THE MAIN ANALYSIS PERSPECTIVES ON REGIONAL RESILIENCE

The understanding of resilience is shaped by concepts that intertwine different knowledge fields and, as a consequence, different reference points are adopted, such as: material bodies, ecological systems, individuals, communities, and, more recently, geographic spaces (MARTIN-BREEN; ANDERIES, 2011) - of which regional resilience is an example.

According to the typology by Pendall et al. (2010), resilience can be understood from two main perspectives: one assumes the existence of an equilibrium system, and the other assumes the occurrence of an evolutionary system. The equilibrium system perspective is subdivided in two perspectives: one understands equilibrium as unique, and the other, more liberal, as multiple (CHRISTOPHERSON; MICHIE; TYLER, 2010).

Resilience in the sense of a unique equilibrium can also be called engineering resilience (SIMMIE; MARTIN, 2010). According to this understanding, resilience is expressed in terms of resistance capacity against disturbances (DI CARO, 2015) and in terms of speed with which a material or system returns to an equilibrium state (HOLLING, 1973).

In the multiple equilibria perspective, also called ecological resilience (PITTERI; BRESCIANI, 2014), resilience is understood as the movement of the system towards a new condition after a disturbance occurrence (PENDALL; FOSTER; COWELL, 2010). It is understood that the impact is absorbed to a certain extent, and, when the system is exhausted, there is a transition to a new equilibrium point (SIMMIE; MARTIN, 2010). This perspective advocates resilience as a recovery capacity (MARTIN, 2012) and focuses on the shock magnitude that can be absorbed before system changes its shape, function, or position (MARTIN-BREEN; ANDERIES, 2011).

Resilience from the perspective of an adaptive or evolutionary system (PIKE; DAWLEY; TOMANEY, 2010) is conceived as a dynamic attribute that leads a system to continuous and spontaneous adjustments (PENDALL; FOSTER; COWELL, 2010), regardless of the occurrence of occasional disturbances (BATHELT; MUNRO; SPIGEL, 2013; DAVOUDI et al., 2012).

Unlike other perspectives in which the focus is on whether or not to be resilient - under the perspective of outcomes - in the evolutionary perspective, resilience corresponds to a dynamic process that involves the ability of anticipation, preparation, and reaction to changes, assuming resilience as a process (COWELL, 2013; MARTIN, 2012). The result of this dynamic process is a temporary stability of the system, different than static stability advocated by equilibrium perspective (BATHELT; MUNRO; SPIGEL, 2013).

According to the adaptive or evolutionary perspective, shocks are not

necessarily interpreted in a negative sense, once they can incite opportunities for reinvention and, as a consequence, lead to a better development trajectory (DUSCHL, 2016; MARTIN, 2012). This is equivalent to saying that opportunities are seen in the midst of adversity (BILLINGTON et al., 2017). The Silicon Valley, which regularly reinvents itself through innovation waves, can be seen as an example of a resilient region that creates favorable conditions for next innovation waves when the potential of the previous one is close to be depleted (HENTON; HELD, 2013).

If maintenance of past structures is the focus of the unique equilibrium perspective - once "the status quo is the point of reference" (EVENHUIS, 2017, p. 2) -, in the dynamic or evolutionary perspective, this status quo is criticized precisely for its opposition to regional renewal processes (BATHELT; MUNRO; SPIGEL, 2013). Adaptive or evolutionary resilience involves more than the ability to absorb effects of crises or to reposition the previous pattern of prosperity (GONÇALVES, 2017). It is the ability to reposition and strengthen the previous development model, overcoming not only a recession, but also a context of development that is proven to be outdated (GONÇALVES, 2017).

This reinvention capacity is commonly referred to in foreign literature as bounce forward (DI CARO, 2015), which is a counterpoint to the equilibrium perspective, also called bounce back (EVENHUIS, 2017). One of the most adopted understandings in the specific literature on regional resilience is that of Martin and Sunley (2015). For them, regional resilience is the dual capacity of an economy to resist and recover from shocks by restoring the status quo or migrating to a new development path in which its physical, human, and environmental resources are used more productively.

Table 1 contains a summary of the main characteristics of resilience according to the discussed perspectives. The theoretical foundations of resilience, such as its concept evolution and its definition within various subjects, can be found in depth, for instance, in the studies of: Pendall, Foster, and Cowell (2010), Martin-Breen and Anderies (2011), Boschma (2015), and Martin and Sunley (2015).

Table 1 - Summary of resilience perspectives and their main characteristics

Perspectives		**Main characteristics**
Equilibrium system	Engeneering resilience	Assumption of unique equilibrium *(bounce back)* Resilience conceived as resistance and elasticity of a system It does not problematize reorganization and reorientation processes
	Ecological resilience	Assumption of multiple equilibria Resilience conceived as replacement and recovery of a system The system identity remains the same
Evolutionary system	Adaptive resilience	Assumption of constant changes *(bounce forward)* Resilience conceived as reorientation or renewal of a development trajectory Resilience is independent of shocks Reorganization and reorientation processes are totally open

Source: Martin-Breen and Anderies (2011)

METHOD

Visualization and analysis of patterns and tendencies in scientific production can be performed with scientometric tools, such as CiteSpace (CHEN, 2014). This program is one of the most famous knowledge mapping tools (LI; MA; QU, 2017) and allows identifying patterns and emerging tendencies in a given literature (CHEN et al., 2012). In the present study, version 5.6 of the mentioned

program was used, in order to identify main discussion topics and subtopics, as well as their evolution over time through the regional resilience co-citation network.

CiteSpace generates and analyzes a network of co-cited references, according to bibliographic records extracted from Web of Science (CHEN et al., 2012), which belongs to the Institute for Scientific Information (ISI). In line with Bar-Ilan (2008), Chen et al. (2012), and Ávila et al. (2014), the choice of this database is justified: i) by its multidisciplinary nature; ii) by the indexation of the most cited journals in various scientific fields; iii) by its accessibility to all citations received by articles, whether or not indexed in WoS platform, and, not least, iv) by its compatibility with CiteSpace program.

With respect to procedures for collecting scientific production, the criterion "topic" was used in Web of Science database search tool. Search strategy was based on the descriptor in English "regional resilience", as well as on the use of quotation marks, in order to return studies involving both terms that comprise the descriptor. No interval of years was used. The search returned 164 documents (articles, conference proceedings, and books). Among them, only scientific articles were selected, a total of 125 publications. The search took place in mid-March 2018.

The construction of co-citation networks, as recommended by Chen (2014), needs be carried out by expanding the initial quantity of articles, including in the analysis the academic production listed in their references. In WoS database, this procedure is performed by using the "citation report" functionality and, subsequently, the selection of "articles without self-citations". At the end of these procedures, 829 publications were found, published between 1993 and 2017.

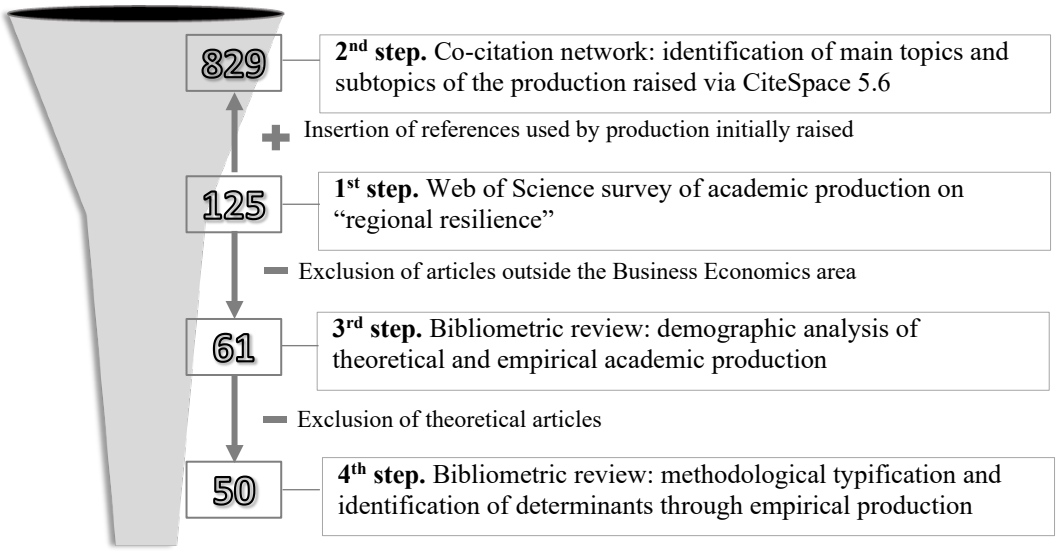
The mapping of co-citation network areas was done by using the functionality "label clusters with log likelihood ratio", which extracts nominal phrases for each of the clusters. The choice of this criterion is justified due to the fact that, according to Chen (2014, p. 15), "it gives the best result in terms of the uniqueness and coverage". In addition to nominal phrases, clusters identified by algorithm are numbered according to their robustness in terms of quantity of articles. The most robust one receives the lowest numbering, and the least robust, on the other hand, the highest possible numbering (CHEN et al., 2012).

These authors also recommend checking biases in the formed clusters by using two metrics: modularity and silhouette. Modularity measures the degree to which a network can be divided into independent clusters, and its value ranges from 0 to 1. Values within the range from 0.4 to 0.8 are acceptable (LI; MA; QU, 2017). Silhouette indicates homogeneity of the formed clusters, and its scores range from -1 to 1. Clusters with values above 0.7 suggest homogeneity and consistency between nodes (LI; MA; QU, 2017).

In addition to identifying areas and their respective discussion topics, a bibliometric review on regional resilience was carried out, from the economic and management perspective, by selecting the knowledge area named by WoS as Business Economics. This procedure returned 61 theoretical and empirical articles. This stage of the study aimed at verifying demographic metrics of the theoretical and empirical scientific production raised.

In addition, based on 50 empirical articles, the objective was to verify metrics of methodological typification of articles, as well as factors commonly associated by them with regional resilience. In order to achieve these objectives, content analysis was performed by reading the articles in full, supported by the use of NVivo v. 11 program. Figure 1 summarizes the adopted steps and procedures.

Figure 1 - Summary of procedures adopted for selecting articles, based on WoS database functionalities and on reading articles



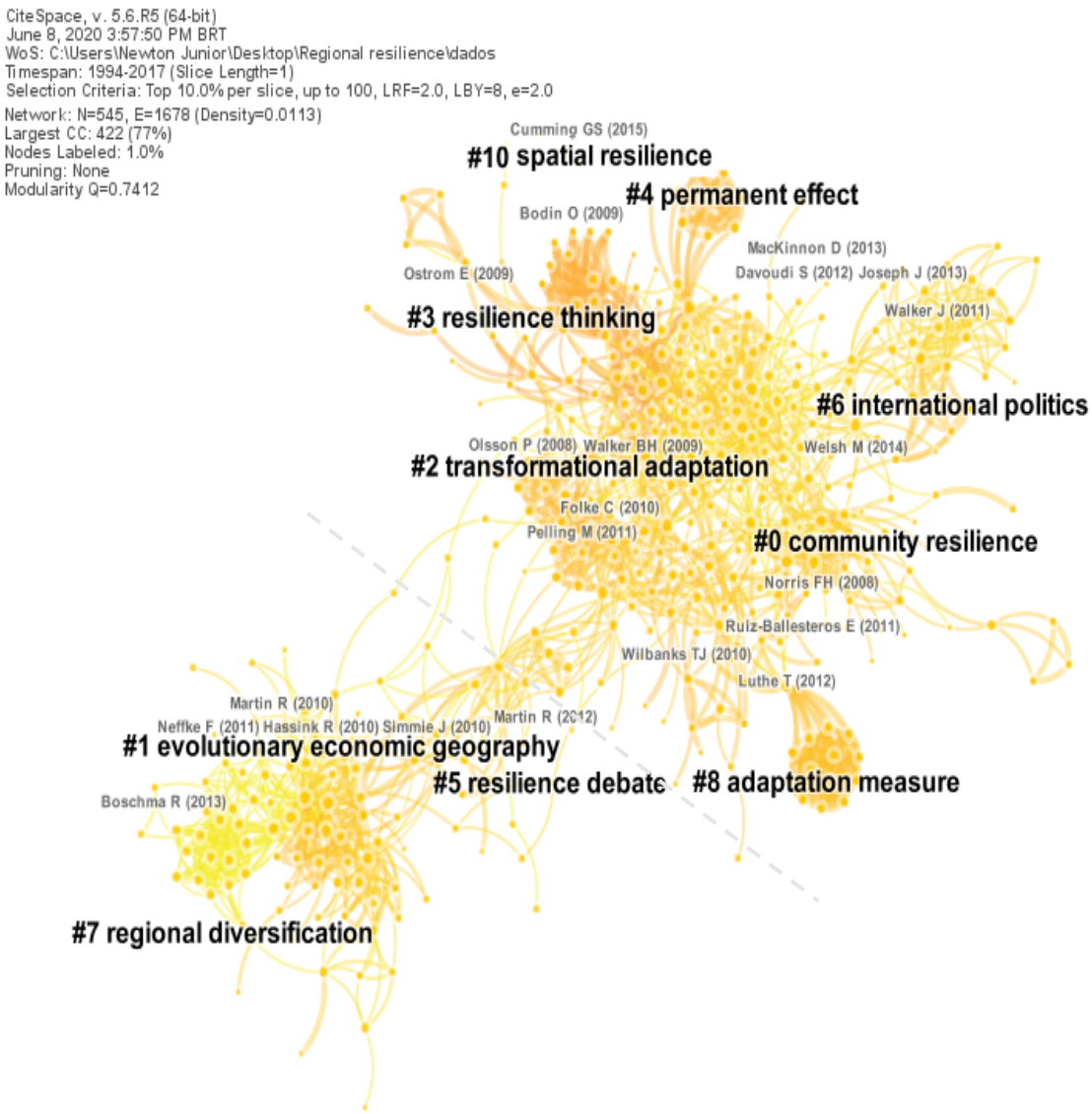
Source: Authors

MAIN TOPICS AND SUBTOPICS OF ACADEMIC PRODUCTION ON REGIONAL RESILIENCE

CiteSpace illustrates a given literature by means of a network synthesized from a series of individual networks. Hence, integrating these individual networks provides an overview of how a scientific field has evolved over time (CHEN et al., 2012), according to the type of node chosen. In the present study, the criterion reference was used.

The modularity value of the main network was Q = 0.74. In total, 59 clusters were identified in it. Nonetheless, only four presented acceptable silhouette values (above 0.7), based on Li, Ma, and Qu (2017). Figure 2 shows the most robust ones, according to CiteSpace analysis. The most robust among them, in terms of quantity of items, was the community resilience with 76 articles.

Figure 2 - Map of co-citation network of academic production on regional resilience indexed in WoS



Source: CiteSpace v. 5.6

It is possible to note the branching of the co-citation network in two regions separated by the dashed line (inserted by the authors). One, in the upper right corner, involves the vast majority of clusters - which are largely based on the design of socio-ecological systems -, and the other, in the lower left part, covers a smaller part of clusters - which are mainly based on the subject evolutionary economic geography.

Table 2 shows, in addition to main discussion topics, the number of articles, the average year of publications pertaining to each topic, the main subtopics, and their most central authors.

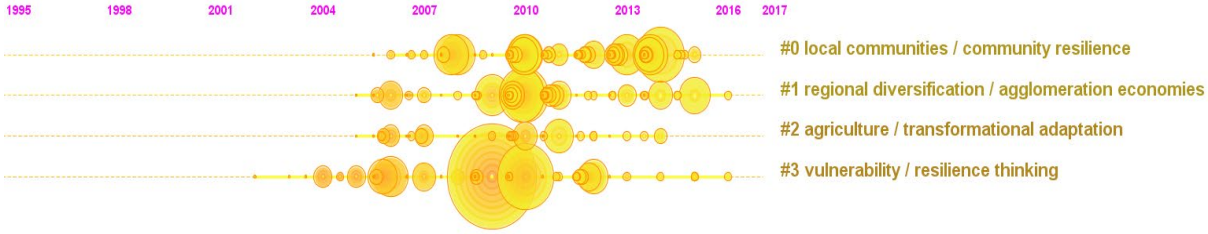
Table 2 - Main topics, metrics, subtopics, and central authors of the co-citation network clusters

Main discussion topics	Qty of articles	Average year	Main discussion subtopics of the cluster	Central authors of the cluster
#0 Community resilience	76	2013	Regional Socioeconomic System / Global Sustainability Agenda / Analytical Statistical Method / Multiple Linear Regression / Natural Risk Studies / Flood Disaster / Katrina / Global Environmental Change	Welsh M (2014), Norris F (2008), Berkes F (2013)
#1 Evolutionary economic geography	59	2010	Industrial Region / Economic Indicator / Location-based characteristics / Economic Structure / New Regional Industrial Trajectory / Measuring Resilience / Quantitative Analysis / Regional Employment Growth / Economic Performance / Economic diversification	Hassink R (2010), Martin R (2010), Boschma R (2015)
#2 Transformational adaptation	55	2011	Local Government / Sociological Concept / New Social Contract / Urban Policy Maker / Essential Ecosystem Service / Structuring Theory / Spatial Behavior	Pelling M (2011), Wilbanks T (2010), Walker B (2006)
#3 Resilience thinking	40	2009	Actor-Structure Duality / Education Level / Governance Challenge / Neighborhood Level / Applied Research / City District / Sociological Concept / Socioeconomic Interaction	Walker B (2004), Folke C (2010), Folke C (2006)

Source: authors' elaboration based on information extracted from CiteSpace v. 5.6

In order to visualize the development of the mentioned discussion topics over time, it was adopted the CiteSpace timeline view functionality (Figure 3). The size of the circles represents the existence and volume of academic production linked to a given topic in a given year. The orange color represents the occurrence of an explosion of citations associated with a specific publication, named as burst in CiteSpace.

Figure 3 - Illustration of the development of co-citation network clusters over time



Source: CiteSpace v. 5.6

This means that "the publication evidently has attracted an extraordinary degree of attention from its scientific community" (CHEN, 2014, p. 19). In the present study, it was noted that one of the factors that may be related to the highlight of these articles in their respective clusters is their theoretical approach, which offers theoretical concepts and assumptions to support empirical studies.

The cluster entitled "community resilience" was the most robust, in terms of quantity of articles. The article by Norris et al. (2008) presented the highest burst value (4.03). As defined by these authors, community resilience is the process that links a network of adaptive capacities (resources with dynamic attributes) to a positive trajectory of functioning and adaptation of populations after a disturbance (NORRIS et al., 2008). Examples of disasters of this kind: terrorist attacks in 2001, tsunami in Southeast Asia in 2004, and Hurricane Katrina in 2005.

The article with the highest burst value (8.71) in the cluster "evolutionary economic geography" was that of Martin and Sunley (2006). The economic geography perspective of resilience is based, especially, on theoretical concepts, such as "path dependence" and "lock-in" (MARTIN; SUNLEY, 2006). It is inferred from the study that resilience is an expression of the ability of regional economies to reinvent themselves through new paths after shocks. These shocks, in turn, are triggered by endogenous forces that limit the duration of a condition - such as, for instance, the adoption of a given technology or production of the same product by several companies (MARTIN; SUNLEY, 2006).

The "transformational adaptation" cluster presented the articles by Gallopín (2006) and by Smit and Wandel (2006) with the highest burst value (4.13). Both were published by the same journal and adopt a systemic perspective. According to Smit and Wandel (2006), resilience is the ability of a system to deal with, adapt to, or recover from effects of dangerous conditions - such as climate change, for instance. For Gallopín (2006), resilience is a change of state between different domains of attraction.

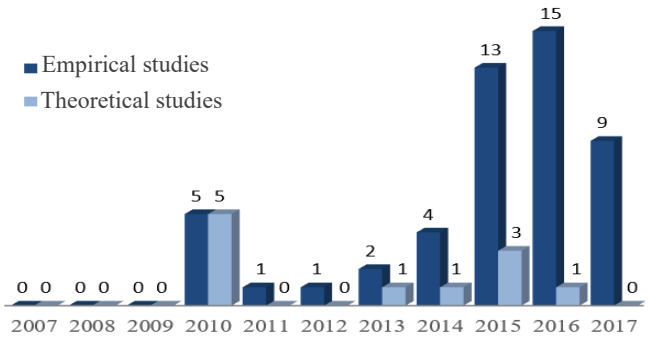
The cluster "resilience thinking" presented the greatest time coverage, as well as the greatest explosion of citations (10.84) - attributed to Folke's article (2006). According to this author, resilience perspective is increasingly used as an approach to understand the dynamics of socio-ecological systems. The study narrates the development of resilience concept from its roots in Ecology, in which mathematical models were used to understand ecosystem changes, up to the ramifications in Social and Environmental Sciences. In the following section, regional resilience is reviewed with the scope limited to research area named by WoS as Business Economics, including 61 theoretical and empirical articles.

BIBLIOMETRIC REVIEW ON REGIONAL RESILIENCE FROM AN ECONOMIC AND MANAGEMENT PERSPECTIVE

Bibliometric review consists of measuring production and dissemination rates of scientific knowledge by quantitative and statistical techniques, in order to objectively evaluate a specific area or subject (ARAÚJO, 2006). On this step, the focus was on the knowledge area named by WoS as Business Economics, which presented 61 articles.

The majority of production (72%) on regional resilience, from the perspective of the aforementioned area, referred to effects of the 2008/2009 global financial crisis, corroborating Raco and Street (2012). According to these authors, this crisis has given new meaning to the concept of resilience in the regional context. With respect to research type, most articles were characterized as empirical (82%), and the others as theoretical (18%). The distribution of articles by year reveals that, initially, in 2010, there was a balance between research types (Figure 4).

Figure 4 - Time distribution of the raised academic production



Source: Authors

It is important to note that most publications in 2010 and in 2015 were due to the publication of two special editions launched by the Cambridge Journal of Regions, Economy, and Society (CJRES) focused on the theme of regional resilience. Although in a smaller quantity, the eminently theoretical articles were leaders in the number of citations received. Out of the theoretical articles published in 2010, only one was not present in the list of five articles with the highest number of citations received, as shown in Table 3. It should be noted that the metrics presented were extracted from WoS in a search carried out in March 2018.

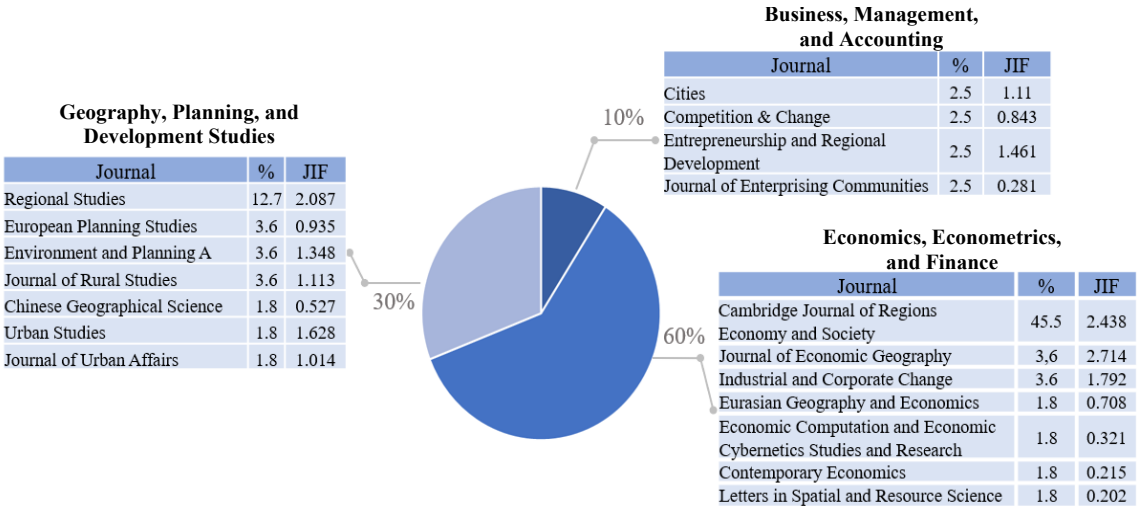
Table 3 - Articles in the raised academic production with the highest number of citations received

Articles	Research type	Authorship	Citations received
The economic resilience of regions: towards an evolutionary approach	Theoretical -Empirical	Simmie and Martin (2010)	279
Resilience, adaptation, and adaptability	Theoretical	Pike et al. (2010)	190
Regional resilience: theoretical and empirical perspectives	Theoretical	Christopherson, Michie, and Tyler (2010)	181
Regional resilience: a promising concept to explain differences in regional economic adaptability?	Theoretical	Hassink (2010)	133
Resilience and regions: building understanding of the metaphor	Theoretical	Pendall, Foster, and Cowell (2010)	133

Source: authors' elaboration based on information from WoS

The Economics, Econometrics, and Finance knowledge area presented the highest number of articles in the sample (60%), followed by Geography, Planning, and Development (30%) - although both cover the same number of journals -, and by Administration, Management, and Accounting (10%). It is possible to note the great presence of journals inserted in what could be called the intersection between Economics and Geography, such as the Journal of Economic Geography. Figure 5 lists journals in each knowledge area, as well as percentage expressiveness of each journal in terms of articles in the total sample, and the respective Journals Impact Factor (JIF) metrics for the year of 2017.

Figure 5 - Distribution of the raised academic production by knowledge area and by journals



Source: Authors

There was a large concentration of publications (45.5%) in the English journal Cambridge Journal of Regions, Economy, and Society (CJRES). From this data, it is inferred that the debate about regional resilience, from the perspective of the investigated area, was especially promoted in the last decade by the aforementioned journal. An evidence of this is the large number of citations received by CJRES, which represented 80% of all citations received by journals listed in Figure 5 - according to data extracted from WoS in early 2018.

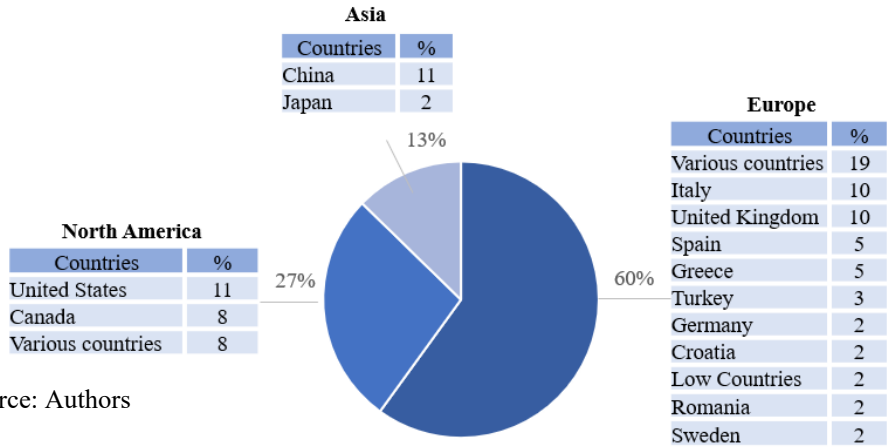
The distribution among authors proved to be quite heterogeneous. Ron Boschma (from the University of Utrecht, Netherlands), Gillian Bristow (from the University of Cardiff, United Kingdom), and Ron Martin (from the University of Cambridge, United Kingdom) stood out with 3 publications each. The authors who presented 2 publications were: Juan Cuadrado-Roura (from the Universidad de Alcalá, Spain), Ayda Eraydin (from the Technical University of the Middle East, Turkey), Ugo Fratesi (from the Polytechnic of Milan, Italy), Robert Hassink (from the University of Kiel, Germany), T. William Lester (from the University of North Carolina, USA), and Andres Rodriguez-Pose (from the London School of Economics, United Kingdom). Other 110 authors presented 1 publication each.

The next analyzes are based exclusively on the 50 empirical articles, in order to discuss the methodological typification adopted by them. Before that, it is highlighted that the most mentioned shock in empirical studies (70%) was the global financial crisis of 2008-2009. With respect to methodological issues, quantitative research approach prevailed (72%), followed by qualitative (25%), and mixed (4%). Most articles used secondary data (72%), extracted, mainly, from databases.

Regarding studies that used primary data (19%), collection strategies took place through interviews and questionnaires, or by combining both types (9%). Longitudinal data design (87%) prevailed over cross-sectional (13%). Time span of studies presented a median and mean of, respectively, 8 and 15 years. The longest time intervals found were in the studies by Cellini and Torrisi (2014) - 119 years -, and by Lagravinese (2015) - 40 years.

The majority of articles combined statistical techniques (74%) in the data analysis phase. Content analysis was less frequent (19%). The residual percentage (7%) refers to studies that combined mixed analysis techniques. Most regions covered in the empirical studies were from the European continent (60%). Figure 6 illustrates this distribution and details it by country. The category “various countries” refers to comparative studies between regions in different countries.

Figure 6 - Distribution of the production raised for bibliometric review by continents and countries



Source: Authors

At last, empirical articles were grouped into emerging categories based on content analysis of their respective objectives. There was the possibility to group each article in more than one category, once categories were not mutually exclusive. Table 4 shows the distribution by category and by year.

Table 4 - Distribution of empirical studies by year and by category, according to objectives

Study objectives	2010	2011	2012	2013	2014	2015	2016	2017	Relative proportion
Comparison of behavior of different regions to shock (s)	2	1	1	2	1	3	6	1	23%
Proposition of models or concepts for regional resilience	5	2	0	0	0	0	2	3	13%
Analysis of determinants of regional resilience	1	0	0	4	3	6	8	4	35%
Analysis of effects of shocks on regions	0	0	0	0	2	6	6	2	21%
Analysis of region recovery after shocks	0	0	0	0	1	3	1	1	8%

Source: Authors

Analysis of determinants of regional resilience was the category with the highest relative proportion, whereas the objective of comparing behavior of different regions to shock (s) was detected in all years. The other objectives were concentrated, in some way, at one of the interval extremes. The proposition of models or concepts for regional resilience was more recurrent, for instance, in early years of the surveyed literature.

On the other hand, the objectives aimed at analyzing determinants of regional resilience, as well as the effects of shocks on regions and their recovery, were more concentrated in the final years of the interval. In the following section, factors and variables associated by studies with determinants of regional resilience are listed.

DETERMINANTS OF REGIONAL RESILIENCE FROM AN ECONOMIC AND MANAGEMENT PERSPECTIVE

One of the main issues on regional resilience, responsible even for popularizing its concept (CHRISTOPHERSON; MICHIE; TYLER, 2010), concerns its determinants - that is, factors related to resilience of regions in facing shocks (CRESCENZI; LUCA; MILIO, 2016).

Martin and Sunley (2015) proposed a theoretical framework comprised of determinants of regional resilience from the economic perspective. According to these authors, from the perspective of resilience as a process, regional resilience expresses the interaction between four main subsystems: Industrial and Business Structure; Labour Market Conditions; Financial Arrangements; and Governance Arrangements. Among these subsystems, the structural and commercial one prevails in the debate about regional resilience, according to Martin and Sunley (2015). This is also due, according to them, to efforts of economic geography to investigate the role of industrial structure in regional development.

The strategies adopted in the present study in order to identify factors associated by empirical studies with determinants of regional resilience were: full reading of articles and adoption of content analysis technique supported by the use of NVivo v. 11 program. Some studies fixed factors of a specific phenomenon and, based on their influence, studied regional resilience. Examples are: local values (HUGGINS; THOMPSON, 2015), innovation capacity (CLARK; HUANG;

WALSH, 2010), specialization of industrial structures (LAGRAVINESE, 2015), entrepreneurship (BISHOP; SHILCOF, 2017), and local knowledge networks (CRESPO; SUIRE; VICENTE, 2016).

Other studies used variables related to several subjects in their statistical analysis. Results of the categorization are shown in Table 5. The respective references are also presented. Categories and variables that emerged from data, considering the theoretical framework of Martin and Sunley (2015), are marked as follows: new categories (subsystems) with one asterisk, and new variables with two.

Table 5 - References of the theoretical framework regarding corroborated and emerging variables

Subsystems	Variables	Subvariables	References
Industrial and Business Structure	Economic diversification	Industrial structure diversification / Diversified economic portfolio	Wolfe (2010), Duschl (2016), Bathelt et al. (2013), Hu and Hassink (2017), Liang (2017), Di Caro (2015)
	Economic specialization	Service sector	Lagravinese (2015)
		Manufacturing sector	Davies (2011), Brakman et al. (2015), Palaskasy et al. (2014), Di Caro (2015), Cuadrado-Roura and Maroto (2016)
		Commerce sector	Petrakos and Psycharis (2016)
		Technology sector	Chapple and Lester (2010), Brakman et al. (2015)
		Public sector	Lagravinese (2015)
	Supply Chain	Supply Chain	Bristow (2010)
	Company characteristics	Company size	Bristow (2010), Clark et al. (2010), Sabatino (2016)
	Entrepreneurship	Entrepreneurial orientation / Spinoffs	Huggins and Thompson (2015)
	Innovation**	Innovation / Investments in R&D / Innovative solutions	Clark et al. (2010), Wolfe (2010), Balland, Rigby, and Boschma (2015), Di Caro (2015), Huggins and Thompson (2015), Crescenzi et al. (2016), Sabatino (2016)
	Openness to exportation **	Market opening / Internationalization	Petrakos and Psycharis (2016), Sabatino (2016)
Governance Arrangements	Institutional support	State agency	Eraydin (2016), Hu and Hassink (2017)
	Support from institutions	Network between Companies, Universities, and Research centers	Rutherford and Holmes (2008), Di Caro (2015)
	External connections	Integration with global market	Bristow (2010), Capello, Caragliuy, and Fratesi (2014), Eraydin (2016)
	Cooperation**	Collaborative networks / Knowledge exchange networks / Industrial relations / Network system	Bristow (2010), Capello, Caragliuy, and Fratesi (2014), Sánchez-Zamora, Gallardo-Cobos, and Ceña-Delgado (2014), Di Caro (2015), Sabatino (2016)
Labour Market Conditions	Qualification of human capital	Level of training / Influence of human capital	Di Caro (2015), Crescenzi et al. (2016), Duschl (2016), Giannakis and Bruggeman (2017)
	Flexibility of wages and workload	Job market flexibility	Bell and Eiser (2016)
	Workforce mobility	Mobility of workers / Immigration of foreigners	Bell and Eiser (2016)

Financial Arrangements	Government financing	Loan concessions / Access to credit	Hu and Hassink (2017)
	Tax policies	Fiscal austerity / Fiscal stimulus	Bell and Eiser (2016), Davies (2011)
Territorial*	Regional expertise**	Experiences with former crises / Knowledge legacy	Bathelt et al. (2013), Treado (2010), Eraydin (2016)
	Urban infrastructure**	Urbanization degree / Urban planning	Capello, Caragliuy, and Fratesi (2014), Brakman et al. (2015)
	Socio-cultural aspects**	Social values	Bristow (2010), Huggins and Thompson (2015)
		Social capital	Petrakos and Psycharis (2016)
		Civic capital	Wolfe (2010), Di Caro (2015)

*Categories (subsystems) emerged from raised production

**Variables emerged from raised production

Source: Authors

The emerged subsystem was named Territorial Subsystem, based on assumptions by Pecqueur (2005). This subsystem was understood as one that gathers variables present in the territory that contribute, in some way, to economic resilience of industrial regions. Examples emerging from the raised academic production are: regional expertise, urban infrastructure, and socio-cultural aspects of a geographical region.

CONCLUSIONS

Initially applied to materials, referring to their elastic capacity to absorb stress caused by external disturbances, resilience has started to be used in other knowledge areas under new interpretations. Effects, in the last decades, of disasters and crises, generically called shocks, have been addressed through a re-reading of the original resilience concepts. According to academic research from Web of Science database, disasters caused by Hurricane Katrina in the mid-2000s and the economic recessions caused by the global financial crisis of 2008-2009 are examples.

The global financial crisis of 2008-2009 was the exponent in the regional resilience literature comprised of the knowledge area entitled by the academic database WoS as Business Economics. Named in the present study as economic and management perspective, this area was comprised of the subjects Economics, Administration, and Geography. Furthermore, this perspective can be considered recent, given that its first studies were published in 2010. It does not differ much from the broad production on regional resilience, considering all knowledge areas, whose publications date from 1993 (one article), and the others only from 2009 on.

The debate within this perspective was mostly conducted, at least until 2017, by European researchers. European regions were also the most addressed, although the shock emerged in the United States. Methodologically, the studies adopted, mostly, quantitative approaches, secondary data, and longitudinal design. The English journal Cambridge Journal of Regions, Economy, and Society accumulated, until 2017, almost the totality of empirical and theoretical productions and has been the leader in number of citations in the economic and management perspective. These results corroborate the findings of Silva and Exterckoter (2016) and of Evenhuis (2017).

Although Cowell (2013) reported the need for a consolidation of factors related to regional resilience, and, years

later, Cuadrado-Roura and Maroto (2016) reinforced this gap, it was not found in a recent search - in mid-June 2020, studies in this sense in the international literature indexed in WoS. In the national literature, the bibliographic research by Silva and Exterckoter (2016) stands out, which did not address the gap in question, although has contributed to the resilience literature from the regional development perspective.

On the other hand, in the international literature, Evenhuis (2017) presents, from an evolutionary perspective, a compilation of mechanisms through which adaptation and resilience occur in various domains of regional economy. In addition to corroborating the factors pointed out by this author, the present study complements it by not sticking to a single perspective. Hence, among the greatest contributions of the present study, it stands out the compilation of factors and variables present in the economic and management perspective in the regional resilience literature, from 2010 to 2017, associated with resilience capacity of regions.

The results that were found also corroborate and expand the theoretical framework of regional resilience subsystems by Martin and Sunley (2015). In addition, the results also corroborate the preponderance of variables of the Industrial and Business Structure in relation to the others. Compiling determinants of regional resilience is important, especially, when one takes into account that resilience of regions can be manageable (FOLKE et al., 2005; MARTIN-BREEN; ANDERIES, 2011). Hence, resilience, once being a desired characteristic in regions, especially in the issue of regional development (BRISTOW, 2010), tends to gradually occupy greater spaces in the debate and in the agenda of regional public policies (ERAYDIN, 2016).

Public policies, in turn, must consider using the capacity of endogenous (ERAYDIN, 2016) or dynamic (NORRIS et al., 2008) resources of a territory not only in the recovery of regions, but also in the construction of strategies to respond successfully to recessive cycles. An additional imperative to this agenda, which places the geographical place at the heart of the debate, are the new - and asymmetric - economic impacts brought up by the most recent world disturbance: the COVID-19 pandemic.

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