

Review

Pension funds in Colombia and implications: A bibliometric analysis from Scopus

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Abstract: This study delves into the dynamic landscape of pension funds in Colombia, examining both its current research status and practical implications. Understanding the state of pension systems is crucial for individuals' financial security and a country's overall economic stability, especially given factors such as an aging population and evolving socio-economic dynamics. By comprehensively analyzing scholarly publications on Colombian pension funds using the Scopus database, this research sheds light on key trends and contributors shaping policy formulation and financial planning. The analysis covers a period from 1987 to 2023, identifying 71 relevant articles through keyword searches and filters. Various metrics, including publication trends, citations, international collaboration, and authorship dynamics, were quantitatively assessed. The results reveal an annual growth rate of 5.37%, with research articles comprising 81.69%, review articles 7.04%, and other formats like books, book chapters, and conference papers making up 11.27% of the total documents. Notably, countries such as the UK, the USA, Spain, and Colombia emerge as key contributors to the literature. Among authors, Mesa-Lago, L., stands out as a significant figure, with one of the earliest publications on the topic. The findings underscore the growing importance of pension funds in Colombia, particularly in the context of fund performance research amid financial crises. The prevalence of international collaboration suggests a global interest in understanding and contributing to the development of Colombian pension systems. Furthermore, the study identifies research gaps, particularly in areas concerning the socio-economic impact of pension policies, providing a roadmap for future investigations. Policymakers, financial practitioners, and researchers can leverage these insights to inform strategic decision-making and address critical challenges in optimizing pension fund management in Colombia.

Keywords: pension; trends; bibliometric; Colombia; standards

1. Introduction

1.1. Background

The Pension and Parafiscal Management Unit (UGPP) is the government institution responsible for ensuring accurate social security contributions from all taxpayers. Established by Article 156 of Law 1151 of 2007, the UGPP conducts monitoring activities and determines the appropriate basis for calculating social security contributions. It also takes enforcement actions against those who evade or omit contributions to the social security system.

In carrying out its duties, the UGPP may collaborate with other government agencies to verify taxpayers' self-assessments and investigate any inconsistencies in

tax information. These functions include requesting information, seeking explanations, and providing support to taxpayers (Delgado López and Pabón Rodríguez, 2019). According to Salgado Morales (2020), the UGPP's inspection processes targeting both legal entities and individuals have seen a notable increase. Consequently, legal disputes with the UGPP, both administratively and judicially, have become more frequent. As a result, the UGPP ranks among the most litigated state entities in Administrative Litigation Jurisdiction Salgado Morales (2024).

In Colombia, social security contributions made by independent merchants fall under the regulation of the Ministry of Finance and Public Credit, but they lack a well-defined legal basis in the law. In the absence of specific legislation, regulatory decree N-1070 of 2013 serves as a reference for determining the Contribution Base Income (IBC) of independent merchant workers. Additionally, the subsidy for this regulation is based on Sentence C-578 of 2009 of the constitutional court, which applies to all individuals working in public or private entities under any contracting model (Henaó Pérez, 2009).

Furthermore, the UGPP (Special Administrative Unit for Pension and Parafiscal Contributions) supervises social security contributions in health and pension. As part of this supervision, final administrative acts of sanction resolution are issued, particularly targeting independent workers engaged in commercial activities classified as merchants under the commercial code. These sanctions create a competitive disadvantage because legal entities conducting similar commercial activities are not required to make social security contributions, as they are considered fictitious entities and contract obligations through their legal representatives. In contrast, natural persons are legally obligated to undergo the affiliation and contribution process according to Colombian legal standards, leading to financial inequality. This obligation often involves allocating a significant portion of cash flows, sometimes equivalent to 25 times the monthly legal minimum wage (SMLV), which is not required for commercial activities conducted by legal entities. Moreover, non-compliance with regulations results in hefty sanctions imposed by the UGPP.

Considering the aforementioned points, within Colombia's social state of law, all administrative actions must adhere to constitutional principles such as equality, contributory capacity, legal security, the right to private property, and the prohibition of confiscatory taxes. This is because the constitutional court, in its interpretation, has deemed parafiscal payments to be akin to taxes (Pardo Schlesinger, 2019). Thus, legislation enacted by the Congress of the Republic, as the sole representative body of all citizens, should clearly define taxpayers, taxable bases, and methods of social security contribution payment. This clarity would alleviate the prevailing uncertainty, especially given that currently, only regulatory decrees and UGPP Resolution 209 of 12 February 2020, exist.

By establishing such legislation, ambiguity surrounding the mandatory nature of social security contributions for independent merchant workers would be dispelled. Hence, it is pertinent to scrutinize the legality of administrative actions issued by the UGPP against independent merchant workers and assess whether these resolutions are unconstitutional or ineffective in the collection process. Given the constitutional court's repeated rulings on the regulatory inclusion of social security-related matters

within national development plans, reflecting government policy, such analysis becomes imperative.

1.2. General aspects

The administrative acts issued by the UGPP against independent traders, which contain sanction resolutions for their failure to contribute to the social security system, are unconstitutional and therefore ineffective in the collection stage. This is because they contradict constitutional provisions regarding the principle of equality and the right to equality, as they do not impose the same sanctions on legal entities engaging in the same commercial activity and incurring the same violations. Given that equality is a fundamental right, its violation not only jeopardizes the effectiveness of our state's social and legal structure but also directly impacts the economy of independent workers. Therefore, it is necessary to identify the factors contributing to this lack of adherence to principles and rights. The academic community proposes an adjustment in accordance with the Political Constitution to unify the legal system with the guiding principles of law.

This research aims to draw attention to the alignment of norms with the Political Constitution as the ultimate norm for legitimizing minor norms, such as those granting the UGPP sanctioning power. This alignment is crucial to ensure equality between natural persons, independent workers, and legal entities engaging in the same commercial activity. In terms of social relevance, this study seeks to reduce inequality gaps that directly affect the working class and hinder the effective enjoyment of fundamental rights within society. It advocates for the UGPP's sanctioning function to adhere to constitutional and labor law parameters to balance burdens on workers and eliminate distinctions detrimental to workers.

Practically, this research promotes critical analysis of the legal reality regarding contributions and social security in Colombia. It fosters a deeper understanding of the relationship between norms and the Political Constitution, critical thinking, and the generation of new knowledge. Methodologically, this research employs a qualitative approach, focusing on documentary sources such as legal texts, doctrine, and jurisprudence in labor law. Through legal hermeneutics, it aims to achieve its research objectives effectively. Theoretically, this study critically analyzes the UGPP's sanctioning powers in relation to non-compliance with contributions by independent workers, compared to legal entities. It underscores the need for equality between workers and legal persons, promoting the effective enjoyment of rights and enriching theoretical discourse through debate and interpretation of regulations.

1.3. Pension standards

1.3.1. Theoretical references

Delgado López and Pabón Rodríguez (2019) conducted a qualitative case study, revealing the UGPP's effectiveness in detecting irregularities among contributors but highlighting its shortcomings in calculating the IBC. They emphasize the necessity for independent workers to understand the significance of contributions to the social security system. Ramírez Trejos and Hernández Gutiérrez (2020) elucidated the legal framework governing the creation of the Administrative Unit for Pension and

Parafiscal Management, concluding its role in safeguarding pension rights, and administering the average premium regime, along with managing parafiscal contributions.

Betancourt and Osorio Ruiz (2020) underscored the Political Constitution of Colombia as the overarching norm guiding administrative and judicial processes, ensuring legality, equity, and equality. They assert that the UGPP adheres to the constitutional principle of legality and exercises the powers conferred by law. Gallego Osorno and Morales Monsalve (2020) analyzed the principle of equality concerning natural persons by the UGPP, emphasizing its indispensability and the need to consider other constitutional principles such as tax equity, efficiency, and progressivity.

García Páez (2021) delved into the concepts comprising the Contribution Base Income (IBC) for settling contributions to the General Social Protection System (SGPS) in private legal-labor relations. The author concluded that the IBC, regulated by various rules, requires precise regulation to align jurisprudence and UGPP administrative actions with the economic reality of companies. This ensures legal support for companies to defend their rights in case of arbitrary determinations.

1.3.2. Theoretical bases

The Political Constitution, in Article 48, defines social security as a public service provided to all Colombians in the national territory, ensuring their well-being and contributing to enhancing their quality of life (Congreso-de-la-Republica, 1991). Consequently, the social security system in Colombia (SSS) consists of several components: the State, represented by the Ministry of Health and Social Protection, which oversees coordination, direction, and control; Health Promotion Entities (EPS), responsible for membership, contribution collection, and ensuring the provision of the Mandatory Health Plan; and healthcare institutions (IPS), including hospitals, clinics, and laboratories, responsible for delivering care to users. Additionally, Territorial Entities and the National Health Superintendency act as control and surveillance entities within the General Social Security System (SGSSS). The primary goal of the SSS is to regulate essential public health services and facilitate access for the entire resident population of the country, providing high-quality, inclusive, and equitable services through a public health delivery model. This model, aligned with the Primary Health Care strategy, encourages coordinated efforts by the State, institutions, and society to improve health outcomes and create a healthy environment (Ministerio, 2024).

Residents in Colombia access the SGSSS through affiliation with an EPS under either the Contributory or Subsidized Regime, depending on their economic capacity. For those without affiliation to any regime, the territorial entities assume expenses incurred in providing health care, as outlined in Article 236 of Law 1955 of 2019. According to the Ministry of Health and Social Protection (2022), the Social Security System comprises contributions to the Pension, Health, and Occupational Risk Systems. Contribution percentages vary, with 12.5% allocated to the General Health System, 16% to the General Pension System, and 0.522% to 6.960% to the General System of Occupational Risks. Additionally, independent workers contribute varying rates to Social Security, as specified.

Independent workers, who operate autonomously without an employment contract, contribute the same percentages to the social security system as employed workers, albeit with a significant difference in contribution responsibilities. While dependent workers typically contribute 4% each to health and pension, independent workers are responsible for the full percentages. Oversight of these contributions falls under the purview of the Pension and Parafiscal Management Unit (UGPP), a national entity under the Ministry of Finance and Public Credit, established by Article 156 of Law 1151 of 2007. The UGPP verifies and supervises independent workers and companies to ensure correct and timely contributions to the SSS. It also oversees the recognition of pension rights, including pensions, pension bonds, and funeral aid, among others (Rios-Herrera et al., 2017).

1.3.3. Legal bases

In Law 1607 of 2012, Article 178 established the Special Administrative Unit of Pension Management and Parafiscal Contributions of Social Protection (UGPP) as the competent entity for determining and collecting Parafiscal Contributions of Social Protection. The UGPP is tasked with addressing cases of omission, inaccuracy, and delay, prioritizing actions to ensure compliance with obligations owed by contributors. Thus, it serves as the supervisory body for both natural and legal persons contributing to the social security system, including employees and independent workers (Congreso-de-la-Republica, 2012). Law 6 of 1992, Article 133, stipulates that inspection and collection processes related to contributions to entities such as the National Learning Service (SENA), the Social Security Institute (ISS), the Colombian Institute of Family Welfare (ICBF), and Family Compensation Funds must be conducted by each respective entity. These contributions are vital for the sustainability and support of entities contributing to the social and technical development of workers (Congreso-de-la-Republica, 1992). Article 26 of Law 1393 of 2010 mandates that the celebration and fulfillment of service provision contracts be contingent upon verification by the contracting party of affiliation and contribution payments to the social protection system, in accordance with regulations set by the National Government.

Regarding the calculation of the Income Base Contribution (IBC) for independent workers, total gross income received during the period must be considered, along with necessary costs and deductions for their activities, in adherence to principles of proportionality and necessity. Independent workers are required to compare their monthly income against expenses to determine the IBC, which must not fall below the current legal minimum wage or exceed 25 times the Legal Monthly Minimum Wage (S.M.L.V). However, discrepancies in these standards, applied by companies handling contribution requirements for the social security system, have led to errors in the IBC calculation, impacting the cash flow of independent individuals. Consequently, these highlights disparities faced by independent workers contracting with such companies, as they bear higher social security contribution costs compared to legal entities exempt from this calculation (Salgado Morales, 2024).

1.4. Aim of this work

Through the comprehensive analysis of BA for Pension Funds in Colombia and Implications aims to: 1) Investigate the current state of research on pension funds in Colombia and explore the historical development and changes in the field over time; 2) identify and analyze the practical implications of the research findings on pension funds; 3) highlight the importance of effective pension policy formulation and financial planning in the context of an aging population and changing socio-economic dynamics; 4) systematically review scholarly publications related to pension funds in Colombia within a specified timeframe (1987 to 2023); 5) utilize keywords and filters to identify relevant articles in the Scopus database, and quantitatively assess metrics such as publication trends, citation counts, international collaboration, and authorship dynamics; 6) discern the key themes and contributors shaping the discourse on pension funds in Colombia, and 7) Identify research gaps, particularly in areas such as the socio-economic impact of pension policies.

2. Materials and methods

For the development of this research, dogmatic legal research was chosen as the methodology, given that the information is primarily sourced from legal norms, jurisprudence, and other relevant documents derived from secondary sources such as labor laws, the Constitution, web documents pertaining to the subject matter, jurisprudence from the Constitutional Court, and related materials. This approach entails conducting a documentary analysis that integrates both qualitative and quantitative aspects, allowing for an examination of legal provisions in conjunction with real-world application. The documentary analysis technique will be employed to gather information from these sources, involving the identification, compilation, and analysis of all documents and regulations pertinent to topics including the right to equality, the functions of the UGPP, sanctions applicable to independent workers, and the legal nature of entities engaged in commercial activities (Jimenez Rodrigo, 2020).

2.1. Bibliometric analysis (BA)

According to García-León et al., 2021, bibliometrics is the science that allows the quantitative analysis of scientific production through literature, with the aim to know the evolution of a specific scientific discipline to observe thematic trends over the years, which allows to obtain quantitative information about publication metrics, geographical points, author collaboration, top research institutions, and the most relevant journals (García-León et al., 2021). Bibliometrics applies statistical and mathematical methods to written sources that contain elements such as language, keywords, descriptions, article title or journal in the publication, authors, type of document, language, and abstract. On the other hand, the BA is also called statistical bibliography due to its need to count or summarize existing publications; its main function is quantifying scientific production (articles and books). The BA was developed using RStudio® software with the BiblioShiny platform and Bibliometrix library (Aria and Cuccurullo, 2017), considering that this software is one of the most used free programs to perform bibliometric analysis on the study related to the

research topic or subject (Aguillo, 2012).

Also, the methodology proposed in **Figure 1** was considered to develop the BA about the Pension Funds in Colombia and Implications considering the three steps, described as follows:

Step I: Topic research: In the initial phase, the research topic “Pension Funds in Colombia and Implications” is defined. This step includes a broad scope, encompassing all subject areas, languages, and document types. It serves as the foundation for the research journey, ensuring inclusivity and a comprehensive understanding of the subject matter.

Step II: Data collection: The second step involves systematic data collection to support the research objectives. Researchers will employ Microsoft Excel software, utilizing the CSV (Comma-Separated Values) format for efficient data organization. Additionally, Scopus, a reputable data source, will be utilized to acquire a diverse range of research materials and publications relevant to Pension Funds in Colombia and Implications.

Step III: Scientific production: The final step focuses on synthesizing the collected data and generating scientific output. Researchers will utilize the wealth of information gathered in Step II to conduct in-depth analyses and create scientific content. This phase aims to contribute valuable knowledge to the field, potentially resulting in research papers, reports, presentations, or other forms of scientific communication (García-León et al., 2023). Besides, the workflow proposed by García-León et al. (2021) was used to develop the BA in this work with the data compiled from the Scopus database step by step.

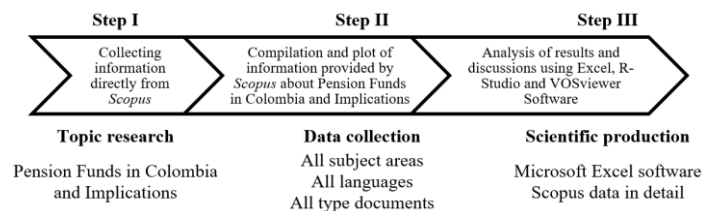


Figure 1. Methodology proposed for the BA.

On the other hand, bibliometric measures such as the h-index and m-index are utilized to evaluate the impact and productivity of a researcher’s scholarly work. The h-index, or Hirsch Index, is a numerical indicator that seeks to capture both the productivity and citation impact of a researcher’s work. For instance, an author has an h-index of h if they have h publications that have been cited at least h times each. The m-index, also known as Egghe’s g-index, complements the h-index by considering the average citation rate of a researcher’s publications. It is defined as the h-index divided by the number of years since the researcher’s first publication (Gisbert and Panés, 2009).

2.2. Data compilation/collection

The detailed information regarding scientific production (including title, abstract, author, keywords, total citations per document, affiliation, among others) was collected on December 22nd, 2023, directly from the Scopus database. The search focused on scientific publications related to biomaterials in concrete for

engineering applications, covering documents published from 2001. The search equation used was: ((pension) AND (Colombia)), resulting in a total of 71 documents found. It is noteworthy that other search equations were attempted, but no documents were retrieved, likely due to the relatively low publication volume on this topic in Colombia, which remains of great interest to researchers in related fields (Jaramillo et al., 2023).

3. Results and discussion

3.1. Main results about the BA

The bibliometric analysis (BA) unveiled a significant increase in the number of publications concerning the studied topic. **Table 1** presents the overall statistical analysis results of the BA conducted on Pension Funds in Colombia and their Implications. It's important to note that a total of 71 documents were analyzed and written in English, as this is the predominant language for scientific production worldwide.

Table 1. BA results.

Description	Result
Timespan	1987–2023
Source	58
Average years from publication	71
Average citations per document	8.37
Average citations per year per doc	4.56
References	0.52
Keywords Plus (ID)	189
Author's Keywords (DE)	235
Document types	
Article	58
Conference-paper	1
Review-article	5
Book-chapter	4
Book	2
Others	1
Authors	
Authors	142
Author Appearances	158
Authors of single-authored documents	23
Authors of multi-authored documents	119
Single-authored documents	25
Documents per Author	0.5
Authors per Document	2
Co-Authors per Documents	2.23
Collaboration Index	2.7

3.2. Documents summary

The analysis, which was conducted based on 71 documents, highlights a noteworthy rise in publications from 1987 to 2023. This suggests that the data and publications scrutinized span a period of 36 years, with an average annual growth rate of 5.37%, which is relatively moderate compared to other fields of significant importance. This trend is visually represented in **Figure 2**, where the blue bars depict the number of articles published each year, and the black line shows the cumulative count of articles over the years.

Upon examining the breakdown of document types as outlined in **Table 1**, it becomes evident that research articles make up the majority at 81.69%, followed by review articles at 7.04%. The remaining 11.27% comprises various formats such as books, book chapters, and conference papers. Additionally, it's worth noting that the observed increase in publications reflects a growing interest and activity within the field, likely fueled by advancements in technology, evolving research methodologies, and increased interdisciplinary collaboration.

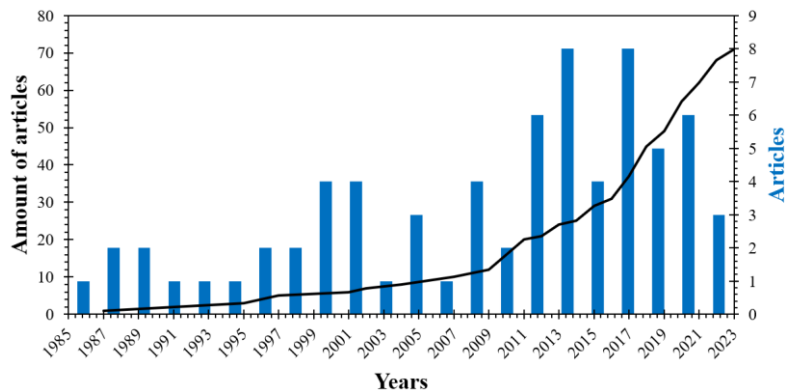


Figure 2. Consolidated publications and number of articles across the years.

3.3. Evolution of the keywords across the years

The analysis involved the extraction and examination of keywords based on their document frequency. Keywords serve as pivotal descriptors for research topics, facilitating improved visualization and targeted searches for specific subjects within databases. To conduct the bibliometric analysis (BA), Author Keywords (AK) were utilized as they offer a more comprehensive representation compared to Keywords Plus (PK).

The study segmented five distinct time periods (1987–2011, 2012–2017, 2018–2020, and 2021–2023) to assess keyword frequency across the 71 collected documents, as depicted in **Figure 3**. Each line in the graph represents the relationship between keywords or synonyms used within each time period, distinguished by varying colors. Notably, certain keywords such as “Latin America,” “Colombia,” and “Social Security” emerged prominently across all periods. However, the analysis also tracked the evolution of keywords over the years, revealing a shift towards terms like “humans,” “health insurance,” and “pension system” in the most recent 5-year period (2018–2023). This evolution underscores the dynamic nature of research interests and the changing landscape of pension fund studies.

Understanding the growth of specific keywords in publications on Pension Funds in Colombia is paramount for comprehending the evolving research landscape, prioritizing areas of focus, and ensuring responsiveness to current challenges and opportunities. This analysis provides valuable insights for researchers, policymakers, financial practitioners, and other stakeholders involved in pension fund management and regulation.

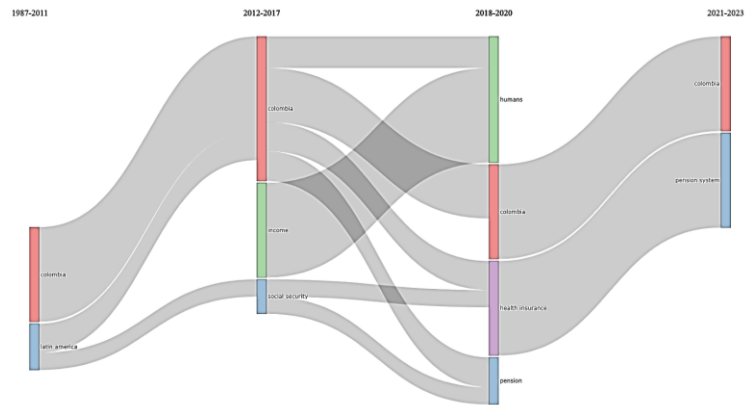


Figure 3. Evolution of the Author’s keywords in four different periods of time.

Evolution of the categories of taxpayers to the obligations towards the SGSS in the Colombian legal order

Pre-Independence era and greater Colombia (19th century): During the colonial era, the tax system primarily revolved around tributes imposed on the native population by the Spanish crown. These tributes were enforced through the “encomienda” system, which involved assigning groups of indigenous people to Spanish colonizers. Under this system, indigenous individuals were obligated to pay tribute to the crown and perform labor for the colonizers. Additionally, alcabalas, which were taxes levied on the sale of merchandise, were significant during this period.

Following Colombia’s independence, efforts were made to establish an appropriate fiscal framework for the nation. In 1821, during the era of Gran Colombia, the first taxes on real estate and personal income were introduced. Throughout the 19th and 20th centuries: In 1870, an initial attempt to implement a tax system incorporating direct taxes was made, which included the introduction of income tax. However, it wasn’t until 1918, with the enactment of Law 48, that a clearer regulatory framework for taxation was established, marking a significant milestone in Colombia’s tax history as it provided more explicit guidelines and regulations.:

- 1) Income tax regulation: This law was crucial for the establishment and regulation of income tax in Colombia. It defined essential aspects such as the tax base, applicable rates and categories of income subject to tax.
- 2) Tax base: Established what components of income would be considered to determine the tax base and how it would be calculated.
- 3) Deductions: Provided guidelines on deductions that could be made from gross income to obtain taxable net income.

- 4) Rates: Established progressive rates for income tax, so that higher income corresponded to a higher tax rate.
- 5) Categorization: Introduced a first approach to the categorization of taxpayers, based mainly on income level.
- 6) Penalty regime: Like any tax law, establish sanctions and fines for those taxpayers who do not comply with their tax obligations, thus providing a control and collection mechanism for the state.

This statute was crucial in establishing an organized structure for the collection of income tax. Although it has been modified and adjusted on multiple occasions over the years, it laid the foundations for the development of the Colombian tax system. In 1932, the Colombian Tax Statute (ETC) was expanded, marking the first systematic compilation of tax regulations. It defined various categories of taxpayers, considering the following aspects:

- 1) Direct and indirect taxes: The statute established a clear differentiation between direct taxes (those that tax people's income and assets) and indirect taxes (that fall on consumption, such as value added tax—VAT).
- 2) Income tax: This statute regulated the income tax, defining the parameters for determining the tax base and the applicable rates. It introduced a progressive rate system based on income levels, meaning that higher incomes corresponded to higher tax rates.
- 3) Categories of taxpayers: The Tax Statute of 1932 developed different categories of taxpayers based on the economic capacity of individuals and companies. Some of the most notable categories were taxpayers from the first to the fifth category, which considers all salary ranges and types of hiring.
- 4) Sanctions and fines: The statute established sanctions and fines for taxpayers who did not comply with their tax obligations, with the objective of ensuring compliance with tax laws.

During the 1980s, efforts were made to modernize the tax system in Colombia. The value-added tax (VAT), an indirect tax, was introduced during this period. In 1986, a tax reform was implemented, which adjusted rates and aimed to simplify the system. Concepts like withholdings at source were introduced, and taxpayers were categorized based on their economic capacity. Law 75 of 1986 was a significant milestone in the modernization of the Colombian tax system, aiming to make it more equitable, efficient, and simple. This reform brought about substantial changes in terms of structure, rates, and, most importantly, the categorization of taxpayers.

The categorization of taxpayers by economic capacity and the simplification of rates aimed to ensure that everyone contributed their fair share without imposing an excessive burden on those with lower incomes. Subsequent reforms and adjustments have been made, but Law 75 remains an important reference point in Colombia's tax history. Then some key aspects introduced by the 1986 tax reform:

- 1) Categorization by economic capacity: Taxpayers were classified based on their economic capacity, with different tax regimes established for different types and sizes of entities or individuals. This included special regimes for large companies and simplified regimes for small businesses and merchants.

- 2) Progressive rates: Income tax rates were adjusted to be progressive, meaning higher rates for higher incomes and lower rates for lower incomes. The number of brackets was reduced, making the system more transparent.
- 3) Withholding at source: The withholding mechanism at source was strengthened to ensure collection and simplify tax declaration and payment. Certain payments, such as salaries and fees, had taxes automatically deducted before being paid to the beneficiary.
- 4) Simplified regime: A simplified regime was introduced for small merchants and businesses, aiming to reduce administrative burden and encourage formalization. The rates in this regime were also simplified.

In the 1990s, new tax reforms aimed to improve equity, simplify the system, reinforce VAT, withholding at source, reclassify taxpayers, impose sanctions, and offer tax incentives. In the early 21st century, reforms focused on increasing tax revenues, reducing evasion, and better defining taxpayers’ obligations and rights. Large taxpayers were identified for specific regulations and controls, considering their significant role in tax collection. The tax reforms of 2012 and 2016 aimed to improve progressivity and strengthen income tax. Specific categories were established for taxpayers, reflecting the country’s fiscal needs, and striving for a fair distribution of the tax burden.

Overall, the Colombian tax system classifies taxpayers based on various criteria, including the nature of their income, economic activity, and economic capacity. These classifications have evolved over time to adapt to changing needs and improve equity in the system. In addition to tax obligations, taxpayers also have obligations regarding the General Social Security System (SGSS). Law 100 of 1993 was a landmark legislation that integrated health, pension, and professional risk systems into a unified system, with specific contribution obligations for employers and workers. The regulatory framework categorizes taxpayers into natural persons and legal persons, with subcategories based on economic activity and applicable tax regime. The Unified Health Social Security (SGSS) was created to ensure access to health, pensions, and protection against occupational risks for all citizens.

Figure 4 displays the twenty most frequent keywords extracted from the research. “Colombian” and “Social Security” are among the most common words, reflecting the importance of social and economic subjects in the publications analyzed. These keywords facilitate optimization in practices and guidelines, promoting innovation and market viability.

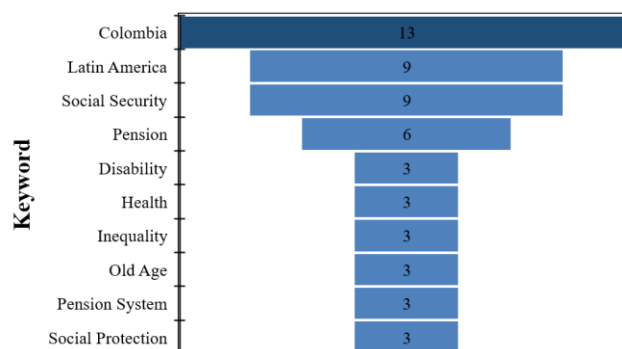


Figure 4. Twenty most popular/frequent keywords.

Figure 4 is complemented by **Figure 5**, which provides visual information about the co-occurrence of principal keywords and their interactions. A similar pattern is observed, but in networks of occurrence, appearance, and areas. Notably, out of the 235 keywords found, “Colombia” appears more than 500 times, emerging as the most prominent subject, alongside “Latin America,” “social security,” and “pensions,” each representing approximately 3.0 percent of appearances.

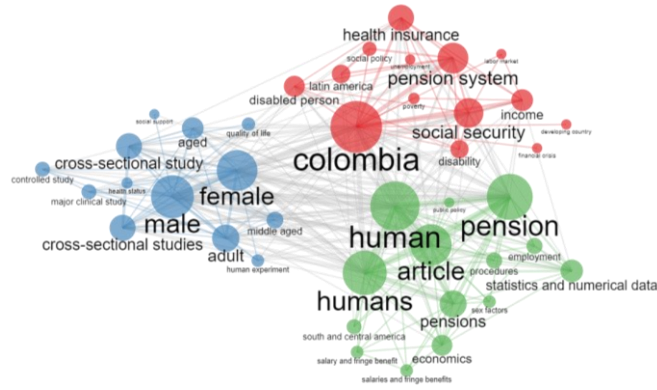


Figure 5. Co-occurrence between the keywords.

In this manner, studies focusing on pensions within the realm of social sciences have analyzed various factors influencing the pension system, including social security, adult demographics, economics, and other relevant topics. This analysis aims to compare performance with Colombian standards and guidelines.

The interaction between keywords and their frequency of appearance by area is depicted in **Figure 6**. Out of the 235 keywords identified in the BA, approximately twenty keywords appear around 10 times in publications, with higher occurrences noted after 2015, coinciding with the increase in publications related to Colombian pension funds (refer to **Figure 5**).



Figure 6. Keywords related to appearance times.

As represented, five circles represent areas of keywords analyzed, associated with motor themes (blue, purple, and green), basic themes (pink), niche themes (not provided by the number of published documents), and emerging themes (orange). Each circle represents keywords from studies focusing on this significant and emerging topic, depending on the country and authors’ focus. However, it is

observed that niche themes do not provide information, in contrast to basic, motor, and emerging themes (such as financial crisis), as observed.

Figure 7 presents a time-series dataset related to pension funds in Colombia, focusing on gender distribution and various factors such as social security, human aspects, and the number of articles (occurrences). It is evident that there has been a consistent growth in the number of pension funds in Colombia over the years, with a notable increase observed from 1998 onwards. The most significant growth occurred between 2017 and 2022, indicating a period of substantial development and potentially increased focus on pension-related initiatives. Furthermore, the representation of both male and female pension funds has increased over time, reflecting a trend towards inclusivity in the pension system. This gender representation in pension funds mirrors an increasing awareness of gender equity considerations within the pension landscape.

The steady increase in the number of pension articles and contributors (authors, researchers, or contributors) from 2007 onwards suggests a growing interest in and contribution to the academic discourse on pension funds in Colombia. This rise in pension-related articles indicates a growing academic and intellectual interest in understanding and potentially addressing challenges and opportunities within the Colombian pension system (refer to **Figure 7b**). Moreover, in **Figure 7c**, a dendrogram derived from the keywords of the BA was obtained to elucidate areas related to the subject studied. Dendrogram analysis could benefit researchers and decision-makers in identifying commonalities or disparities among pension funds, facilitating a nuanced understanding of the pension fund landscape in Colombia and its potential implications for policy and practice.

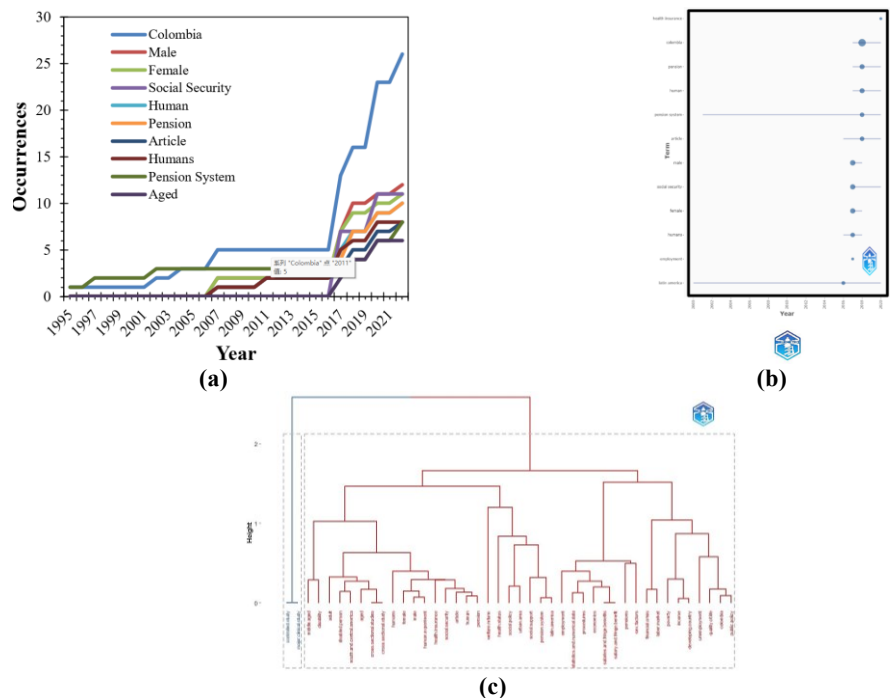


Figure 7. Top 10 keywords across the years. **(a)** behavior; **(b)** trend topic; **(c)** dendrogram.

Over the years, modifications have been made to tax and social security regulations in Colombia, aiming to strengthen the system and ensure greater coverage and protection. Some important milestones in the evolution of taxpayer categories and their obligations towards the SGSS are:

- Law 100 of 1993: This law established the General Social Security System in Colombia, introducing significant changes in health, pensions, and occupational risks. It mandated joining the system and making corresponding contributions.
- Creation of the Special Administrative Unit for Pension Management and Parafiscal Contributions of Social Protection (UGPP): The UGPP was established in the National Development Plan 2006-2010 (Law 1151 of 2007) as an entity attached to the Ministry of Finance and Public Credit. It was endowed with legal status, administrative autonomy, and independent assets.

The UGPP's functions are twofold: firstly, to recognize pension rights accrued by administrators of the National Average Premium Regime and national public entities in liquidation, and secondly, to monitor, collaborate, and ensure the adequate, complete, and timely liquidation and payment of parafiscal contributions of Social Protection. This provision was regulated by Decree 169 of 2008, outlining the Unit's functions. Additionally, Article 123 of Law 1438 of 2011 established the UGPP's role in verifying compliance with the duties of employers and other obligated contributors regarding the payment of social security contributions.

- 2016 tax reform: This reform introduced changes in withholding rates at source and contributions to the social security system, aiming for greater equity and progressivity in the tax system.
- Law 1819 of 2016: This law made modifications to the Colombian Tax Statute, establishing changes in the tax regimes applicable to natural and legal persons, as well as in the rates and conditions of withholding at source.

However, these modifications have not ensured the guarantee of the principle of equality, which is the focus of this study. There remains a differentiation in the imposition of sanctions for non-compliance with the obligation to contribute to the SGSS between independent workers and sole proprietor legal entities. Despite efforts and legal evolution, this differentiation represents a violation of rights such as tax equity and constitutional equality. The normative reality does not align with the practical reality, where legal entities are ultimately supported by natural persons. Therefore, obligations and sanctions for non-compliance should be equal and equitable for both types of individuals.

Figure 8 presents two conceptual clusters considering Author Keywords (AK). Cluster 1, represented by red with a 71.96% share, includes employment, social policy, welfare reform, social security, and other related subjects. Cluster 2, with a lesser proportion (10%), is related to controlled studies and variables. The evolution of pension funds in Colombia offers valuable quantitative information, but a deeper understanding would require additional context, especially regarding the "Social Security" and "Human" categories. The observed trends in gender representation and academic contributions suggest a dynamic and evolving pension landscape in Colombia.



Figure 8. Conceptual structure map for all keyword analyzed by clusters.

3.4. Most important journals

58 journals contain the 71 documents utilized in the BA. These documents were predominantly published in quartiles Q1, Q2, and Q3, authored by 142 individuals, of which 16 had occurrences in publications. The top 20 most relevant journals account for 37.97% of the total documents, as depicted in **Table 2**. Both the h-index and m-index are quantitative tools commonly employed in academic and research settings to evaluate and compare the impact of scholars. While the h-index highlights the impact of a researcher’s most highly cited works, the m-index incorporates the temporal aspect by considering the duration of the researcher’s career. Researchers and institutions may utilize these indices to assess academic productivity, often alongside other metrics, when evaluating scholarly contributions.

Table 2 provides data on various academic journals related to topics such as management, globalization, development, aging studies, international development, health affairs, pension systems, public health, and economics. Each journal is evaluated based on its h-index, m-index, total citations (TC), number of publications (NP), and start year. From the data, it is observed that most journals have relatively low h-indices, ranging from 1 to 2, indicating that they have a limited number of highly cited publications. The m-index also tends to be low, suggesting that the average citation rate of the publications is not very high.

Table 2. Twenty most local relevant journals.

Source	h_index	m_index	TC	NP	Start year
Estudios gerenciales	2	0.13	7	3	2009
Journal of globalization and development	1	0.13	35	1	2016
International social security review	1	0.03	17	1	1995
Journal of aging studies	1	0.04	13	1	2001
Journal of international development	1	0.10	12	1	2014
Health affairs	1	0.17	11	1	2018
Economic challenges of pension systems	1	0.25	5	1	2020

Table 2. (Continued).

Source	h_index	m_index	TC	NP	Start year
Ensayos sobre politica economica	1	0.07	5	1	2010
International journal of public health	1	0.14	5	1	2017
America Latina hoy	1	0.11	3	1	2015
Ethnic and racial studies	1	0.25	3	1	2020
Handbooks of sociology and social research	1	0.11	3	1	2015
CIRIEC-Revista de economia publica, social y cooperativa	1	0.17	2	1	2018
Economia	1	0.20	2	1	2019
International journal of housing markets and analysis	1	0.50	2	1	2022
Journals of gerontology-series B	1	0.33	2	1	2021
Pension reform in Latin America	1	0.17	2	1	2018
Iatreia	1	0.17	1	1	2018
Lecturas de economia	1	0.06	1	1	2007
Pensions: Challenges and reforms	1	0.14	1	1	2017

The most relevant journal observed is Estudios Gerenciales, an Ibero-American journal of administration and economics not indexed in Scopus but primarily focused on thematic subareas such as organizational management, entrepreneurship, business innovation, marketing, accounting, finance, strategy, international business, and business economics. This journal boasts an h-index of 2 with 3 publications and 7 total citations since its inception in 2009, when the first article on the topic under study was published. On the other hand, the Journal of Globalization and Development has amassed a total of 35 citations from a single document published in 2016.

Figure 9 illustrates the evolution of the five most relevant journals over the years, showcasing the impact and trajectory of each publication. Notably, Estudios Gerenciales stands out as the most impactful journal in the field, particularly regarding Pension Funds in Colombia and its implications, with a significant article published in 2009.

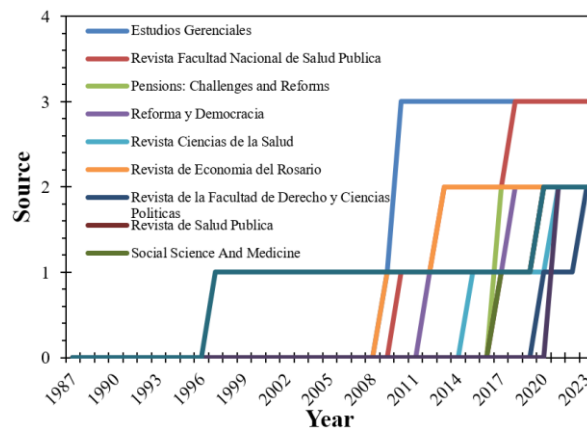


Figure 9. Evolution of the eleventh more relevant journals across the years.

Among the listed journals, the International Journal of Housing Markets and Analysis stands out with an h-index of 1 and an impressive m-index of 0.50, suggesting a publication with a substantial impact relative to its size. Similarly, Ethnic and Racial Studies also demonstrates a high m-index of 0.25, indicating a notable citation rate for its publications. In terms of total citations, the Journal of Globalization and Development leads with 35 citations, followed by the International Social Security Review with 17 citations. However, these numbers are relatively low compared to mainstream journals in the field.

Most of the listed journals have relatively recent start years, with many established in the 2010s and 2020s, indicating their emergence as new players in their respective fields. Overall, the analysis of these journals provides insights into the academic landscape related to management, globalization, development, aging studies, health affairs, and economics. While some journals exhibit promise with their citation rates and impact, others may still be in the process of establishing themselves within their fields.

3.5. Most relevant authors

Table 3. First 10 most relevant authors from BA.

Element	Local					Most relevant document from Scopus profile	Document citations
	h_index	m_index	TC	NP	Start year		
Barrientos, A	2	0.07	17	2	1997	Aerial remote sensing in agriculture: A practical approach to area coverage and path planning for fleets of mini aerial robots	218
Avendano, M	2	0.29	16	2	2017	Socioeconomic status and the 25 × 25 risk factors as determinants of premature mortality: a multicohort study and meta-analysis of 1.7 million men and women	715
Cuadros-Meñaca, A	1	0.25	13	1	2020	Remittances, health insurance, and pension contributions: Evidence from Colombia	13
Bonizzi, B	1	0.33	12	1	2021	Financialization in Developing and Emerging Countries: A Survey	102
Churchill, J	1	0.33	12	1	2021	Evaluation of the Illumina® Beta Version ForenSeq™ DNA Signature Prep Kit for use in genetic profiling	171
Abadía-Barrero, CE	1	0.14	7	1	2017	Syndemic vulnerability and the right to health	129
Buitrago-Echeverri, MT	1	0.14	7	1	2017	Work-related illness, work-related accidents, and lack of social security in Colombia	7
Buchely, L	1	0.09	4	1	2013	Bureaucratic activism and Colombian community mothers: The daily construction of the rule of law	8
Chois, PML	1	0.09	4	1	2013	Perceptions of peer tutoring in academic writing	11
Almeida, P	1	0.11	3	1	2015	Opportunity Organizations and Threat-Induced Contention: Protest Waves in Authoritarian Settings	249

Note: TC means total citations and NP is the number of publications.

Table 3 presents the first 10 most important authors on the topic of Pension Funds in Colombia and Implications. Barrientos (1997) exhibits a relatively low h-index and m-index, yet the most relevant document boasts a substantial number of citations (218). This suggests that while the individual's overall impact may be

moderate, there exists a specific work that has garnered significant attention. Avendano, M, demonstrates a moderate h-index and m-index, with the most relevant document accumulating a high number of citations (715). This indicates a consistent impact over the years, particularly attributable to an influential publication. Bonizzi, B, displays a relatively high m-index, indicating sustained impact relative to the duration of their academic career. The most relevant document by Bonizzi, B, has also accumulated a substantial number of citations (102). Lastly, Almeida, P, exhibits a low m-index and h-index, but the most relevant document has garnered a remarkably high number of citations (249). This suggests the potential impact of an individual publication.

The production of the top ten authors across the years is depicted in **Figure 10**, revealing fluctuating publication patterns among the authors, which may contribute to a lack of consistency in the number of documents in this scientific field. Overall, the individuals listed in the table possess diverse academic profiles, characterized by varying levels of impact, productivity, and duration of their academic careers. The substantial number of citations for the most relevant documents underscores the notable influence of certain works within their respective fields. Researchers and institutions may utilize these metrics to evaluate the scholarly impact and productivity of individuals, while academic administrators might consider such metrics when assessing faculty contributions. Additionally, collaborators and peers can use this information to identify influential researchers for potential collaborations. It is important to note, however, that while quantitative metrics offer valuable insights, they represent only one aspect of evaluating academic contributions, and qualitative assessments of the actual content and impact of publications are equally crucial.

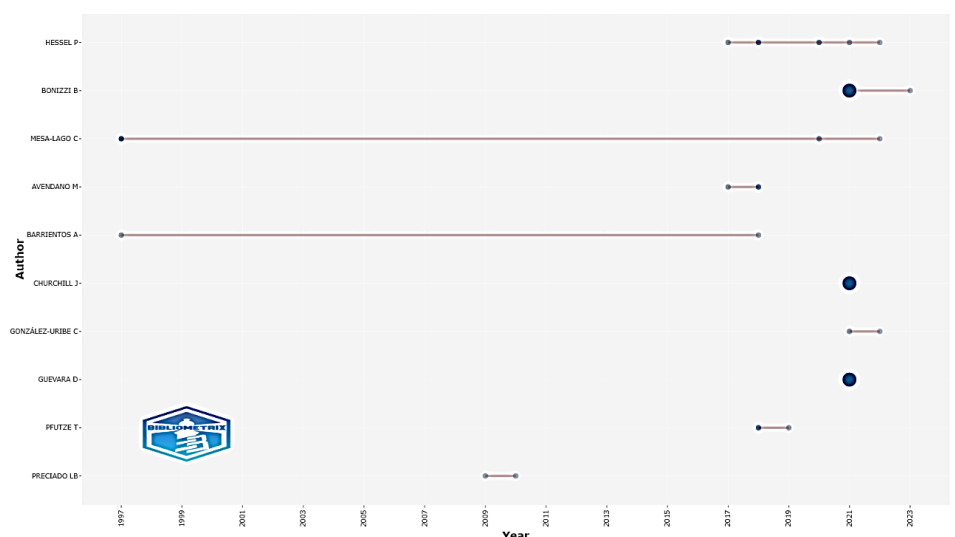


Figure 10. Ten top authors production across years.

3.6. Most local cited documents (from the BA)

Table 4 presents a compilation of the 10 most significant documents extensively cited by the local references (LC) analyzed in this study. These documents were published across different journals, focusing on topics pertaining to

Pension Funds in Colombia and Implications in the social sciences, spanning from 2011 to 2021. The notable increase in publications in this field, as observed in **Figure 2**, underscores a relatively recent and ongoing interest in these subjects within the academic community.

Table 4. Most local 10 cited references.

Author	Document title	Journal	DOI	Year	Local citations	Global citations	References
Mesa-Lago L	Social welfare reform in the context of economic-political liberalization: Latin American cases	World Development	10.1016/S0305-750X(96)00125-8	1997	0	64	Mesa-Lago (1997)
Bruno B, et al.	Variegated financialization and pension fund asset demand: the case of Colombia and Perú	Socio-Economic Review	10.1093/ser/mwa a033	2021	0	12	Bonizzi et al. (2021)
Hessel P, et al.	Social Pension Income Associated with Small Improvements in Self-Reported Health of Poor Older Men in Colombia	Health Aff (Millwood)	10.1377/hlthaff.2017.1284	2018	0	11	Hessel et al. (2018)
Buitrago Echeverri MT, et al.	Work-related illness, work-related accidents, and lack of social security in Colombia	Social Science & Medicine	10.1016/j.socscim ed.2017.06.030	2017	0	7	Buitrago Echeverri et al. (2017)
Olarte L and Peña X	El efecto de la maternidad sobre los ingresos femeninos	Revista Ensayos Sobre Política Económica	10.32468/espe.6305	2010	0	5	Olarte and Peña (2010)
Muñoz A and Choís P	Salud, trabajo e informalidad en el Cauca, Colombia	Revista Facultad Nacional de Salud Publica	10.17533/udea.rfn sp.13292	2013	0	4	Muñoz and Choís (2013)
Buchely L	Overcoming Gender Disadvantages. Social Policy Analysis of urban middle-class women in Colombia	Revista de Economía del Rosario	redalyc.org/pdf/5095/509555097006.pdf	2013	0	4	Buchely et al. (2013)
Preciado B and Roger VC	How to develop an investment portfolio considering the different alternatives that voluntary pension funds offer in Colombia: The Case of Skandia	Estudios Gerenciales	10.1016/S0123-5923(09)70097-X	2009	0	3	Preciado and Roger (2009)
Vásquez-Trespalcios EM and Martínez-Herrera E	Políticas públicas en seguridad social para la protección de los trabajadores informales en Colombia	Revista Gerencia y Políticas de Salud	redalyc.org/pdf/545/54526806006.pdf	2013	0	3	Vásquez-Trespalcios and Martínez-Herrera (2013)
Overbye E	Pensions: Challenges and Reforms	Routledge	10.4324/9781351151801	2018	1	1	Overbye (2018)

The articles primarily delve into financial crises, health insurance, and economic practices. Most of these articles are published in journals related to social sciences, underscoring the significance of these subjects within the pension system in Latin America and social policy. The Total Citation (TC) count for each article reflects their impact and influence within the research community. Notably, several articles have garnered a substantial number of citations, underscoring their importance in the field. Some of these articles are reviews or overviews, synthesizing existing research and offering comprehensive insights into specific topics.

Among the documents, Mesa-Lago’s article titled “Social welfare reform in the context of economic-political liberalization: Latin American cases” emerges as the

most relevant reference related to the studied topic, with 64 global citations. Following closely is Bruno’s article titled “Variegated financialization and pension fund asset demand: the case of Colombia and Peru” with 12 global citations. Finally, Hessel’s article titled “Social Pension Income Associated with Small Improvements in Self-Reported Health of Poor Older Men in Colombia” secures the third position with 11 global citations.

Overall, the publications cover a diverse array of topics related to social welfare, pensions, health, and gender issues in Colombia. The varying levels of global citations indicate the international impact of these studies, highlighting their relevance beyond the local context. Furthermore, these publications contribute significantly to the global academic discourse on social and economic issues, showcasing the research output from Colombian scholars and researchers.

Table 5. Most global relevant documents.

Author	Document title	DOI	Total Citations	References
Mesa-Lago C	Social welfare reform in the context of economic-political liberalization: Latin American cases	10.1016/S0305-750X(96)00125-8	64	Mesa-Lago (1997)
Lustig N	Inequality and Fiscal Redistribution in Middle Income Countries: Brazil, Chile, Colombia, Indonesia, Mexico, Peru and South Africa	10.1515/jgd-2016-0015	35	Lustig (2016)
Kritzer BE, et al.	Next generation of individual account pension reforms in Latin America	https://pubmed.ncbi.nlm.nih.gov/21466033/	28	Kritzer et al. (2011)
Queisser M	Chile and beyond: The second-generation pension reforms in Latin America	10.1111/j.1468-246X.1995.tb00444.x	17	Queisser (1995)
Gómez-Salcedo MS, et al.	Quality of Work Life in Colombia: A Multidimensional Fuzzy Indicator	10.1007/s11205-015-1226-9	15	Gómez-Salcedo et al. (2017)
Barrientos A	The Changing Face of Pensions in Latin America: Design and Prospects of Individual Capitalization Pension Plans	10.1111/1467-9515.00063	15	Barrientos (1997)
Williamson JB. 2001	Privatizing public pension systems: Lessons from Latin America	10.1016/S0890-4065(01)00024-X	13	Williamson (2001)
Cuadros-Meñaca A	Remittances, health insurance, and pension contributions: Evidence from Colombia	10.1016/j.worlddev.2019.104766	13	Cuadros-Meñaca (2020)
Bonizzi B	Variegated financialization and pension fund asset demand: the case of Colombia and Perú	10.1093/ser/mwaa033	12	Bonizzi et al. (2021)
Olivera J and Zuluaga B	The ex-ante effects of non-contributory pensions in Colombia and Peru	10.1002/jid.3008	12	Olivera and Zuluaga (2014)

On the other hand, **Table 5** summarizes the most globally relevant documents related to the analyzed topic, with author Mesa-Lago, L being one of the foremost contributors with several significant publications. This compilation of scholarly works offers a nuanced exploration of social welfare and pension reforms in Latin American countries. Covering diverse dimensions of economic and political changes, the selected publications delve into critical aspects such as inequality, fiscal redistribution, individual account pension reforms, and the multifaceted quality of work life. Each work contributes to the evolving discourse on the design,

implementation, and consequences of pension systems in the region. Collectively, these works significantly enhance the academic understanding of pension and social welfare reforms in Latin America, offering valuable insights into the challenges, prospects, and multidimensional aspects of these complex policy domains.

Figure 10 presents a summary of research citations for the main countries, alongside the frequency of articles and the average number of citations per article. The total number of citations reflects the overall impact and influence of research from each country. Colombia has collaborated extensively with Spain, the UK, and the USA, as evidenced by the keywords used in the article titles and the affiliation of the authors.

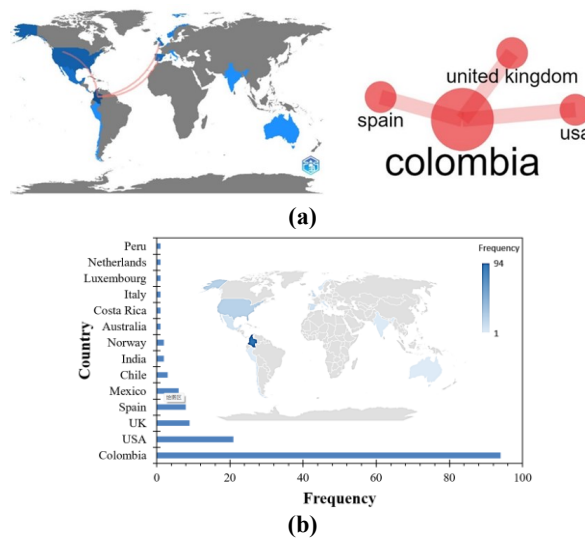


Figure 10. Countries. (a) Collaboration map; (b) Top 14 by scientific production.

Figure 11 shows the relationship between country, authors, and keywords; as was observed in the previous **Figure 10**, the relevant countries are Colombia, the UK, the USA, and Spain, and with less contribution, Mexico, and Costa Rica. In this way, authors such as Hessel has used more keywords related to his research on Colombia, Latin America, Pension, Social protection, health, and inequality, which have worked with the UK and the USA as collaborative author partners.

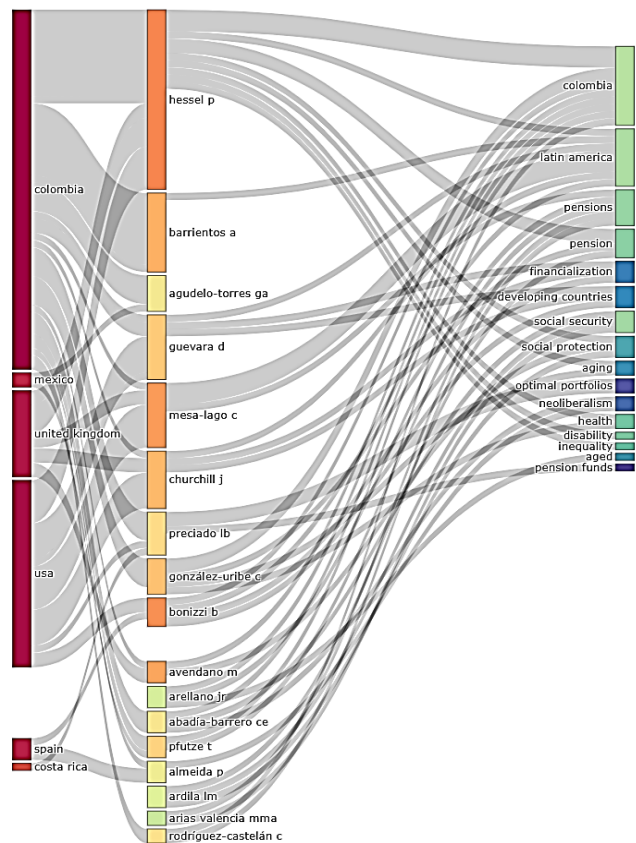


Figure 11. Relationship between country, authors and keywords.

3.7. Most relevant 20 institutions/universities

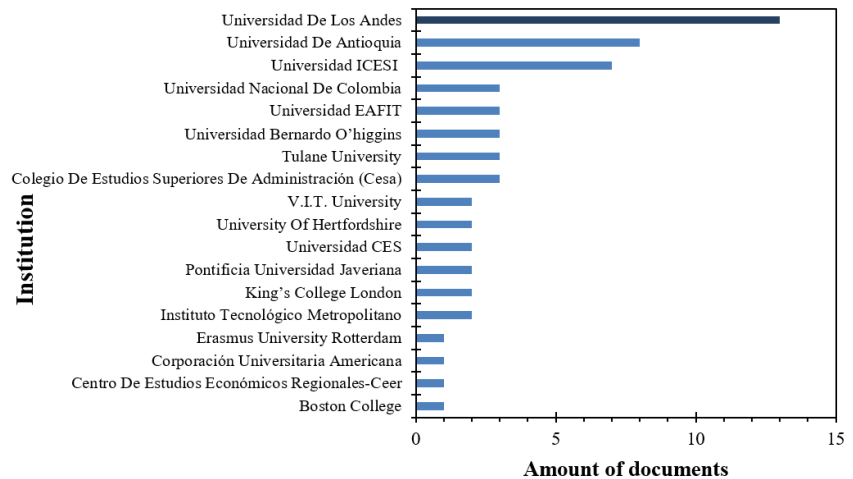


Figure 12. More relevant universities.

The most relevant institutions are presented in **Figure 12**. This plot was obtained by considering the number of publications and their frequency of appearance since 1987, based on the affiliation of the authors in the analyzed publications. The Universidad de los Andes emerges as the most important institution, with 13 articles, followed by the Universidad de Antioquia with 8 documents, and the Universidad ICESI in third place with 7 published papers. Together, these institutions account for a total of 39.44% (28 documents) of the

published works, while the remaining percentage (60.56%) pertains to institutions with fewer than 43 documents.

3.8. Collaboration between authors

Figure 13 illustrates the most significant collaborative networks identified in the BA. It is noteworthy that Rofman and Galiani predominantly conducted studies in collaboration with researchers from other countries, particularly the UK, the USA, and Spain, sharing a common focus on the theme of “Pension Funds in Colombia and Implications”. The collaborative networks are depicted in five distinct colors: red, blue, orange, purple, and green, representing authors from the same country who have formed alliances with fewer connections to researchers from other nations, specifically within the realm of social sciences literature.

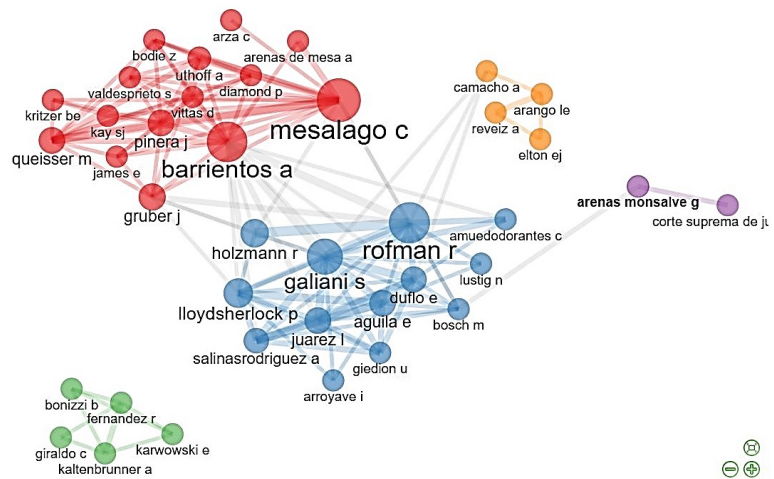


Figure 13. Collaborative networks between authors.

4. Trends and future research

The field of Pension Funds in Colombia and its implications is evolving, marked by various social trends and avenues for future research. These trends underscore an increasing interest in informing and anticipating regulatory changes in Colombia to mitigate losses and address societal inconveniences. Table 6 outlines some key trends and potential areas for future research.

Table 6. Trends and future research.

Variable	Detail
Integration of sustainable and responsible investment:	Future research could center on integrating sustainable and responsible investment practices within Colombian pension funds. Exploring how environmental, social, and governance (ESG) factors can be incorporated into investment strategies could align pension funds with global trends and promote socially responsible investing.
Technological innovations in pension management:	-
Behavioral economics in retirement planning:	Investigating the adoption of technology in pension fund management is crucial. Research could explore the implementation of fintech solutions, blockchain, and artificial intelligence to enhance efficiency, reduce costs, and improve overall performance and security in managing pension assets.
Longevity risk and retirement adequacy:	-

Table 6. (Continued).

Variable	Detail
Policy implications and reforms:	Understanding the behavioral aspects of individuals in their retirement planning is an emerging area. Future research may delve into behavioral economics to analyze how decision-making biases and psychological factors influence pension fund participation, contribution patterns, and withdrawal decisions.
Financial inclusion and access to pension services:	-
Adapting to economic and social trends:	With an aging population, assessing longevity risk and its impact on retirement adequacy is essential. Future studies could focus on developing models to estimate longevity risk, exploring strategies to mitigate its effects, and evaluating the adequacy of pension funds in providing for longer retirement periods.
Global economic factors impacting Colombian pension funds:	-
Innovative pension products and retirement income solutions:	Research could delve into the potential implications of policy changes and reforms on the pension system in Colombia. Analyzing the impact of regulatory adjustments, retirement age modifications, or changes in contribution structures on the effectiveness and sustainability of pension funds would be valuable for policymakers and stakeholders.
Adoption of outcome-based pension strategies:	-

5. Challenges and barriers

Table 7. Challenges and barriers.

Variable	Detail
Low pension coverage:	A significant challenge in Colombia is the low pension coverage, particularly among those in the informal sector who lack access to formal pension plans. Barriers to expanding coverage include informal employment practices, low-income levels, and limited awareness of pension benefits.
Informality and irregular income:	-
Sustainability of pension systems:	The prevalence of informal labor markets poses a barrier to consistent and adequate pension contributions. Workers in the informal sector often face irregular income streams, making it challenging to maintain consistent contributions to pension funds. Addressing this issue requires innovative solutions to accommodate the unique characteristics of informal employment.
Inadequate contribution levels:	-
Complex regulatory environment:	Ensuring the long-term sustainability of pension systems is a persistent concern. Factors such as demographic shifts, increasing life expectancy, and economic uncertainties can strain pension funds. Addressing the sustainability challenge involves implementing effective risk management strategies, adjusting contribution rates, and exploring alternative funding mechanisms.
Volatility in investment returns:	-
Longevity risk:	Many individuals contribute insufficient amounts to their pension funds, leading to concerns about the adequacy of retirement savings. Barriers to higher contributions include competing financial priorities, lack of financial literacy, and a perception that current contributions are adequate. Overcoming these barriers requires targeted financial education and incentive programs.
Public perception and trust:	-
Gender disparities in pensions:	The regulatory framework governing pension funds in Colombia can be complex, posing a barrier to efficient fund management. Compliance with evolving regulations and navigating administrative complexities can be challenging for both pension fund managers and contributors. Streamlining regulations and providing clearer guidelines may alleviate this challenge.
Impact of economic downturns:	-

Table 7 exposed main key variables related to the pension landscape in Colombia, highlighting significant challenges and considerations for policymakers, stakeholders, and researchers. These variables encompass various aspects of pension systems, including coverage, informality, sustainability, contribution levels, regulatory environment, investment returns, longevity risk, public perception, gender disparities, and economic downturns. Understanding these variables is essential for developing effective strategies to address existing challenges and enhance the overall resilience and effectiveness of pension systems in Colombia.

6. Disciplinary processes

6.1. Sanctions

The sanctioning procedure by the Pension and Parafiscal Management Unit (UGPP) regarding the omission of payment to the General Social Security System (SGSS) by independent merchants and natural persons follows a set of steps established by current regulations. These steps include: Detection of non-payment, Notification and request for information, Evaluation of the situation and determination of the obligation, Disclaimers, Issuance of the administrative sanctioning act, Notification and deadline for payment, Resources and legal actions, and Payment of sanctions.

According to the official government website, payment facilities may be offered within the collection process. These facilities are benefits granted by the UGPP to debtor natural persons to facilitate payment of the obligation, provided they meet certain requirements. Debtors can access these benefits at any time. Additionally, the UGPP may implement precautionary measures during the collection process to guarantee payment of the obligation through the seizure of the debtor's assets. The persuasive collection method seeks voluntary compliance without resorting to coercive measures or precautionary measures (Ministerio, 2024). However, if persuasive collection efforts fail, coercive collection measures may be initiated. The tax rule outlined in article 826 stipulates that coercive collection cannot exceed five years from the moment the obligation becomes payable. This period is interrupted by the issuance of a payment order and suspended with the agreement to pay, with the payment order being an administrative directive for the debtor to settle their debts within a maximum period of 15 days. Failure to comply with the payment order initiates coercive collection proceedings.

UGPP sanctions arise from negligence, inaccuracy, or delay in complying with payment obligations or providing required information. The UGPP is responsible for ensuring that both companies and taxpayers fulfill their obligations towards health, pensions, and parafiscal payments, and sanctions transgressions related to these payments. Independent workers who fail to make contributions to the social security system, either by not registering or by making insufficient payments, are also subject to sanctions by the UGPP. The sanctions that the UGPP can apply include:

- Penalty for late or missing payments.
- Fines for errors or inaccuracies.
- Punishments for not providing information, doing it incorrectly or out of time.

- Sanctions directed at the administrative entities of the social security system.
- Penalties for organizations that register self-employed workers as a group.
- Fines for not complying with social security payments.
- Sanction for Omission or Default.
- Penalty for Inaccuracy.
- Penalty for not providing information.

The UGPP may request information or evidence regarding the contributions made by taxpayers. If this information is not provided in a timely manner or is incomplete, the UGPP will impose sanctions for each month or fraction of a month that passes without compliance. With this in mind, **Table 8** illustrates the comparative conditions between natural person merchants and legal entities, highlighting the mandatory nature of contributions to the SGSS for individuals engaged in the same economic activity.

Table 8. Comparison of natural and legal persons against the SGSS.

Independent merchants: Natural person	Legal persons
Unlimited Liability: Natural person independent merchants bear unlimited liability for their debts and commercial obligations. This means that their personal assets may be at risk in the event of default or bankruptcy.	Limited Liability: Legal entities, such as commercial companies, benefit from limited liability. This implies that their liability for debts and commercial obligations is confined to the contributed capital and assets of the company, thus safeguarding the personal assets of the partners or shareholders.
Simplified Tax Regime: Natural person independent merchants can opt for the simplified tax regime, provided they meet the requirements outlined in the regulations. This regime entails simplified taxation and a reduced tax base.	General Tax Regime: Legal entities are subject to the general tax regime, which entails adhering to a set of more intricate tax obligations and a broader tax base.
No Legal Constitution Required: Natural person independent merchants can commence their economic activities without the necessity of establishing a legal entity. They can operate under their own name or a trade name and are subject to regulations applicable to natural persons.	Legal Constitution Requirement: Legal entities must undergo a formal legal constitution process, which includes registration and compliance with requirements stipulated by law. This entails selecting an appropriate legal structure, such as a public limited company or limited liability company, among others.
Contributions to the SGSS as Independent Workers: Natural person independent merchants are obligated to make contributions to the SGSS as independent workers. These contributions include affiliation to a Health Promotion Entity (EPS) and a Pension Fund Administrator (AFP), as well as contributions to occupational risks.	Contributions to the SGSS as Employers: Legal entities are mandated to make contributions to the SGSS solely as employers. This encompasses fulfilling social security contributions on behalf of their employees, including affiliation to an EPS, an AFP, and remuneration for occupational hazards.

Considering the above, the most significant differentiation that pertains to our study topic lies in the factor of responsibility. In the case of independent merchants who are natural persons, the responsibility for compliance with obligations before the SGSS falls directly on them as individuals. Conversely, legal entities are regarded as separate legal entities from their owners, implying that the responsibility lies with the entity itself and not with the owners individually. Therefore, they are not subject to sanctions by the UGPP.

Furthermore, differences are also evident in the contribution regime to the SGSS. Natural persons are subject to a contribution regime based on percentages of their income, whereas legal entities must calculate contributions to the SGSS in relation to the salaries paid to their employees. It is important to note that this disparity applies to legal entities with employees under their control, as single-person

legal entities are considered independent of their owners, and this contribution regime does not apply to them.

Lastly, regarding compliance and supervision of the SGSS, both natural persons and legal entities are subject to oversight by competent entities such as the Administrator of the Resources of the General System of Social Security in Health (ADRES) and the Administrative Unit Special Pension Management and Parafiscal Contributions of Social Protection (UGPP). Natural persons, including independent workers, are liable to sanctions by the UGPP in case of non-compliance with their contribution obligations to the SGSS (Cubides, 2023).

6.2. Obligations to the SGSS

The Social Security System (SGSS), as the entity ensuring protection and coverage in terms of social security in Colombia, stipulates that taxpayers' obligations vary depending on their category. However, for the purposes of this project, they include the following items:

- 1) Contributions to the social security system: Employers are mandated to make contributions to social security on behalf of their employees, which are allocated to the health, pension, and occupational risk systems. These contributions are determined based on a set percentage of the worker's salary or income. Conversely, independent workers must contribute the entire defined percentage on all their income, which is 12.5% for health and 16% for pensions. Legal entities or companies are not required to make such contributions.
- 2) Withholding at source: Employers are also obligated to withhold at source on the payments they make to their employees, which is utilized to finance the resources of the SGSS.
- 3) Declaration and payment of contributions: Taxpayers, both natural and legal persons, must submit declarations and make the payment of contributions to the SGSS on the dates and under the conditions established by current regulations.
- 4) Membership in EPS and AFP: Contributors must enroll in a Health Promotion Entity (EPS) and a Pension Fund Administrator (AFP), as applicable, and adhere to the membership obligations established by the regulations.

Normatively, both natural persons and legal entities as employers have obligations to the Social Security System. These obligations primarily pertain to membership in the system and the contributions they must make.

6.2.1. Obligations of natural persons

The General Social Security System in Colombia (SGSS) encompasses an integrated framework of policies, entities, regimes, standards, and procedures aimed at safeguarding fundamental rights to health, pensions, and occupational risks. Within this framework, various categories of taxpayers bear specific obligations to uphold the system's functionality, including: Affiliation to the General Social Security Health System (SGSSS), Contributions to health, Contributions to the General Pension System, Contributions to the Occupational Risk System.

6.2.2. Obligations of legal entities

Legal entities, as employers, are obligated to affiliate their employees to the General Social Security Health System (EPS) and the General Pension System (AFP) as appropriate. However, legal entities without employees are exempt from making contributions, and therefore, they are not subject to possible sanctions by the UGPP.

On the other hand, legal entities must withhold contributions to the SGSSS at the source, including health and pension contributions, on the payments they make to their employees. Subsequently, they must remit these contributions to the corresponding entities. Likewise, they must contribute to the Occupational Risk System to cover the risks to which their employees are exposed. These contributions are calculated based on the employees' payroll and must be paid periodically.

The obligations of this class of entities pertain to scenarios in which they transition into companies with two or more employees. Single-person units, on the other hand, are not subject to sanctions by the UGPP for failure to comply with SGSS contribution obligations. This discrepancy leads to inequality and an imbalanced tax burden when compared to the obligations of natural persons. Furthermore, natural and independent persons face greater disadvantages compared to legal entities regarding the operation of the collection system. This disparity increases the likelihood of being subject to sanctions by the UGPP and places them in an unfavorable and inequitable situation.

6.3. Fundamentals of the obligation to contribute to the social security system of independent trade workers

The principle of solidarity stands as one of the fundamental pillars of the Social Security System. Rooted in the notion that all members of society should contribute, according to their means, to the collective welfare and the safeguarding of those facing vulnerability, this principle underscores various aspects aimed at advancing the common good. These include ensuring Universal Protection, redistributing wealth, maintaining the Stability and Sustainability of the System, promoting Equity, preparing for Contingencies, and fostering Formality.

7. Conclusions

The Bibliometrix Analysis relies significantly on the appropriate categorization, quality assurance, and proper organization of the data sourced from databases. Furthermore, challenges arise due to the constraints posed by logical operators, such as accented characters in authors' names, which may not be reliably recognized by R-Studio software. Consequently, to minimize the margin of error, meticulous attention was devoted to rectifying inaccuracies encountered during the data import process using Excel software. In this way, the following conclusions are listed:

- The bibliometric analysis (BA) reveals a significant growth in the number of publications related to Pension Funds in Colombia and its implications. Over the period of 1987 to 2023 (71 documents in English), there has been a substantial increase in the number of documents analyzed, indicating a dynamic and evolving research landscape, with an annual growth rate in publications of 5.37%. This indicates a consistent increase in scholarly output over the years.

- Research articles represent most of the documents analyzed (81.69%), followed by review articles (7.04%), and others including books, book chapters, and conference papers (11.27%).
- The time-series data set reveals a consistent growth in the number of pension funds in Colombia, particularly notable from 1998 onwards, with significant growth between 2017 and 2022. Gender representation in pension funds is also increasing, indicating a trend towards inclusivity.
- Author Mesa-Lago, L with one of the first publications, emerges as the most relevant author on this topic. This compilation of scholarly works offers a nuanced exploration of social welfare and pension reforms in Latin American countries. Covering diverse dimensions of economic and political changes, the selected publications delve into critical aspects such as inequality, fiscal redistribution, individual account pension reforms, and the multifaceted quality of work life.
- The relevant countries are Colombia, the UK, the USA, and Spain, with lesser contributions from Mexico and Costa Rica. Authors such as Hessel, P., have used more keywords related to his research on Colombia, Latin America, Pension, Social protection, health, and inequality.
- The Universidad de los Andes is the most important institution, with 13 articles in appearances, followed by the Universidad de Antioquia with 8 documents, and Universidad ICESI in third place with 7 published papers. These institutions account for a total of 39.44% (28 documents) of the published documents, with the remaining percentage (60.56%) representing institutions with fewer than 43 documents.

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