The Research Progress of Economic Geography ——Bibliometric Analysis Based on Citespace

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Abstract—Economic geography is a discipline that studies the spatial distribution, evolution and influence of economic activities on the earth 's surface. With the continuous development of economic globalization, economic geography has attracted more and more attention. In order to explore the research status and hotspots of economic geography in the field of economics, the core collection database of Web of Sciences papers was used as the retrieval database, and the papers from 1998 to 2022 were retrieved by inputting subject words. The literature analysis tool and Histcite of Web of Sciences were used to statistically analyze the retrieved literature information, and the publication and citation of basic knowledge papers in different years, countries, journals and disciplines were analyzed. The CiteSpace software was used to analyze the hot spots and draw the knowledge map. The study found that there is still a gap between China's economic geography and the United States, Britain and other countries in the field of economics. There are more and more studies on economic geography, but there are some changes in the research direction. More and more studies focus on the impact of geographical factors such as geographical location, geographical environment and geographical relations on the economy, the impact of agglomeration on the economy, and the impact of global production networks on the economy.

Keywords : economic geography ; visual analysis ; research hotspots ; citeSpace

1 Introduction

In 1760, Russian scientist Lomonosov first put forward the name of " economic geography " in his " geographical investigation, " pointing out that the study of national economy must be carried out in combination with geographical factors, but did not explain the characteristics of this discipline in detail. In 1882, the German geographer Getz published an article " the task of economic geography, " which discussed the nature and characteristics of economic geography[1]. By the end of December 2022, there were more than 13,000 SCI papers on economic geography in the Web of Science (WOS) database. This method was applied to the field of economics in 1999[2]. Early economic geography research mainly focused on the impact of geographical endowments on economic development and the impact of agglomeration on regional economic development[3, 4]. In recent years, with the development of economic disciplines, economic geography research has been widely used in global production networks[5]. In 2003, Yang Weicong and Lin Chusheng first applied economic geography to domestic economic research[6].

ICEMBDA 2023, October 27-29, Tianjin, People's Republic of China

DOI 10.4108/eai.27-10-2023.2341935

With the development of economic globalization and the complexity and diversity of geographical factors, economic geography research has gradually shown the characteristics of multi-angle, multi-level and multi-disciplinary. In the field of economics, there are many similar studies on the same problem. However, because the study itself involves a variety of complex geographical factors, the conclusions of the study may not be static, typical examples such as the impact of geographical proximity on innovation[7]. The mining and analysis of tacit knowledge in economic geography has played a positive role in promoting social learning and stimulating innovation in the field of economics, and has received more and more attention[8]. However, previous studies on economic geography in the field of economics are mostly qualitative induction, subjective, less quantitative analysis, and lack of potential significance of mining data[9-11]. Therefore, from a macro perspective, this paper makes a quantitative and qualitative visual analysis of the literature of economic geography under the classification of economic disciplines, and shows the research overview, research hotspots and hot trends of ecological services in the ecological field in a more intuitive way, in order to provide reference for future research in this field.

2 Analysis method and data source

Bibliometrics is to study the quantitative characteristics of the literature through mathematical and statistical methods, and then evaluate and predict the current situation and development trend of the course[12]. With the continuous development of bibliometrics and visual analysis, more and more visualization software of bibliometrics is known and used[13]. CiteSpace is a commonly used software developed by Dr.Chen Chaomei, which is widely used in text analysis, mining and visualization of bibliographic databases. Through cooperative network analysis, co-occurrence analysis, co-citation analysis and literature coupling analysis, the software intuitively presents the knowledge structure, research hotspots and development trends of specific subject areas in the form of maps. This paper makes a preliminary analysis of the literature sources by using the function of ' analysis of search results and citation report ' in WOS database, and uses the key literature in the citation network relationship extracted by Histcite software as the basic knowledge literature of the discipline, and uses CiteSpace 5.7.R5 software to visualize the literature data and track the research hotspots and frontiers. The network structure of the knowledge graph and the clarity of the clustering results are represented by Modularity Q and Mean Silhouette. The module value of 0.4-0.8 is considered as the network structure is more significant, and the contour value is between 0-1. The closer to 1, the greater the internal similarity of the same cluster[14].

The data of this study are derived from the Institute for Scientific Information (ISI) Web of Science core collection database. The search time is June 5,2023, and the time period is from 1998 to 2022. The search conditions are economic geography, and the economic disciplines are selected according to the subject classification of WOS. A total of 3368 documents are retrieved.

3 Results and analysis

3.1 Analysis of the number of papers and citations

Based on the statistical analysis function of WOS, between 1998 and 2022, there were 3368 articles, with a total citation frequency of 120879. The number of citations removed from self-citation was 109288, the average number of citations per article was 35.89, and the h-index was 147. From 1998 to 2022, the number of papers on economic geography in the field of economics fluctuated slightly, but showed a steady upward trend (Fig.1). In 1999 and 2000, the annual number of publications was only 1. From 2003 to 2012, the number of publications increased rapidly. From 59 articles in 2003 to 198 articles in 2012. From 2013 to 2017, the number of publications decreased slightly, staying between 160 and 185. In 2018, the number of publications continued to increase, reaching 230. In 2019, the maximum number of publications was 255. Since then, the number of publications has gradually declined for several years. In 2022, the number was 217.

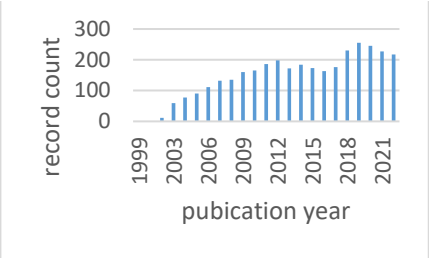

Figure 1 Total number of papers published per year (1999-2022).

3.2 Ranking of national publication volume

WOS 's own literature analysis tool counted the countries of all authors in the literature and the same country in the same literature was counted only once, and finally the total frequency of the same country was accumulated. The top 10 countries with the largest number of publications are the United States, the United Kingdom, Germany, the Netherlands, Italy, China, France, Canada, Spain and Japan. (Table 1). Among them, the United States has published 816 papers, which is significantly more than other countries, accounting for 24.23 % of the total number of papers in the world. Compared with other countries, the United States has the highest h index (h index refers to at most h papers are cited at least h times) and the highest number of citations per paper, indicating that the United States is in the world leading position in the research level of ecological services in the ecological field. The number of publications in China is 211, ranking 6th. However, compared with other countries, China 's h-index is lower and the number of citations per article is the lowest, indicating that the quality of papers is lower. The total number of publications in the top 10 countries was 3177, accounting for 94 % of the total number of publications in the world.

3.3 Status of publications in China

China 's research on economic geography started three years later than the international. China has published relevant SCI papers since 2002, and published less than 5 papers from 2002 to

2011. After 2012, the number of published papers began to fluctuate. 11 in 2012. In 2013, there were 5 articles. In 2018, there were 18 articles. In 2020, the largest number of papers was 30. There was a slight decline in 2021 and 2022, which were 22 and 28, respectively. The number of articles published by Chinese in the following journals is large: Regional Studies (17), Journal of Transport Geography (13), China Economic Review (12), Journal of Economic Geography (9), Annals of Regional Science(8). Regional Science And Urban Economics (8). Among them, the top 4 journals were classified as the second-region journals by the SCI journals of the Chinese Academy of Sciences, and the Annals of Regional Science and Regional Science And Urban Economics were the fourth-region and the third-region journals respectively. The top five institutions that published more papers in China were Zhejiang University (21 papers), Hong Kong University (18 papers), Chinese Academy of Sciences (15 papers), Peking University (15 papers) and Renmin University of China (10 papers). Zhejiang University has the largest number of publications, indicating that it has strong scientific research strength in this field. The top 5 authors in China are: He Canfei (Peking University), Zeng Daozhi (Zhejiang University), Zhu Shengjun (Peking University), Yang Chun (Hong Kong University), Zhou Yiming (Jiangxi University of Finance and Economics).

3.4 Journal rankings

So far, there are 465 journals in the field of economics that have published economic geography, and the top 10 journals are shown in Table 2. The number of papers published in the top 10 journals accounted for 45.4 % of the total number of papers, and the h-index (h index) of the papers published in these journals was 120, indicating that the articles of economic geography in the field of economics have high academic influence. Among them, Economic Geography, which has the third largest number of publications, is the top journal in the field of economics, and the rest are not top journals.

3.5 Analysis of highly cited authors

The number of SCI papers published by the top 10 authors, a total of 12 people, respectively from seven countries, of which the Dutch and British per capita for three, Belgian two (Table 3). Boschma R from the Netherlands and Thisse JF from Belgium published the same number of papers of 25,

Table 1 Top 10 countries with the highest number of publications

No.	Country	Records	proportions	h-index	Citations per papers	Total cites	Other citation
1	USA	816	24.228	101	52.95	43211	42228
2	ENGLAND	686	20.368	83	46.91	32181	31021
3	GERMANY	297	8.818	48	30.91	9180	8981
4	NETHERLANDS	221	6.562	52	69.18	15288	14950
5	ITALY	218	6.473	43	26.67	5813	5691
6	CHINA	211	6.265	35	16.82	3550	3485
7	FRANCE	208	6.176	44	33.96	7063	6923
8	CANADA	187	5.552	43	40.04	7487	7380

9	SPAIN	184	5.463	31	17.65	3248	3173
10	JAPAN	149	4.424	29	17.4	2593	2374

Table 2 Top 10 journals in economic geography research from 1999 to 2022

No.	Journal name	Records	proportions	IF in 2022
1	Regional Studies	322	9.561	4.595
2	Journal of Economic Geography	319	9.471	5.117
3	Economic Geography	232	6.888	14.921
4	Tijdschrift Voor Economische En Sociale Geografie	122	3.622	4.194
5	Papers in Regional Science	106	3.147	2.186
6	Journal of Regional Science	91	2.702	2.807
7	Regional Science and Urban Economics	91	2.702	3.438
8	Annals of Regional Science	89	2.643	1.709
9	Cambridge Journal of Regions Economy and Society	80	2.375	5.176
10	Journal of Transport Geography	77	2.286	5.899

Table 3 Highly cited papers on economic geography

Author	Journal name	Tittle	Cited frequency
Boschma, RA	Regional Studies	Proximity and innovation: A critical assessment	3208
Rodrik, D	Journal of Economic Growth	Institutions rule: The primacy of institutions over geography and integration in economic development	1984
Glaeser, EL	Journal of Economic Growth	Do institutions cause growth?	1406
Martin, R	Journal of Economic Geography	Path dependence and regional economic evolution	1285
Martin, R	Journal of Economic Geography	Deconstructing clusters: chaotic concept or policy panacea?	1247
Gertler, MS	Journal of Economic Geography	Tacit knowledge and the economic geography of context, or The undefinable tacitness of being (there)	1106
Acs, ZJ	Small Business Economics	The knowledge spillover theory of entrepreneurship	1029
Coe, NM	Journal of Economic Geography	Global production networks: realizing the potential	838
Porter, ME	Regional Studies	The economic performance of regions	824

Easterly, W	Journal of Monetary Economics	Tropics, germs, and crops: how endowments influence economic development	745

Table 4 Authors of the top 10 papers

No.	Author	Country	Records	Total cites
1	Mccann P	Netherlands	36	2788
2	Garretsen H	Netherlands	27	629
3	Boschma R	Netherlands	25	3396
3	Thisse JF	Belgium	25	889
5	Rodriguez-pose A	England	24	3110
6	Fingleton B	England	23	570
7	Martin R	England	22	5108
8	Behrens K	Belgium	19	560
8	Kubin I	Austria	19	107
10	Pike A	England	17	1773
10	Storper M	France	17	2103
10	Tabuchi T	Japan	17	456

Table 5 Highly cited papers on economic geography in the field of economics

First Author	Publication/year	Tittle	LCS	GCS
Gertler MS	2003	Tacit knowledge and the economic geography of context, or The undefinable tacitness of being (there)	168	1106
Easterly W	2003	Tropics, germs, and crops: how endowments influence economic development	104	745
Rodrik D	2004	Institutions rule: The primacy of institutions over geography and integration in economic development	204	1985
Redding S	2004	Economic geography and international inequality	191	580
Boschma RA	2005	Proximity and innovation: A critical assessment	180	3208
Hanson GH	2005	Market potential, increasing returns and geographic concentration	133	337
Martin R	2006	Path dependence and regional economic evolution	170	1285
Boschma RA	2006	Why is economic geography not an evolutionary science? Towards an evolutionary economic geography	159	625

Martin R	2010	Roepke Lecture in Economic Geography-Rethinking Regional Path Dependence: Beyond Lock-in to Evolution	104	517
Neffke F	2011	How Do Regions Diversify over Time? Industry Relatedness and the Development of New Growth Paths in Regions	110	653

Table 6 Top 10 countries with the highest number of publications

Cluster ID	Size	Silhouette	Mean(Year)
0	98	0.611	2012
1	97	0.652	2009
2	89	0.643	2009
3	74	0.667	2015
4	61	0.589	2013
5	18	0.815	2011
6	4	0.973	2015

Behrens K from Belgium and Kubin I from Austria published the same number of papers of 19, Pike A from the United Kingdom, Storper M from France and Tabuchi T from Japan published the same number of papers of 17. Martin R from the United Kingdom published 22 papers ranked seventh, but the total number of citations reached 5108.

3.6 Analysis of highly cited papers

According to the distribution of highly cited papers, 6 of them were published in the top ten journals (Table 4). From the content of the highly cited papers, three of them are related to the impact of the system on economic development, including: in economic development, the importance of the system is higher than the geographical location and integration; the rationality of institutional quality indicators and the interaction between institutions and human capital and policies; natural geographical conditions have an impact on the economy through institutions. In addition, the research results of the impact of geographical proximity on economic development, the impact of path dependence on economic development, the impact of industrial clusters on economic development, the discovery and application of invisible knowledge in geography, the emergence of entrepreneurs and their economic and social significance, and the impact of the global economy on territorial development have been frequently cited.

3.7 Basic knowledge of the subject

The Histcite software developed by Thomson Reuters was used to analyze the local citation score (LCS) and global citation score (GCS) of the downloaded data. LCS is the number of times that the paper is cited by all papers in the local data set (all literature exported after retrieval), and the high LCS means that the paper has a high influence in this research field; gCS refers to the total number of citations in the WOS database, but the cited papers do not necessarily belong to the field. Therefore, highly cited literature does not necessarily belong to the basic literature in this field. For this reason, this paper uses Histcite to analyze the citation

relationship of the downloaded literature, and obtains the top 10 literatures in the complete citation relationship knowledge network based on LCS ranking (Table 5).

According to the chronological order, Gertler MS published an article in Journal of Economic Geography in 2003, which made a critical analysis of the tacit and explicit economic geography under tacit knowledge, focusing on the relationship between tacit knowledge and institutions. It is believed that the geographical environment of tacit knowledge cannot be sorted out without exploring the basis of culture and background, as well as the institutional basis of economic activities[8]. In 2003, Easterly W published an article in Journal of Monetary Geography. By verifying the role of natural geographical advantage conditions, systems and policies in economic development in many countries, it was found that natural geographical advantage conditions can only affect national economic development through systems, and policies have no impact on economic development[3]. Rodrik D published an article in Journal of Economic Growth in 2004, using instrumental variables to assess the contribution of institutions, geographical environment and trade conditions to income levels around the world. He believes that the institutions are the most important for economic development, while others have little impact on economic development[15]. In 2004, Redding S published an article in the Journal of International Economic, using multi-country data, including data on per capita income, bilateral trade and relative prices of manufactured goods, an economic geography structure model was constructed. The model takes into account other economic, geographical, social and institutional characteristics, and finds that geographical location is extremely important for economic development[16]. Boschma RA 's article published in regional studies in 2005 argued that the impact of geographical proximity on interactive learning and innovation should be comprehensively assessed in conjunction with other aspects of proximity, and proposed mechanisms that help solve coordination and locking problems, thereby increasing the positive impact of geographical proximity on interactive learning and innovation[7]. In 2005, Hanson GH published an article in the Journal of International Economic. He studied the spatial correlation between wages and consumer purchasing power in various regions of the United States, and found that the demand links between regions are strong and will increase over time. However, it is quite limited in geographical scope[17]. Martin R 's article published in Journal of Economic Geography in 2006 argued that although path dependence is an important feature of the economic landscape, the concept needs to be further elaborated if it is to play a central role in evolutionary economic geography[9]. In 2006, Boschma RA published an article in the Journal of Economic Geography, arguing that evolutionary economic geography is an emerging paradigm in economic geography, but it is not isolated from the development of other theoretical methods[10]. In 2010, Martin R published an article in Economic Geography, arguing that the normative path dependence model actually emphasizes continuity rather than change, and advocates rethinking the path dependence thought in economic geography, emphasizing change rather than continuity[18]. In 2011, Neffke F published an article in Economic Geography, arguing that the rise and fall of the industry depends largely on the industrial relevance at the regional level[19].

From the perspective of content, it focuses on the impact of system, geographical location, path dependence and geographical proximity on economic development. These highly cited literatures in this field usually reflect the history of discipline development and help to quickly understand the process and trends of discipline research development.

3.8 Analysis of research hotspots

The software time zone is selected from 1998 to 2022, the time span (Slice length) is 1a, and the node type is ' keyword '. After parameter screening, a total of 441 keywords appeared in the map, forming 4727 links. The contour value in this paper is 0.6445, and the module value is 0.2928, indicating that the internal similarity of the same cluster is large, but the network structure is not significant enough. In addition, this paper uses the LLR algorithm and names the clusters with keywords (Fig.2). The size of the ' dots ' represents the frequency of occurrence. The higher the frequency is, the larger the ' dots ' are. High-frequency keywords reflect research hotspots in this field[20].

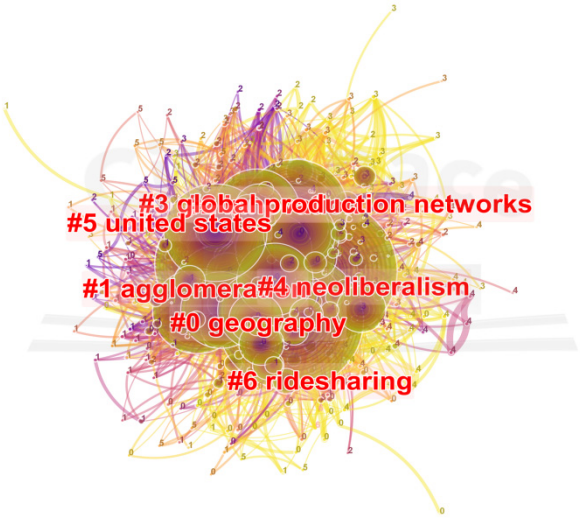

Figure 2. Keyword clustering knowledge map

Figure 3. Keyword clustering knowledge map

The timeline map mainly reflects the change of clustering with time. According to the order of time, the nodes of the same cluster are arranged on the same horizontal line in turn. According to the order of frequency, different clusters are arranged from top to bottom, showing the development of each cluster in the research field and the activity of the research. The keyword

clustering timeline map was drawn for the obtained literature, and a total of 7 clusters were formed. By referring to the clustering labels of each cluster and the cited literature in the cluster, we can roughly understand the research frontier represented by each cluster. Figure 2, Figure 3 and Table 6 show the research hotspots divided into seven categories: Cluster 0 mainly focuses on geography. This kind of research focuses on evolutionary economic geography, relational economic geography, and regional economics. The research of cluster 1 mainly focuses on the impact of industrial agglomeration on the economy, involving the new economic geography, the generation and application of tacit knowledge under industrial agglomeration, the significant positive effect of industrial agglomeration on technological change, and the positive correlation between industrial agglomeration and economic performance. Cluster 2 mainly focuses on innovation, involving appropriate geographical proximity to help mutual learning and innovation, the dynamic process of geographical location of innovation, research on sustainable transformation, opportunities for intra-regional and cross-regional innovation, the role of related and unrelated varieties in promoting innovation, and various factors affecting innovation. Cluster 3 focuses on global production networks. This kind of research focuses on the dynamic theory of global production networks and its impact on economic development, the contribution of global production networks to strategic coupling, and the establishment of links with economic geography to assess the economic landscape. Cluster 4 mainly focuses on neoliberalism, and pays more attention to the critical exploration of the word " neoliberalism " and the related research of economic geography under the background of neoliberalism. Cluster 5 mainly focuses on the related research of American economic geography, involving the comparison between Europe and the United States, the American economy, and the content of American innovation; cluster 6 focuses on carpooling, the geographical location of carpooling, and the consumer surplus brought by carpooling.

The above is a hot area of economic geography research in the field of economics. The study of economic geography depends on many previous studies on the same topic, which is the integration and enrichment of previous studies. Therefore, in terms of methods, economic geography pays more attention to interdisciplinary research and improves the quality of research. In addition, from the perspective of research hotspots, the impact of geographical factors such as geographical location, geographical environment and geographical relations on the economy, the impact of agglomeration on the economy, and the impact of global production networks on the economy are still the hot areas of economic geography.

4 Discussion

Since economic geography was introduced into the field of economics in 1999, the focus of economic research has undergone many changes. Economic geography is increasingly used in basic research and applied research on economic development issues, providing practical predictions and solutions, such as regional economic development, industrial agglomeration development and technological change, global production networks, and the effectiveness of corresponding development strategies and management mechanisms[21-23]. In the study of this paper, there have been studies such as geographical environment, agglomeration, innovation, and global production networks. The emergence of these keywords indicates that economic globalization research is included in the economic geography research of economics and has

become an important direction. The development of economic geography has promoted the development of economic globalization[24].

The research methods of economic geography in the field of economics are becoming more and more mature. The introduction of spatial analysis methods has helped the realization of multi-angle and multi-level research in economic geography[25]. The concept of intelligent specialization is introduced, and its content is gradually improved and applied to economic geography research[26]. Under the trend that scientific research is more and more inclined to large-scale and extensive cooperation, our economic researchers should maintain an open attitude, learn from the knowledge and experience of other disciplines, expand the scope of economic geography research, and improve the quality of economic geography research.

5 Conclusions

This paper uses the method of bibliometrics, using WOS, Histcite and CiteSpace to analyze the papers and citations on the theme of economic geography in the field of economics. The research conclusions are as follows :

(1) From the perspective of the quantity and quality of published papers, there is still a big gap between China and the United States, Britain and other countries in the field of research. On the one hand, because of the late start of research in this field in China, the accumulation and sharing of experimental data are not enough ; on the other hand, Chinese researchers do not pay much attention to economic geography, and the contribution of originality is less.

(2) From the perspective of journals published in this field, the research on the theme of economic geography has a high academic influence, and high-quality journals such as Economic Geography have published the most relevant articles.

(3) Through citation analysis and scientific mapping, it is found that the influence of geographical factors on economic development, the influence of industrial agglomeration on economic development, and the influence of global production network on economic development are the latest and most popular research frontiers in this field.

Acknowledgment : This research was support by the National Natural Science Foundation of China (Grant No. 42062020), and Yunnan Philosophy and Social Science Planning Social Think Tank Project(Grant No.SHZK2023352).

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