

Bibliometric and Visual Analysis Review of Employment Migration: Characteristics and Trends Perspective

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Abstract

Purpose: This study aims to provide a systematic knowledge graph for the field of employment migration research, including author collaboration, institutional collaboration, research hotspots, scholar evolution, and cutting-edge research.

Methodology: This study adopts bibliometric methods and uses CiteSpace to analyze the retrieved literature data quantitatively. This study presents the analysis results through tables and visualization graphs.

Results: The results indicate that research on employment migration has grown rapidly in recent years, and interdisciplinary research has received much attention. The cooperation between scholars could be more robust. At present, the research field of employment migration has scattered content and uses single research methods but has expanded its focus to areas such as childcare, health, youth employment, etc. Future research can focus on the strategic choices, employment issues, health status, freelance employment, and entrepreneurship of migrants and explore the relationship between employment migration and urban choice, exploring the economic returns and quality of life trade-offs of cities.

Value: Previous literature reviews have conducted qualitative research on employment migration, with little quantitative research conducted. Therefore, this study adopts quantitative research methods such as bibliometrics, data mining, and knowledge mapping to systematically and intuitively reveal the research progress and trends of research data themes based on published literature, providing references for further research on future research.

Keywords: Employment migration, Visualization, Bibliometric, Characteristics and Trends.

1. Introduction

Talent is widely recognized as the first resource (Thompson & Eijkemans, 2018). If a country or region has talent resources, it can continuously attract innovative talents, which will bring various positive impacts to the country or region. With the advent of the information economy, how to retain and attract talents has always been a common focus of global, regional, and urban development (Arntz, 2010; Esmailpoorarabi et al., 2016; Sebastien et al., 2010). Population migration has always been an important topic of concern for academia and policymakers and an essential indicator of regional development.

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Previous research has shown that a region's stock of human capital—the percentage of the adult population with a college degree—effectively predicts future population growth. Furthermore, highly educated workers positively impact the productivity of other workers in nearby labor markets, thereby raising local wages (Winters, 2011). Therefore, the academic community concentrates on studying how college graduates migrate or transition from graduation to employment (Faggian & McCann, 2009; Greenwood, 1973; Venhorst & Cörvers, 2018).

Countries worldwide attach great importance to the flow of young talents, especially college graduates (Jin et al., 2022). Graduates will consider factors such as job opportunities and attractiveness in different regions when choosing employment destinations. Some regions attract more graduates due to their advantages in job opportunities and industry development opportunities. Raco (2008) pointed out that addressing housing issues is crucial for employee recruitment and retention. Research in Italy has shown that retaining college students can promote regional development (Dotti et al., 2013).

Similarly, research on the situation of college students immigrating to New York State explained that attracting college students to immigrate to the state is of great significance (Wonseon & Kyung, 2016). Meanwhile, some scholars have also explored the issue of intra-state migration, using the study of Groen (2004) as an example to explore the possible relationship between employment migration and education policies and regional development, which positively impacts formulating education plans and regional development strategies. Furthermore, some literature studies specifically target postgraduates and find that many doctoral students are willing to go abroad to find the best job opportunities (Mavroudi & Warren, 2013). Therefore, the research on employment migration is dynamic.

In the current fierce talent competition environment, it is crucial to comprehensively grasp the relevant trends to promote the reasonable flow and total employment of various talents (Kane et al., 2017). Therefore, it is necessary to systematically review the relevant literature on employment migration in recent years. Bibliometric analysis is an effective method that comprehensively reviews relevant literature from different perspectives and fills knowledge gaps (Donthu et al., 2021). Therefore, this study will use CiteSpace for bibliometric analysis to provide convenience for subsequent research.

This study explores the following research questions: (1) To analyze the main publishing characteristics of employment migration research, including the author's involvement, countries, annual production, and author collaboration. (2) To identify the active areas and future development trends of employment migration research to gain insight into this field's research focus and frontiers. We can better understand the current situation and direction of employment migration through in-depth research on these issues.

2. Methodology

2.1 Visualization Technology

The integration of visualization technology and citation analysis has become a significant highlight in the field of citation analysis in recent years. Existing research on knowledge visualization based on citation data can be traced back 40 years ago when a historical map of DNA research was manually drawn (Garfield et al., 1964). Price (1965) also used the same data in his classic scientific network graph research. Knowledge domain visualization provides necessary

methods for interdisciplinary and rapidly developing knowledge domains, known as "science" by Garfield, which can predict emerging trends in subject domains (Garfield, 1994).

In early research on citation relationship networks, social networkers Hummon and Dereian (1989) proposed a search algorithm for the main paths in citation networks based on the concept of paths in social networks, namely the critical path algorithm. The concept of bibliometric mapping was further developed by Dutch scholars Noyons and Van Raan (Noyons & Van Raan, 1998; Noyons et al., 1999; Van Raan, 2000). They introduced special mathematical techniques to measure the impact levels of different sub-domains and themes, combining performance evaluation with the production process of bibliometric graphs. The traditional author co-citation analysis (ACA) method uses static maps, which have some limitations and are unsuitable for retrieval (White & Griffith, 1981). Scholars like White have proposed that Author Link and ConceptLink can generate author co-citation analysis graphs based on PFNet or Self Organizing Maps. The author relationship and domain structure are clearly displayed using co-citation author data to construct a path network. Path networks allow searchers to conduct literature searches based on co-citation relationships, which is closer to scholars' cognition (White et al., 2000). The visualization graph of scientific knowledge is a graph that displays the development and structural relationships of scientific knowledge. By evaluating the characteristics of publications such as types, languages, journals, and countries, it graphically displays the knowledge structure and evolution patterns, reveals scientific knowledge and its activity patterns, and identifies trends or hotspots in a certain research field. These advantages mark the transformation of scientific metrology from mathematical expression to graphical expression.

Dr. Chen Chaomei has published many academic papers on knowledge visualization since 1998. He first introduced the Pathfinder algorithm for exploring critical paths in network analysis and developed the CiteSpace citation network analysis tool using Java (Chen, 1999). This software graphically displays the evolutionary trends and cutting-edge fields of scientific development by analyzing and processing title data of scientific literature, especially citation and keyword data (Chen, 1999). Different visualization software can be used for this purpose. This study selects CiteSpace software to create an evolutionary knowledge graph in the field of citation analysis to demonstrate the development process and trends of the discipline of citation analysis.

The atlas used by CiteSpace is the matrix after standardization based on the original matrix rather than original co-occurrence matrix. The standardization methods mainly include cosine, PMI, dice, and Jaccard. Generally, cosine similarity is used by default. The cosine algorithm is used to calculate the similarity between papers (Li & Chen, 2016). Specifically, it compares the similarity between the two literatures by calculating the cosine value of two vectors. The cosine calculation formula between two vectors in two-dimensional space is shown in (1):

$$\text{Cosine}(x, y) = \frac{xy}{[x][y]} \quad (1)$$

This formula can be used in two-dimensional and multi-dimensional space to compare the similarity of any two literatures (Brandes et al., 2016). Its calculation formula is shown in (2):

$$\text{Cosine}(C_{ij}, S_i, S_j) = \frac{c_{ij}}{\sqrt{s_i s_j}} \quad (2)$$

Among them, S_i and S_j represent the number of articles published by author i and j , respectively. C_{ij} represents the number of papers co-authored (authors) published, and the cooperation intensity value ranges from 0 to 1. The closer the result is to 1, the higher the similarity between them.

Citespace is a powerful information visualization software that can perform quantitative analysis of specific field literature and draw various visual graphs. Its main goal is to help analyze trends that appear in knowledge, pay attention to research frontiers, and timely discover new trends and mutations, which helps us gain a deeper understanding of research trends in the field (Chen, 2006). Therefore, using Citespace can help us reveal the evolutionary path and potential driving mechanisms of the employment migration field and also explore cutting-edge research directions in the employment migration field.

2.1 Data sources

Web of Science (WoS) is a well-known academic database covering multiple disciplines such as natural sciences, engineering technology, social sciences, art, and humanities, including approximately 34000 journals. It also integrates other professional databases and citation databases. It is a catalog of academic publications and provides structured citation links and rich metadata, widely used in scientific metrology analysis (Birkle et al., 2020). The data selected for this study is from the WoS core collection Social Sciences Citation Index, with AK=(migration employment) as the search condition. The search was limited to January 1, 1980, to August 11, 2023. A total of 302 literature were selected through screening, and editorial materials, conference papers, and bibliographies were excluded. Finally, 295 articles from SSCI sources were selected as the sample dataset for analysis in this study. This study analyzes the author, research institution, keywords, and prominent words using CiteSpace 6.2.R2 software and draws corresponding knowledge graphs to display the current situation and development trends of research on employment migration.

2.3 Software Settings

Before running CiteSpace, set the relevant parameters: "Time Slicing": 1991-2023 (according to the data log, the earliest article in this period appeared in 1991);

Years Per Slice: 2 years;

Term Source: Select Title, Abstract, Author Keywords, and Keywords Plus.

Node Types: Select Keywords, Author, Institution, etc.

When conducting keyword analysis, the threshold standard is set to g-index, $k=25$;

When conducting author, country, and institutional analysis, the threshold standard is set to Top N=50.

Pruning: Select Pathfinder and Pruning the merged network.

Set other parameters as the default initial parameters of the system.

3. Result analysis

3.1 Annual Results of Employment Migration Research

Firstly, statistical analysis is conducted on the distribution of publication years, disciplines, and journal sources of the literature to obtain a preliminary understanding of the current status of employment migration research. Figure 1

shows that the research and development process in the employment migration field can be roughly divided into three stages. The first stage is the embryonic stage (1991-2006), and the number of related literature research during this stage is relatively small. The second stage is the development period (2007-2018), with the increase in the number of literature, indicating that research in this field has gradually attracted the attention of scholars during this period. The third stage is a period of rapid development (from 2018 to the present), and the number of literature has remained high, indicating that employment migration research has become a hot topic. Currently, research on this topic is in a state of rapid development.

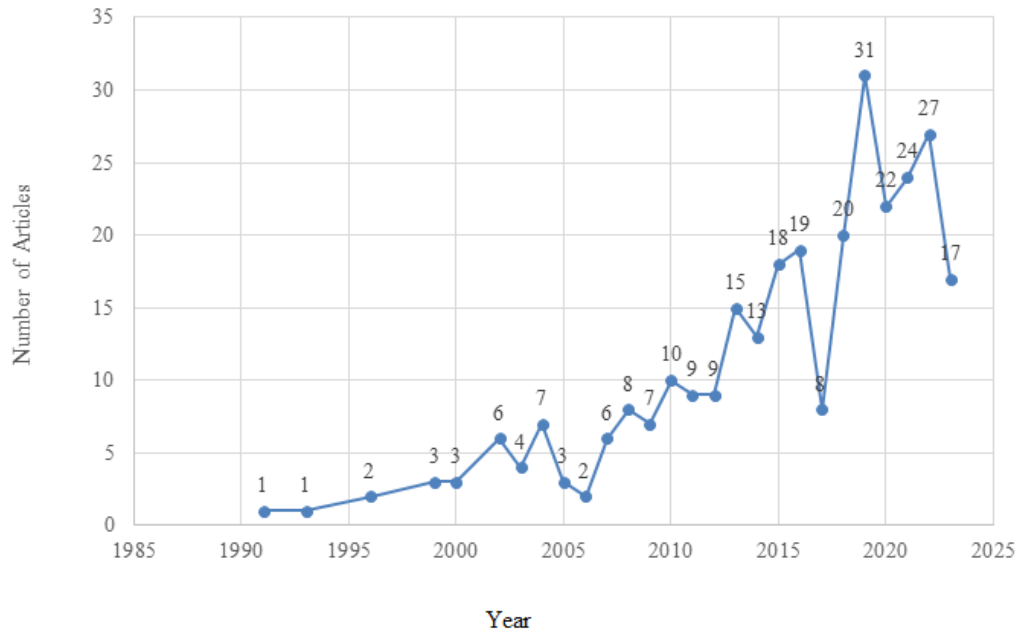


Fig. 1. Time distribution of published literature on employment migration research

From the perspective of publication sources, the research literature covers 182 journals belonging to multiple disciplines, such as economics, geography, sociology, demographics, and management. According to Table 1, there are eight journals with over five publications. These publications are distributed in economics, sociology, and interdisciplinary journals, indicating that employment migration research is more in-depth in the dimensions of economics and sociology, showing interdisciplinary characteristics.

Table 1: Publication of Employment Migration Literature and Periodicals

Journals	Number of records
CHINA AGRICULTURAL ECONOMIC REVIEW	9
JOURNAL OF ETHNIC AND MIGRATION STUDIES	8
POPULATION SPACE AND PLACE	8
REGIONAL STUDIES	8
SUSTAINABILITY	7
WORLD DEVELOPMENT	6
ASIAN AND PACIFIC MIGRATION JOURNAL	5
WORK EMPLOYMENT AND SOCIETY	5

3.2 Author of Employment Migration Research

Set "Threshold" in the parameter selection panel of the software: Top 50 per slice, then select Author in Node Types and set Threshold to 0 in Node Labels to obtain clear visualization results. The knowledge graph of the author's

collaboration is shown in the following figure. The text in the upper left corner of the figure shows the relevant data, where "N=621, E=606" has a density equal to 0.0031. Therefore, results show that the co-occurrence network density of authors in this research field node is low, which means that the degree of cooperation between authors is low. A specific scale of research cooperation team has not been formed. The connections between nodes represent the connections between authors. Graph data shows that authors such as Mueller and Valerie have formed a collaborative team of a particular scale, while other authors have not formed a truly collaborative team. Beyond that, there are not many connections between other authors, indicating that there is no close collaboration among authors in employment migration research, and scholars' research is relatively independent.

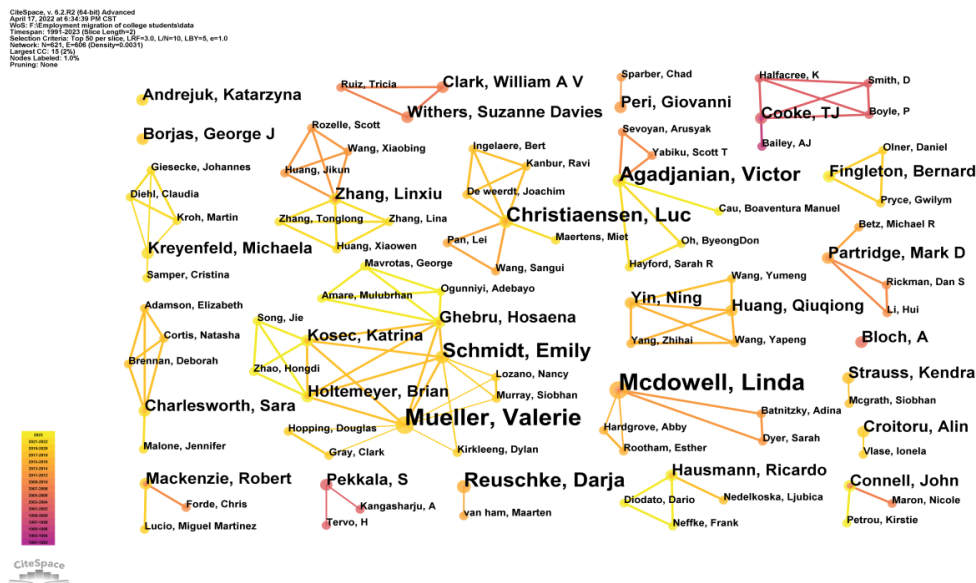


Fig. 2. Graph of Cooperation Networks among Authors in the Field of Employment Migration Research

From the graph, it can be seen that different nodes have different sizes, indicating differences in the author's publication frequency. The larger the nodes in the graph, the higher the author's publication frequency. Six authors have published more than three times. The color of the node represents the order in which the node (author) posts. Among them, the closer the center color of the node is to the purple color, the earlier the author first published the article. Click on the Network Summary Table to obtain the author's publication frequency and year information, as shown in the table below.

Table 2 Top 6 authors in the field of employment migration research with a total citation frequency

No.	Freq	Author	Year
1	4	Mueller, Valerie	2018
2	4	Mcdowell, Linda	2008
3	3	Agadjanian, Victor	2010
4	3	Schmidt, Emily	2018
5	3	Reuschke, Darja	2013
6	3	Christiaensen, Luc	2013

The higher the author's publication frequency, the higher the contribution rate to the number of literature in the field. In addition, it can be seen from the figure that authors Mueller and Valerie have close cooperative relationships with many authors, indicating they have made significant academic contributions and

influence in this field. This influence is quantified as the node's degree centrality (degree value), which refers to the number of connections between other nodes in the network and the node. Nodes with high centrality are relatively easy to become critical nodes in the network. After sorting the data, the top 3 centrality rankings of nodes (authors) are shown in Table 3.

Table 3 Top 3 Authors in the Centrality Ranking of Employment Migration Research Field

No.	Degree	Author
1	9	Mueller, Valerie
2	7	Agadjanian, Victor
3	7	Andrejuk, Katarzyna

3.3 Top Employment Migration Research Countries

This study runs the Citespace software, selects the node type as the country "Country," and sets the "Top N Persice" to 50. It means that we select the 50 regions with the highest citation frequency each year and obtain the graph of employment migration hotspots research areas shown in Figure 3. The statistical table of the top 5 countries and regions was selected and shown in Table 4.

The country analysis of literature can generally reflect the contributions and differences made by different countries and regions in specific research fields. Table 4 and Figure 3 indicate that employment migration appears to be a global issue, with corresponding authors in 58 countries and regions. The three countries, the USA, ENGLAND, and PEOPLES CHINA, rank among the top in terms of publication volume, centrality, and node size, making them core member countries in employment migration research. The USA has the most significant node size and more connections with other countries, indicating that it has cooperative research with many other countries and is the country with the greatest influence in this research field. It may be because the data source of this study chose the journal database indexed by SSCI.



Fig. 3. A visualization of the country collaboration network

Table 4 Statistical Table of Top 5 Hot Research Areas Before Employment Migration

No.	Country/Region	Count	Centrality	Year
1	USA	82	0.6	1993
2	ENGLAND	43	0.4	2002
3	PEOPLES R CHINA	38	0.24	2002
4	GERMANY	29	0.05	2007
5	AUSTRALIA	20	0.14	2008

3.4 Keyword Analysis

3.4.1 Keyword Time Zone Analysis

The Time Zone View function of Citespace can spread out all keywords in the sample dataset in chronological order, clearly presenting the development of keywords. Figure 4 is a visual knowledge graph created using the Time Zone View function. All nodes are located in a two-dimensional coordinate with a horizontal axis of time. Based on the time when the keyword first appears, the nodes are set in different time zones, and their positions move up along the time axis. A knowledge evolution diagram is visually displayed from left to right and from bottom to top. From Figure 4, it can be seen that high-frequency keywords such as gender and internal migration first appeared in 1996. New high-frequency keywords have emerged in the past 30 years, indicating that research on employment migration is still constantly developing. The global financial crisis broke out from the end of the 20th century to the beginning of the 21st century, and the unemployment rate significantly increased. Therefore, from 1996 to 2005, the focus was on exploring the influencing factors and consequences of employment migration and analyzing employment opportunity models. The topic concerns the national employment and immigration policies and how to choose between protection and openness. The migration behavior of the unemployed population and its impact on employment was also the focus. From 2006 to 2015, keywords such as labor market, earnings, international migration, return migration, enrollment, policy, and migrations began to appear. Existing studies focused on international and returning migrants in the Labour market, their impact on income, and how international migration affected the labor market of destination countries. At the same time, these studies also examined the impact of immigration policies formulated by different countries on immigration and the labor market, as well as their economic activities in terms of returning immigrants or entrepreneurship. Since 2016, keywords such as women, strategy, China, market, child care, health, employment opportunities, young employment, and recruitment have emerged, focusing on exploring how to promote women's employment in different fields and improve employment opportunities. In employment migration, attention will be paid to child care and health factors. Meanwhile, research also focuses on youth employment and employment agglomeration.

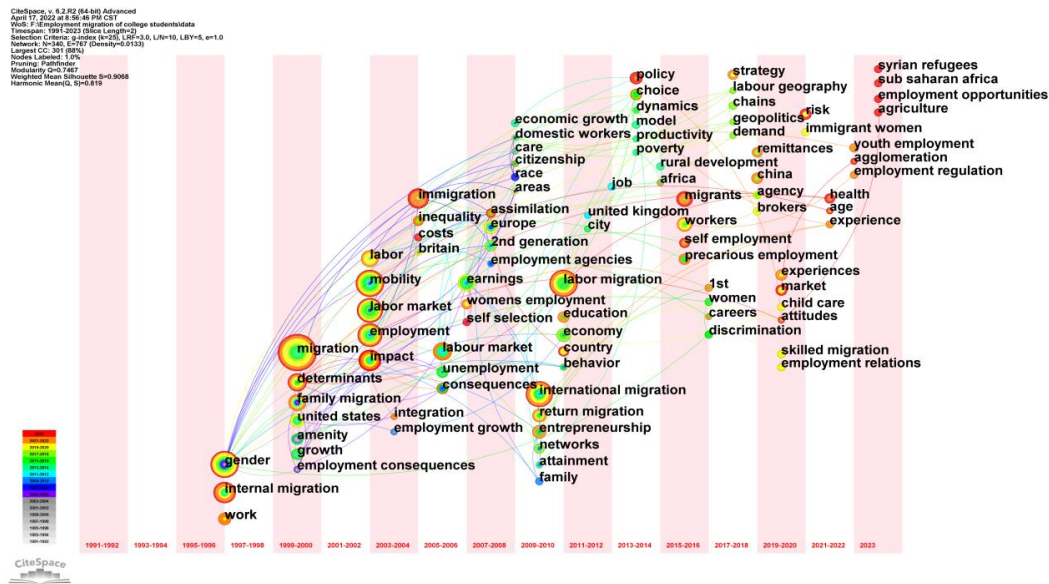


Fig. 4. Time Zone Graph of Key Words in the Field of Employment Migration Research

3.4.2 Keyword co-occurrence analysis

Keywords summarize the core content of the literature, and through co-occurrence analysis of high-frequency keywords, research hotspots on employment migration can be captured. The default selection algorithm is $k=25$. Click on "Node Types" in the parameter panel of the software, select Keywords, and obtain 340 nodes (keywords) and 767 connections (co-occurrence relationships) with a density equal to 0.0133. Select the Keyword in Node Types, set the Threshold in Node Labels to 3, and obtain precise visualization results. The knowledge graph of the primary keyword co-occurrence obtained is shown in the figure 5.

The centrality value of mediation can reflect the importance and influence of keywords, and the larger the centrality value, the greater the mediating effect of keywords. After analyzing the co-occurrence of keywords in 295 employment migration literature in the SSCI database, it can be seen from the graph that different node sizes indicate differences in the frequency of keyword co-occurrence. The larger the node in the graph, the higher the frequency of keyword co-occurrence. Click on the Network Summary Table to obtain detailed parameters for keywords. After sorting, the co-occurrence frequency of keywords can be obtained. Based on the frequency of keyword occurrences ($\text{Count} \geq 20$) or their centrality value ($\text{Centrality} \geq 0.15$), sorting can be done (see Table 5). From the frequency of keyword occurrences, keywords such as migration, labor migration, and migration are more frequent. Judging from the centrality values of keywords, gender (centrality = 0.36) and employee (centrality = 0.035) rank in the top two and are most closely related to other keywords. In addition, keywords such as assessment, labor, family migration, earnings, and determinants also have higher centrality values ($\text{centrality} \geq 0.15$). In CiteSpace, nodes with more than 0.1 mediation centrality become the key points (Small, 1973). Combined with the frequency and centrality of keywords, the research hotspots of employment migration mainly include labor market, gender, family migration, income, determining factors, etc. The research focuses on understanding the relationship between employment migration and multiple factors, such as family and social integration, and how it affects individual employment and salary.

the labor market and labor migration has also received much attention, covering workers' experience, unemployment, and skilled migration. The three mutated words with the most extended duration, amenity, earnings, and family migration, indicate that these aspects have aroused widespread interest among scholars. In recent years, there have been six emerging keywords: strategy, work, women's employment, migrations, health, and self-employment. The last three are the emergent words that started in 2021 and are ongoing. These prominent words indicate that future research may focus more on strategic choices, employment issues, health status, and challenges and opportunities in the freelance and entrepreneurship of migrants. These research directions will help to gain a deeper understanding of the impact of migration on individuals and society, as well as how to better support migrants in achieving economic and social integration in new environments.

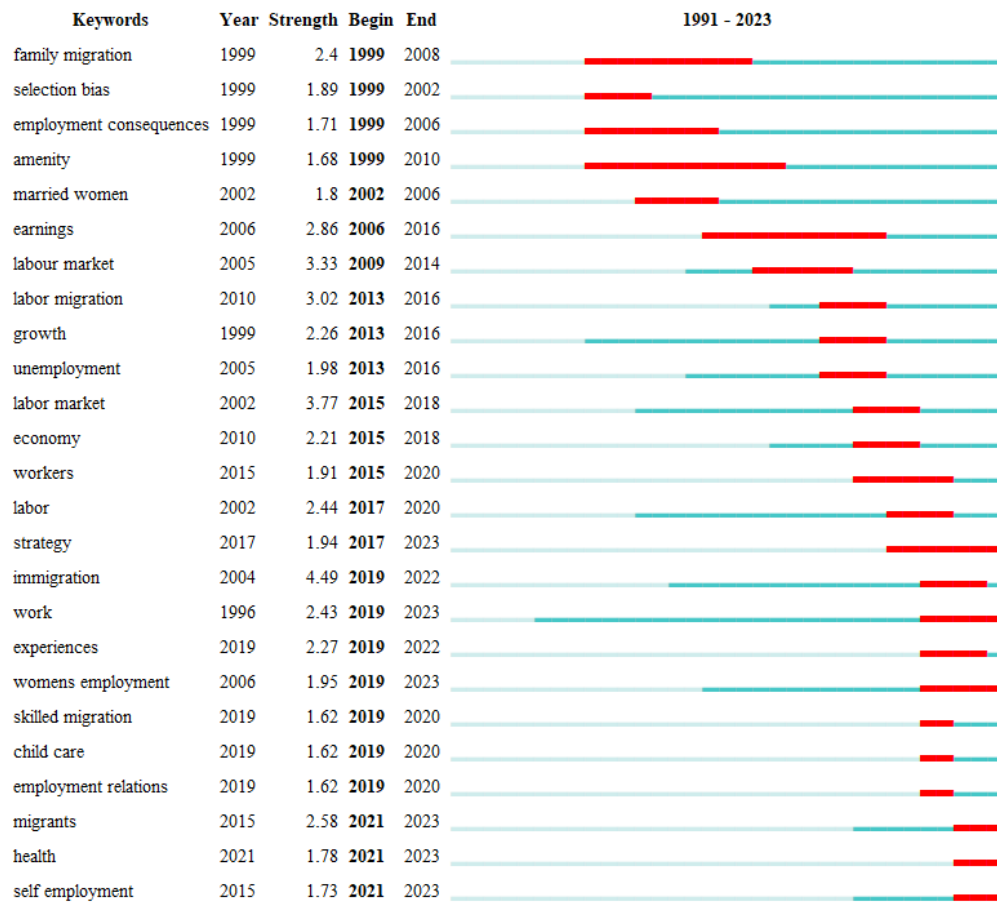


Fig. 6. Top 25 keywords with the most robust citation bursts

4. Conclusion

4.1 Discussion and Conclusion

This study uses Citespace visualization software to plot and visualize 295 SSCI papers on employment migration in the WOS database from January 1, 1980, to August 11, 2023. From the author's perspective and the country of publication, it is reflected that the issue of employment migration is a global research topic of concern. Meanwhile, our results also show that a relatively stable research group is forming in the field of employment migration. However, a close cooperative network among research authors has yet to exist. A comprehensive analysis of

keyword time zone analysis, co-occurrence analysis, and the trend was conducted on the sample literature using the CiteSpace software's keyword time zone view function, co-occurrence function, and mutation detection function. The current status and development trend of employment migration research were clearly presented, and this study drew the following findings.

Firstly, research on employment migration is showing a rapid growth trend. The literature has proliferated and remained high in recent years, reflecting its sustained development trend. The research covers multiple disciplinary fields, including economics, geography, sociology, demographics, and management. Among these fields, economics and sociology became the main research areas. In addition, interdisciplinary journals have also received widespread attention, further emphasizing the interdisciplinary nature of this field. Future research can consider more in-depth interdisciplinary research.

Secondly, the existing study on employment migration is relatively scattered and the research methods are single. There are currently mainstreaming research trends in the study of employment migration. First, the research focus has expanded to include women's employment, the Chinese market, childcare, health, youth employment, and employment agglomeration(Cairns, 2014; Vidal & Huinink, 2019; Wang et al., 2023). These keywords highlight the promotion of employment for different groups and the interest in improving employment opportunities. At the same time, the study also explored factors related to childcare, health, youth employment, and employment agglomeration(Cebula, 2022; Zhou & Tang, 2022). Overall, the research focused on understanding the relationship between employment migration and multiple factors, such as family and social integration, and how these factors affect individual employment and salary. Then, other mainstreaming research trends indicate that future research may focus more on strategic choices, employment issues, health status, as well as the challenges and opportunities of freelance and entrepreneurship for migrants. In particular, the influencing factors of employment migration and urban choice should be given more attention. With people's increasing pursuit of quality of life, cities are places for high-paying employment and to improve the quality of life. Therefore, job seekers will weigh the city's economic returns and quality of life when considering employment migration, which will be an important direction for future research. These two trends reflect the breadth and complexity of employment migration research and provide theoretical implications for future research.

4.2 Limitation and Future Research

Research on employment migration has recently achieved fruitful results, but there are still areas for improvement in the depth and breadth of research. Future research can be advanced through the following aspects.

Firstly, academic exchange and cooperation in the employment migration field should be strengthened between researchers and research countries. Employment migration is a complex process that involves different aspects to form a systematic analytical framework and effectively promote the quality of employment migration.

Secondly, in terms of research methods, emphasis should be placed on combining empirical research with theoretical research. The research on employment migration is not biased toward empirical or theoretical research. Future research should combine theory with practice to achieve the unity of instrumental rationality and value rationality, as well as the unity of history and logic.

Finally, in terms of research content, research on employment migration should focus on macro factors and profoundly consider the micro factors, including personal factors of workers' characteristics. These micro factors have a crucial impact on population mobility. Also, gender, age, education level, and marital status play a decisive role in the selection of population mobility. It is also necessary to consider the critical role of urban public service supply capacity in attracting the influx of employed population. Employment migration is not only influenced by social factors such as urban public service capacity (such as transportation, education, healthcare, and greening), air quality, housing costs, population size, and urban human capital stock but also by environmental factors such as air pollution level (Cairns & Smyth, 2011; Dang et al., 2019). The ability of urban public services significantly impacts the choice of labor flow, and they are more willing to flow to cities with better services. These factors will become important topics for future research on employment migration.

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