Nexus Between Economic Growth and Unemployment Rates: A Bibliometric Analysis of Various Methods and Mechanisms

Dr. Sana Fatima[1], Dr. Prabhat Mittal[2] and Dr. Renu Jain[3]

1. Assistant Professor, Symbiosis Centre for Management Studies, NOIDA
2. Professor, Satyawati College (Eve.), University of Delhi
3. Corresponding author, Associate Professor, Deptt. of Commerce, Satyawati College, University of Delhi

Abstract: *In economics, the nexus between economic growth and unemployment rates could be called a "puzzle." In developed or developing countries, the major problem in many countries is long-term unemployment. In this research, a bibliometric analysis is made using a quantitative method to find the main patterns of the research line on this topic. We looked at two different time periods: 2003–2012 and 2013–2021. Most articles show that the nexus between growth and unemployment significantly depends on the actions of policymakers. During the period 2003-2012, "formal" methods were used most of the time. From 2013 to 2021, we saw that the "empirical" method was used more, while the "formal" method became less important. Instead, articles about the role of institutions in the labor market and the bargaining structure got the highest score.*
Keywords: "Economic growth," "Unemployment rates," "Bibliometric analysis."

Introduction

Over the past few decades, numerous advancements in research have been related to the nexus between economic growth and unemployment rates. Nonetheless, economists and scholars have not yet come to a common understanding of the relationship between these two factors. High unemployment rates are a long-term problem for many economies, particularly Europe (Srinivasan & Mitra, 2014). Because of the importance of this issue to the European labor market, it is imperative to investigate the connection between these two factors. Since the first oil crisis in 1973, many developed economies have seen a decline in economic growth and a rise in their unemployment rates after the post-war era. Gross domestic product (GDP) growth in the United States (US) and European countries have both been on the decline since the early 1970s, although the rise in the unemployment rate has been more pronounced in Europe (Ljungqvist & Sargent, 1998). In addition, Europe's recession was not as severe as in other regions. Therefore it cannot be the primary reason for the country's persistently high unemployment rate. So, the probable reason behind this is the fundamental differences between European institutions governing the labor market. This states that the nexus between economic growth and the high unemployment rate is not universal (Haruyama & Leith, 2010).

Okun's Law is a well-known tool for studying this nexus, and its coefficients are often calculated in the literature. The correlation between unemployment and the

cyclical component of GDP is known as Okun's Law (Dixon, Lim, and van Ours, 2016). Because of this, Okun's cross-country coefficients imply that the nexus between economic growth and unemployment differs among nations based on the peculiarities of their respective labor market institutions, demographics, and other factors.

The primary purpose of this review study is to evaluate progress made in the field since the release of Aricó's (2003) ground-breaking assessment. Until the paper's publication, the author presented the most pertinent literature on unemployment's persistence in a growing economy and provided a preliminary categorization of the contributions. For their bibliometric study, Neto and Silva (2013) considered 84 publications published between 2000 and 2012. Beyond the impacts, Aricó (2003) identified, they found a substantial increase of "new effects" in the literature about this relationship. The authors urged the development of a novel theoretical framework to account for these emerging consequences and empirical findings. By analyzing almost a thousand articles, this study tries to bridge the existing literature with the most current developments since 2003.

In Section 2, the researcher examined some of the early attempts to investigate the persistence of unemployment in a thriving economy and some more recent contributions to the topic. In Section 3, all the research methods used in this review paper have been discussed. Section 4 discusses the evolution of articles related to the nexus between economic growth and unemployment rates. Section 5 reports the most important results from the Scopus database bibliometric analysis. Finally, Section 6 concludes with some final thoughts and highlights the primary findings of this study.

Literature review
Kuznets (1973) argues that economic growth can be characterized as a sustained improvement in a country's ability to provide a broader range of economic commodities to its population. Research on the relationship between economic growth and unemployment, as outlined by Aricó (2003), can be traced back to the works of Harrod (1939) and Domar (1947) in the middle of the 20th century. Although significant, these were not part of a larger collection of research because they did not spark a new discussion in the literature.

Pissarides's (1990) "job-search model" incorporates a standard screening function with a neoclassical growth theory and formally establishes the first link between economic growth and unemployment taking profits and hiring costs into account. According to the author, a higher economic growth rate results in a lower employment rate in a non-frictionless labor market. In this situation, firms increase their workforce, increasing job opportunities because they anticipate higher recruitment costs. Companies benefit from growing earnings since higher growth rates also boost future profits. Aghion and Howitt (1994) called this process of the increasing growth rate through increased employment a "capitalization effect." This group of researchers introduced a search

model of equilibrium unemployment that pays special attention to the redistributive facet of economic growth. Unemployment is caused, according to their model, when companies relocate their workforce.

The "creative destruction effect" has been identified by Aghion and Howitt (1994). The equilibrium rate of unemployment rises as the economic growth rate increases because the job-matching period shortens. This can happen either directly, as in the case of a spike in the job-destruction rate (unlike Pissarides's (1990) model), or indirectly, as a result of its negative impacts on employers' incentives to open new vacancies and, by extension, the job-finding rate.

Economic growth was treated as an exogenous factor in the two preceding models. Also, there was a direct link between economic growth and increased unemployment. Both economic growth and unemployment are treated as endogenous variables in the framework proposed by Bean and Pissarides (1993).

In the model of Pissarides (1990) and Aghion and Howitt (1994), rising unemployment lowers economic development because it reduces the "pool of savings" (the total amount of savings in the economy) that can be invested. Since the labor supply issue had not been addressed prior to Acemoglu's (1997) introduction of the "coordination failure effect," he has made a significant addition to the debate on the growth-unemployment nexus.

Acemoglu (1997) proposes two alternative equilibrium states depending on the entrepreneur's expectations. The first is analogous to the scenario when all businesses opt out of innovation, which results in a rise in the unemployment rate. In the latter, businesses embrace the new technology, resulting in a decline in the national unemployment rate. The "coordination failure effect" is counteracted by the "social planner" who directs the incentives of businesses for economic growth.

However, incorporating Okun's law into the model makes it more responsive to policy changes, resulting in less expansionary optimal fiscal and monetary policy. Additional fiscal policy may contribute to fewer benefits in economic growth when the unemployment rate is close to or below its natural rate, in contrast to a model that does not consider unemployment. (Crowley and Hudgins, 2021).

Following this, the researcher discusses some of the theoretical and methodological findings of Scopus-based bibliometric analysis. The goal is to determine where the literature that has developed since the survey conducted by Aricó (2003) uncovered the early primary contributions. Given the explosion of literature on the topic of growth and unemployment over the past two decades, it seems sensible to study the most important trends in this area and focus on the most significant contributions.

Methodology
To better understand the research done on the nexus between economic growth and unemployment rates, a bibliometric study was carried out. Article information for this bibliometric analysis was gathered

Comparing it to other databases like Google Scholar, World of Science, and CSA Illumina, this one stands out as the clear winner when assessing the significance of social science research (Norris and Oppenheim, 2007).

In the "keywords," "article title," and "abstract" fields on November 11th, 2021, the terms "economic growth" and "unemployment" were utilized to conduct this study. Only articles published between 2003 and 2021 were included in the search, and only the categories "Economics, Econometrics, and Finance" and "Business, Management, and Accounting" were selected as subject areas. Accordingly, 913 articles were downloaded.

More than 400 publications failed the first screening because their abstracts did not explicitly or implicitly address the "economic growth-unemployment" relationship. The full-text study of other publications was necessary to determine their applicability to the discussion. While eight publications passed the first relevance criteria, they were excluded from this analysis since requesting access was unsuccessful.

Methods and mechanisms were then used to classify the remaining articles. Six types of studies were taken into account ("formal," "empirical," "appreciative," "formal + empirical," "appreciative + empirical," and "survey") in accordance with Nelson and Winter (1982) and Nagarajan et al. (2017). The publications the researcher labeled "formal" either rely heavily on statistical models or are grounded in a rigorous analytic or logical structure. Further, articles were tagged as "formal + empirical" if they included data testing within the built model. The term "empirical" was coined to describe a category of publications that heavily or exclusively employ econometric or statistical examination of data. An article was categorized as "appreciative" if it offered an argumentative analysis, critique, judgment, appreciation, or assessment without using mathematical modeling. Similarly, the "appreciative + empirical" referred to the articles that included an appreciation or comment with testing results. Lastly, a "survey" is a collection of publications that have been through a documented exhaustive evaluation of both published and unpublished research from secondary sources data.

To classify the effects reported in the literature, the researcher divided them into two groups: "Initial effects," which included publications that documented one of the four main effects found by Aricó (2003), and "New effects," which included all other effects such as "Policymaker effects"; "labor market institutions and bargaining structure"; "entrepreneurial activity effects"; "structural shift, productivity growth, education and training"; "technological skills and agglomeration economies"; "financial market effects"; "migration and brain drain"; "internal and external factors"; "and inequalities." Finally, 17 papers were removed from the analysis since they did not formally show a transmission mechanism between economic growth and unemployment, providing us with 356 articles. The researcher utilized the VOSviewer software to compile a bibliographic review of the literature.

In the next section, the researcher will use VOSviewer to conduct several types of analysis, including a look at the most commonly used keywords, a network of authors, and a study of citations and co-citations. The results of this bibliometric literature analysis related to the nexus between economic growth and unemployment rates are presented below.

Evolution of articles on the nexus between economic growth and unemployment rates

Figure 1 below evaluates the relative importance of "Initial effects" and "New effects," considering all relevant studies. The first group was designed to incorporate works dealing with Okun's Law and the four primary links indicated in Aricó's (2003) paper ("Creative destruction effect," "capitalization effect," "pool of savings effect," and "coordination effect"). Reviewing the 356 publications, however, revealed that neither the "pool of savings effect" nor the "coordination effect" is mentioned once.

These results, consistent with that of Neto and Silva (2013) for the years 2000-2012, show that these two effects may have been obsolete or misinterpreted over the last two decades. As a result, the "Initial effects" part comprises only works pertaining to the remaining three references.

Articles that describe at least one effect that is unique from those already mentioned can be found under the "New effects." 88% of the total number of articles obtained fall into this category, indicating that economists have been considering a wider range of variables in their attempts to study this relationship.
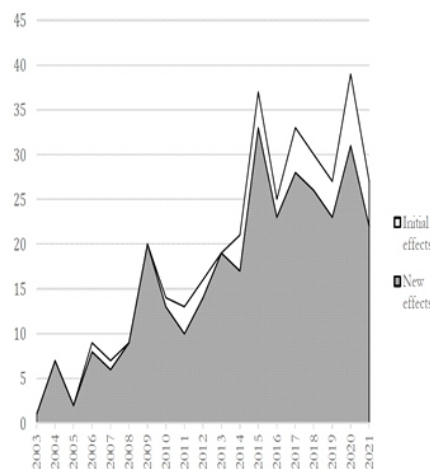
Figure 1: Distribution of articles on the nexus between economic growth and unemployment rates (2003-2021) by mechanism
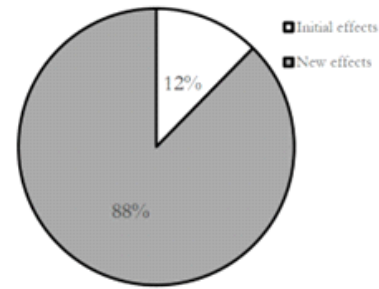
Source: Researcher's evaluation

Amid "new effects," growth-unemployment studies have surfaced over the past two decades, reaching a zenith in 2020 with 39 papers. Since 2012, there have been roughly 29 articles published annually on the topic. In addition, the study of Okun's Law appears to have refocused some economists' attention on the "Initial effects" category (44 publications) (Figure 2). Compared to the "New effects," this remains a relatively small number (312 articles).
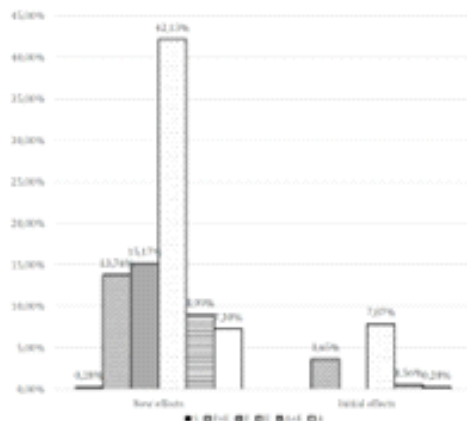
Figure 2: Evolution of articles on the economic growth-unemployment nexus (2003-2021) by mechanism

Source: Researcher's evaluation

Figure 3 displays the number of articles published by contrasting the "New effects" and the "Initial effects."

Figure 3: Distribution of articles on the nexus between economic growth and unemployment rates (2003-2021) by methodology


Source: Researcher's evaluation

The "Empirical" subcategory contains about half of all publications in this field that are relevant to the discussion at hand. Similarly, the "Formal + Empirical" category comprises both the "New effects" and "Initial effects," indicating its significance in the growth-unemployment nexus-related research. While 15% of "New effects" publications fall into the "Formal" category, not a single "Initial effects" work relies completely on this approach. Compared to the final three categories, "Formal + Empirical" and "Formal" only carry a weight limit of about 9.5% and 7%. Only one article was categorized as a "Survey" on the "New effects."

Given the rapid increase in the publication after 2012, the timeline is split in half to reflect this trend. The financial crisis of 2008, which wreaked havoc on many economies, is also linked to this schism. For this reason, it is logical to suppose that

the growth-unemployment literature increased in the years following the financial crisis (Dixon, Lim, and van Ours, 2016; Novák and Darmo, 2019). The first time frame will include all papers published between 2003 and 2012, while the second time frame will include 2013 through 2021.

For the first period, which includes 90 papers, the main "New effects" subcategories are displayed in Figure 4. Evidence suggests that effects induced by policymakers predominate. In contrast, those related to "financial markets and banking sector," "entrepreneurial activity," "technological skills and agglomeration economies," and "migration and brain drain" are less prominent. On the other hand, the "innovation process" and the "labor market institutions" are major topics in these journals. An essential point to make is that the "underground economy effects" subcategory has no examples from this time frame.

Figure 4: Distribution of articles on the economic growth-unemployment rates nexus (2003-2012) regarding "New effects" by subcategory
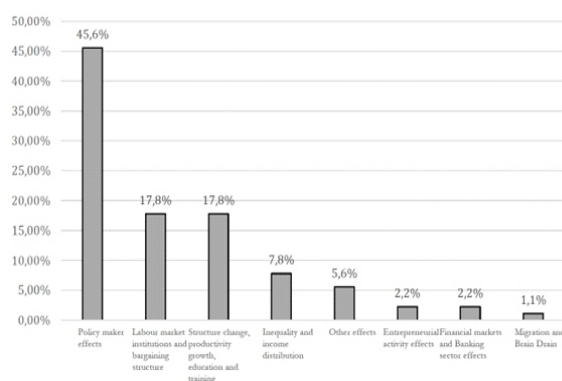
When comparing the first and second periods, the "policy maker effects" subcategory maintains its importance in the second period. However, economists appear to be paying more attention to studies regarding the consequences provoked by "entrepreneurial activity," with 27 papers published on the topic throughout the time considered. "Migration and brain drain," "financial markets and banking sector effects," and "technology skills and agglomeration economies" have all grown in both relative and absolute "weight" in the associated literature. In contrast, papers on "inequality and income distribution" have declined. (Figure 5).
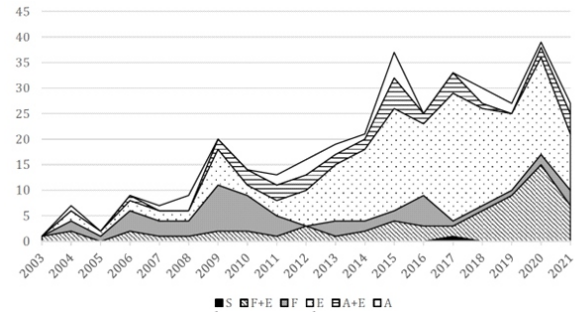
Figure 5: Distribution of articles on the economic growth-unemployment rates nexus (2013-2021) regarding "New effects" by subcategory
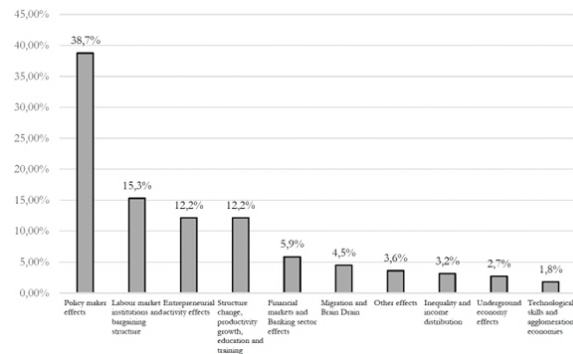
Source: Researcher's evaluation

Figure 6 shows that before 2012, the "formal" category of publications about the approach utilized was more common. After 2017, both the "Empirical" and "formal + empirical" categories see significant growth. This might be interpreted as a recognition by researchers of the need for adequate theoretical modeling to supplement the huge body of empirical research that has evolved over the past decade.

Figure 6: Evolution of articles on the economic growth-unemployment nexus related to "New effects" (2003-2021) by methodology.

Source: Researcher's evaluation

More than a third of all articles on the subject between 2003 and 2012 fell into the "formal" category, while nearly a third fell into the "empirical" category. Although the "formal + empirical" group accounts for more than 15% of the total, the other three categories also play significant roles in the relevant literature (Figure 7).

Figure 7: Distribution of articles on the economic growth-unemployment rates nexus (2003-2012) regarding "New effects" by methodology
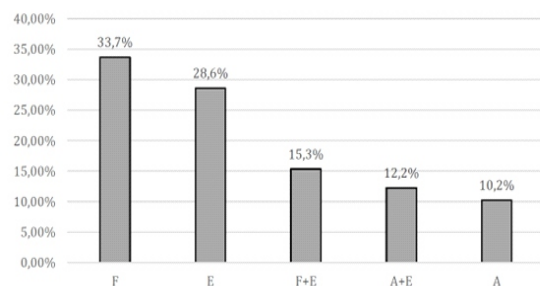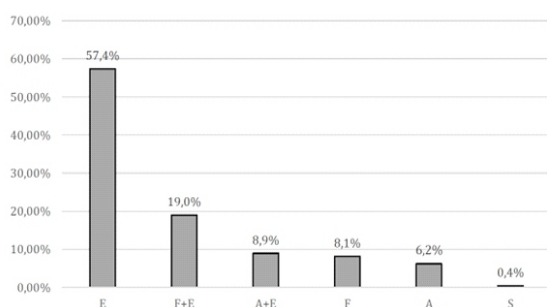

Source: Researcher's evaluation

Figure 8 presents some findings with regard to the "methodology" category when the years 2013-2021 are considered. The "formal" category now carries only 8.1% of the total. Compared to the earlier period, fewer authors opted for argumentative or hybrid approaches that combined

theoretical frameworks with empirical investigation. More than half of the publications eventually published used an empirical methodology, making it the most popular choice. This bridges the research gap caused by the theoretical approach. Finally, the combination of the "formal + empirical" approach ranks second, with 20% of studies.

Figure 8: Distribution of articles on the economic growth-unemployment rates nexus (2013-2021) regarding "New effects" by methodology
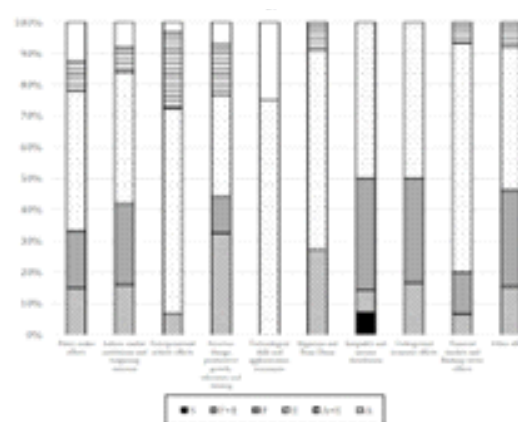

Source: Researcher's evaluation

Finally, Figure 9 shows the full-time span of 2003-2021 for each subcategory of the "New effects," combining the "mechanism" and "methodology" categories. According to the primary data, the "empirical" group is larger than any of the other "New effects" groups in every single category. The "underground economy effects" indicate a shift toward an empirical strategy. A large number of publications in subcategories, including "inequality and income distribution" and "labor market institutions and bargaining structure," are also being given a "formal" treatment. Subcategories such as "entrepreneurial activity effects," "structure change, productivity growth, education and training," "technological skills and agglomeration economies," and

"migration and brain drain" appear to benefit greatly from a "formal + empirical" approach. Finally, the "appreciative" and "appreciative + empirical" categories are underrepresented in nearly all of the "New effects," which is consistent with earlier findings.

Figure 9: Distribution of articles on the economic growth-unemployment rates nexus (2003-2021) regarding "New effects" by mechanism and methodology

Source: Researcher's evaluation

Bibliometric analysis
Figure 10 is a network diagram depicting the relationships between various keywords. In this bibliometric analysis, 356 publications were chosen using a total of 1035 keywords. If the minimum keyword occurrence count in VOSviewer is set to 4, it will recognize 79 keywords. The network visualization option displays eight distinct color groups, illustrating the connections between keywords. According to this diagram, the growth-unemployment nexus literature is only moderately homogeneous, with authors using a variety of approaches to the same problem.

Figure 10: Co-occurrences of keywords

Consequently, "economic growth" (176 occurrences) and "unemployment" (185 occurrences) are the two most often used keywords, followed by "employment" (33 occurrences), "labor market" (31 occurrences), and "entrepreneurship" (23) (Table 1).

Table 1: Occurrences of keywords

Keywords	Occurences	Total link strength
Unemployment	185	557
Economic growth	176	541
Employment	33	121
Labor market	31	152
Entrepreneurship	23	52
Gross Domestic Product	21	94
Okun's Law	18	56
GDP	15	42
Inflation	15	48
Income distribution	14	54

Source: Researcher's evaluation

The most frequently cited authors and the total number of works in the field are listed in Table 2. Table 2 includes the total number of citations for each author in our domain of 356 articles. One striking feature is the authors' low output in published works. While many have explored writing on the nexus between economic growth and unemployment rates, the vast majority have only one publication to their name. It was found that only 6 authors have written more than 2 articles, and none of them is in the top 15.

Table 2: Top cited authors

| Author	Number of Articles	Citations
Dosi, G.	1	289
Fabiolo, G.	1	289
Roventini, A.	1	289
Tregenna, F.	1	102
Cai, F.	1	100
Wang, M.	1	100
Himanshu	1	97
Stockhammer, E.	2	87
Onaran, Ö.	1	86
Kus, B.	1	77
Knight, J.	2	74
Kingdon, G.	1	74
Boubtane, E.	2	58
Coulibaly, D.	2	58
Rault, C.	2	58

Source: Researcher's evaluation

Next, the researcher examines the scholarly collaboration measured by the co-authorships network (Donthu, Kumar, and Pattnaik, 2020). From a total of 712 authors identified in the relevant literature, 138 were selected using VOSviewer on the basis of meeting the evaluation components: having at least one paper published and a minimum of 10 citations. The number of articles a group of authors has contributed to determines how large each cluster appears on the map.

The map (Figure 11) shows minimal contact between the various groups of authors. It appears that authors in the relevant literature generally research in silos and don't connect with one another. But in exceptional cases, they'll take in an "outsider" to collaborate with the existing team.

the impact of unionization on economic growth and unemployment. Jan C. van Ours came in second with 40 global and 13 local citations. The researcher has two works by this author in the collection, examining the nexus between economic growth and high unemployment. In third place, both Ching-chong Lai and Ming-fu Shaw, who both co-authored with Juin-jen Chang, have received 12 local citations.

Figure 12: Author citation network
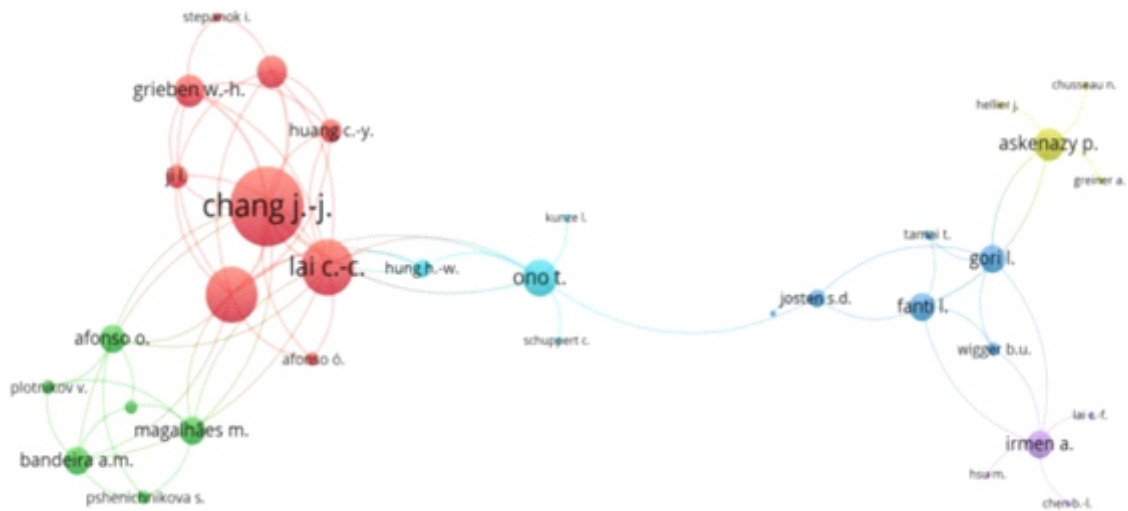
Source: Researcher's evaluation

The co-citation analysis, which enables the identification of networks of authors and articles pertaining to the same style, paradigms, or theory, provides more intriguing insights into the empirical and theoretical underpinning of this research (Acedo et al., 2006). The researcher may utilize these co-citation patterns to draw a picture of the interconnections between these foundational ideas that underpin the most current research.

Figure 13: Author co-citation network
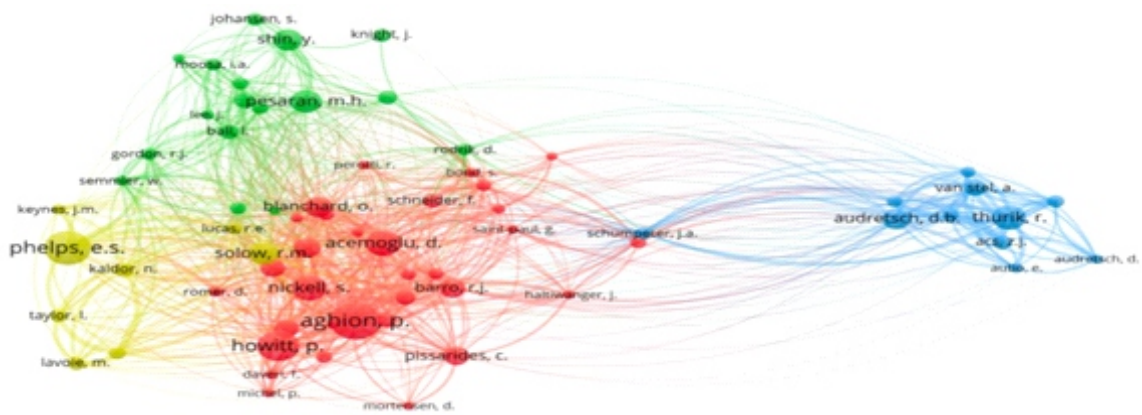
Source: Researcher's evaluation

Figure 11: Co-authorship network

Source: Researcher's evaluation

Ortega (2014) argues that studying scientific collaboration through examining authorship networks is the most effective method. However, opinions on how collaboration affects the quality of research vary widely. Compared to other fields like Physics, Geosciences, and Engineering, the researcher discovered that co-authorship networks in the "Economics & Business" research field are typically quite small and sparse. An abundance of centrality in the field of "Economics & Business" demonstrates the dominance of a single author over the work of all other researchers working in the same field. These results were in agreement with our findings shown in Figure 11. Another study by Ortega (2014) demonstrates that authors in the field of "Economics & Business" receive more citations per document than those in any other academic field. Thus, there is a negative correlation between citations per paper and clustering degree but a positive correlation between citations per paper and betweenness centrality. Therefore, academics in "Economics & Business," who tend to have scarce and narrow networks, isolated co-authors, and a high level of control over their network, tend to have more research effect (Ortega, 2014).

The citation connectivity between authors is another sign of this low level of interaction. Again using VOSviewer, 33 referenced authors and 6 clusters (out of a total of 712) were identified. (Figure 12). Data on how often each of the 712 authors is referenced by other authors in their field is provided (local citations). The most important authors in this field are shown in Figure 12 below.

Using VOSviewer, the researcher found that Juin-jen Chang has received the most local citations from other authors in the field of related literature. After compiling all of the citations from throughout the world, the author had 38 citations in Scopus. However, within the scope of this bibliometric review (356 publications by 712 authors), the author has been cited 17 times. Chang is a member of the "Labour market institutions and bargaining structure" group and a co-author of three of the articles the researcher analyzed, all of which examine

Regarding the mapping pattern, the software discovered 12703 cited authors, of which 68 exceeded the requirement of having at least 20 citations in the most recent literature. The map confirms that many of the academics cited in Aricó (2003)'s work remain among the most influential thinkers in the field (Figure 13). Nearly a quarter of the relevant literature cites one of Philippe Aghion's works, making him the most referenced author.

Conclusion

In this study, the researcher conducted a quantitative bibliometric analysis to identify the most prevalent trends in the literature related to the nexus between economic growth and unemployment rates. After searching the Scopus database, 356 papers were chosen between 2003–2021. Each paper was organized according to a set of categories that described the mechanisms and methods with which it dealt. The investigation revealed that novel mechanisms contribute to the growth-unemployment nexus field of study. Therefore, an "initial effects" versus "new effects" strategy was adopted, with the former mentioned in the survey by Aricó (2003) and the latter taking into account Okun's law.

Further, over 90% of articles from 2003 to 2021 reported on at least one "new effect." The research was then split into two-time intervals, with 2012 serving as a baseline for both. This may be because of the 2008 financial crisis, which prompted more scholars to investigate the relationship between the two factors. In the second time period between 2013 and 2021, the empirically oriented became strong. The "empirical" category contains 57.4% of the articles related to this relationship.

The "theoretical + argumentative" analysis with an "empirical" analysis also increased their weight in the overall number of related articles compared to the period between 2003 and 2012. In the case of the "formal" category, there was a significant shift from 34% in the first period to 8.1% in the second period. The "policy maker effects" category ranks highest for both periods when the articles are sorted by how they affect policymakers. But between 2013 and 2021, two new groups surfaced: "underground economy effects" and "technological skills and agglomeration economies." There was also a significant increase in the number of papers related to "entrepreneurial activity consequences," from two in the first period to twenty-seven in the second. The researcher used the VOSviewer software to produce a thorough bibliographic survey of the relevant literature. The results in both the citation and co-citation networks demonstrate limited interaction between groups of authors. Defining a new theoretical framework that can account for some of these new effects observed in the current literature may be helpful in future studies.

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