

# TITLE: EXPLORING THE DYNAMICS OF DEFENSE EXPENDITURE AND ECONOMIC DEVELOPMENT: A BIBLIOMETRIC ANALYSIS

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## ABSTRACT

This study used bibliometric analysis to derive meaningful insights from the literature related to the field of defense expenditure and economic development. The analysis covered 381 documents published across a range of journals from 1991–2021. The Scopus database and the bibliometric R package (R studio) were utilized to identify prominent journals, authors, countries, articles, and themes in the area under study. The study's findings revealed a noticeable increase in publications and citations over the years, indicating a positive yearly growth rate of 2.16%. Among the 161 journals examined, *Defence and Peace Economics* was found to be the most impactful, with 99 published articles, 1,743 citations, an h-index of 25, and a g-index of 34. Moreover, Dunne JP published the most papers, consistently remained the most cited author, and continued to be the most influential author, with an h-index of 12. The USA, China, and Greece produced the highest number of articles, while the collaborative networks of countries were divided into four major clusters, with researchers from the USA collaborating the most with researchers from other countries and the University of Cape Town and COMSATS Institute of Information Technology collaborating the most with other universities.

**Keywords:** Bibliometric, R package, R studio, Defense spending, Military expenditure, Economic development, Economic growth, Literature review, Descriptive analysis.

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## **1. INTRODUCTION**

It is the fundamental objective of any government to effectively and equitably distribute and allocate its available resources to address various competing needs. In the field of public economics, this particular scenario is commonly referred to as the "guns or butter" dilemma. Although national security is regarded as the foremost concern of every nation, the substantial outlay on military endeavors places a significant strain on the government's ability to effectively allocate funds for the well-being of its populace. It is well documented that over the years 2013–2022, global spending on military expenditure increased by 19%. Moreover, in real terms, global military spending increased by 3.7% in 2022 to reach a record high of \$2240 billion (Tian, Lopes da Silva, Liang, Scarazzato, Béraud-Sudreau, & de Oliveira Assis, 2022). Current conflicts, including the war between Israel and Palestine and the crisis between Russia and Ukraine, will also have a significant impact on the military spending of various countries across the globe. The literature has extensively explored the consequences of military expenditures on economic conditions. This discussion of the allocation of resources to military spending and its effects on the economy can be traced back to pioneering research conducted by Benoit (1973), which established a significant correlation between these two variables. Benoit's work then inspired a slew of other studies on the relationship between the two variables (Abu-Bader & Abu-Qarn, 2003; Ahmed et al., 2020; Alptekin & Levine, 2012; Apanisile & Okunlola, 2014; Awaworyi Churchill & Yew, 2018; Blomberg, 1996; Cappelen et al., 1984; Castillo et al., 2001; Chang et al., 2011; d'Agostino et al., 2017; Deger & Smith, 1983; Dimitraki & Win, 2021; Emmanouilidis & Karpelis, 2021). While some studies found there to be a non-linear relationship between military expenditure and economic growth, most of the literature on the relationship between defense spending and economic growth explores whether defense spending increases or decreases economic growth, with some studies identifying a positive correlation and others identifying a negative correlation. Also, of note is the fact that, since early 1991, the amount of academic research in the area has increased.

One key trend across the studies is that defense spending has a detrimental effect on economic growth, which is consistent with the classical school of thought. More specifically, the increase in defense expenditure slows private investment, thereby reducing domestic savings and aggregate demand, which in turn leads to a fall in consumption and, ultimately, political stability. Several researchers produced empirical evidence to suggest this was the case in multiple countries (Maizels & Nissanke, 1986; Manamperi, 2016; McMillan, 1992; Njamenkengdo et al., 2018; Sarwar & Idrees, 2022; Saudi et al., 2019; Tao et al., 2020; Töngür & Elveren, 2017).

Numerous other studies, however, highlight the beneficial effect of defense spending on economic growth. Military expenditure has the potential to stimulate economic growth through aggregate demand effects, in line with Keynesian principles. Infrastructure and human capital could have positive externalities and technology spillovers. Defense spending may act as an economic stimulus, particularly in underemployed economies, by boosting aggregate demand, production, and employment. Another area where defense spending may exert significant positive externalities on the rest of the economy is human capital investment, as shown by a number of researchers (Alptekin & Levine, 2012; Awaworyi Churchill & Yew, 2018; Heo & Ye, 2019; Mukhopadhyay et al., 2022; Palavenis, 2020; Pan et al., 2015; Shahbaz et al., 2013; Yildirim† et al., 2005).

Despite the recent surge in interest in this field, there continues to be a notable absence of quantitative or qualitative analyses. This paper seeks to address this gap by conducting a bibliometric analysis exploring the historical evolution of the relationship between defense spending and economic growth. By doing so, it shows how objectives, guidelines, and areas of research have changed over time. Also, it provides insights into how various nations see defense spending and its effects on their economies, thereby offering a global perspective that could prove useful to scholars and policymakers alike. To investigate this area of study, we analyze the most influential authors, journals, institutions, and networks. Moreover, it was important to conduct a quantitative investigation of the literature in the field in order to provide an overview, trace its evolution, and identify emergent themes from the literature and directions for further study. Thus, we conduct a bibliometric analysis of the literature on defense spending and, in doing so, address the following research questions:

Which authors, sources, and affiliations in the area produced the most results?

What are the most frequently cited articles, popular search terms, and hot topics?

What are the social, intellectual, and conceptual frameworks that surround the field?

The paper is structured as follows: Section 1 introduces the study and explains its significance; Section 2 describes the background to the study; Section 3 presents a bibliometric analysis and the results of the study; and Section 4 provides a conclusion, including recommendations for future research directions.

## **2. METHODOLOGY**

This study uses bibliometric analysis to derive meaningful insights from the literature published in this field. Bibliometrics, initially introduced by Pritchard in 1969 as "the mathematical and statistical analysis of bibliographic records," is a well-recognized research technique used to statistically and numerically evaluate scientific literature. In recent times, the practice of bibliometric analysis has received significant attention (Aria & Cuccurullo, 2017; C. Chen, 2006; Donthu, Kumar, Mukherjee, et al., 2021; Swain et al., 2013). It encompasses a range of techniques for scrutinizing textual and data-based information, especially when dealing with extensive datasets (Chen et al., 2016; Cobo et al., 2011; Ingale & Paluri, 2022), and it serves as a powerful instrument for assessing the scholarly productions of research journals, authors, institutions, and even nations (Liao et al., 2019). By employing bibliometric research, one can not only identify prevailing trends in ongoing research but also chart potential trajectories for future investigations (Kent Baker et al., 2020). For these reasons, its adoption has become increasingly common across various academic domains (Chen et al., 2016; Merigó & Yang, 2017; Rialti et al., 2019; Solanki et al., 2023; Subramanyam, 1983; Swain et al., 2013; Wasserman & Faust, 1994; Zupic & Čater, 2015). Moreover, its use is expanding across a number of subject areas such as economics (Castillo-Vergara et al., 2018; Solanki et al., 2023), finance (Abad-Segura & González-Zamar, 2019; Akter et al., 2021; Goyal & Kumar, 2021; Ingale & Paluri, 2022; Martínez-Climent et al., 2018; Pattnaik et al., 2020), knowledge management (Agostini et al., 2020; Agrifoglio et al., 2021; Farooq, 2021, 2022; Gaviria-Marin et al., 2019; Sanguankaew & Vathanophas Ractham, 2019; Serenko, 2021), tourism (Atsız et al., 2022; Kim & So, 2022; León-Gómez et al., 2021; Mulet-Forteza et al., 2019; Şimşek & Kalıpçı, 2023), and education (Budd, 1988).

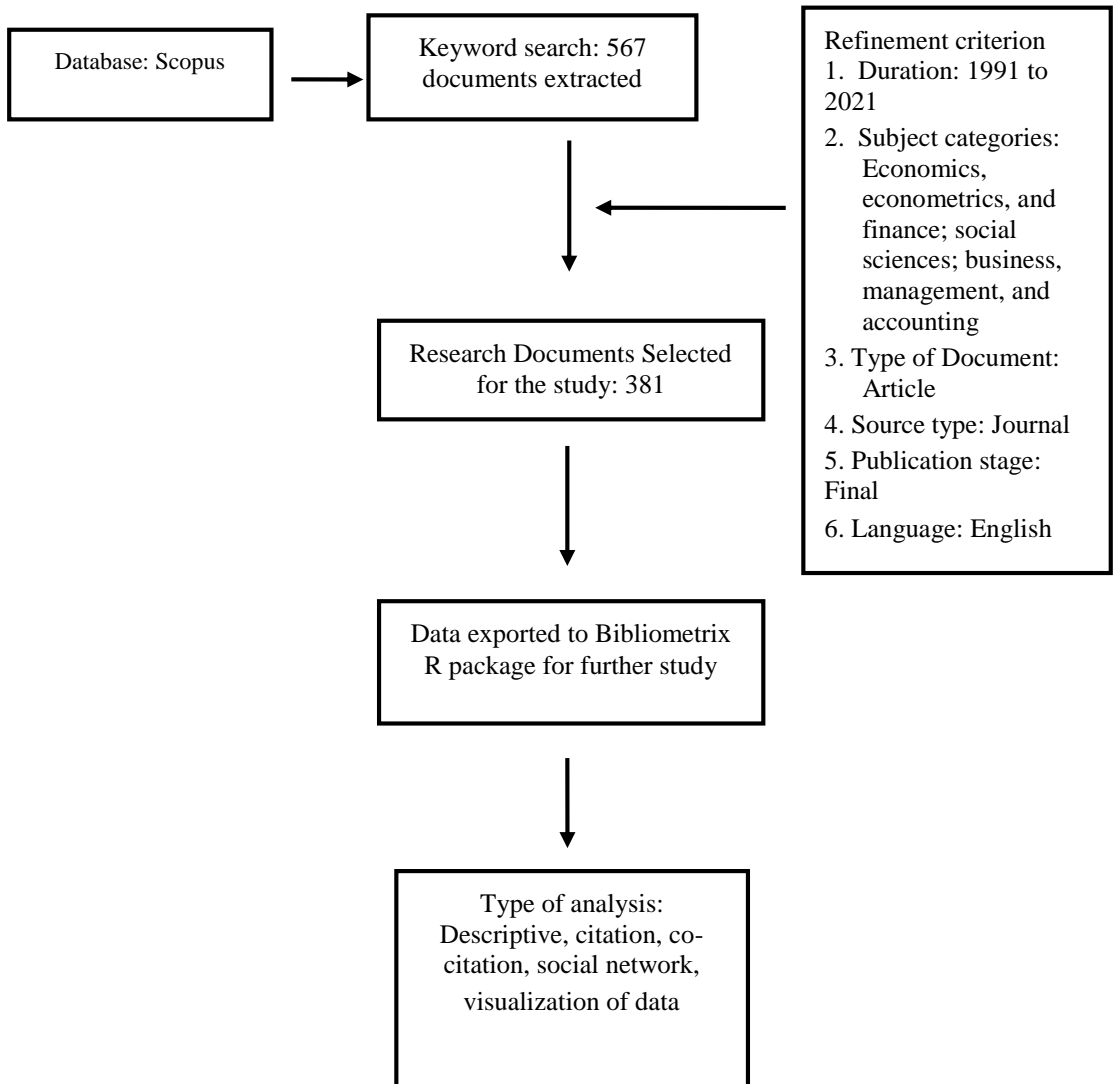
## **2.1. Data Collection and Search Strategy**

To conduct a review of defense expenditure and its impact on economic development, we searched the keywords "defence expenditure" or "defence spending" or "defense expenditure" or "defense spending" or "military expenditure" or "military spending" or "economic development" or "economic growth" to extract data from Scopus from between 1991 and 2021. In total, the search yielded 567 records. These articles were published in journals covering a range of disciplines, including social sciences, business, management, accounting, environmental science, the arts and humanities, engineering, and others. The three subject areas with the most publications on the given subject from 1991 to 2021 were the social sciences (366), economics, econometrics, and finance (324), and business, management, and accounting (64), so these areas were considered for inclusion in the study. After the initial screening of articles, the dataset was narrowed down to 511 articles from the original 567 articles published between 1991 and 2021.

In the second stage of the article screening process, we further refined the search by considering only papers published in journals and excluding those published in books, book series, conference proceedings, and trade journals, following the recommendation of Paul et al. (2021). This reduced our dataset from 511 to 432 articles. We then excluded articles labeled as reviews, conference papers, editorials, errata, and press articles, instead selecting only papers published under the category "Article," which cut the total down to 394. In the final search process, we excluded articles published in languages other than English, as discussed by Donthu et al. (2021) and Kumar et al. (2021). This left us with 381 articles on the relevant keywords from 1991 to 2021. The search was completed on July 27, 2022, and Boolean operators such as AND and OR were employed to combine keywords.

“(TITLE-ABS-KEY ( "defence expenditure" ) OR TITLE-ABS-KEY ( "defence spending" ) OR TITLE-ABS-KEY ( "defense expenditure" ) OR TITLE-ABS-KEY ( "defense spending" ) OR TITLE-ABS-KEY ( "military expenditure" ) OR TITLE-ABS-KEY ( "military spending" ) AND TITLE-ABS-KEY ( "economic development" ) OR TITLE-ABS-KEY ( "economic growth" ) ) AND PUBYEAR > 1990 AND PUBYEAR < 2022 AND ( LIMIT-TO ( SUBJAREA , "SOCI" ) OR LIMIT-TO ( SUBJAREA , "ECON" ) OR LIMIT-TO ( SUBJAREA , "BUSI" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( PUBSTAGE , "final" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )”

The process for selecting documents can be seen in Figure 1 below.



**Figure 1:** Document Selection Using PRISMA Protocol

## 2.2. Selection of Database

Many researchers use widely recognized databases, namely Web of Science, Scopus, and Google Scholar, to conduct bibliometric analysis (Solanki et al., 2023). Of these, we chose to use Scopus because it hosts the highest number of journals (Falagas et al., 2008; Farooq, 2022), its author-based citation and co-citation are the most precise (Zupic & Čater, 2015), its featured journals are

reviewed every year to ensure they are of a high quality (Low & Siegel, 2019; Sharma et al., 2021), and it is ideal for projects that require an extensive corpus to review (Kumar et al., 2021).

### 2.3 Selection of Bibliometric Tool

In this study, we utilized an open-source statistical application called Bibliometrix R package (R studio) for data analysis and interpretation. a tool developed in the R language (Aria & Cuccurullo, 2017). R was chosen for this investigation due to its various features, including integrated data visualization and a practical statistical approach, which sets it apart from other tools (Aria & Cuccurullo, 2017; Singh & Dhir, 2019). Moreover, the R package makes bibliometric research easier through data processing and visualization (Ingale & Paluri, 2022), leading to it being widely used among researchers, data analysts, and analytical professionals across the world (Linnenluecke et al., 2020).

## 3. BIBLIOMETRIC ANALYSIS AND RESULTS

### 3.1.1. Descriptive Analysis

Bibliometric indicators are employed to conduct a descriptive analysis of the structural aspects of publishing and citation as well as to identify highly productive authors, documents, journals, organizations, nations, and author keywords.

### 3.1.2. Summary of Data

Table 1 provides a summary of the bibliometric dataset comprising 381 articles chosen after an extensive search of the Scopus database. These 381 articles were published in 161 different journals from 1991 to 2021, with an average of 12.7 years since publication. There were 16.73 citations per document on average, translating to 1.47 citations per document annually. The dataset included 582 authors, 613 author keywords, 117 single-authored papers, and 465 documents with multiple authors. The results of the collaboration index, which gauges the extent of author partnership, showed a value of 1.88, indicating that a considerable number of studies involved researcher collaboration.

**Table 1:** Summary of Data from 1991 to 2021

Description	Results
Documents	381
Average years from publication	12.7
Average citations per document	16.73
Average citations per year per doc	1.47
DOCUMENT CONTENTS	
Authors	582
Author keywords (DE)	613
Authors of single-authored documents	117

Authors of multi-authored documents	465
AUTHOR COLLABORATION	
Single-authored documents	134
Documents per author	0.655
Authors per document	1.53
Co-authors per documents	2.03
Collaboration index	1.88

### 3.1.3. Scientific Production and Citation Analysis (1991–2021)

The publication trend from 1991 to 2021 showed a consistent annual growth rate of 2.16%, as seen in Table 2 and Figure 2. Ten publications were published in 1991, with an average of 27.6 citations per article and 0.89 citations per year. In terms of the number of published research articles, the year 2004 was the least prolific as there were only five publications that year. 2016 was the year in which the highest number of papers were published (28). Figure 3 shows that the average citation count has sharply dropped from 27.6 in the year 1991 to 3.07 in the year 2021. However, it is important to note that from 0.89 in 1991 to 3.74 in 2021, the average annual number of citations has climbed. The largest number of citations (average citations per article) was 39.8, which was recorded in 2003, with an average of 2.10 each year.

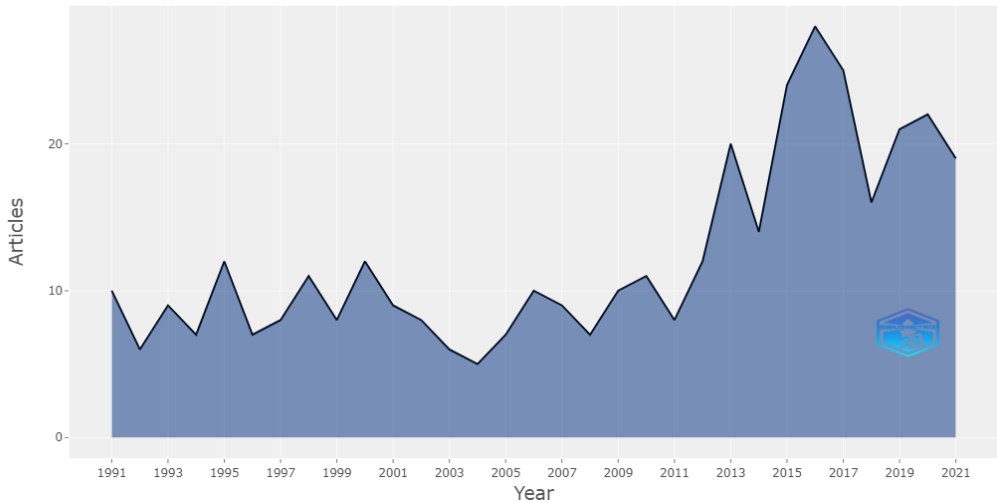
**Table 2:** Annual Publications and Citations (1991–2021)

Year	N	MeanTCperArt	MeanTCperYear
1991	10	27.6	0.89
1992	6	20.0	0.67
1993	9	13.2	0.46
1994	7	22.1	0.79
1995	12	23.9	0.89
1996	7	18.0	0.69
1997	8	32.3	1.29
1998	11	37.8	1.58
1999	8	14.1	0.61
2000	12	10.7	0.48
2001	9	35.2	1.68
2002	8	23.5	1.18
2003	6	39.8	2.10
2004	5	34.4	1.91
2005	7	16.0	0.94
2006	10	19.8	1.24
2007	9	25.1	1.67

2008	7	5.9	0.42
2009	10	34.5	2.65
2010	11	12.6	1.05
2011	8	20.0	1.82
2012	12	25.6	2.56
2013	20	15.1	1.67
2014	14	13.6	1.71
2015	24	11.2	1.60
2016	28	14.5	2.41
2017	25	11.6	2.31
2018	16	7.5	1.88
2019	21	8.6	2.87
2020	22	4.8	2.39
2021	19	3.7	3.74

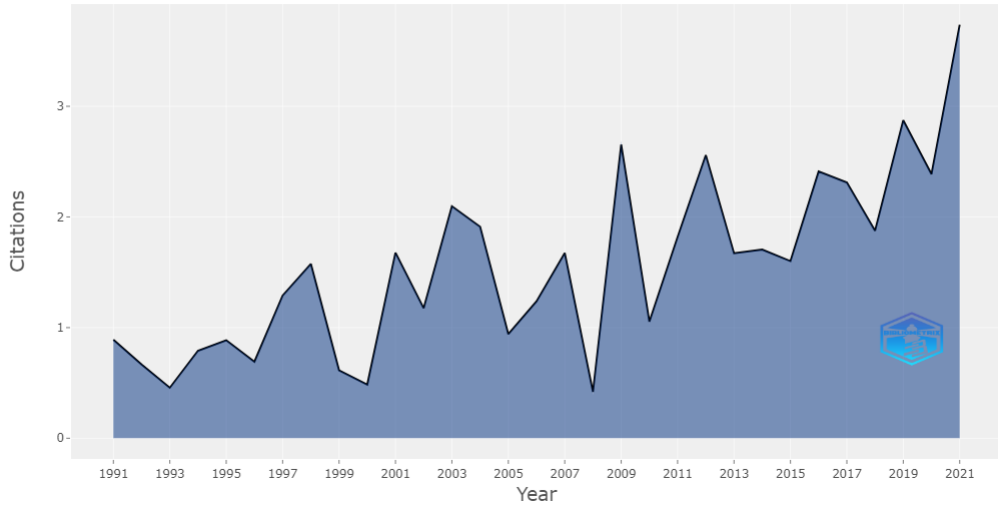
**Notes:** N = Number of publications, MeanTCperArt = Average total citations per article, MeanTCperYear = Average total citations per year

**Figure 2: Annual Scientific Production**  
Annual Scientific Production





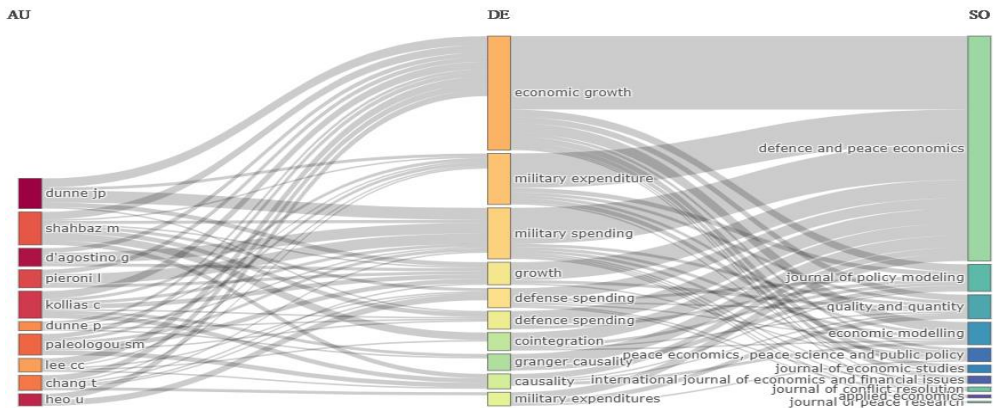
**Figure 3: Average Article Citations per Year**  
Average Article Citations per Year



### 3.1.4. Three-fields Plots

Figure 4 depicts a three-element diagram known as a three-fields plot. A three-fields plot features a list of authors on the left, a list of keywords in the center rows, and a list of journal publications on the right. These three components are linked together by a gray plot. Each author is linked to the keywords they commonly used in their research and the journals where their work was published. In this specific analysis, ten items, which include ten authors, ten keywords, and ten journals, were selected. Figure 4 displays the ten authors in the first element of the three-fields plot, with Dunne JP having the highest number of publications. All of these ten authors primarily focus on the theme of economic growth, as indicated by the size of the rectangle, which is the largest. The journal *Defence and Peace Economics* has the most significant rectangles, indicating that most publications in this field were published in this journal.

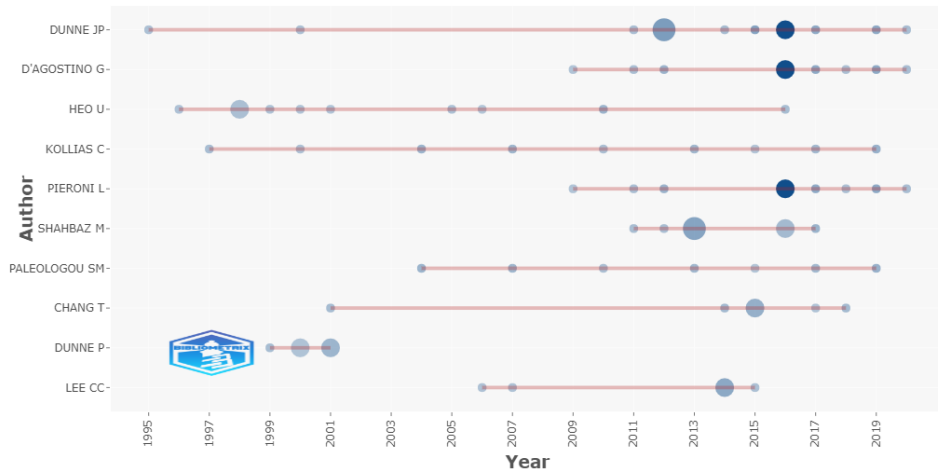
**Figure 4: Three-field Plots**



### 3.1.5. Analysis of the Most Productive Authors (Top 10)

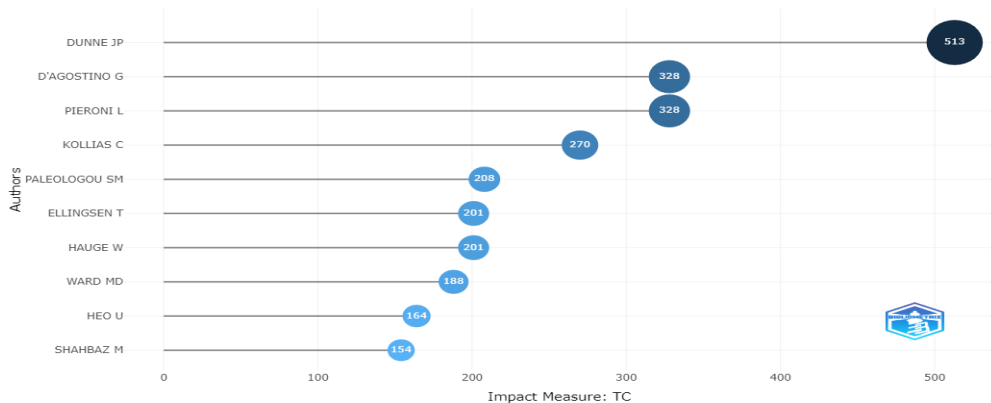
Figure 5 depicts the number of papers written by each author. Out of 582 authors, Dunne JP was the author with the most publications (13 papers) in the field. Moreover, his period of publication ranges from 1995 to 2020. Following closely behind, Heo U authored ten papers, while D'Agostino G, Kollias C, and Pieroni L each contributed nine papers to the field.

**Figure 5:** Top Authors' Production over Time  
Top-Authors' Production over Time



Citation analysis aids us in comprehending and evaluating the contributions of writers to a particular study area (Dhamija & Bag, 2020). In terms of this study, Dunne JP published the most publications and was the most cited author, having 513 citations in total, followed by D'Agostion G (328) and Pieroni L (328). Other authors' local impact, as measured by the total citation index, is highlighted in Figure 6.

**Figure 6:** Authors' Local Impact by TC Index  
Author Local Impact by TC Index



Dunne JP remains the most influential author, with an h-index of 12, followed by Kollias C with an h-index of 8. Other authors' local impact, as measured by h-index, is presented in Figure 7. Dunne JP published the most papers (13 papers), had the most total citations (513), and had the highest h-index (12) amongst these authors from 1991–2021.

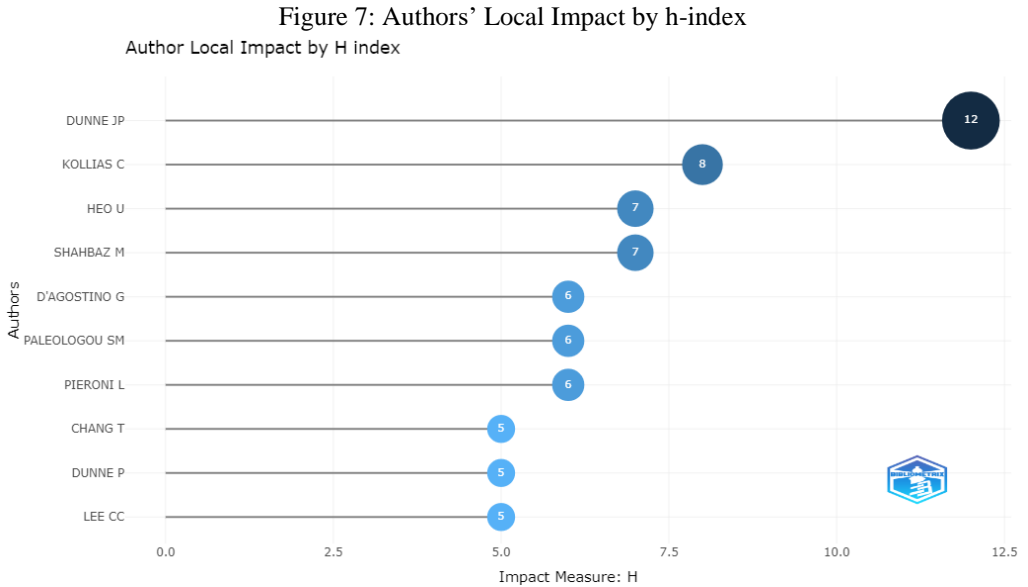
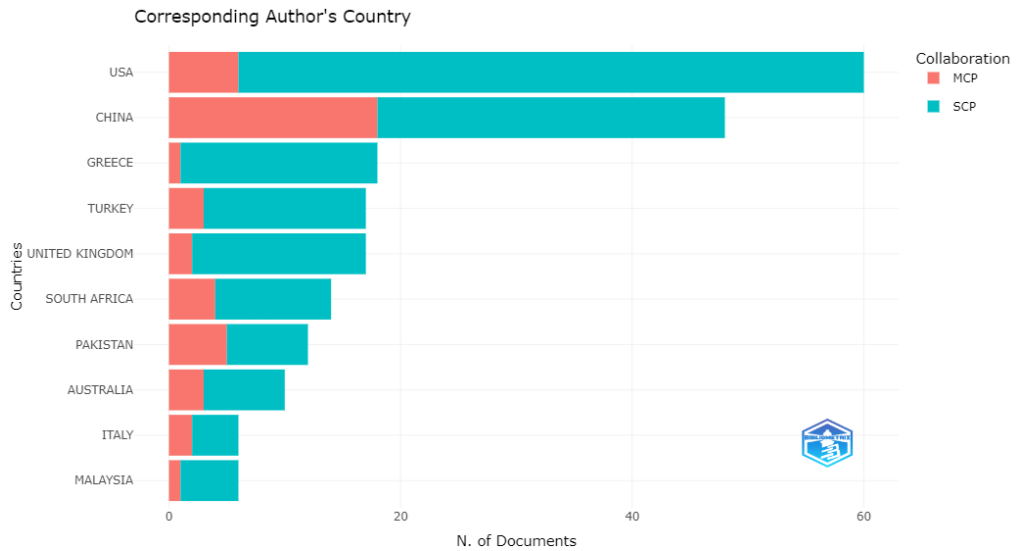


Figure 8 displays the level of collaboration across various nations for each publication. The USA ranked highest with 60 publications, including 54 single-country research paper publications and 6 multiple-country research paper publications. China came second with 48 publications, including 30 single-country publications and 18 multi-country publications. Greece secured third position with 18 articles, including 17 single-country publications and 1 multiple-country publication. Other countries, such as Singapore, Israel, Austria, Cameroon, Iran, and Japan, did not collaborate with any other countries on their publications. This suggests potential for collaboration between these countries in the field.

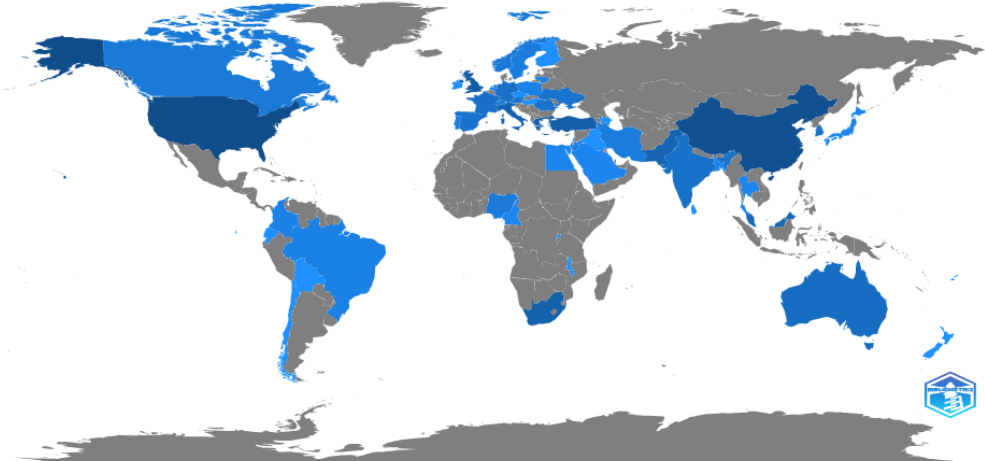
**Figure 8:** Corresponding Author’s Country



### 3.1.6. Country-Specific Production (Top 10)

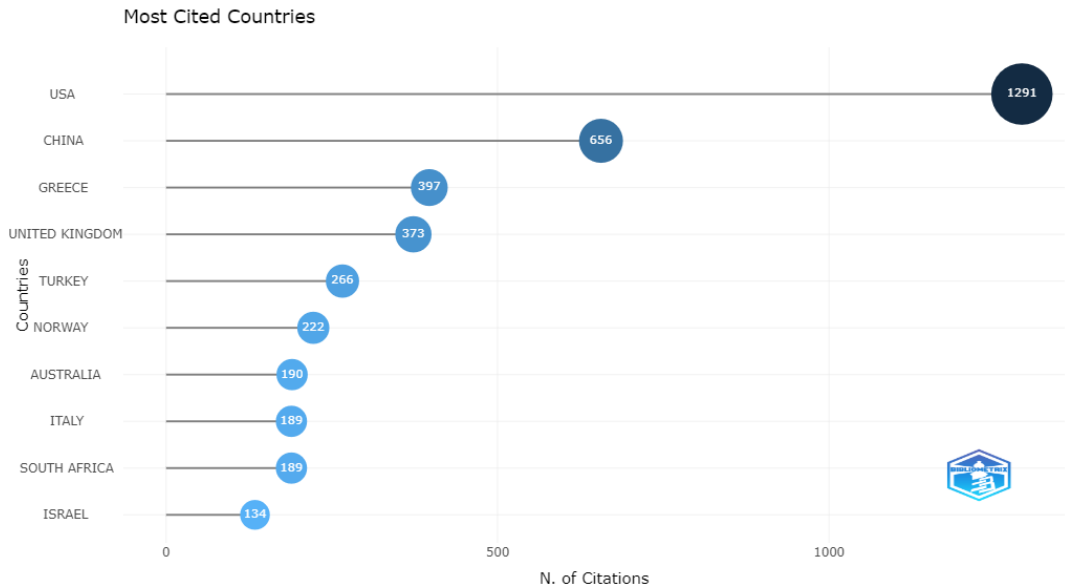
As shown in Figure 9, 54 countries published articles on the given theme. The publication count ranged from only one article in some countries to as many as 138 articles in others. The USA topped the list of countries with 138 articles publications, followed by China (105 articles), the UK (44 articles), and Turkey (38 articles). Several countries, such as Azerbaijan, Bolivia, Chile, Czech Republic, Ecuador, Fiji, and Finland, produced only one article each, meaning there is room for these countries to publish more on the given theme.

**Figure 9:** Country-specific Production



The top ten nations in terms of citations are shown in Figure 10. Papers on the specified topic have been published in a total of 54 countries. Zero was the lowest citation score recorded, while over a thousand was the most. With 1,291 citations, the USA was the most cited country in the field, while China ranked second with 656 citations, followed by Greece (397) and the UK (373). Canada, meanwhile, reported the fewest citations, with just 26. Thus, the USA led in terms of total number of publications, single-and multiple-country collaborations, and total citations.

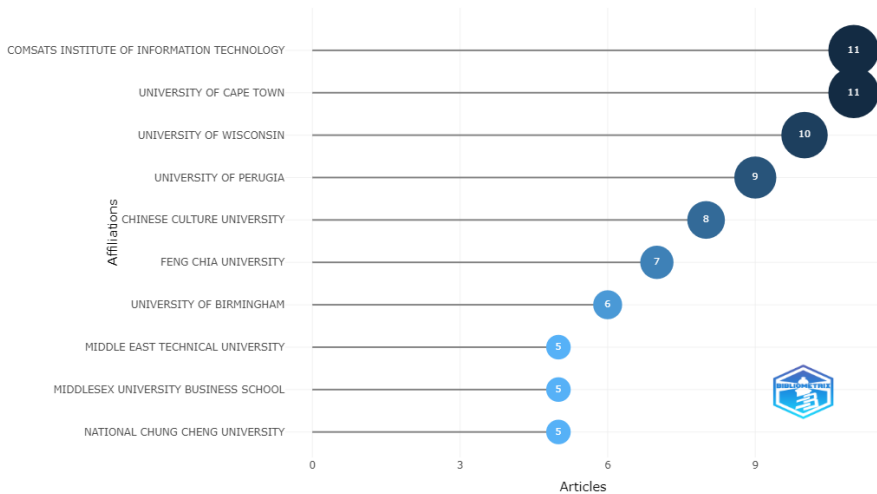
**Figure 10: Most Cited Countries**



### 3.1.7. The Affiliations that Contributed the Most (Top 10)

A total of 420 organizations have contributed articles in the field, with varying levels of input ranging from one article to as many as 11 articles. Figure 11 presents the top ten most prolific institutes. Of these, COMSATS Institute of Information Technology and the University of Cape Town were the most prolific, each with a total number of 11 publications, followed by the University of Wisconsin with ten papers, the University of Perugia with nine papers, Chinese Culture University with eight papers, Feng Chia University with seven articles, and so on.

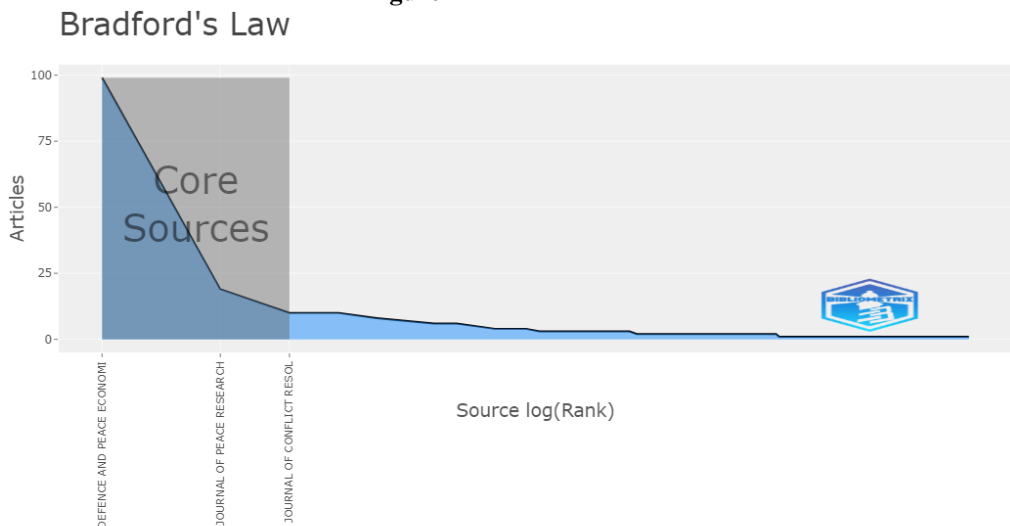
**Figure 11:** Affiliations that Contributed the Most Most Relevant Affiliations



### 3.1.8. Bradford's Law

As shown in Figure 12 below, Bradford's law classifies journals into three categories: core journals, intermediate journals, and broad journals. Of the 161 journals in the field, three were categorized into the core group, 41 into the intermediate group, and 117 into the broad group. Shaded areas and annotated core sources identify the main journal categories. According to Bradford's law of scattering, the main group of journals in the field are *Defence and Peace Economics*, *Journal of Peace Research*, and *Journal of Conflict Resolution*.

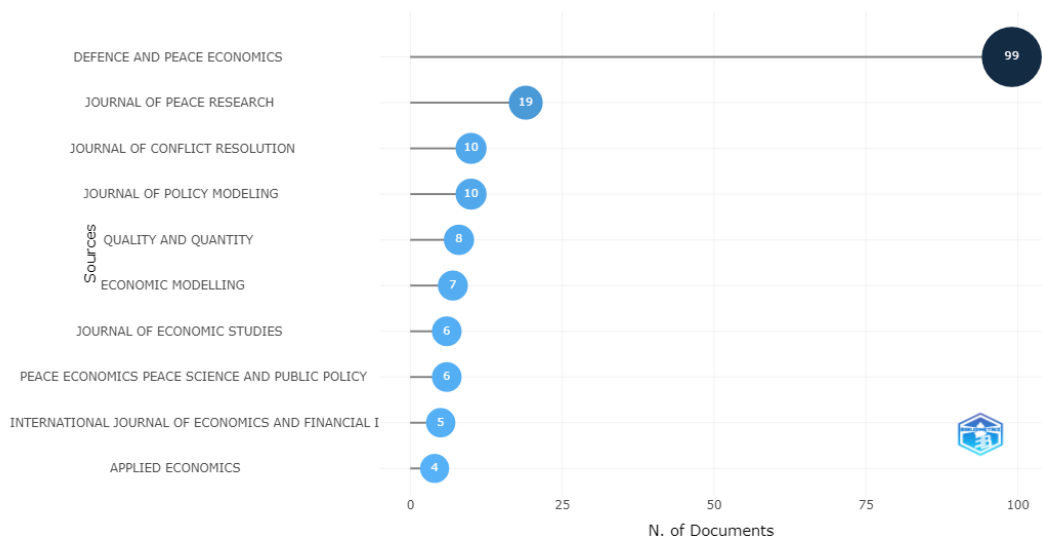
**Figure 12:** Bradford's Law



### 3.1.9. The Most Relevant Sources (Top 10)

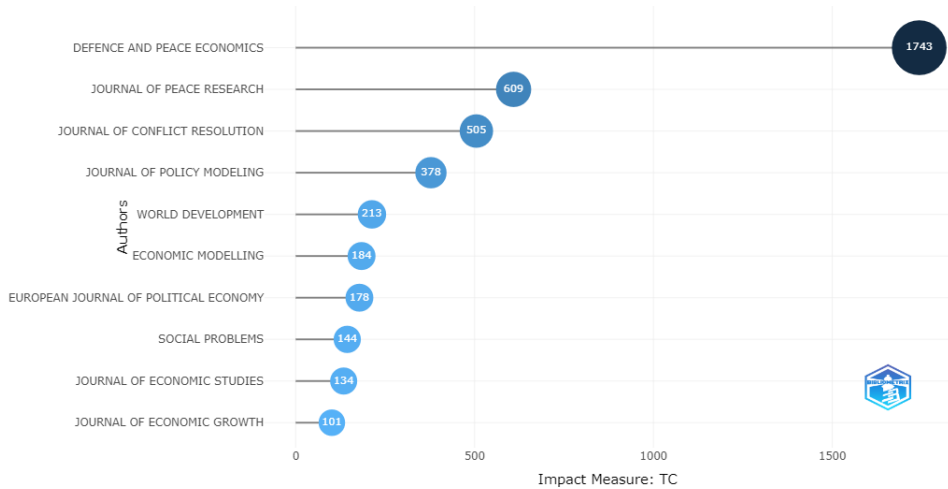
The top ten journals, as measured by the quantity of research papers published, are shown in Figure 13. Out of 161 journals, the top journal was found to be *Defence and Peace Economics*, with 99 papers published, followed by *the Journal of Peace Research* with 19 articles. Various journals, such as *Word Economy*, *World Bank Discussion Papers*, *Urban Forum*, *Transition Studies Review*, *Trames*, and *Third World Planning Review*, had one publication, suggesting that these journals have not given sufficient attention to the subject of defense and economic growth.

**Figure 13: Most Relevant Journals**  
Most Relevant Sources



The citations within journals are often indicative of their quality and influence. Out of 161 journals, the ten most cited journals are shown in Figure 14. *Defence and Peace Economics* had the most citations (1,743), followed by the *Journal of Peace Research* (609), *Journal of Conflict Resolution* (505), *Journal of Policy Modeling* (378), and so on. Several journals, such as *Asian-Pacific Economic Literature*, *Bulletin of Concerned Asian Scholars*, *Contemporary Review of the Middle East*, *Cooperation and Conflict*, *International Business Management*, and *International Journal of Applied Business and Economic Research*, only had one citation.

**Figure 14: Source Local Impact by Total Citation**  
Source Local Impact by TC index



Out of 164 journals, Figure 15 depicts the ten most influential on the subject at hand, as measured by the h-index. *Defence and Peace Economics* held the highest h-index, with a score of 25, followed by *Journal of Peace Research*, *Journal of Conflict Resolution*, and *Journal of Policy Modeling*. Thus, *Defence and Peace Economics* had the highest h-index (25), g-index (34), and total citations (1,743) of all the journals, making it the most influential journal.

**Figure 15: The Most Impactful Journals**  
Source Local Impact by H index

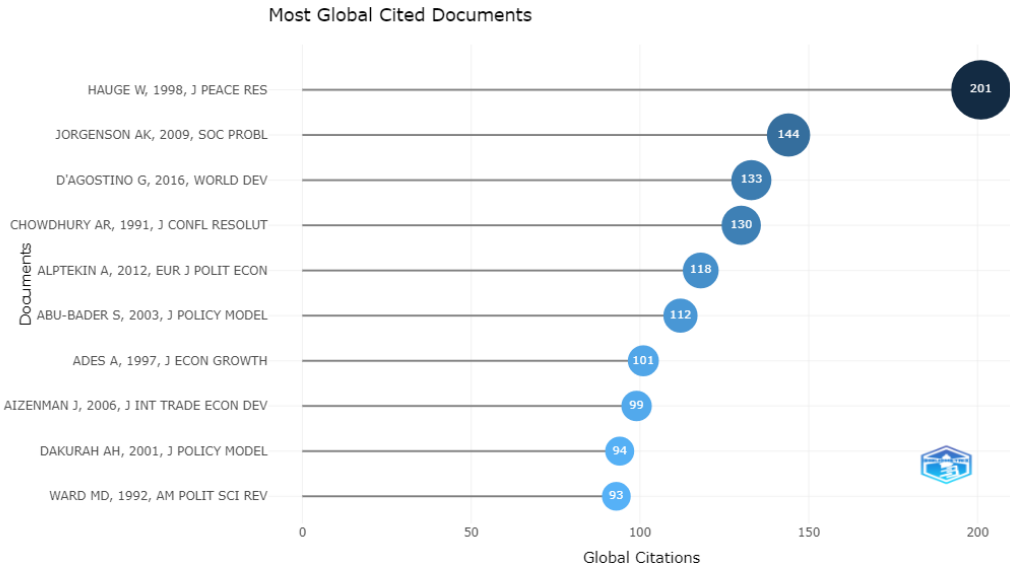




### 3.1.10. The Most Cited Documents (Top 10)

Figure 16 shows the top ten globally cited papers on the given research theme from 1993–2021. Some articles received no citations at all, while others received over 200. Hauge W (1998) published the most cited paper in the *Journal of Peace Research*, with 201 citations, followed by Jorgenson AK (2009), with 144 citations, in *Social Problems*. The citation information for other authors is shown in Figure 16.

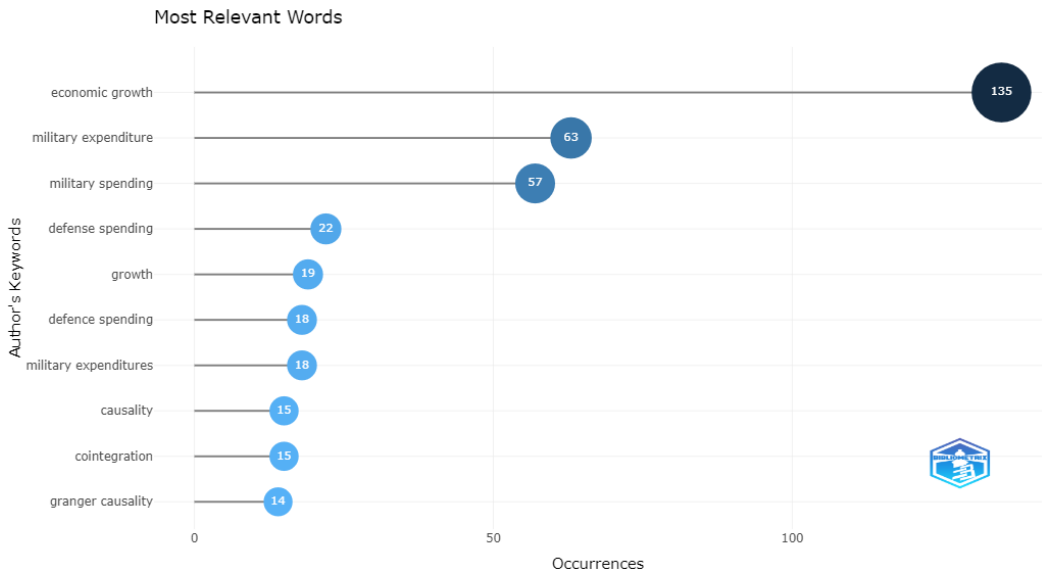
**Figure 16: Most Cited Documents (Top 10)**



### 3.1.11. Analysis of Keywords

Figure 17 provides an analysis of author keywords, which reveals important research trends and focus areas, shedding light on the domains of interest and attention among researchers (Qiu & Lv, 2014). In total, 613 author keywords were identified, with some appearing only once and others as many as 135 times. The top ten keywords are shown in the results. "Economic growth" emerges as the top author keyword, appearing 135 times and indicating its strong association with the research theme. "Military expenditure" was the second most frequently used keyword, with over 60 occurrences, followed by "military spending," "defense spending," "growth," and "defence spending," among others, as shown in Figure 17. The word treemap visualizes frequently used words in boxes resembling geographic regions, with larger squares representing more commonly used words. The data from the treemap indicates that 23% of all keywords were related to economic growth, followed by military expenditure (11%) and military spending (10%), as shown in Figure 18. Moreover, the word dynamic shows that the cumulative word growth of "economic growth" was the highest.

**Figure 17: The Most Relevant Words**



**Figure 18: Word Treemap**

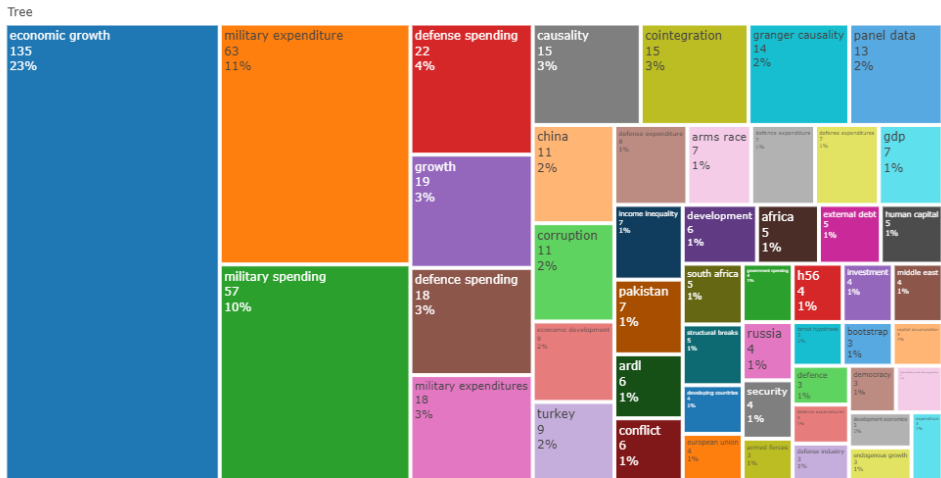


Figure 19 presents a word cloud, displaying words in varying sizes based on their frequency of appearance, with dominant words appearing prominently in the center of the word cloud due to their larger size. This word cloud is constructed using the author keywords from the articles under consideration. The keyword “military expenditure” is central to the theme, followed by “military spending,” “defense spending,” and so on.

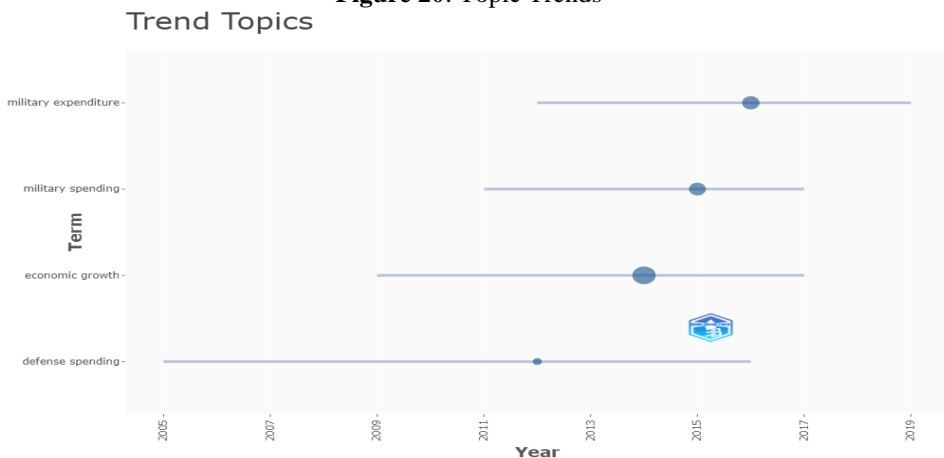
Figure 19: Word Cloud



### 3.1.12. Topic Trends

The study goes on to analyze the popular economic growth subjects using the author keywords, focusing on terms that must appear at least 20 times per year and have a minimum word count of 20. By monitoring the terms year by year, the topic trends provide an impression of the issue's evolution over time. In addition, the topic trends show which topics are currently popular versus those that have only recently gained popularity. The more frequently a word is used, the higher it is positioned, while the more recently it appears, the farther to the right it is positioned. The findings indicated that “economic growth” was the most discussed theme, with 135 mentions from 2009 to 2017, while the theme “defense spending” was the most popular theme between 2005 to 2016, as shown in Figure 20.

Figure 20: Topic Trends



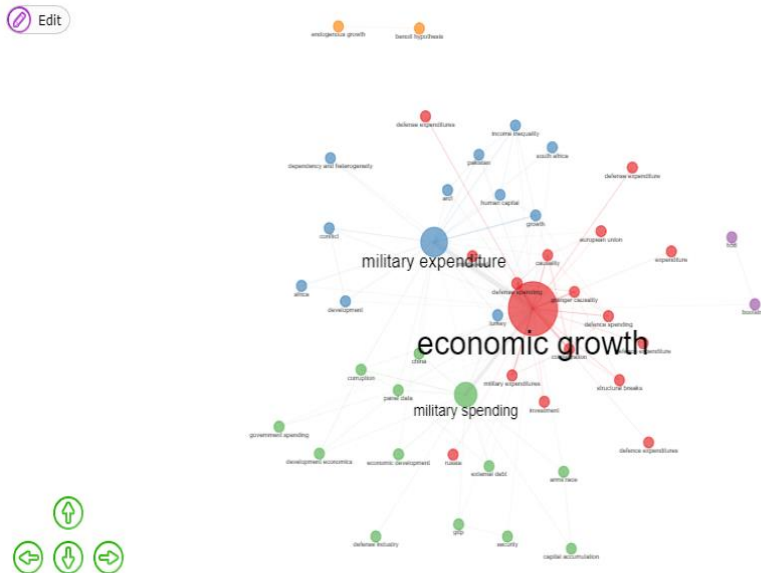
### 3.2. Conceptual Structure Analysis

Several important concepts and themes studied in the discipline were identified through the use of conceptual structure analysis. More specifically, a co-word analysis was performed utilizing the keywords provided by the authors to create a thematic map.

#### 3.2.1. Co-occurrence of Keywords

The relationship between themes, subjects, and trends can be demonstrated by the co-occurrence of networks or co-words analysis, as suggested by Ingale and Paluri (2022). Keyword co-occurrence aids in comprehending a domain's conceptual structure (Kumar et al., 2021) and enables the identification of emerging trends. Zupic and Čater (2015) noted that when words appear in papers frequently, it indicates that the thoughts behind those words are strongly related. Co-word analysis enables the identification and exploration of the distribution of terms within a research domain. In this study, the co-occurrence network of keywords was established using the author keywords. The analysis employed default parameters such as automatic arrangement and normalization through association, utilizing the Louvain clustering algorithm with 50 nodes. The largest node, reflecting the most popular keyword, was the term “economic growth.” As shown in Figure 21, the results revealed five clusters: red, blue, green, purple, and orange. The blue cluster emphasizes phrases like military expenditure, growth, and Turkey; the red cluster's primary focus is concepts like economic growth, defense spending, defense spending, and military expenditure; the green cluster highlights words like military expenditure, panel data, and China; the purple cluster highlights words like h56 and bootstrap; and the orange cluster shows words like endogenous growth and Benoit hypothesis.

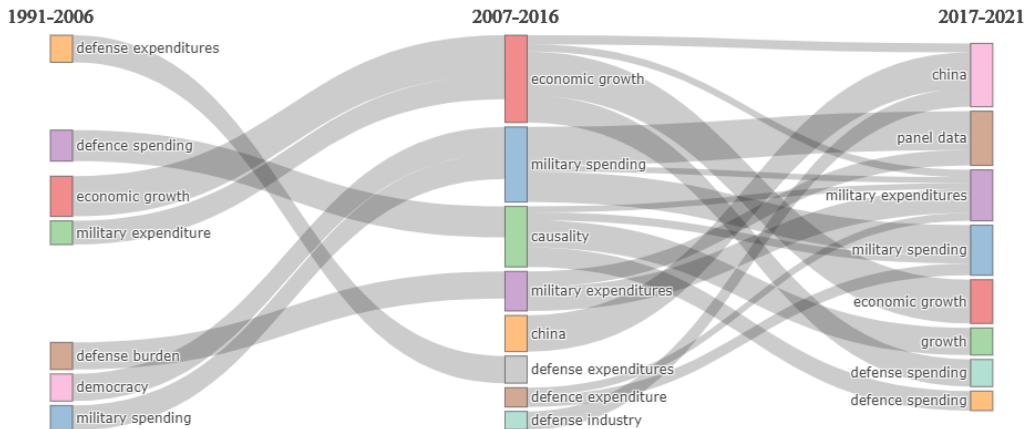
**Figure 21:** Co-occurrence Network



### 3.2.2. Thematic Map

The evolution of research topics in published articles is particularly evident when comparing recently published studies to those that have been published for a considerably longer duration. Figure 22 presents a visual representation of this evolution. The left half of the figure displays several trending topics from 1991 to 2006. Seven themes are specified, with the size of each varying depending on how frequently it is utilized. Themes such as economic growth, defense expenditure, and defense spending were widely used during the period under study. The second part of the central section displays numerous prominent topics from 2007 to 2016. Some themes emerged during this time, while others exhibit a content relationship with earlier topics. For example, the theme “economic growth” appears to have evolved from themes such as “defense expenditure,” “defence spending,” “economic growth,” and “military expenditure,” indicating that the study of the extension themes is a continuation of earlier research on the themes. Similarly, the topic “military spending” grew from the themes “defense burden,” “democracy,” and “military spending.” Additionally, themes related to causality, China, and the defense industry emerged during this period. The third section, on the right of the figure, lists the topics that were most prevalent from 2017 to 2021, with eight themes identified. Some of these themes are continuations of earlier topics, while others represent entirely new areas of research.

**Figure 22: Thematic Map**

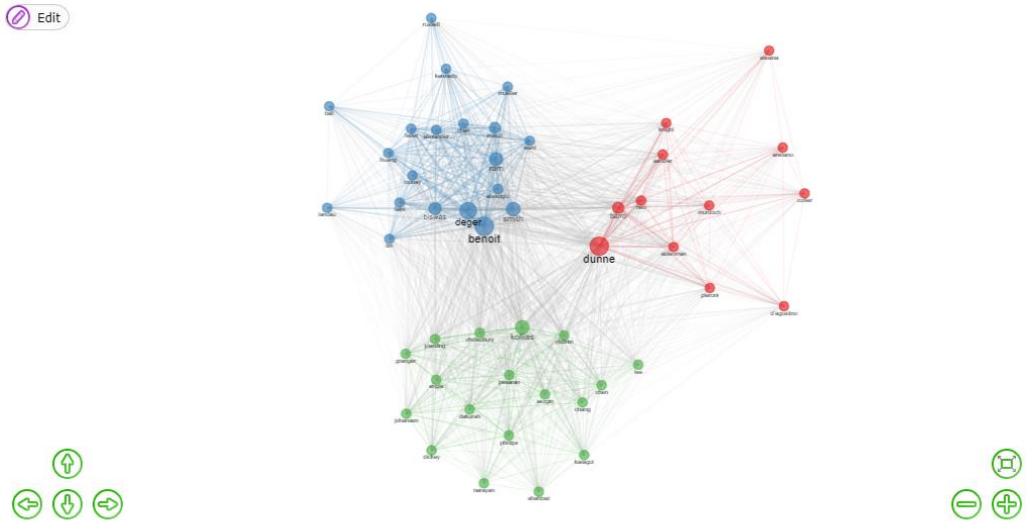


### 3.3. Intellectual Structure: Co-citation Analysis

The intellectual structure of the field was explored by employing co-citation analysis, focusing on the co-citation network established by the authors. Co-citation analysis is a common technique in bibliometric studies to examine the intellectual structure of a specific research area. It involves identifying cases where two authors' works are cited together in a new area of study (Culnan, 1986). The diagram (Figure 23) shows three groups of researchers represented by three different colors. For this study, the Louvain clustering technique was employed, with authors serving as the primary unit of analysis and a total of 50 nodes being used. In cluster 1, Dunne emerges as the most prominent author, with the highest betweenness centrality scores, followed by Barro and Heo. In

cluster 2, Benoit is the author with the greatest betweenness centrality scores, followed by Deger and Smith. Cluster 3 features Kollias as the author with the highest betweenness centrality measures, followed by Chowdhury and Yildirim, indicating their central positions in this group. The betweenness centrality ratings reflect the importance of authors in connecting and influencing the intellectual structure of their respective clusters.

**Figure 23:** Co-citations Analysis



### 3.4 Social Structure: Collaborative Network of Authors, Institutes, and Countries

The study conducted a social structure analysis to investigate how authors, institutions, and nations collaborate in the field. The collaborative network diagram (Figure 24) illustrates the partnerships and collaborations among researchers, institutions, and nations working in this specific area of study. Groups of color equations and lines from one author's name to the next are used to represent the relationship between the authors. The number of publications on each node is also indicated by its size. Authors are categorized into 14 groups. The collaboration between Dunne JP, D'Agostino G, and Pieroni L is shown in cluster 1's red color. The collaboration between Heo U and Derouen JR. K is shown in the second cluster's blue color. Collaboration between Kollias C. and Paleologou SM is seen in the third cluster, which is light green in color. Similar information about other clusters and authors' collaboration can also be found in Figure 24.

**Figure 24:** Collaborative Network of Authors

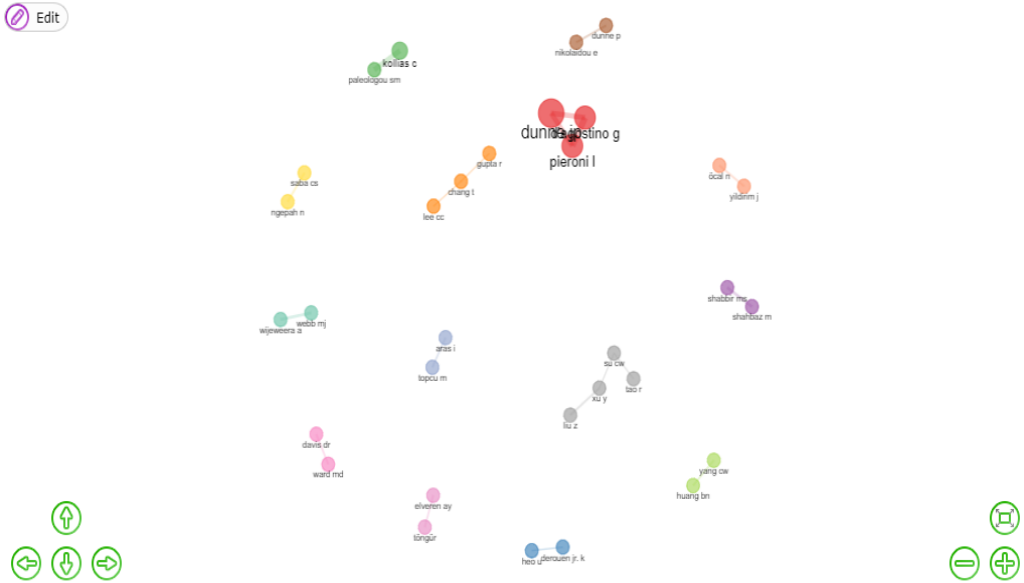


Figure 25 shows the institutional collaborations across eight clusters. In cluster 1, COMSATS Institute of Information Technology is the dominant contributor and collaborates with the University of Illinois at Urbana Champaign. In cluster 2, the University of Cape Town is the primary and collaborates with the University of Perugia and the University of the West of England. In cluster 3, the University of Wisconsin collaborates the most with the University of Wisconsin-Milwaukee. In cluster 4, Chinese Culture University collaborates the most with Fu-Jen Catholic University.

**Figure 25:** Collaborative Network of Institutes

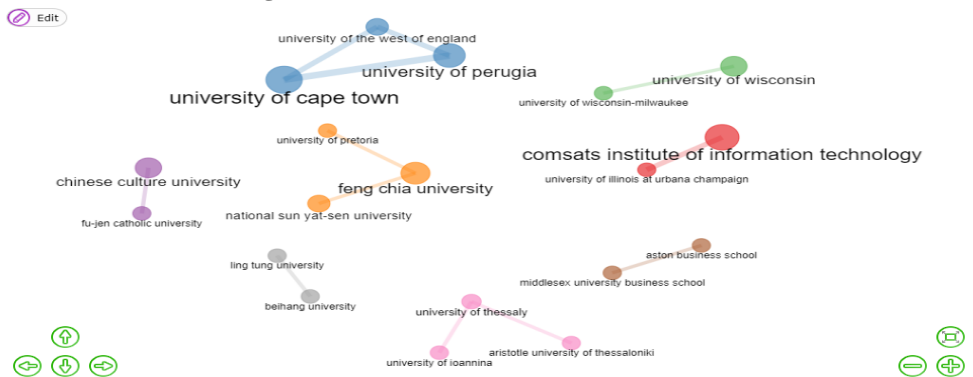
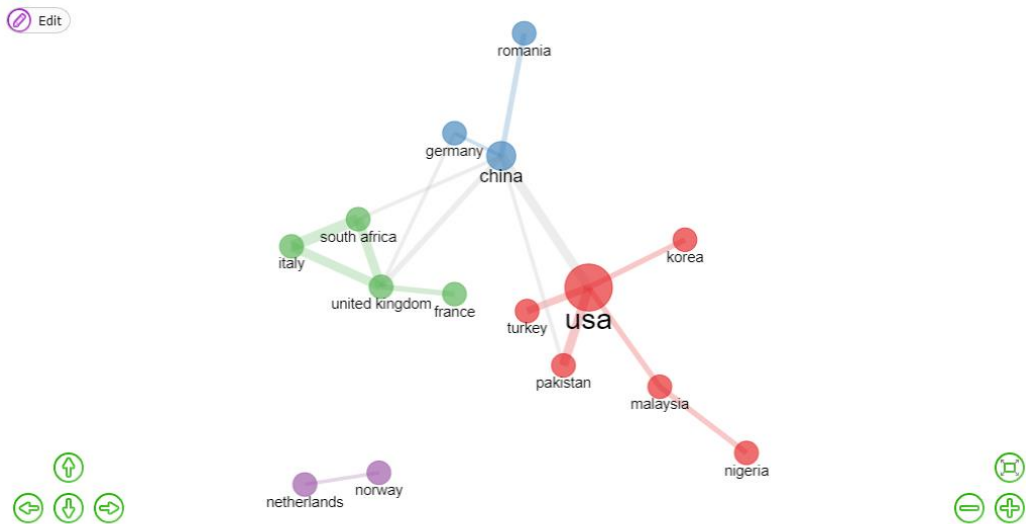


Figure 26 shows the global cooperation among all countries. The number of items produced by each country is represented by the node sizes, and the level of collaboration is indicated by the breadth of the connecting lines (Wang et al., 2019). It can be seen from the figure that there are four clusters. In cluster 1, the USA is the dominant force, collaborating with other countries such as Turkey, Pakistan, Malaysia, Korea, and Nigeria. In cluster 2, China, Germany, and Romania collaborated in the field, with China exhibiting the highest betweenness. In cluster 3, the UK, South Africa, Italy, and France collaborated the most, with the UK exhibiting the highest betweenness. In cluster 4, the Netherlands and Norway collaborated the most.

**Figure 26:** Collaborative Network of Countries



## 4. DISCUSSION AND CONCLUSIONS

### 4.1. Future Research Direction

This study focused on research papers published exclusively within a single Scopus database, but future researchers could consider consolidating research papers published in other databases (e.g., WoS) in order to better understand the relationship between defense expenditure and economic development. These would reflect a different or complementary view of this topic of research. Moreover, future research might include additional types of research literature, such as book chapters and conference papers, to provide a more comprehensive analysis of the subject. Furthermore, this study covers literature within the domain of defense expenditure and economic development published between 1991 and 2021, but future research could extend its scope to encompass a broader time span beyond the last decade. Lastly, R studio's R package was used to analyze the data for this investigation, but future research could use a wider range of analytical tools, like VOS viewer.



## 4.2. Conclusions

This analysis provides valuable insights into the most eminent authors, journals, and organizations in the field of defense spending and economic development. The prevalence of English as the primary language for publications indicates the international reach and accessibility of this research area, making it a suitable entry point for researchers from various backgrounds. Each indicator used in this study reflects the growth of this field; such growth suggests that this topic is likely to attract even more attention from researchers across diverse disciplines. This bibliometric analysis used 381 articles extracted from the Scopus database to answer the three research questions. Dunne, Heo, and D'Agostino were the most influential authors in the field, while the USA, China, and Greece produced the greatest number of articles. Collaborative networks of countries showed four major clusters evolving. Researchers from the USA collaborated the most with researchers from other countries, while the University of Cape Town and COMSATS Institute of Information Technology collaborated the most with other universities. Lastly, the co-citation analysis revealed that Dunne and Benoit were co-cited the most.

## 4.3. Limitations

An important limitation of this study is that an abundance of good research may not have been included. For future research, more databases like Google Scholar or Web of Science as well as other materials like proceedings and book reviews should be investigated.

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