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A Bibliometric Analysis of Tax-Benefit Microsimulation Models' Literature

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ABSTRACT: Tax-benefit microsimulation models' literature has not had a rapid growth, but it has exhibited a consistent annual scientific production, especially in the last decade, with the support of the European Commission and the widely use of EUROMOD microsimulation model for the analysis of policy systems, not only in Europe, but in many countries in the world. In this paper, we report on a bibliometric analysis of the literature that focuses on (1) examining publication trends and geographic focus of research (2), identifying the most influential literature through a citation-based analysis, (3) assessing the integrated nature of research, and (4) evaluating the development of this topic and its relevance for the design of public policies. This research is based on the used of Elsevier's Scopus database, which we used to search for publications from January 1997 to February 2021 on EUROMOD tax-benefit microsimulations of poverty or inequality, analyzing a final sample of 192 documents using Bibliometrix through R Studio software. The analysis has shown a slow but consistent growth in the publications in these specific topics, exhibiting an increase in the academic productions since 2006, and specially in 2020, considering the COVID-19 pandemic scenario, which shown the importance of the analysis of public policies, with an emphasis on those related to poverty and inequality.

Our paper concludes with a discussion of the advantages offered by microsimulation for policy analysis.

KEYWORDS: TAXES, BENEFITS, MICROSIMULATION, POVERTY, INEQUALITY, EUROMOD.

JEL classification: I32, I38, H24, D13

1 INTRODUCTION

The theory and literature of microsimulations has evolved in the last 60 years, since its origin, around the end of the 1950s decade. Moreover, the theory of microsimulations has been gaining more relevance, especially since the end of the 80s, with the first academic publications focused on the cross-country comparability of policy systems and the distributive effects of public policies.

These developments and the upturn in microsimulation theory have been the base for the different models (statics and dynamics) that has arrived in the last 2 decades, allowing the, structured and standardized, study and comparison of public policies, fiscal reforms, cash transfer policies, policy swaps, income redistribution policies, distributive effects on poverty and inequality, among many others useful analyses.

This study makes part of the introductory framework of a research project oriented to the analysis of the distributive effects of public policies on poverty and inequality in Paraguay in the context of the COVID-19 pandemic.

In the following sections we will present a brief description of the state of art of microsimulations and the most relevant aspects of the tax-benefit microsimulation model for the European Union EUROMOD.

1.1. Microsimulations

As we have mentioned before, the microsimulation theory has more than 60 years of evolution and development. Some authors estimate its origin with the pioneer studies of Orcutt (1957) and Orcutt et al. (1961), which have described the first microsimulation models. Moreover, most of the dynamic microsimulation models developed in the last decades are based on these studies and in the concepts or methodologies proposed on these.

Nevertheless, as mentioned by Spadaro (2007), it was not until the end of the 80s, when the microsimulation tools began to be used widely, through the publication of the first articles focused on the analysis of fiscal and redistributive policies in Europe (Atkinson et al., 1988). Then, since the end of the 90s, we observe a series of relevant contributions of Sutherland (1997, 2000, 2001, 2007, 2013), that with the support of partner institutions and, more recently, the European Union, have created the tax-benefit microsimulation model named EUROMOD, widening the analysis and debate of public policies in Europe and around the world (SOUTHMOD, LATINMOD, etc.), through a standardized model for cross-country comparability.

The accelerated adoption of the microsimulation models as tools for the analysis of public policies in the last 20 years has been explained by 2 main variables: the increased availability and accessibility to reliable microdata (at household and individual levels), as well as the rapid expansion of the computational capacity to run complex models with high volume of microdata.

Additionally, the used of microsimulation tools has favored the evaluation (ex-ante and ex-post) of public policies and income redistribution policies (Spadaro, 2007; Sutherland & Figari, 2013). Moreover, the literature of microsimulations underlines its advantages as a tool for the analysis of public policies, because it offers a holistic vision of the effects of changes in simulated scenarios (i.e. baseline scenario vs simulated scenario), taking advantage of the information richness within the microdata used (individually and at the household level), based on a set of socio-economic characteristics (Merz, 1991; Citro & Hanushek, 1991).

The area of application of the microsimulations is wide, including different sciences and themes of analysis as: analysis of redistribution effects of tax-benefit policies; analysis policy swaps; design and analysis of fiscal reforms; design of public policies; work incentives and labor policies; among many others (Sutherland & Figari, 2013; Sutherland, 2007, Citro & Hanushek, 1991).

The microsimulation models can be classified in 2 main groups: static models and dynamic models.

The static models, also named as arithmetic models, are models that replicate the institutional framework, without simulating the responses (behaviors) of the agents. These models are frequently used to simulate changes in taxes and benefits policies, where the analysis is limited to

the first order effects (Spadaro, 2007; Merz, 1991). Within this typology we can find numerous and diverse studies based on EUROMOD and analogous models (SOUTHMOD, LATINMOD, etc.).

Then, the dynamic models, also named as behavioral models, are models that include in the analysis the response (behavior) of the agent to the simulated changes (Li & O`Donoghue, 2013; Spadaro, 2007, Merz, 1991).

1.2. EUROMOD

EUROMOD¹ is the tax-benefit microsimulation model of the European Union, created in the year 1997 (Sutherland. 1997). This microsimulation model allows the simulation of fiscal policies and cash transfers (means-tested, non-means-tested and other benefits), according to the policy rules previously defined in each analyzed country (Sutherland & Figari, 2013).

EUROMOD is an open access model and policy analysis tool. Nevertheless, the access to the microdata of the countries requires the completion of the EUROMOD and Input Data Request form, available at the official website of EUROMOD.

The EUROMOD microsimulation tool shows many advantages that can be underlined, including: its flexibility to adapt to different context and situations of the countries, which facilitates the cross-country comparability and consistency of the obtained results; the analysis of policy swaps (through the import of national or regional policies); and the diversity of users (Sutherland, 2007).

As we have mentioned before, EUROMOD is a static microsimulation model, and by construction, the model assumes that the potential responses and the socio-demographic characteristics of the agents are fixed through the period of analysis. The EUROMOD model is based on the use of reliable and representative microdata, obtained through national or regional household surveys, which are collected regularly in the analyzed countries, allowing the generation of the necessary inputs to run the microsimulations (Sutherland, 2000; Sutherland, 2013).

The EUROMOD microsimulation model, initially oriented to facilitate the cross-country comparability of policy systems in Europe, has expanded its area of application, currently allowing many complementary analyses, including: identification of efficient public policies (with a special focus on poverty and inequality); policy swaps (import of national policy systems, fiscal reforms, labor incentives, etc.); evaluation of cash transfers (ex-ante or ex-post); evaluation of the relationship between fiscal policies and poverty/inequality in developing or developed countries; among many others (Sutherland, 2007; Sutherland, 2013).

Nowadays, in the context of COVID-19 pandemic, EUROMOD is being used to analyze the efficiency of the emergency policies and cash transfers that have been applied to mitigate the negative effects of COVID-19 on the poverty and inequality of the countries (and in the general economy as well) (O`Donoghue et al., 2020; Huesca et al., 2021, Jara et al., 2021).

2 DATA AND METHODOLOGY

In this study, we applied different bibliometric methods in order to assess the evolution of research in microsimulation literature. As mentioned by Opejin et al. (2020), “bibliometric analysis of a field, subject or concept is a descriptive and statistical evaluation for tracking progress and identifying areas for future research”.

This research is based on the use of Elsevier`s Scopus database, which we used to search for publications from January 1997 to February 2021 on EUROMOD tax-benefit microsimulations of poverty or inequality, analyzing a final sample of 192 documents using Bibliometrix through R Studio software. The decision of using Elsevier`s Scopus database is based on 2 main ideas: (I) Scopus database offers a comprehensive and high-quality catalog covering the topic of analysis; and (II) Scopus database is one of the largest abstracts and citations databases of peer-reviewed literature.

¹ EUROMOD: <https://www.euromod.ac.uk/>

The search applied in the Scopus database contained the following query string:

ALL (euromod AND tax-benefit AND poverty OR inequality) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE , "cp"))

As a result of this search, we obtained 192 documents for the bibliometric study, including all the documents for the period from the year 1997 to February 2021. We downloaded the bibliometric information from this sample, including: citation information, bibliographical information, abstract & keywords, funding details, and other information. Then, we conducted the bibliometric analysis with Bibliometrix in R software (R Core Team).

The bibliometric analysis focused on the analysis of some critical variables, including the impact of the documents, sources, and authors, as well as the conceptual, intellectual, and social structure of the analyzed documents, through the use of the different options within the analysis tool.

3 RESULTS

The results of the search query applied in the Scopus database helped us to identify and select the 192 documents for the bibliometric study. The main information of the sample obtained is resumed in Table 1.

| Description | Results |
|--------------------------------------|-----------|
| MAIN INFORMATION ABOUT DATA | |
| Timespan | 1997:2021 |
| Sources (Journals, Books, etc) | 99 |
| Documents | 192 |
| Average years from publication | 5.55 |
| Average citations per documents | 8.979 |
| Average citations per year per doc | 1.051 |
| References | 8067 |
| DOCUMENT TYPES | |
| article | 188 |
| conference paper | 4 |
| DOCUMENT CONTENTS | |
| Keywords Plus (ID) | 232 |
| Author's Keywords (DE) | 432 |
| AUTHORS | |
| Authors | 300 |
| Author Appearances | 536 |
| Authors of single-authored documents | 36 |
| Authors of multi-authored documents | 264 |
| AUTHORS COLLABORATION | |
| Single-authored documents | 42 |
| Documents per Author | 0.64 |
| Authors per Document | 1.56 |
| Co-Authors per Documents | 2.79 |
| Collaboration Index | 1.76 |

Table 1: Main information of data sample obtained from the search in Scopus

In Table 1 we observe that the period of analysis included the timespan 1997-2021, considering that EUROMOD program started in the year 1996. As explained in Section 2, our search query only considered articles and conference papers, as these documents usually consolidate most of the knowledge in a given topic.

The inclusion-exclusion criteria used in the search allowed us to identify 192 documents (188 articles and 4 conference papers), including 300 authors, 99 sources and more than 8.000 references.

Figure 1 shows the evolution of the annual scientific production in the topic of analysis, measured by the number of articles produced each year. It must be noted that the trend is not well captured in 2021, considering that period of analysis only covers the period up to February 2021.

Additionally, we evaluate further the characteristics of these trends, fitting linear and exponential trends lines on the data for the number of publications, as shown in Figure 2.

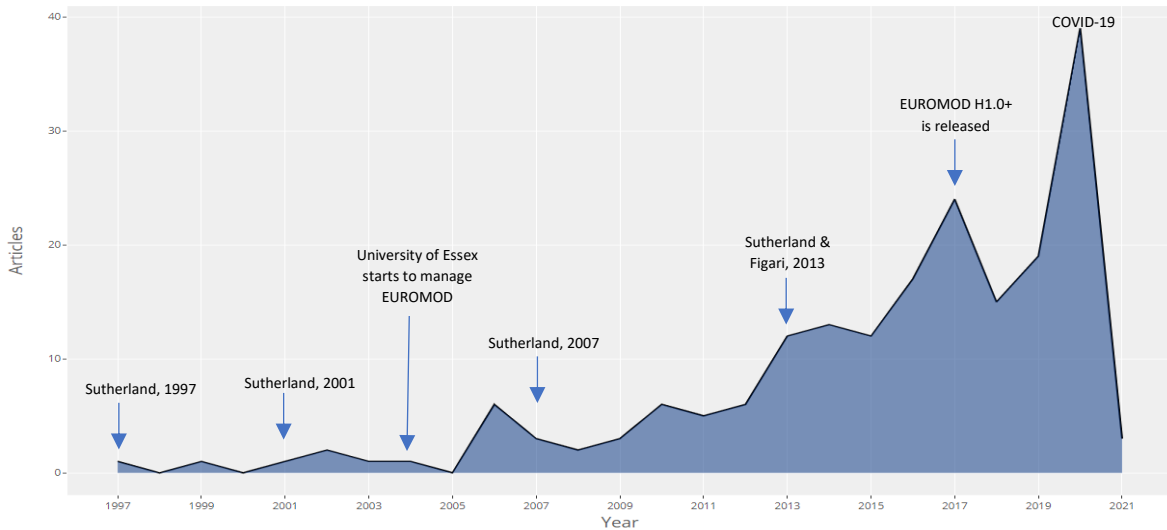


Figure 1: Annual Scientific Production

The exponential trend line provides a better fit ($R^2 = 0,73 > 0,52$), thus providing an evidence of the exponential growth (opposed to linear growth) in the number of publications over the timespan of analysis.

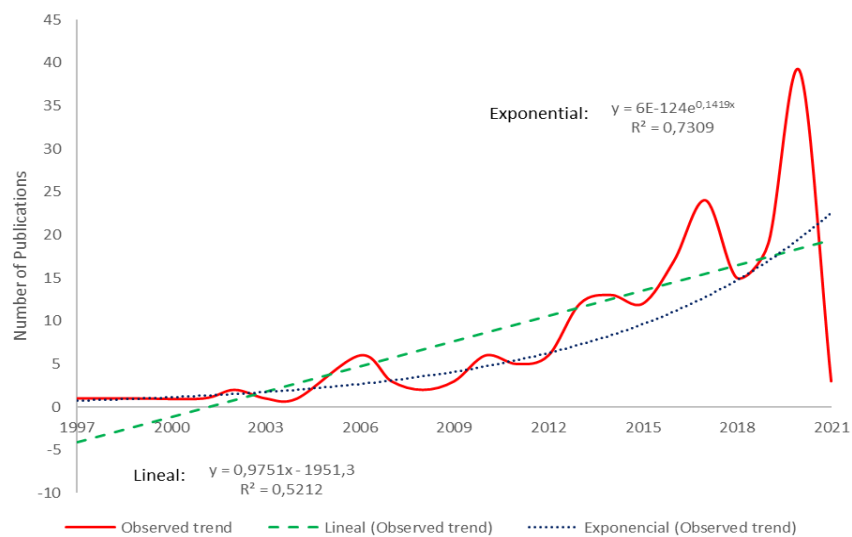


Figure 2: Exponential vs Linear trend lines for the number of publications

Nevertheless, as we observe in Figure 3, the average number of article citations per year is still very limited. This could be explained by the specificity of the microsimulation models, and particularly the case of the EUROMOD microsimulation model that is studied in this research. Additionally, in Figure 3, we observe some specific peaks (1999, 2007, 2013) that could be related to some of the most important publications in the literature of microsimulations in EUROMOD, published in most cases by the pioneers in this area: Sutherland, Spadaro, Figari, O`Donoghue, Bargain, Bourguignon, etc.).

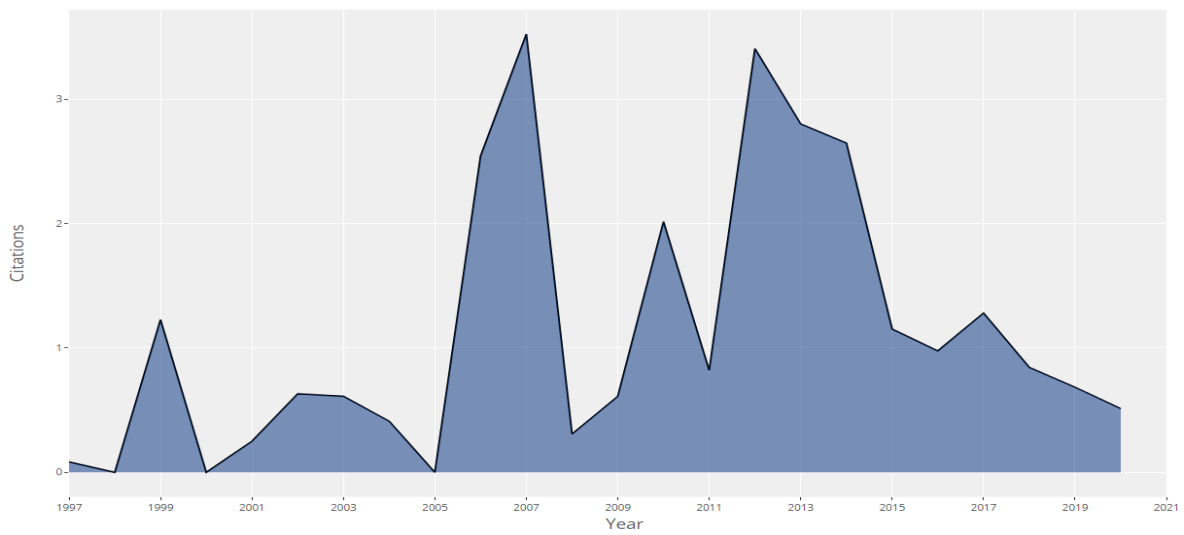


Figure 3: Average article citations per year

Furthermore, in order to identify and visualize the existing relations between affiliations, authors and author's keywords, we constructed a three-fields plot with these variables. In Figure 4 we can observe the obtained results, where it can be distinguished the important role of the University of Essex (with the support of the Joint Research Center of the European Commission) in the dissemination of knowledge about microsimulations and EUROMOD, with a strong relationship with almost every author (in the top 20) in the area. Other institutions, as University of Oxford, University of Insubria and University of Antwerp, have also played a relevant role in the area of microsimulation, with numerous publications through the period of analysis.

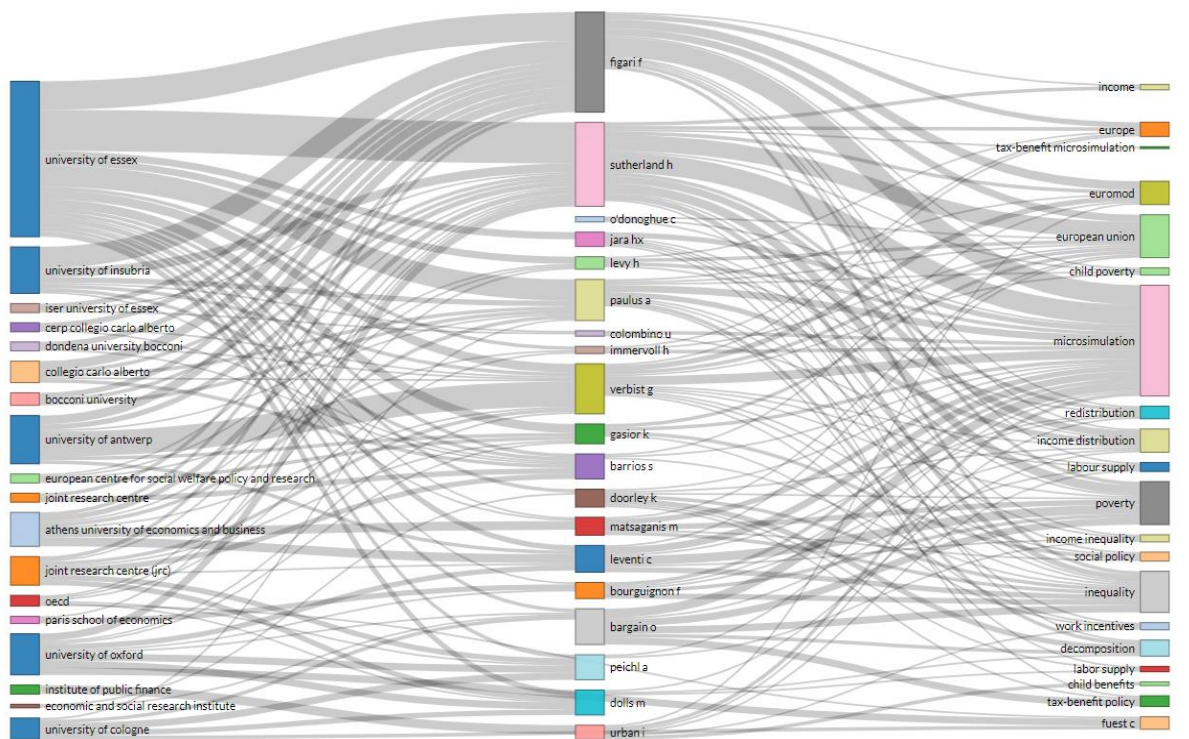


Figure 4: Three-Fields Plot (affiliation, author, author's keywords)

Again, through the results obtained and visualized in Figure 4, we identify the most prolific authors in the area of microsimulations and the EUROMOD microsimulation model. In the middle column we find some of the authors that we have already mentioned before (Sutherland, Figari, Bargain, Bourguignon, etc.).

In fact, most of these authors have actively participate in the creation and/or the dissemination of the methodology of microsimulation models for the analysis of public policies. As we can observe in Figure 5, most of these authors have consistently produced articles in the area during the period of analysis. The most relevant author, measured by its contribution to the topic of microsimulations in EUROMOD, is the Professor Holly Sutherland, who has actively supported the creation of EUROMOD and its use for the analysis of public policies in the European Union, since the beginning of the program in the 90s until the present.

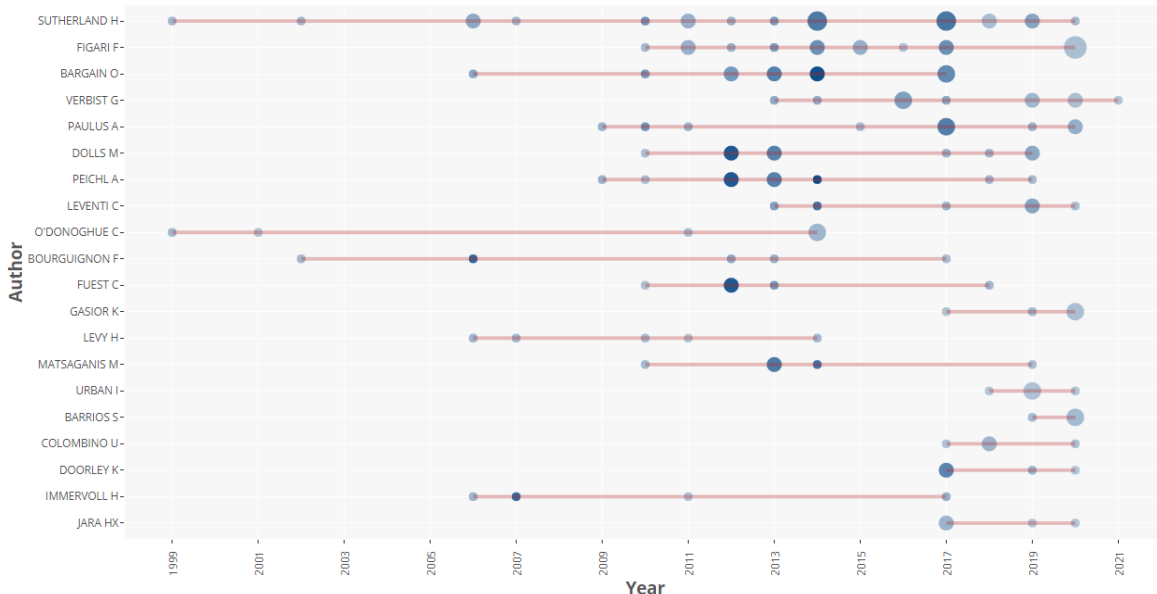


Figure 5: Top-authors` production over the time (color intensity proportional to the total citations per year; bubble size is proportional to the number of documents; the line represents an author`s timeline)

Additionally, when analyzing the number of publications and authors through Lotka`s Law², we obtained the following results, shown in Table 2.

| Documents written | N. of Authors | Proportion of Authors |
|-------------------|---------------|-----------------------|
| 1 | 205 | 0.683 |
| 2 | 50 | 0.167 |
| 3 | 22 | 0.073 |
| 4 | 8 | 0.027 |
| 5 | 6 | 0.020 |
| 6 | 2 | 0.007 |
| 9 | 2 | 0.007 |
| 10 | 1 | 0.003 |
| 11 | 2 | 0.007 |
| 18 | 1 | 0.003 |
| 23 | 1 | 0.003 |

Table 2: Author productivity through Lotka`s Law

In Table 2, we observe than only 1,6% of the authors have 10 or more documents written in the period of analysis, while 85% of the authors accumulate 1-2 documents written at the present. This could indicate 2 situations: (I) most of the authors are occasional authors in the area of analysis, or (II) there are many emerging authors that are starting to publish articles in the area of analysis.

Then, deepening the analysis of the top authors, we can observe that a greater number of publications not necessarily means a greater number of total citations (global citations)³. For example, Immervoll cumulates 4 publications with a total of 166 citations, while Figari cumulates 18 publications with a total of 165 citations. In the same way, authors that started before than more recent authors, not necessarily cumulate more citations.

² Lotka`s law affirms that as the number of articles published increases, authors producing that many publications become less frequent.

³ Global citations measure the number of citations of a document has received from documents contained in the entire database (Scopus), while Local citations measure the number of citations a document has received from documents included in the analyzed collection.

| Author | h_index | g_index | m_index | TC | NP | PY_start |
|---------------|---------|---------|---------|-----|----|----------|
| SUTHERLAND H | 12 | 18 | 0.522 | 340 | 23 | 1999 |
| BARGAIN O | 8 | 11 | 0.500 | 309 | 11 | 2006 |
| PEICHLA | 6 | 9 | 0.462 | 282 | 9 | 2009 |
| BOURGUIGNON F | 4 | 5 | 0.200 | 209 | 5 | 2002 |
| DOLLS M | 5 | 9 | 0.417 | 184 | 9 | 2010 |
| IMMERVOLL H | 3 | 4 | 0.188 | 166 | 4 | 2006 |
| SPADARO A | 2 | 2 | 0.125 | 166 | 2 | 2006 |
| FIGARI F | 8 | 12 | 0.667 | 165 | 18 | 2010 |
| FUEST C | 5 | 5 | 0.417 | 147 | 5 | 2010 |
| PAULUS A | 6 | 10 | 0.462 | 141 | 10 | 2009 |
| MATSAGANIS M | 4 | 5 | 0.333 | 137 | 5 | 2010 |
| ORSINI K | 2 | 2 | 0.125 | 133 | 2 | 2006 |
| KLEVEN HJ | 1 | 1 | 0.067 | 130 | 1 | 2007 |
| KREINER CT | 1 | 1 | 0.067 | 130 | 1 | 2007 |
| SAEZ E | 1 | 1 | 0.067 | 130 | 1 | 2007 |
| LEVENTI C | 4 | 6 | 0.444 | 108 | 6 | 2013 |
| VERBIST G | 4 | 8 | 0.444 | 78 | 11 | 2013 |
| CALLAN T | 2 | 3 | 0.167 | 73 | 3 | 2010 |
| BENNETT F | 1 | 1 | 0.111 | 72 | 1 | 2013 |
| TSAKLOGLOU P | 2 | 3 | 0.167 | 68 | 3 | 2010 |

Table 3: Top-20 Author Local Impact measured by total citations (global citations)

The analysis of local citations of authors through the period of analysis, provides us a list of emerging authors, giving a new perspective of the path that the analysis of microsimulations in EUROMOD is following. The analysis of local citations provides an estimation of the impact of an author in the sample (subset of documents) that we imported from the Scopus database.

In Figure 6 we identify the most local cited authors, observing a very different list of names, compared to those obtained in Table 3. These results are important because it gives us more information about trending authors in the specific topic of analysis, serving as a second filter for the identification of more relevant authors and documents. Additionally, we don't observe any correlation between the number of documents written and total of local citations.

It must be mention that bibliometric literature also underlines that more citations (local or global) don't necessarily means that a document is relevant or important for the science or the topic of analysis, considering that a document can also be cited for negative aspects or to refute a wrong hypothesis supported on it.

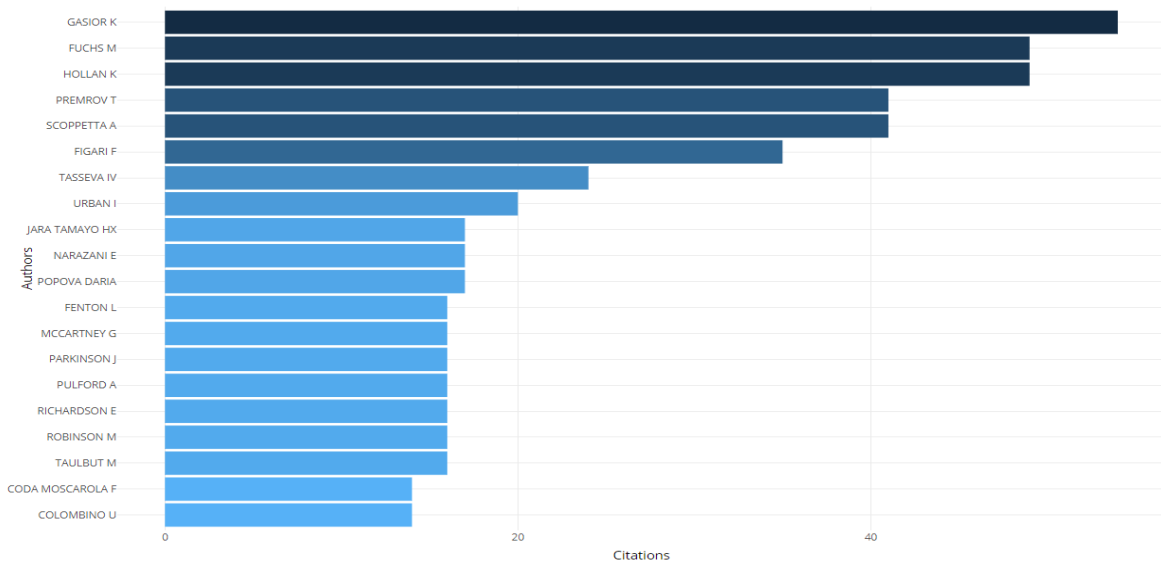


Figure 6: Most local cited authors

The analysis of sources has given us some interesting perspective of the concentration of the knowledge about microsimulations and EUROMOD in 7 journals, that can be identified in Figure 7. In Figure 7A, we can observe that the 7 most relevant sources, measured by the number of documents, are the International Journal of Microsimulation, the Journal of Economic Inequality, the Journal of European Social Policy, Fiscal Studies, Review of Income and Wealth, International Tax and Public Finance, and the Social Indicators Research. The same order of relevance is obtained through the source clustering, measured through the Bradford's law⁴, as we can observe in Figure 7B, considering these 7 journals as the "core sources" of the literature of microsimulations and EUROMOD.

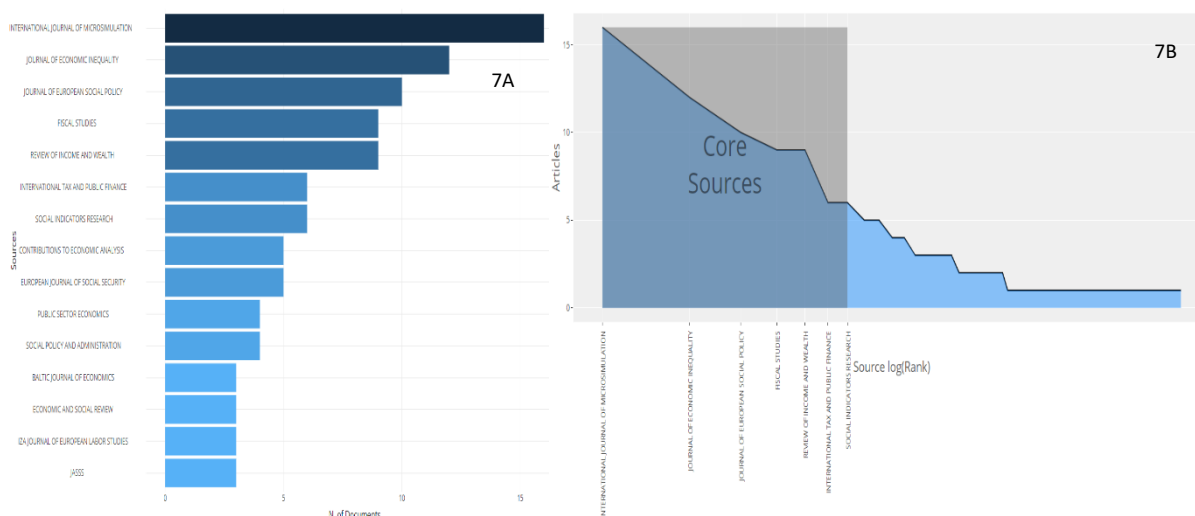


Figure 7A: Most relevant sources (by number of documents)

Figure 7B: Source clustering through Bradford's Law

As we have mentioned before, and as the same case of the analysis of authors, we observe that a greater number of publications, not necessarily means a greater number of total citations (global or local citations). In Table 4 (measures source impact based on local citations), we observe that, even though the International Journal of Microsimulation has the greatest number of publications in our sample (from Figure 7A), it does not have the greatest number of total citations and is not even in the top 20 of journals with more total citations.

| Source | h_index | g_index | m_index | TC | NP | PY_start |
|---|---------|---------|--------------------|-----|----|----------|
| JOURNAL OF ECONOMIC INEQUALITY | 5 | 12 | 0.3125 | 255 | 12 | 2006 |
| ECONOMIC JOURNAL | 1 | 1 | 0.0666666666666667 | 130 | 1 | 2007 |
| FISCAL STUDIES | 5 | 9 | 0.357142857142857 | 95 | 9 | 2008 |
| JOURNAL OF PUBLIC ECONOMICS | 1 | 1 | 0.1 | 90 | 1 | 2012 |
| JOURNAL OF HUMAN RESOURCES | 1 | 1 | 0.125 | 89 | 1 | 2014 |
| JOURNAL OF MARRIAGE AND FAMILY | 1 | 1 | 0.111111111111111 | 72 | 1 | 2013 |
| SOUTH EUROPEAN SOCIETY AND POLITICS | 1 | 1 | 0.125 | 61 | 1 | 2014 |
| JOURNAL OF POLICY ANALYSIS AND MANAGEMENT | 2 | 2 | 0.166666666666667 | 57 | 2 | 2010 |
| JOURNAL OF EUROPEAN SOCIAL POLICY | 5 | 7 | 0.416666666666667 | 54 | 10 | 2010 |
| REVIEW OF INCOME AND WEALTH | 4 | 7 | 0.5 | 52 | 9 | 2014 |
| CAMBRIDGE JOURNAL OF ECONOMICS | 2 | 2 | 0.0869565217391304 | 50 | 2 | 1999 |
| COMMUNITY, WORK AND FAMILY | 1 | 1 | 0.142857142857143 | 46 | 1 | 2015 |
| LABOUR ECONOMICS | 1 | 1 | 0.0625 | 44 | 1 | 2006 |
| OXFORD BULLETIN OF ECONOMICS AND STATISTICS | 2 | 3 | 0.125 | 43 | 3 | 2006 |
| SOCIAL INDICATORS RESEARCH | 3 | 6 | 0.3 | 42 | 6 | 2012 |
| INTERNATIONAL TAX AND PUBLIC FINANCE | 4 | 6 | 0.4 | 40 | 6 | 2012 |
| ECONOMIC POLICY | 1 | 1 | 0.111111111111111 | 36 | 1 | 2013 |
| INTERNATIONAL JOURNAL OF SOCIAL WELFARE | 1 | 2 | 0.0769230769230769 | 34 | 2 | 2009 |
| EUROPEAN JOURNAL OF SOCIAL SECURITY | 2 | 4 | 0.105263157894737 | 23 | 5 | 2003 |
| JOURNAL OF POLICY MODELING | 1 | 2 | 0.0769230769230769 | 23 | 2 | 2009 |

Table 4: Source Local Impact based on total citations

Nevertheless, independently of the analysis from a local or global citation perspective, we observe in Figure 8, that the International Journal of Microsimulation has experienced an exponential growth in the last decade. In the same figure we distinguish an accelerated growth in all the analyzed journals, reinforcing our results that the microsimulation literature, in general, has experienced this rapid and exponential growth in the last decades.

⁴ Bradford's Law states that: "if the journals are arranged in descending order of the number of articles they carried on the subject, then successive zone of periodicals containing the same number of articles on the subject form the simple geometric series 1: n_s:n_s²:n_s³"

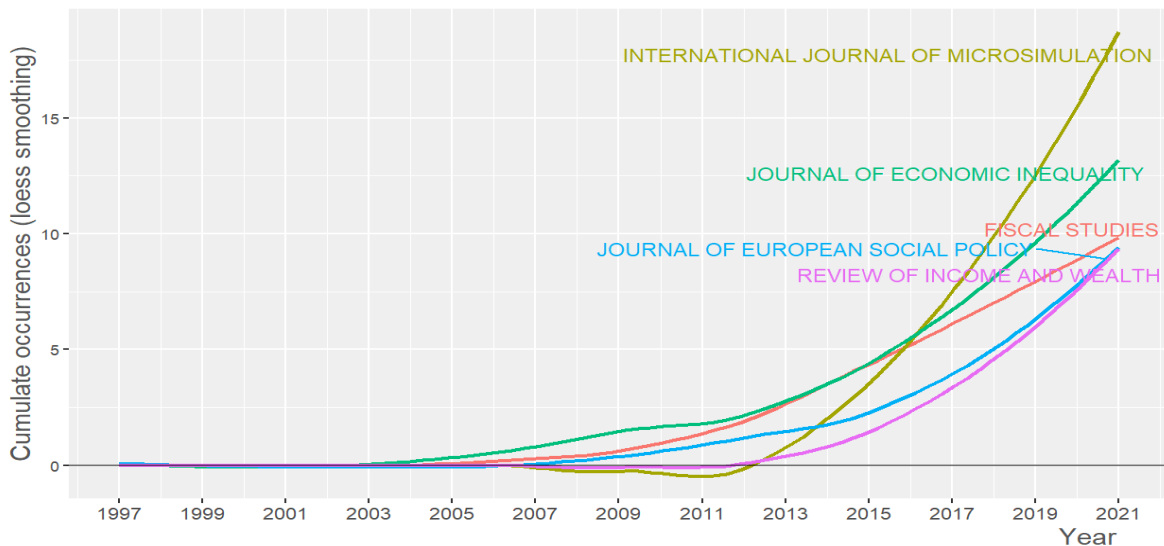


Figure 8: Source growth (top 5)

The network of collaboration between countries is shown in Figure 9B, allowing us to identify a stronger collaboration network between developing countries, mostly located in the United States and Europe. There are some single country publications that can be identified in some regions, for example South America, Africa, Oceania and Asia.

Then, in Figure 9A we can identify the nationality of the authors of the different documents that make part of the sample. It can be clearly identified the United Kingdom as the country with the greater number of authors in the area of analysis, as well as the country with the greatest number of multiple country publications. This situation could be explained considering the important role that the University of Essex have played in the developing of the EUROMOD microsimulation model, as well as the microsimulation theory in general, with the support of the European Commission through the Joint Research Center. Moreover, when analyzing the MCP Ratio (multiple country publication ratio), that measures the international collaboration intensity of a country, we find that Luxembourg, Spain, Canada, Slovenia and Sweden have the greater scores, presenting only multiple country publications (their publications have at least one co-author from a different country).

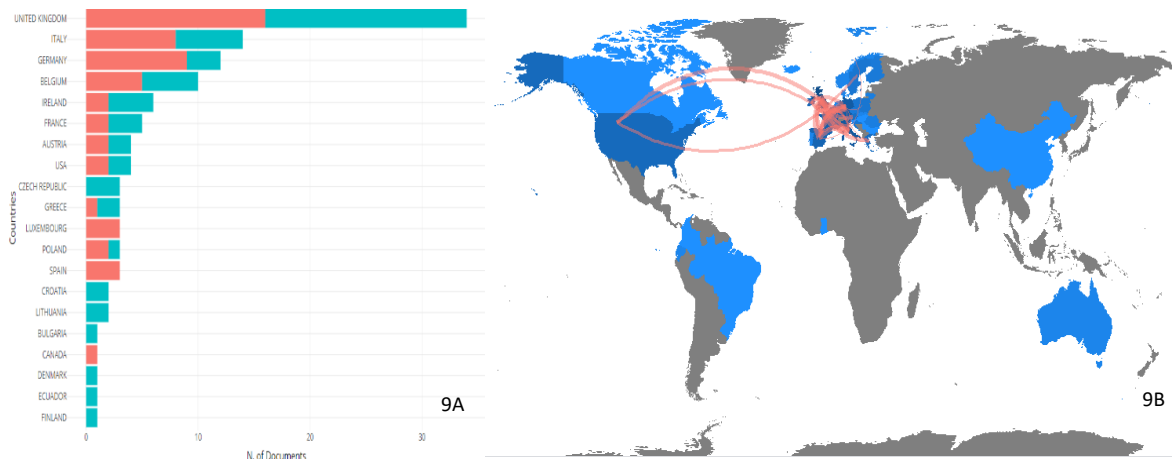


Figure 9A: Corresponding Author's Country (red: multiple country publication, green: single country publication)
 Figure 9B: Country Collaboration Map (color intensity is proportional to the number of publications)

Furthermore, in Table 5, we observe a detail of the documents with their respective number of citations, contrasting local and global citations. When analyzing the documents, we identify Bourguignon (2006) as the article with the greatest number of total citations (141 global citations), nearly followed by Immervoll (2007). Additionally, we can identify Bargain (2014, 2006, 2013, 2012, 2017) as the author with the greatest number of publications in the top 20 of the documents with more global citations in our sample.

Finally, the bibliometric analysis also included the study of the future trends and the evolution of the literature of microsimulations, through the construction of a thematic map, as shown in Figure 10. Applying the methodology proposed by Cobo et al. (2011), we grouped the top author's keywords by theme in the thematic map, giving us a vision of the evolution and trends in the study of microsimulations. Within the quadrant of the "niche themes" (highly developed and isolated themes) we find articles related to gender, minimum wage and basic income; in the quadrant of

“motor themes” we find those related to fiscal policy, work incentives and household simulations; in the quadrant of “emerging themes” we observe those related to spatial microsimulation”; while in the quadrant of “basic themes” we distinguish those related to child benefit, labour supply, redistribution and poverty.

| Document | DOI | Year | Local Citations | Global Citations | LC/GC Ratio (%) | Normalized Local Citations | Normalized Global Citations |
|---|---|------|-----------------|------------------|-----------------|----------------------------|-----------------------------|
| BOURGUIGNON F, 2006, J ECON INEQUAL | 10.1007/s10888-005-9012-6 | 2006 | 41 | 141 | 29.08 | 3.90 | 3.69 |
| IMMERVOLL H, 2007, ECON J | 10.1111/j.1468-0297.2007.02000.x | 2007 | 17 | 130 | 13.08 | 2.13 | 2.64 |
| DOLLS M, 2012, J PUBLIC ECON | 10.1016/j.jpubeco.2011.11.001 | 2012 | 17 | 90 | 18.89 | 2.49 | 2.93 |
| BARGAIN O, 2014, J HUM RESOUR | 10.3368/jhr.49.3.723 | 2014 | 6 | 89 | 6.74 | 1.77 | 4.80 |
| BENNETT F, 2013, J MARRIAGE FAM | 10.1111/jomf.12020 | 2013 | 0 | 72 | 0.00 | 0.00 | 3.21 |
| MATSAGANIS M, 2014, SOUTH EUR SOC POLIT | 10.1080/13608746.2014.947700 | 2014 | 4 | 61 | 6.56 | 1.18 | 3.29 |
| PAULUS A, 2010, J POLICY ANAL MANAGE | 10.1002/pam.20490 | 2010 | 7 | 54 | 12.96 | 1.50 | 2.44 |
| BARGAIN O, 2010, J ECON INEQUAL | 10.1007/s10888-008-9101-4 | 2010 | 16 | 51 | 31.37 | 3.43 | 2.30 |
| MALDONADO LC, 2015, COMMUNITY WORK FAM | 10.1080/13668803.2015.1080661 | 2015 | 2 | 46 | 4.35 | 3.43 | 6.65 |
| BARGAIN O, 2006, LABOUR ECON | 10.1016/j.labeco.2005.10.007 | 2006 | 10 | 44 | 22.73 | 0.95 | 1.15 |
| BARGAIN O, 2013, ECON POLICY | 10.1111/1468-0327.12011 | 2013 | 1 | 36 | 2.78 | 0.40 | 1.61 |
| FIGARI F, 2013, INT J SOC WELF | 10.1111/j.1468-2397.2012.00885.x | 2013 | 4 | 34 | 11.76 | 1.60 | 1.52 |
| MATSAGANIS M, 2013, FISC STUD | 10.1111/j.1475-5890.2013.00178.x | 2013 | 5 | 29 | 17.24 | 2.00 | 1.29 |
| O'DONOGHUE C, 1999, CMB J ECON | 10.1093/cje/23.5.565 | 1999 | 3 | 27 | 11.11 | 1.00 | 1.00 |
| BOURGUIGNON F, 2012, J ECON INEQUAL | 10.1007/s10888-010-9153-0 | 2012 | 0 | 25 | 0.00 | 0.00 | 0.82 |
| IMMERVOLL H, 2006, CMB J ECON | 10.1093/cje/bei054 | 2006 | 8 | 23 | 34.78 | 0.76 | 0.60 |
| BARGAIN O, 2012, OXF BULL ECON STAT | 10.1111/j.1468-0084.2011.00684.x | 2012 | 6 | 23 | 26.09 | 0.88 | 0.75 |
| SALGADO MF, 2014, REV INCOME WEALTH | 10.1111/roiw.12035 | 2014 | 10 | 22 | 45.45 | 2.95 | 1.19 |
| BARGAIN O, 2017, FISC STUD | 10.1111/1475-5890.12113 | 2017 | 8 | 22 | 36.36 | 5.65 | 4.29 |
| ATKINSON T, 2002, ECONOMICA | 10.1111/1468-0335.00281 | 2002 | 7 | 22 | 31.82 | 2.00 | 1.83 |

Table 5: Most cited documents (global vs local citations, ordered from the highest to lowest global citation, top 20 documents)

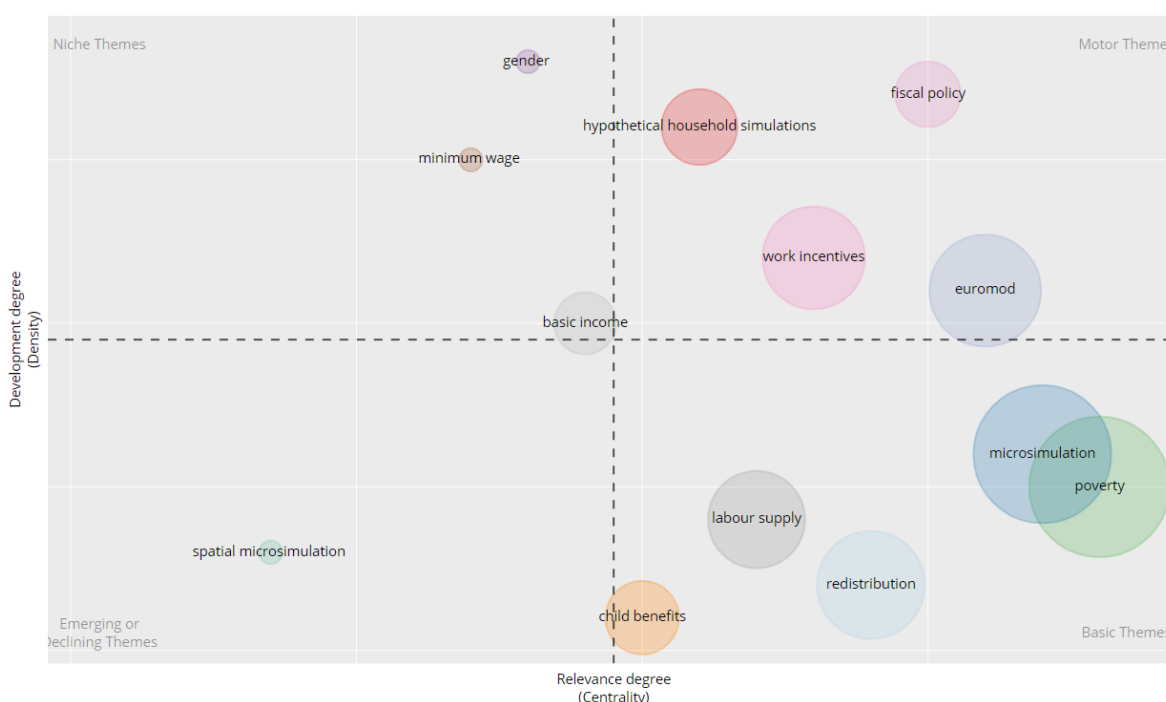


Figure 10: Thematic map (based on author's keywords)

From the sample and considering the 232 keywords plus⁵ we constructed the co-occurrence network shown in Figure 11. The analysis was limited to 50 nodes and the isolated nodes were excluded. The keywords have been clustered in 4 groups, in red: the main countries and challenges studied through microsimulations; in green: regions and secondary themes studied through microsimulations; in pink: targets or impact of the use of microsimulations; and blue: poverty and wellbeing. The co-occurrence network can help us to improve our understanding of knowledge components and knowledge structure of this field.

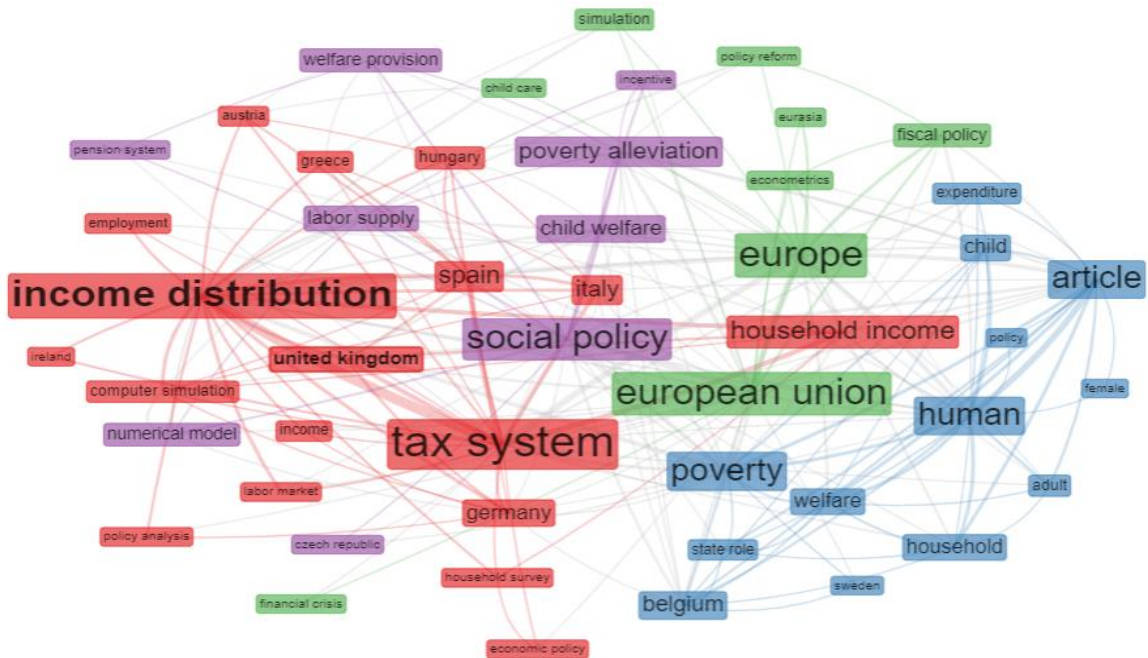


Figure 11: Co-occurrence network based on keywords plus

Looking at the network map, we find that the terms “tax system” and “income distribution” are central nodes with several interconnections with the rest of the nodes and clusters in the network. This underlines the importance and relevance of these themes within the microsimulation literature. In the other hand, terms as “financial crisis”, “economic policy” and “Eurasia” are on the edges of the co-occurrence network, with few interconnections with other nodes, and not being a central topic in the microsimulation literature.

Additionally, through the analysis of the author’s and title keywords, we can also improve our understanding about how authors frame the research, allowing the identification of potential trends in the literature. The results shown in Table 6 lists the top 10 authors’ and title keywords based on the frequency of occurrence, excluding from the list the keywords that have been used for the initial search in the Scopus database.

The results shown in Table 6 support our previous results positioning income distribution as a basic theme studied through microsimulations in EUROMOD. Additionally, we observe an important focus on Europe and the European Union, probably related with the practical use of the user-friendly tool for the analysis of policies represented by EUROMOD.

| Rank | Author’s Keywords | Title Keywords |
|------|---------------------|-----------------|
| 1 | Microsimulation | Income |
| 2 | Income distribution | Microsimulation |
| 3 | European Union | Europe |
| 4 | Redistribution | European |
| 5 | Income inequality | Impact |
| 6 | Decomposition | Policy |
| 7 | Labour Supply | Distributional |
| 8 | Work incentives | Effects |
| 9 | European Union | Policies |
| 10 | Social policy | Social |

Table 6: Keywords ranking

Nowadays, in the context of COVID-19 pandemic, we observe that new literature focused on the use of microsimulations on EUROMOD for the analysis and design of social policies to mitigate

⁵ Keywords plus terms are able to capture an article’s content with greater depth and variety than author’s keywords (Garfield, 1993)

poverty and inequality (as consequences of COVID-19 crisis) is emerging. Even though this situation is not yet directly reflected in our results of the keywords analysis. However, in the following years we expect to see an important increase in the scientific production in the area of microsimulation on EUROMOD oriented to this field.

4 CONCLUSIONS

This research described the results from the bibliometric analysis regarding the different aspects of the analysis of the microsimulation's literature, including: citation-based analysis, trends in publication, prolific authors, evolution of themes and leading countries and journals in the study of these topics. The bibliometric analysis allowed us to identify key challenges, questions and trending themes that have been guiding the study of microsimulations on EUROMOD.

The use of microsimulations for the analysis of policies is not a new topic. The use of microsimulations for the analysis of policy systems has more than 60 years. Nevertheless, since the end of the 90s, a new path emerged with the EUROMOD program. Moreover, we observe an exponential growth in the microsimulation's on EUROMOD literature, with a focus on income distribution and income inequality, related to the major challenges of reducing poverty and inequality in the world.

Additionally, we observe that since 2007 the microsimulation literature experienced a sustained growth, supporting the analysis of major concerns as poverty, inequality, income distribution, and social policies. These issues have been at the center of the discussions, especially after the global financial crisis.

We have identified the leading sources of knowledge in this literature, analyzed through the lens of the most influential journal, most prolific authors, and most cited articles. The results show that the core of knowledge in this topic is concentrated in 7 main journals, where most publications and relevant articles. We found that, with 16 documents, the International Journal of Microsimulation is the leading journal in terms of number of publications. It must be underlined that only 3 journals account more than 10 published documents, while the rest of the studied sources (96 additional sources) have less than 10 articles published.

Additionally, we observe an important relationship between relevant authors and the University of Essex, underlining its relevance as institution in charge of managing, maintaining, and developing EUROMOD, since 2004 until 2020. From the beginning of 2021, this responsibility is held by the JRC-Seville and Eurostat, starting a new era in the history of EUROMOD.

Moreover, in terms of the most influential authors, we find that Sutherland is the most cited authors based on global citations (340), number of publications (23) and fractional number of publications (7.84), however, Gasior is the most relevant author in terms of local citations (54). Not correlation was found between date of publication and number of citations, nor between number of publications and number of citations. Then, we also noted an important number of occasional authors in this topic of analysis, having only 1-2 written documents.

From the sample obtained through the search in the Scopus database, we could not identify any survey, systematic review, or bibliometric analysis on this specific topic. Nevertheless, we should mention as methodological limitation, that our research only focused on Elsevier's Scopus database, and not included other databases or the analysis of complementary gray literature⁶. Surveys, and bibliometric analyzes, and systematic literature reviews are important to identify key challenges, questions, and thematic trends in the study of area of study, providing potential avenues for addressing some research gaps.

The results from the thematic map, constructed through the analysis of author's keywords, provided some insightful information that allowed us to identify the different main themes of analysis. It was interesting to prove that some topics as "poverty", "child benefits", "labour supply", and "income distribution or redistribution" were classified as "basic themes"; while others topics as "hypothetical household simulations", "fiscal policy" and "work incentives", which we are starting to find more frequently in the literature, were classified as motor themes.

⁶ Several documents can be found in the official EUROMOD's website: <https://www.euromod.ac.uk/publications>

Future studies should consider a wider scope for the systematic literature review, including more databases (others than Scopus) and gray literature, in order to provide a closer evaluation of the reality of this topic. Studies providing an in-depth analysis of the most relevant articles could be also suggested to identify some of the fundamental articles in this area, to improve our understanding of key conceptualizations on microsimulation theory, and to identify the drivers in the study of microsimulations for the analysis of policies.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analysis, or interpretation of the data; in the writing of the manuscript; and in the decision to publish the results.

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APPENDIX

Appendix I: Scopus.bib - Imported Sample from Scopus Database (.bib file)