BRAZILIAN AUTHORS AND THEIR CONTRIBUTIONS ON THE ECONOMICS: THE ORTHODOX AND HETERODOX APPROACHES

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ABSTRACT: This article uses the statistical apparatus of bibliometrics to present the contributions of Brazilian authors to orthodox and heterodox frontier economics from a comparative perspective. To this end, we analyzed a sample of 918 articles published between 1966 and 2022. They represent all works published by Brazilian authors in one of the 50 most prestigious journals of orthodox economics (according to the Scimago index) or heterodox economics (according to the HJQS index). Three analyzes were performed: a contextual and historical study of the sample documents, the creation and analysis of bibliometric networks of co-citations and co-occurrences for articles from both directions, and a thematic analysis of the articles. The results show that: (i) the contributions of Brazilians to heterodox economics enjoy greater prestige in the global heterodox community than the contributions to orthodox economics before the global orthodox community; (ii) the contributions to orthodox economics are more homogeneous than the contributions to heterodox economics; (iii) the contributions of both approaches show some convergence in terms of the importance of the methods used, with the orthodox contributions focusing on the creation of methods and the heterodox on the application in empirical studies of macroeconomics.

Keywords: Orthodox Economics; Heterodox Economics; Bibliometrics; Brazil
JEI: A23; A14; B40

1. INTRODUCTION

Conceptually, in choosing criteria for defining an approach in particular science, one can be guided by the work of Lakatos (1968-1969), according to which a paradigm established in a particular field of knowledge can be summarized as a collection of ideas grouped around a set of central arguments outlined in a series of canonical texts that illuminate the common or essential aspects of the approach in question. Since orthodox economics is strongly associated with the theoretical and methodological elements of the neoclassical school of economists (DEQUECH, 2007), such an approach can be defined as drawing its central ideas from the influence of a select

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group of works that helped extend Marshall's static analysis in his Principles of Economics (2009 [1890]) and merge it with the marginalist contributions of Edgeworth (1881), Jevons (1871), and Walras's general equilibrium (1899) (TOWLER, 2019).

Important writings such as Robbins (1932), Hicks (1939), Arrow and Debreu (1954), Koopmans (1957), Debreu (1959), and Friedman (1962) fulfill this role. One can also include the theoretical contributions of game theory, grouped around the contributions of Nash (2016 [1950a]), 1950b and 1951) and Harsanyi (1961 and 1977), which provided orthodox economics with the necessary tools to study strategic interactions and imperfectly competitive markets. Alternatively, the orthodox paradigm in its more current form can be defined as a set of works heavily influenced by the central canon of Mas-Collel, Whinston, and Green (1995), Rubinstein (2006), Jehle and Reny (2011), and Kreps (2018), which provide important syntheses of ideas summarized in handbooks and combine them with sophisticated mathematical modeling. The ideas developed, which are in some sense common to these works, can be divided into two basic concepts: (i) methodological individualism, underpinned by rational choice theory, according to which individuals respond to stimuli and make choices aimed at maximizing their marginal utility by consuming their marginal net utility and equating that utility with their marginal cost; and (ii) an emphasis on the notion of equilibrium.

Due to heterodox economics and the great heterogeneity of approaches that constitute it (LAVOIE, 2014), a definition inspired by Lakatos (1969-1969) is not possible. From now on, the term "heterodox economics" will always be used as a synonym for dissident economics, anti-orthodox economics, or non-mainstream economics. As with so many approaches, there is opposition to mainstream economics in addition to very general features such as a focus on historical processes (LAVOIE, 2014; LEE, 2009 and 2016). In this sense, in most parts of the world, heterodox academic economics is usually considered as economics without relevance, whose activities are confined by researchers and professors to less prestigious universities that do not have access to the main sources of funding, while its adherents publish in journals of lesser relevance (DEQUECH, 2018).

In Brazil, on the other hand, the organization of academic economics has particularly remarkable features. It is one of the few countries where the heterodox approach has gained wide recognition. Its adherents occupy important positions in several prestigious universities, receive academic awards, have access to the main sources of funding, and publish in prestigious journals (DEQUECH, 2018). Regarding this last point, it is worth highlighting the character that promotes equality between approaches imposed by the Qualis journal evaluation system (ALMEIDA; ALMEIDA; CARVALHO, 2018).

Several papers have already been written that look at the origins and implications for economic research in Brazil to understand this condition. Fernandez and Suprinyak (2018) examine the relationship between the pioneering North American agencies in the granting of funding for academic economics in Brazil, with their particular pluralistic interest and conflict-mediating attitude, the emergence of the Associação Nacional de Pós-graduação em Economia (ANPEC), and the promotion of academic pluralism in the field. In another article, the same authors classify the centers of postgraduate economics affiliated to ANPEC into orthodox, heterodox, and pluralist (FERNANDEZ; SUPRINYAK, 2019).

The collection of interviews with heterodox economists published by Mearman, Berger, and Guizzo (2019) sheds light on this issue and includes statements by Fernando Cardim de Carvalho and David Dequech addressing this issue. Hodgson (2019), while lamenting the "failure" of heterodox economics to foster an environment of plurality and spaces of contestation in the mainstream, acknowledges that Brazil is one of the few important countries where heterodox economics is relatively strong (HODGSON; 2021).

This paper aims to contribute to this debate by quantifying the processes of written communication and comparing the academic production of Brazilian authors in the top-rated journals of orthodox (mainstream) and heterodox economics. To this end, the statistical apparatus of bibliometrics is used to create networks that allow identifying the main contrasts between publications of orthodox and heterodox origin and to verify if there is a convergent potential between them. Considering that the main economics journals are not accessible to heterodox approaches (LEE, 2009; LEE et al. 2010; ALEXIOU, 2021; STOCKHAMMER; DAMMERER and KAPUR, 2021), this work chooses the methodological option of aggregating the articles published by Brazilian authors in the main economics journals based on two different indexes: one that evaluates heterodox economics journals and one that evaluates mainstream journals, as explained in the Methods and Procedures section. This choice is supported by the uniqueness described for the Brazilian case, which is further explained in the following section, which discusses the evidence that heterodox economics in Brazil is anything but marginal and discredited. This paper has two other sections: one for the examination of the main bibliometric results and one for the concluding reflections on this study.

2 PLURALISM IN THE BRAZILIAN ECONOMICS

Regarding pluralism in economics, the main conclusion of the seminal work by Dobusch and Kapeller (2012) is that environments where a pluralistic approach to economic thinking is not

only encouraged but also readily practiced (DOBUSCH; KAPELLER, 2012). This seems to be the case in Brazil in particular.

2.1 Historical roots of pluralism

Even before the institutionalization of economics as a discipline in Brazil, there are signs of pluralism. In the early republican years of Brazilian history, "papelistas" and "metallistas" contributed to the tupiniquim reproduction of the English banking controversy, in which the proponents of fiat currency and the advocates of the gold standard faced each other (FRANCO; LAGO, 2011). Between the 1930s and 1940s, the famous "planning controversy" between Roberto Simonsen, who defended state interventionism to promote Brazil's industrialization, and Eugênio Gudin, a liberal and staunch opponent of Simonsen's ideas, stands out. In the late 1950s, inflationary acceleration was opposed by the "monetarist" currents led by Gudin, Bulhões, and Campos, as well as by "structuralists" such as Celso Furtado and Rangel, who opposed the understanding of and strategies to cope with price distortions. When the discipline of economics was finally institutionalized in Brazil, the economic debate was already characterized by a great plurality.

In the 1960s, the development of academic economics in Brazil was strongly encouraged by the intense support of North American institutions such as the United States Agency for International Development (USAID) and the Ford Foundation, which were pioneers in funding graduate programs focused on economics (FERNANDEZ; SUPRINYAK, 2018). The creation of ANPEC in 1973 is another important milestone in the process of institutionalizing academic economics and promoting a pluralism of approaches in Brazil. Fernandez and Suprinyak (2019) point out that the crucial episode in ANPEC's decision to adopt a pluralist and conflict-mediated stance occurred in its first year of existence, when ANPEC decided to host the heterodox program of the Universidade Estadual de Campinas (Unicamp), despite the threat of boycott and withdrawal by one of its most prestigious members, Fundação Getúlio Vargas.

Unicamp's economic program developed with a strong heterodox orientation. By the 1970s and 1980s, the university had become one of the most prestigious in the country, with an Institute of Economics founded primarily by heterodox economists (DEQUECH, 2018). As David Dequech notes, "this was not as readily apparent at other universities due to the military dictatorship" (MEARMAN; BERGER; GUIZZO, 2019, p.268). With the expansion of the number of universities in Brazil, it did not take long for the heterodox pioneering spirit of the "Escola de Campinas" to radiate. Many students trained at Unicamp's Department (and later Institute) of Economics went on to teach at other universities in Brazil, bringing heterodox ideas with them. This highlights the

prominent role of this department/institute in the spread of heterodox economics in Brazil between the 1980s and 2000s (MEARMAN; BERGER; GUIZZO, 2019).

The institutionalization of pluralism in economics is strengthened by Law 10.861 of April 14, 2004, which established the Exame Nacional de Desempenho dos Estudantes (ENADE), based on which questionnaires are used to evaluate students' knowledge. The economics subject covers heterodox topics such as post-Keynesian economics, industrial economics, economic history, and economic reasoning, among others. On July 13, 2007, the Ministry of Education (Ministério da Educação, MEC) published Resolution CNE/CES nº 4/2007, which establishes the national curriculum guidelines for undergraduate economics. From this, it appears that several requirements must be taken into account in the elaboration of a pedagogical project for the undergraduate study of economics, including "methodological pluralism, which corresponds to the plural character of economics, characterized by different currents of thought and paradigms" (MEC, 2007, p. 02).

2.2 Pluralism today

The Graduate Program in Economics had 67 programs recommended by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) in the 2013-2016 quadrennium. Twenty-one of these were academic master's programs, 28 offered master's and doctoral programs, 1 offered only a doctoral program, and 17 offered a professional master's program. This group of programs includes a total of 95 graduate programs (CAPES, 2017). Of these, 54 are affiliated with ANPEC, distributed among programs in economic theory, development economics, and applied economics (ANPEC, 2021).

Since the pluralistic specifications of the MEC do not exist at the time of graduation, centers are free to choose their theoretical affiliations. Therefore, to confirm the hypothesis of a prevailing pluralism in Brazilian academic economics, both orthodox and heterodox economists must occupy prominent positions in major universities. Given this autonomy, Fernandez and Suprinyak (2019) devoted themselves to the task of verifying whether pluralism exists in graduate programs.

To this end, the authors classified each professor from each ANPEC-affiliated center as orthodox or heterodox based on curriculum analysis and direct questioning and then assigned each institution to one of three categories: orthodox, heterodox, and plural. The same reasoning was applied to the academic environment as a whole, which is considered plural when the sum of plural institutions and institutions that follow the minority approach is greater than the number of programs that follow the majority approach, whether orthodox or heterodox (FERNANDEZ; SUPRINYAK, 2019).

Fernandez and Suprinyak's (2019) results show that the most orthodox programs represent only 27% of all postgraduate programs in economics in Brazil. These include the programs of

Fundação Getúlio Vargas (EPGE and EESP), the programs of the University of São Paulo (USP-SP and USP-RP), the program of the Federal University of Pernambuco (UFPB/PIMES), and others. The predominantly heterodox group is slightly more represented, with 32.6%. These include the programs of the University of Campinas (Economic Theory and Economic Development) and the programs of the Federal University of Rio de Janeiro, the Fluminense Federal University, and others. Plural programs are the majority and represent about 40.4% of the total, including the University of Brasília, the Federal University of Minas Gerais, the Federal University of Rio Grande do Sul, and others. The 67.4% resulting from the sum of plural and orthodox institutions (minority approach) indicates a plural academic environment.

The quality assessment of the programs is carried out by CAPES itself, which evaluates them every four years based on four criteria: program proposal, faculty, student body (theses and dissertations), intellectual production, and social interaction (CAPES, 2017). At the end of the assessment, programs are assigned scores ranging from 3 to 7. Programs that receive a score of 6 or 7 are considered excellent programs. In the assessment in effect at the time of this writing (CAPES, 2017), four programs received a score of 7, and six programs received a score of 6. These are the Graduate Programs in Economics at the University of São Paulo (USP-SP), the São Paulo School of Economics (EESP/FGV- SP), the Brazilian School of Economics and Finance (EPGE/FGV-RJ), and the Pontifical Catholic University of Rio de Janeiro (PUC-RJ), with a rating of 7 and with a rating of 6, respectively, those of the University of Campinas [Economic Theory] (UNICAMP), the University of Brasília (UNB), the Federal University of Minas Gerais (UFMG), the Federal University of Rio de Janeiro (UFRJ), the Fluminense Federal University (UFF) and the Catholic University of Brasília (UCB).

According to the methodology of Fernandez and Suprinyak (2019), all level 7 programs are majority orthodox, while level 6 programs include three majority heterodox programs (UNICAMP, UFF, and UFRJ), two majority pluralistic programs (UNB, UFMG), and one majority orthodox program (UCB). That is, of the 10 programs of excellence, 5 are pluralistic or heterodox and 5 are orthodox, suggesting that heterodox economists can find jobs in some of the most important universities in Brazil, quite different from the United States, for example (DEQUECH, 2018).

Funding for research in economics in Brazil depends mainly on public funds. Currently, the main funding agencies at the federal level are CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - and CNPQ - Conselho Nacional de Desenvolvimento Científico e Tecnológico. At the state level, it is worth highlighting the foundations that support research, such as FAPESP - Fundação de Amparo à Pesquisa do Estado de São Paulo -, FAPERJ -Fundação de

Amparo à Pesquisa do Estado do Rio de Janeiro -, FAPMG - Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro to the Minas Gerais State Survey - and others.

Together, these institutions are responsible for virtually all postgraduate scholarships for business students. These sources also provide a significant portion of the funds used for research projects, the presentation of papers at academic events at the national or international level, and the organization of academic events in the country. The procedures for the publication of scientific journals, the research of Brazilian academics abroad, the visits of foreign academics to Brazil, and the purchase of notebooks and desktop computers are also financed from these funds. Regarding the theoretical affiliation of the planned projects, the main funders, CAPES, and CNPQ, do not distinguish between more orthodox and unorthodox approaches, since the number of grants allocated to each program is related to its grade. in the four-year evaluation of CAPES, which, as seen, has a large number of heterodox programs among the programs of excellence. In short, the pluralistic situation persists today.

3. METHODS AND PROCEDURES

To operationalize the bibliometric study in an organized and systematic way, the procedures carried out by Costa et al. (2017) were used, which divided the steps of the bibliometric study into five steps: (i) the selection of the object of analysis and the database; (ii) search procedures and criteria; (iii) data collection and structuring; (iv) contextual and historical analysis of the results; and (v) construction and analysis of bibliometric networks.

3.1 Step 01: Selection of the analysis object and the database

The goal of the study was outlined, which is the focus of the discussion in this article. The theoretical sample size and choice of the database were then determined. The database chosen is Scopus, which indexes all major economics journals. The theoretical scope was not specified in advance, since the intended target was general production rather than a specific topic.

3.2 Step 02: Search procedures and criteria

Parameters for filtering the main sample were worked out. Two searches were conducted, one to determine the sample with studies of orthodox economics and the other with studies of heterodox economics. Both were restricted by the same filters that limited the selection to the set of documents that: (a) at least one of the authors is Brazilian; (b) were published in one of the 50

highest ranked journals according to the Scimago Journal & Country Rank (SCImago Index)[3] or the Heterodox Journal Quality Score (HJQS Index)[4]

3.3 Step 03: Data collection and structuring

Step dedicated to choosing the analysis software, download the sample to the database and import it into the selected software. The R language software RStudio (version 4.1.1) and the bibliometric display interface VOSViewer (version 1.618) were used for the analysis. The sample was downloaded from the database in CSV format and contained all the elements provided by the platform, including the author's name, the title of the work, author ID, journal name, publication volume and issue, abstract, keywords, DOI (Digital Object Identifier System), and others. The full sample yielded 918 documents published between 1966 and 2022, authored by 1431 different authors and co-authors, and with 38,041 references.

3.4 Step 04: Contextual and historical analysis of outputs

At this stage, the main sample was divided into two groups: (i) "sample with an orthodox tendency" and (ii) "sample with a heterodox tendency". Then, the data of the two samples were compared considering historical and geographical aspects as well as the respective descriptive statistics. First, the time series of publications for each of the approaches were compared. Then, maps of the density of co-authorship between nationalities were created for each of the samples to illustrate the respective degree of internationalization. Finally, the main journals, the main affiliations, and the authors with the greatest influence for each aspect were also comparatively identified.

3.5 Step 05: Construction and analysis of bibliometric networks

In this phase, bibliometric networks of co-citation, co-occurrence of keywords, and bibliographic coupling were built and analyzed, resources that "make it possible to identify the structural relationships of theoretical-methodological connectivity of a field, proximity, adjacency, association, and interlocution between documents and researchers" (GRÁCIO, 2016, p. 82).

3.5.1 Document co-citation network

It consists of a quantitative method of bibliometric study of the structures of development of scientific research around the cooperation centers (TANG; MUSA, 2011). The co-citation network

[3] The SCImago index evaluates the scientific quality of a journal using the ranking algorithm of the Scopus database (FALAGAS et al., 2008). What interests us in this study is that it also takes into account relevant qualitative aspects, such as the "prestige" of the journal within the academic community (FALAGAS et al., 2008).

[4] The HJQS is distinguished by being an indicator that specifically evaluates heterodox economics journals. According to Lee et al. (2010), the discrepancy between the scores of orthodox and heterodox journals is of policy importance for the construction of the model. From the Total Citation Score (TCS) and the Journal Peer Evaluation Quality Score (JPEQS), the index is obtained as follows: $HJQS = (0{,}5) * \left(\frac{TCS}{14} + \frac{JPEQS}{5}\right)$. The derivation of the TCS and the JPEQS is described in detail in the paper by Lee et al (2010).

measures the relationship between two articles by the number of publications in which they are cited simultaneously (GRÁCIO, 2016). It is therefore an important visual resource when it comes to showing the intellectual structure of academic research fields (WEI, 2019).

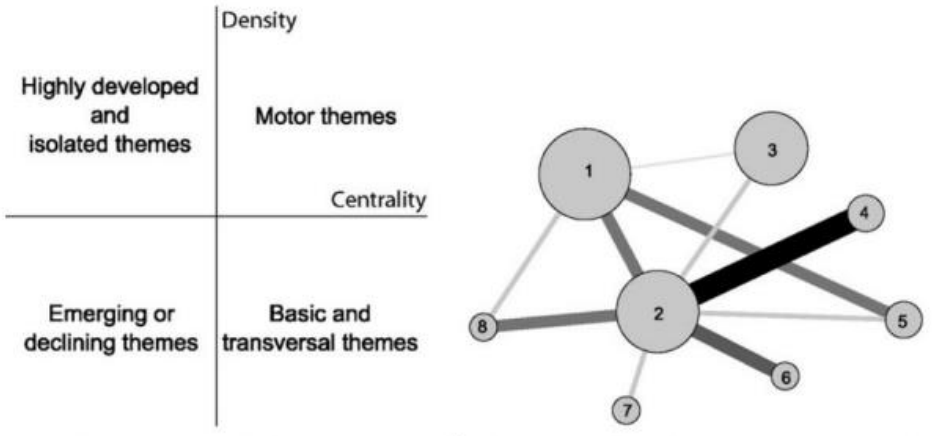
3.5.2 Keyword co-occurrence network

Highly effective tool for grouping article topics using a hybrid method (quantitative and qualitative) for text and keyword analysis. First, the strength of the relationship is determined based on the relative frequency of keywords between groups of text documents and the identification of words that occur more frequently in certain groups compared to others (SEALE, 2008; WEI, 2019) by clustering them, where the co-occurrence relationship between two keywords is determined by the number of documents in which both occur together for a given sample (ECK; WALTMAN, 2014).

3.6 Thematic analysis

This phase combined performance analysis and scientific mapping to identify and visualize conceptual sub-areas (specific topics or general themes) (COBO et al., 2011). This also allowed us to quantify and visualize the thematic evolution of research within the two approaches. To this end, we used the co-word analysis proposed by Callon et al. (1983) to estimate the strength of association between information in the textual data of the document sample based on the interactions of key terms. To better interpret the results, strategic longitudinal diagrams were used to categorize the identified themes. The strategic diagram (Figure 01) is a two-dimensional space constructed by tracking themes according to their centrality and density classification values, using the median to classify clusters along two axes: Centrality (x-axis) and Density (y-axis). Thematic areas are used to show conceptual evolution. Thus, a visualization approach is proposed to graphically represent the thematic evolution of the studied area (COBO et al, 2011).

Figure 01. Strategic diagram and thematic networks



a The strategic diagram. b An example of a the- matic network.

Source: Cobo *et al*., 2011.

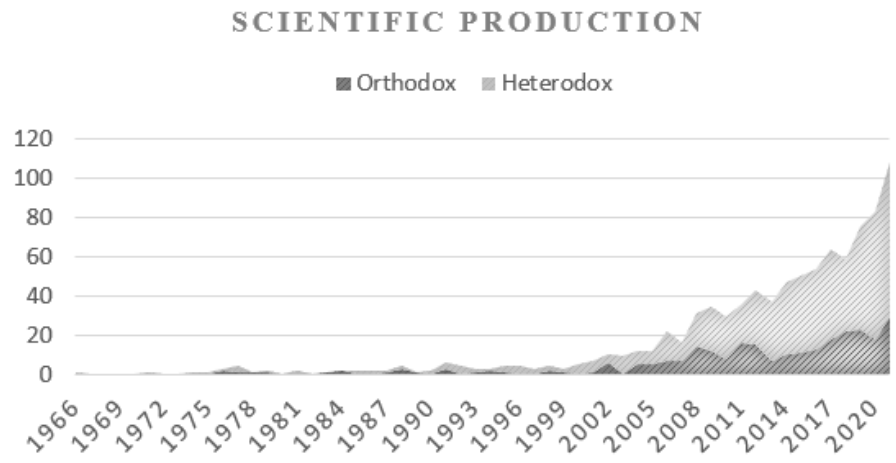
In a theme, the keywords and their connections draw a network graph called a thematic network. Each thematic network is labeled with the name of the most important keyword in the associated theme (usually by the most central keyword in the theme) (COBO et al. 2011). The terms in the upper right quadrant have high density and high centrality and are therefore considered prominent topics (or engines) in that domain; the terms in the upper left quadrant have high density and low centrality, indicating well-developed internal features associated with low importance, and are therefore considered niche topics; the lower right quadrant contains the topics with high centrality and low density, indicating that they are still poorly developed despite their importance to the research; finally, the lower left quadrant groups topics with low density and low centrality, indicating that they are emerging or declining topics.

4 DISCUSSION

4.1 Contextual and historical analysis

Although the number of publications on both sides has increased, heterodox economists have published relatively more than orthodox economists in the main heterodox economics journals. Some factors could explain this development: First, the increasing internationalization of Brazilian academia has contributed to the increase in international publications by top scholars in both fields; second, the competition factor helps explain the lower number of publications according to the orthodox orientation, since the main orthodox economics journals are also the most prestigious in economics in general. Figure 02 illustrates these movements.

Figure 02. Orthodox and unorthodox publications over time



Source: Outlined by the authors.

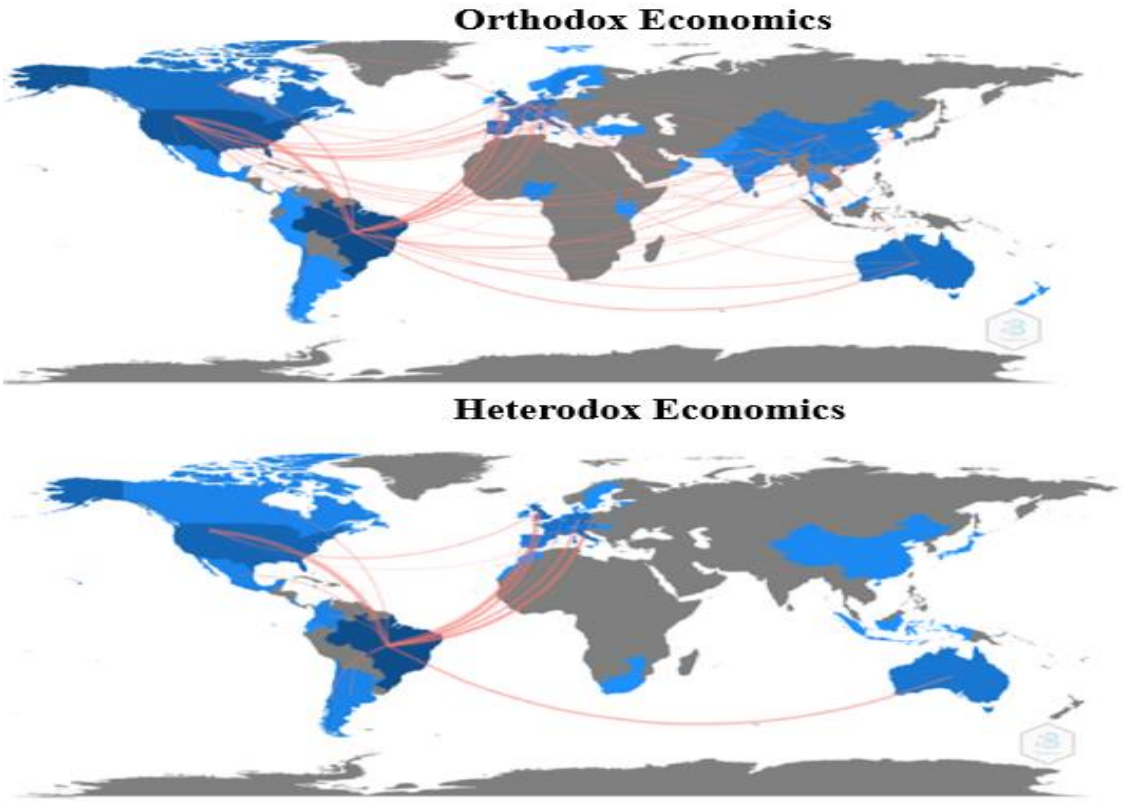
In the area of the internationalization process that the academic economy is undergoing in Brazil, it can be noted that the degree of internationalization within the orthodox economy is much higher.

Figure 03 shows that the more intense the coloring of a field, the higher the number of papers published by researchers of these nationalities.

For documents published within the Orthodox tradition, there is significant cooperation on several continents, with a focus on North America, particularly the United States of America and Canada, and some countries in Europe. These relationships are also significant with some countries in Asia and Oceania, although to a lesser extent. The heterodox research, produced with the participation of Brazilian authors, is strongly related to the production of a more limited niche of countries, at least compared to the orthodox data, and is strongly focused on Europe, followed by the United States of America and Australia. These data can illustrate the difference between the diffusion of orthodox and heterodox research from a worldwide perspective.

The 20 authors highlighted in Figure 04 are those whose production in the top journals (orthodox and heterodox) has the greatest impact, taking into account the H-index. This index considers in its calculation the number of articles published by the researcher and the number of citations these articles have (THOMAZ, 2011).

Figure 03. Collaborations between countries in both approaches



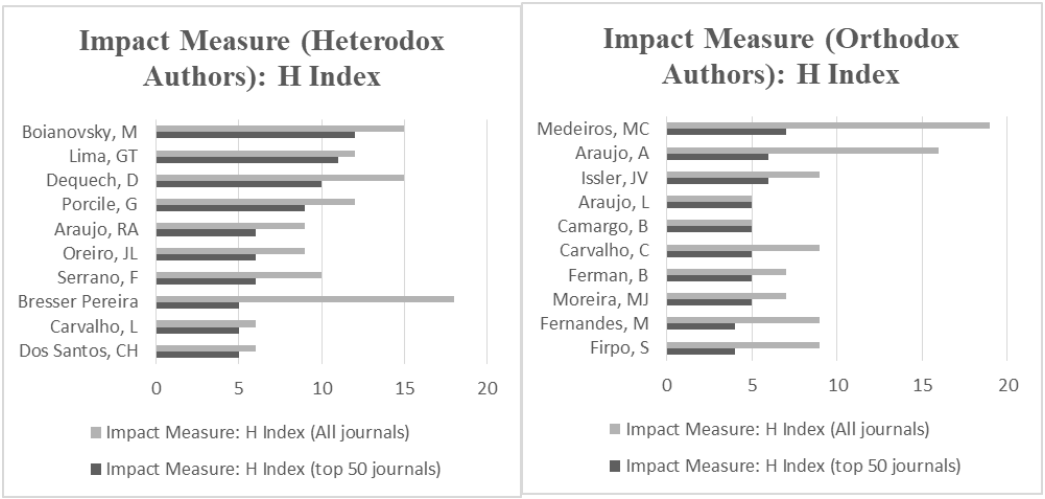
Source: Outlined by the authors.

The heterodox Brazilian with the greatest influence is Mauro Boianovsky UNB. His H-index is 12 if we consider only the 50 most important journals in heterodox economics, and 15 if we

consider his total production on the Scopus base. This means that he has published at least 12 articles in one of the top 50 heterodox economics journals, each cited at least 12 times, and at least 15 articles in Scopus-indexed journals, each with at least 15 citations.

The Brazilian with the greatest influence on the top 50 heterodox journals is Professor Marcelo Medeiros PUC-RJ, with an H-index of 7 for the most important journals and 19 for his publications indexed in the Scopus database. For both the group of orthodox economists and the group of heterodox economists, differences can be observed in the H-index for the top journals and the production indexed in Scopus. The difference is larger on the orthodox side, suggesting that their main authors write important papers outside these top journals. Another interesting contrast is the fact that the most influential Brazilian heterodox authors at the top journals have, on average, a higher H-index than the main orthodox authors. This may indicate that heterodox economics texts published with at least one Brazilian author among the authors have greater prestige in the world heterodox community than orthodox economics texts published with at least one Brazilian author among the authors have in the world orthodox community.

Figure 04. Most impactful authors



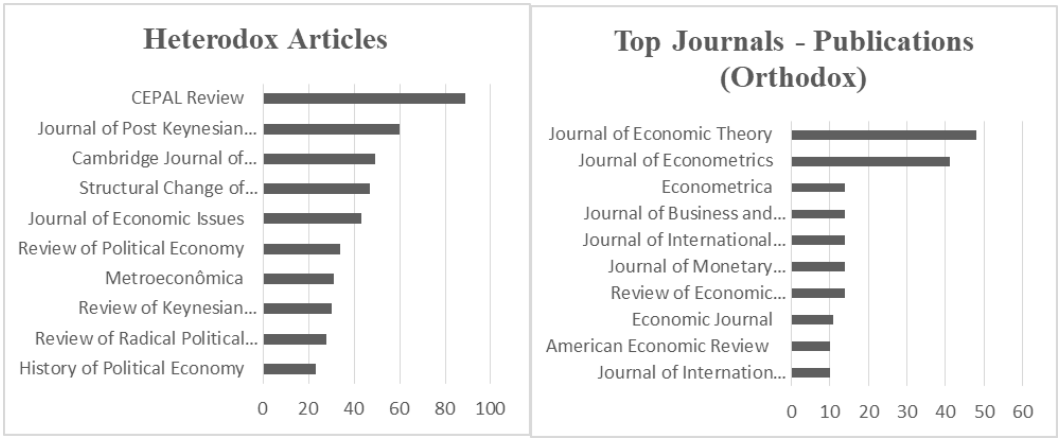
Source: Outlined by the authors.

Figure 05 shows the top journals in which Brazilian researchers have published the most. The journal with the most publications of the heterodox approach is CEPAL Review, which is ranked 50th in the ranking proposed by Lee et al. (2011), with 89 published articles. The following positions are occupied by the two most prestigious journals of heterodox economics: Journals of Post Keynesian Economics (ranked 2nd in the HJQS ranking) with 60 publications and Cambridge Journal of Economics (ranked 1st in the HJQS ranking) with 49 publications. Rounding out the top 5 are Structural Change and Economic Dynamics (21st in HJQS ranking) with 47 published articles and the Journal of Economic Issues (3rd in HJQS ranking) with 43 published articles. The top 10 are completed by the Review of Political Economy (6th in the HJQS ranking) with 34 publications,

Metroeconomica (9th in the HJQS ranking) with 31, Review of Keynesian Economics (23rd in the HJQS ranking) with 30, Review of Radical Political Economy (4th in the HJQS ranking), and History of Political Economy (11th in the HJQS ranking) with 28 and 23 publications, respectively.

Among papers in the orthodox field, the Journal of Economic Theory (ranked 48th in the Scimago ranking) and the Journal of Econometrics (ranked 45th in the Scimago ranking) occupy the top spots with 48 and 41 published articles, respectively. The journals Econometrica (3rd in the Scimago ranking), Journal of Business and Economic Statistics (27th in the Scimago ranking), Journal of International Economics (46th in the Scimago ranking), Journal of Monetary Economics (29th in the Scimago ranking), and Review of Economic Dynamics (47th in the Scimago ranking) are ranked next. Rounding out the top 10 in the orthodox aspect are the Economic Journal (32nd in the Scimago ranking) with 11 published articles, the American Economic Review (4th in the Scimago ranking), and the Journal of International Economics Business Studies (31st in the Scimago ranking) with 10 publications each.

Figure 05. Journals with the most publications



Source: Outlined by the authors.

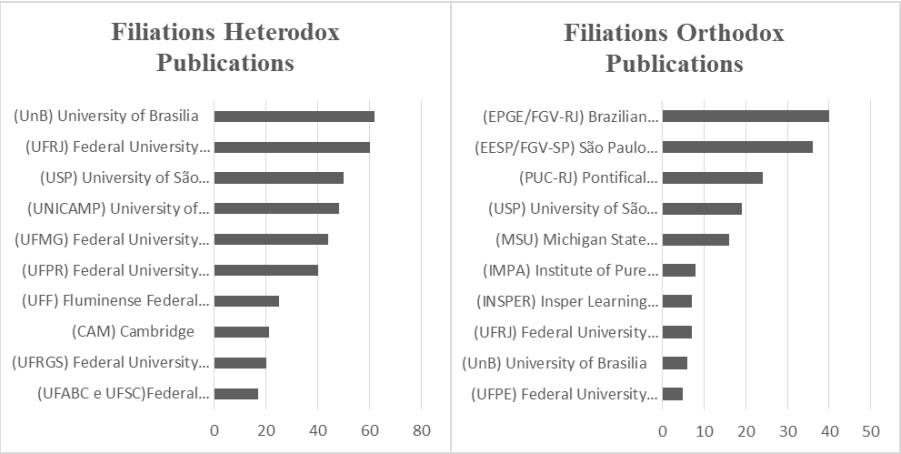
As can be seen, the production of the heterodox Brazilians is concentrated in the top positions of the HJQS ranking, with 8 of the 10 journals in which they publish most occupying a place among the top 20 most important heterodox economics journals (with 6 within the top 10), while the scientific production in the main orthodox economics journals is concentrated in the latter, with only 2 of the top 10 highlighted in Figure 05 occupying places among the top 20 and 6 places below the thirtieth position. Figure 06 shows the main affiliations of articles published in the top 50 orthodox economics journals and the top 50 heterodox economics journals.

In terms of institutional affiliations associated with publications in the field of heterodox economics, the University of Brasília (UNB), the Federal University of Rio de Janeiro (UFRJ), the University of São Paulo (USP), the University of Campinas (UNICAMP), and the Federal University of Minas Gerais (UFMG) rank in the top five. According to the study by Fernandez and

Suprinyak (2019), there are two institutions whose economic programs are pluralistic (UNB and UFMG), two predominantly heterodox programs (UNICAMP and UFRJ), and one orthodox majority (USP). The only foreign institution in the top 10 is the University of Cambridge, which ranks seventh. Rounding out the list are the heterodox programs of the Federal University of Fluminense (UFF) and the Federal University ABC (UFABC), and the pluralistic programs of the Federal University of Rio Grande do Sul (UFRGS) and the Federal University of Santa Catarina (UFSC).

In the field of publications on orthodox economics, the first two places are the São Paulo and Rio de Janeiro branches of the Fundação Getúlio Vargas, the São Paulo Schools of Economics (EESP/FGV- SP) and the Brazilian School of Economics And Finance (EPGE/ FGV-RJ), respectively, followed by the Pontifical Catholic University of Rio de Janeiro (PUC-RJ) in third place, the University of São Paulo (USP) in fourth place, and Michigan State University (MSU) in fifth place. Also according to Fernandez and Suprinyak (2019), no pluralistic programme occupies the first five places, as four are predominantly Orthodox programs (EESP, EPGE, PUC-RJ, and USP) and one is a foreign university. The last places in the orthodox top 10 are occupied by the pluralistic programs of the University of Brasília, the predominantly heterodox programme of the Federal University of Rio de Janeiro (UFRJ), the Institute of Pure and Applied Mathematics (IMPA), which itself does not offer a postgraduate programme in economics, and the predominantly orthodox programs of the Insper Learning Institution (INSPER) and the Federal University of Pernambuco (UFPE).

Figure 06. Affiliations of heterodox and orthodox publications (top 50 journals)



Source: Outlined by the authors

The University of São Paulo (USP) is the only one that stands out among the top 5 orthodox and heterodox approaches, and also the only one that is predominantly orthodox and makes significant contributions to heterodox economics. The University of Brasília (UNB) and the Federal

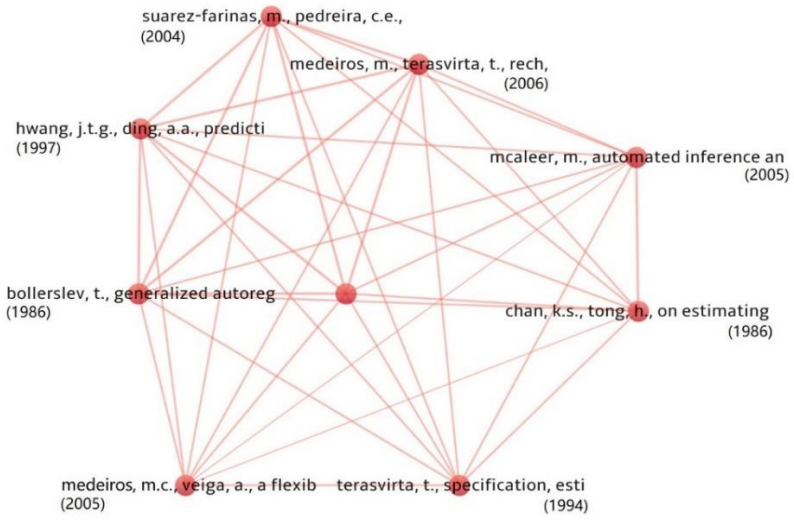
University of Rio de Janeiro (UFRJ) are also in the top 10 in both rankings. Still, in dialogue with the results of Fernandez and Suprinyak (2019), the most heterodox programme that occupies the highest position in the ranking of contributions from the two approaches is that of the Federal University of Rio de Janeiro (UFRJ), ranked 2nd in heterodox contributions and 7th when it comes to contributions to orthodox economics. The pluralistic programme of the University of Brasília is also present in both rankings, in 1st place when it comes to contributions to heterodox economics and in 8th place when it comes to contributions to orthodox economics.

4.2 Bibliometric networks

4.2.1 Orthodox and heterodox co-citation networks

Figures 07 and 08 illustrate the co-citation networks for orthodox and heterodox economics.

Figure 07. Orthodox co-citation network



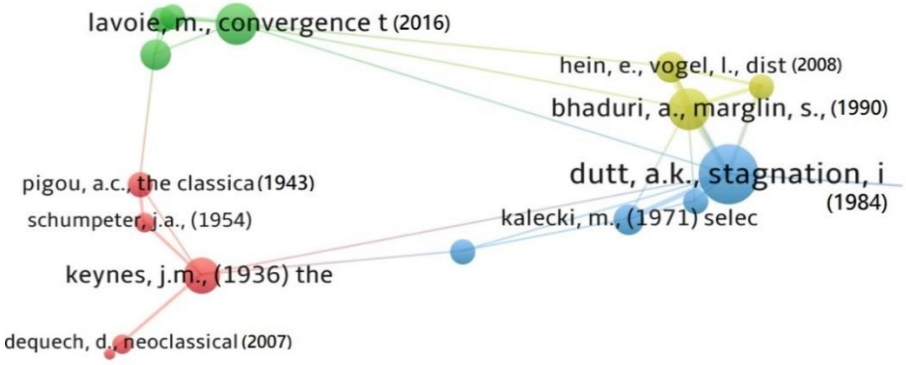
Source: Outlined by the authors.

In the orthodox co-citation network, there is only one cluster in which texts dealing with advanced econometric methods stand out. The work of Bollerlev (1986) dates from his time when he proposed to address the problem of heteroskedasticity in modeling time series with autoregressive vectors - VAR - by postulating that past conditional variances affect the current conditional variance equation. Given its more than 30,000 citations, it is a canonical text. The other papers integrating the network also focus on econometric modeling of time series. In addition to autoregressive vector models, neural network modeling has been used repeatedly in the study of time series.

Chan and Tong (1986) propose solutions to several econometric problems involving the estimation of the threshold parameter, i.e., the inflection point, of an autoregressive model; Hwang and Ding (1997) focus on the construction of prediction intervals through the application of an

artificial neural network (ANN). According to the authors, the previous statistical theory used in constructing confidence intervals for the parameters (or the weights in an ANN) is inadequate because they are not identifiable, and they show that the problem disappears when predicting with an ANN model; Mcaller (2005) discusses methodological implications related to modeling univariate and multivariate financial volatility and addresses 20 important issues in specifying, estimating, and testing conditional and stochastic volatility models; Medeiros and Veiga (2005) consider a flexible autoregressive smooth transition model (STAR) with multiple regimes and multiple transitions and formulation variables to propose a linear time-varying model where the coefficients are the outputs of a single feedforward neural network with hidden layer; Medeiros et al. (2006) present a modeling strategy for time series from feedforward network models with a single hidden layer. In summary, the co-citation network of the sample of orthodox economic science documents highlights the importance of empirical methods, especially in the area of time series modeling with neural networks.

Figure 08. Heterodox co-citation network



Source: Outlined by the authors.

The co-citation network of the heterodox economic sample (Figure 08) is more diversified and consists of four clusters. In the first cluster (green cluster), the seminal article by Marc Lavoie (2016) stands out, proving for a neo-Kaleckian model that Harrod's dynamic instability principle is dominated by the presence of autonomous consumption expenditures. In the second (yellow cluster), the work of Bhaduri and Marglin (1990) and Hein and Vogel (2008) is the most important. The former is considered a great classic of the post-Keynesian macrodynamics literature, a pioneer in defending that the assumptions of markup-based pricing, together with the differentiation of the propensity to save from wages and profits and the presence of idle capacity, are not sufficient conditions for the occurrence of a wage-led stagnation regime and open room for profit-led solutions (BHADURI; MARGLIN, 1990).

The second study is one of the most renowned empirical studies dealing with income distribution and economic growth, to determine long-run demand systems. The authors analyze the

relationship between the functional distribution of income and economic growth in Austria, France, Germany, the Netherlands, the United Kingdom, and the United States over the period 1960-2005 and find that growth in France, Germany, the United Kingdom, and the United States was led by wages, while in Austria and the Netherlands it was led by profits (HEIN; VOGEL, 2008).

The third cluster (red cluster) concentrates on important works for the historiography of economic thought. Here, in addition to Keynes' General Theory of Interest and Money and the History of Economic Thought (Schumpeter, 1954), are two of the most famous books ever published in economics, Pigou's famous article (1943) on the classical steady state, and the work of Dequech (2007) in which he defines the terms orthodox, mainstream, and heterodox economics. The fourth group (blue) summarises post-Keynesian macroeconomic work that focuses on underdeveloped economies. The collection by Kalecki (1971) contains important articles on this topic, while Dutt (1984) addresses the problem of the interaction between growth and income distribution, taking into account the characteristics of underdeveloped economies, using a representative model of the Indian economy.

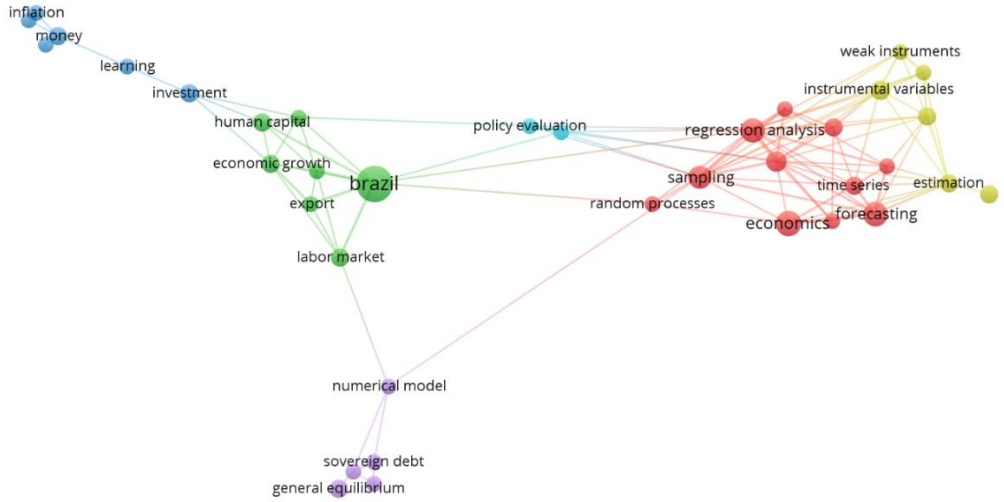
A comparison of the two networks shows that the orthodox economics network is completely homogeneous and methodologically focused on econometric techniques and applied econometric studies. The heterodox economics network, in turn, is heterogeneous and includes empirical work on macrodynamics, the history of economic thought and economic history, and work on institutional economics. As a result, Brazilian researchers with publications in the most prestigious journals within the orthodox network are involved in discussions that tend to be limited to econometric methods and applied econometric research, while in the field of heterodox economics there are broader and more heterogeneous discussions. These include institutional economics, the history of ideas, and applied labor. On this last point, it is noteworthy that post-Keynesian macrodynamics occupies half of the network, indicating a strong presence of this type of discussion in the articles in the sample and a slight convergence in applied studies in both networks.

4.2.2 Orthodox and heterodox keyword co-occurrence networks

Figure 09 shows the keyword co-occurrence network for orthodox economics, which contains 6 clusters. The distance between clusters and the small number of networks suggests that the topics of the articles in the orthodox economic sample are more heterogeneous and independent from each other. The central theme is "Brazil," although it has little to do with the adjacent groupings. The most interrelated clusters are on the upper right side of the figure, indicating strong interconnectedness among econometric approaches that use different techniques and methods. In the red cluster, the topics of "regression analysis" and "time series" are the most interrelated, with the strongest links between clusters using the keywords "numerical model," "estimation," and

"instrumental variables." The purple cluster also concentrates on important topics but has little to do with the others: the "general equilibrium" case.

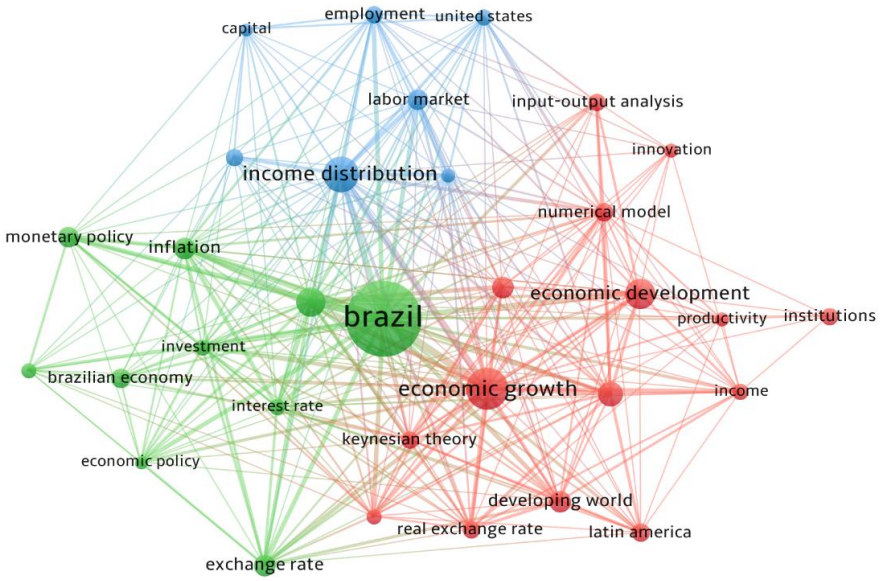
Figure 09. Orthodox keyword co-occurrence network



Source: Outlined by the authors.

The heterodox network of keyword co-occurrence is shown in Figure 10, where three distinct clusters are observed.

Figure 10. Heterodox keyword co-occurrence network



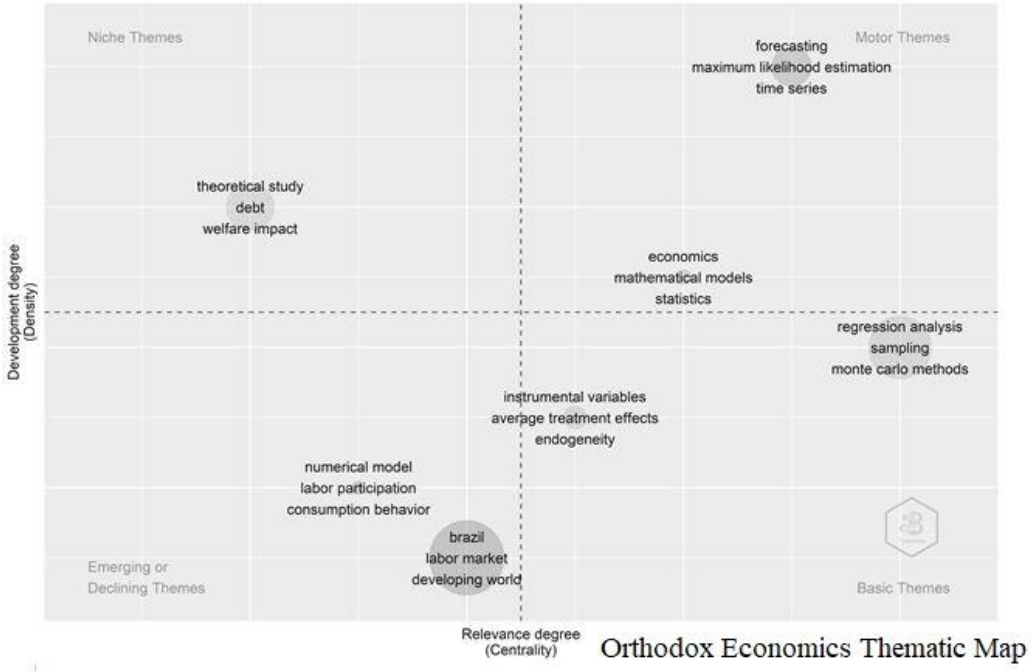
Source: Outlined by the authors.

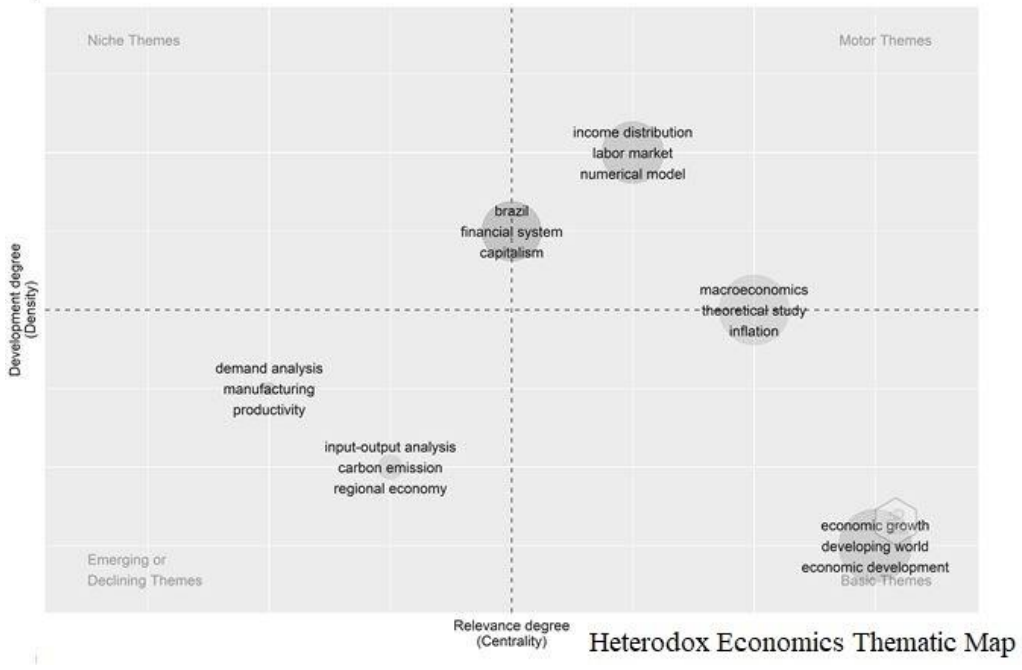
The upper central cluster (blue cluster) has income distribution as its most intense theme, with the main related themes being "employment," "capital," "labor market," and "United States." This cluster may summarize words that are common in macrodynamics research. In the cluster in the lower left part of the image (green cluster), "Brazil" is the main topic. Associated with it are topics such as "inflation", "Brazilian economy", "interest rate" and others. Finally, at the bottom

right (red cluster), the focus is on "economic growth," which is associated with topics such as "economic growth," "Keynesian theory," and mathematical modeling in empirical studies. Compared to the network of orthodox economics, it can be said that the topics are more integrated and broader than in the field of heterodox economics. What they have in common is that the issues that affect Brazil are the most prominent. Economic growth also appears as an important subject of study in both samples.

4.3 Thematic Analysis

Figure 11. Thematics maps





Source: Outlined by the authors.

Figure 11 shows the thematic mapping of the orthodox and heterodox economic sample according to the criteria of density and centrality. In the orthodox sample, seven groups could be distinguished, almost evenly distributed among the four quadrants. Niche topics include theoretical studies, debt, and well-being impacts. Two groups are in the motor topics quadrant, focusing on the group formed by the words forecasting, time series, and maximum likelihood estimates. Basic topics include regression analysis, sampling, and Monte Carlo methods, as well as instrumental variables, endogeneity, and mean treatment effects. Finally, emerging and declining topics that stand out are the labor market, global development, labor force participation, numerical models, consumer behavior, and Brazil.

The thematic map of the heterodox sample shows five clusters, mostly located in three of the four quadrants of the plan. As basic themes, they are found in the keywords economy, world development, and economic development. Their location at the bottom of the picture indicates that topics are eminent for an aspect that has not been elaborated with the appropriate intensity. For the motor topics, note the presence of keywords such as numerical models, labor market, and income distribution. As for the specific topics in the selection or the emerging groups, two can be identified: the first, with greater density, is characterized by the keywords, production and demand analysis, the second, with lower density, while the following keywords: analysis input and emission, carbon emission and regional economy.

The thematic analysis shows a certain degree of convergence in both samples when it comes to the importance of mathematical, numerical, and econometric methods, which are present in both cases with great intensity and density in the samples. From the comparative analysis of the basic topics (with high centrality and lower density), different interests can be identified: While orthodoxy is concerned with the development of new methods and analytical techniques, heterodoxy focuses on studies of a macroeconomic nature. As for Brazil, it is a central topic in the work of the heterodox samples and an emerging topic in the orthodox work, and in both cases, there is potential for an increase in its relative importance.

CONCLUDING REMARKS

This article aimed to contribute to the debate on the particular pluralistic conditions that characterize the academic environment of economics in Brazil. To this end, it quantifies and analyzes the processes of written communication and academic production of Brazilian authors in the main journals of orthodox and heterodox economics, using a series of bibliometric techniques to identify the main differences between these publications and to examine whether or not there is a potential for convergence between them.

The three fronts of analysis, according to which this work was methodologically structured, led to three groups of results: (i) in the contextual and historical analysis framework, the findings on the fate of the publications and the influence of the main authors indicate that the contributions of Brazilian authors to heterodox economics enjoy a greater prestige in the world heterodox community than the contributions to orthodox economics in the global orthodox community; (ii) in the context of bibliometric networks for co-citations of documents and co-occurrences of keywords, the contributions to orthodox economics were found to be more homogeneous than the contributions to heterodox economics, with an emphasis on selective contributions to econometric methods related to time series and neural networks in the former and empirical studies of macrodynamics in the heterodox; and (iii) in terms of thematic analysis, the contributions of both approaches were found to show some convergence in terms of the importance of the methods used, with the orthodox contributions focusing on the development of methods and the heterodox on the application of empirical studies of macroeconomics, although it is clear that both aspects are devoted to different problems.

Two aspects are highlighted as suggestions for future research: deepening the convergence tendencies between the two aspects, to obtain more information about this supposed convergence of orthodox economics and heterodox economics around the importance given to empiricism, and exploring the aspects that make it difficult to access articles with the participation of Brazilian authors within the orthodox world structure. Due to the large size of the sample of documents, the work encountered some limitations, including the lack of more robust tests related to the meaning of convergence; the limited mapping of the contributions of Brazilian authors.

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