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Contribution of CEE authors to psychological science: is the growing trend of publishing in non-CEE journals still present 10 years after its inception?

Marina Martinčević[1] · **Darja Maslić Seršić**[1] · **Davor Jokić**[2]

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Abstract
Following the previous research on the contribution of Central and Eastern European (CEE) authors to psychological science, this study aims to expand the research scope by investigating the process of internationalization of science in CEE countries which is closely related. The CEE authors belong to the geopolitically sidelined group of European countries. Their presence in psychological journals can be one of the indicators of the success of internationalization in psychology. The aim of this study is to analyse the trends in the scientific productivity of authors from CEE countries in the field of psychology by comparing papers published in CEE journals (published in CEE countries) and non-CEE journals (published in non-CEE countries) for the period 2014–2020. Using a qualitative and quantitative approach, 13,388 scientific papers published in 2089 journals indexed in Scopus were analysed. The goal was to define differences in trends in the paper publication in CEE and non-CEE psychological journals by authors from CEE countries. The results showed that CEE authors mostly published their work in non-CEE journals (69%), with the trend accelerating since 2019. The papers in both types of journals deal with similar topics of which most represented are clinical and health psychology, social psychology and cognitive psychology. The papers published in non-CEE journals mostly have a more complex methodology and greater institutional and international collaboration, which, along with the Anglicanization of CEE journals and the increased presence of CEE authors in psychological publications, confirms the internationalization of psychology.

Keywords Psychology · Central and Eastern Europe · Internationalization · Scientific productivity

✉ Marina Martinčević
mmartincevic@ffzg.hr

[1] Department of Psychology Faculty of Humanities and Social Sciences, University of Zagreb, Ivana Lučića 3, 10 000 Zagreb, Croatia

[2] Faculty of Textile Technology, University of Zagreb, Prilaz baruna Filipovića 28a, 10 000 Zagreb, Croatia

Introduction

The current study aims to identify trends in the scientific productivity of authors from Central and Eastern European (CEE) countries in the field of psychology by comparing papers published in CEE journals (published in CEE countries) and non-CEE journals (published in non-CEE countries). The study is a continuation of research conducted for the period 1996–2013, which showed that CEE psychologists, until 2004, published their work more often in CEE journals and that behind the growth in total productivity, after 2007, was the increase of publications in non-CEE journals. The number of publications in non-CEE journals prevailed in 2011 and continued to grow for 2 consecutive years (Maslić Seršić et al., 2021). Although the data collected relate to individual behaviour, i.e. individual scientific productivity, they well reflect the process of integration of CEE countries with Western Europe at the macro and organizational levels that symbolically began with the fall of the Berlin Wall in 1989. The process of CEE integration in this area has been successful, but rather long and non-linear. These findings were also confirmed by other studies showing other objective indicators of European scientific integration, such as co-authorship among EU member states and their connection with scientific productivity (Frenken, 2002; Frenken & Leydesdorff, 2004; Nagy, 2018).

The main purpose of this study is to extend the conducted comparative analysis of papers published in Scopus-indexed CEE and non-CEE journals to the period 2014–2020. Therefore, the current research contributes to a comprehensive picture of the trend of internationalization of CEE psychological science over a longer period, right after the end of the social and economic transition (i.e. 1996) until today (i.e. 2020). In addition, the purpose of the research is to determine qualitative differences (i.e. differences in topics and methodology used) between papers published by CEE authors in CEE and non-CEE journals. These results should indicate the integration of CEE science at the institutional and not only individual level. Reducing the difference in the methodological complexity of papers in CEE and non-CEE journals, which was established in the earlier period (Maslić Seršić et al., 2021), would indicate an increase in the prestige of CEE scientific journals and the trend of their qualitative equalization with non-CEE scientific journals.

The results will add to our knowledge of the international visibility of psychological research in CEE countries, and in a broader sense, the study will contribute to empirical methods that could be applied in the analysis of objective indicators of European integration (Frenken & Leydesdorff, 2004). Scientometric data on the representation of CEE authors in national and international scientific journals, as well as the results on the qualitative differences between these two groups of papers can serve as an objective indicator of the opening of CEE countries, the equalization of performance standards with the countries of the developed Western world and, finally, the influence of CEE countries on global science.

Study background

Scientific productivity quantification by scientometric measurement of the paper number in the world's leading journals indexed in selective databases (e.g. Web of Science or Scopus) was adopted in Central and Eastern European (CEE) transition countries as a confirmation of their integration into Western society (Cordón-García et al., 2017; Pajić & Jevremov, 2014). During the 1980s, the quantification of scientific research through objective

parameters of written productivity and its impact was not present in CEE countries. The scientific research was evaluated through non-objective indicators of its quality such as personal assessment of leading authorities/experts in the field (Jurajda et al., 2017). At the same time the motto: "who publish flourish; those who do not fail", was accepted as a paradigm in Western academic circles. The salience and measurability of publications and citations as performance criteria inspired social scientists to explore their determinants (Leydesdorff, 2005). Accordingly, Rodgers and Maranto (1989) conducted one of the first comprehensive and theoretically framed analyses of scientific productivity predictors in psychology. On a convenient sample of young graduate doctors of science, they revealed abilities (measured by multiple academic achievements of an individual) and the quality of an individual's graduate department (measured by multiple reputation indicators that include scientometric indicators of program faculties' productivity) as the strongest predictors of later scientific productivity. It was shown that prestigious departments employing highly cited authors recruit the best candidates and, in addition, facilitate research and their productivity. In this sense, authors from CEE countries were deprived and the whole community was locked in a vicious circle of low scientific productivity. Herendy et al. (2022) conducted a survey study among 481 social scientists from 16 CEE countries and revealed that 47% of them felt that their PhD study did not prepare them for publishing articles in international journals, an additional 24.4% only touched on the topic in passing. Besides, almost 26% of the respondents had a doctoral supervisor without any international publication output. These recent data have shown the underprivileged position of CEE social scientists in the early years of their careers, which are crucial for later scientific productivity. The lack of scientific infrastructure affected the scientist migration to Western countries and the overall low scientific output of CEE countries. Well-known Hungarian academics and neuroscientist Vizi (1993) warned of the need for "drastic changes" in policy towards science and scientists in CEE to prevent migration to Western countries with better scientific infrastructure and prestige.

However, financial investments alone are not enough to achieve high results in any field, and thus not for scientific excellence measured by indicators defined by Western culture. Organizational learning is crucial and arises as a result of multi-level interaction between individuals, groups and organizations over a period of time. Until scientific institutions in CEE countries redefined performance standards and learned through 'organizational inquire' how to improve task performance, a significant increase in the representation of authors from those countries in high-ranking international journals was not possible (Argyris & Schön, 1996; Cyert & March, 1992). Consequently, the process of integration has been slow and did not match the scientific productivity of non-CEE countries. The adoption of quantitative measures of scientific productivity resulted in an increase in CEE authors' presence in highly-rated international scientific journals. However, the international productivity of CEE psychologists stagnates until the early 2000s, that is in the first decade of the integration process (Maslić Seršić et al., 2021). Consequently, CEE universities are not among the 200 top universities in the world (with the only exception of the 84th-ranked Lomonosov Moscow State University) (World University Rankings, 2020) even 30 years after the integration started. Nagy (2018) recently stated that "International publication links of the top universities in Central and Eastern Europe (CEE), although showing a growing trend, are still lagging behind Western European or North American higher education institutions." (p. 45). The impression of CEE countries' lag in scientific productivity was supplemented by a recent extensive analysis of scientific papers' citations. Leydesdorff et al. (2014) showed that the EU28 (all 28 member countries of the European Union) increased its share among the top-cited publications (top 10% and top 1%) between

the years 2000 and 2010. Although some EU countries overtook the US in this respect, a clear distinction between the EU15 (Western Countries) and the Accession Countries (i.e. CEE countries) still exists. CEE countries have clearly defined as a less productive European group in this regard. The current study addresses the gap between CEE and non-CEE countries by analyzing empirical data on CEE authors' progress in psychology. The intention is not to compare CEE authors with Western psychologists, but to continue to track transition trends in psychology. Data on the dynamics of the transition process can be used to evaluate the process, as well as to define EU and national policy in this area.

Research questions and hypotheses

To our knowledge, there has not been much research addressing the issue of scientific productivity and the international integration of CEE authors in the social sciences (Jokić, 2020; Jokić et al., 2009, 2019; Maslić Seršić et al., 2021). This study aims to contribute to existing knowledge regarding the scientific productivity of CEE authors by analysing their international productivity in the field of psychology.

The current study focuses on the period 2014–2020. It is a continuation of Maslić Seršić et al. (2021) research on the quantitative and qualitative characteristics of papers in psychology from 15 CEE countries in the period 1996–2013. Consequently, two research problems and related hypotheses were in focus:

(1) Differences in quantitative trends in the publication of papers in CEE and non-CEE psychological journals during the investigated period;
(2) Qualitative differences between these two groups of papers concerning research areas and the applied methodology.

We expect the dominance of publications in non-CEE journals, first observed in 2011, demonstrating the international relevance of psychological science developed in CEE countries (H_1), as well as a faster increase in the number of papers published in non-CEE than in CEE journals (H_2). In addition, it is assumed that papers published in non-CEE journals (which according to bibliometric data are of higher rank than CEE journals) would show qualitative characteristics of higher methodological requirements and data analysis complexity than papers published in CEE journals (H_3). This greater complexity of papers published in non-CEE journals is likely to require a greater scope of collaboration for their production. Therefore, we assumed that papers published in non-CEE journals would have a significantly higher number of authors (H_4) and author collaboration from a significantly larger number of institutions (H_5).

Methods

To get the relevant sample an amount of bibliographic data on CEE authors was crucial. Therefore, in obtaining the sample, the Scopus database was used as it covers more journals in the field of psychology than the Web of Science. In 2020 there were 1269 psychology journals in Scopus out of which 56 were CEE journals, and 834 in WoS out of which 13 were CEE journals. Access to the wider relevant literature enabled a better perspective in the identification of the CEE authors' publishing trends.

In terms of extracting the sample from Scopus, four criteria were applied: (1) Discipline criteria: Subject Area—Social Sciences, Psychology; (2) Time criteria: Period—2014–2020; (3) Country criteria: Affiliation country—CEE countries (Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, North Macedonia OR Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia); and (4) Document type criteria: Document type—Article and Review.

A total of 13,467 documents were extracted based on the described criteria. After document verification by six subject specialists, a 1071 document was excluded based on incorrect field categorization, doubling, lack of abstract and incorrect article categorization. Most of the excluded documents ($N=670$) were assigned to psychology but were actually of different scientific disciplines, mostly medicine. The lack of abstract in documents ($N=193$) indicated an unacceptable article structure. Namely, the key methodological approach required abstract as a main source for the analysis. Checking the original documents, some of them were published with abstract but it was not displayed in Scopus for an unknown reason. The rest of the documents published without abstracts were some kind of report, commentary, notice or editorial. They were miscategorized in Scopus as articles. The 194 documents appeared twice, and 14 preliminary communications were displayed as articles. A total of 14 journals were excluded as not psychological or lacked abstracts. Accordingly, 12,396 documents were obtained.

Finally, some of the documents contained two or more studies ($N=718$) which were coded as separate studies (except the data on general information about the paper). The total number of analysed papers was $N=13{,}388$, of which $n=4181$ were published in CEE journals and $n=9207$ in non-CEE journals.

Data analyses

Data analysis is divided into two parts: (1) quantitative and qualitative analysis of coded data, and (2) bibliometric visualization analysis.

Quantitative and qualitative analyses were performed on general information and abstracts of all included papers that were coded by 6 separate coders. To be able to compare the data, the coding scheme was the same as in Maslić Seršić et al. (2021). The coders practiced coding schema on $N=100$ abstracts, and all disagreements in the coding process were resolved with the project team. The following data were coded:

1. *General information about the paper* Title of the paper, authors, year and journal in which the paper was published, total number of authors, number of institutions, number of countries, and language.
2. *The main topic of the paper* Included several areas of psychology: (a) cognitive; (b) neuropsychology; (c) personality; (d) developmental; (e) social; (f) clinical and health; (g) educational; (h) industrial/organizational; (i) forensic; (j) sports; (k) evolutionary; (l) psychology of religion; (m) psychometrics and methodology; (n) history and general topics on psychology.
3. *Type of study and methodology applied* Based on study type, papers were categorized into the following categories: (a) quantitative research; (b) qualitative research; (c) review paper; (d) meta-analysis; (e) comparative research. Regarding methodology applied, the following categories were used: (a) experiment; (b) quasi-experiment; (c) cross-sectional, correlational study; (d) longitudinal study; (e) interview; (f) focus

groups; (g) naturalistic observations; (h) qualitative data analyses. Additionally, in this study, we added a case study category.

4. *Study sample* The following characteristics of the sample included in the papers were coded: (a) who were the participants (humans or animals); (b) the nationality of the sample (national or international); (c) sample type based on sampling method (representative, convenient, stratified, quota, and snowball sample which we added as a new category); (d) population from which the sample was drawn (clinical or non-clinical); (e) age group (children, adolescents, adults or a wide age range); (f) gender (male, female, mixed); (g) educational level (primary, secondary, post-secondary or a diverse range of educational levels). The size of the sample was also coded.
5. *Type of data analysis* The following classification was used: (a) univariate; (b) bivariate; (c) multivariate; (d) latent variable analysis.

In the case where it was not possible to code the variable, the category 'unknown' was used. The Chi-Square tests were used to test the differences in the aforementioned categories between CEE and non-CEE journals. Due to the sensitivity of the Chi-Square test to the sample size, the Cramer's V or Phi effect sizes (Rea & Parker, 1992) which show how large the significant effects are, were used. Analyses were conducted using SPSS 26 software (IBM Corporation, 2019).

Bibliometric visualization analysis was performed using VOSviewer software (Van Eck & Waltman, 2010, 2014). The software analyses the occurrence of terms in article titles and abstracts based on the automatic term identification approach developed by Van Eck and Waltman (2011). Using a binary counting approach, a total of 177,577 terms were identified of which 2017 terms that occurred at least 20 times were included in further analysis. The names of countries (e.g. United Kingdom, Hungary), general terms (e.g. psychology, p001, beneficial effect) and words not related to the topic (e.g. night, room, July) were omitted. Based on 1210 terms, which represent 60% of previously identified terms, a network visualization map was constructed. The map consists of nodes of different sizes and colours and the links between them. The size of a node is determined by its weight, with a larger node representing a term with a higher weight. The colour of the node is determined by a cluster, that is, a set of closely related terms. The number of clusters is defined by a resolution parameter, with a higher value indicating a greater number of clusters. In this study, a 0.90 resolution parameter was used. The strength of the connection between different terms is determined by the thickness of the connection between nodes. To determine the affiliation of a particular term to CEE or non-CEE journals, two separate maps, each representing one type of journal, was created. The CEE map shows 457 terms and the non-CEE map shows 810 terms.

Results

General information analysis

Analysis of the top 10 journals showed the domination of CEE journals (Table 1), but the largest number of papers have been published in the non-CEE journal *Frontiers in Psychology*.

Papers published in CEE journals are predominantly papers by three authors (Mode = 3, Range = 1–194) from one institution (Mode = 1, Range = 1–136) and country (Mode = 1,

Table 1 Top 10 CEE and non-CEE journals according to the frequency and percentage of published papers ($n=2621$)

	Name of journal	Frequency	Percent	Cumulative percent	Type of journal
1.	Frontiers in Psychology	652	4.9	4.9	non-CEE
2.	Personality and Individual Differences	308	2.3	7.2	non-CEE
3.	Polish Psychological Bulletin	256	1.9	9.1	CEE
4.	Ceskoslovenska Psychologie	239	1.8	10.9	CEE
5.	Psychiatria i Psychologia Kliniczna	237	1.8	12.7	CEE
6.	Current Psychology	207	1.5	14.2	non-CEE
7.	Revista de Cercetare si Interventie Sociala	193	1.4	15.6	CEE
8.	Magyar Pszichologiai Szemle	190	1.4	17.0	CEE
9.	Journal of Alzheimer's Disease	172	1.3	18.3	non-CEE
10.	Hrvatska Revija za Rehabilitacijska Istraživanja	167	1.2	19.5	CEE

Legend: *CEE* domestic journals; *non-CEE* international journals

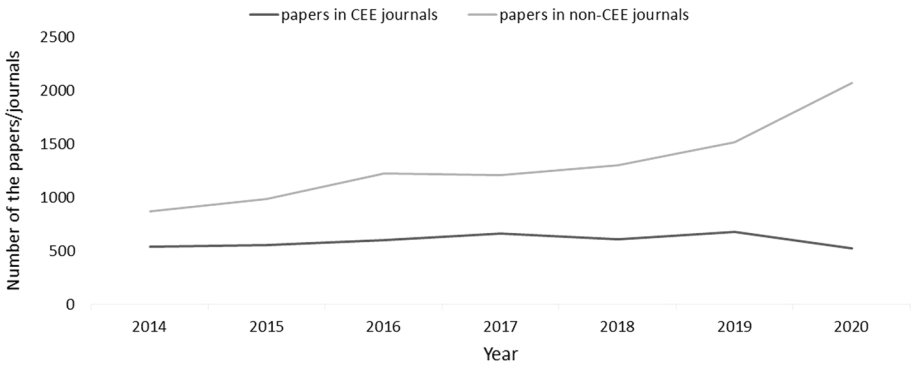

Fig. 1 Number of published papers in CEE ($n=4181$) and non-CEE journals ($n=9207$) per year. *CEE* domestic journals; *non-CEE* international journals

Range = 1–59). Papers published in non-CEE journals are predominantly papers by four authors (Mode = 4, Range = 1–912) from three institutions (Mode = 3, Range = 1–185) and two countries (Mode = 2, Range = 1–61). Most CEE papers were published in English (78%), while other papers were published in Polish (11%), Croatian (4%), Czech (2%), Serbian (2%), Slovenian (2%), Slovak (< 1%) and Lithuanian (< 1%). Of all papers, 5% were published in two languages. The dominance of the English language is also visible in non-CCE journals in which more than 99% of papers are published in English. Less than 1% of papers have been published in Russian, Spanish, French, German, Italian, Bulgarian and Croatian.[1] Only a small part of the papers ($N=22$) was published in two languages.

In the period from 2014 to 2020, there is a steady increase in the publication of papers in non-CEE journals, which dominate in relation to CEE journals (Fig. 1). After 2019, there

[1] Bulgarian and Croatian languages were used in papers that were published in two languages.

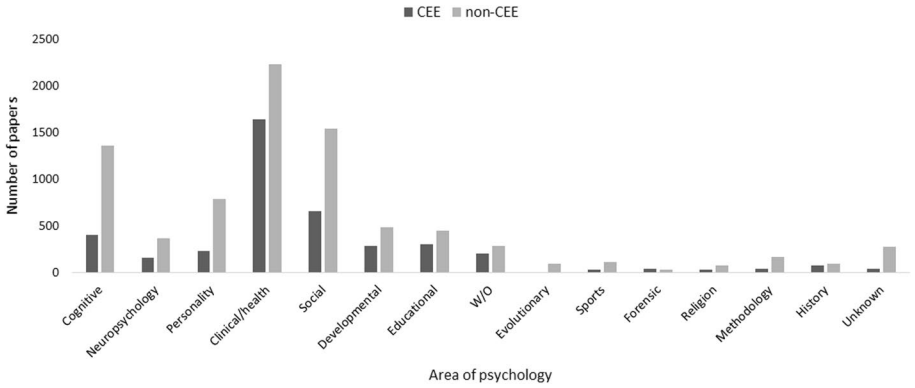

Fig. 2 Frequency of papers in CEE and non-CEE journals based on the research topic ($N = 13{,}179$)

Table 2 Results of testing the differences in the frequency of topics in CEE and non-CEE journal

Topic of the paper	χ^2	*df*	*N*	*p*	φ
Cognitive psychology	511.83	1	1767	> .001	.29
Neuropsychology	86.08	1	532	> .001	.16
Psychology of personality	296.36	1	1017	> .001	.29
Developmental psychology	52.27	1	773	> .001	.07
Social psychology	353.28	1	2202	> .001	.16
Clinical and health psychology	88.50	1	3867	> .001	.02
Educational psychology	27.50	1	754	> .001	.04
Industrial/organizational psychology	13.86	1	497	> .001	.03
Forensic psychology	1.08	1	75	.30	.01
Sports psychology	48.66	1	152	> .001	.32
Evolutionary psychology	73.28	1	113	> .001	.64
Psychology of religion	16.96	1	109	> .001	.16
Psychometrics and methodology	75.72	1	213	> .001	.36
History and general topics on psychology	3.57	1	175	.06	.02
Unknown	173.28	1	316	> .001	.55

CEE domestic journals; *non-CEE* international journals

is a rapid growth in the publication of papers in non-CEE journals and a decline in the publication of papers in CEE journals, indicating further internationalization of psychological science, but also the abandonment of domestic journals as a place of publication.

Qualitative analyses

Qualitative analysis of abstracts is focused on two aspects: (1) the topic addressed by the published papers and (2) the methodology used.

Analysis of the main research topic showed that the dominant research topic in CEE and non-CEE journals is clinical and health psychology, followed by social and cognitive

Table 3 Results of testing the differences in the frequency of methodological aspects by comparing CEE and non-CEE journals for each category of measured variable

Variable	Category	*n* of CEE journals	*n* of non-CEE journals	χ^2	*df*	*N*	*p*	φ
Type of study	Quantitative research	2230	5562	1424.82	1	7792	> .001	.18
	Qualitative research	558	1052	151.58	1	1610	> .001	.09
	Review paper	1413	1274	7.19	1	2687	.01	.00
	Meta-analysis	10	145	117.58	1	155	> .001	.76
	Comparative research	2	191	185.08	1	193	> .001	.96
	Unknown	281	461	43.67	1	742	> .001	.06
Methodology	Experiment	262	1060	481.70	1	1322	> .001	.36
	Quasi-experiment	112	404	165.24	1	516	> .001	.32
	Cross-sectional, correlational	1636	3440	641.14	1	5076	> .001	.01
	Longitudinal	102	541	299.72	1	643	> .001	.47
	Interview	150	262	30.45	1	412	> .001	.07
	Focus groups	21	42	7.00	1	63	.01	.11
	Naturalistic observation	52	140	40.33	1	192	> .001	.21
	Qualitative data analysis	185	470	125.07	1	654	> .001	.19
	Case study	130	70	18.00	1	200	> .001	.09
	Unknown	386	678	80.76	1	1063	> .001	.08
Data analysis	Univariate analysis	599	245	148.48	1	844	> .001	.18
	Bivariate analysis	661	1167	140.06	1	1828	> .001	.08
	Multivariate analysis	827	2677	976.74	1	3504	> .001	.28
	Latent variable analysis	239	586	145.95	1	825	> .001	.18
	Unknown	678	1623	387.45	1	2300	> .001	.17

CEE domestic journals; *non-CEE* international journals

psychology (see Fig. 2). Differences between the two groups of journals was significant ($\chi^2(14, N=12{,}562)=470.27$, $p<0.01$, $V=0.19$) for all areas except for forensic psychology and history and general topics on psychology (Table 2). A greater number of papers for all areas were published in non-CEE journals than expected. Still, the largest effect size that can be interpreted as a strong association was found for evolutionary psychology, a moderate association for psychometrics and methodology, sports psychology, cognitive psychology and psychology of personality, and a weak association for neuropsychology, social psychology and psychology of religion. In other areas, the association between the research topic and the group of the journal was negligible. It is also important to note that a large number of unknown topics have been found in non-CEE journals, with the effect size belonging to a relatively strong association.

The methodological analysis of the abstracts included several aspects—the type of the paper, the methodology of the conducted research, different characteristics of the sample and the analysis of the results. Regarding the type of study, there is a significant relationship between the journal in which the paper is published and the type of studies ($\chi^2(5, N=13{,}179)=664.34$, $p<0.01$, $V=0.23$; Table 3). Both types of journals most often publish quantitative research, but the greatest effects are obtained for comparative studies (very

strong association) and meta-analysis (strong association), while the effects for other types of studies are weak or negligible. A significant association was also found between the type of journal and the methodology used ($\chi^2(9, N=10{,}143)=306.91$, $p<0.01$, $V=0.17$; Table 3). Correlational research designs are most common in both CEE and non-CEE journals. Although the difference between journals is significant, the magnitude of the effect is negligible. The largest effect size (relatively strong association) exists for longitudinal studies, while a moderate effect size is found for experiments, quasi-experiments and naturalistic observations that are more frequently published in non-CEE journals. A weak association was found between qualitative data analysis (more frequently published in CEE journals) and focus groups (more frequently published in non-CEE journals). Differences between journals also exist in the sample characteristics: participants ($\chi^2(2, N=9771)=105.57$, $p<0.01$, $V=0.10$), their nationality ($\chi^2(2, N=9516)=462.84$, $p<0.01$, $V=0.22$), the type of sample ($\chi^2(5, N=9508)=505.87$, $p<0.01$, $V=0.23$), the population from which the sample is recruited ($\chi^2(2, N=9515)=97.25$, $p<0.01$, $V=0.10$), age group ($\chi^2(4, N=9501)=134.90$, $p<0.01$, $V=0.12$), gender ($\chi^2(3, N=9408)=30.80$, $p<0.01$, $V=0.06$) and their level of education ($\chi^2(4, N=9502)=161.12$, $p<0.01$, $V=0.13$). As can be seen in Table 4, CEE and non-CEE journals most often publish studies conducted with humans, a national, convenient sample from a non-clinical population. Participants are most often both female and male adults of diverse educational levels. It is important to note that studies conducted with animals, and international and representative samples are more often published in non-CEE journals. The median sample size in the CEE journals is lower than in non-CEE journals ($Mdn_{CEE}=168$, $IQR_{CEE}=61–402$; $Mdn_{non\text{-}CEE}=244$, $IQR_{non\text{-}CEE}=80–692$). Regarding journal type and data analysis, the observed cell counts were significantly different from the expected ($\chi^2(4, N=9302)=724.01$, $p<0.01$, $V=0.28$; Table 3). The most common analysis in both CEE and non-CEE journals is multivariate analysis (moderate association). A weak association exists for latent variable analysis (more common in non-CEE journals) and univariate analysis (more common in CEE journals), while for bivariate analysis the effect is negligible.

Bibliometric visualization analysis

To better understand the content of papers in CEE and non-CEE journals, a bibliometric visualization analysis was performed, the results of which are shown in Figs. 3 and 4.

Figure 3 shows four major areas (clusters) that are predominantly explored in CEE and non-CEE journals. The first cluster (marked in yellow in Fig. 3) represents the field of validation studies and differential psychology. This cluster is dominated by terms such as *scale*, *validation*, *correlation*, *personality*, *trait*, and *inventory* which suggests that this is an area of validation of instruments designed to measure individual differences. The second cluster (marked in blue in Fig. 3) denotes the field of clinical and health psychology, and this is supported by terms such as *patient*, *treatment*, and *symptom*. *Depression* and *anxiety* are also frequent terms, suggesting that these are the disorders that occupy the authors the most in the studied period. The third cluster (marked in green in Fig. 3) is the field of cognitive and neurocognitive psychology which are investigated by experimental methodology. Terms such as *language*, *learning*, and *memory* reveal topics that occupy cognitive psychologists, while terms *deficit*, *impairment*, *brain*, and *Alzheimer* show a greater emphasis on research in the field of neurocognitive psychology. Terms *experiment*, *performance*, and *control group* emphasize the experimental approach. In the fourth cluster (marked in red in Fig. 3), different areas of psychology are intertwined, such as

Table 4 Results of testing the differences in the frequency of the sample characteristics in CEE and non-CEE journals by comparing CEE and non-CEE journals for each category of measured variable

Variable	Category	*n* of CEE journals	*n* of non-CEE journals	χ^2	*df*	*N*	*p*	φ
Participants	Humans	2880	6476	1383.64	1	9351	< .001	.15
	Animals	0	233	Not testable				
	Unknown	66	116	13.74	1	182	< .001	.08
Nationality	National	1882	2733	156.92	1	4615	< .001	.03
	International	115	860	569.26	1	975	< .001	.58
	Unknown	946	2980	1053.02	1	3925	< .001	.27
Sample type	Representative	82	344	161.14	1	426	< .001	.38
	Convenient	1786	2385	86.02	1	4171	< .001	.02
	Stratified	14	39	11.79	1	53	.001	.22
	Quota sample	9	35	15.36	1	44	< .001	.35
	Snowball	5	1	2.67	1	6	.10	.45
	Unknown	1046	3762	1535.70	1	4807	< .001	.32
Population	Clinical	323	1041	87.35	1	1697	< .001	.05
	Non-clinical	2088	4771	1049.50	1	6860	< .001	.15
	Unknown	197	762	330.38	1	953	< .001	.35
Age group	Children	230	473	84.00	1	703	< .001	.12
	Adolescents	293	508	57.71	1	801	< .001	.07
	Adults	1429	2548	314.85	1	3977	< .001	.08
	Wide range	181	503	151.59	1	684	< .001	.02
	Unknown	810	2526	882.69	1	3336	< .001	.26
Gender	Female	184	282	20.61	1	466	< .001	.04
	Male	99	172	19.66	1	271	< .001	.07
	Mixed	1441	3557	895.85	1	4998	< .001	.18
	Unknown	1160	2513	498.40	1	3673	< .001	.14
Educational level	Primary	582	1136	178.65	1	1718	< .001	.10
	Secondary	300	415	18.50	1	715	< .001	.03
	Post-secondary	153	188	3.59	1	341	.06	.01
	Diverse range	637	1142	143.35	1	1779	< .001	.08
	Unknown	1273	3676	1166.78	1	4949	< .001	.24

CEE domestic journals; *non-CEE* international journals

educational, social and organizational psychology. Terms belonging to this cluster, such as *student*, *teacher*, *practice*, *employee*, *organization*, *society*, and *integration* suggest that this cluster represents applied areas of psychology.

Network visualization (Fig. 4) separately for CEE and non-CEE journals showed some similarities and differences between terms that occur in CEE and non-CEE journals. In both visualizations, three interpretable clusters were identified. For CEE journals (Fig. 4a), these are: (1) differential psychology; (2) clinical and health psychology; and (3) applied psychology. For non-CEE journals (Fig. 4b), clusters are defined as: (1) differential psychology; (2) clinical and health psychology; (3) cognitive and neurocognitive psychology. In other words, it seems that in both types of journals, the authors deal with differential psychology, although the topics they publish in CEE and

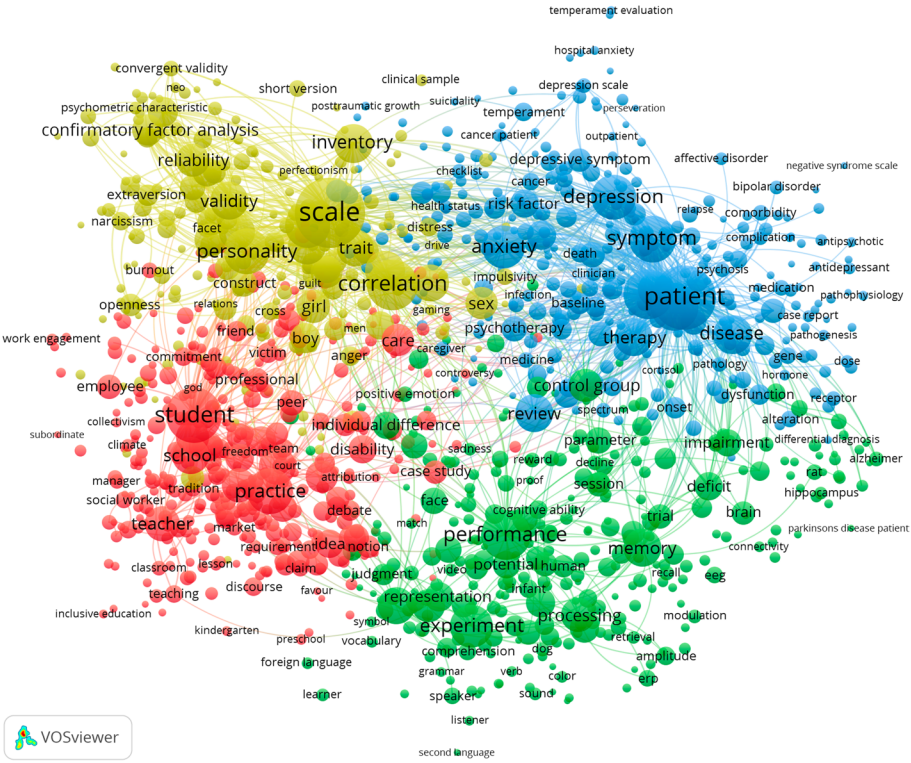

Fig. 3 Network visualization of $N = 1210$ terms in the titles and abstracts of CEE and non-CEE journals

non-CEE journals are different. In the CEE map, this cluster is much clearer in terms of interpretation—that is, it reflects research on individual differences (e.g. personality) and instrument validation, while in the non-CEE map, this cluster is intertwined with some terms from applied psychology. In the non-CEE map, the greater emphasis is on national differences regarding personality traits and constructs of social psychology (e.g. social identity), and the role of individual differences in the field of organizational psychology (e.g. management). On the other hand, in the CEE map, applied psychology is represented in a separate cluster with greater emphasis on the field of education, although topics from organizational and social psychology also appear. In both maps, clinical psychology is represented with similar terms. However, in the non-CEE map, the concepts of public health and epidemiology are more prominent, suggesting the more frequent publication of epidemiological data from the field of clinical psychology in non-CEE journals. In addition, in the non-CEE map, clinical psychology terms are connected to the cluster of cognitive and neurocognitive psychology, suggesting that neurocognitive research with clinical populations is more often published in non-CEE journals. Accordingly, the cluster of experimental, cognitive and neurocognitive terms, which also suggests more time-consuming research that requires greater financial resources, was identified only in the non-CEE map.

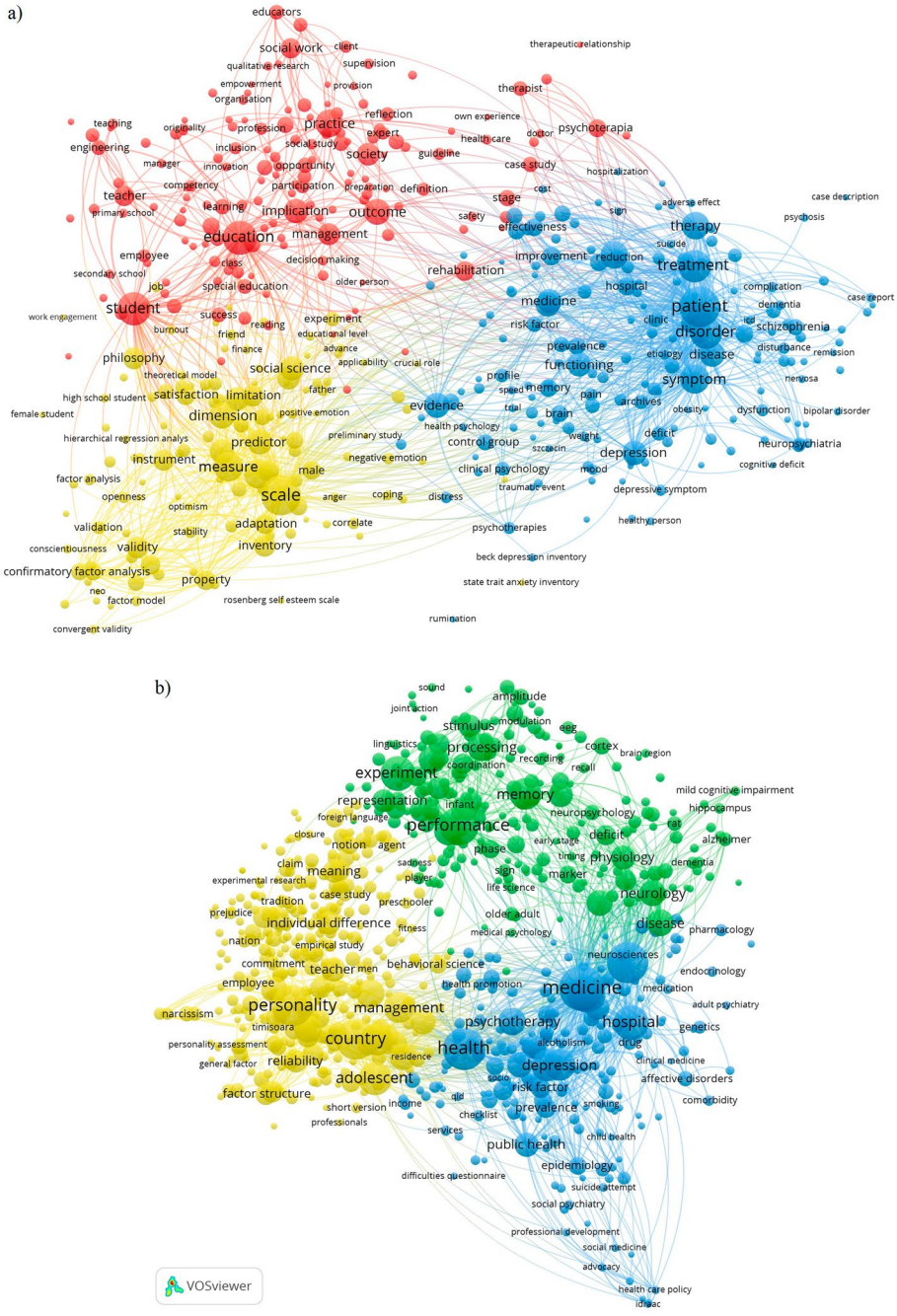

Fig. 4 Network visualization of **a** CEE ($n = 457$ terms) and **b** non-CEE journals ($n = 810$ terms)

Discussion

The results confirm the stated hypotheses on the growing internationalization of psychology science in CEE: the dominance of publications in non-CEE journals (H1) and a faster increase in the number of papers published in non-CEE than in CEE journals (H_2). The study shows a constant increase in the number of published papers in non-CEE journals compared to CEE journals, especially since 2019 when there was a rapid growth in the number of published papers in non-CEE journals and a decrease in CEE journals. The trend showed the increasing internationalization of psychology in CEE in the period from 2014 to 2020, which is a prerequisite for the increasing influence of Central and Eastern European psychologists on global science. The scientific work of CEE scientists became globally relevant and interesting, so they managed to publish more results of their research in non-CEE journals. This positive trend continued by the increasing acceptance of CEE authors in the prestigious society of Western scientists. This trend is in line with the aspiration of CEE countries towards integration with Western values, which includes adopting the aim of doing science to produce papers and trying to get them into the most prestigious journals possible (Lawrence, 2003), and the current study shows that this process is not finished yet. On the contrary, its effects are especially notable in recent years. At the same time, results do not show similar trends when it comes to CEE journals. They are still perceived as less prestigious compared to non-CEE journals (Jokić et al., 2009). Therefore, in CEE journals, authors publish results that are based on a less demanding methodology, which is less recognized and cited in global science, thus maintaining a lower impact factor of the journal.

Encouraged by a different evaluation of scientific productivity, CEE scientists increasingly manage to cope with international standards and thus publish their works in high-ranking international journals. For example, CEE countries have issued institutional promotion regulations in recent years that prescribe Western standards and encourage publication in reputable journals which are more often non-CEE journals (Herendy et al., 2022; Pajić, 2015). In addition, scientists in CEE countries have received financial support in the form of science projects whose achievement is evaluated through publications in highly ranked journals (National Foundation for Science, Higher Education and Technological Development of the Republic of Croatia, 2007). This is in line with the new trend in evaluating scientific productivity, which is the ranking of scientists according to the number of citations of their papers (Lawrence, 2008). The trend of publishing papers of funded projects in highly cited journals is confirmed by our results, which show that in the analysed period, scientists most often publish papers in *Frontiers in Psychology*, which is an open-access journal with a high impact factor and citing score charging article processing charge (Frontiers in Psychology, 2022). The trend is also due to difficulties in the transformation of CEE journals, which led to the loss of their rank or closure (Pajić, 2015). The surviving journals have made several changes, and one of them is anglicization. Compared to the period 1996–2013 when less than 50% of papers in CEE journals were published in English (Maslić Seršić et al., 2021), in the period 2014–2020 English became the dominant language of publication (78%), displacing local languages (primarily Czech and Hungarian). Anglicization opened journals to authors and audiences from non-CEE countries, which contributed to their greater recognition in the scientific field of psychology (Krampen et al., 2012).

Internationalization is also visible in more frequent networking—compared to the previously analyzed period (Maslić Seršić et al., 2021), authors collaborate with authors from

other institutions and countries when publishing papers in non-CEE journals (H_4 & H_5). Also, when publishing papers in CEE journals, authors collaborate more often with a larger number of colleagues, but still from the same institution and country. Greater collaboration of authors is in line with the modern science thesis (Ziman, 1994), according to which modern scientific research, due to greater specialization of science, the complexity of research problems and research costs, requires more sharing of knowledge, skills and institutional resources. Funded research projects, reduced communication and travel costs, have made it easier for CEE authors to collaborate with scientists from other institutions and countries (Lee & Bozeman, 2005). This has contributed to facilitated collaboration with more prestigious laboratories and research groups, which opened up a greater opportunity for CEE authors to publish papers in renowned non-CEE journals. However, collaboration between institutions and countries is lacking when publishing in CEE journals. This finding is inconsistent with the recent study by Gazni and Ghaseminik (2016) who showed that journals from national publishers increased their internationality (measured by authorship) far more than those from international publishers. They also found that journals became more international 4–6 years after as indexed by WoS. However, their study was focused on scientific journals from different fields and considered journals from the wider region, not only CEE countries. It seems that psychologists from CEE countries still perceive domestic journals as less prestigious, which leads to a vicious circle that increased the gap between CEE and non-CEE scientific journals, as shown by our quantitative data in recent years, i.e. since 2019.

Qualitative and bibliometric analyses confirm the preference of CEE authors to publish their higher-quality papers in non-CEE journals (H_3). This is in line with the previously mentioned study by Herendy et al. (2022) who found that today less than 16% of CEE social scientists do not have any international publication requirements. In other words, the majority are required to publish their work in the best possible, or international, scientific journals. To meet the requirement, they publish their "best" papers in non-CEE journals. This is most evident in the research methodology used, but also in the topics they choose to publish in CEE and non-CEE journals. Journals from both categories are dominated by quantitative and correlation studies with national, convenient and non-clinical samples. However, when more demanding and expensive research is done (e.g. neurocognitive experiments, longitudinal research, international sample), with more complex data analysis, authors are more likely to publish in non-CEE journals. Similar to the previously analysed period, the authors in the period 2014–2020 mostly researched topics in the field of clinical and health psychology, social psychology and cognitive psychology. They are also interested in the field of differential psychology in which they most often conduct validation studies, but also other areas of applied psychology such as educational and organizational psychology. The growing trend of publishing papers in non-CEE journals has resulted in all topics being most frequently published in non-CEE journals. The effect is strong for evolutionary psychology, moderate for psychometrics and methodology, sports psychology, cognitive psychology and psychology of personality. The higher quality of non-CEE journals resulted in a greater number of received papers, which also led to greater specialization of non-CEE journals compared to CEE journals (e.g. evolutionary psychology journals). This further directed certain CEE authors dealing with specific topics to publish in non-CEE journals. Additionally, bibliometric analysis shows that non-CEE journals are dominated by topics in the field of cognitive and neurocognitive studies, clinical and health psychology, and differential psychology with an emphasis on national differences. Interest in national differences is especially prominent in the field of personality traits and social psychology which deal with cultural differences and identity. The fields

of cognitive, personality and social psychology are considered to be the most internationalized fields of psychology because their subject of research is individual and cultural differences (Thalmayer et al., 2021), so it is easier for international authors to publish papers in non-CEE journals. On the other hand, topics in the field of clinical and health psychology, differential psychology and applied psychology (especially educational psychology) are published in CEE journals. Educational psychology is a field of psychology dominated by authors from North America and West Europe (Begeny et al., 2018). Given that CEE educational psychologists mostly work in schools and are less involved in scientific work, it is possible that the level of their research knowledge is not the same as that of Western scientists, which leads to more frequent rejections in methodologically more rigorous journals. In addition, English is not their native language, so they are less inclined to write a paper in a foreign language and thus prefer to write in their language.

The methodology used in CEE and non-CEE journals follows the trend of the previously analyzed period (Maslić Seršić et al., 2021). That is, in both types of journals, the authors predominantly publish quantitative studies with correlational research designs and a convenient non-clinical sample, which corresponds to the general trend of publishing in psychological journals (Munley et al., 2002). Following global trends is also visible through the more frequent publishing of papers with qualitative methodology (naturalistic observations and qualitative data analysis) in non-CEE journals, which in recent years has been recognized as an important form of psychological research, especially in obtaining deeper information on a specific topic (Kidd, 2002). Compared to the previous period in which authors frequently published review papers in CEE journals, in the period 2014–2020, the number of review papers in CEE and non-CEE journals is almost equal. In addition, there is a visible increase in the number of meta-analyses that are published more often in non-CEE papers. Given that review papers and meta-analyses are the most cited types of articles in the literature (Patsopoulos et al., 2005), this suggests a greater recognition of CEE authors in the field of psychology.

The results of this work provide information about the role of CEE countries in the world of psychology. In relation to the previous study, this research surpassed the prior methodological limitations. On the question of obtaining a representative sample, the journals that have been previously omitted were included in the research based on the determination of psychology journals and relevant keywords. The wider time span in comparison to the previous one gave the complete picture of author trends in international scientific productivity. However, this research has certain limitations. One of them is the conclusion about internationalization based only on the number of papers published in CEE and non-CEE journals. Future studies should include other indicators, such as the number of citations, collaboration networks or mobility of scientists so that the conclusions about the internationalization of authors from CEE countries are stronger. The citation rate of these papers would reflect the internationalization, but to draw the valid conclusions it would be necessary to extend the research until 2030 due to the aggregate cited half-life in JCR Psychology category of 10, 1 years. In addition, this paper does not address differences in the representation of CEE and non-CEE authors in the CEE journals, and future research could consider this issue when discussing internationalization. These considerations about internationalization are particularly important in light of new findings that show a correlation between the productivity of CEE authors and the number of indexed national journals in Scopus, thus suggesting that authors become recognized at the national level, while recognition outside their country/region is absent (Pajić & Biro, 2023). Furthermore, the paper implies that non-CEE journals are more influential in psychology, however, future studies should verify this assumption, for example by comparing the impact factors of the

CEE and non-CEE journals. This study focuses only on the CEE region and does not consider trends in other regions, which are also underrepresented in psychology (e.g. South America). To get a complete answer to how much psychology is an international science, similar studies should be conducted in other regions. And finally, after more than three decades of transition, it is reasonable to question the validity of treating CEE countries as a single group that shares a similar history and social characteristics that distinguish them from Western countries. This is especially true if we know that these countries previously had different histories and that there were significant differences in their economic development. The transition period, although it started around the same time in all CEE countries, was not equally successful and fast. Today, some of the countries have been full members of the EU for almost 20 years, Croatia as the newest member for 10 years, while some of them are still candidate countries. In the future, we foresee further diversification of CEE countries, which will be reflected in their influence on science. This influence will probably depend on the degree of their economic and democratic development (Pietrucha, 2018), and it will make less and less sense to treat CEE countries as a whole. The assumption is in line with a recent study by Ianoş and Parişor (2020), who found significant differences between CEE countries in scientific visibility. In addition, they determined that the period 2010–2018 brought significant changes compared to the entire period covered by the data (1996–2018). Their analysis revealed the positive effect of a long research tradition in some areas, which was better for the overall situation in the country, as well as the advantage of EU membership for the development of an appropriate policy to encourage research at the individual and institutional level.

Conclusion

This study is a continuation of monitoring the trend of the internationalisation of CEE authors through the publication of papers in CEE and non-CEE journals in the period from 2014 to 2020. The results show a constant increase in the number of published papers in non-CEE journals compared to CEE, especially since 2019 when there was a rapid growth in the number of published papers in non-CEE journals and a decrease in CEE journals. In addition to the quantitative gap between CEE and non-CEE psychology journals, qualitative and bibliometric analysis confirm the preference of CEE authors to publish their higher-quality papers in non-CEE journals. This is most evident in the research methodology used, the number of authors per paper and their international networking, but also in the topics they choose to publish in CEE and non-CEE journals. The observed trends of the constant increase in the internationalization of CEE psychology in the last 25 years have shown that the process of bringing CEE psychologists closer to Western standards of scientific production is still in full swing. This finding results from treating the CEE countries as a single group and shows an average trend.

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Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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