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Inconsistent quality signals: evidence from the regional journals

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Abstract
Nowadays many countries and institutions use bibliometric assessment of journal quality in their research evaluation policies. However, bibliometric measures, such as impact factor or quartile, may provide a biased quality assessment for relatively new, regional, or non-mainstream journals, as these outlets usually do not possess a longstanding history, and may not be included into indexing databases. To reduce the information asymmetry between academic community (researchers, editors, policymakers) and journal management, we propose an alternative approach to evaluate journals quality signals using previous publication track record of authors. We explore the difference in the quality signals sent by regional journals. Traditional, journal-level, bibliometric measures are contrasted with generalised measures of authors' publishing records. We used a set of 50,477 articles and reviews in 83 regional journals in Physics and Astronomy (2014–2019) to extract and process data on 73 866 authors and their additional 329,245 publications in other Scopus-indexed journals. We found that traditional journal-level measures (such as journal quartile, CiteScore percentile, Scimago Journal Rank) tend to under-evaluate journal quality, thus contributing to an image of low-quality research venues. Author-level measures (including the share of papers in the Nature Index journals) send positive signals of journal quality and allow us to subdivide regional journals by their publishing strategies. These results suggest that research evaluation policies might consider attributing greater weight to regional journals, not only for the training purposes of doctoral students but also for gaining international visibility and impact.

Keywords Journal quality · Signalling theory · Research impact · Research policy · Regional journal

Introduction

The market of academic publications is expanding rapidly in numbers. At the same time researchers, publishers, and editors have time and attention constraints, thus they cannot keep track of all the scientific literature (Bikard, 2018), and must rely on information

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cues about journal and article quality. But (1) there is little or no agreement on what journal quality is and how it should be measured (Baum, 2012; Osterloh & Frey, 2020), and (2) there is asymmetric information between main stakeholders and journals' editorial board. For instance, the editorial board, having more information on reviewing process and the contents of the papers, may find it complicated to convey their quality standards to the wider audience correctly. This study proposes to apply signalling theory for the investigation of the inconsistency of journal quality signals measured by different quality proxies.

Signalling theory concerns the reduction of information asymmetries via various observable signals sent by actors, in this case—by journals (Connelly et al., 2011). We consider the asymmetry of information in the decisions related to the choice of the journal: authors, readers, university administration and policymakers represent actors to some extent lacking information about the quality of journals. The journals, therefore, need to pertain to certain actions or statuses to signal their quality and reduce information asymmetry. Some of the studies attempted to define proxies of journal quality signals, including specific reviewing strategies (Anderson et al., 2021; Baghestanian & Popov 2018; Garcia et al., 2021), and skewness of citation distribution for best papers (Baum, 2012). These are, however, more unusual approaches to the definition of a quality signal. Most sources build their understanding of journal quality signals on common and publicly available bibliometric measures, including journal impact factor (IF), quartiles, and the presence in specific journal lists (Chavarro et al., 2018; Chipidza & Tripp, 2021; Kuskova et al., 2011; Osterloh & Frey, 2020). These bibliometric data-based approaches, in general, fit the requirements of objectivity and consistency of journal quality assessment. However, upon closer inspection, the use of bibliometric measures may have ambiguous consequences for certain categories of journals. In the case of rather young, regional (local), or non-mainstream publication sources use of IF or journal quartile can diminish the perceived quality for the potential receivers. These journals, on average, have lower international impact and visibility, but still can be considered sources of new and potentially valuable knowledge (Chavarro et al., 2017). Signal receivers, to decrease their time and effort, usually pay attention to publicly available and common quality signals. Thus, once they see lower levels of IF or lower quartiles of a regional journal—they are most likely to interpret these values as signals of lower journal quality. This possible misinterpretation reinforces the Matthew effect (Drivas & Kremmydas, 2020), thus pushing regional journals even further from gaining attention and credit from scientific audiences. To mitigate the risk of incorrect journal quality assessment we offer an approach that captures and compares various quality signals send by journals. More specifically, we separate bibliometric journal quality signals into two "beams": journal-level measures and author-level measures. Business studies have a long-standing history of using employee experience and track record as quality signals of a company's reputation and prestige (Connelly et al., 2011; Spence, 1973). We propose to adapt this practice and use various measures of journal authors' previous publishing records as quality signals. Nowadays the use of various author characteristics as a proxy of quality is not common at the level of the journal, and it is a discussable issue at the level of the article. Some authors, however, suggest that the social status of authors signals that an article deserves attention (Bikard & Marx, 2020; van Dalen & Henkens, 2005). The others point out that most scientists do not have time to track who are journal authors or do not consider that any past publication or patent is a valuable signal of current work. We demonstrate that there is a discrepancy in quality signals sent by regional journals if we measure the signals using traditional bibliometric measures on a level of the journal, and if we use measures capturing authors' publishing records, as defined by the

number and type of publications they have had before publication at a selected regional journal. Following this possible discrepancy, we aim to uncover the following question: What is the difference (if any) in the quality of regional journals from journal-based and author-based signals?

We focus our attention on 83 post-Soviet journals on Physics and Astronomy. Journals in our sample fall under the definition of regional, or local journals (Chankseliani et al., 2021; Moed et al., 2021): their regional affiliation in Scopus corresponds to one of the post-Soviet countries. The choices of geography and subject area are interwoven. Some studies challenge the stereotype of regional journals being a source of questionable, if not worse, quality and extend the possible functions of local journals (Chavarro et al., 2017). However, Physics and Astronomy have several features that give them the potential for investigation. Firstly, this area is part of Physical Sciences, which is considered a more general and international area than Social Sciences (Hladchenko & Moed, 2021; Kirchik et al., 2012). Physical Sciences are, by their nature, less prone to biases of regional publication sources. Secondly, the studies consider the Soviet Union to be the most extensive scientific community and one of the world-recognized physics and math leaders before its dissolution (Chankseliani et al., 2021). Soviet studies in Physics used to impact both local and international research arenas (Graham, 1992; Markusova & Griffith, 1991). The dissolution of the Soviet Union caused various effects on researchers from the post-Soviet region: from wider access to international sources for publications to lower levels of centralization in scientific activity administration, and, eventually, dramatically reduced access to research funding (Kuzminov & Yudkevich, 2022). Regional journals in Physics and Astronomy affiliated with post-Soviet countries provide us with rich empirical data and context. We can observe the difference in journal quality signals in well-established and recognized research subject fields.

This paper is of interest to the scientific community for several reasons. Previous studies on regional/non-mainstream journals, mostly, explored the measures of localisation/internationalisation of science (Kirchik et al., 2012; Macháček, 2019; Moed et al., 2020, 2021; Zitt & Bassecoulard, 1998; Zitt et al., 1998), functions of publications (Chavarro et al., 2017), description of bibliometric statistics on impact, collaboration, themes (Andrei et al., 2016; Chankseliani et al., 2021; Graham, 1992; Hladchenko & Moed, 2021; Li & Yang, 2020). This paper is one of the first attempts to assess regional journals from the perspective of inconsistent quality signals they are sending to potential receivers. In addition, we investigate the consistency of quality signals based on the type of journal, which sheds light on the role of language on the international visibility of output from emerging research countries, and countries in transitional states of scientific development (Kirchik et al., 2012). The proposed approach is especially valuable for specific categories of academic journals—local (Chavarro et al., 2017; Moed et al., 2021) or regional (Suárez-Tamayo et al., 2018), non-mainstream (less recognized by academic groups or not indexed in Web of Science/Scopus) or relatively young ones.

Theoretical considerations

Journal quality signals

In addition to being a key instrument of academic communication, academic journals provide a quality-control mechanism in science (Tiokhin et al., 2021). However, this

mechanism is prone to biases, as there are information asymmetries between journals and various interest groups. Three interest groups are in the spotlight: a researcher, who makes a choice of publication source for his/her paper; an institution or policymakers, who oversee research evaluation procedures (funding, hiring, assigning scientific degrees) (Chipidza & Tripp, 2021); readers who are limited in their abilities to consume all possible relevant publications and look for the most prominent ones (Bikard, 2018; Bikard & Marx, 2020). These groups possess various information, and that potentially creates asymmetries in decision-making processes. For instance, researchers usually have more information about the paper submitted for review (Tiokhin et al., 2021), in comparison with journal editors who decide on quality based on reviewers' comments, and other codified or tacit merits. Reviewers and editors have an imperfect ability to capture papers that may increase journal prestige (Sugimoto et al., 2013) and quality (McCabe & Snyder, 2005). Readers and researchers sometimes make a choice due to the high rank of a journal, rather than the actual quality or relevance of the paper (Baum, 2012; Chipidza & Tripp, 2021; Osterloh & Frey, 2020).

Signalling aims to reduce information asymmetries, not only in business practice but also in academia (Anderson et al., 2021; Baum, 2012; Garcia et al., 2021; Medoff, 2003; van Dalen & Henkens, 2005). Two broad types of information are usually related to asymmetries: information about quality and information about behaviour or behavioural intentions. We focus our attention on resolving information asymmetries in the case of latent and unobservable quality when one actor is not fully aware of the characteristics of another (Connelly et al., 2011).

In this article, we consider journals as signal senders. One of their major goals is to publish rigorously selected research which drives science and technology forward (Tiokhin et al., 2021). Journals operate in an open and highly competitive market, so how do they attract communities' attention? They send certain signals to the receivers. Theory presupposes that signals vary based on the sender's aim and the receivers' perception. For example, journals may want to lower the share of irrelevant papers sent by authors to reduce reviewing costs (Borba et al., 2021; Endenich & Trapp, 2018). These would be the signals of publication preferences in a form of the editorial team composition, or the "aim and scope" section description. Journal quality signals may manifest themselves in the standards of peer review or publication statistics (acceptance rate, average article processing time, data, and code disclosure requirements), working experience of editorial teams (Endenich & Trapp, 2018), the inclusion of journal into various indexes and national bases (Chavarro et al., 2018), bibliometric measures such as quartile and IF (Kuskova et al., 2011). These signals take various forms and are aimed at various receivers. But they follow the same goal—to state the journal's quality as a proxy for prestige (Kwiek, 2021), and legitimacy (Ryazanova et al., 2017) that one receives by reading, publishing at or using the specific publication outlet. The existence of various forms of the signal (Connelly et al., 2011; Spence, 1973) raises a logical question: how do receivers choose among those signals? Consider a similar situation in a job market: a company interviews an applicant who has no university degree (possible signal of low quality), but has vast, relevant, and verified working experience (possible signal of high quality). The discrepancy of signals was rarely touched upon in previous studies, but it currently receives more attention, as more information becomes openly available.

Academia addresses the issue of mixed signals in the discussion related to correspondence between journal quality and article quality (Tiokhin et al., 2021). Numerous papers spotlighted the signals of papers' quality and impact (Aksnes, 2003; Didegah & Thelwall,

2013; Michayluk & Zurbruegg, 2014; Rowley et al., 2022), focusing primarily on citation counts as a proxy for "excellent scientific research" (Aksnes, 2003). Journal's impact factor is sometimes used as a quality signal on a level of a single paper (Didegah & Thelwall, 2013; van Dalen & Henkens, 2005): high impact journal signals to readers that a paper may be of high quality. However, there is also a discussion on honesty in science, which presumes that sometimes journals may be deceived and thus a low-quality publication may appear in a high-quality journal. The studies provide opposite examples as well: for example, 9% of the highly cited papers from the Norwegian subset of articles within the National Science Indicators Database appeared in poorly cited journals (Aksnes, 2003). There are various reasons why researchers cite the paper, from the actual willingness to give credit to the significance of the cited paper, to the citations to comply with editors' requirements (Baum, 2012). Thus citation-based bibliometric indicators do not necessarily fully and correctly grasp the quality of a journal and the quality of papers within a journal. But the IF and quartiles, and other traditional bibliometric journal quality signals, for all their faults, have higher observability and lower cost for the receivers. Observability measures the extent to which readers and other receivers can notice the signal (Connelly et al., 2011). The IF is a widespread evaluation of quality (Baum, 2012), even journal websites have built-in dashboards of bibliometric measures, so that most visitors can notice this information without additional costs. Journal websites also publish other quality signals of high visibility: editorial teams' composition (Endenich & Trapp, 2018), journal rankings like ABS list (Baum, 2012; Chipidza & Tripp, 2021; Osterloh & Frey, 2020), article acceptance rates. Characteristics of authors who publish their work in journals are, however, rarely present on journal websites. Those features, including, but not limited to, the track record of authors (approximated by their publications list, number of citations or prizes received), academic affiliation or the country of residence are also considered signals of journal quality (van Dalen & Henkens, 2005). Social status and other characteristics of the authors are usually attributed to the quality signal of an article, rather than a journal (Bikard, 2018; Bikard & Marx, 2020). However, current access to bibliometric databases allows us to generalize author-level data for journal-level conclusions. We assume that journal quality can be approximated using the authors' publication track record. Moreover, we presuppose that the journal quality signal assessed via bibliometric measures such as quartiles and IF may be different from the one assessed via the track record of publications previously made by journal authors. These mixed signals appear, because authors consider various aspects when selecting a journal for publication (Aksnes, 2003; Baum, 2012) and because citation-based metrics depict only a citation-based approach to the quality assessment of journals. The information that 80% of authors from the selected journal have published a paper in Science or Nature provides the academic audience with additional cues about journal quality. We consider that these extra cues on journal quality might be useful for regional or local journals with, by their nature, lower IF and, thus, lower international visibility (Chavarro et al., 2017), and consistently under-evaluated quality. The use of traditional journal-level quality signals keeps these journals off the radar for a wider academic audience.

Specifics of regional journals

Mixed journal quality signals create a potential risk for regional journals. Previous studies use the concepts of national (Lovakov et al., 2022; Moed et al., 2021), local (Chavarro et al., 2017) and regional journals (Huang et al., 2017; Suárez-Tamayo et al., 2018) interchangeably

to address the issue of regionality. Although researchers have varying approaches as to the definition of a regional journal, we use the Scopus database registration country as a basis for this study. A journal registered as Russian in Scopus will be counted as regional for Russia, whereas, for other countries, it would be an international one. The definition of a regional journal, however, goes beyond the country of registration. We approach the concept of a regional journal from the perspective of the intranational model of knowledge dissemination (Zitt et al., 1998). This model is still present in several countries with an extensive research community and strong traditions to publish articles in local and commonly used languages (Kirchik et al., 2012). Post-Soviet bloc countries, as well as Japan, China, India, and Brazil, are examples of countries with intranational or transitional models (Macháček, 2019; Reategui et al., 2020). Publication sources in these countries exploit various combinations of the publication language (Kirchik et al., 2012): journals published in English, or both in local and English languages.

Researchers agree on the difficulties regional journals face in terms of competition with international sources for researchers' attention. While some publications in regional venues can be used to disseminate research results locally (Reategui et al., 2020), others appear in regional journals because of training, knowledge bridging, or non-mainstream publication purposes (Chavarro et al., 2017). This difference in purposes and target audiences contrasts regional journals with international journals. Some authors consider that "when scientists have something important on their hands … they will submit the paper to a high-status journal…" (Aksnes, 2003, p. 163), rather than submitting to a regional one with lower international reach and citation rates. Low international visibility may serve as a low-quality signal for a regional journal. However, regional journals usually have a short track record in international indexing databases, thus, they did not have enough time to collect impact and citations, resulting in weaker signals (Macháček, 2019). Lower citation rates, and sometimes a regional focus of publications, negatively impact a journal's ability to pass the Web of Science or Scopus standards for being indexed in a database (Chavarro et al., 2017; Chavarro et al., 2018). The inability of regional or non-mainstream journals to enter the database impacts bibliometric journal quality signals but does not stop the knowledge-creation process. We assume that regional journals can rely on alternative measurements to signal their unobserved quality to the academic community.

Authors' previous publication records can potentially serve as a more reliable quality signal for regional journals. Publication record contains community information: whether the authors who publish in regional journals also have publications in reputable international journals with consolidated IF. Given that the reach of a journal (share of authors that represent relevant topic community) can be either local, glocal or global, we assume that information on authors' publication records can provide regional journals with extra opportunities to signal their quality.

Physical sciences in Post-Soviet countries: a justified choice of physics and astronomy

Scientists being confident in the journal's content is one of the journal quality criteria (Pisoschi & Pisoschi, 2016). Each scientific discipline has its community and its standards regarding quality. Thus, the across-area comparison of journal quality signals has a subject bias. To minimise this bias, we focus our attention on one subject area, which, in addition, has a low level of regional bias. Our choice is Physics and Astronomy, a part of Physical Sciences, known for being general and low dependent on the geography of publications (Kirchik et al., 2012): atoms and electrons are the same in the USA and India.

In comparison with the social sciences, whose focus may be more localized in terms of place and time, the natural sciences have inherently higher visibility of the research (Kirchik et al., 2012). Thus, the chosen area of Physics and Astronomy potentially has a lower probability to lower academic communities' attention to the journal.

We analyse Physics and Astronomy journals that have Scopus registration in one of the post-Soviet countries. Some studies stress that countries' research output and international competitive power, may vary due to national innovation and research strategies (Chankseliani et al., 2021). The history of the Soviet Union provides us with up-and-coming empirical evidence of how quality and impact in previously well-developed research areas fluctuate. Unlike studies in social sciences, soviet physical sciences research has had a long and successful track record in world sciences (Graham, 1992), and in local journals (Markusova & Griffith, 1991). Findings of the latter study reveal that soviet journals in Physical Sciences demonstrated a vastly superior increase in citedness compared to international journals before the dissolution of the Soviet Union. Recent papers conclude that the Soviet Union's breakdown provoked visible changes in innovation, research, and development policies of former soviet countries (Chankseliani et al., 2021).

Data and method

This section consequently describes three elements: the selection of the Physics and Astronomy subject area, data wrangling procedure, and measurements of journal quality signals.

Citation patterns may fluctuate significantly from one subject area to another even within one discipline (Ke et al., 2015). Thus, there is a need to narrow the focus to one or several categories within Physical Sciences. To ensure lower biases in conclusions, we opt for a relatively homogeneous research field, both in terms of country-level and subject-level distributions. We rely on Scopus journal classification, which defines Physical Sciences as a vast and synthetic subject category, comprising eleven subject areas. Scopus data on regional journals from post-Soviet countries highlights the three top areas based on the share of area-related articles: Material Sciences (59 journals), Physics and Astronomy (83 journals), and Earth and Planetary Sciences (62 journals). Materials Science and Physics and Astronomy almost equally contribute in terms of article share; the journal share is almost twice as large in Physics and Astronomy. Thus, we focus our study on this category within Physical Sciences.

We identified a unique author ID (ScopusID) for a set of 50,477 articles and reviews in 83 regional journals. The list of journals' title, Scopus Source ID and country of registration is provided in the Appendix. Scopus database provides ScopusID and country of affiliation in the publication metadata. Using text data wrangling procedures in R, we extracted a set of 73,866 unique author IDs and the country of affiliation for each author. Approximately 0.2% of publications had problems with the identification of authors (no author id was provided, or data contained errors), and 1, 4% of publications lack any affiliation data for all authors. We excluded these authors from the analysis; however, we kept the paper if at least one author had a relevant ScopusID. If the author was affiliated with institutions from several countries, we used the country that appeared more often.

For every author in our sample, we extracted a limited set of previous publications. Due to limitations in data availability and differences in career length, we decided to use the data on publications that appeared in the same timeframe (2014–2019) in any Scopus-indexed

journal, including the original 83 journals. The Scival database provided information about an additional sum of 329,245 articles and reviews that authors published in other Scopus-indexed journals. For each of the additional publications, we collected metadata on the language of a document, journal name, year of publication, subject area, and citation count. The CiteScore dataset[1] was used to obtain data on bibliometric journal quality measurements, such as SJR, CiteScore 2020, and the relevant journal quartile.

Bibliometric signals of journal quality are widely accepted as signal measurement instruments (Ahmad et al., 2019; Pisoschi & Pisoschi, 2016). Literature does not offer similar measurements for the assessment of authors' previous publication records. We propose to measure signals at the level of the author by using the quality indicators, that are commonly applied at the level of the journal. Thus, we coded each additional publication (based on the journal metadata) to capture both sides of journal quality—bibliometric measures and review-based assessment:

- whether a journal has a Q1 or Q2 quartile in the publication year. The Scimago Journal Rank produces journal quartiles as a commonly used indicator of quality (Chankseliani et al., 2021; Lovakov et al., 2022; Walker et al., 2019). The national research systems of several Post Soviet countries (e.g., Ukraine), used quartiles as a proxy of journal quality in publication assessment procedures during certain periods (Hladchenko & Moed, 2021).
- whether the CiteScore percentile of a journal is higher/lower than 90.
- whether a journal is included in the Scopus set of post-Soviet journals on any topic other than Physics and Astronomy.
- whether a journal is included in the Nature Index list of journals. The Nature Index journal list[2] is an example of an expert-based predefined set of publication sources of the highest quality and prestige (Bendels et al., 2018; Sterligov et al., 2020).
- whether a journal is included in the Top 10 Scimago list of journals for the "Physics and Astronomy" subject. The Scimago Top 10 journal list is based on the Scimago Journal Rank for a particular research area and does not include any multidisciplinary journals, which limits the search. We constructed the list of top Physics & Astronomy journals, resulting in 12 unique journals which appeared at least once in 2014–2019: Reviews of Modern Physics, Living Reviews in Relativity, Nature Physics, Physics Reports, Physical Review X, Reports on Progress in Physics, ACS Nano, Nature Communications, Advanced Science, Applied Physics Reviews, Physical Review Letters, New Journal of Physics. We assume that the Top 10 Scimago list measure will show more focused efforts of authors (quality in the area), whereas inclusion in the Nature index list is going to capture the more general top international sources experience of the authors.

We have then generalized data at the level of the author (in the year 2019, including all additional publications in 2014–2019, if the author published in several journals—he will appear separately for each journal). For instance, Author X from JETP Letters had 10 previous publications in other journals, that were not included in a sample of regional journals on Physics and Astronomy. His indicators have the following values: 80% publications in Q1 journals, 20% publications in Q2 journals, 90% publications in journals having 90 + CiteScore percentile, 10% publications in other post-Soviet journals (Earth Science

[1] Retrieved January 17th, 2022, from https://www.elsevier.com/about/press-releases/science-and-technology/elsevier-releases-2019-citescore-values.

[2] Retrieved from https://www.natureindex.com/faq.

journals), 20% publications in journals from Nature index list and 40% of publications in Top 10 Scimago list for Physics and Astronomy. Once the generalized data for each author was computed, we generalised the statistics to a journal-level by calculating the shares of authors with a relative score. For instance, we can measure that a certain sample journal in 2019 had 90% of authors who published at least 1 additional article or review in any other Q1 journal between 2014 and 2019; and, for the sake of comparison, to see that a similar journal had this indicator at the value of 10%, stating that most author either publish in less reputable journals or do not publish at all. The final values have a relative nature, which provides us with an opportunity for source—and size-unbiased cross-journal comparison. Our data do not allow us to compute the generalized scores for each year (t) with a 5-year (t−5) window. This remains the area of additional exploration, on the one hand. On the other hand, we assume that these relative values are endogenous to journal policy and thus remain relatively stable across several years.

The results section has the following structure: we first report the journal quality signals based on traditional bibliometrics measurements, then we overview the previous publication record of those authors who published in regional journals, and finally, we contrast the journal quality signals sent by bibliometric measurements and by authors' publication record.

Results

Regional journals quality: traditional bibliometric measures

Post-Soviet countries' contribution to the dissemination of knowledge in Physical Sciences has a heterogeneous structure. Some countries (Tajikistan, Kyrgyzstan, and Turkmenistan) do not have a single journal on this subject, which is no surprise as these countries do not have any journals registered in the Scopus database. This fact may be attributed to the low degree of development designated to research and higher education systems in these countries (Lovakov et al., 2022). Physics and Astronomy turned out to also have geographical differences. Moldova, Azerbaijan, Georgia, and Uzbekistan placed their attention on other subjects of Physical Sciences, thus, limiting our choices to eight countries (Armenia, Belarus, Estonia, Kazakhstan, Latvia, Lithuania, Russia, and Ukraine). Russia (61) and Ukraine (14) are the only two countries with more than 10 regional journals in Physics and Astronomy, which, in turn, can be attributed to a significant resource base, including nuclear research and industry.

Previous studies highlight that research publications in local languages would gradually decrease due to the transition to the English language (Kirchik et al., 2012). We observe a different trend for a sample of local journals: the annual number of articles and reviews has an upward trend (Table 1), which probably attests to the continuing need for national sources for knowledge dissemination. Our journals demonstrate a 7% increase in the number of articles between 2014 and 2019. This dynamic contradicts the world benchmark: Scival data reports a 22.9% increase in the volume of scholarly output in Physics and Astronomy from 2014 to 2019. Physics and Astronomy research published in post-Soviet countries is dominantly distributed through translated journals, which follows the intrinsic nature of these journals—striving for higher international visibility of output.

Table 1 Number of journals, articles, and reviews in 2014–2019

Category	Number of journals	Number of articles & reviews						Subtotal
		2014	2015	2016	2017	2018	2019	
Total	83	7,961	8,281	8,326	8,496	8,891	8,522	50,477
Translated Journals	44	6,081	6,287	6,258	6,355	6,614	6,162	37,757
Not Translated Journals	39	1,880	1,994	2,068	2,141	2,277	2,360	12,720

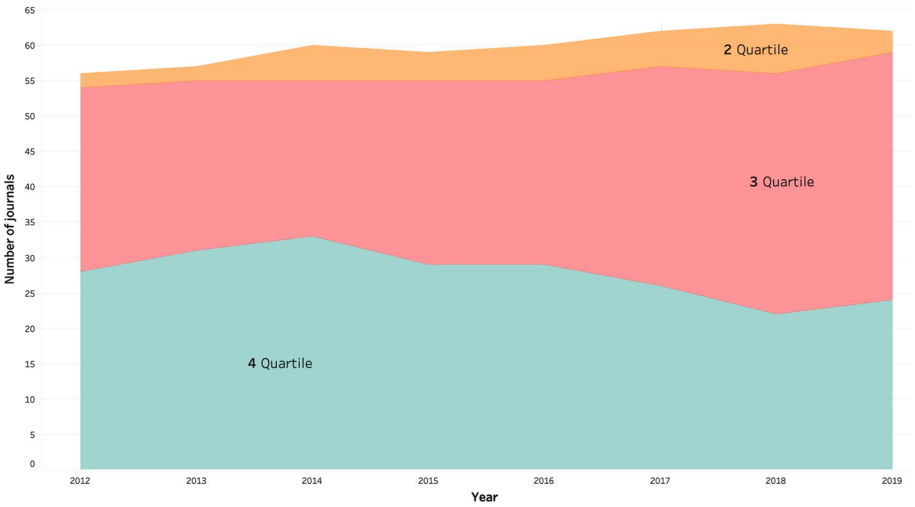

Fig. 1 Distribution of regional journals in Physics and Astronomy by years and quartiles. The colours of the area chart indicate the type of quartile (Q2–orange, Q3–red, Q4–turquoise). There is only one year journal of observation of the Q1 quartile in 2017, it was excluded from the graph. (Color figure online)

We observe a gradual increase in regional journal quality as signalled by relevant Scopus quartiles (Fig. 1). Quartile, as a derivative of the Scimago Journal Rank (Ahmad et al., 2019; Pisoschi & Pisoschi, 2016), is an easily accessible and distinctive tool which subdivides Scopus journals into four levels of quality. Some Post-Soviet countries base their scientific measurement systems on the quartile data, thus making the quartile a substantial signal of journal quality. The overall number of Q4 journals is decreasing, accompanied by a substantial and minor increase in the number of Q3 and Q2 journals, respectively. The large body of Q2 and Q3 journals is constituted of translated sources, which rapidly gain higher quartile ranks (Fig. 2).

The impact (citedness) of regional journals, considered one of the components of journal quality (Ahmad et al., 2019), has a slow-growing trend (Table 2). Countries with a single journal in Physics and Astronomy, including Armenia, Belarus, Estonia, and Kazakhstan, have marginal to low levels (0.1–0.9) of the CiteScore. Given that the 2019 world average CiteScore for Physics and Astronomy is approximately 3.83, the regional journals of these countries are in lower percentiles. Lithuania, Ukraine, and Russia with mean values of 0.5–1.47 are also cited three times less than the subject area's world average, signalling a potentially low journal quality.

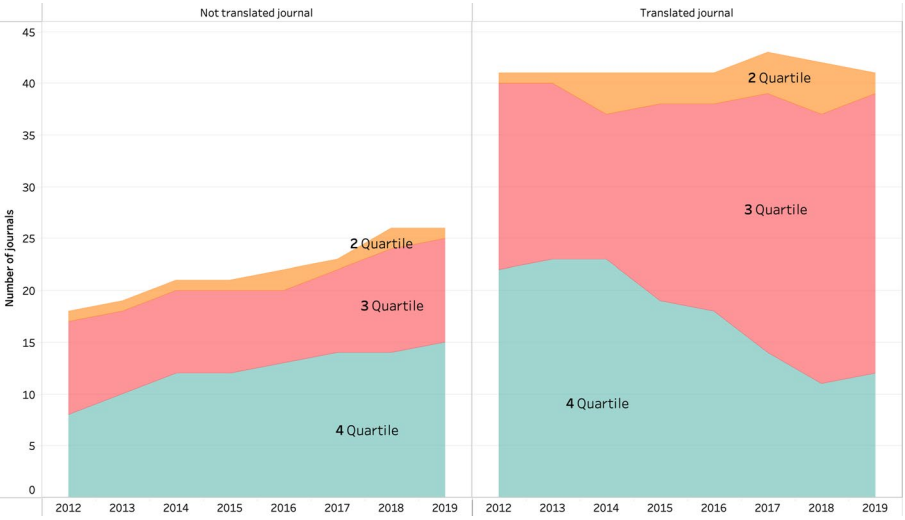

Fig. 2 Comparison of translated and non-translated regional journals in Physics and Astronomy by years and Scopus quartiles. The left part of the Figure captures statistics on the non-translated regional journals, and the right part of the Figure describes statistics on translated regional journals. The colours of the area chart indicate the type of the quartile (Q2–orange, Q3–red, Q4–turquoise). There is only one year-journal of observation of the Q1 quartile in 2017 (non-translated journal), and it was excluded from the graph. (Color figure online)

Physical Sciences is inclined toward collaborative publications, where some papers have hundreds of co-authors (Fields, 2015; Newman, 2001). In regional journals on Physics and Astronomy from Post-Soviet countries, we observe low to moderate shares of articles and reviews with 6 and more authors (Table 3). Even though articles with 21 + co-authors appear in a quarter of sampled journals (21 out of 83), we have only 156 papers from this category. The training and knowledge-gap-filling functions of regional journals can potentially explain the observed statistics (Chavarro et al., 2017). Due to the specifics of national research systems, doctoral students or early career researchers can be obliged to publish in regional journals. At the same time, national funding institutions may provide small research groups with grants to investigate cutting-edge, or off the official paradigm research topics. In the latter case, the specifics of the non-mainstream topic make it hard to publish results in international well-established journals, thus making regional journals the only opportunity for knowledge dissemination.

International authorship is underrepresented in regional journals on Physics and Astronomy. Post-Soviet journals are mostly constituted of articles and reviews with local affiliations (Russia and Ukraine), or local and Russian affiliations (Belarus, Kazakhstan, Latvia). The share of papers, authored by or co-authored with people outside the post-Soviet bloc is visible only in the single journals of Latvia, Lithuania, and Ukraine (Table 4). Estonia has a single year of observations, and a divergent Figure: most papers have authors from Ukraine, which we can attribute to the specifics of the journal in focus. Higher shares of internationally authored and co-authored papers can rather be associated with editorial policy, rather than the specifics of journal type. Translated and non-translated local journals are almost similar in substantially high

Table 2 Descriptive statistics on CiteScore measure by countries for regional journals. If there is only 1 journal per country—the actual value of CiteScore is presented in a relevant row

Country	Category	CiteScore	2014	2015	2016	2017	2018	2019
Armenia	Translated	N of journals	1	1	1	1	1	1
		CiteScore	0.4	0.5	0.7	0.7	0.8	0.8
Belarus	Not translated	N of journals	1	1	1	1	1	1
		CiteScore	0.3	0.4	0.7	0.9	0.9	0.9
Estonia	Not translated	N of journals						1
		CiteScore						0.3
Kazakhstan	Not translated	N of journals	1	1	1	1	1	2
		Mean	0.2	0.2	0.2	0.3	0.6	0.5
		SD						0.42
		Max						0.8
Latvia	Not translated	N of journals	1	1	1	1	1	1
		CiteScore	0.9	0.8	0.8	1.0	1.3	1.2
Lithuania	Not translated	N of journals	2	2	2	2	2	2
		Mean	0.9	0.9	0.9	0.95	1.2	1.15
		SD	0.14	0.0	0.14	0.35	0.42	0.21
		Max	1.0	0.9	1.0	1.2	1.5	1.3
Russia	Not translated	N of journals	10	10	11	12	13	13
		Mean	0.88	1.01	1.04	1.12	1.16	1.09
		SD	0.75	0.76	0.87	1.16	0.98	0.89
		Max	2.4	2.7	2.8	4.3	3.4	3.7
	Translated	N of journals	39	39	39	39	39	38
		Mean	0.97	1.03	1.19	1.29	1.42	1.47
		SD	0.52	0.47	0.53	0.55	0.56	0.62
		Max	2.2	2.2	3.2	3.6	3.8	4.0
Ukraine	Not translated	N of journals	8	8	9	10	10	11
		Mean	0.58	0.64	0.69	0.72	0.85	0.86
		SD	0.4	0.41	0.39	0.45	0.45	0.5
		Max	1.2	1.3	1.3	1.4	1.6	1.8
	Translated	N of journals	2	2	2	3	3	3
		Mean	0.5	0.6	0.65	0.77	0.83	0.77
		SD	0.0	0.0	0.07	0.21	0.15	0.15
		Max	0.5	0.6	0.7	1.0	1.0	0.9

shares of local authors, with the only exception that Ukrainian translated journals have a slight upward trend to partner with researchers from Russia.

Table 3 Number and share of articles and reviews with regard to the number of authors and the journal's country of registration

Country	Non-translated regional journals					Translated regional journals				
	Subtotal	Single author	2–5 authors	6–20 authors	21 + authors	Subtotal	Single author	2–5 authors	6–20 authors	21 + authors
Armenia						317	91	195	31	
Belarus	290	73	204	12	1					
Estonia	51	5	34	12						
Kazakhstan	290	18	183	89						
Latvia	327	38	260	29						
Lithuania	719	75	548	96						
Russia	6,325	1,114	4,547	657	7	35,452	5,403	23,237	6,669	143
Ukraine	4,718	623	3,046	1,044	5	1,988	399	1,264	325	
Total	12,720	1,946	8,822	1,939	13	37,757	5,893	24,696	7,025	143

Table 4 Heatmap of journals' country of registration by authors' country of affiliation

	Armenia	Belarus	Estonia	Kazakhstan	Latvia	Lithuania	Russia		Ukraine	
	yes	no	no	no	no	no	no	yes	no	yes
Armenia	93.66	1.78	0.00	0.37	0.00	0.20	0.24	0.40	0.04	0.00
Azerbaijan	0.00	0.00	6.00	0.00	0.00	0.45	0.41	0.62	0.55	1.99
Belarus	0.60	52.30	0.00	2.83	2.58	2.71	0.85	1.39	0.79	0.83
Estonia	0.00	0.00	0.00	0.00	0.00	0.21	0.22	0.06	0.00	0.17
Georgia	0.00	0.00	1.00	0.73	0.45	0.00	0.22	0.09	0.11	0.14
Kazakhstan	0.30	0.37	0.00	56.61	0.51	1.35	1.28	0.70	0.23	1.33
Latvia	0.30	0.00	0.00	0.00	12.78	1.77	0.04	0.04	0.02	0.59
Lithuania	0.00	0.00	0.00	0.00	0.00	49.36	0.04	0.04	0.09	0.23
Moldova	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.48	0.18	0.29
Russia	7.53	37.62	4.00	31.36	56.18	6.00	83.30	85.91	6.26	14.46
Ukraine	0.95	2.37	88.00	2.92	3.12	2.43	0.56	3.41	71.35	73.70
Uzbekistan	0.00	0.35	0.00	2.17	0.00	0.00	0.83	0.49	0.16	0.92
Algeria	0.00	0.49	0.00	0.00	0.23	6.75	0.22	0.24	2.23	0.07
Brazil	0.00	0.49	0.00	0.37	0.00	0.00	0.82	0.21	0.32	0.21
Bulgaria	0.31	0.00	0.00	0.35	0.51	0.21	0.29	0.24	0.14	0.13
China	0.93	0.39	0.00	1.79	2.48	11.55	2.61	2.38	2.42	1.72
Czech Republic	0.00	0.37	0.00	0.71	0.00	0.71	0.45	0.38	0.29	0.50
Finland	0.00	0.00	0.00	0.00	0.23	1.73	0.36	0.38	0.07	0.14
France	1.87	1.21	0.00	4.09	8.26	3.28	1.04	1.29	2.47	1.83
Germany	1.61	4.87	0.00	6.17	16.04	2.07	1.48	2.25	1.96	3.52
India	0.31	0.65	0.00	1.06	3.14	2.39	3.08	1.53	3.86	0.55
Iran	0.62	0.00	0.00	0.00	0.73	3.25	1.03	1.10	0.85	0.22
Iraq	0.00	0.00	1.00	0.00	0.00	0.13	0.22	0.04	0.89	0.65
Israel	0.00	0.36	0.00	0.39	1.02	0.20	0.35	0.16	0.03	1.08
Italy	0.34	4.35	0.00	3.04	1.48	0.99	1.30	1.03	1.63	0.70
Japan	0.00	1.57	0.00	2.11	1.04	0.90	0.68	0.46	1.32	0.72
Jordan	0.00	0.00	0.00	0.00	0.00	0.17	0.08	0.08	0.27	0.00
Korea	1.25	0.00	0.00	1.39	0.23	0.45	0.61	0.37	0.25	0.93
Malaysia	0.00	0.00	0.00	0.33	0.47	0.00	0.36	0.14	1.03	0.13
Palestine	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.10	0.00
Poland	0.00	1.04	0.00	1.05	2.52	7.64	0.62	0.78	3.15	3.59
Slovakia	0.31	0.36	0.00	0.00	0.23	0.72	0.07	0.30	0.51	1.15
Spain	0.00	0.00	0.00	1.44	0.74	0.95	0.32	0.39	0.17	0.77
Swiss	0.31	0.00	0.00	0.00	0.69	0.42	0.12	0.20	0.19	0.43
Turkey	0.00	0.00	0.00	1.02	0.23	4.87	0.60	0.42	0.73	0.51
UK	0.62	3.00	0.00	2.73	2.07	1.58	0.57	0.53	3.25	1.84
USA	3.06	0.76	0.00	8.93	3.31	2.69	1.36	1.95	2.66	2.89
No affiliation	0.00	0.00	0.00	0.00	0.00	0.11	0.07	0.01	1.91	10.56
Other countries	2.52	7.93	3.00	8.65	8.53	7.59	6.09	3.53	7.34	6.45

Numbers in cells represent the mean share of publications with authors of specific country affiliation (rows) in regional journals registered in different post-Soviet countries (columns). The average is across 2014–2019 and journals. All publications (including solo papers) were considered. For example: on average, regional journals in Physics and Astronomy from Belarus have 1.78% of articles and reviews with at least 1 author whose institution of affiliation is in Armenia. The "Other" category summarises data on publications authored or co-authored with authors from countries not included in the table. The "No affiliation" category summarises data on publications without affiliation metadata

Previous publication record: what and where was published by authors from regional journals

Authors' countries of affiliation vary. With a limitation of at least 200 articles per country, we identified authors from 30 countries, including 12 post-Soviet representatives. Russia, Ukraine, and China are the top three countries of affiliation for sampled authors. One would hypothesise that the vast variation in affiliated countries stems from the double affiliation of researchers. Physical Sciences is an area exploiting extensive resources provided by large-scale, multi-country institutions. However, this is not the case for authors from post-Soviet regional journals. Only 2.5% of authors are affiliated with more than one disambiguated.

A high variation of publication sources and subject areas is evident in a set of previous publications of authors. The number of unique journals (9055 unique Scopus Source IDs) exceeds the original set of 83 sources by more than 100 times. Only 10.6% of all previous articles and reviews stem from post-Soviet regional journals other than the Physics and Astronomy subjects. The data on authors' previous publications record signals high

Table 5 Count of articles and reviews additionally published by authors in regional journals in 2014–2019, split by the number of authors in publications

Number of authors	Single author	2–5	6–20	21 +	Subtotal
Number of Articles and Reviews	13,155	188,382	118,581	9127	329,245

international and subject experience of authors in regional journals. This leads us to a preliminary conclusion about mixed journal quality signals.

The collaboration patterns in previous articles and reviews are not so different from the regional journals' dataset. Most of the publications fall into the category of between 2 and 20 authors. The share of single-authored papers are substantially lower: 3.99% in other journals versus 15.52% in regional journals (Table 5). This aligns with our proposition explaining the opposite trend for regional journals. International journals are, perhaps, treated by authors as sources for publications of mainstream research (Chavarro et al., 2017). Articles and reviews with training functions would, on their part, rarely be presented in international sources as the acceptance rates are lower, and the entry barriers (language, methodology, fit to content policies) for manuscripts are higher. The share of 21 + authors' collaborative publications is somewhat larger: 2.78% for previous publications in comparison with 0.3% in regional journals. Though being higher than the sample's value, this share does not provide us with evidence that other publications of authors mostly stem from mega collaboration projects with international scientists.

Regional journals on Physics and Astronomy turned out to be one of many alternative outlets for authors' publications. Most authors from regional journals (68.7%) have at least one additional article or review published in any other Scopus-indexed journal in 2014–2019. The author's previous publication track record goes beyond the choice of regional journals from post-Soviet countries. A small share of 10.6% of previous publications originates from post-Soviet journals related to any other research area but Physics and Astronomy. The diversity of the authors' experience is treated as a proxy of the reputation of the author (van Dalen & Henkens, 2005), which, in turn, signals the quality of the journal (Connelly et al., 2011), as top managers' experience signals the reputation of a company in business studies.

The authors' previous track record is mostly constituent of high quartile journals. This result is drastically different from the one obtained via journal-level signal measurement. Q1 articles and reviews constitute approximately 30% of all previous publications, and Q2 is the second largest category with 80 240 (24.37%) observations. Journal-level measurement (only 1 journal had Q1 status once) signalled low quality to the potential audience. However, the signals obtained from author-level data (Fig. 3) can be interpreted as possibly positive, as a major part of the previous track record stems from prestigious journals.

Regional journal quality signals: evidence from previous publications of authors

Author-level signals were processed in several steps: (1) we computed all indicators from the methodology for every unique AuthorId using the data about additional publications for these authors in 2014–2019; so these measures represent a 5-year assessment of research activity in Scopus for the sample authors; (2) next, we averaged data at the level of the regional journal using statistics from all unique authors who published at

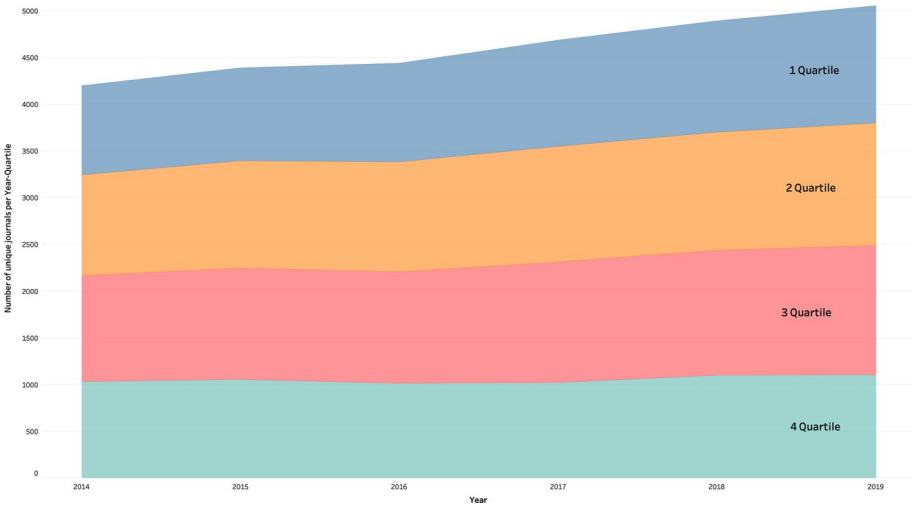

Fig. 3 Distribution of other journals by years and quartiles. The colours of the area chart indicate the type of quartile (Q1–blue, Q2–orange, Q3–red, Q4–turquoise). (Color figure online)

least one article in this journal in 2014–2019. Thus, each journal is assessed by additional (not regional) research activity of its unique authors in 2014–2019 (total).

We first contrast the highest quartile of the journal with the average statistics on authors' previous experience (Table 6). Authors of regional journals, on average, publish twice as active in other than regional Scopus-indexed journals. These additional publications are largely constituted of Q1 and Q2 journal articles and reviews. Authors from Q4 regional journals are more inclined to publish in other regional Post Soviet journals, but their experience also includes publications in top field research outlets. Inconsistency of signals is evident from this data: Q3 and Q4 regional journals have a substantial share of authors with rich previous experience in reputable journals. There is a regional difference in the previous publications' records of authors. Authors, who publish in regional journals from Latvia, Lithuania, and Armenia publish, on average, 4–9 times more articles and reviews in additional journals at the same time.

There are geographical variations in the shares of authors with Q1 and Q2 publications in the previous record. Physics and Astronomy journals from Latvia, Lithuania, and Ukraine demonstrate the highest scores on authors' experience in Q1 journals (Table 7). We attribute this success to possible differences in the categories of authors who publish papers in the journals of these countries: more international collaborations, participation in "big science" and mega collaborations that provide specific requirements for the quality of published sources.

Conversely, regional journals from all countries but Kazakhstan and Russia are less likely to have many authors who publish anything in other post-Soviet regional journals. Initially, we expected to observe a larger share as in several Post Soviet countries' publications in regional journals are an obligatory part of doctoral studies or research grant reporting. The calculated shares (Table 7) support this idea, as Russia and Kazakhstan still use regional journals for practice purposes, while other countries have probably shifted to alternative models of doctoral research.

Table 6 Average measures of authors' previous experience by country of the regional journal, journal category and highest quartile (2014–2019)

Country	Translated Journal	Highest Regional Journal Quartile in 2014–2019	N of journals	Mean N of sample publications	Mean N of other publications	Mean N of publications in Nature Index list	Mean N of publications in Top 10 Scimago Rank	Mean N of publications in the Top 10 Percentile	Mean N of publications in other regional Post Soviet journals	Mean N of publications in other Q1 journals	Mean N of publications in other Q2 journals
Armenia	Yes	3	1	2.63	9.61	2.41	0.45	4.82	0.18	6.04	2.10
Belarus	No	4	1	3.02	11.26	3.36	0.81	5.61	0.72	6.71	1.78
Estonia	No	4	1	1.26	4.07	0.02	0.00	0.04	0.30	0.06	0.28
Kazakhstan	No	4	2	2.04	9.67	0.18	0.04	2.28	1.84	3.03	2.04
Latvia	No	3	1	2.68	9.97	0.30	0.12	2.62	0.43	4.10	3.13
Lithuania	No	3	2	1.71	11.51	0.62	0.09	3.07	0.45	4.40	3.20
Russia	No	1	1	3.69	18.75	0.30	0.05	5.23	1.08	7.41	5.05
		2	1	3.48	5.24	0.16	0.02	0.82	0.91	1.43	1.03
		3	6	3.69	12.66	0.94	0.22	3.16	1.12	4.49	3.43
		4	12	3.55	6.56	0.25	0.06	1.07	1.80	1.68	1.31
	Yes	2	4	5.62	14.43	2.90	0.68	5.58	0.82	7.70	3.19
		3	27	4.73	10.45	1.34	0.29	2.93	1.27	4.47	2.31
		4	9	4.30	10.71	1.53	0.34	3.21	1.34	4.56	2.32
Ukraine	No	3	3	3.00	13.22	0.85	0.28	3.43	0.61	5.20	3.63
		4	8	3.38	6.17	0.42	0.10	1.18	0.61	1.97	1.66
	Yes	4	3	3.77	11.60	1.97	0.46	3.85	0.49	5.39	2.55

Table 7 Journal-level statistics on seven variables to describe shares of authors with specific publication experience. Min, Max, and Standard deviation (SD) are shown only in the case of two and more journal observations per country

Country of journal		Armenia	Belarus	Estonia	Latvia	Kazakhstan	Lithuania	Russia		Ukraine	
Category		Translated	Not	Not	Not	Not	Not	Not	Translated	Not	Translated
Signals of journal quality (author-level)											
(1) At least one article or review in any other Scopus-indexed journal	*Mean*	57.7	71.3	61.4	77.2	63.8	82.9	75.1	74.5	68.4	80.0
	Min					55.7	75.3	51.1	54.4	50.3	67.9
	Max					72.0	90.5	100.0	89.6	84.8	97.5
	SD					11.5	10.8	10.9	8.2	12.1	15.5
(2) At least one article or review in any of the other regional post-Soviet journals (not related to Physics & Astronomy)	*Mean*	6.2	18.4	16.5	15.9	33.8	18.9	36.7	30.5	20.6	15.8
	Min					31.1	18.0	0.0	5.8	2.2	12.4
	Max					36.4	19.9	62.7	62.9	40.9	19.7
	SD					3.7	1.3	17.5	13.9	10.1	3.7
(3) At least one article or review in any other Q1 (first quartile) journal	*Mean*	34.2	46.5	3.4	55.0	24.1	58.4	40.9	46.8	38.5	52.7
	Min					8.5	41.2	13.1	21.2	20.4	45.5
	Max					39.6	75.7	68.3	73.6	64.8	65.1
	SD					22.0	24.4	17.3	12.3	14.3	10.8
(4) At least one article or review in any other Q2 (second quartile) journal	*Mean*	42.9	45.3	13.6	55.5	29.0	66.4	44.1	46.1	44.6	46.4
	Min					17.9	54.4	14.7	24.7	24.4	25.4
	Max					40.1	78.4	75.0	66.5	64.6	62.8
	SD					15.7	16.9	17.7	10.4	15.1	19.1
(5) At least one article or review in any of the Nature Index journals	*Mean*	10.5	21.8	2.3	12.0	3.7	17.0	10.8	16.1	10.9	25.3
	Min					1.9	1.0	0.0	1.3	3.5	14.7
	Max					5.5	33.0	37.1	53.4	28.0	37.2
	SD					2.5	22.6	10.9	12.6	8.0	11.3

Table 7 (continued)

Country of journal		Armenia	Belarus	Estonia	Latvia	Kazakhstan	Lithuania	Russia		Ukraine	
Category		Translated	Not	Not	Not	Not	Not	Not	Translated	Not	Translated
(6) At least one article or review in any of Scimago Top 10 (Physics & Astronomy) journals	*Mean*	5.2	11.6	0.0	5.9	1.7	5.3	3.2	5.3	3.7	7.6
	Min					0.9	0.2	0.0	0.2	1.0	0.0
	Max					2.5	10.4	14.6	32.8	13.5	17.5
	SD					1.1	7.2	4.0	6.6	3.6	9.0
(7) At least one article or review in any of 90+CiteScore percentile (any of journals that have CiteScore value higher than 90% of journals in category)	*Mean*	22.9	36.9	2.8	45.3	19.4	49.5	32.7	35.9	28.5	35.7
	Min					4.7	33.5	8.9	16.2	14.8	16.1
	Max					34.1	65.4	58.8	63.2	57.4	56.5
	SD					20.8	22.6	15.1	11.1	13.1	20.3

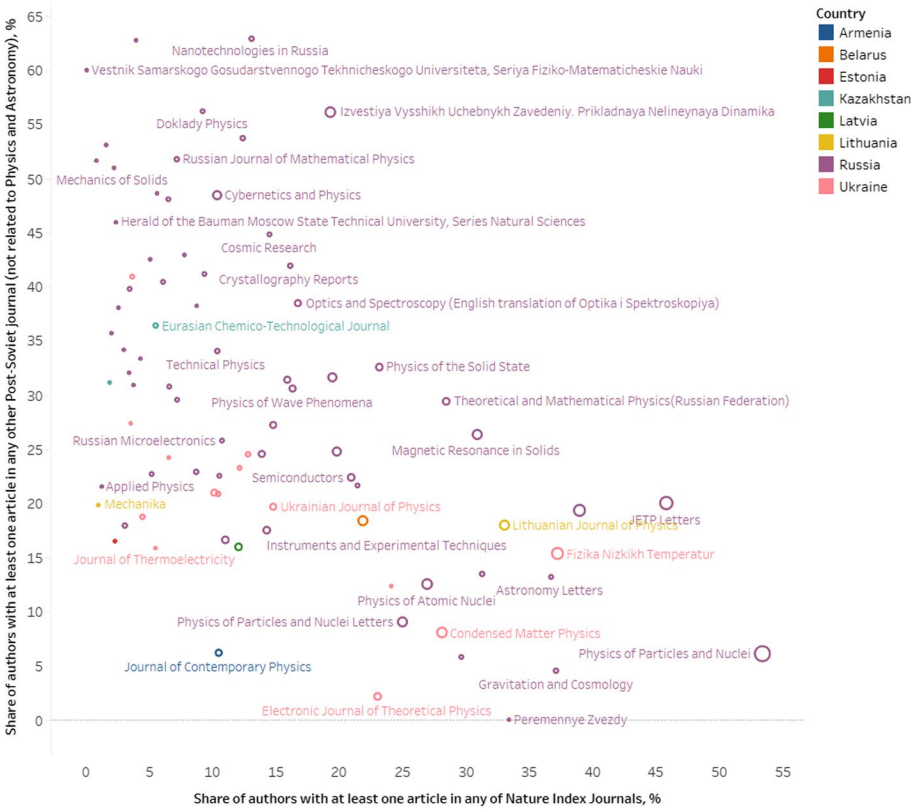

Fig. 4 Distribution of regional journals on Physics and Astronomy registered in Post-Soviet Countries. Each node represents one of 83 sample journals; node size reflects the share of authors with at least one article in any of the Scimago Top 10 journals (indicator 6 from Table 7)

Regional journals show a surprisingly high percentage of authors with top field-level (6) and world-level (5) experience. Every second (every third—for Ukraine and Lithuania) author in the best of sampled regional journals of Russia has published at least one article or review in any of the Nature Index journals. The shares of (6) are relatively higher for translated journals, which assures the stereotype of this category as relatively important for regional articles, reviews, and authors. The use of author-level signals demonstrates a completely different assessment of a regional journal's quality. Moreover, as a valid source of measurement, it allows us to map different groups of journals within one field. In the case of Physics and Astronomy, we see a clear distinction into two distant subgroups—journals which mostly have authors with Post Soviet journal experience (1) in Table 7 and journals with mostly international experience of authors. This distinction goes in line with qualitative data provided by previous studies on the functions of regional journals. One may assume that the journals in the left upper corner of the Figure (Fig. 4) have the training and knowledge-bridging functions; whereas the set of journals in the lower right corner are the venues with the potential to have wider international visibility and impact. Due to the difference in measurement scale, our study does not provide the ranking comparison of journal quality assessed via

standard bibliometric measures, and the measures capture authors' previous publication records large-scale comparison remains an area for future studies.

The difference in the signals sent by journals via basic bibliometric data, and by authors' experience data provokes a discussion on several policy implications.

Firstly, should all the national systems orient themselves on the use of journal-level bibliometric signals only? Our study corroborates this ongoing discussion with quantitative evidence of descriptive nature—on the level of specific categories of journals, traditional approaches may send negative signals to the wider audience, by systemic under-evaluation of journal quality. Publication of Impact factofactorsauthors' experience statistics are signals of seemingly equal costs for a journal. Acquisition and decoding costs are surely higher for author-level signals, as many receivers are not so familiar with the alternative approaches to journal quality assessment. Thus, one cannot expect a quick change toward the widespread publication of various journal quality statistics on journal websites and aggregators. The movement toward the construction and publication of a national expert list of high-quality journals is still in its nascent stage, but more and more countries join the discussion (Kulczycki et al., 2022; Pölönen et al., 2021).

Secondly, should we treat regional journals as a source of lower, if not to say, poorer quality? The case of Physics and Astronomy journals on Post Soviet landscape demonstrates that a once-established internationally well-recognised field has not lost much credit in terms of reputation and quality. Our data shows that these journals still attract or select articles written by authors with a wide, multifaceted experience of high quality (as measured by publications in the best world journals).

Discussion and conclusions

Most work on quality signals of journals has concentrated on the single signal case. Managerial and economics studies, for their part, have already drawn attention to multiple signalling, or the idea of consistency in signals (Engers, 1987; Gao et al., 2008; Riley, 1975). Inconsistency in signals, as defined by the disagreement between multiple signals from one sender (Connelly et al., 2011; Gao et al., 2008), has a negative impact on the reduction of information asymmetry. Receivers may be confused by conflicting signals; thus, the communication and decision-making processes may become more complex and less effective. Signalling in science also struggles from the inconsistency of data. However, researchers' attention is mostly brought to signal honesty (Tiokhin et al., 2021), reliability, and fit or the extent to which the signal is correlated with unobservable quality (Borba et al., 2021; Chavarro et al., 2017; Osterloh & Frey, 2020). Our study attempts to calculate measures of mixed signals for a set of regional journals in a field with low regionality and subject area biases. We found that these journals have different quality assessment values if approached via standard bibliometric data, and via authors' previous experience statistics. Using a set of regional journals as a case, we constitute the ongoing underrepresentation of quality for non-mainstream, local/regional publication sources. This conclusion challenges the stereotype of regional journals being a source of lower quality publications, or publications with purposes other than knowledge transfer. The conclusion is robust to the type of the journal—translated or untranslated. Translated journals, by their nature, reach a more widely spread audience (usually—English-speaking) (Kirchik et al., 2012), but in our case, the problem of lower quality measurement is visible for both categories of journals.

We test a framework that analyses signal quality from the perspectives of journal-level and author-level bibliometric data. Whereas journal-level quality for a sample of regional journals was marginal, the quality signal sent by the author-level measures depicts a completely different outcome. Not only do we see a source diversity in the previous publication track record of authors from regional journals, but also the high world- and subject-wide impact of these publications.

The literature on signalling highlights several requirements that verify the workability of a signal: (1) is observable, (2) is difficult to alter, (3) is costly to produce and change, (4) is difficult to imitate, (5) is persistent, and (6) reduces asymmetry between senders and receivers (Engers, 1987; Gao et al., 2008; Riley, 1975; Spence, 1973). The authors' previous publishing track record, as a signal, fulfils most of these requirements. Thus, the use of both traditional methods to assess journal quality and an author-based approach has relevant grounds. The use of an author-based approach has its limitations, among which the complexity of computations is only a technical issue. Persistence, or in other terms, the consistency of measurement is a hardly reachable requirement, as the review process is endogenous at the level of editors and the journal's editorial policy. There are numerous cases when classical economics articles of future Nobel prize winners were rejected due to lack of novelty (Gans & Shepherd, 1994; Lee et al., 2013). Journals' development is not a monotonous process: the change of editors, the exogenous shocks (COVID-19 provoked a long series of Special Issues in most journals, for instance)—all these changes may alter the selection of preferable research topics, methods and even languages of publications. Thus, the reliance on author-level data is prone to a bias of journal policy, as well as any other well-appropriated measures of journal quality. The generalization of author-level conclusions on the level of the journal itself is the second weak spot of the proposed signal measurements. Authors' track record is hard to collect and pre-process, even at a level of large bibliometric databases like Scopus or Web of Science, and open access projects such as Microsoft Academic Graph are not without numerous errors in metadata. There is certain criticism of generalizing the assumption of the best or the selection of best authors to a level of the journal, but the proposed approach currently relies on the use of multiple average and relative measures, with confidence intervals calculated for each measure. This approximation hinders the possible bias of overweight given by highly experienced authors.

However, we assume that the costs of sending these two different signals should be investigated further. Most of the journals, and bibliometric data providers already have handy and visible dashboards providing possible contributors with all the information regarding journal-level metrics. However, only rare journals have specific, author-based measures published on their websites (for example Research Policy, and some Elsevier journals[3]). In addition, the clarity of author-based signals for various receivers should be accounted for. Potential experienced contributors (authors, reviewers), as a part of the relevant scientific community, will easily understand in which way author-based data signals quality; other receivers, such as funding agencies and educational management, may find it harder to interpret this type of signal. Distortion or noise in signal deciphering may occur as, sometimes, grant applications and research support initiatives are discussed by a wider community that has limited knowledge of what is counted as a valid experience of authors who publish articles and reviews in specific journals.

[3] Example retrieved from https://journalinsights.elsevier.com/journals/0048-7333/authors

Appendix

List of post-Soviet regional journals in Physics and Astronomy.

N	Scopus Source ID	Journal title	Country of registration
1	21100210917	Journal of Nano- and Electronic Physics	Ukraine
2	21100,223804	Magnetic Resonance in Solids	Russian Federation
3	21100260918	Journal of Thermoelectricity	Ukraine
4	21100305004	Journal of Siberian Federal University—Mathematics and Physics	Russian Federation
5	21100410100	Applied Physics	Russian Federation
6	21100431105	Atmospheric and Oceanic Optics	Russian Federation
7	21100438188	Uspehi Fiziki Metallov	Ukraine
8	21100434068	Problems of Atomic Science and Technology, Series Thermonuclear Fusion	Russian Federation
9	21100469656	Radiation and Risk	Russian Federation
10	21100466428	Herald of the Bauman Moscow State Technical University, Series Natural Sciences	Russian Federation
11	21100818722	Cybernetics and Physics	Russian Federation
12	21100824452	Fundamentalnaya i Prikladnaya Gidrofizika	Russian Federation
13	21100864538	Izvestiya Vysshikh Uchebnykh Zavedeniy. Prikladnaya Nelineynaya Dinamika	Russian Federation
14	21100875598	Fizika Nizkikh Temperatur	Ukraine
15	21100912212	EUREKA, Physics and Engineering	Estonia
16	21100911934	Semiconductor Physics, Quantum Electronics and Optoelectronics	Ukraine
17	21100920795	Eurasian Physical Technical Journal	Kazakhstan
18	21100928218	Vestnik Samarskogo Gosudarstvennogo Tekhnicheskogo Universiteta, Seriya Fiziko-Matematicheskie Nauki	Russian Federation
19	21100932649	Peremennye Zvezdy	Russian Federation
20	21100942105	Chelyabinsk Physical and Mathematical Journal	Russian Federation
21	21139	Journal of Applied Mechanics and Technical Physics	Russian Federation
22	21622	Glass Physics and Chemistry	Russian Federation
23	24676	Crystallography Reports	Russian Federation
24	26760	Astronomy Reports	Russian Federation
25	26758	Astronomy Letters	Russian Federation
26	27056	Colloid Journal	Russian Federation
27	27163	Russian Microelectronics	Russian Federation
28	27347	Metallofizika i Noveishie Tekhnologii	Ukraine
29	27502	Doklady Physics	Russian Federation
30	27866	Physics of Metals and Metallography	Russian Federation
31	28115	JETP Letters	Russian Federation
32	28246	Solar System Research	Russian Federation
33	28517	Journal of Experimental and Theoretical Physics	Russian Federation
34	28721	Moscow University Physics Bulletin	Russian Federation
35	28901	Tsvetnye Metally	Russian Federation
36	29223	Physics of the Solid State	Russian Federation
37	29483	Physics of Atomic Nuclei	Russian Federation

N	Scopus Source ID	Journal title	Country of registration
38	29252	Plasma Physics Reports	Russian Federation
39	29485	Physics of Particles and Nuclei	Russian Federation
40	29785	Russian Journal of Mathematical Physics	Russian Federation
41	29834	Semiconductors	Russian Federation
42	37960	Magnetohydrodynamics	Latvia
43	3900148203	Bulletin of the Russian Academy of Sciences: Physics	Russian Federation
44	4400151401	Condensed Matter Physics	Ukraine
45	4700152462	Physics of Particles and Nuclei Letters	Russian Federation
46	5000154402	Thermophysics and Aeromechanics	Russian Federation
47	5700165211	Electronic Journal of Theoretical Physics	Ukraine
48	59007	Materials Physics and Mechanics	Russian Federation
49	68682	Optoelectronics, Instrumentation and Data Processing	Russian Federation
50	7700153114	Journal of Engineering Thermophysics	Russian Federation
51	7200153124	Eurasian Chemico-Technological Journal	Kazakhstan
52	85920	Reviews on Advanced Materials Science	Russian Federation
53	9100153108	Physical Mesomechanics	Russian Federation
54	21100203110	Computer Optics	Russian Federation
55	12310	Technical Physics	Russian Federation
56	12311	Technical Physics Letters	Russian Federation
57	12340	Theoretical and Mathematical Physics(Russian Federation)	Russian Federation
58	12351	Optics and Spectroscopy (English translation of Optika i Spektroskopiya)	Russian Federation
59	12893	Combustion, Explosion and Shock Waves	Russian Federation
60	12922	Acoustical Physics	Russian Federation
61	13751	High Temperature	Russian Federation
62	13876	Cosmic Research	Russian Federation
63	14371	Fluid Dynamics	Russian Federation
64	14497	Mechanics of Solids	Russian Federation
65	145393	Mechanika	Lithuania
66	145506	Journal of Physical Studies	Ukraine
67	11400153315	Ukrainian Journal of Physical Optics	Ukraine
68	15467	Instruments and Experimental Techniques	Russian Federation
69	11700154397	Surface Engineering and Applied Electrochemistry	Russian Federation
70	17600155002	Gravitation and Cosmology	Russian Federation
71	17903	Russian Journal of Nondestructive Testing	Russian Federation
72	11700154705	Nuclear Physics and Atomic Energy	Ukraine
73	19554	Journal of Communications Technology and Electronics	Russian Federation
74	19700173015	Astrophysical Bulletin	Russian Federation
75	19700173016	Bulletin of the Lebedev Physics Institute	Russian Federation
76	19700173017	Kinematics and Physics of Celestial Bodies	Ukraine
77	19700173019	Journal of Contemporary Physics	Armenia
78	19700173018	Physics of Wave Phenomena	Russian Federation
79	19700174657	Lithuanian Journal of Physics	Lithuania
80	19700182270	Problems of Atomic Science and Technology	Ukraine
81	19700186876	Nanotechnologies in Russia	Russian Federation

N	Scopus Source ID	Journal title	Country of registration
82	12000154541	Ukrainian Journal of Physics	Ukraine
83	19700200801	Nonlinear Phenomena in Complex Systems	Belarus

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