INSTITUT PRO DEMOKRACII A EKONOMICKOU ANALÝZU

projekt Národohospodářského ústavu AV ČR, v. v. i.

INSTITUT FOR DEMOCRACY AND ECONOMIC ANALYSIS

A Project of the Economic Institute of the Czech Academy of Sciences

# Predatory journals in Scopus

March 2017

VÍT MACHÁČEK, MARTIN SRHOLEC

IDEA CERGE EI

PROJEKT NÁRODOHOSPODÁŘSKÉHO ÚSTAVU

# O AUTORECH / ABOUT THE AUTHORS

## Vít Macháček

Joined IDEA as a researcher in October 2015. He earned his Master´s degree in 2016 at the Institute of Economic Studies of the Charles University and bachelor´s degree at the Faculty of Economics of the University of Economics, Prague. In addition to working for IDEA he is also the analyst of the EU Office/ Knowledge Centre of the Czech Savings Bank where he focuses on economic affairs in the European Union.

## Martin Srholec

Earned his PhD. degree in Economics from the University of Economics, Prague in 2003 and in Science, technology and innovation studies (2005) from the University of Oslo, Norway in 2005. From 2002 until 2010 he was based at the TIK centre, University of Oslo, Norway. Since 2010 he works as a Senior Researcher at CERGE-EI, the Economics Institute of the Czech Academy of Sciences. Since 2011 he is Associate Professor in CIRCLE, Lund University, Sweden.



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Studie 2 / 2017



Národohospodářský ústav AV ČR, v. v. i., 2017

ISBN 978-80-7344-407-5 (Národohospodářský ústav AV ČR, v. v. i.)

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# Predatory journals in Scopus[1]

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## Summary

- The study maps the penetration of so-called "predatory" scholarly journals into the citation database Scopus. Predatory journals exploit the author pays open access model, and conduct only cursory or no peer review, despite claims to the contrary. Some such journals will publish almost anything for money. In the Czech context whether a journal is indexed in Scopus is crucial for determining the points that publications in that journal are awarded in the national performance-based evaluation of research organizations, which in turn is the basis for the allocation of institutional funding. Hence, in this evaluation framework, publishing in predatory journals that are indexed in Scopus has a clear "fiscal" advantage.

- Our analysis is based on a survey of "potential, possible, or probable" predatory journals by Jeffrey Beall at the University of Colorado. He maintains a blog with two regularly updated lists: i) a list of *standalone journals*, which contains individual predatory journals; and ii) a list of *publishers*, which implicates questionable publishing houses, usually with multiple journals. Beall's lists suffer from their own limitations but are – in our view – representative enough of the overall problem of predatory publishing.

- Using the Ulrichsweb register we compiled a comprehensive database of the journals that Jeffrey Beall considers predatory. The database covers both standalone journals, the names of which are easily obtained directly from Beall's first list, as well as the journals issued by predatory publishers in Beall's second list. We then searched Scopus using the ISSN of each predatory journal in our database. To the best of our knowledge, the resulting database provides the first ever overview of predatory journals in Scopus.

[1] This study received support from the research programme Strategy AV21 of the Czech Academy of Sciences. We would like to thank Daniel Münich for his comments. Any ambiguities, omissions or errors are the authors' responsibility.

- In total we found 3 218 predatory journals in Ulrichsweb, of which 281 came from the list of standalone journals and 2 937 from the list of predatory publishers. Our subsequent Scopus search yielded 405 journals with at least one indexed document. Over the period 2004-2015, we identified 306 thousand documents in Scopus that were published in journals nowadays considered by Jeffrey Beall to be predatory. Scopus is therefore surely not resistant to penetration by predatory journals.
- The long term trend is clear. In 2004, these predatory journals produced less than 2 thousand documents indexed in Scopus, accounting for a negligible 0.1% share; however, by 2015 this figure had increased to nearly 60 thousand, and accounted for almost 3.0% of all indexed documents. Until 2011 the share of predatory documents in Scopus grew exponentially; the expansion then stalled for a few years, but soared once again in 2015.
- Predatory publishing undermines the credibility of science most seriously in middle-income countries in Asia and North Africa that suffer from an underdeveloped culture of research evaluation. The results also call for caution in the Czech Republic. Nevertheless, fears that this phenomenon has the capacity to seriously damage Czech science turn out to be unwarranted at this point. Czech authors publish a few hundred articles annually in the predatory journals that are indexed in Scopus; this is a tiny fraction of the total national scientific output. Moreover, these questionable outputs are heavily concentrated in only a handful of predatory journals, hence the practice would be relatively easy to track and possibly stop, if tackled head on.
- Finally, our analysis reveals that Beall's lists need to be used with caution. Predatory publishing is a real problem and no doubt there are indeed fake outlets dressed up as scholarly journals, which are prepared to print anything for money. However, a very brief look at more detailed data for the Czech Republic is sufficient to reveal that Beall's list of publishers may implicate journals that are not necessarily "predatory" in the true sense. This is corroborated by the fact that some journals in the list of publishers publish have a large share of documents by authors from countries with an advanced research evaluation culture, where truly fraudulent publications offer a low payoff in terms of career progression or research funding.

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*Studie 2 / 2017*

# Predátorské časopisy ve Scopusu[2]

BŘEZEN 2016

VÍT MACHÁČEK a MARTIN SRHOLEC

## Shrnutí

- Studie mapuje rozsah pronikání tzv. „predátorských“ vědeckých časopisů do citační databáze Scopus. Predátorské časopisy jsou postaveny na placeném open access modelu, provádějí ledabylé či vůbec žádné peer review, i když navenek tvrdí opak. Nejhorší z nich za úplatu otisknou téměř cokoliv. Z pohledu českého prostředí je zařazení časopisu do Scopusu rozhodující pro získání bodů ve vládním hodnocení výsledků výzkumných organizací, tzv. kafemlejnku. Motivace využívat služeb predátorských časopisů indexovaných ve Scopusu tak v tomto systému hodnocení dostávají zřejmý fiskální rozměr.
- Analýza vychází ze seznamu potenciálních „predátorů“ od Jeffreyho Bealla z University of Colorado. Na svém blogu vede dva pravidelně aktualizované seznamy: i) seznam *samostatných časopisů*, tj. „list of stand-alone journals“, který obsahuje jednotlivé predátorské časopisy; a ii) seznam *vydavatelství*, tj. „list of publishers“, který poukazuje na pochybná vydavatelství zpravidla s více časopisy. Seznamy určitě nejsou bezchybné, ale jsme přesvědčeni, že jsou poměrně reprezentativní.
- S pomocí databáze Ulrichsweb jsme sestavili ucelený přehled časopisů, které Jeffrey Beall podezírá z predátorství. Přehled zahrnuje nejenom samostatné časopisy, jejichž názvy jsou snadno k mání přímo v seznamu samostatných časopisů, ale také časopisy, které vychází pod hlavičkou vydavatelství uvedených seznamu vydavatelství. ISSN těchto časopisů byly následně vyhledány v databázi Scopus. Seznam predátorských časopisů, které pronikly do Scopusu, jsme vytvořili jako vůbec první na světě.
- Celkově bylo v Ulrichswebu nalezeno 3 218 časopisů, z toho 281 na seznamu samostatných časopisů a 2 937 podle seznamu vydavatelství. Při prohledání Scopusu bylo zjištěno 405 časopisů s alespoň jedním indexovaným výsledkem. Za období

[2] Tato studie vznikla díky podpoře AV ČR v rámci Strategie AV21 v české mutaci jako Studie 16/2016 v listopadu téhož roku. Za cenné připomínky děkujeme Danielu Münichovi. Případné nepřesnosti, opominutí nebo chyby však padají jen a pouze na hlavy autorů.

2004-2015 jsme ve Scopusu nalezli 306 tisíc výsledků v časopisech, které Jeffrey Beall v současné době považuje za predátorské. Scopus vůči predátorským časopisům rozhodně není imunní.

- Dlouhodobý trend je jednoznačný. Zatímco v roce 2004 se z těchto časopisů do Scopusu dostalo méně než 2 tisíce výsledků, což tvořilo zanedbatelný 0,1% podíl, v roce 2015 bylo nalezeno bezmála 60 tisíc výsledků, což odpovídalo téměř 3,0 % ze všech indexovaných výsledků. Do roku 2011 rostl podíl predátorských výsledků ve Scopusu po exponenciální křivce. Potom se růst na několik let zastavil. Avšak v roce 2015 došlo opět k výraznému nárůstu.
- Rostoucí rozsah predátorského publikování ohrožuje kredibilitu vědy zejména ve středně rozvinutých zemích v Asii a severní Africe s nízkou kulturou hodnocení vědecké práce a výsledků. Do budoucna je tedy třeba se mít na pozoru i v České republice. Nicméně obavy z toho, že vlivem tohoto fenoménu může dojít k rozkladu české vědy, se prozatím ukazují jako přehnané. Od českých autorů vychází v predátorských časopisech indexovaných ve Scopusu pár stovek článků ročně. Jedná se o zlomek z celkových výsledků s českou stopou. Navíc jsou tyto pochybné články silně soustředěny v několika málo predátorských časopisech.
- Beallovy seznamy je nutné používat opatrně. Predátorské časopisy, které za poplatek obratem otisknou cokoliv, určitě existují. Nicméně i zběžný pohled na data za Českou republiku ukazuje, že zejména na základě seznamu vydavatelství mohou být nařčeny i časopisy, které „predátorské“ v pravém slova smyslu být nemusí. Nasvědčuje tomu i zjištění, že v časopisech nalezených na seznamu vydavatelství se soustřeďují výsledky od autorů ze zemí s vyspělou kulturou hodnocení vědy, ve kterých mají pochybné publikace mizivou šanci na úspěch.

## Introduction

The business model of so-called "predatory" scholarly journals is based on a paid open-access publication model: the publisher does not charge for subscription, but receives money directly from the authors. As a result, the content is accessible for free to anyone. However, this model entails a conflict of interests that undermines the credibility of scholarly publishing. Authors are motivated to pay to have their work published for the sake of career progression or obtaining points in research evaluation systems that count the number of research outputs but not consider their quality. In return, fraudulent publishers turn a blind eye to limitations of the submitted papers during peer review. Predators' primary goal is to generate income from authors' fees. The worst of them simply fake peer review and print anything for money, without scruples.

The open-access publication model is not at fault per se, however. Many scholars are in favour of this model, because they are frustrated by the fact that a handful of publishing houses control the majority of top journals and make excessive profits by charging subscription fees from those who wish to read their work. Libraries often pay these subscriptions using public funds, academic research is almost entirely financed by governments, and peer review is usually performed by scholars for free. In addition, expensive subscriptions hinder access of some researchers, as well as the wider public, to the research results. New journals based on open-access could be a solution. Problems occur when organizations that publish the open-access journals do not care about upholding the principles of peer review, but are driven solely by financial profits.

Jeffrey Beall, a librarian at the University of Colorado, has done pioneering work in identifying fraudulent practices in scholarly open access publishing. On his blog he maintains two regularly updated lists of "potential, possible, or probable" predators: i) a "*list of standalone journals*", which contains individual journals suspected of predatory practices that are likely to exist independently of any publishing house; and ii) a *"list of publishers*", which highlights questionable publishers, most of which print multiple journals. Beall adds journals and publishing houses to these lists on the basis of elaborated criteria, which take into account among other aspects the journals' editorial procedures, their management and their compliance with ethical standards.[3]

[3] Beall's blog went off-line reportedly due to legal reasons on January 15th, 2017. It is not clear whether and when the blog is coming back. In our view, this makes it even more pertinent to bring new evidence on predatory publishing.

Predatory publishing has recently attracted growing attention, including in the Czech Republic, in particular thanks to the *Antipredátor* project run by the *Věda žije!* forum, which provides a list or records in the Czech Register of Research Outputs, i.e. *Rejstřík informací o výsledcích* (RIV), that are published in journals on Beall's list. On the base of outputs recorded in the RIV are awarded points in the Czech government's research evaluation system (known as the "coffee grinder"), which in turn determine the allocation of institutional funding for research (for more details see Good, et al. 2015). However, the *Antipredátor* project did not uncover everything. Although they used Beall's first list in full, their only partly covered the journals under publishing houses that appear on Beall's second list.

The aim of this study is to map the penetration of predatory journals in the Scopus citation database. Scopus is less selective and covers substantially more journals than the Web of Science (Mongeon a Paul-Hus 2016), thus could be more susceptible to the infiltration by predators. Yet journals indexed in Scopus should fulfil certain minimum quality criteria, which include a thorough peer review process (Scopus 2016). Scopus-listed journals are therefore generally considered to be trustworthy. From the Czech perspective, a journal's inclusion in Scopus is decisive for obtaining points in the "coffee grinder". While there are various reasons why scholars might pay to publish papers in predatory journals that are not listed in Scopus, if such a journal appears in the Scopus database the motivation to publish in it gets a clear "fiscal" spin.

## Database

Using the two lists published on Jeffrey Beall's blog and the Ulrichsweb database, which is the most comprehensive list of periodicals, we built a comprehensive overview of journals suspected of predatory practices. The overview includes not only the standalone journals, whose names are available on Beall's first list, but also journals that fall under the umbrella of the publishing houses listed on Beall's second list. We then searched for these journals using their ISSNs in the Scopus citation database. To the best of our knowledge, this is the first time that an overview of predatory journals listed on Scopus has been ever compiled. Not even Jeffrey Beall has yet made this investigation.

## Compiling the database

Box 1 explains on how we constructed the database. Beall's lists were downloaded on 1st April 2016. The names of individual journals and publishers were searched for in the Ulrichsweb database on the same day, using an automatic script programmed in Python. The script searched for the exact name of the journal or publisher and then saved all relevant entries. Together with each entry from Ulrichsweb it also downloaded a unique journal indicator in the form of the International Standard Serial Number (ISSN). Journals whose ISSN were not found in Ulrichsweb, indicating that they had not been registered with an ISSN or had a false ISSN, were excluded from further scrutiny.

In order to resolve any inconsistencies, for example due to inaccurate names, the entries found by the automatic script were manually checked. Beall's lists consist of hypertext links. To check our entries for independent journals we compared the ISSN on the journal's website with the ISSN found on Ulrichsweb. If the two ISSNs matched, the entry was retained; if they differed, the entry was removed from our database. Publisher's identity was confirmed if at least one ISSN listed on its web site was found in an entry linked to the publisher's name on Ulrichsweb. If a matching ISSN was found, all other journals of the same publisher were also retained in our database. If no matching ISSN was found, and the entries therefore referred to a different publisher, they were removed.

In total we confirmed 4,580 ISSNs associated with Beall's lists. Many journals have dual ISSNs, one for a printed and one for an electronic version. The number of individual journals is 3,218, of which 281 feature on the list of standalone journals and 2,937 refer to his list of publishers. Hence, the standalone journals represent only the tip of the iceberg. Moreover, there are 1,003 hypertext links on the list of standalone journals, from which follows that more than three quarters of them are not covered in Ulrichsweb, let alone in more selective databases, and so apart from the unverified information on their own web pages, we know nothing about them. For this study that is not a problem, because journals that are not even included in Ulrichweb can hardly be listed in Scopus. Nevertheless it is important to realize that predatory publishing is far more widespread than we are able to demonstrate using existing databases.

The next step was to search for these "predatory" ISSNs in the Scopus citation database. Once again, this search was performed using an automatic script programmed in Python. For each ISSN detected in Scopus, the script downloaded basic data

on the number of documents in the "article" and "review" categories for the years 2004-2015, henceforth referred to as "documents" only, as well as more detailed data on the number of these documents by author's country of origin in the period 2010-2015.[4] 405 individual journals were identified. This means that almost 13% of the journals in our database had at least one entry indexed in Scopus. Evidently, Scopus is not immune to their infiltration.

To avoid double-counting of documents in the journals with dual ISSNs for printed and electronic versions, one of these had to be removed. 119 journals had entries in Scopus under both ISSNs. Of these, 83 had exactly the same number of results for the same period, which indicates that the entries were identical. For the remaining 36 journals we retained data for the ISSN with a larger number of documents. A more detailed look at the individual entries revealed that in the vast majority of cases the deleted entries indeed contained only duplicate documents.

**Box 1: The Data Generation Process**

1) Obtaining the "predatory" ISSNs
    a. Beall's lists downloaded on the 1st April 2016.
    b. The names on Beall's lists were searched for using an automatic script in Ulrichsweb on the same day.
    c. The entries found in Ulrichsweb were manually verified with the help of hypertext links in Beall's lists.
    d. 4,580 ISSNs of 3,218 individual journals were confirmed to be associated with Beall's lists.
2) Searching for ISSNs in Scopus
    a. The "predatory" ISSNs were searched for using an automatic script in Scopus in October 2016; the script downloaded the number of indexed documents and their distribution by author's country of origin.
    b. 524 ISSNs of 405 individual journals with at least one entry in Scopus were identified.
    c. To avoid double-counting of documents in journals with both printed and electronic ISSNs, the duplicates had to be eliminated.

[4] In addition to articles and reviews, the so-called "citable documents" in Scopus – which serve as a denominator in the shares presented below – also include conference papers. Conference paper data was not downloaded for practical reasons. Needless to say, this is a marginal category, which is in fact irrelevant for most predatory journals. The vast majority, i.e. nearly 90%, of citable documents are articles, therefore not covering conference papers entails a negligible bias.

## Data limitations

Jeffrey Beall's verdict is solely based on his own judgement. He does not seem to consult anyone. However, keeping track of such a large number of cases is a tough task. Despite the best effort and intention, mistakes may occur. Furthermore, some journals are surely more "predatory" than others. Some are truly fraudulent, while many others may be on the margin. But we have to work with a binary classification only, in which a journal is labelled either predatory or not. Beall does not provide explanation of his decisions in a systematic manner, except of occasional notes on his blog, despite the fact that elaborated criteria exist. Beall's lists are also not exhaustive, because new fraudulent journals come into existence literally every day.[5]

A caution is especially warranted when working with Beall's list of publishers. Classifying the entire publishing house as predatory is problematic, as it cannot be ruled out that alongside with truly fraudulent journals have been blacklisted also those that are fine. The list includes publishers maintaining broad portfolios of dozens and even hundreds of journals, so it well might be that some of them strictly speaking do not deserve the predatory label. It is likely that they will be of poor quality, but this is not a crime per se. After all, many non-predatory but local journals which publish research of marginal relevance, have also already found their way into the main citation databases. One must therefore keep in mind that the list of publishers is a relatively rough brush.

Nevertheless, respectable publishing houses should have zero tolerance to predatory practices. Just as in the banking sector, academic publishing services are based on trust, and if that is lost the business is doomed. A single journal with predatory inclinations that are not quickly corrected by the publisher can substantially damage the entire label. Beall's predatory mark implies at the very least doubts about the publisher's internal quality assurance mechanisms. It is thus safe to assume, for instance, that a fake peer review process is prevalent in the whole portfolio of predatory publisher's journals, that there is not just one rotten egg.

Another concern arises from the timescale. The predatory status is derived from the content of Beall's lists on 1st April 2016. Jeffrey Beall continuously updates his lists adding new entries and sometimes (albeit not very frequently) removing no longer relevant ones. But the lists always reflect only the current status, with no indication

[5] Just during April and May 2016 nearly 200 new entries were added to the list of standalone journals.

of when the journal or publisher became predatory. From this follows that when looking back in time we may run into the problem of including in the predatory category records that actually do not deserve that label, because the journal switched to the predatory regime only recently. In other words, it well might be that older articles in journals that are currently considered to be predatory may in fact have gone through a standard peer review. Hence, historical data must be taken only as indicative of general trends.

## Trends over time

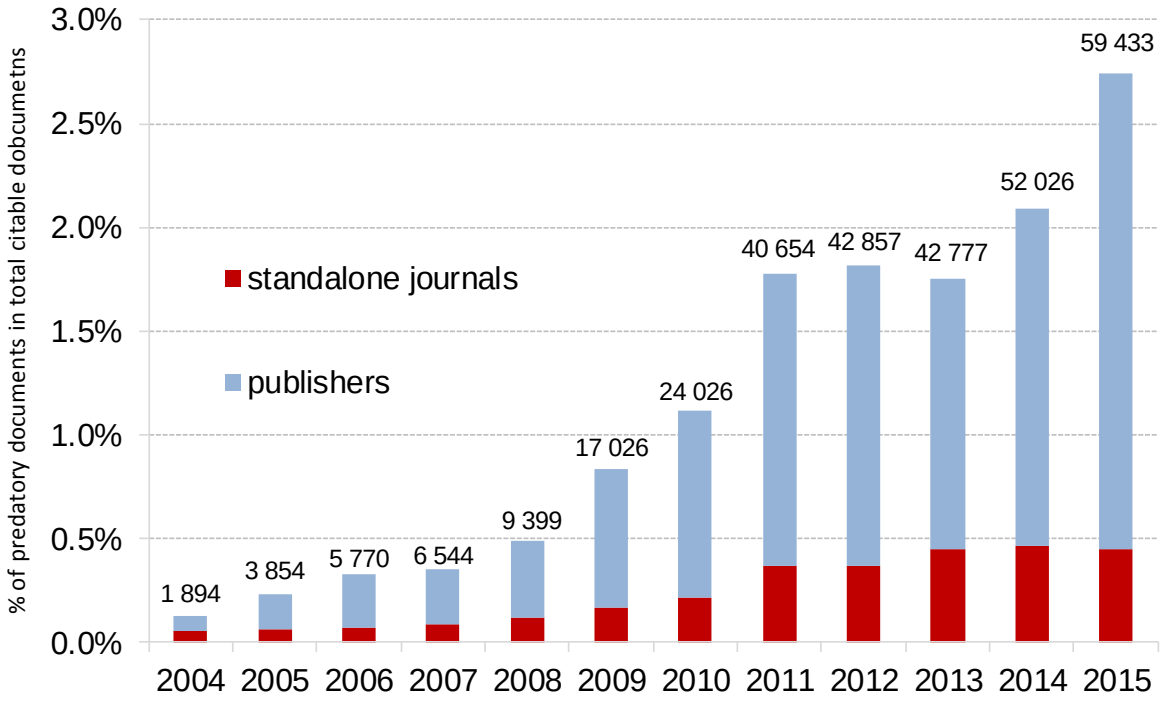
Shen and Björk (2015) is to the best of our knowledge the only study that has attempted to estimate the growth of predatory journals worldwide so far. Based on Beall's lists (on 1st September 2014) the authors manually went through the relevant web sites. They identified 11,873 journals in total, from which they selected a stratified sample of 613 titles. Analysis of detailed data for this sample suggests that after inferring from these figures to the total population between 2010 and 2014 the number of "active" predatory journals (with at least one article) and the number of articles published by them quadrupled from approximately 2 thousand to 8 thousand and from 53 thousand to 420 thousand, respectively. As they themselves point out, however, these are only rough estimates.

Crawford (2014a) did not track trends over time, but analysed the content of every single web link on Beall's lists (in late March and early April 2014). He found 9,219 journals in total, of which 320 were from the list of standalone journals and 8,899 from the list of publishers. His most interesting finding, from our perspective, was that between 2012 and 2014 almost 40 % of those journals published fewer than four articles or none at all, in other words were empty shells, and that a further 20 % published only a handful of articles. Another 4 % consisted of dying or dormant journals with a quick drop to few articles in 2014, and 6 % were unreachable (the web link was broken, for instance). Hence only approximately one third of the identified journals publish articles on a regular basis.

Figure 1 reveals that the number of documents in predatory journals that have managed to make their way into the respected citation database Scopus has also grown sharply. The vertical axis indicates the share of these predatory documents in the overall number of so-called "citable" documents indexed in the Scopus database. Put simply, this shows

the extent to which the predatory results have infiltrated Scopus each year. The absolute numbers of indexed predatory results are shown at the top of the individual columns for information. The two colours distinguish results from Beall's list of standalone journals (red) and those from his list of publishers (blue).

**Figure 1: Share of predatory documents in Scopus (%)**




*Note: The absolute number of indexed predatory documents is reported above each column.*
*Source: Scopus (on 11th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

During the period 2004-2015 a total of 306 thousand documents recorded in Scopus came from journals that Jeffrey Beall considers as predatory. This represents 1.2% of all indexed results for this period. The long-term trend is clear. In 2004, fewer than 2 thousand documents from these journals appeared in Scopus, which was a negligible 0.1% of the total. Additionally, some of these can undoubtedly be attributed to journals that were not yet predatory at that time. By 2015 the number of suspicious results in Scopus had already reached 60 thousand, making up a share of nearly 3.0%. Thus, today, almost every thirty-sixth result indexed in Scopus is from a suspected predatory source.

Predatory publishing long escaped notice. Until 2011, the share of predatory results in Scopus rose exponentially. The greatest increases were recorded in the period between

2008 and 2011. After this, there was a distinct break in the trend, as the share of predatory documents settled at just under 2.0% for a few years, and even dropped slightly. Scopus perhaps uncovered their tactics and began tackling the problem. Jeffrey Beall may also have played a role, as he launched his blog just at this time, and thus raised awareness of the issue. Nevertheless, 2015 saw another significant growth again.

It is worth noting the differences between the results based on Beall's list of standalone journals (red columns) and journals found using Beall's list of publishers (blue columns). The standalone journals make up a small share of the predatory documents. For most of the period, about four fifths of all the predatory documents come from the list of publishers. Although growth in the number of documents from standalone predatory journals has slowed down substantially over the last few years, growth in the documents from predatory publishers continues apace. The overall growth in predatory documents over the last three years has been almost entirely from the list of publishers.

Overall, these results confirm that the problem of predatory publishing worsened considerably only recently. Their share of almost 3% of the total indexed results in Scopus still does not look like a particularly high number, and that all the more so given that the vast majority of them come from Beall's list of publishers, which – as we discussed earlier – could result in an overestimation of the true "predators". What is undoubtedly alarming, however, is the growth trend in their infiltration into Scopus, which is once again gaining strength after a few weaker years. Furthermore, it is possible that in some countries this problem is far more serious than it is on a global level, which is the question that we focus on now.

## Cross-country comparisons

Out of more than two hundred countries from which at least one author of a “citable” document in Scopus came, according to data from the Scimago Country Rank, we have for the sake of clarity excluded dependent territories and countries with fewer than 300 thousand inhabitants. Among others, we have therefore excluded a number of small island states in the Caribbean and Oceania, which are not the main focus of our analysis. As a result, the sample consists of 171 states, including a large number of developing countries, which together cover the overwhelming majority of the world's population and research activity.

The analysis considers evidence from the period between 2013 and 2015. As already discussed, using older data bears the risk that some of the journals currently featuring on Beall's lists did not yet have predatory characteristics at that time. But we use data from the last three years, rather than only the most recent year, in order to increase the number of documents available and thus the robustness of our comparison. Each of the countries included in the analysis has more than 30 documents in Scopus during this period.

The comparative analysis is presented with the help of bar charts for various groups of countries. On the vertical axis is shown the percentage of predatory documents in total citable documents by authors from the given country. In other words the number of documents published in predatory journals divided by the total publication output of each country. This reveals to what extent each country is affected by the problem of predatory publishing. First, we present evidence from OECD members, then look at the most affected countries in the world, followed by the largest countries in terms of population, and finally present the results for larger groups of countries with regards to income levels and geographic areas.

### OECD countries

Figure 2 shows that South Korea comes out by far the worst among OECD countries, with 5% of its research outputs published in journals suspected of predatory practices. Another "Asian tiger", Taiwan, which is not part of the OECD club due to political reasons but belongs there in terms of the level of development, would take fourth place in this comparison with a share of 1.5%. Although both these countries have recorded

a great success in technological catching up, they have not been able to prevent part of their fast growing research sector from being lured into in the trap of predatory publishing.

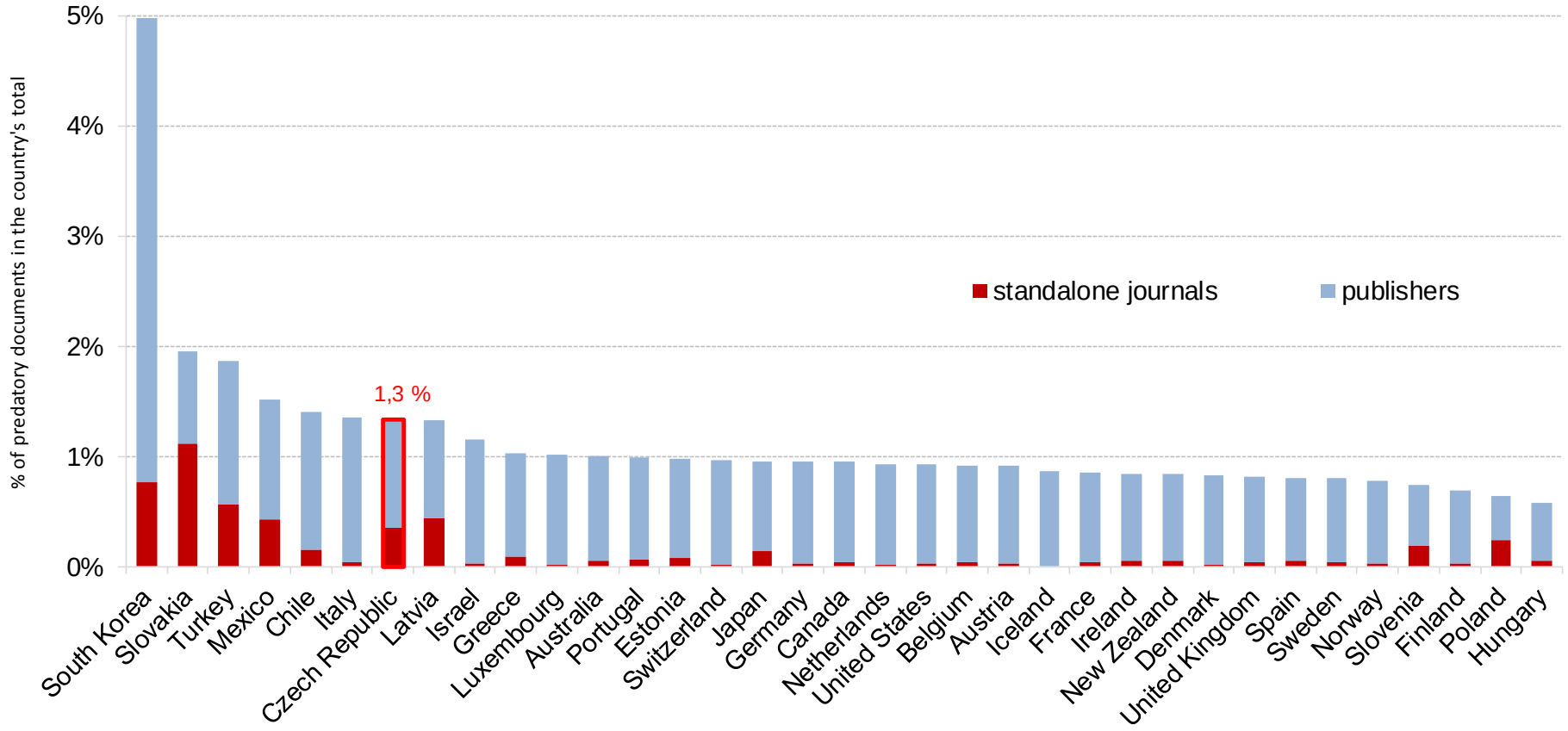
Far behind, but in second place, is Slovakia, with an almost 2% share of predatory documents, which is twice the average of the OECD countries. Nevertheless, if only the list of individual journals is considered, Slovakia actually comes out the worst off. Evidently Slovakia did not manage to tackle the onset of predatory publishing either. Turkey, Mexico and Chile come out with lower shares than Slovakia, even though these are OECD members which, at the very least given their level of productivity, are not usually classified as developed countries. It is thus not surprising that they appear in the upper part of this comparison.

The Czech Republic comes out with a 1.3% share as the seventh most affected country in the OECD. Admittedly, one would hope for a better ranking. Neither, however, this result should cause too much concern at the moment, because this is still a relatively low share. If compared to the technologically most advanced countries, such as Israel, Japan and the USA, or with its more advanced neighbours Germany and Austria, as well as with the OECD average, the Czech result is only a few tenths of a percentage worse. From a global perspective this is a negligible difference.

The results for Slovakia and the Czech Republic, which are among the worst affected countries, contrast with Poland, Hungary and Slovenia, which scored at the opposite end of the ranking. It is particularly surprising to find that Poland and Hungary appear, in this comparison, with the lowest shares of predatory documents; lower even than in Scandinavian countries, where research governance is known to be at a top level. Yet small differences observed in the lower two thirds of the ranking perhaps should not be overrated.

Standalone predatory journals do not sell well in OECD countries. With only a few exceptions, their share is negligible compared with that of the predatory publishers, especially in the less affected countries. Publication in standalone journals may be more easily noticed, because their titles are directly reported in the Beall's list, hence easier to prevent. If it is the case that indeed not all journals from the list of publishers are necessarily predatory, and that authors from countries with the most advanced research evaluation culture are most likely to publish in the unfairly implicated ones, the vast majority of these countries is not much affected by the predatory publishing problem.

**Figure 2: Share of predatory documents in Scopus in OECD countries, 2013 - 2015 (%)**




*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

## The most affected countries

Figure 3 gives the most affected countries worldwide. Developing countries generally suffer far more from predatory publishing than the advanced ones, but the problem plagues the whole world, across continents, cultures and political systems. Interestingly, the worst affected countries do not tend to be the poorest ones. Many of them actually invest in research infrastructure, in particular universities, even though in terms of equipment and financing they lag behind the technology frontier. Researchers in these countries therefore often have limited opportunities to do cutting edge research. Still, they must report publications, which coupled with weak research evaluation culture makes a fertile ground for the expansion of predatory publishing.

Albania looks dreadful with roughly every third paper of more than a thousand in total being published in a predatory journal. Kazakhstan ranks second with almost every fourth paper flagged as predatory. Another five countries, namely Indonesia, Nigeria, Iraq, Syria and India, come out with more than ten percent. Apart from Syria and Iraq, there are a number of other conflict-ridden countries including Libya, Yemen, Sudan and Eritrea. Several countries that have become rich as a result of oil exports, such as Brunei, Oman and Saudi Arabia, also appear among the worst affected.

Latin America is the only major area without any country on this list. Jamaica, the most affected country in this region, ranks only in 59$^{th}$ place with a 2.2% share of predatory documents. In the top half of the worldwide ranking there are only three other countries in Latin America, namely Mexico, Chile and Trinidad and Tobago. More than anything else, however this may reflect that Beall's lists contain almost exclusively journals in English. Likewise, Scopus primarily indexes documents in English. It well might be that in Latin America predatory journals are predominantly published in Spanish.

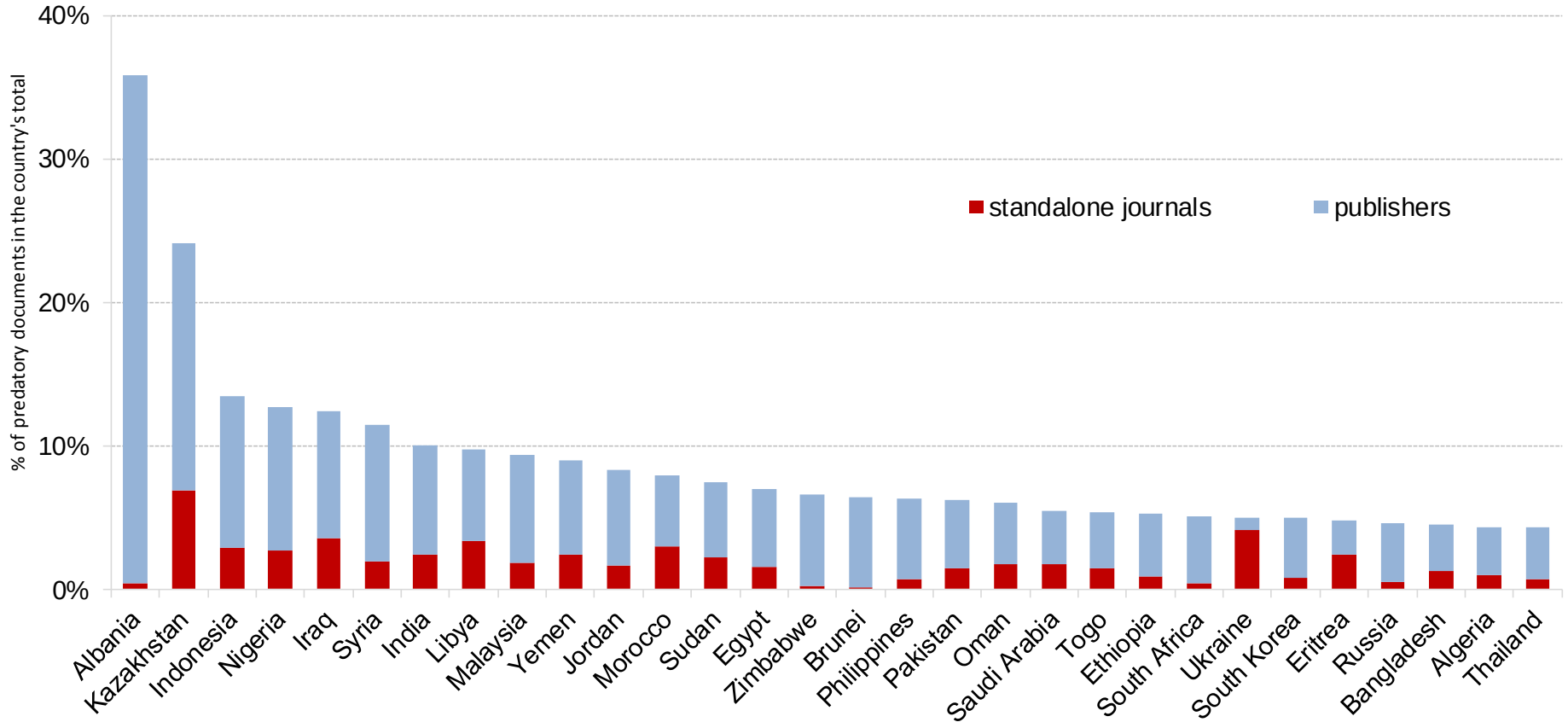
Some of the most affected countries have only a few hundred or even a few dozen indexed documents per year, either because they are very small or because they have a small research sector. These include Eritrea, Togo, Brunei and Yemen. At this level of output, the country's share of predatory documents can be easily driven by a few rogue individuals; it is therefore not advisable to make too much from that.

Nevertheless, in countries with a large number of indexed documents, in the order of thousands or tens of thousands per year, such as in India, South Korea, Russia, Malaysia, South Africa, Saudi Arabia, Egypt and a few others, a high share evidently indicates a systemic problem.

It is worth to notice that the scale on the vertical axis is different on this figure from the previous one. The propensity to publish in predatory journals is significantly lower in OECD countries than in the rest of the world. The only OECD country that appears in the figure of most affected countries is South Korea but far from the top of the ranking. Yet this underlines how serious of the problem of predatory publishing is in this otherwise developed country. It would be difficult to find any other socio-economic indicator for which South Korea is on a comparable level with South Africa, Ukraine or Eritrea. Slovakia, which ranked as the second worst in the OECD, takes 66$^{st}$ place in the worldwide comparison. The Czech Republic takes 83$^{th}$ place, roughly half way down the ranking.

Surprisingly, the opposite end of the spectrum with the lowest shares of predatory documents in also dominated by developing countries. Some of them have the shares of predatory documents very close to zero and in a few cases there are no authors publishing in predatory journals whatsoever. These include many of the least developed countries, such as Chad, Haiti, Congo (Dem. Rep.), Madagascar and Mali. Arguably, they are so behind the curve that the pandemic of predatory publishing has not to reach them.

**Figure 3: Share of predatory documents in Scopus in the 30 most affected countries, 2013 - 2015 (%)**




*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

## Large countries

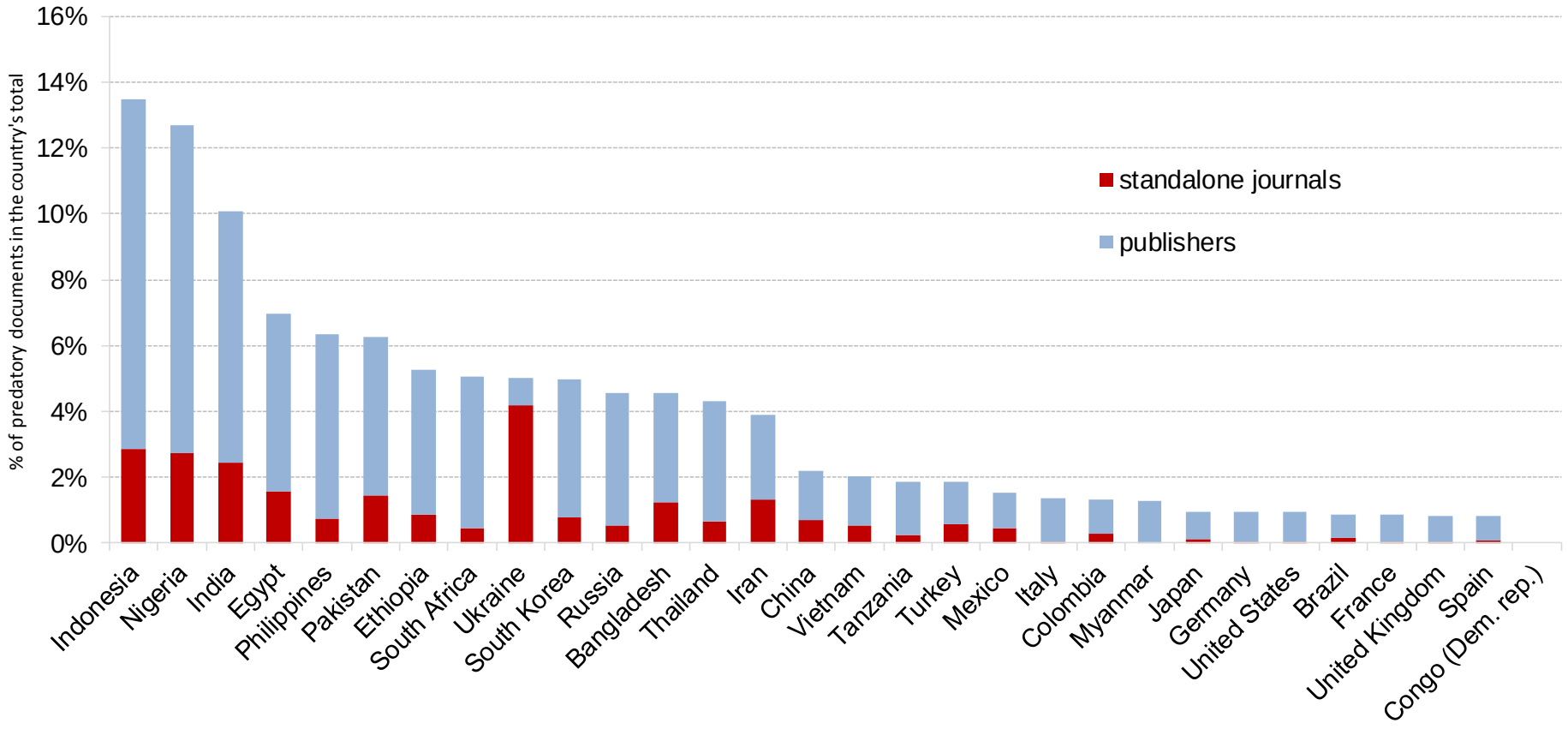
Figure 4 provides results for the largest countries given by population. Several important countries that deserve closer scrutiny but have not made it into the previous comparisons are included, most notably China and Brazil. Furthermore, comparing all these countries on the same scale clearly shows the immense differences in the propensity to predatory publishing across the globe. Besides the aforementioned Congo (Dem. Rep.)[6], which has no predatory results, the tail end of this ranking contains predominantly developed countries. At the opposite end of the spectrum are exclusively developing countries.

It is revealing to compare the two largest countries. India is heavily affected, while China does not seem to be fertile ground for the predators. Shen and Björk (2015) found that more than a quarter of predatory publishers are in fact based in India, which gives indigenous authors a "home field" advantage. It is then hardly surprising that the problem of predatory publishing has reached such proportions there. On the other hand we must not forget the caveat already mentioned above that the data predominantly covers journals published in English. English is an official language in India, while in China not only is the language different, but the writing system too; thus local problems with the predatory model of publication may largely escape our attention.

Anyway, let us not be deceived by the proportional indicator. Even in China predatory publishing is extensive, though not so bad in proportion to the total publication output. In fact, however, in absolute terms the number of indexed predatory documents was very similar in China and India, at around 30 thousand each. Put together, these two countries account for 35.7% of the world total. The next, in absolute terms, is the USA, with almost 15 thousand documents and a 8.2% share globally; thus even in countries at the top of the technology ladder, there is a large number of researchers who are willing to pay to have their work published in predatory journals. If we add the fourth largest victim, South Korea, with a 6.1% share, then if combined these countries account for as much as half of the world total.

[6] Congo (Dem. Rep.) is with almost 75 million inhabitants the fourth largest country in Africa and nineteenth largest in the world. Out of only 141 documents in Scopus by authors from this country during the three year period under consideration, none was associated with predatory journals or publishers.

**Figure 4: Share of predatory documents in Scopus in the 30 most populated countries, 2013 - 2015 (%)**




*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

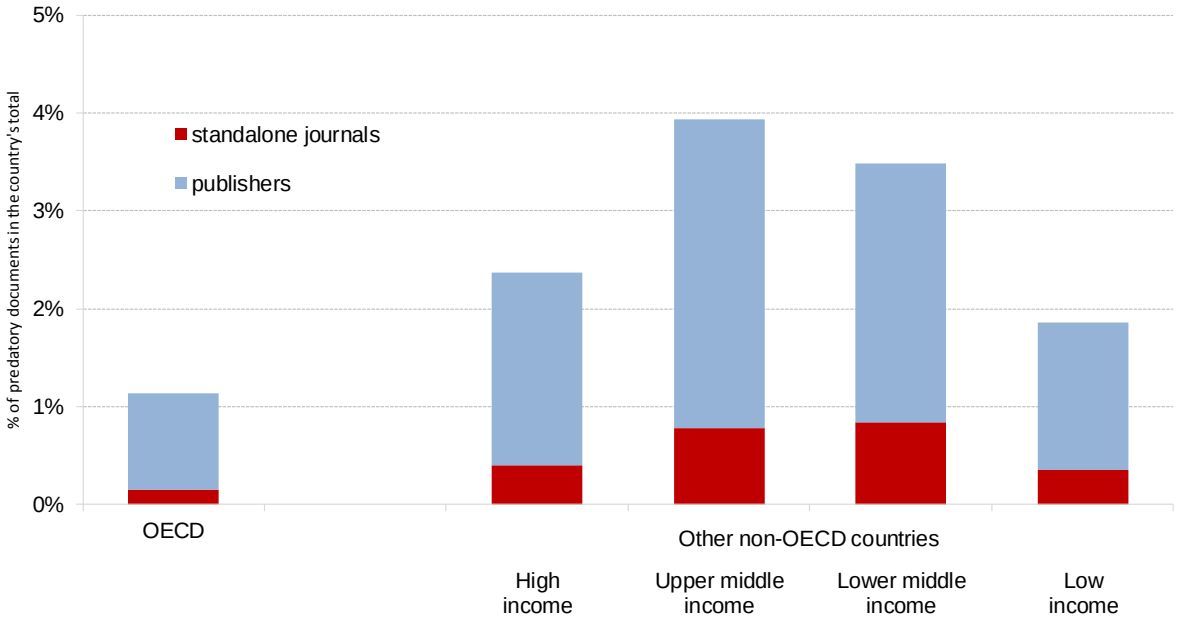
## Broad country groups

Figures 5 and 6 summarize the results by broad income levels and geographical areas. The OECD countries are presented separately on the left hand side, so that they do not distort averages of the other four and nine groups based on income and geography, respectively, on the right hand side. The division by income level follows the classification of the World Bank (2016), which divides countries according to gross national income per capita into "high income", "upper middle income", "lower middle income" and "low income". The division by geographical area is based on large (sub)continental groupings.

The OECD countries are confirmed to be the least affected. Other high income countries that are not members of OECD fall prey to predators roughly twice as much. The average for this rather diverse group is driven up by oil-rich countries like Brunei, Oman, Saudi Arabia, Russia, Kuwait, Bahrain, Equatorial Guinea and the United Arab Emirates. By far the worst situation, though, is in middle income countries, many of which recognize the role of research for development but lag behind the technology frontier. Despite this, academics in these countries are expected to publish in journals. The pressure to publish combined with weak evaluation culture provides breeding ground for predators.

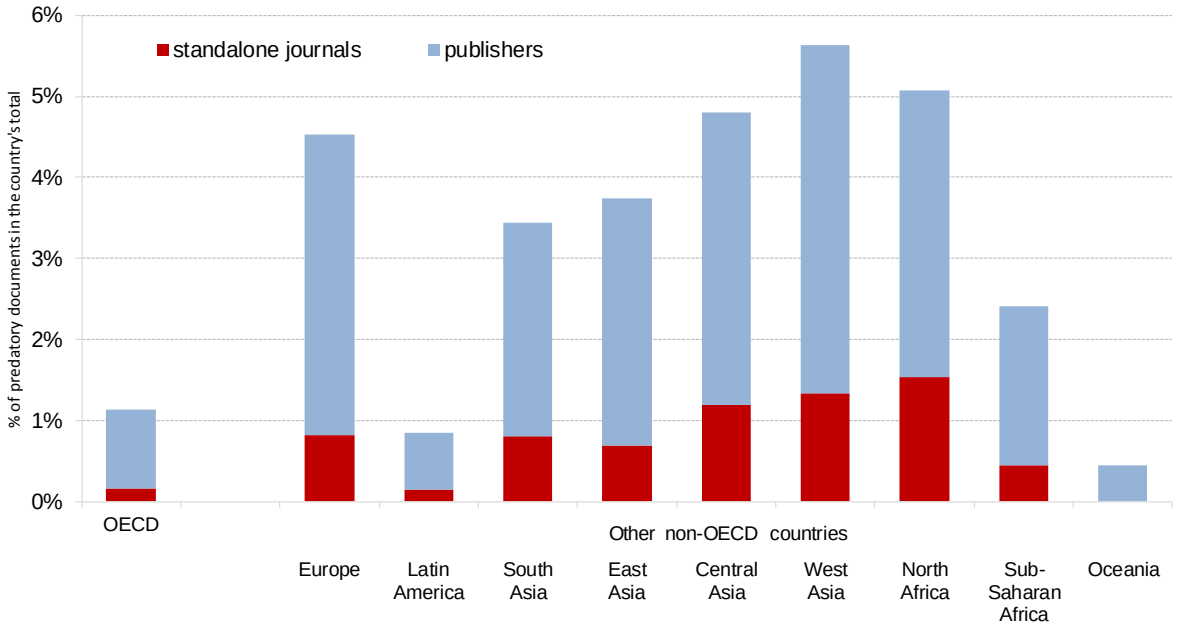
The comparison by geography underlines the general patterns that could have been noticed previously. The most affected are the predominantly Arab countries in West Asia and North Africa. Predatory publishing also thrives in the developing countries of Central, South and East Asia. Meanwhile, the peripheral areas of South and East Europe appear strongly affected, although it is important to note that this group includes Albania, which is a major outlier and without which the group average is halved. Unlike these areas, Latin America and Oceania (without OECD members there are just three countries in this group) seems even less prone to publishing in predatory journals than the OECD countries. Latin America and the OECD countries also share similar proportions between documents associated with the list of standalone journals and the list of publishers.

## Figure 5: Share of predatory documents in Scopus by income groups, 2013 - 2015 (%)




*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

## Figure 6: Share of predatory documents in Scopus by geographical area, 2013 - 2015 (%)




*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

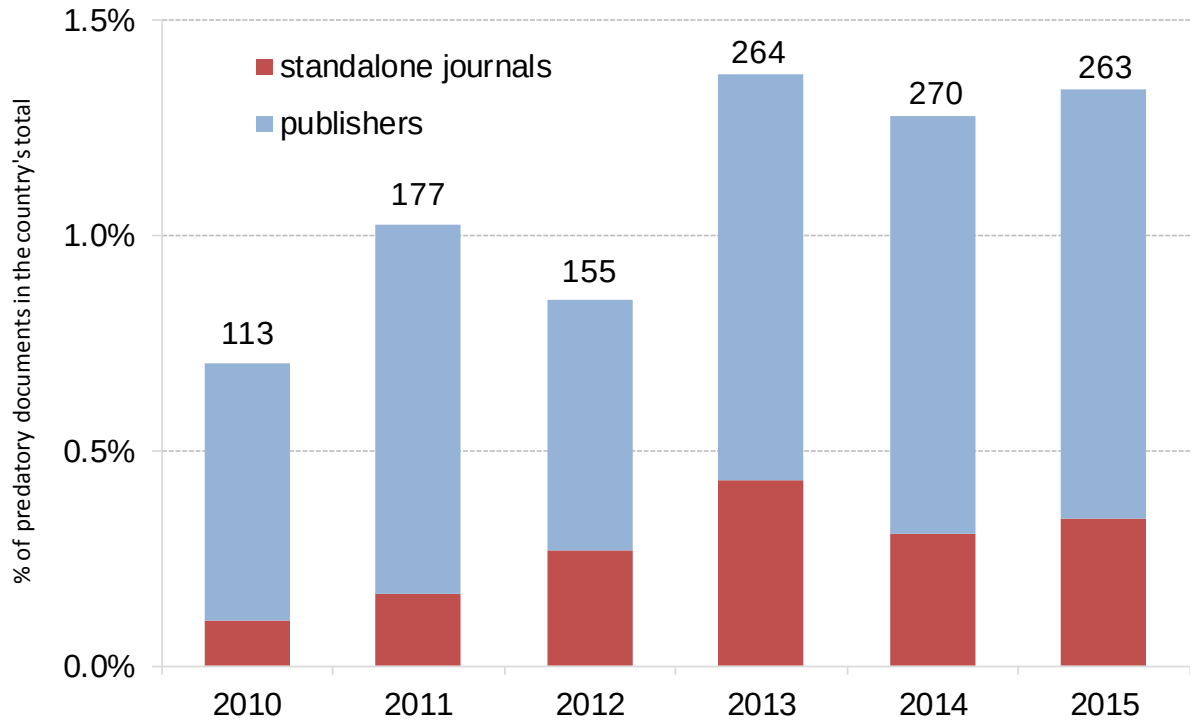
## The Czech Republic

Figure 7 provides details on the growth of predatory documents indexed in Scopus by authors from the Czech Republic. On the one hand, there is a similar increasing trend as we observed worldwide. Between 2010 a 2015 the number of predatory documents more than doubled. On the other hand, in terms of absolute numbers, we are looking at just a few hundred documents, which make up just over 1% of the country's total. The "coffee grinder" evaluation system assigns on the base of these documents to the author's research organizations institutional funding in the range of tens of millions of CZK per year, which is surely not trivial, yet this amounts to only a tiny fraction, roughly thousandths, of the overall budget. From the perspective of the system as a whole this is not a burning issue.

Since 2013, the number of points allocated by the "coffee grinder" for journal articles indexed in Scopus has started to increase depending on the journal's relative SJR index within the field in the range of 10-305 points (Office of the Government of the Czech Republic 2013, p. 31). Up until then the evaluation method allocated only 12 points across the board for any result in Scopus (Office of the Government of the Czech Republic 2012, p. 33). Hence, the "fiscal" motive has rapidly increased. Between 2012 and 2013 the number of predatory documents jumped up suggesting an immediate effect. However, the stagnation after that indicates otherwise. It is important to realize that the change in the evaluation system was approved by the government in mid-2013, and the impact has become widely recognized only after the first results were published at the end of 2014. Admittedly, changes in the government evaluation system affect publication behaviour only with a sizeable delay.[7]

[7] During the first ten months of 2016 (up to 30th October 2016) 227 predatory documents by authors from the Czech Republic were recorded in Scopus, so unless there is a major change in the trend for the rest of the year, there should not be a drop nor a significant increase compared to the previous year. It should be mentioned that the local awareness of predatory publishing has increased enormously since 2015 when the so-called Strielkowski scandal has been reported by mainstream media, as the result of which the academic community has started to take this problem seriously (Komm 2016).

**Figure 7: Share of predatory documents in Scopus by authors from the Czech Republic**




*Note: The absolute number of indexed predatory documents is reported above each column.*
*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

Table 1 shows that these documents are strongly concentrated in only a handful of journals. More specifically, over 2013-2015 nine predatory journals with the largest number of documents by authors originating from the Czech Republic accounted for a half, and the two most popular of them alone for a quarter, of the country's total. Indeed, this overview provides an insightful snapshot of how diverse the journals suspected of predatory practices look like. Five of them are, for various reasons, suspect at first sight. Nevertheless, branding four of these journals as predatory appears to be at the very least questionable.[8]

First of all, there are the journals *Frontiers in Plant Science*, *Frontiers in Microbiology* and *Frontiers in Behavioral Neuroscience* published by the open-access publisher Frontiers. Besides Scopus, these journals are also indexed in Web

[8] Our list differs from that provided by Komm (2016, p. 18) largely because we only look at documents from the years 2013-2015. For example, during this period only 5 results from Czech authors were recorded in Scopus for the journal Interdisciplinary Toxicology, while in the previous three years 2010-2012 there were 22 such results. It is "safer" to use data from the most recent period, since journals' predator" status may change over time, as already discussed above.

of Science and have been assigned Article Influence Score (AIS) and Journal Impact Factor (IMP) with similarly impressive results. Frontiers in Plant Science achieved AIS of 1.302 and IMP of 4.495, which marks it in 15th place out of 209 journals in the "Plant Sciences" field. Frontiers in Microbiology has AIS of 1.393 and IMP of 4.165, placing it 23rd out of 123 Journals in the "Microbiology" field. Frontiers in Behavioral Neuroscience scores AIS of 1.179 and IMP of 3.392, ranking it in 6th place out of 51 journals in the "Behavioural Sciences" field. From the point of citation metrics, all three have managed to build up a rather sound reputation in their respective fields. Authors have to pay a rather lofty fee to publish in them, but similar amounts are charged for open-access by "standard" academic journals under the most respected publishing houses.

Jeffrey Beall has discussed the Frontiers publishing house on his blog a number of times (Beall 2013a, 2015, 2016ab). In August 2015 he wrote that "*the publisher Frontiers is not on my list, though I do regularly receive inquiries and complaints about it*", but by July 2016 he had reached the conclusion that "*Frontiers' peer review process is flawed. It is stacked in favor of accepting as many papers as possible in order to generate more revenue for the company. Frontiers is little more than a vanity press.*", and announced his decision to mark it as predatory.[9] Beall repeatedly pointed to reports about their lax approach to peer review and pressure on the editors to accept articles for publication. He aired the question: Why would anybody pay such publication fees, if there are so many other journals willing to publish a decent article for free?

Frontiers publishes 57 open-access journals, of which half are indexed in Scopus and a third in Web of Science. It does not look like a fraudulent publisher that would print anything for money. Not surprisingly, therefore, its inclusion on Beall's list triggered mixed reactions in the academic community, as vindicated by the follow-up discussions on his blog. Some welcomed his decision and contributed with their own bad experiences, while others reproached him for opposing the open-access publication model as such (Berger a Cirasella 2015, Crawford 2014b), for which there is indeed some evidence (Beall 2013b,). A note in the journal Nature reported that

[9]Frontiers is listed on the version of Beall's list that was used in this study, which was downloaded on 1st April 2016, so this publisher must have been added to the list at least several months before the cited blog post was published (Beall 2016b).

"*Critics spoke out against Beall's blacklisting of Frontiers, maintaining that the open-access publisher is legitimate and reputable and does offer proper peer review.*" and criticized the subjectivity of his list (Bloudoff-Indelicato 2015). The accusations that these journals are predatory therefore need to be taken with a pinch of salt.

Arguably, this is symptomatic of the previously mentioned limitation of Beall's list of publishers, in that some journals may unfairly be implicated as predatory, if the whole publishing house is added to the list. No matter how unlikely, it cannot be ruled out that individual journals may, thanks to the work of a sensible editor, not be fraudulent, if even if operating in an adverse context; there could be exceptions that prove the rule. Journals need to be evaluated with regards to the predatory practices one by one. Moreover, the fact that mistakes happen does not make the journal predatory in the true sense. Pointing fingers at a particular journal that does not rectify the problem promptly is fair, but implicating the entire fleet of journals under the same publisher is problematic. Unfortunately, many journals that are otherwise fine suffer from bad peer review and even plagiarism from time to time (Martin 2013). How many traditional journals that do not subscribe to the open-access model would need to be strictly speaking labelled predatory if they were judged according to the same criteria?

The *International Journal of Electrochemical Science* appears to be on the borderline between a second-rate journal and a truly predatory one. It is the most popular indexed journal on Beall's lists in the Czech Republic. It is indexed not only in Scopus, but also Web of Science, and has been so for some time. Most of its contributors come from China, Saudi Arabia, Egypt and other developing countries. Czech authors are the ninth most frequent. Komm (2016) cites Jeffrey Beall, according to which it has an unusually high rate of articles withdrawn due to earlier publication elsewhere, and is run by the same editor as numerous other suspect journals. Nevertheless, Komm (2016) also notes that reportedly the journal "*is of low quality, but does meet the criteria of predatory journals*". Münich (2016) is suspicious of this journal, pointing to the fact that the identity of its publisher is unclear, though, in a discussion on this blog a Czech member of its editorial board claims that it is not predatory.

The other journals really look strange. The *International Journal of Mathematical Models and Methods in Applied Sciences* and *WSEAS Transactions on Business and Economics* have surprisingly high share of authors from the Czech Republic, which is by far the most frequent country of origin. According to the journals' websites, editorial boards of both include academics from Czech universities. Furthermore, it is once again difficult to identify these journals' publisher, because on their websites there is no reference. Ulrichsweb reports that both journals are based in Greece, but this is difficult to believe. Greeks are not present in their editorial boards, nor are Greeks frequent contributors. Both journals' have identical publication fees and their websites use the very same templates. It well might be that these journals are more linked with the Czech Republic than Greece.

Another intriguing case is the journal *Actual Problems of Economics*. It is a local eastern European journal based in Ukraine, whence more than half of its contributors come from. In addition to English, the articles are also published in Russian and Ukrainian. Apart from Ukraine and the Czech Republic, its contributors originate most frequently from Kazakhstan, Russia, Poland, Serbia and Slovakia. Although Web of Science listed this journal only briefly in 2010 and 2011, Scopus indexes it to this day. Similarly, the journal *Advanced Science Letters* only managed to sneak into Web of Science in 2010, but apparently was then quickly purged out again. By contrast, it remains to be indexed in Scopus.

Finally, the predatory nature of the journal *Mediterranean Journal of Social Sciences* has been safely proven thanks to the provocation by Jan Švelch, Jaroslav Švelch and Tereza Krobová of the Faculty of Social Sciences, Charles University (iDnes 2016). They submitted to this journal a fake article, which deliberately contained numerous grammatical errors and was based on a non-existent scientific method. What is more, the text of the article even included the following sentence: "*This article was produced as an experiment intended to verify suspected unethical publishing practices of so-called predatory or junk journals*", which was one of a few sentences that did not contain any grammatical errors. Before long the editor confirmed that the article has been accepted for publication upon paying the publication fee.

It goes without saying that the five most suspect journals maintain a very low SJR index, which probably ranks them close to the bottom in their respective fields. It seems fair to question whether their peer review process complies with the standards and whether the authors, by paying for open access, are indeed not actually buying the right to publish as such. It is hard to understand why so many authors based in the Czech Republic would rush to publish in these journals, if not for squeezing "coffee-grinder" points out of thin air, which in turn grants them research funding that far exceeds the publication fees. It will be interesting to see how much the propensity of Czech authors to publish in these journals drops, after the "coffee grinder" system is abandoned.

Nevertheless, it is also fair to acknowledge that some journals on Beall's lists may not be any more problematic than journals of similarly low quality, if not equally predatory, published in the Czech Republic that are indexed in Scopus but financed by methods other than paid open-access. For example, rogue research institutions can use the "coffee grinder" money to finance journals, the primary objective of which is not to communicate research results but in turn to generate "coffee grinder" points for themselves. Scopus may find it difficult to tell the difference between genuine local journals and schemes like these. Arguably, the difference between low quality, irrelevant and fake research is often thin and hard to prove with the benefit of doubt, especially in social sciences and related disciplines. At the end of the day, it does not matter whether money earmarked for research is diverted using predatory journals or else. In any case that money is not being spent effectively.

**Table 1: Predatory journals in Scopus with the largest number of documents from the Czech Republic, 2013-2015**

| Journal | Beall's list | Country of publication | Author's publication fee | Scopus SJR (2015) | Web of Science AIS (2015) | Number of documents from the Czech Republic | % of predatory documents from the Czech Republic | % of authors from the Czech Republic in the journal's total |
|---|---|---|---|---|---|---|---|---|
| International Journal of Electrochemical Science | Standalone journals | Serbia | 500 EUR | 0.510 | 0.293 | 115 | 14.4% | 4.5% |
| International Journal of Mathematical Models and Methods in Applied Sciences | Publishers | Greece | 600 EUR* | 0.207 | .. | 78 | 9.8% | 32.8% |
| Actual Problems of Economics | Standalone journals | Ukraine | 100 – 300 USD | 0.124 | .. | 56 | 7.0% | 2.5% |
| WSEAS Transactions on Business and Economics | Publishers | Greece | 600 EUR* | 0.327 | .. | 39 | 4.9% | 28.5% |
| Frontiers in Plant Science | Publishers | Switzerland | 2,490 USD | 2.067 | 1.302 | 36 | 4.5% | 1.5% |
| Frontiers in Microbiology | Publishers | Switzerland | 2,490 USD | 1.970 | 1.393 | 23 | 2.9% | 1.0% |
| Advanced Science Letters | Publishers | USA | n.a. | 0.154 | .. | 22 | 2.8% | 1.0% |
| Frontiers in Behavioral Neuroscience | Publishers | Switzerland | 2,490 USD | 1.803 | 1.179 | 21 | 2.6% | 2.2% |
| Mediterranean Journal of Social Sciences | Publishers | Italy | 200 EUR | 0.174 | .. | 18 | 2.3% | 0.3% |

*) 600 EUR per article up to 10 pages and 50 EUR for every additional page..

*Source: Scopus (on 27th October 2016), Beall's lists (on 1st April 2016), authors' calculations.*

## Conclusions

Predatory publishing is on the rise. If we assume that the fee for open-access publication in a predatory journal is on average 500 USD, then the worldwide market for these "services" is already worth about 30 million USD per year, and that is if we only take into account documents recorded in Scopus. Its total value, including publications outside Scopus is no doubt several times larger. It is in line with the estimate made by Shen and Björk (2015) that the market in predatory journal publishing is worth 74 million USD, which however, was the case a couple of years ago. Unfortunately, this market has a great growth potential, because there does not seem to be a systematic effort to tackle the problem. In fact, quite the contrary appears to be the case. Beall's blog, the only comprehensive reference point, is down. At this point, nobody really knows how many fraudulent research journals lurk out there.

Predatory publishing undermines the credibility of academic research particularly in middle income countries in Asia and North Africa. What is most worrying is not necessarily the current level in most countries but the increasing trend, which if not reversed has a potential to turn predatory publishing into a truly potent disruptive force worldwide. Looking ahead, we must also be concerned in the Czech Republic. Even so, fears that this problem is serious appear for the time being to be exaggerated. Czech authors only publish a few hundred articles in the predatory journals indexed in Scopus each year, which is a tiny fraction of the country's total. Furthermore, these articles are strongly concentrated in a few journals, and so most likely come from a rather narrow circle of authors. To solve the problem to a great extent it might suffice to put an end to this publication practice in the few most badly affected workplaces.

Overall, it is also clear that Beall's lists must be taken with a pinch of salt. No doubt that predatory journals ready to print anything in return for a fee, of the type that Jeffrey Beall and others give as the anecdotal examples to make their point, do exist. It is a real problem, which must be stopped in tracks. Beall's lists provided an invaluable service in raising public awareness of this problem. Nevertheless, even a cursory look at the data for the Czech Republic demonstrates that on the basis of the list of publishers, in particular, journals may be implicated even though they are not in fact truly "predatory". At least indirectly, this is vindicated by the fact that

in journals found via the list of publishers are concentrated documents by authors from countries with the most advanced research systems, where fraudulent publications have little chance of fooling anybody.

Without further, more detailed analysis, we can only speculate as to what exactly explains the differences we have observed in the propensity to predatory publishing across countries. However, it should not come as a surprise if this is strongly associated with the way in which research is evaluated in each country, both on a national level in terms of the evaluation of research institutions and project proposals, and on an individual level when deciding on career progression, and consequently indeed the way in which public money for research is allocated. It is likely that the more primitive a system a given country has for evaluating research, and the more it relies only on counting publications, the better the conditions it provides for predatory journals. To pin down these factors is major challenge for further analytical work on this topic.

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Economics Institute of the Czech Academy of Sciences, 2017

ISBN 978-80-7344-407-5

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