Coverage of Business Administration Literature in Google Scholar: Analysis and Comparison with EconBiz, Scopus and Web of Science

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Abstract

Google Scholar is used for literature research as well as for evaluations of research performance. To establish Google Scholar's functional compliance, we generate a heuristic method and apply it to business relevant journals, namely those ascertained and rated in the German business journal ranking VHB-JOURQUAL2 by Schrader/Hennig-Thurau (2009). It is shown that Google Scholar primarily indexes international, i.e. English-language journals with a high rating grade; national language, here German-language literature, is hardly covered systematically. Furthermore, we compare these results with the business journal content of the German database EconBiz and the international databases Web of Science and Scopus. While Google Scholar is definitely competitive with Web of Science and Scopus for English-language literature, German-language literature is systematically covered by EconBiz, only. The comparison is additionally done for special business research fields. With regard to the journal coverage of some of these research areas, it becomes evident that the national database EconBiz even dominates the databases Scopus and Web of Science.

Keywords

Bibliometric Analyses, Google Scholar, Journal Rating, Literature Databases, Literature Researches, Performance Measurement, Scopus, VHB-JOURQUAL, Web of Science

JEL-classification

I23; L31; M19

Coverage of Business Administration Literature in Google Scholar: Analysis and Comparison with EconBiz, Scopus and Web of Science[1]

1 Introduction

Literature databases – in particular citation indexes – can basically be used in scientific analyses for two purposes: on the one hand, to find relevant, high quality articles on a specific research topic and, on the other hand, to evaluate the performance of researchers. Authors of bibliometric analyses of business researchers primarily make use of the literature database Web of Science (WoS) when undertaking their analyses (e.g. Sternberg/Litzenberg 2005, Dyckhoff/Schmitz 2007). Scopus – the rival database of the publishing company Elsevier – has so far only been used in a few studies (e.g. Jansen et al. 2007).

The utilization of these two databases is expensive. Since 2004, however, there has been a no-cost alternative: Google Scholar. According to Google (2011), "Scholar provides a simple way to broadly search for scholarly literature", and Google Scholar claims that "from one place, you can search across many disciplines and sources: articles, theses, books, abstracts and court opinions, from academic publishers, professional societies, online repositories, universities and other websites." The results of bibliometric analyses with Google Scholar show a high correlation with results of WoS data (e.g. Breuer 2009, Mingers/Lipitakis 2010). Thus, Google Scholar can be regarded as a costless alternative to WoS or Scopus.

An important criterion for the quality of a literature and citation database as a basis for re-

[1] A previous – with regard to the data presentation more detailed – version of this paper was published in SSRN under the same title. This version is available from the authors on request.

search evaluation is the degree of coverage of the relevant publication outlets. Hofmeister/Ursprung (2008: 256) point out that "a generally usable research indicator must aim at the assessment of total research output". If the analyses are carried out by means of databases, it is necessary to verify the databases' ability to generate total coverage. For instance, if renowned journals are missing in a database, research performance evaluations can be distorted to such an extent that the publication or citation performance of researchers or their superordinate institutions are systematically underrated. Particularly with regard to publication and citation analyses of business administration researchers, the question about the indexed content of the databases used usually remains unanswered. In this context, Ball/Tunger (2006: 293) recommend: „In future, people who generate bibliometric analyses must be able to justify why they chose to use one database and not the other."

These statements are also relevant for literature research as users should know whether the applied database actually completely covers the searched topic. The literature overview will be incomplete if relevant publications are missing in the database. This might even lead to the assumption of a supposed research gap, which is already closed in reality.

To evaluate the usability of a database, its literature content has to be checked. This information on literature content is relevant for researcher to decide in which journal to publish their research results, when knowing their research performance will be evaluated by a publication or citation analysis which is done with data of a certain database. Taking reference to Bakkalbasi et al.'s (2006) stating that the selection of a database for bibliometric analyses should depend on the particular research discipline, we asked from the specific viewpoint of business administration:

1. What is Google Scholar's quantitative and qualitative degree of coverage of business journals?

Google (2011) promotes its scholar-search engine via the slogan: "Google Scholar helps you find relevant work across the *world of scholarly research*". Therefore, it is to be asked, how well Google Scholar ascertains national publications. With regard to German-speaking business researchers, Breuer (2009: 5ff.) sees the particular advantage of Google Scholar vis à vis WoS or Scopus in its better coverage of journals in German. Dilger/Müller (2010) and Müller (2010) take these supposed advantages into account when generating rankings of German-speaking researchers in Business Administration and claim that "with Google Scholar we have a very comprehensive and high-performance database, which can be used for implementing citation based rankings". Hence, we have to find out:

2. How good is the coverage of national, and here especially German-language business journals by Google Scholar?

In order to be able to assess Google Scholar's coverage of business journals, a comparison with other literature and citation databases is reasonable. From an international point of view, the interdisciplinary databases WoS and Scopus seem particularly suitable. This becomes even more valid as these two databases take account of citations, too. Despite Dilger's (2000) appeal for a national citation database in Germany, there has been no German counterpart to Scopus or WoS until today. However, the meta literature database EconBiz seems to be an encouraging alternative (Albers 2009: 306f.), leading us to the following question:

3. What is the quantitative and qualitative degree of business journal coverage by Google Scholar in comparison with that of EconBiz, Scopus and WoS?

In order to answer all three research questions, the paper is organized as follows: Chapter 2 presents previous studies on Google Scholar's quantitative and qualitative coverage of business journals. In these studies, the evaluation is primarily implemented through a comparison of Google Scholar's contents with those of other literature and citation databases. However, as these databases also have their drawbacks, a more "objective" approach is adopted for our analyses (Chapter 3). Chapter 4 compares the resulting degree of journal coverage by Google Scholar with that by EconBiz, WoS and Scopus. Finally, Chapter 5 brings all our results together and identifies implications for the applicability of Google Scholar (and the other analyzed databases) for finding sources and for evaluating research from the viewpoint of business disciplines. The limitations resulting from the analyses are also discussed.

2 Analyses of Google Scholar's Content – State of the Art

Google Scholar is an academic search engine, which indexes the websites of universities and academicians as well as the contents of academic publishing companies. With the help of Google Scholar, academic material from various areas of scientific research can be found. Apart from articles in journals, also monographs, contributions in anthologies, working papers, degree theses and seminar papers are

indexed (Burright 2006). However, exact details of the spectrum of sources remain unknown as they are not made public by Google (Lewandowski 2005: 17 and Mayr/Walter 2007: 815). When a search is started with Google Scholar, a previously created Google database is analyzed. To create this database, Google Scholar – just like the original Google search engine – uses so-called web crawlers (Lewandowski 2005: 19). In order for web crawlers to be able to access websites which require a password, they need to have been granted access. Therefore, Google must enter into agreements with (academic) publishing companies and associations. In contrast to commercial literature databases inserting the data themselves, the internet-based web crawler method facilitates the compilation and updating of the database (Lewandowski 2005: 13).

Many scientific studies examined the publication and citation coverage of Google Scholar. However, we found only four studies taking explicitly business literature into account. On the right-hand side of Figure 1 these four studies are listed. Each of them is attributed to one of four principal possibilities for the generation of comparative data pools. Before the studies will be briefly presented below, we explain the four possibilities presented on the left-hand side of Figure 1.

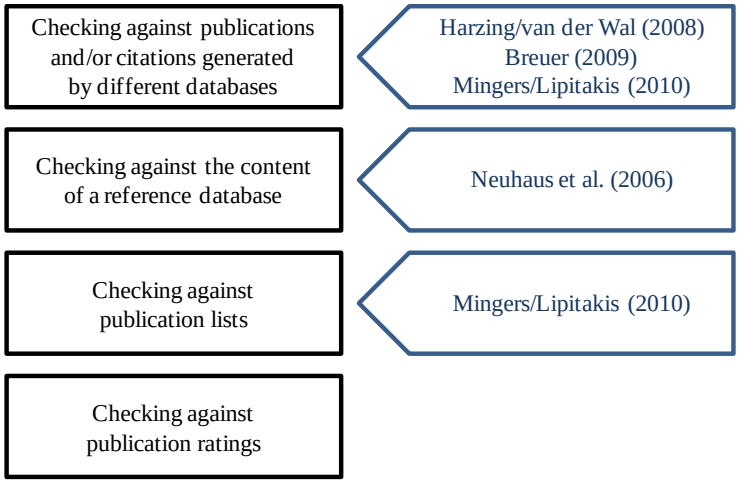

Figure 1: Possibilities to Create Comparable Data and their Application to Evaluate Google Scholar

The validity of a content study of databases depends on the quality of the data pool selected for comparison. On the one hand, there are studies in which the content of the selected databases is either compared to each other as a whole, or in terms of a specific subject area (e.g. Gavel/Iselid 2008 and López-Illescas/de Moya-Anegón/Moed 2008). Thereby, the articles and/or citations resulting from the inquiry made are usually juxtaposed, e.g. in an overlap analysis. In that way it is investigated, which contents are represented by all databases examined and which content is covered by one database exclusively. Such unique articles or unique citations are then subjected to deeper analyses. On the other hand, there are studies in which one database is set as a reference. The content of one or several databases examined is then aligned with the content of the reference database, for instance with regard to professional or linguistic structure (e.g. Meier/Conkling 2008 und de Moya-Anegón et al. 2007). In other studies, external publication data is processed, e.g. universities' or faculties' publications of a specific period (e.g. Vieira/Gomes 2009). It is subsequently examined, whether this external publication data can be found with the help of databases and – if applicable – which citation quantities are generated by the databases for these publications. In order to make additional quality statements on the content of literature and citation databases, publication ratings are used as a comparative data pool. Consequently, the quality of the database's content can be deduced from the quality of the publication media covered (Clermont/Schmitz 2008 and Clermont/Dyckhoff 2012).

Neuhaus et al. (2006) are one of the first researchers who analyzed Google Scholar's content. They check 50 randomly selected articles from one or several subject-specific reference databases against Google Scholar. Only one of 47 selected reference databases – ABI/INFORM Global – refers to the research area of business. The authors show that 26 of the 50 randomly selected articles in ABI/INFORM Global are found by Google Scholar.

Harzing/van der Wal (2008) compare for 20 management journals the 2002-2006 and the

2006 journal impact-factor released by WoS with the journal h-Index (Hirsch 2005), g-Index (Egghe 2006) and the indicator citations-per-paper, which were calculated with Google Scholar. They generate a journal ranking for each indicator mentioned above and analyze the resulting rank correlations. Especially the Google Scholar derived citations-per-paper metric shows a strong correlation with the journal impact-factor. However, also the h-Index and g-Index oriented rankings have high correlations with the journal impact-factor ranking. Subsequently, Harzing and van der Wal compare the citation indexes for seven international business journals. Only two of these journals are listed in WoS, though, constituting the reason why a rank correlation analysis is not suitable. Finally, they analyze the citations in WoS and Google Scholar for the Terry Book award winning books between 1991 and 2001. They find out that Google Scholar reports nearly 2.5 times as many citations for these books as WoS.

Similarly to Harzing and van der Wal, Breuer (2009) compares in a first step the impact-factor of 25 financial and 34 marketing as well as 23 general business administration journals, which results from the usage of Google Scholar and WoS. Breuer generates journal rankings for each of these three research fields. With regard to the three time periods regarded, high rank correlations appear. In a second step, Breuer determines Google Scholar's citation quantity of the most frequently cited business articles of German-speaking authors between 1990 and 2004, ascertained by WoS. The resulting correlation between the ranking of the WoS data and the Google Scholar data is also high. Finally, he compares the ranking of German-speaking business researchers. Thereto, he uses the ranking by Macharzina/Wolf/Rohn (2004), the Handelsblatt ranking of the 25 best business researchers and a list of the 25 most frequently cited business researchers in WoS, as declared by Schmitz (2008: 212). In all these cases only little rank correlations result.

Mingers and Lipitakis (2010) analyze the coverage of three British business schools' publications by utilizing both Google Scholar and the WoS. They collected the publications over the past 26-29 years from all these business schools' scientists. They identify 4600 publications, including 2070 journal articles. 66% of all publications can be found with Google Scholar. With respect to the journal articles, the coverage degree rises up to 89%. The authors show that the publications of 46 researchers of one specific business school are covered better by Google Scholar than by the WoS databases. The degree of article coverage for individual single researchers fluctuates between the two databases but is in favor of Google Scholar in every case.

The four studies presented show that although initial studies on Google Scholar's content of business publications exist, a comprehensive analysis from the perspective of German-speaking business administration has not yet been done. In this sense, the comparative database selected by Neuhaus et al. (2006) is published by an English company not focusing on the requirements of German-speaking business researchers. Furthermore, the selected sample of 50 articles is rather low and hardly significant. Harzing and van der Wal's (2008) as well as Mingers and Lipitakis' (2010) analyses are more suited for the evaluation of Google Scholar's usability – both with regard to its conception and the data pool created for comparison. However, the analyses focus on top management journals and British scientists or British business schools, respectively. An interesting study for the evaluation of Google Scholar's content from a German-speaking point of view is the one by Breuer (2009). Nevertheless, it remains unclear what reasons lie behind the different correlations produced. Is a better coverage by Google Scholar responsible for the correlation, entailing a better picture of the scientists' research performances? Or is the broader coverage of articles and citations only an effect based on Google Scholar's broader coverage of publication media in comparison to the WoS, indexing only scientific journals systematically? In this sense, it must also be questioned whether the two databases are at all comparable to each other, given their diverse evaluation policy goals or whether a restriction shall be made to the content analyses of journals, only.

It becomes obvious that none of the studies presented provides a satisfying answer to the three research questions posed in the introduction. Moreover, no publication rating has yet been used as comparative data pool for the analysis of Google Scholar's content so that it is impossible until today to make a statement about its content's quality. This is for the first time implemented in the present study, the methodology of which is drafted in the following Section 3.1.

3 Coverage of Business Journals

3.1 Methodology

To analyze Google Scholar's coverage of business journals, an overview of the relevant journals is necessary. From a German point of view, JOURQUAL2 – the second part of the official journal rating organized by the German

Academic Association for Business Research (VHB) – is predestined for this role (in the following cf. Schrader/Hennig-Thurau 2009) and delivers an acceptable measure of scientific journal quality (Eisend 2011). This journal rating is based on a survey carried out among the members of the VHB association. With support of the chairpersons of the scientific commissions of the VHB, 1633 journals were identified and attributed to scientific research fields. The members of the VHB were then asked for their opinion of the journals' scientific quality and the reviewing process applied by them. This resulted in 666 identified business journals, being apportioned to rating categories ranging from A+ down to E (A+ constituting the best rating; E the poorest). Due to this classification in rating categories, which can be seen as quality criteria, it will be possible to generate quantitative and qualitative statements about Google Scholar's journal content.

Further on, it is necessary to identify which of the JOURQUAL2 journals are actually listed in Google Scholar. Commercial databases usually publish corresponding lists stating which journals are currently utilized. Unfortunately, Google Scholar does not publish such information. A direct request for information was unsuccessful because according to Google, "details of the literature which we cover are – even if available – not going to provide guidance on how or when Google Scholar should be used." Due to Google Scholar's poor information policy, it was necessary for our analysis to apply a methodology different from that of comparing lists of journal coverage.

One solution is to determine whether the individual articles of all 666 business journals of JOURQUAL2 published over a specific time period are existent in Google Scholar. As long as the articles of a journal are found by Google Scholar, the journal may be regarded as being covered. To do that, we chose a heuristic method. For 2007, we determine the number of articles in a journal found by Google Scholar and compare this figure with the real number of a journal's published articles. Thus, we get a *degree of article coverage* by Google Scholar with regard to each journal, assuming that all articles from 2007 have been included in the literature database by now.

For 592 of the 666 JOURQUAL2 journals, information on the number of articles published in 2007 was obtained from the yearly content overviews given by the respective journals. These were either available online on the website of the respective publishing companies or they were obtained via the reference library of a university. 74 journals had to be omitted from the analysis because no overview of the yearly content was available.

We examined how many articles from 2007 were found by Google Scholar for each of the 592 journals mentioned above. Given the lack of structure and sorting possibilities, Google Scholar's result overview itself is unsuitable for our analysis. In this context, the program "Publish or Perish" (PoP) helps out. This program was developed by the academic Anne-Wil Harzing and is available free of charge from Tarma Software Research Pty Ltd.[2] It enables citation analyses of authors and journals as well as searches for specific articles (for details see Harzing 2010). PoP obtains the required datasets exclusively from Google Scholar. In our analysis, the "Journal Citation Analysis" mask was used for investigating the number of articles because it provides the possibility to directly work through the result summaries. For a more efficient search, the title of the journal was placed in inverted commas and the search date was limited to 2007. For longer titles, such as "Voluntas – International Journal of Voluntary and Nonprofit Organizations" or "Research Policy – A Journal Devoted to Research Policy Research Management", only the shorter main part of the title was typed in, e.g. "Voluntas" and "Research Policy". This is necessary as the full journal title is not always completely available in Google Scholar; with a search involving the full title, these articles cannot be found. In line with these searches, thirteen further journals (as mentioned above) had to be removed from the analysis. Their names are so common that Google Scholar shows over 1000 hits for each of them. Since Google Scholar only shows the first 1000 hits, there is no guarantee that all the relevant ones are actually found. Refining the search criteria does not help, because subsequently no hits having these criteria in their essay titles are shown. In order to avoid systematic errors, these journals were removed in advance. Table 1 shows the number of observed articles according to rating category and language.

[2] The software can be downloaded free of charge from http://www.harzing.com/pop.htm as a Windows, Linux or Mac OS X version.

Rating category	A+	A	B	C	D	E	Σ
English	13	48	139	159	88	21	468
German	-	-	6	10	29	66	111

Table 1: Number of observed JOURQUAL2 journals

3.2 Overview

With regard to the 579 journals analyzed, Google Scholar found 41360 articles. However, according to the publishing companies, a total of only 39523 articles actually does exist. There are two (systematic) reasons behind this phenomenon: On the one hand, Google Scholar shows numerous journals not corresponding to the journal in question although the search was implemented using inverted commas. For instance, the search for "Journal of Finance" leads to journals such as "International Research Journal of Finance and Economics" and "Japan Journal of Finance". To eliminate this error, the articles in PoP were sorted alphabetically according to the relevant journal name. Then all the non-relevant journals were removed by hand. The number of articles was thus reduced by approx. 35.5% to 26659. On the other hand, numerous articles are displayed more than once. It is not always possible to sift out these multiple showings. Frequently, the same author was listed with different article titles. As it is generally possible that authors publish more than one article in the same journal within one publication year, these articles cannot simply be removed. Accordingly, a removal was only carried out when dublicates of the article were ascertained. This was the case when an article was registered twice, for instance, once with and once without the subheading, such as "Banking deregulation and industry structure*: Evidence from the French Banking Reforms of 1985*" by Bertrand/Schoar/Thesmar. Similarly, hits with the same or similar titles to those by other authors were generated. In this case too, the titles could principally constitute a response or a commentary and therefore the articles were left in. There were also cases in which first and family names had been accidentally inverted: the first name was spelled in total and the surname was abbreviated. For instance, the article "A theory of friendly boards" is once mentioned with the authors' surnames "Ferrera" and "Adams" and once with the authors' first names "Daniel" and "Renee". As these – apart from the author names – correspond to an already counted article, such incorrect entries were eliminated. We similarly eliminated hits with missing article titles or when the title of the journal was taken for the title of the article. After clearing out multiple counts and hits involving missing titles, 23893 hits remained. This means that on average, a total of 57.8% of all articles of one publication year for the journals examined was found.

Figures 2 and 3 give an aggregate overview of the article coverage for the examined journals by Google Scholar, listed according to the JOURQUAL2 rating categories. The x-axis shows the real number of articles in a journal; the y-axis indicates the number of articles found by Google Scholar. The number of articles published by the publishing company and the number of articles found by Google Scholar match on the drawn intersection line. English-language journals are illustrated by means of rhombi and German-language journals by means of circles. A rhombus or circle above the intersection line means that more articles were found for this journal by Google Scholar than were actually published according to the publishing company. Correspondingly, rhombi or circles below the line signify that not all articles were found by Google Scholar. Journals for which Google Scholar lists no articles for 2007 are found exactly on the x-axis.

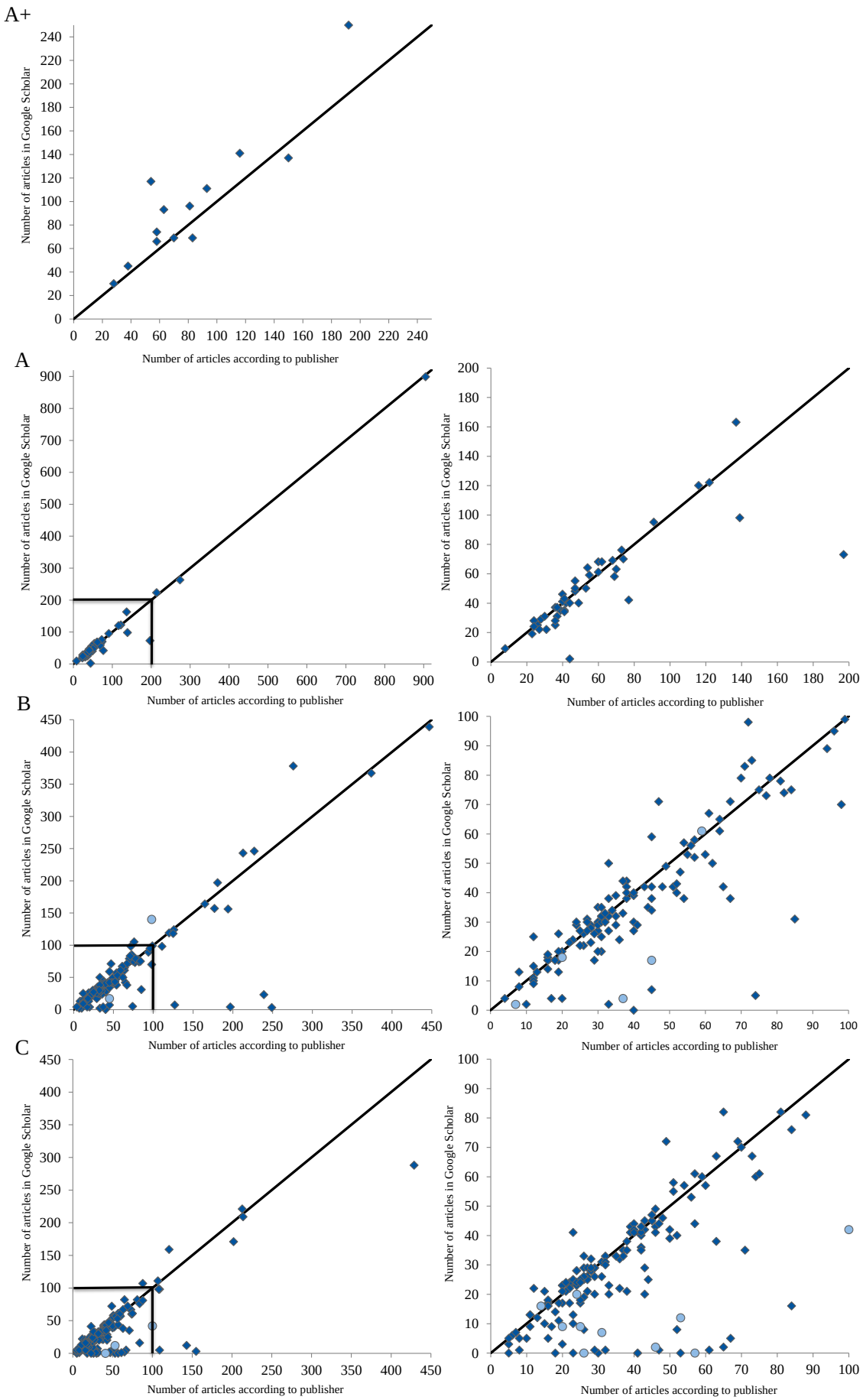

Figure 2: Article Coverage of the Rating Categories A+ to C

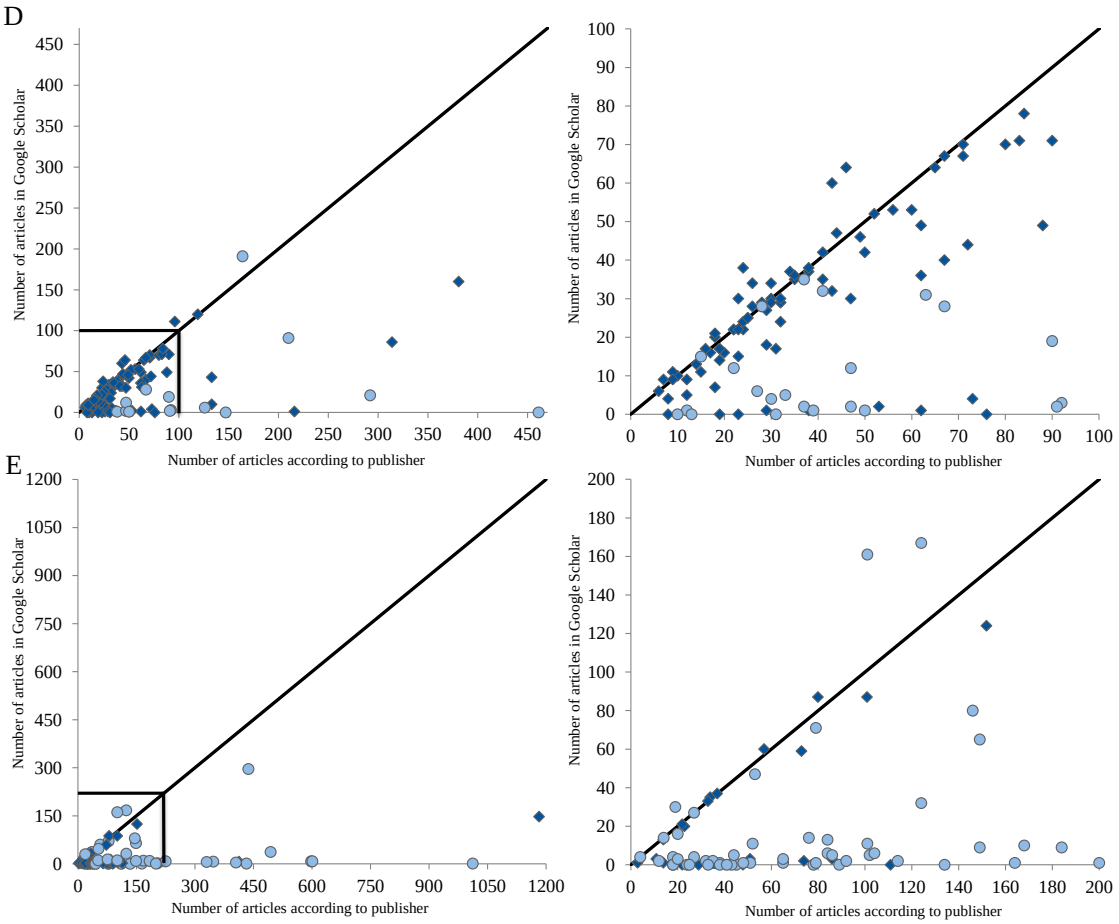

Figure 3: Article Coverage of the Rating Categories D and E

As the figures show, Google Scholar's coverage of the analyzed 579 business journals varies according to JOURQUAL2 rating category. Thus, for ten of the thirteen observed A+ journals, more articles were found than have actually been published. Similarly, in 25 of the 48 A journals, exactly 100% or over 100% of the articles are listed and for 32 journals, a degree of article coverage of at least 90% is achieved. These high degrees of coverage drop as the rating category gets lower. In particular, 25% of E-rated journals are not covered at all and 70% of them have a coverage of below 25%.

With regard to the evaluation strategy, we can acknowledge the claim by Lewandowski (2005) that Google Scholar covers mainly journals written in English. German-language business journals are – if at all – evaluated in a very non-systematic way. In this sense, articles in 69% of the German-language journals are either not covered at all (22%) or only up to a maximum of 25% (47%). Only 19 journals are evaluated to 80% or more. Only 19 of the 111 German-language journals are evaluated to 80% or more. Apart from this marginal coverage of German business journals by Google Scholar, it must also be examined to which degree they are relevant for or representative of German business literature with regard to literature searches or the measurement of research performance. For example, in the area of general business administration, the journals "Zeitschrift für betriebswirtschaftliche Forschung" and "Die Betriebswirtschaft" (rated as B and C, respectively) have coverage rates of 38% and 23%, respectively, and are only incompletely or sporadically evaluated. In contrast, (complete) evaluations of more practitioner-oriented journals such as "Die Bank" and "VDI-Zeitung" – both only E-rated by JOURQUAL2 – are less relevant for research.

It is astonishing that – despite the methodology adopted and described in Section 3.1 – for more than 26% of the journals, Google Scholar shows more articles than were – according to the publishing companies – actually published in 2007. On the one hand, this might be due to errors made in the gathering of our data. Since – as described above – no elimination of an article was implemented when an error of doubt was involved, it is possible that some articles have been counted more than once. On the other hand, Google might have attributed articles to journals which were not published in them, or the year of publication

was incorrectly allocated. A deeper look into these journals with article coverage of above 100%, leads to the assumption that journals with these degrees basically portend that all articles of this journal are listed in Google Scholar (although with incorrect data at some places). An exemplary analysis of all journals with degrees of article coverage of over 100% and an A+ or A rating confirms this assumption.

4 Comparison of Google Scholar's Content with National and International Databases

4.1 Choice of Databases for Comparison

With regard to international and – like Google Scholar – interdisciplinary orientated databases, Thomson Reuters hold a market dominating position with its WoS. Some authors (e.g. van Raan 2005: 54 and Weingart 2003: 8) characterized this position as a monopole. The WoS wants „[…] to provide comprehensive coverage of the world's most important journals for our subscribers' current awareness and information retrieval needs" (Garfield 1990: 186). In 2004 a publisher's consortium under Elsevier's leadership entered this database market with Scopus. The database publishers also want „[…] to cover relevant and high quality titles; not just any and all titles." Scopus' providers merchandise their product as an index, which offers „[…] broadest available coverage of scientific, technical, medical and social science literature" (Scopus 2006).

Given their interdisciplinary approach and coverage of citations, WoS and Scopus seem suitable for a comparison with Google Scholar. To ensure a comparison of the coverage of national journals by Google Scholar, we integrated a German database. The metadatabase EconBiz seems appropriate as it enables simultaneous access to several different German literature databases. Furthermore, the use of EconBiz is also free of charge. However, this database does not ascertain citations.

The WoS consists of four citation databases covering various subject-specific fields: Science Citation Index-Expanded (SCI-X), Social Sciences Citation Index (SSCI), Arts&Humanities Citation Index (A&HCI) and Conference Proceedings Citation Index (CPCI). Scopus is not subdivided into partial databases and is generally designed in an interdisciplinary manner. EconBiz is run by the German National Library of Economics (ZBW) in Kiel and the University and City-Library of Cologne (USB). When a search request in EconBiz is carried out, seven different databases are checked: Econis, USB Cologne, USB Volltexte (complete texts), RePec, Online Contents Wirtschaft (business), EconBiz Internetquellen (Internet sources) and the so called Veranstaltungskalender (event calendar). Contrary to WoS, not all of the integrated databases are issued by the EconBiz publishers. Since four of the mentioned databases do not index any journal articles, only those three subdatabases covering journal articles are integrated into our comparison. These three subdatabases are Econis, RePec and Online Contents Wirtschaft.

4.2 Methodology

In contrast to Google Scholar, obtaining its data from the WWW in an uncontrolled way, EconBiz, Scopus and the WoS evaluate selected journals directly, systematically, and independently. As EconBiz, Scopus and WoS know exactly which journals they cover in their databases, they make corresponding overviews available in form of lists. It can thus be assumed that all articles of these journals are included and that the degree of article coverage will be 100%. A direct comparison of the individual degrees of article coverage by Google Scholar with those of EconBiz, Scopus and WoS would consequently not lead to any new scientific revelation. Instead, we will compare the degrees of journal coverage of the individual rating categories of the JOURQUAL2 journals with each other.

In order to ensure – with reference to the previous findings on Google Scholar – an accurate comparison of the databases, the degree of article coverage at which a journal is regarded as being covered by Google Scholar must be defined. Of course it would be possible to only regard those journals as being covered for which 100% (or more) of the articles were found. Referring to the before-mentioned deliberations, the problems with (incomplete) datasets in Google Scholar, and the heuristic method used here, this sort of approach would presumably have a tendency to underestimate Google Scholar's journal coverage. However, a too strong reduction of the article coverage rate at which a journal should be regarded as "covered" would probably result in the actual coverage being overestimated.

In order to overcome these problems, three options are simultaneously investigated. First, only those journals are regarded as "covered" for which full or "over full" degrees of article coverage were found. Second, journals are also defined as "covered" if – in accordance with our heuristic – at least 90% of the articles were registered. Finally, also those journals

shall be included for which at least 80% of articles are covered.

4.3 Overview

Figure 4 shows the degrees of journal coverage for JOURQUAL2 rated journals – listed according to the rating categories – for EconBiz, Scopus and WoS in comparison with the three Google Scholar groups. Additionally, below the rating category, the respective number of analyzed journals is given. The orange colored parts of the bars visualize the share of German-language JOURQUAL2 journals in the respective databases according to rating categories.

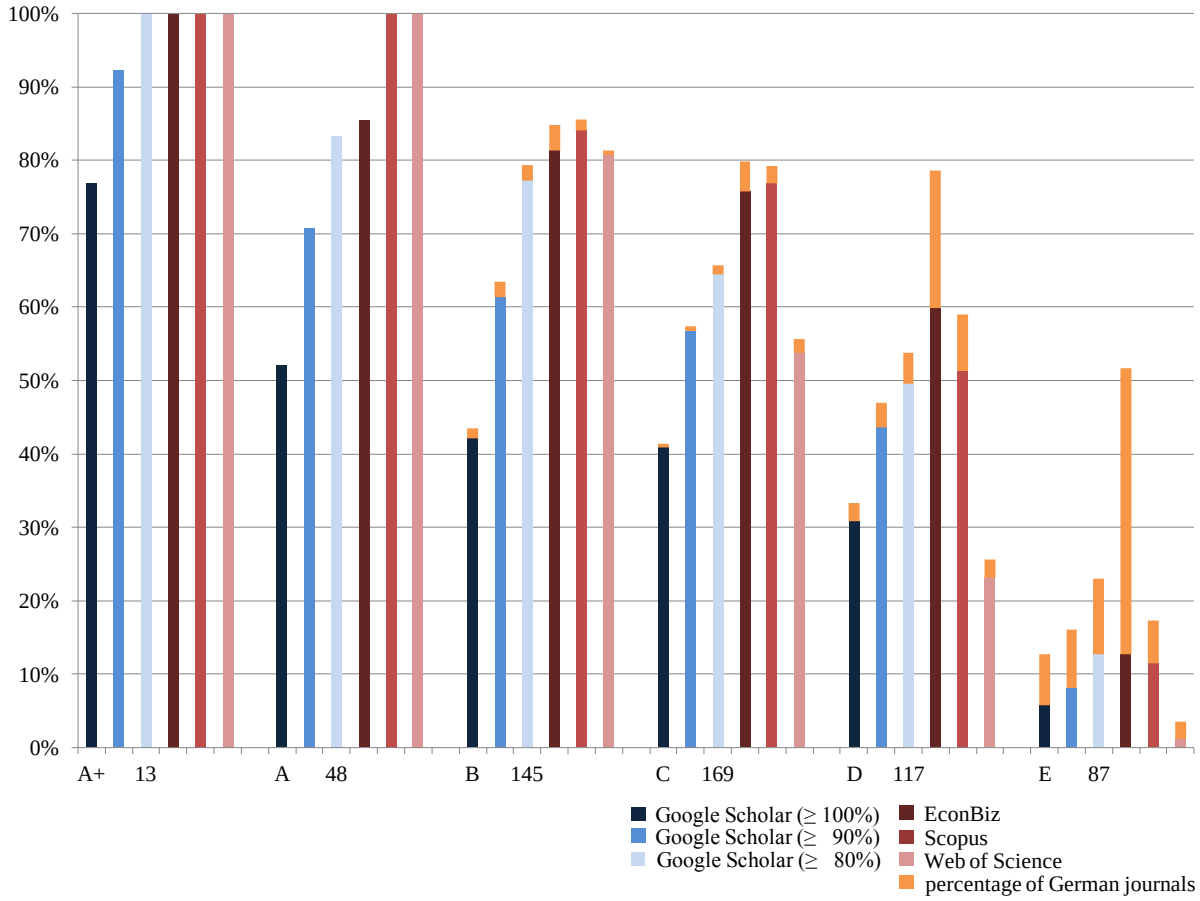

Figure 4: Coverage of Journals by Google Scholar, EconBiz, Scopus and WoS

It is shown that Scopus has an equally high or higher coverage of business journals than WoS in all categories. Only for the highest rated journals (A+ and A) do both databases evaluate all journals. In a direct comparison, Google Scholar rates more poorly than Scopus in almost all rating categories. Only when all journals are defined as "covered" with a degree of article coverage amounting to 80% and more, Google Scholar achieves greater coverage of E-rated journals than Scopus. However, the degrees of coverage by WoS for the C to E-rated journals lag behind those of Google Scholar, even when the 90% (C) respectively 100% (D and E) option is taken as a basis. For the top journals and those with a B rating, the WoS covers more business journals. In line with the expectations of a high coverage of German-language journals in EconBiz, this database performs particularly strong in direct comparison to the other databases reviewed. In the rating categories C and E for instance, EconBiz has the highest overall coverage. Also in category A+, all journals are indexed and in category B, EconBiz covers almost as many journals as Scopus. Only in category A, EconBiz performs considerably weaker than Scopus and WoS. As it will be seen later (Figures 5 and 6), this is mainly due to the weaker coverage of journals of other disciplines in the areas of *Business Informatics* and *Operations Research* (e.g. journals like "Applied Discrete Mathematics" are missing in EconBiz).

As a next step, it is interesting to identify the quantity of journals, which is exclusively evaluated by one database. In order to enable this, the four databases are juxtaposed. Thereby, a journal is regarded as covered by Google Scholar if at least 80% of its articles are found. The results are shown in Table 2, whereby category A+ is not included, since all four databases fully list the journals in this category

(see Figure 4). For example, the numbers (8, 23, 1, 0) in category D indicate that eight journals are exclusively covered by Google Scholar, 23 by EconBiz, one by Scopus and none by WoS.

Database	A	B	C	D	E
Google Scholar	0	0	0	8	4
EconBiz	0	3	12	23	31
Scopus	0	0	1	1	0
Web of Science	0	1	0	0	0

Table 2: Number of Exclusively Covered Journals

It can be seen that with regard to all rating categories, EconBiz exclusively evaluates more journals than Google Scholar, Scopus or WoS. This finding might, however, result from the fact that Google Scholar, Scopus and WoS jointly evaluate large quantities of the journals, and thus, given the parallel observation of all databases, their exclusive coverage is lower than EconBiz's. This is due to the fact that most of the exclusive journals in EconBiz are German-language publications, while the other three databases are specialized on English-language literature; consequently journals in German are lacking. Therefore, a comparison of all possible combinations is displayed in Table 3, i.e. comparisons of Google Scholar with EconBiz, Scopus and WoS, WoS with EconBiz and Scopus, as well as Scopus with WoS. Comparing, for instance, Google Scholar with EconBiz, five A-rated journals are only covered by Google Scholar, while six journals are only covered by EconBiz.

Database	A	B	C	D	E
Google Scholar	5	13	17	15	9
EconBiz	6	21	41	44	34
Google Scholar	**0**	11	10	16	8
Scopus	**8**	20	33	22	3
Google Scholar	**0**	19	46	43	18
Web of Science	**8**	22	29	10	1
EconBiz	**0**	16	25	32	35
Scopus	**7**	17	24	9	5
EconBiz	**0**	23	61	68	43
Web of Science	**7**	18	20	6	1
Scopus	0	13	43	41	13
Web of Science	0	7	3	2	1

Table 3: Number of Exclusively Covered Journals when Taking Two Databases Together

A direct comparison of Google Scholar with Scopus shows that with A to D-rated journals, the number of exclusively evaluated journals by Scopus is higher than that by Google Scholar; for the WoS, this only holds for A and B-rated journals. For the B to E journals the share of journals being exclusively covered by Google Scholar is considerably higher. A comparison of Google Scholar with EconBiz reveals that EconBiz exclusively covers more journals in all rating categories than Google Scholar. Also in direct comparison to Scopus and WoS, EconBiz covers more journals exclusively. However, there is also a high quantity of journals being covered exclusively by the other databases Google Scholar, Scopus or WoS, accordingly. The journals not being covered by EconBiz are mainly English-language publications. EconBiz's high count of additional journals in the categories C to E is mostly due to German-language journals. A domination of one database over another can only be found in four cases for the rating category A (marked in bold in Table 3). We consider one database dominating another when all journals of the second database are also covered by the first and at least one journal is covered exclusively.

4.4 Comparison for Business Research Fields

A characteristic of the discipline "Business Administration" is the broad range of specialized fields (or areas) which it embraces. For most of these, there are numerous relevant journals with articles primarily dealing with the specialized areas' questions. As business

economists usually specialize in individual research fields, it is crucial to know – in order for their research publication performance to be comprehensively evaluated and also for the relevant literature to be found – to what extent a database like Google Scholar lists the various specialized areas.

To answer this question, one possibility is to analyze the 26 sub rankings of different business fields in JOURQUAL2. The number of evaluated journals varies considerably between these research fields. The fewer the number of journals listed for a research field, the more significant are missing articles in a database. For example, a missing article can be a problem during a literature study if an important contribution to the research question was made by precisely this missing article. To generate significant results, we excluded those 15 research fields for which less than 20 journals were integrated. Analogous to Figure 4, Figures 5 and 6 show the degrees of journal coverage by the individual databases for these eleven observed research fields, listed according to rating category. The respective number of analyzed journals for each research field is given below the rating category. For the sake of clarity, we do not differentiate between English- and German-language journals.

The Figures show that EconBiz has the highest degree of journal coverage in five of all research fields examined, namely *Accounting & Controlling*, *Entrepreneurship*, *Finance & Banking*, *General Business Administration* and *Technology and Innovation Management*. Taking only categories A+ to C into account, this statement is valid for the database Scopus concerning the research fields *Business Informatics*, *Operations Management* and *Personnel & Organization*. Regarding *Operations Research*, the highest degrees of journal coverage in the categories A+ to C are achieved by Scopus as well as by WoS. All journals in the categories A+ to B are covered by both databases. Even though Google Scholar's degrees of journal coverage are – depending on the respective research field – generally good, they are inferior to those of EconBiz and Scopus.

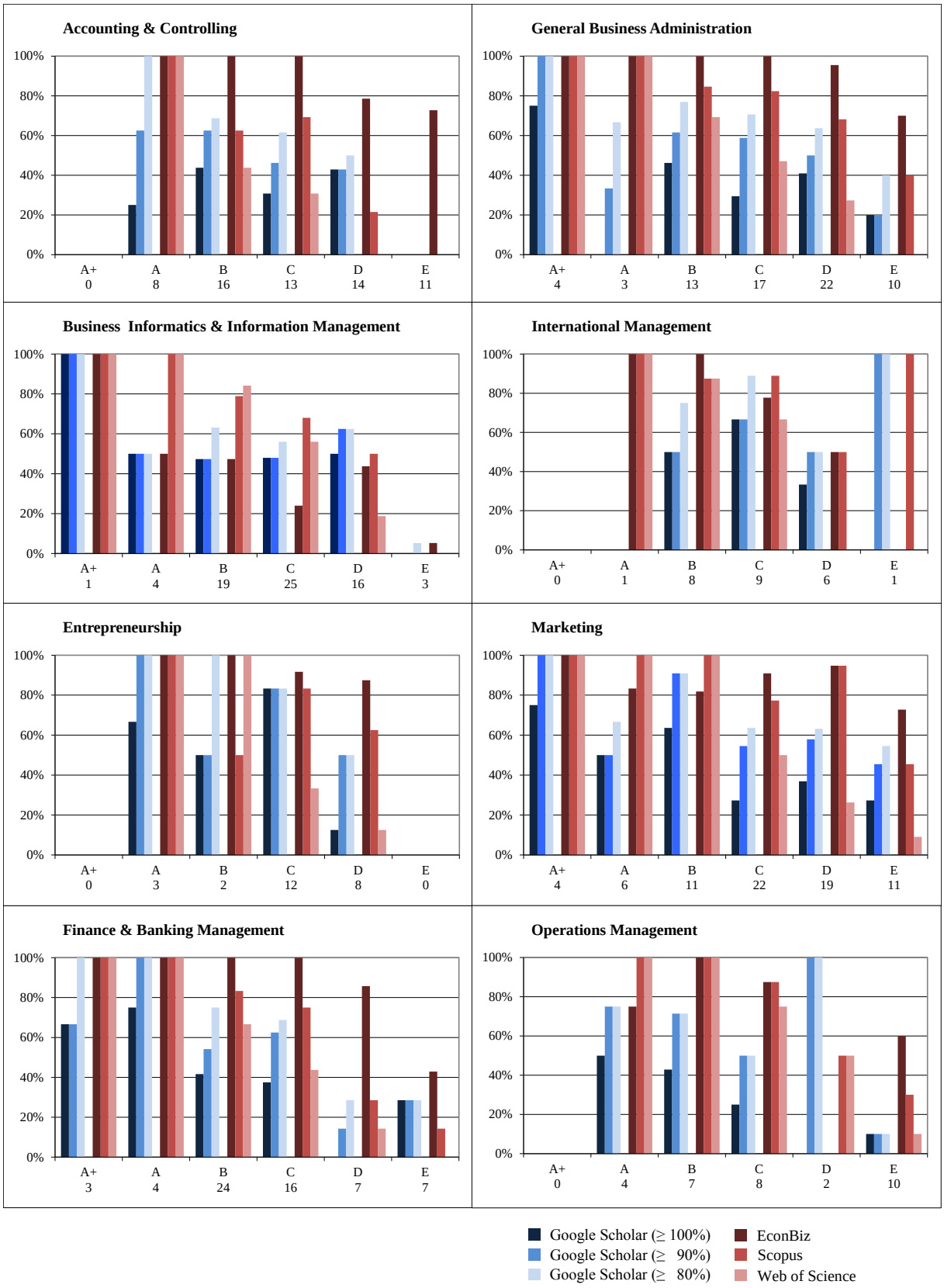

Figure 5: Journal Coverage per Database and Research Field (1/2)

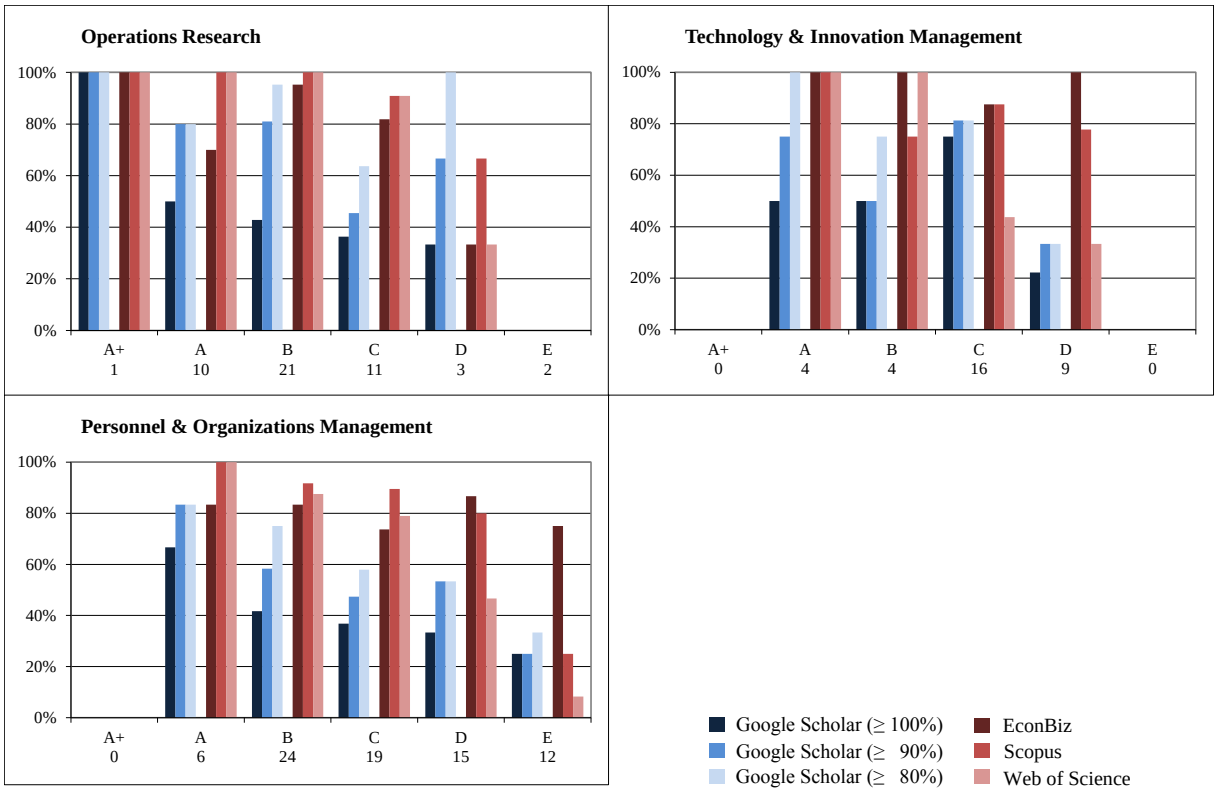

Figure 6: Journal Coverage per Database and Research Field (2/2)

Table 4 shows how many journals are exclusively evaluated by a database in each research field for each rating category. A pair-wise comparison is implemented, i.e. Google Scholar (GS in Table 4) with EconBiz, Scopus and WoS; EconBiz with Scopus and Wos as well as Scopus with WoS. Again, those journals with regard to Google Scholar are examined for which at least 80% of the articles were found. On account of the complete coverage of A+ journals by all four databases, once more no details are provided here.

The first number in the pair-wise comparison for a research field and rating category is the number of journals for this research field and this rating category which is exclusively covered by the first named database. The second number is the number of exclusively covered journals of the second named database. In this sense, in the research field *Marketing* in the rating category C, one journal is only listed in Google Scholar and four only in Scopus when these two databases are compared.

All positions in which one database dominates the other one are marked in bold. Particularly in the top categories, we see a dominance by Scopus. A "real" dominance in the sense of one database having an advantage in a complete research field is only observable when comparing EconBiz with Scopus or WoS or when comparing Scopus with the WoS (the dominant database is then underlined). With regard to EconBiz, this is the case for the business research fields of *Accounting & Controlling*, *Entrepreneurship*, *Finance & Banking* and *General Business Administration*. Scopus dominates the WoS-databases for the research fields *International Management*, *Operations Management*, *Operations Research* and *Personnel & Organization*.

	A	B	C	D	E
Accounting & Controlling					
GS / EconBiz	0 / 0	**0 / 5**	**0 / 5**	3 / 7	**0 / 8**
GS / Scopus	0 / 0	4 / 3	3 / 4	5 / 1	0 / 0
GS / WoS	0 / 0	7 / 3	5 / 1	**7 / 0**	0 / 0
EconBiz / Scopus	0 / 0	**6 / 0**	**4 / 0**	**8 / 0**	**8 / 0**
EconBiz / WoS	0 / 0	**9 / 0**	**9 / 0**	**11 / 0**	**8 / 0**
Scopus / WoS	0 / 0	4 / 1	**5 / 0**	**3 / 0**	0 / 0
Business Informatics & Information Management					
GS / EconBiz	1 / 1	5 / 2	9 / 1	7 / 4	1 / 1
GS / Scopus	**0 / 2**	1 / 4	**0 / 3**	4 / 2	**1 / 0**
GS / WoS	**0 / 2**	1 / 5	3 / 3	8 / 1	**1 / 0**
EconBiz / Scopus	**0 / 2**	1 / 7	1 / 12	3 / 4	**1 / 0**
EconBiz / WoS	**0 / 2**	1 / 8	2 / 10	6 / 2	**1 / 0**
Scopus / WoS	0 / 0	**0 / 1**	4 / 1	**5 / 0**	0 / 0
Entrepreneurship					
GS / EconBiz	0 / 0	0 / 0	1 / 2	**0 / 3**	-
GS / Scopus	0 / 0	**1 / 0**	1 / 1	1 / 2	-
GS / WoS	0 / 0	0 / 0	7 / 1	4 / 1	-
EconBiz / Scopus	0 / 0	**1 / 0**	2 / 1	**2 / 0**	-
EconBiz / WoS	0 / 0	0 / 0	**7 / 0**	**6 / 0**	-
Scopus / WoS	0 / 0	**0 / 1**	**6 / 0**	**4 / 0**	-
Finance & Banking Management					
GS / EconBiz	0 / 0	**0 / 6**	**0 / 5**	1 / 5	**0 / 1**
GS / Scopus	0 / 0	2 / 4	3 / 4	1 / 1	**1 / 0**
GS / WoS	0 / 0	7 / 5	7 / 3	**1 / 0**	**2 / 0**
EconBiz / Scopus	0 / 0	**4 / 0**	**4 / 0**	**4 / 0**	**2 / 0**
EconBiz / WoS	0 / 0	**8 / 0**	**9 / 0**	**5 / 0**	**3 / 0**
Scopus / WoS	0 / 0	7 / 3	**5 / 0**	**1 / 0**	**1 / 0**
General Business Administration					
GS / EconBiz	**0 / 1**	**0 / 3**	**0 / 5**	1 / 8	2 / 5
GS / Scopus	**0 / 1**	**0 / 1**	**0 / 2**	1 / 2	1 / 1
GS / WoS	**0 / 1**	2 / 1	7 / 3	9 / 1	**4 / 0**
EconBiz / Scopus	0 / 0	**2 / 0**	**3 / 0**	7 / 1	4 / 1
EconBiz / WoS	0 / 0	**4 / 0**	**9 / 0**	**15 / 0**	**7 / 0**
Scopus / WoS	0 / 0	**2 / 0**	7 / 1	**9 / 0**	**4 / 0**
International Management					
GS / EconBiz	**0 / 1**	**0 / 2**	**1 / 0**	1 / 1	**1 / 0**
GS / Scopus	**0 / 1**	1 / 2	0 / 0	1 / 1	0 / 0
GS / WoS	**0 / 1**	1 / 2	**2 / 0**	**3 / 0**	**1 / 0**
EconBiz / Scopus	0 / 0	**1 / 0**	**0 / 1**	0 / 0	**0 / 1**
EconBiz / WoS	0 / 0	**1 / 0**	2 / 1	**3 / 0**	0 / 0
Scopus / WoS	0 / 0	0 / 0	**2 / 0**	**3 / 0**	**1 / 0**

	A	B	C	D	E
Marketing					
GS / EconBiz	1 / 2	2 / 1	**0 / 6**	**0 / 6**	1 / 3
GS / Scopus	**0 / 2**	**0 / 1**	1 / 4	**0 / 6**	**1 / 0**
GS / WoS	**0 / 2**	**0 / 1**	5 / 2	8 / 1	**5 / 0**
EconBiz / Scopus	**0 / 1**	**0 / 2**	**3 / 0**	0 / 0	4 / 1
EconBiz / WoS	**0 / 1**	**0 / 2**	**9 / 0**	**13 / 0**	**7 / 0**
Scopus / WoS	0 / 0	0 / 0	**6 / 0**	**13 / 0**	5 / 1
Operations Management					
GS / EconBiz	1 / 1	**0 / 2**	**0 / 3**	**2 / 0**	1 / 6
GS / Scopus	**0 / 1**	**0 / 2**	**0 / 3**	**1 / 0**	**0 / 2**
GS / WoS	**0 / 1**	**0 / 2**	1 / 3	**1 / 0**	1 / 1
EconBiz / Scopus	**0 / 1**	0 / 0	1 / 1	**0 / 1**	4 / 1
EconBiz / WoS	**0 / 1**	0 / 0	2 / 1	**0 / 1**	**5 / 0**
Scopus / WoS	0 / 0	0 / 0	**1 / 0**	0 / 0	**2 / 0**
Operations Research					
GS / EconBiz	2 / 1	1 / 1	1 / 3	**2 / 0**	0 / 0
GS / Scopus	**0 / 2**	**0 / 1**	**0 / 3**	**1 / 0**	0 / 0
GS / WoS	**0 / 2**	**0 / 1**	**0 / 3**	**2 / 0**	0 / 0
EconBiz / Scopus	**0 / 3**	**0 / 1**	1 / 2	1 / 2	0 / 0
EconBiz / WoS	**0 / 3**	**0 / 1**	1 / 2	1 / 1	0 / 0
Scopus / WoS	0 / 0	0 / 0	0 / 0	**1 / 0**	0 / 0
Personnel & Organizations Management					
GS / EconBiz	1 / 1	1 / 3	3 / 6	2 / 7	1 / 6
GS / Scopus	**0 / 1**	**0 / 4**	**0 / 6**	1 / 5	**1 / 0**
GS / WoS	**0 / 1**	1 / 4	2 / 6	5 / 4	**3 / 0**
EconBiz / Scopus	**0 / 1**	**0 / 2**	2 / 5	3 / 2	7 / 1
EconBiz / WoS	**0 / 1**	1 / 2	4 / 5	8 / 2	9 / 1
Scopus / WoS	0 / 0	**1 / 0**	**2 / 0**	**5 / 0**	**2 / 0**
Technology & Innovation Management					
GS / EconBiz	0 / 0	**0 / 1**	1 / 2	**0 / 6**	-
GS / Scopus	0 / 0	1 / 1	2 / 3	1 / 5	-
GS / WoS	0 / 0	**0 / 1**	9 / 3	2 / 2	-
EconBiz / Scopus	0 / 0	**1 / 0**	2 / 2	**2 / 0**	-
EconBiz / WoS	0 / 0	0 / 0	8 / 1	**6 / 0**	-
Scopus / WoS	0 / 0	**0 / 1**	**7 / 0**	**4 / 0**	-

Table 4: Number of Exclusively Listed Journals According to Research Fields

5 Implications, Limitations and Outlook

5.1 Implications for Literature Research and Performance Measurement

On grounds of the attribution problem and the partly sporadic and unsystematic coverage of business journals, there are different effects on Google Scholar's functional compliance as a literature database. Literature researches are usually not implemented by an automated process. Depending on the strategy used, relevant and current articles are searched for a particular topic in order to establish this topic's state-of-the-art. Then, a researcher can correspondingly integrate his or her own research work or ideas. Researchers (and students) are more or less compelled to analyze the literature they find with regard to its topical content. This is done in a first step by a brief review or a look at the introduction or abstract. If the article is deemed relevant, the article – in parts or as a whole – is studied intensively. Incorrect attributions are then easily noticed by the reader, and corrected. However, it is much more user-friendly to rely on the correctness of the generated datasets directly.

Arguments often mentioned in favor of Google Scholar are its free usage and the increasing coverage enabled through the inclusion of further publication media like e.g. monographs and articles in anthologies or conference proceedings. These advantages do not support the utilization of the international databases

Scopus or WoS[3] but are completely valid for the usage of EconBiz: it is likewise free of charge and it contains sub-databases covering also other publication media than journal articles only. Due to these advantages and the high degrees of business journals' coverage identified by us, particularly concerning German-language journal articles, EconBiz is preferable to the other databases. However, due to EconBiz's weak coverage of journals in mathematics and computer sciences, it is rather recommended using one of the other databases to investigate research fields like *Business Information* or *Operations Research*.

Furthermore, it must be restrictively mentioned that EconBiz does not collect any citations. This means that the implementation of all possible literature research strategies is not feasible. If such strategies are to be executed, a different citation database needs to be considered. Preferably, this should be Google Scholar or Scopus given their higher degrees of coverage. In this case, the arguments mentioned above may be the crucial factor for choosing Google Scholar.

The manual process of a literature research is different from the standardized and mainly automated analyses for ascertaining the publishing performance of academics. Such analyses usually have the objective of assessing academics directly, or the departments or universities for which they work, and of ranking them. To this end, the amount of academic publications is established and/or the number of times a publication is cited. In publication analyses the quantity of essays issued by an academic is counted. By using PoP and not Google Scholar's search mask on its homepage, duplications can be easily identified and eliminated. This sort of error can also be avoided by the contributing researchers being allowed to access the datasets that are created with a database and commenting on them or correcting mistakes or adding missing articles. If an (independent) database is further maintained by the contributing researchers, it is – from the viewpoint of this particular group – a vast improvement over any other literature database.

While publication analyses can principally be carried out on the basis of manual surveys – e.g. by referring to publication lists released –, citation analyses are only feasible with the help of databases. Probably it is impossible for any researcher to tell who has cited his or her works in own papers. This is why citation databases are so-called credence goods: the user has to trust that the generated data is correct. Only trust in this data can establish the acceptance necessary for such a performance measurement. Such acceptance is particularly obtained through the generated datasets' transparency. The transparency process implemented by both commercial citation database providers Thomson Reuters (WoS) and Elsevier (Scopus) is unfortunately non-existent with Google Scholar. The commercial databases only use citations from well-known and evaluated specialized journals. With Google Scholar, principally all citations from any available online sources can be used, which means that the quality of the citation data is doubtful. Furthermore, missing articles from individual journals, incorrect or missing data attribution and existing duplicates lead to distortions in citation analyses. Consequently, a citation analysis of individual researchers with Google Scholar may be problematic: not because of Google Scholar's content but rather because of the data's generation process. Google Scholar's ascertainment errors or inaccuracies must be particularly taken into account with regard to the evaluation of few articles or individual researchers. When a larger quantity of articles is regarded – for instance, when evaluating faculties, special research fields or whole journals – it may be possible that random faults or inaccuracies are balanced out, providing such analyses with validity in terms of statistical ratios. However, attention should be paid to systematic contortions in evaluations, like Google Scholar's lack of coverage of German-language sources.

5.2 Limitations and Outlook

The present analysis shall contribute to an objectification of controversies existent with regard to performance analyses of business researchers carried out on the basis of databases. It shall raise the awareness of certain limitations for any analysis choosing a specific database, here Google Scholar (and PoP as user interface) in particular, for the implementation of a research performance analysis. However, there are also some limitations with regard to our own analysis resulting from the study's conception:

Snapshot

The details provided here only constitute a "snapshot", since the crawler technique means that new articles can be incorporated into the Google Scholar database at any time. A test showed, however, that the number of articles had remained stable (at least relatively) when 20 randomly selected journals were re-analyzed. This can be explained by the decision to examine articles from the publication

[3] However, in November 2011 Thomson Reuters launched a new citation database in the WoS, which indexes monographs and their citations.

year 2007, as all articles for 2007 should already be covered in our analysis. This argumentation is only valid for journals the publishing company's websites of which are systematically searched by Google Scholar, though. For those journals which are not systematically searched, and for which only few articles were found, the number of articles can vary greatly. This is the case when such an article was cited and this citation was found by a crawler and placed into the database in January 2012, for instance.

Application of a heuristic research design

The validity of the analysis is also limited by the fact that – on account of the enormous amount of data collection involved – a heuristic was used for ascertaining the rate of coverage of articles. Apart from the basic problem that not each individual article was looked at and the coverage rate can thus result from incorrect attribution, it cannot be assumed that these coverage rates would also be valid for an analysis of the publication year 2008 or 2009. However, with coverage rates of 100% or more, it can be concluded that the Google Scholar crawlers have access to the publishing companies websites and that, consequently, a systematic evaluation has taken place. Nevertheless, it seems appropriate to validate our study design by the implementation of a statistical analysis – especially with regard to an advanced application of our method in other scientific disciplines. For instance, the degrees of article coverage could be ascertained for a representative sample for several years to draw corresponding statistical conclusions about the method's consistence.

JOURQUAL as a standard for comparison

The usage of a journal rating as a standard for comparison has indeed the benefits already described but, admittedly, the JOURQUAL is not the only one of its kind. Therefore – in spite of the correlations found by Eisend 2011 – it is questionable whether the generated conclusions and implications also apply when another (business oriented) journal rating or a ranking is chosen. Furthermore, there are special journal ratings for specifically selected business research fields. In this sense, there is a rating of journals from the research field *Sport Management* published by Woratschek/Schafmeister/Schymetziki (2009). The extent of the involved literature and citation databases' coverage of journals from such detailed subratings of business research fields thus still remains to be analyzed. The inclusion of an international point of view – like the meta-ranking by Mingers/Harzing (2007) – can also lead to better transparency about the database's qualitative and subject-specific content (see Clermont/Schmitz 2008).

JOURQUAL's thematic structure also constitutes a problem with regard to the database's business content analysis as it also lists and evaluates journals not focusing on business administration. Therefore, it is doubtful whether e.g. A-journals missing in EconBiz while actually mostly focusing on other disciplines really represent a deficit in EconBiz's business journal coverage. The lack could also be interpreted insofar that EconBiz fulfills its envisaged purpose, namely to index business administration (and other economic) journals and that the coverage of such (e.g. mathematical, engineering or psychological) journals is consequently omitted deliberately.

Concentration on journal articles

Business researchers use different media to publish their research results. In our analysis, only journal articles were regarded. In spite of the fact that business administration journals are respected as the main medium for the publication of research results, such results are also published in the form of monographs or articles in – usually thematic – anthologies. New research results are mainly found in working papers, which are accessible on homepages or on special portals like the „Social Science Research Network (SSRN)".

Such publication media are covered by Google Scholar and EconBiz in particular. However, a corresponding content analysis has not yet been carried out. Concerning Google Scholar, for instance, it is to clarify to which extent students' academic works – like bachelor or master theses – are covered as a citation source. In this context, it still needs to be defined whether the coverage of such sources constitutes an advantage or a drawback. On the one hand, the citation of a scientific article in a bachelor or master thesis shows proof of the student's appreciation. On the other hand, there is the possibility that bias result as a consequence from the student citing many works by his or her thesis adviser.

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