Bibliometric Study of FWF Austrian Science Fund 2001-2010/11

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Executive summary

In this report we present the main results of a bibliometric study for the FWF Austrian Science Fund. The *Fonds zur Förderung der wissenschaftlichen Forschung* - the Austrian Science Fund (FWF) is Austria's central funding organization for basic research. The scientific output supported by the FWF Austrian Science Fund is analyzed on the basis of journal publications, its distribution over fields of science, and scientific cooperation. The main focus of this study is on the research publications in international, refereed journal publications, covered by the Web of Science (WoS).

The bibliometric indicators used in this study are state of the art and built on the research experience of the Center for Science and Technology Studies (CWTS).

Data collection

This study is based on the bibliographic multidisciplinary database Web of Science (WoS) of Thomson Reuters. The quantitative scores presented are the result of the application of advanced bibliometric techniques on the in-house CWTS data-system covering the period 2001 to 2010. In the studies of CWTS, only articles, letters and reviews are used as types of documents. We exclude meeting abstracts and editorials, due to the rather heterogeneous nature and contents of these types of publication.

The data collection for the study has been based on an authorized input list of publications from FWF itself. An advanced computer algorithm has been used for matching FWF records with WoS records resulting in 13,773 unique FWF-funded publications finally matched in the database.

OECD classification

For this bibliometric study of the FWF funded output a disciplinary scheme based on the OECD classification (with some minor differences) has been applied. This classification of the OCED is based on the re-classification of the different JCR subject categories in which the journals covered by WoS are classified, and which is currently available at CWTS.

Indicators and benchmark analysis

A standard set of basic bibliometric has been calculated for the analysis of the FWF funded output, including bibliometric indicators on production, impact, field-normalized impact, journal-normalized impact, frequently cited publications, scientific collaboration, etc.

Also a large body of publication data has been also collected for a number of benchmark countries: Austria (as a whole and without the output funded by FWF), Switzerland, the Netherlands, Sweden, Denmark, Finland, USA, Germany and the United Kingdom. For all these countries, their production (limited to the same OECD fields as for FWF) has been collected and used as a benchmark in several of the analyses carried out in the study.

Main results

CWTS calculated the internal and external coverage of the FWF output. The internal coverage is the share of cited references from FWF that are also covered in the WoS, while the external coverage is the share of publications included in the FWF authorized list that were matched in the WoS. These two coverage measures indicate how suitable are the bibliometric study for the proper analysis of the FWF output. The higher the two coverage values the better the suitability of the bibliometric study for assessment and analytical purposes. In this case, the external/internal coverage analyses of the FWF funded output (81% external coverage, 84% internal coverage) indicate that the current bibliometric study is relevant and valid to extract robust conclusions for the FWF.

The total output of FWF as a whole (considering the different weighting given to letters in our analysis) is composed by 13,720.5 publications in the period 2001-2010, which get cited 296,806.5 times in total over the period of time 2001-2011, including self-citations. An average publication funded by the FWF receives 21.6 citations, and eliminating self-citations this value is 16.4.

The overall field-normalized impact of the FWF is 1.35. This means that the publications by the FWF receive on average 35% more citations that an average paper at the international level normalizing by their discipline. The researchers funded by

FWF Austrian Science Fund also tend to publish in journals that have an impact well above the international field impact level (as MNJS is 1.28), this meaning that the researchers funded by the FWF publish in journals that have 28% more scientific impact than the average journals in their different disciplines. This means that the overall impact of FWF funded publications and their journals are both well above the international level.

Trend analyses show that FWF funded research output amounts on average well over 1000 papers per year, although this average has slightly decreased in the last years. Reasons for this decrease can be the delay in the publication (and incorporation into the database) of publications linked to the most recent projects funded by FWF. The average impact of the FWF output shows an increasing pattern over time. The field-normalized impact (MNCS) score is stable in the high level, although a slight decrease is observed in the last years, whereas at the same time the impact level of the publication journals remains at the same international high level.

OECD disciplines analysis

There are some differences by production levels across disciplines, with fields such as *Physical sciences* (30%) and *Chemical sciences* (16%) that concentrate an important share of the FWF supported production. Other fields where the FWF has supported a substantial amount of publications are *Biochemistry & Molecular Biology* or *Engineering and Technology* among others.

In any case, all the OECD fields covered by FWF present high levels of scientific performance (field-normalized impact values higher than 1 in all the cases), being the lowest values for the fields *Economics and Business* and *Other social sciences* that are also the fields with the lowest internal coverage and thus worst represented by this bibliometric study.

Benchmark with other countries

The benchmark analysis of FWF funded output shows that FWF supports 14% of the Austrian WoS-covered scientific production (excluding humanities fields), while the FWF output receives 20% of Austrian citations, thus showing the strong role of FWF in the Austrian scientific landscape.

Comparatively speaking, the performance (in terms of field-normalized citation impact) of the FWF supported output is quite similar to that of the USA and just slightly below of that of some other benchmark countries such as Switzerland, the Netherlands or Denmark.

Comparing the average impact (CPP) of FWF output with that of the benchmark countries by OECD fields, it is possible to see how FWF outperforms the raw average impact of all the benchmark countries in fields like *Computer and information sciences*, *Earth and environmental sciences*, *Biology*, the medical fields (*Basic Medicine*, *Clinical Medicine* and *Health Sciences*), and also in *Agricultural sciences*, *Psychology* and *Other social sciences*, although due to the low numbers involved in these last disciplines it is not possible to extract strong conclusions.

The comparison of the field-normalized impact values by OECD disciplines shows that the FWF shows a strong international position compared to the benchmark countries, being the USA, Switzerland, the Netherlands and Denmark the most common outperformers of the FWF output across the different OECD disciplines.

Cooperation analysis

The scientific cooperation profile of FWF funded research shows a preference for international cooperation, with roughly 50% of the total output being the result of collaboration with foreign partners. Publications in international collaboration are also the ones that generate the highest impact for FWF. It is remarkable that the scientific production without any type of institutional collaboration is also important in terms of the share of total output (~30%). The field-normalized impact of the non-collaborative FWF output, although still very high, the lowest as compared to the more collaborative publications.

Use of FWF funded publications

Regarding the users of the knowledge supported by the FWF, this output is cited frequently by authors from the US, United Kingdom, Germany and the People's Republic of China. Remarkably, the publications that cite the FWF output also get themselves an important high impact. Among the individual institutes that cite (use) most of the FWF production, we find *the Chinese Academy of Science* popping up as the most dominant user of FWF publications with *Harvard University* second and the *University of Wien* coming third.

Highly Cited Publications

The analysis of the share of FWF publications that are among the top 10% most cited publications in their respective fields shows a high visibility pattern of the FWF in this competitive top quartile of the world science. FWF funded publications outperform the rest of the country in their presence among the top 10% most cited publications at the international level. This pattern is also observed in the breakdown by OECD fields, where FWF publications tend to outperform in terms of field-normalized impact those of the rest of the country in most of the disciplines.

Main conclusions

Based on the bibliometrics results of this study it is possible to suggest that FWF funded output is cited well above the international level, thus aligning with the own mission of the institution of supporting "Austrian science and basic research at a high international level".

FWF has supported research that has performed in terms of scientific impact at the level of other scientifically strong countries such as USA, Switzerland, the Netherlands or Denmark. The results of the study show a high performance of FWF supported output in most fields of science and that it plays a predominant role in the Austrian and international scientific landscape.

1. Introduction

Bibliometrics is the quantitative study of written products of research. It is assumed that scientific subjects develop at an international research front (Price, 1963). Research results are communicated in publications that are submitted to evaluation by professional colleagues. In the references of their papers, scientists acknowledge relevant publications by others, as they build on previous work. Therefore, the number of times a publication is referred to gives a partial indication of the 'impact' of a publication, its reception and use by scientists at the research front.

Since the 1980s, bibliometric analysis has become part and parcel of evaluating scientific performance. Most bibliometric indicators are based on citation analysis, which is assessing the impact of a scientific work by analyzing the citations it has received. Citations partly represent the debate with peers in peer reviewed journals that still forms and develops the scientific quality of research. Therefore bibliometric analyses are an essential part of research evaluation.

CWTS emphasizes that citation analysis cannot capture all aspects of scientific performance and a wise combination of different approaches (e.g. peer review, societal impact analysis, etc.), may lead to improved evaluations. For instance peer reviewers can take into account qualitative information about aspects that are not easily quantifiable (e.g. teaching activities, editorial and academic memberships, other outputs not covered by bibliographic databases, appearances in the media, etc.) and they can be asked to pay specific attention to the divergences between their judgments and the results of citation analysis.

In this report we present the main results of a bibliometric study of FWF Austrian Science Fund. In this study, the scientific output of FWF Austrian Science Fund is analyzed on the basis of journal publications, its distribution over fields of science, and scientific cooperation. The focus of this study is on the research publications in international, refereed journal publications, covered by the former Institute for Scientific Information, nowadays Thomson Reuters. Thomson Reuters produces the internet version of the citation indexes, the Web of Science (WoS). This focus provides a clear insight into two major aspects of science: to what extent a research

institution is capable of publishing in high-standard scientific journals, and to what extent that institution is recognized as an important, or even outstanding, contributor to scientific development in specific fields of science. Co-operation is another crucial aspect of today's scientific endeavor. We distinguish three types based on addresses in publications: single institute output (no other partner is involved), national co-operation (only addresses of partners in the same nation are found), and international co-operation (in which one finds at least one foreign address next to that of the institution concerned).

The bibliometric indicators used in this study are state of the art and built on the experience of our center (Moed, 2005; Van Raan, 2005). Still we expect to be able to further improve them in the coming years. With optimal transparency we hope to further contribute to a culture of evaluation that serves the development of scientific and scholarly knowledge. In chapter 3.1 we give a detailed description of the standard indicators used in this study.

The Fonds zur Förderung der wissenschaftlichen Forschung - FWF Austrian Science Fund

The Austrian Science Fund (FWF) is Austria's central funding organization for basic research (FWF, 2011, p.8). The mission of FWF is *to support the ongoing development of Austrian science and basic research at a high international level. In this way, the FWF makes a significant contribution to cultural development, to the advancement of Austrian knowledge-based society, and thus the creation of value and wealth in Austria.*

The main objectives of FWF are the following (FWF, 2011, p.8):

- *To strengthen Austria's international performance and capabilities in science and research as well as the country's attractiveness as a location for high-level scientific activities, primarily by funding top-quality research projects for individual and teams and by enhancing the competitiveness of Austria's innovation systems and its research facilities.*

- *To develop Austria's human resources for science and research in both qualitative and quantitative terms based on the principle of research-driven education.*
- *To emphasize and enhance the interactive effects of science and research with all other areas of culture, the economy and society, and in particularly to increase the acceptance of science and research through concerted public relations activities.*

In addition to the previous, FWF also declares a number of "values" (FWF, 2011, p. 9):

- *Excellence and competition: the FWF's funding activities focus on research efforts devoted to generating new knowledge; the quality of research is assessed by international referees on a competitive basis.*
- *International orientation: the FWF is guided by the standards on the international scientific community and actively supports cooperation across national borders.*
- *Equal treatment of all disciplines: the FWF treats all researchers according to the same standards, without giving preference to or discriminating against individual disciplines.*

Objective and structure of this report

In this study, we focus primarily on a bibliometric analysis of the scientific publications funded by the FWF (see chapter 2.2 and Appendix V for a description of the data analyzed). In this sense, this report seeks to provide bibliometric figures and indicators from an analytical point of view. However, it is also an objective of this report to contextualize and discuss these results in relation to the mission, objectives and values of the organization found on publicly available sources of information about the FWF (e.g. Annual reports, its website, etc.).

The report is divided into different chapters. In chapter 2 an introduction and discussion of the data collection carried out for this study is presented. In chapter 3 the main methodological issues regarding the indicators and the different analysis

presented are described. Chapter 4 presents the main results and analyses obtained in the study and chapter 5 discusses the results and main conclusions of the study. The report is complemented with Appendices that are meant to extend the analytical possibilities of the readers and to be able to study more dimensions of the performance of FWF.

2. Data collection

2.1 Introduction

Data collection for this study started with the bibliographic database(s) of Thomson Reuters. These databases consist of nearly 35 million scientific publications and hundreds of millions of citations, from 1980 up to 2011, covering all fields of science. We re-structured these databases into a CWTS in-house bibliometric data-system. Next to the well known Science Citation Index Expanded (SCIE), our CWTS data-system also contains journal publications covered by the Social Science Citation Index (SSCI) and the Arts & Humanities Citation Index (A&HCI).

The quantitative scores presented in this study are the result of the application of advanced bibliometric techniques on the in-house CWTS data-system. Thomson Reuters claims to index these journals on a so-called 'cover-to-cover' basis: all contributions in a journal are in principal represented in the index. The citation indexes created by Thomson Reuters are unique databases in two ways: first, they are the only databases that include, on such a large scale, and over a very long period, the citations of indexed journals; second, because the indexes include all the addresses attached to the publications indexed. These two features make the citation indexes a unique database, on which advanced bibliometric tools can be applied.

Nowadays, in the area of the web version of the citation indexes, Thomson Reuters has left the (full) claim of a cover-to-cover processing of the journals indexed, the other criteria applied before entering a journal as a 'Thomson Reuters-journal' are still applied, and are:

- a journal should be peer-reviewed,
- the scope has to be internationally oriented,
- the publication language is preferably English,
- the frequency of appearance is a regular one, and finally,
- as Thomson Reuters can distill from their own data-material, a journal should have at least some significant impact in its field(s).

As stated above, the current CWTS database, used in the study for FWF Austrian Science Fund, is covering the period 2001 to 2010. In the studies of CWTS, only articles, letters and reviews are used as types of documents. We exclude meeting abstracts and editorials, due to the rather heterogeneous nature and contents of these types of publication.

2.2 Methodological aspects related to the data-collection

For this analysis of the FWF Austrian Science Fund, we have collected the publication data from the WoS based on an authorized input list of publications from FWF themselves. We have to a large extent cleaned the data supplied (removing special characters, detecting duplicate records, etc.). This was necessary because small omissions and inaccuracies were in this case of extreme importance as the first page number of the publications was not available in the original data provided by FWF. In this sense, we had to significantly improve our algorithm for matching FWF records with WoS records. A complete description of our algorithm for data matching can be seen in Appendix V. After all the data handing we were left with ***13,773*** unique publications that is the final number of items included in the analysis. However, publication numbers within the analysis may not always arrive at this number or even at a round figure as the article-type *letter* is counted within the bibliometric computation as one fourth (see Appendix VI on the special treatment of letters).

2.3 Methodological aspects related to OECD classification

For this bibliometric study of the FWF funded output a special disciplinary scheme for the analysis of publications has been applied with the aim of studying the disciplinary scope of the organization. The selected scheme has been the OECD classification with some minor differences (see Appendix VII for a description of he classification). This classification of the OCED is based on the re-classification of the

different JCR subject categories which is currently available at CWTS. In general, all the indicators and analysis have been based on this classification, with the only exception of the indicator MNCS that is still standard and based on the JCR subject categories (see explanations in chapter 3 and Appendix VI), however given the fact that the OECD disciplines are formed by the same subject categories they are comparable across the different units (e.g. FWF and benchmark countries) and all the indicators (including MNCS).

An important element to take into account regarding the OECD category applied in this study is related with the publications that appear under the JCR subject category "Multidisciplinary sciences". This JCR category includes all the publications from the most important scientific journals such as *Nature*, *Science* or the *Proceedings of the National Academy of Sciences* of the United States (PNAS) among others. In our OEDC classification these publications are (multi)classified[1] in the following OECD fields: "1.1 Mathematics", "1.2 Computer and information sciences", "1.3 Physical sciences", "1.4 Chemical sciences", "1.5 Earth and environmental sciences", "1.6.2 Biology" and "3.1 Basic medicine". This re-classification of the multidisciplinary papers can have effects over the overall level of impact of the publications in these OCED categories. Thus, the level of citation in these categories (e.g. the average impact of the publications) cannot be understood as 'purely' the impact of publications in these categories. In any case, this re-classification of Multidisciplinary papers has no major effect for the comparability of the different units of analysis across the same OECD categories, as they are delineated in the same way for all the units of analysis.

[1] Here multi-classified meaning that all the papers from the 'Multidisciplinary sciences' subject category are classified simultaneously in several OCED categories.

3. Methodology

3.1 Basic Indicators

A standard set of basic indicators plays a central role in our bibliometric evaluation studies. The main focus here will be on three indicators, namely the number of publications (***P***), the citation per publication ratio (***CPP***), and comparison of this impact of the unit with the worldwide average 'field citation score' (***FCSm***), the ***MNCS***, in order to normalize the measured impact in a field-specific way. For a detailed description we refer to our publications given in the reference list. In these publications we amply discuss the usefulness of bibliometric (citation-based) impact measurements as a 'proxy' for the assessment of scientific quality.

The first indicator in each of the tables gives the total number of papers published by the institution during the given period (***P***). We considered only normal articles, letters and reviews. Meeting abstracts, corrections and editorials are *not* included. In a few cases a paper is published in a journal for which no citation data are available, or in a journal that is not assigned to any Thomson Reuters journal category ('field'). These papers are not considered in the calculation of the indicators presented in this report.
The next two indicators give the total number of citations received (***C+sc***), and the average number of citations per publication (***CPP+sc***). In these figures, self-citations are included. A self-citation to a paper is a citation given in a publication of which at least one author (either first author or co-author) is also an author of the cited paper (either first author or co-author). The following indicator is the average number of citations per publication with exclusion of self-citations (***CPP***). The ***%Pnc*** indicator in the tables is the percentage of articles *not cited* during the time period considered.
The ***JCSm*** (Journal Citation Score mean) is the average citation rate of all articles published in the journals in which a unit has published (excluding self-citations). The ***FCSm*** (Field Citation Score mean) is the average citation rate of all articles in the fields in which the unit is active. In calculating ***FCSm***, we used a similar procedure as the one we applied in the calculation of ***JCSm***, with journals replaced by fields (i.e., sets of journals). Our definition of a scientific 'field' is based on a classification of scientific journals into subject categories developed by Thomson Reuters. Although this classification is far from perfect, it provides a good approximation.

The ***MNJS*** is the Mean Normalized Journal Score of the journals in which the institution has published, taking into account both the type of paper (e.g., article, review), as well as the specific years in which the papers were published. To give an example, the number of citations received during the period 2005-2011 by an *article* published in 2005 in journal X, is compared to the average number of citations received during the period (2005-2011) by *all articles* published in the *same* journal (X) in the *same* year (2005). Of course, an institution as a whole publishes its papers in many journals. Therefore, we calculated an average normalized journal citation score indicated as ***MNJS***, with the score normalized by using an expected value that is defined as the average citation score within the scientific field the journal belongs to. We corrected for self-citations on this worldwide level. As can be deduced from the above given definitions, a value above 1.0 means that the citation score of all journals in which the institution has published exceeds the mean citation score of all papers published in the field(s) to which the journals belong. This implies that the institution publishes in journals with a (relatively) high impact.

MNCS refers to the Mean Normalized Citation Score, in which citation scores are normalized against the expected value of the scientific field, the sum of which is used to compute the average. The MNCS indicator is an item-oriented field-normalized citation score, this meaning that a field-normalized score is calculated for every item in the output of the analyzed unit and then averaged for all the items of the unit (for more discussions on the methodology of the MNCS and comparisons with other similar methodologies see Waltman et al, 2011a, 2011b). In terms of interpretation, if the ratio ***MNCS*** is above 1.0, the institution is cited more frequently than an 'average' publication in its field(s). In this way, an indication of the international position of an institution, in terms of its impact compared to a worldwide average, is given. This worldwide average is calculated for the total ensemble of articles published in Thomson Reuters journals assigned to a particular field. This indicator ***MNCS*** is considered as an important, because it emphasizes the position of an institution within worldwide, 'field-normalized' perspectives. About 80 percent of the world's scientific papers are authored by scientists from the United States, Canada, Western Europe, and Japan. Therefore, any 'worldwide average' is dominated by the Western world.

We also calculate the ***TNCS***, which is really a derivative of the number of publications multiplied by their field-normalized impact (***MNCS***) this value can be

interpreted as a "raw power" or "visibility" indicator. It stands to reason this if the analyzed body of publications is very small but have a very high normalized impact, the visibility is still small when compared to a larger body of publications with the same normalized impact. This measures doesn't say anything about impact, as such, but more about the level at which the body of publications will be noticed up within the scientific world.

Finally, we also calculated the percentage of self-citations (***% Selfcits***), relative to the total number of citations received. The percentage of self-citations is influenced by a number of factors, such as the field in which researchers are active; type of articles; age distribution of the articles; size of the aggregation level and number of articles; and the extent to which the papers are cognitively related.

All the above-defined indicators have been calculated with the following *counting procedure*. If indicators are given for the entire period 2005-2010, citations to 2005 publications are counted for 2005-2011; citations to 2006 publications are counted for 2006-2011, and so on. Next, we conducted a trend analysis, dividing the output in seven blocks of four years (with one extra year for citations). In this analysis, we applied exactly the same procedure, with only a shorter citation window, which allows observing a possible trend in both output and citation impact. For statistical reasons (see Appendix VI), we excluded 2011 publications from the impact measurement as these 'young publications' tend to distort the calculation of impact measures over a longer period for the output of an organization.

3.2 Frequently cited publications

An additional set of impact indicators reflects the contribution to the most frequently cited papers world-wide. To examine the distribution of frequently cited papers, we have ranked each publication on the number of citations it received up to four years after publication. We marked those belonging to different percentiles (i.e. P90 and P99) most frequently cited papers. The use of the fixed length four-year citation window implies that the analysis only involves papers published during 2001-2008. Moreover, letters were excluded.

We calculate the number of papers of a unit that appear in the top percentiles of the most frequently cited publications world-wide. We then calculate the expected number of highly cited papers based on the number of papers published by the

research unit. Finally, we are able to determine the relative contribution to the most frequently cited papers within the different percentile levels, and the indicator of highly cited publications is calculated as the ratio of the actual number of publications that belong to most highly cited publications, at different percentile levels, and the expected number of highly cited publications. Here, a value above (below) 1 indicates a relatively high (low) contribution to that percentile most frequently cited papers.

3.3 Scientific cooperation profiles

We distinguish three types of cooperation in scientific publications: "***Single Institute***", the publications carrying only one address; secondly, "***National Cooperation***" stands for the category that carries multiple addresses from one country, in which no foreign research groups are mentioned; and finally, "***International Cooperation***", publications in which we find at least one address from a foreign university or institution.

3.4 Research Profiles

Another important part of the CWTS bibliometric analysis is the *breakdown* of an organization's *output* (publications) *and impact* into research fields. This 'spectral analysis' yields a *research profile* of the organization. These research profiles are based on an analysis of all fields (i.e. OECD fields) attached to the papers. The purpose of this analysis is to show the output size of FWF funded output as well as the benchmark countries in terms of (relative) numbers of papers per OECD field, as well as the impact in these fields.

From the above it is clear that the indicators ***P*** and ***MNCS*** play a central role in the research profile. In the graphical presentations of these profiles (the Figures), we use relative output data. We calculate the number of publications in a specific field *relative* to the total output of the FWF.

Overview of standard CWTS bibliometric indicators

P	Number of articles (normal articles, letters and reviews) published in journals processed for the Web of Science (Wos), the internet version of the Thomson Reuters Citation Indexes (CI).
C+sc	Number of citations recorded in CI journals to all articles involved. Self-citations are included.
CPP+sc	Average number of citations per publication, or citation per publication ratio. Self-citations are included.
CPP	Average number of citations per publication. Self-citations are not included.
%Pnc	Percentage of articles not cited during the time period considered.
JCSm	Average citation rate of all articles published in the journals in which an institute/group has published (excluding self-citations).
FCSm	Average citation rate of all articles in the fields in which the institute/group is active. Also indicated as the world citation average in those fields. Fields are defined by means of Thomson Reuter's journal categories (excluding self-citations).
TNCS	Total field normalized citation score (Excluding self-citations).
MNCS	Impact of an institute/group's articles, compared to the world citation average in the (sub)fields in which the institute/group is active.
MNJS	Impact of the journals in which an institute/group has published, compared to the world citation average in the fields covered by these journals.
% SELFCITS	Percentage of self-citations. A self-citation is defined as a citation in which the citing and the cited paper have at least one author in common (first author or co-author).
P01-10	Number of papers (normal articles and reviews) published in journals processed for the Web of Science version of Thomson Reuters's Citation Indexes (CI) in the period 2001 – 2010.
Ptop	The absolute number of papers that are among the 10% most frequently cited of all similar papers in the period 2001 – 2008.
E (Ptop)	Reference value. The expected number of papers among the top 10%, based on the number of papers published by the research unit in the period 2001 - 2008.
A/E (Ptop)	indicates the relative contribution of a unit to the upper percentiles of the citation distribution in the period 2001 - 2008. A/E (Ptop) is equal to Ptop/E (Ptop).

4. Results

In the first place, we compute indications of the level at which the database used (i.e. WoS) can be considered as an adequate environment to perform this kind of bibliometric study, thus being a means of quality control for the subsequent results. To determine the appropriateness of our indicators for assessing a particular unit, we often look at the internal and the external WoS coverage of the unit. The external WoS coverage of a unit is defined as the proportion of the publications of the unit that are covered by WoS. Thus, the external WoS coverage can be calculated only if a complete list of all publications of a unit is available (as this is the case of FWF). The internal WoS coverage of a unit is defined as the proportion of the references in the publications of the unit that point to publications covered by WoS. The lower the internal and external WoS coverage of a unit, the more careful one should be in the interpretation of our indicators.

These internal/external coverage analyses are important in order to give indications on the importance and validity that this study can have for the assessment of the publications of the FWF overall and across the selection of OECD categories.

Regarding the external coverage, if we consider the results indicated in Appendix V we can estimate an 81% of external coverage of the list of publications (records) initially supplied by FWF, as this is the percentage of publications that are covered by Web of Science. With regards to the internal coverage, we find that 84% of the total references in FWF funded research papers are covered in Web of Science.

These results suggest that both the internal and external coverage of the FWF funded output can be considered as high, therefore we can assume that the current bibliometric study is relevant and valid to extract robust conclusions. We present also the different figures of internal coverage divided up per OECD categories:

Category	P 01-10	Avg Nr Refs	%Refs <1980	Nr Refs >1979	%Refs CI
FWF Austria Science Fund (overall)	13773	39.18	7%	499929	84%
1.1 Mathematics	1329	25.86	13%	30071	63%
1.2 Computer and information sciences	828	28.77	6%	22316	59%
1.3 Physical sciences	4122	32.81	9%	123482	85%
1.4 Chemical sciences	2141	35.85	8%	70644	87%
1.5 Earth and related environmental sciences	929	45.71	12%	37385	73%
1.6.1 Biochemistry & Molecular Biology	2001	44.94	4%	86181	93%
1.6.2 Biology	1294	47.27	9%	55713	82%
1.6.3 Microbiology & Genetics	1432	50.30	4%	68834	92%
2 Engineering and Technology	1872	28.38	8%	48929	76%
3.1 Basic Medicine	1614	47.14	4%	73265	93%
3.2 Clinical Medicine	1411	45.83	3%	62513	94%
3.3 Health sciences	442	42.85	3%	18312	90%
4 Agricultural sciences	375	41.90	6%	14790	84%
5.1 Psychology	87	44.59	10%	3506	71%
5.2 Economics and Business	155	30.94	8%	4401	51%
5.9 Other social sciences (Soc sc, Interdisc)	86	42.20	10%	3256	42%

As can be seen in the column "%Refs CI", except for the output in the OECD categories "5.9 Other social sciences" and "5.2 Economics and Business" all the outputs of the other categories fall well within an acceptable to very good relevance bandwidth of internal coverage (59%-94%). The number of publications within "Other social sciences" is really negligible when compared to the total number of publications. So we can safely say that our citation analysis will give a fair view on the total data collection involved.

Regarding the distribution of publications by document types, 'Article' is the most predominant type among all the publications finally collected (94.1% - 12,960 Articles), followed by 'Reviews' (5.4% - 743 reviews) and finally 'Letters', which only amount to 70 items (0.5%) and which have been fractionalized by 1/4 in the rest of the analysis (amounting to 17.5 items in the bibliometric analysis) (see Appendix VI for an explanation of the fractionalization of letters).

Additionally a large body of publication data was collected for benchmark countries. These were proposed by FWF and encompass: Austria (as a whole and without the output funded by FWF), Switzerland, the Netherlands, Sweden, Denmark, Finland,

USA, Germany and the United Kingdom (Great Britain). For all these countries, their production (limited to the same OECD fields as for FWF) has been collected and used as a benchmark in most of the analyses carried out in this study. We like to draw attention to the fact that the way in which the selection for Austria as a whole is formulated, defines publications funded by FWF as a subset of this larger selection. Thereby the indexes for Austria as a whole will also be influenced by the values for FWF funded research and in this case they can not be seen as totally independent of each other. For this reason we have also calculated indicators for the subset of publications from Austria but without the FWF participation, thus being able to analyze the role of the organization in the context of Austria.

4.1 Overall bibliometric results

In **Table 1**, the standard bibliometric indicators are presented for FWF Austrian Science Fund. We find 13,720.50 FWF funded journal publications in the period 2001-2010, which get cited 296,806.50 times in total over this period of time, including self-citations. The total number of publications that enter in this analysis is lower than the total number retrieved because only citable items (articles, letters and reviews) are considered and it is not an integer number because due to the document type *letters* that have been fractionalized (see Appendix VI). The mean impact score of this output is 21.63 and corrected for self-citations it is 16.44.

Compared to the ISI fields (to whom the publication journals belong) in which the funded authors have published their results (MNCS) the result is 1.35. This means that the funded publications by the FWF are cited 35% above the international level. The researchers funded by FWF Austrian Science Fund publish in journals that have an impact well above the international field impact level (as MNJS is 1.28).

Over this period of 10 years, we find that 11% of all publications funded by FWF do not get cited, which is not particularly high. The percentage of self-citations is 24%, which is rather normal, and in line with what we most often find during our studies, namely percentages of self-citations between 20 and 40%. The trend analysis shows

that FWF funded research output amounts on average well over 1000 papers per year, while this average has slightly decreased in the last years. A reason that can explain this decrement in the number of publications in the last part of the period can be the fact that some papers (linked to a project) are published after the project has finished, therefore they are not yet published (or included in the FWF records) and thus they are not yet counted in this analysis.

The average impact (CPP) related with the FWF Austrian Science Fund output shows a very steady high level. As a result, the MNCS scores are rock solid as well, however there is an indication of a slight decrease in the field normalized impact (MNCS) whereas at the same time the journal normalized citation (MNJS) score remains at the same level. Citation rates are rising for FWF funded research but citation rates are rising even more rapidly within the scientific field and the journal mix they are published in. The work is published in higher ranking journals in scientific fields that are well cited but with a hint of lagging behind within the bigger picture.

In comparison to the benchmark countries in **Table 2**, the FWF funded publications show on average more citations per paper (FWF funded publications have the highest CPP score compared to all the benchmark countries). The FWF supports around 14% of the total Austrian publications[2] which receive 20% of the total Austrian citations. The output funded by the FWF presents a sensibly higher impact (CPP, MNCS and MNJS) as compared with Austria as a whole and also with Austria without the FWF output.

The normalized impact (MNCS) by FWF is by and large on the same level as that of the benchmark countries or even higher. In this sense the FWF funded publications are on the same level as those from the USA and are only really outperformed by Switzerland (also by Denmark and the Netherlands but to a lower degree).

[2] We have detected that around 447.25 (3%) publications from FWF do not have any address or any Austrian affiliation.

Table 1: Bibliometric Statistics, Trend Analysis 2001 – 2010/11

FWF Austrian Science Fund	P	C+sc	CPP+sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
2001-2010/11	13720.50	296806.50	21.63	16.44	11%	15.95	12.52	18578.88	1.35	1.28	24%
2001-2004/5	5602.25	52263.50	9.33	6.61	23%	6.48	5.03	8005.12	1.43	1.30	29%
2002-2005/6	6056.00	60216.25	9.94	7.10	22%	6.76	5.29	8736.25	1.44	1.28	29%
2003-2006/7	6192.25	64115.00	10.35	7.42	22%	6.89	5.37	8807.93	1.42	1.28	28%
2004-2007/8	6001.25	65802.75	10.96	7.89	20%	7.33	5.68	8462.69	1.41	1.28	28%
2005-2008/9	5899.25	65590.50	11.12	7.98	21%	7.43	5.77	8046.85	1.36	1.27	28%
2006-2009/10	5541.25	60662.75	10.95	7.79	20%	7.71	5.82	7470.89	1.35	1.29	29%
2007-2010/11	5027.00	57587.00	11.46	8.20	18%	8.21	6.23	6734.77	1.34	1.29	28%

Table 2: Bibliometric Statistics, Country Analysis 2001 - 2010/11

Country	P	C+sc	CPP+sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
Austria	92910.00	1415330.00	15.23	11.99	18%	11.17	10.64	107297.78	1.15	1.07	21%
Austria (without FWF)	79636.75	1127055.25	14.15	11.24	19%	10.36	10.31	89443.82	1.12	1.04	21%
Denmark	94368.75	1765498.75	18.71	14.94	12%	12.98	11.05	131328.07	1.39	1.21	20%
Finland	86230.25	1368512.75	15.87	12.55	15%	11.86	10.51	102047.90	1.18	1.14	21%
Germany	764478.00	11889107.50	15.55	12.17	19%	11.45	10.84	873394.51	1.14	1.07	22%
United Kingdom	796725.75	13524372.25	16.97	14.00	15%	13.00	11.16	1020798.35	1.28	1.17	18%
Netherlands	244128.25	4491884.00	18.40	14.88	13%	13.45	10.96	340331.42	1.39	1.25	19%
Sweden	173326.00	3001222.50	17.32	13.96	14%	12.64	11.23	218685.03	1.26	1.16	19%
Switzerland	176426.50	3476133.75	19.70	15.92	14%	13.81	11.17	256718.92	1.46	1.24	19%
USA	2961854.50	54397120.25	18.37	15.47	15%	14.38	11.43	4036981.40	1.36	1.26	16%

4.2 Research profile

In this section the research profile for FWF Austrian Science Fund is presented. Figure 1 shows the profile for FWF Austrian Science Fund by OECD classification. Nearly all FWF funded research categories have a "high" field normalized impact level. Only three categories miss this "high" qualification as they are just below the threshold 1.21 which is considered as "high" in this graph. The category "1.3 Physical Sciences" is the most prominent category in terms of output, taking a share of almost double that of the next largest share category ("1.4 Chemical sciences"). There are a few small categories ("5.1 Psychology" and "5.9 Other social Sciences") that in contrast show a very high impact. But the data volume is so limited that no strong conclusions should be drawn on the basis of this observation. Particularly well cited publications are those from "1.2 Computer and Information Sciences" (1.81) and "3.3 Health Sciences" (1.63). FWF funded research is by and large well cited across the entire scope of OECD defined Scientific Fields. More detailed indicators for this research profile of FWF can be found in Appendix I[3].

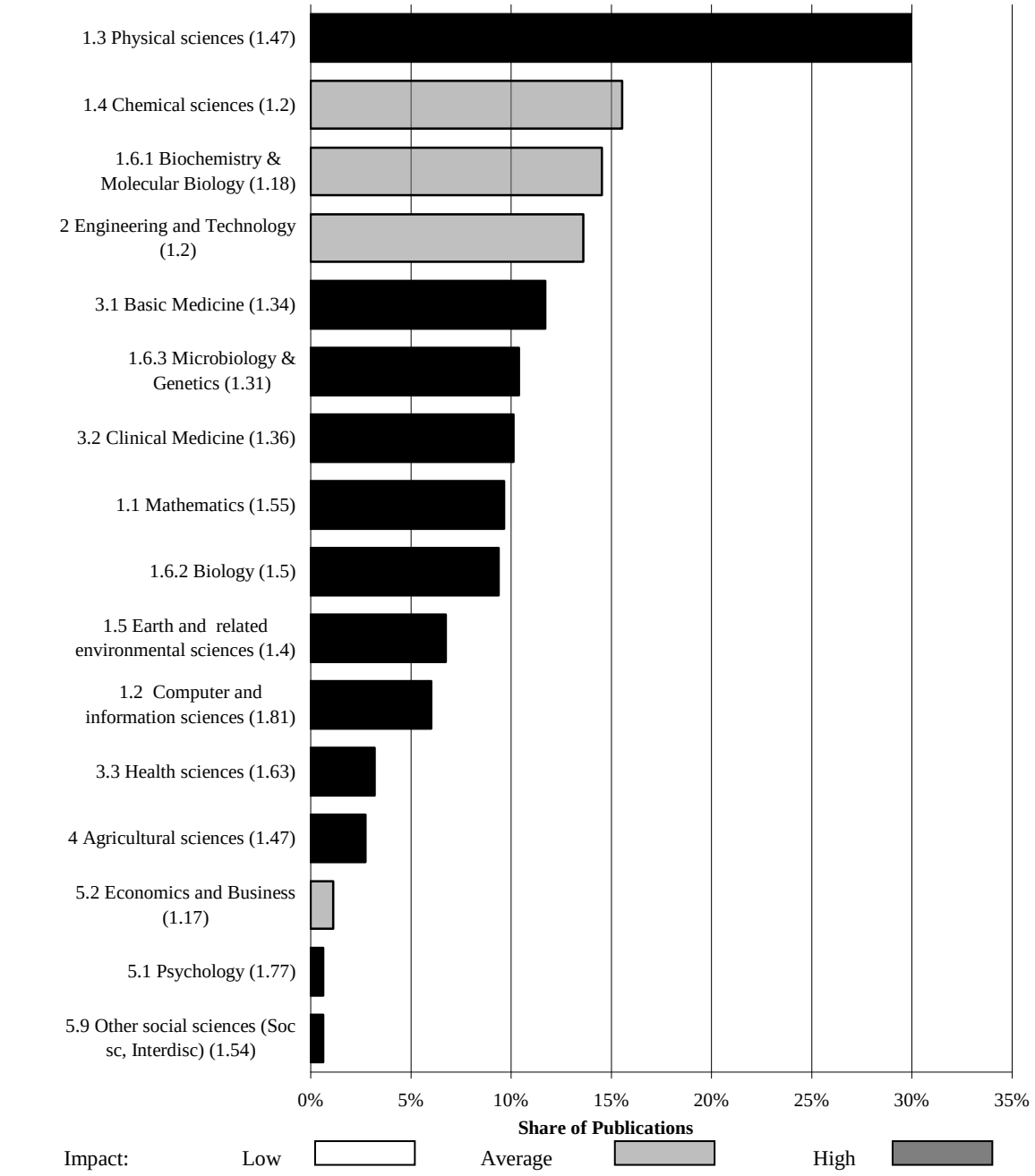
Regarding the comparison of the FWF with the benchmark countries, the breakdown of indicators for the different countries by OECD categories can be found in Appendix II. In Appendix VIII it is also possible to compare the performance of the output by the FWF to that of Austria as a whole and Austria without the output of the FWF. In this figure of Appendix VIII it is possible to see how in most of the OCED fields the FWF funded output presents a substantially higher field normalized impact as compared to the rest of the country. The only exceptions to this pattern are the cases of "1.4 Chemical sciences" where the differences are quite small and in "1.6.3 Microbiology & Genetics" where the impact of the FWF funded production does not outperform that of the rest of the country in the same discipline.

[3] The share of publications in Figure 1 is calculated based on the total number of weighted publications of the FWF (i.e. 13,720.50 publications).

Figure 1:

Research Profile:
Output and Impact per Field
2001 - 2010/11

FWF Austrian Science Fund



4.3 Analysis by grant types

The FWF has shown its interest in analyzing two different grant types: the *Special Research Programs* (type F) and the *National Research Networks* (type S). These two types are, after the type P (*Stand Alone Project*s), the most important grant types in terms of the share of the total FWF budget (Streicher et al, 2004) and publications.

According to **Table 3**, the outputs resulting from grant type F present in general higher scores in all indicators than those coming from grant type S. The percentage not cited is noticeably lower, as is the percentage self citations. The MNCS value is high for both types of grants, being type F higher than type S. This doesn't mean that grant type S is performing badly. The value for the MNCS for this grant type of 1.58 is in fact also very high, outperforming the value observed for the whole FWF funded output (1.35) as well as the same indicator of most of the benchmark countries (being this true also for the CPP and MNJS indicators). All contributions are published in highly visible journals that are between 40 to 50% above international average.

Table 3: Indicators per Grant type 2001-2010/11

Grant Type	P	C+sc	CPP+sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
F	2055.75	61851.25	30.09	24.61	8%	21.66	13.94	3708.69	1.80	1.50	18%
S	789.25	16123.50	20.43	15.62	14%	13.84	10.15	1243.17	1.58	1.39	24%

All the other indicators for the comparison of these two grant types can be analyzed in Appendix III.

4.3 Scientific cooperation profile

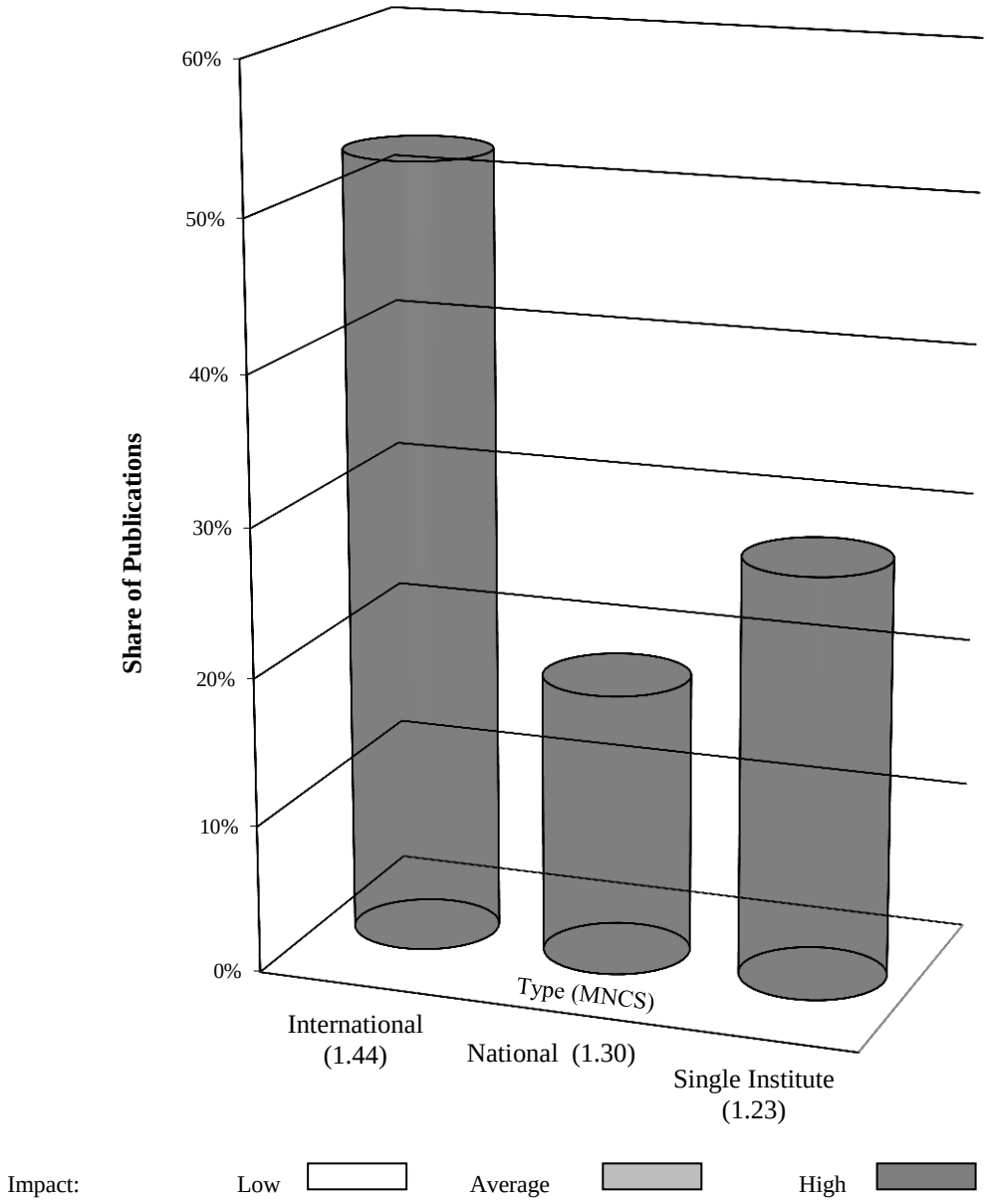
The scientific cooperation profile (**Figure 2**) of FWF Funded research shows a preference for international collaboration, as this type of scientific activity covers over 50% of the total FWF funded output. The second largest type is the single address publication, with slightly below 30% of the output covered by this type. Thirdly, the national cooperation type which covers some 20% of the FWF funded output. Finally, the smallest output share is found for publications which carry no address what's however. This is not depicted here as this is a very small (1‰) and therefore an uninformative analysis type.

In terms of the impact, we find the highest impact level for the output resulting from international cooperation (MNCS is 1.44). Single institute publications just reach the "high" impact label (1.23). We can conclude that the publications in international cooperation carry the impact of the FWF funded research with a very high impact level, the highest of all cooperation types, and a share of more than half of the publications.

Figure 2:

Scientific Cooperation Profile:
Output and Impact per type
2001 - 2010/11

FWF Austrian Science Fund



4.4 Knowledge user profiles

In this section, the focus shifts towards the citing side of bibliometric analysis, and for FWF Austrian Science Fund, the users of their produced knowledge. In other words, in this analysis, the distribution of the countries and institutions that have cited the FWF funded output is studied. In the same line, the impact of these publications that have cited the FWF output is also studied. As the citers express a certain interest towards the output of FWF Austrian Science Fund, as can be measured by the reference behavior of the citing research output, the profiles presented in Figures 3 and 4 open up the citing dimension of the numbers of received citations shown in Table 1.

In **Figure 3**, it becomes immediately clear that the largest share of the impact received by publications from the FWF Austrian Science Fund come from the USA (some 24%), followed by nearly 10% of the citing publications from Germany, United Kingdom and People's Republic of China nearly 7%, France, and Japan some 5%. The impact-level of the countries citing towards FWF Austrian Science Fund research output are almost invariably high, with the only exception being the papers citing from India, Brazil, Poland and the Czech Republic, which show average citation levels although always above the international threshold of 1.

In **Figure 4**, the citing institutes are presented. The citing institute most prominently visible in the top of the profile is from China, the Chinese Academy of Science. Harvard University is the second most important citer of FWF funded publications, having a field-normalized impact twice that of the Chinese Academy. Bear in mind that the share of total citations is bound to be limited over the entire scope of this study because of the total data volume involved.

In the top of the list we find the University of Vienna and also the American National Institute of Health, both with very strong citation impact. The only prominently visible institute with less spectacular results is the Russian Academy of Sciences, it features low impact, although it only just misses out on the average label (0.80).

Figure 3:

Knowledge user profiel:
Share and Impact per citing country
2001 - 2010/11

FWF Austrian Science Fund

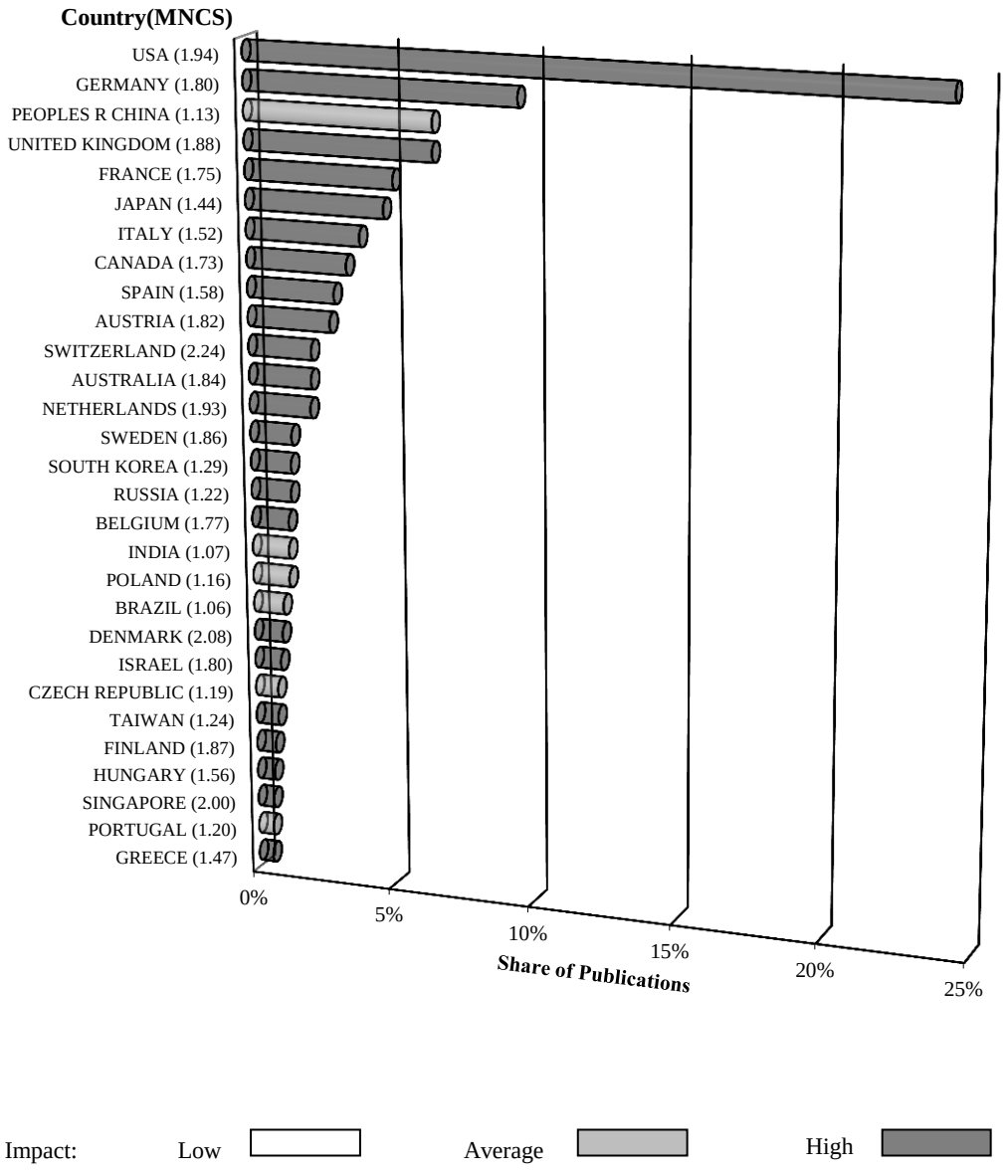
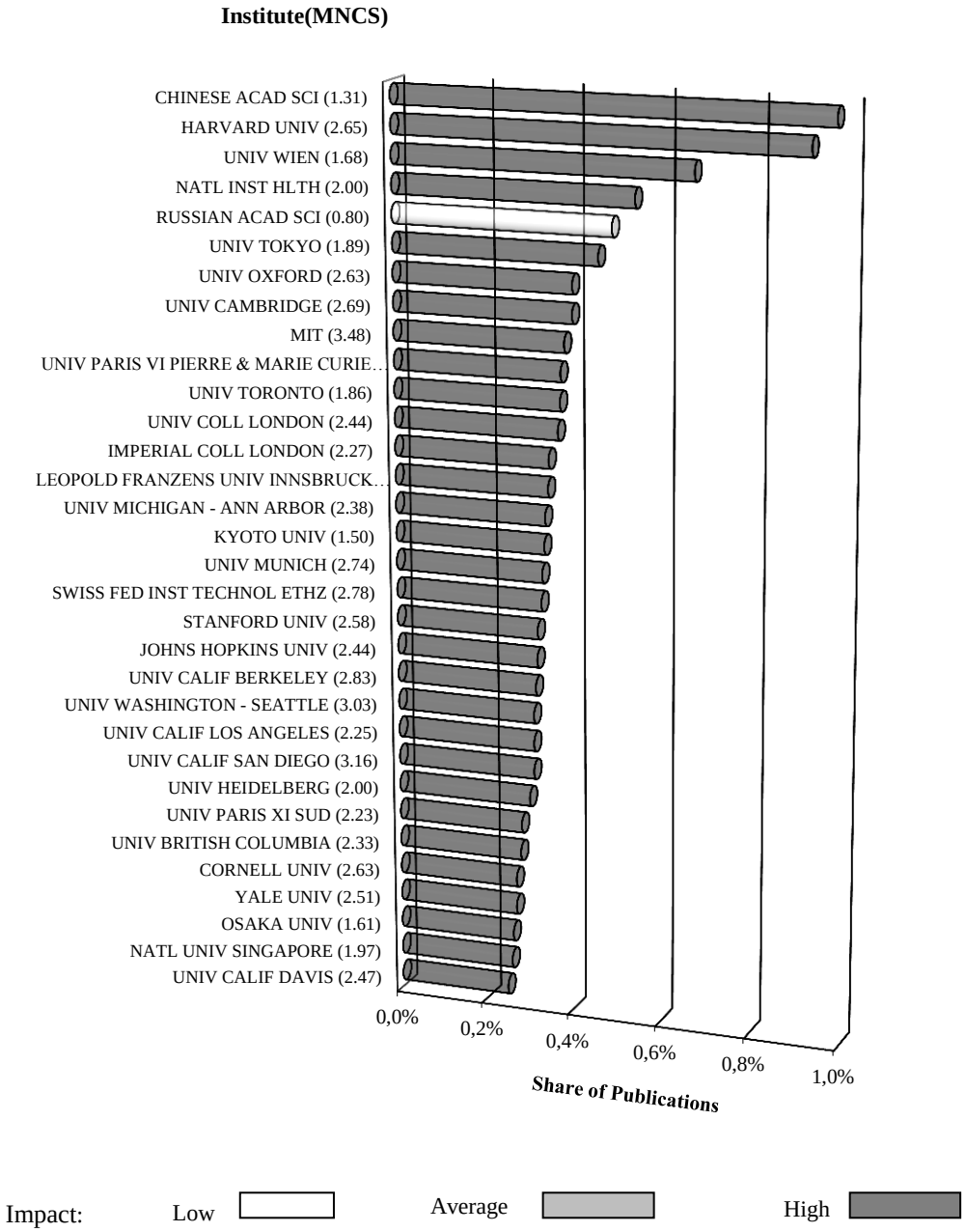


Figure 4:

Knowledge user profile:
Share and impact per citing Institute
2001 - 2010/11

FWF Austrian Science Fund

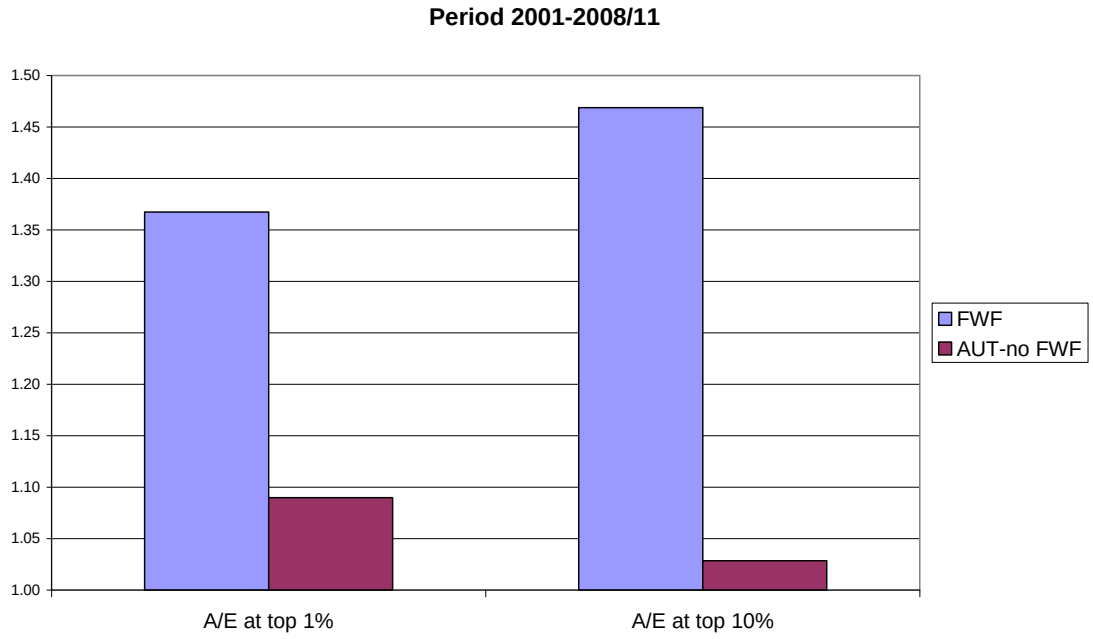


4.5 Highly cited publications

In this section we present the results of the analysis of Highly Cited Publications (HCP). As this analysis requires a fixed four-year length citation window[4], the analysis is covering the period 2001-2008. In **Figure 5**, we display the number of HCP's considering the top-10% / 1% most highly cited publications in the fields in which FWF Austrian Science Fund is active itself, together with the same indicator for the production of the rest of Austria. The bars indicate the level at which FWF and Austria (without FWF) complies with the expected value (in terms of % of HCP) in all scientific fields. As this is world wide, the expected value is always 1, thus meaning that values above this threshold indicate a performance above the international level in terms of Highly Cited Publications. As Figure 5 shows, the visibility of FWF and the rest of Austria in the share of HCP is very strong and always above 1 in the top 10% HCP. FWF outperforms the rest of the country also in terms of Highly Cited Publications in the percentage of HCP as FWF presents proportionally more papers in the 10% of the different disciplines worldwide. In fact, FWF produces around 20% of all the HCP of the country.

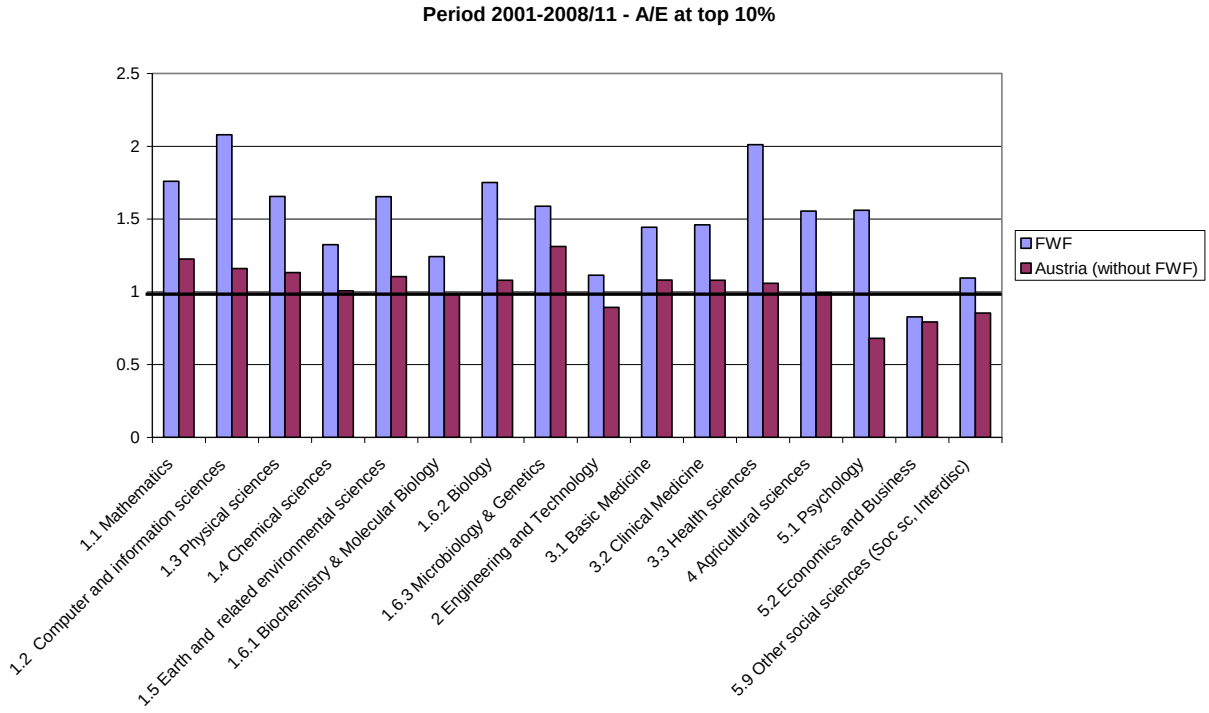
[4] We have empirically observed in our studies that this is generally the period of time necessary for publications to get stable levels of citations – e.g. comparing the impact of universities after 4 years and after 11 years, we got Spearman correlation coefficients of around 0.98, meaning that citations are stable abler 4 years.

Figure 5: Highly cited publications of FWF Austrian Science Fund and Austria (without FWF), visibility among the Top-1%/10% most highly cited publications, 2001-2008/11



In addition to Figure 5, the same HCP analysis has been performed by OECD categories (Figure 6). Focusing on the world top 10% production of papers, FWF presents a share higher than 1 in almost all categories, outperforming rest of the country in this indicator.

Figure 6: Highly cited publications of FWF Austrian Science Fund and Austria (without FWF), visibility among the Top-10% most highly cited publications, 2001-2008/11, by OECD fields



The ten most highly cited publications that were produced with funding by the FWF are presented in **Table 4**: The 25 most highly cited papers are presented in Appendix IX (attached in a separated document).

Table 4: Ten most highly cited papers 2001 - 2010/11

* CITATIONS: Total number of citations (self citations). RECNO: internal CWTS code (WOS UT code).

```
Citations:  1531  (85)
Per Year:   2005: 112   (4)   2007: 248   (17)  2009: 236   (19)
      2011: 194   (8)
            2006: 234   (9)   2008: 271   (20)  2010: 236   (8)
Author(s):  KAPPE CO;
Source:     ANGEWANDTE CHEMIE-INTERNATIONAL EDITION VOL. 43, PG.
            6250- 6284, 2004 (REVIEW)
Title:      CONTROLLED MICROWAVE HEATING IN MODERN ORGANIC SYNTHESIS
Address:    KARL FRANZENS UNIV GRAZ; INST CHEM ORGAN & BIOORGAN CHEM;
            A-8010 GRAZ; AUSTRIA
Recno(Ut):  24132589 (000225575600006)

Citations:  1265  (17)
Per Year:   2004: 5     (1)   2006: 119   (4)   2008: 189   (2)
      2010: 240   (0)
            2005: 73    (2)   2007: 121   (3)   2009: 250   (4)
      2011: 268   (1)
```

Author(s): APEL K; HIRT H;
Source: ANNUAL REVIEW OF PLANT BIOLOGY VOL. 55, PG. 373- 399, 2004 (REVIEW)
Title: REACTIVE OXYGEN SPECIES: METABOLISM, OXIDATIVE STRESS, AND SIGNAL TRANSDUCTION
Address: ETH; SWISS FED INST TECHNOL, INST PLANT SCI; CH-8092 ZURICH; SWITZERLAND
UNIV VIENNA; MAX F PERUTZ LABS, GREGOR MENDEL INST MOL PLANT SCI, AUSTRIAN ACAD SCI, VIENNA BIOCTR; A-1030 VIENNA; AUSTRIA
Recno(Ut): 23658508 (000222766000015)

Citations: 988 (80)
Per Year: 2001: 1 (0) 2004: 101 (8) 2007: 107 (13)
2010: 91 (8)
2002: 44 (8) 2005: 122 (10) 2008: 125 (5)
2011: 91 (5)
2003: 87 (8) 2006: 105 (12) 2009: 114 (3)
Author(s): HENTSCHEL M; KIENBERGER R; SPIELMANN C; REIDER GA; MILOSEVIC N; BRABEC T; CORKUM P; HEINZMANN U; DRESCHER M; KRAUSZ F;
Source: NATURE VOL. 414, PG. 509- 513, 2001 (ARTICLE)
Title: ATTOSECOND METROLOGY
Address: VIENNA TECH UNIV; INST PHOTON; A-1040 VIENNA; AUSTRIA
NATL RES COUNCIL CANADA; STEACIE INST MOL SCI; OTTAWA; ON K1A 0R6; CANADA
UNIV BIELEFELD; FAK PHYS; D-33615 BIELEFELD; GERMANY
Recno(Ut): 20458196 (000172405900038)

Citations: 767 (51)
Per Year: 2001: 0 (0) 2004: 39 (7) 2007: 87 (10)
2010: 130 (4)
2002: 12 (3) 2005: 65 (5) 2008: 101 (5)
2011: 108 (4)
2003: 36 (6) 2006: 60 (5) 2009: 129 (2)
Author(s): DUAN LM; LUKIN MD; CIRAC JI; ZOLLER P;
Source: NATURE VOL. 414, PG. 413- 418, 2001 (ARTICLE)
Title: LONG-DISTANCE QUANTUM COMMUNICATION WITH ATOMIC ENSEMBLES AND LINEAR OPTICS
Address: INNSBRUCK UNIV; INST THEORET PHYS; A-6020 INNSBRUCK; AUSTRIA
UNIV SCI & TECHNOL CHINA; LAB QUANTUM COMMUN & COMPUTAT; HEFEI 230026; PEOPLES R CHINA
HARVARD UNIV; DEPT PHYS; CAMBRIDGE; MA 02138; USA
HARVARD UNIV; ITAMP; CAMBRIDGE; MA 02138; USA
Recno(Ut): 20431244 (000172304500034)

Citations: 656 (28)
Per Year: 2003: 0 (0) 2006: 118 (0) 2009: 70 (2)
2004: 84 (5) 2007: 78 (4) 2010: 51 (3)
2005: 143 (5) 2008: 76 (5) 2011: 36 (4)
Author(s): JOCHIM S; BARTENSTEIN M; ALTMEYER A; HENDL G; RIEDL S; CHIN C; DENSCHLAG JH; GRIMM R;
Source: SCIENCE VOL. 302, PG. 2101- 2103, 2003 (ARTICLE)
Title: BOSE-EINSTEIN CONDENSATION OF MOLECULES
Address: INNSBRUCK UNIV; INST EXPT PHYS; A-6020 INNSBRUCK; AUSTRIA AUSTRIAN ACAD SCI-INST QUANTENOPT & QUANTENINFORMAT; A-6020 INNSBRUCK; AUSTRIA
Recno(Ut): 22892884 (000187385200037)

Citations: 624 (16)
Per Year: 2003: 1 (0) 2006: 73 (4) 2009: 86 (0)
2004: 28 (4) 2007: 81 (1) 2010: 84 (1)
2005: 64 (2) 2008: 103 (4) 2011: 104 (0)
Author(s): HOFACKER IL;
Source: NUCLEIC ACIDS RESEARCH VOL. 31, PG. 3429- 3431, 2003 (ARTICLE)
Title: VIENNA RNA SECONDARY STRUCTURE SERVER
Address: UNIV VIENNA; INST THEORET CHEM & MOL STRUKTURBIOL; A-1090 VIENNA; AUSTRIA
Recno(Ut): 22315991 (000183832900032)

Citations: 676 (73)
Per Year: 2003: 32 (3) 2006: 106 (11) 2009: 87 (3)
2004: 69 (10) 2007: 80 (10) 2010: 61 (7)
2005: 92 (13) 2008: 87 (9) 2011: 62 (7)
Author(s): BALTUSKA A; UDEM T; UIBERACKER M; HENTSCHEL M; GOULIELMAKIS E; GOHLE C; HOLZWARTH R; YAKOVIEV VS; SCRINZI A; HANSCH TW; KRAUSZ F;
Source: NATURE VOL. 421, PG. 611- 615, 2003 (ARTICLE)
Title: ATTOSECOND CONTROL OF ELECTRONIC PROCESSES BY INTENSE LIGHT FIELDS
Address: VIENNA TECH UNIV; INST PHOTON; A-1040 VIENNA; AUSTRIA MAX PLANCK INST QUANTUM OPT; D-85748 GARCHING; GERMANY
Recno(Ut): 21785440 (000180803200036)

Citations: 569 (17)
Per Year: 2002: 11 (0) 2005: 127 (5) 2008: 42 (1)
2011: 25 (0)
2003: 58 (3) 2006: 88 (5) 2009: 28 (1)
2004: 110 (2) 2007: 48 (0) 2010: 32 (0)
Author(s): PETERS JM;
Source: MOLECULAR CELL VOL. 9, PG. 931- 943, 2002 (REVIEW)
Title: THE ANAPHASE-PROMOTING COMPLEX: PROTEOLYSIS IN MITOSIS AND BEYOND
Address: RES INST MOL PATHOL; A-1030 VIENNA; AUSTRIA
Recno(Ut): 21055717 (000175967100006)

5. Discussion and conclusions

We start this final chapter with a few general comments on the use of bibliometric indicators for the assessment of research performance. It is our experience in previous studies on research performance in the natural and life sciences, medicine, the humanities, and in the social and behavioral sciences, that bibliometric indicators provide useful information to a peer review committee evaluating research performance. These studies revealed a fair correspondence between the results of bibliometric analyses on the one hand, and judgments on scientific quality by peers on the other hand. In our view, a quality judgment on a research unit, department or institute can only be given by peers, based on a detailed insight into content and nature of the research conducted by the group or institute in question. The citation-based indicators applied in this study, measure the impact at the short or middle-long term of research activities at the international research front, as reflected in publication and citation patterns. Impact and scientific quality are not necessarily identical concepts.

Bibliometric indicators cannot be interpreted properly without background knowledge on both the research units that are evaluated, and the subfields in which the research units are active. In fact, in previous studies we have encountered a few cases in which a bibliometric indicator pointed in one direction (e.g., a low impact), while statements by peers or even other indicators pointed in another direction (e.g., a high quality). Analyzing such discrepancies from a bibliometric point of view, specific limitations related to the bibliometric methodology applied in the study in question may be identified. While in most cases such limitations do hardly affect the results or have no effect at all, in exceptional cases the bibliometric outcomes may provide an incomplete or even distorted picture.. In this study, special care must be observed for the analysis of the FWF funded research in *Economics and Business* and *Other Social Sciences* as in these categories the internal coverage is close to or even lower than 50%.

Another limitation of bibliometric analysis relates to time delays. It may take several years for a collection of papers to generate a high impact. We have analyzed research units that had generated only a moderate impact at the time. Confronted with the bibliometric results, several peers stated that these research units had recently made important contributions to the field. When we updated the results after a few years, several research units indeed showed a sharply rising impact curve.

We do not wish to imply that all discrepancies between bibliometric indicators and peer judgments are necessarily due to problems or limitations of the bibliometric methods applied (Nederhof, 1988). Equally, it would not be appropriate to attribute such discrepancies only to peers expressing incorrect or biased views on the scientific quality of a research unit. Still reasoning from the point of view of the bibliometrician, discrepancies between bibliometric indicators and peer judgments often constitute a research problem in itself and often, a considerable effort is required to examine a discrepancy in sufficient detail.

Nevertheless, also peer review has its disadvantages (van Raan 1996; Moed, 2007; Bornmann, 2011). Therefore, the appropriate combination of peer-based qualitative assessment and quantitative, particularly bibliometric indicators appears to be the most successful approach in order to reinforce objectivity, transparency, comparability and reproducibility in the assessment of research performance.

Scientific performance of the scientific output funded by FWF

For FWF Austrian Science Fund a total of 13,773 unique publications in the period 2001-2010 were matched to the CWTS database and analyzed from a bibliometric point of view. On average these publications get cited 21.63 times and 16.44 after correction for self citations. This impact, when normalized by ISI fields (MNCS) it can be considered as being 35% higher than the average worldwide impact. In the trend analysis we see that over the seven four year periods the Mean Normalized Citation Score (MNCS) is slightly waning. Impact level of the journal package in which the research was published is high and remains high over the total period. FWF publications are published in highly visible and well cited journals, as the MNJS indicator suggests.

The research profile of FWF shows that 30% of the output is published in *Physical sciences*, in which a very high field-normalized impact is observed. That very high impact is almost a standard feature in this table, and this high to very high impact is observed in most of the fields.

The scientific cooperation profile of FWF funded research shows a preference for international cooperation: roughly 50% of the total output is the result of collaboration with foreign partners, while this part of the output generates the highest impact. The single institute cooperation is also important in terms of share of total output. Impact here is, although commendable, the lowest of the three cooperation types.

The knowledge user analysis shows that the FWF Austrian Science Fund is cited most frequently from the US, United Kingdom, Germany and the People's Republic of China, by research with a high impact itself. China comes in at a somewhat lower impact but still comfortably above average. Overall the impact of the citing research countries is high, indicating an influence on researchers from those countries that play a role on the research front. Among the citing institutes, we find *the Chinese Academy of Science* popping up as the most dominant user institute with *Harvard University* hot on its heels and the *University of Wien* coming in as good third. The impact of Harvard is twice as high as that of the Chinese Academy.

The analysis of the highly cited publications supported by FWF Austrian Science Fund shows an increasing tendency for the visibility in the top 10%. The other percentiles show a somewhat less clear pattern but all in all we can conclude that the presence of highly cited FWF funded scientific work is clearly above world average and higher.

Regarding the grant types: overall grant type F supported research scores better than grant S supported research. This pattern is not as such visible if we break the analysis down by OECD categories. Here there is no clear-cut structure other than that the research when analyzed within the confines of the OECD categories is solidly above average.

Discussion of the bibliometric analysis of the FWF funded output

General performance

Based on the bibliometric results obtained in this study, where all the internationally-normalized indicators show a performance of the FWF funded output higher than the international level, it is possible to suggest that FWF aligns with its own mission of supporting "Austrian science and basic research at a high international level".

The benchmark analysis of FWF funded output with that of Austria (with and without the output of FWF) and other countries also shows a strong picture. FWF supports 14% of the Austrian WoS-covered scientific production (excluding humanities fields), but the FWF output receives 20% of Austrian citations. In addition to the previous, FWF supports research that on average performs higher in some of the normalized indicators (MNJS and MNCS). In any case, it can be suggested that these results reinforce the objective of the FWF of strengthening the Austria's international performance and capabilities in science and research.

In general terms, the performance (in terms of citation impact) of the FWF supported output is similar to that of the USA and slightly below of that of some other countries such as Switzerland, the Netherlands or Denmark.

OECD disciplines

One of the values of the FWF is that "the FWF treats all researchers according to the same standards, without giving preference to or discriminating against individual disciplines." In general terms we can see how, although there are differences by production levels (fields such as Physical sciences and Chemical sciences concentrate an important share of the production), all the OECD fields covered by FWF (in this study) present high levels of performance (MNCS values higher than 1 in all the cases), being the lowest values for "5.2 Economics and Business" and "5.9 Other social sciences" that in this study are also the fields with the lowest coverage.

Comparing the average impact (CPP) of FWF output with that of the benchmark countries by OECD fields we can see how FWF outperforms the average impact of all the benchmark countries in the fields "1.2 Computer and information sciences", "1.5 Earth and

environmental sciences", "1.6.2 Biology", the medical fields ("3.1 Basic Medicine", "3.2 Clinical Medicine" and "3.3 Health Sciences"), and also in "4 Agricultural sciences", "5.1 Psychology" and "5.9 Other social sciences", although due to the low numbers involved in these last disciplines it is not possible to extract strong conclusions.

If we focus on the comparison of MNCS values by OECD disciplines, they are very similar although slightly different to the previous patterns based on the CPP. This has to do with the more fine grained normalization used for the MNCS (normalizing by JCR subject categories, document types and publication years). In any case, the FWF still presents a strong position compared to the benchmark countries, being the USA, Switzerland, the Netherlands and Denmark the most common outperformers of the FWF output across the different OECD disciplines. Interestingly enough, Finland is suggested in the FWF Annual Report (2011, p.18) as an international role model in the field of R&D, however as a benchmark of the FWF, Finland plays a relatively more modest role.

Cooperation

Our analysis on the cooperation profile of the output presents a very straightforward picture, with more than 50% of the output carried out in international cooperation. This clearly supports the value of the organization that "the FWF is guided by the standards of the international community and actively supports cooperation across national borders".

User profiles

Within the mission of the FWF it is stated that "FWF makes a significant contribution to (…) the advancement of our knowledge-based society, and thus to the creation of value and wealth in Austria". Taking this statement from a bibliometric point of view and considering the knowledge user profiles obtained in this study, it is possible to see how FWF output is creating more value (i.e. more impact) in Austria itself, as Austrian citing papers of the FWF publications are themselves highly cited (MNCS=1.82). However, Austria is not the only benefited country by the knowledge supported by FWF; other countries such as the USA, the Netherlands, the UK, Denmark and particularly Switzerland, are highly benefited in terms of impact by the knowledge supported by the Austrian FWF funds.

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Appendices

Appendix I: Data underlying the Research Profile, FWF Austrian Science Fund, 2001-2010/11

FWF/ OECD Category	P	C+sc	CPP+sc	CPP	% Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
FWF 1.1 Mathematics	1324.50	31104.25	23.48	19.34	25%	16.37	9.72	2049.63	1.55	1.21	18%
FWF 1.2 Computer and information sciences	825.00	27691.50	33.57	28.45	22%	24.94	13.84	1491.55	1.81	1.47	15%
FWF 1.3 Physical sciences	4111.50	92718.75	22.55	16.80	13%	15.27	10.80	6027.25	1.47	1.31	26%
FWF 1.4 Chemical sciences	2133.50	58411.00	27.38	20.98	8%	21.50	14.75	2554.01	1.20	1.38	23%
FWF 1.5 Earth and related environmental sciences	926.00	32438.50	35.03	28.16	9%	25.60	16.27	1296.58	1.40	1.27	20%
FWF 1.6.1 Biochemistry & Molecular Biology	1993.50	54349.25	27.26	21.46	7%	21.52	18.21	2351.65	1.18	1.22	21%
FWF 1.6.2 Biology	1288.00	46834.25	36.36	29.47	6%	26.50	17.34	1936.58	1.50	1.38	19%
FWF 1.6.3 Microbiology & Genetics	1426.00	44584.25	31.27	25.14	4%	25.12	19.74	1868.36	1.31	1.34	20%
FWF 2 Engineering and Technology	1867.50	24537.25	13.14	9.54	18%	9.45	8.19	2242.01	1.20	1.20	27%
FWF 3.1 Basic Medicine	1605.75	58834.00	36.64	29.59	3%	29.29	21.63	2144.13	1.34	1.34	19%
FWF 3.2 Clinical Medicine	1389.25	39292.25	28.28	22.11	3%	22.40	17.92	1887.90	1.36	1.34	22%
FWF 3.3 Health sciences	439.00	12524.00	28.53	22.39	7%	21.92	14.83	717.39	1.63	1.53	22%
FWF 4 Agricultural sciences	375.00	7822.00	20.86	15.98	10%	14.04	11.10	552.42	1.47	1.35	23%
FWF 5.1 Psychology	87.00	1348.00	15.49	12.20	10%	8.68	10.73	153.98	1.77	1.27	21%
FWF 5.2 Economics and Business	155.00	1244.00	8.03	6.87	16%	6.75	6.26	180.88	1.17	1.08	14%
FWF 5.9 Other social sciences (Soc sc, Interdisc)	85.25	842.00	9.88	7.78	10%	5.36	5.79	131.19	1.54	1.07	21%

Appendix II: Scientific Research Profile, Benchmark Countries, 2001-2010/11

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	1.1 Mathematics	4663.00	83849.75	17.98	14.68	31%	12.71	8.50	6076.02	1.30	1.13	18%
AUSTRIA (without FWF)	1.1 Mathematics	3467.75	54540.75	15.73	12.78	34%	11.21	7.96	4215.42	1.22	1.10	19%
DENMARK	1.1 Mathematics	3115.00	93325.00	29.96	24.66	24%	22.42	13.67	4701.88	1.51	1.34	18%
FINLAND	1.1 Mathematics	2732.75	49578.50	18.14	14.09	32%	13.22	8.88	3643.21	1.33	1.16	22%
GERMANY	1.1 Mathematics	32545.25	651955.50	20.03	16.36	31%	16.02	10.94	39188.75	1.20	1.16	18%
GREAT BRITAIN	1.1 Mathematics	32093.00	811933.00	25.30	21.39	26%	21.17	14.70	42184.76	1.31	1.23	15%
NETHERLANDS	1.1 Mathematics	7852.75	208247.75	26.52	22.29	26%	19.89	12.12	10615.99	1.35	1.25	16%
SWEDEN	1.1 Mathematics	5802.75	151890.75	26.18	21.60	27%	20.49	13.24	7709.38	1.33	1.23	17%
SWITZERLAND	1.1 Mathematics	6258.25	214160.00	34.22	29.04	23%	28.33	16.45	9577.40	1.53	1.41	15%
USA	1.1 Mathematics	137089.50	4049326.00	29.54	25.68	25%	24.09	15.47	198810.60	1.45	1.33	13%
AUSTRIA	1.2 Computer and information sciences	4631.75	83193.75	17.96	14.98	33%	13.22	8.80	6035.62	1.30	1.17	17%
AUSTRIA (without FWF)	1.2 Computer and information sciences	3835.75	56509.25	14.73	12.19	35%	10.82	7.79	4579.64	1.19	1.11	17%
DENMARK	1.2 Computer and information sciences	3477.25	95347.50	27.42	22.73	25%	20.36	12.50	5296.55	1.52	1.29	17%
FINLAND	1.2 Computer and information sciences	3873.75	55143.00	14.24	11.42	34%	11.08	7.80	4614.51	1.19	1.16	20%
GERMANY	1.2 Computer and information sciences	29780.00	640068.75	21.49	17.88	31%	17.58	11.91	36657.64	1.23	1.17	17%
GREAT BRITAIN	1.2 Computer and information sciences	35357.75	825196.50	23.34	19.89	28%	19.75	13.86	46553.89	1.32	1.21	15%
NETHERLANDS	1.2 Computer and information sciences	10011.25	227948.00	22.77	19.27	27%	16.96	10.23	14792.93	1.48	1.25	15%
SWEDEN	1.2 Computer and information sciences	5568.50	152965.25	27.47	23.01	28%	22.04	13.87	7220.52	1.30	1.25	16%
SWITZERLAND	1.2 Computer and information sciences	7642.00	231774.25	30.33	25.85	23%	24.44	14.29	13453.96	1.76	1.40	15%
USA	1.2 Computer and information sciences	132026.25	4120000.75	31.21	27.53	22%	25.62	16.20	207918.59	1.57	1.40	12%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	1.3 Physical sciences	13909.50	259789.75	18.68	13.98	19%	12.20	9.80	18567.94	1.33	1.18	25%
AUSTRIA (without FWF)	1.3 Physical sciences	9937.25	170650.00	17.17	12.90	22%	10.99	9.40	12794.32	1.29	1.13	25%
DENMARK	1.3 Physical sciences	10979.00	244533.75	22.27	16.91	15%	15.12	11.10	16397.15	1.49	1.28	24%
FINLAND	1.3 Physical sciences	11246.75	186373.00	16.57	11.94	19%	11.37	9.53	12932.89	1.15	1.11	28%
GERMANY	1.3 Physical sciences	149461.25	2672780.50	17.88	13.23	18%	12.29	10.10	190394.99	1.27	1.18	26%
GREAT BRITAIN	1.3 Physical sciences	101782.50	2136725.00	20.99	16.23	17%	15.12	11.88	135575.14	1.33	1.21	23%
NETHERLANDS	1.3 Physical sciences	28328.50	653347.75	23.06	17.80	15%	15.26	11.10	44169.45	1.56	1.30	23%
SWEDEN	1.3 Physical sciences	22731.50	426077.75	18.74	14.01	18%	13.23	10.55	28012.84	1.23	1.17	25%
SWITZERLAND	1.3 Physical sciences	31416.00	702089.75	22.35	17.19	16%	14.94	10.86	48380.68	1.54	1.28	23%
USA	1.3 Physical sciences	360173.75	8807988.75	24.45	20.00	15%	17.84	12.63	545941.08	1.52	1.31	18%
AUSTRIA	1.4 Chemical sciences	10724.50	211536.00	19.72	15.39	14%	14.84	12.02	12652.70	1.18	1.21	22%
AUSTRIA (without FWF)	1.4 Chemical sciences	8629.00	154825.00	17.94	14.10	15%	13.27	11.38	10173.07	1.18	1.18	21%
DENMARK	1.4 Chemical sciences	8566.25	218583.25	25.52	20.57	9%	18.90	13.20	13482.17	1.57	1.42	19%
FINLAND	1.4 Chemical sciences	8330.00	146458.00	17.58	13.36	14%	14.12	11.22	9728.63	1.17	1.25	24%
GERMANY	1.4 Chemical sciences	105986.25	2175563.00	20.53	15.87	14%	16.11	12.36	133520.58	1.26	1.29	23%
GREAT BRITAIN	1.4 Chemical sciences	75790.50	1834195.00	24.20	19.76	11%	19.82	14.36	105070.43	1.39	1.38	18%
NETHERLANDS	1.4 Chemical sciences	21646.25	578204.00	26.71	21.89	9%	20.17	13.00	35424.26	1.64	1.53	18%
SWEDEN	1.4 Chemical sciences	17988.25	410037.50	22.79	18.25	10%	17.80	12.99	24847.54	1.38	1.37	20%
SWITZERLAND	1.4 Chemical sciences	23285.75	584529.00	25.10	20.02	12%	19.07	13.48	34719.44	1.49	1.38	20%
USA	1.4 Chemical sciences	285879.75	8479844.75	29.66	25.18	10%	23.37	15.30	474593.27	1.66	1.53	15%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	1.5 Earth and related environmental sciences	6452.75	132380.00	20.52	16.16	16%	14.27	11.46	7833.86	1.21	1.09	21%
AUSTRIA (without FWF)	1.5 Earth and related environmental sciences	5570.75	101248.50	18.18	14.23	17%	12.45	10.70	6598.60	1.18	1.06	22%
DENMARK	1.5 Earth and related environmental sciences	8376.50	193818.50	23.14	18.11	10%	16.24	12.07	12075.29	1.44	1.24	22%
FINLAND	1.5 Earth and related environmental sciences	6739.25	129825.00	19.26	14.27	12%	13.79	11.26	8138.02	1.21	1.17	26%
GERMANY	1.5 Earth and related environmental sciences	49255.00	1117803.50	22.69	17.84	13%	16.97	12.94	63512.23	1.29	1.20	21%
GREAT BRITAIN	1.5 Earth and related environmental sciences	60281.00	1405986.50	23.32	19.02	12%	18.09	13.84	82595.32	1.37	1.24	18%
NETHERLANDS	1.5 Earth and related environmental sciences	16540.75	395726.25	23.92	19.26	11%	16.88	11.99	24464.51	1.48	1.28	20%
SWEDEN	1.5 Earth and related environmental sciences	13028.25	295031.50	22.65	17.92	11%	16.52	12.70	17104.53	1.31	1.20	21%
SWITZERLAND	1.5 Earth and related environmental sciences	14656.75	396670.50	27.06	21.68	10%	19.64	13.28	23104.65	1.58	1.33	20%
USA	1.5 Earth and related environmental sciences	213413.00	5950110.00	27.88	23.61	11%	22.09	15.68	298289.44	1.40	1.29	15%
AUSTRIA	1.6.1 Biochemistry & Molecular Biology	7492.75	159000.25	21.22	16.83	10%	16.87	15.24	8276.49	1.10	1.13	21%
AUSTRIA (without FWF)	1.6.1 Biochemistry & Molecular Biology	5524.25	105582.00	19.11	15.22	11%	15.23	14.18	5978.22	1.08	1.11	20%
DENMARK	1.6.1 Biochemistry & Molecular Biology	7705.75	191153.75	24.81	20.07	7%	17.70	16.14	10007.72	1.30	1.16	19%
FINLAND	1.6.1 Biochemistry & Molecular Biology	5753.75	117515.50	20.42	15.99	9%	16.79	15.70	6199.80	1.08	1.10	22%
GERMANY	1.6.1 Biochemistry & Molecular Biology	60767.75	1384416.50	22.78	18.23	10%	17.57	15.57	75851.67	1.25	1.16	20%
GREAT BRITAIN	1.6.1 Biochemistry & Molecular Biology	55534.25	1461270.00	26.31	21.95	8%	19.93	16.53	80362.44	1.45	1.26	17%
NETHERLANDS	1.6.1 Biochemistry & Molecular Biology	14886.50	377500.00	25.36	20.70	7%	19.05	16.30	21784.65	1.46	1.24	18%
SWEDEN	1.6.1 Biochemistry & Molecular Biology	14661.75	352409.00	24.04	19.61	7%	17.89	16.32	18047.57	1.23	1.13	18%
SWITZERLAND	1.6.1 Biochemistry & Molecular Biology	14029.50	398614.50	28.41	23.61	7%	20.64	16.47	21172.81	1.51	1.32	17%
USA	1.6.1 Biochemistry & Molecular Biology	234900.75	6398747.00	27.24	22.92	7%	21.51	17.41	318052.00	1.35	1.27	16%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	1.6.2 Biology	7368.75	160929.75	21.84	17.59	13%	15.96	12.60	9391.52	1.27	1.17	19%
AUSTRIA (without FWF)	1.6.2 Biology	6122.75	115767.50	18.91	15.18	14%	13.83	11.65	7525.39	1.23	1.12	20%
DENMARK	1.6.2 Biology	10129.50	229966.50	22.70	18.07	10%	16.29	12.54	14389.51	1.42	1.25	20%
FINLAND	1.6.2 Biology	8171.75	163508.50	20.01	15.74	11%	14.97	12.07	10472.74	1.28	1.21	21%
GERMANY	1.6.2 Biology	56868.75	1342630.25	23.61	19.00	11%	18.50	14.38	73820.44	1.30	1.24	20%
GREAT BRITAIN	1.6.2 Biology	73142.50	1858784.75	25.41	21.22	10%	20.29	15.28	104487.20	1.43	1.31	17%
NETHERLANDS	1.6.2 Biology	20380.00	499643.50	24.52	19.97	10%	17.88	13.18	29985.41	1.47	1.30	19%
SWEDEN	1.6.2 Biology	16383.25	405476.00	24.75	20.30	9%	18.07	13.58	23675.29	1.45	1.29	18%
SWITZERLAND	1.6.2 Biology	15020.25	441782.25	29.41	24.43	9%	22.25	15.12	24426.19	1.63	1.37	17%
USA	1.6.2 Biology	274321.75	7330984.50	26.72	22.87	12%	21.54	15.83	366920.10	1.34	1.25	14%
AUSTRIA	1.6.3 Microbiology & Genetics	5919.25	158299.25	26.74	21.77	7%	20.48	16.91	7922.62	1.34	1.27	19%
AUSTRIA (without FWF)	1.6.3 Microbiology & Genetics	4517.25	114721.00	25.40	20.77	8%	19.06	16.02	6105.49	1.35	1.25	18%
DENMARK	1.6.3 Microbiology & Genetics	7483.25	200546.75	26.80	21.86	6%	18.41	16.45	10853.76	1.45	1.22	18%
FINLAND	1.6.3 Microbiology & Genetics	6030.25	154555.25	25.63	20.47	6%	19.49	17.17	7827.40	1.30	1.22	20%
GERMANY	1.6.3 Microbiology & Genetics	48564.50	1297455.75	26.72	21.73	6%	21.14	18.27	62051.32	1.28	1.24	19%
GREAT BRITAIN	1.6.3 Microbiology & Genetics	53052.00	1588757.75	29.95	25.23	5%	23.49	18.78	76568.56	1.44	1.32	16%
NETHERLANDS	1.6.3 Microbiology & Genetics	17717.75	483528.00	27.29	22.29	5%	20.60	17.02	25547.23	1.44	1.31	18%
SWEDEN	1.6.3 Microbiology & Genetics	12130.75	312806.00	25.79	21.02	5%	19.91	17.60	15780.86	1.30	1.23	18%
SWITZERLAND	1.6.3 Microbiology & Genetics	12373.25	384417.00	31.07	25.96	5%	24.20	18.14	19411.18	1.57	1.43	16%
USA	1.6.3 Microbiology & Genetics	207756.00	6394000.00	30.78	26.32	5%	24.98	19.15	300916.33	1.45	1.37	14%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	2 Engineering and Technology	15420.50	152715.25	9.90	7.63	26%	6.90	6.94	16994.13	1.10	1.04	23%
AUSTRIA (without FWF)	2 Engineering and Technology	13593.00	128567.00	9.46	7.36	27%	6.55	6.77	14804.52	1.09	1.02	22%
DENMARK	2 Engineering and Technology	14584.50	199980.25	13.71	10.87	15%	9.42	7.70	21624.10	1.48	1.27	21%
FINLAND	2 Engineering and Technology	15821.00	154859.50	9.79	7.49	23%	7.55	6.89	17956.99	1.14	1.12	23%
GERMANY	2 Engineering and Technology	130100.00	1317316.00	10.13	7.76	27%	7.42	7.10	143933.00	1.11	1.05	23%
GREAT BRITAIN	2 Engineering and Technology	122743.75	1266757.25	10.32	8.17	22%	7.98	7.20	145422.89	1.18	1.14	21%
NETHERLANDS	2 Engineering and Technology	37253.50	460214.25	12.35	9.89	19%	9.20	7.46	50827.38	1.36	1.26	20%
SWEDEN	2 Engineering and Technology	29068.25	336855.25	11.59	9.24	20%	8.43	7.20	37023.79	1.27	1.21	20%
SWITZERLAND	2 Engineering and Technology	28118.25	369877.25	13.15	10.23	20%	8.90	7.11	41257.97	1.47	1.26	22%
USA	2 Engineering and Technology	464105.00	5569411.00	12.00	9.86	22%	8.75	7.14	651579.02	1.40	1.25	18%
AUSTRIA	3.1 Basic Medicine	9934.00	240235.00	24.18	19.70	9%	18.56	16.23	11899.60	1.20	1.13	19%
AUSTRIA (without FWF)	3.1 Basic Medicine	8361.25	183095.00	21.90	17.90	10%	16.61	15.22	9824.34	1.17	1.10	18%
DENMARK	3.1 Basic Medicine	12682.25	306103.50	24.14	19.24	7%	17.50	15.55	15826.56	1.25	1.11	20%
FINLAND	3.1 Basic Medicine	9078.50	203558.50	22.42	18.14	7%	17.26	15.44	10817.45	1.19	1.13	19%
GERMANY	3.1 Basic Medicine	82018.75	1983284.50	24.18	19.77	10%	19.09	16.82	96345.44	1.17	1.12	18%
GREAT BRITAIN	3.1 Basic Medicine	90292.25	2490290.00	27.58	23.32	8%	21.82	17.85	120054.92	1.33	1.21	15%
NETHERLANDS	3.1 Basic Medicine	28885.25	729256.75	25.25	20.80	6%	19.33	16.04	37422.46	1.30	1.20	18%
SWEDEN	3.1 Basic Medicine	21566.75	517025.25	23.97	19.62	7%	18.51	16.74	25384.24	1.18	1.10	18%
SWITZERLAND	3.1 Basic Medicine	22367.25	665394.25	29.75	24.97	7%	22.86	17.28	32277.13	1.44	1.28	16%
USA	3.1 Basic Medicine	394390.25	11337935.00	28.75	24.61	7%	23.17	18.05	526137.98	1.33	1.25	14%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	3.2 Clinical Medicine	27893.00	478947.75	17.17	14.20	13%	12.84	13.24	32463.09	1.16	1.04	17%
AUSTRIA (without FWF)	3.2 Clinical Medicine	26521.50	440316.00	16.60	13.79	14%	12.34	12.99	30620.24	1.15	1.02	17%
DENMARK	3.2 Clinical Medicine	24947.00	578102.25	23.17	19.19	9%	15.68	13.22	37236.48	1.49	1.23	17%
FINLAND	3.2 Clinical Medicine	21862.50	463133.75	21.18	17.85	8%	15.62	13.44	28558.81	1.31	1.18	16%
GERMANY	3.2 Clinical Medicine	187070.50	2954590.00	15.79	13.06	17%	11.69	13.08	195266.22	1.04	0.93	17%
GREAT BRITAIN	3.2 Clinical Medicine	202146.50	3806558.00	18.83	16.25	13%	14.86	13.29	252881.35	1.25	1.15	14%
NETHERLANDS	3.2 Clinical Medicine	74901.00	1597603.25	21.33	17.75	9%	15.79	12.88	106201.97	1.42	1.27	17%
SWEDEN	3.2 Clinical Medicine	47548.50	982691.00	20.67	17.30	9%	14.58	13.35	63493.16	1.34	1.14	16%
SWITZERLAND	3.2 Clinical Medicine	43346.25	908944.50	20.97	17.69	12%	14.74	12.87	60755.59	1.40	1.18	16%
USA	3.2 Clinical Medicine	751275.75	14961307.00	19.91	17.26	11%	16.20	13.27	989134.95	1.32	1.24	13%
AUSTRIA	3.3 Health sciences	5332.25	87910.25	16.49	13.23	12%	12.23	11.65	6445.40	1.21	1.10	20%
AUSTRIA (without FWF)	3.3 Health sciences	4898.25	75712.25	15.46	12.45	12%	11.39	11.37	5749.37	1.17	1.07	19%
DENMARK	3.3 Health sciences	10026.75	175859.25	17.54	14.04	10%	12.38	11.35	12877.78	1.28	1.14	20%
FINLAND	3.3 Health sciences	8363.75	133364.25	15.95	12.90	11%	12.22	11.35	9804.45	1.17	1.11	19%
GERMANY	3.3 Health sciences	40445.25	690332.50	17.07	13.74	13%	13.12	12.02	47897.54	1.18	1.13	20%
GREAT BRITAIN	3.3 Health sciences	73572.25	1188440.50	16.15	13.55	12%	12.64	11.67	91579.91	1.24	1.15	16%
NETHERLANDS	3.3 Health sciences	23163.75	401646.75	17.34	14.12	10%	13.10	11.44	30322.78	1.31	1.21	19%
SWEDEN	3.3 Health sciences	17699.50	296126.50	16.73	13.82	11%	12.19	11.23	21748.64	1.23	1.13	17%
SWITZERLAND	3.3 Health sciences	14143.00	285918.00	20.22	16.66	10%	14.53	11.81	20730.49	1.47	1.27	18%
USA	3.3 Health sciences	275278.75	4793510.75	17.41	14.89	12%	13.89	11.57	360997.35	1.31	1.23	15%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	4 Agricultural sciences	4718.25	55059.00	11.67	9.22	21%	7.85	7.84	5708.51	1.21	1.04	21%
AUSTRIA (without FWF)	4 Agricultural sciences	4347.25	47315.00	10.88	8.64	21%	7.32	7.56	5163.82	1.19	1.02	21%
DENMARK	4 Agricultural sciences	7514.50	110649.50	14.72	11.77	13%	10.15	8.47	10945.58	1.46	1.28	20%
FINLAND	4 Agricultural sciences	5757.75	72325.00	12.56	9.66	13%	9.28	8.34	7340.02	1.27	1.18	23%
GERMANY	4 Agricultural sciences	32672.50	401985.25	12.30	9.66	21%	9.10	8.63	36283.86	1.11	1.04	21%
GREAT BRITAIN	4 Agricultural sciences	35732.25	501443.00	14.03	11.45	14%	10.66	9.24	49666.74	1.39	1.25	18%
NETHERLANDS	4 Agricultural sciences	12527.50	178619.75	14.26	11.37	13%	10.22	8.95	17803.54	1.42	1.24	20%
SWEDEN	4 Agricultural sciences	8695.00	138110.00	15.88	13.11	12%	10.56	9.00	12543.01	1.44	1.25	17%
SWITZERLAND	4 Agricultural sciences	8388.50	112202.25	13.38	10.68	20%	9.44	7.93	11454.29	1.37	1.19	20%
USA	4 Agricultural sciences	142381.00	1930868.75	13.56	11.25	16%	10.37	8.68	188533.97	1.32	1.24	17%
AUSTRIA	5.1 Psychology	1616.00	15348.00	9.50	7.45	25%	7.20	9.07	1592.54	0.99	0.91	22%
AUSTRIA (without FWF)	5.1 Psychology	1532.00	14072.00	9.19	7.21	26%	7.11	8.98	1452.53	0.95	0.89	22%
DENMARK	5.1 Psychology	1562.75	15554.25	9.95	7.73	20%	7.53	8.13	1761.17	1.13	1.03	22%
FINLAND	5.1 Psychology	2466.50	26762.25	10.85	8.76	17%	9.10	8.81	2782.96	1.13	1.14	19%
GERMANY	5.1 Psychology	17315.50	186822.75	10.79	8.30	20%	7.86	9.29	17601.65	1.02	0.96	23%
GREAT BRITAIN	5.1 Psychology	32586.75	413583.25	12.69	10.47	16%	10.00	9.36	38412.44	1.18	1.11	18%
NETHERLANDS	5.1 Psychology	13086.50	166672.00	12.74	10.11	16%	9.72	8.50	16525.25	1.26	1.21	21%
SWEDEN	5.1 Psychology	4785.25	51289.50	10.72	8.78	16%	8.31	8.37	5469.82	1.14	1.06	18%
SWITZERLAND	5.1 Psychology	3726.50	37947.75	10.18	7.66	21%	7.32	8.21	3959.34	1.06	1.00	25%
USA	5.1 Psychology	143622.25	1906207.25	13.27	11.31	16%	10.88	9.69	175357.08	1.22	1.17	15%

Country	Country	P	C+sc	CPP +sc	CPP	Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
AUSTRIA	5.2 Economics and Business	1568.00	9879.25	6.30	5.40	27%	5.17	5.92	1572.90	1.00	0.93	14%
AUSTRIA (without FWF)	5.2 Economics and Business	1443.00	8842.25	6.13	5.25	28%	5.01	5.86	1438.49	1.00	0.92	14%
DENMARK	5.2 Economics and Business	2034.25	15461.50	7.60	6.75	24%	6.32	6.37	2249.98	1.11	1.05	11%
FINLAND	5.2 Economics and Business	1711.75	10303.50	6.02	5.21	27%	5.48	5.96	1618.23	0.95	0.98	13%
GERMANY	5.2 Economics and Business	9746.25	58557.00	6.01	5.12	30%	4.85	5.69	9548.66	0.98	0.92	15%
GREAT BRITAIN	5.2 Economics and Business	24507.25	206850.75	8.44	7.47	22%	6.98	6.90	28664.39	1.17	1.08	12%
NETHERLANDS	5.2 Economics and Business	7771.50	66207.25	8.52	7.28	22%	7.00	6.54	9127.96	1.17	1.12	14%
SWEDEN	5.2 Economics and Business	3249.75	26358.00	8.11	7.18	22%	6.90	6.64	3684.28	1.13	1.09	11%
SWITZERLAND	5.2 Economics and Business	2837.50	23562.50	8.30	7.25	25%	5.99	5.69	3757.68	1.32	1.11	13%
USA	5.2 Economics and Business	79995.75	885231.25	11.07	10.12	20%	9.63	6.98	117319.74	1.47	1.40	9%
AUSTRIA	5.9 Other social sciences (Soc sc, Interdisc)	1784.00	9941.00	5.57	4.67	37%	4.12	4.85	1733.28	0.97	0.91	16%
AUSTRIA (without FWF)	5.9 Other social sciences (Soc sc, Interdisc)	1712.75	9181.00	5.36	4.51	38%	4.06	4.80	1617.77	0.94	0.90	16%
DENMARK	5.9 Other social sciences (Soc sc, Interdisc)	2648.25	16572.75	6.26	5.37	26%	4.84	4.62	3391.46	1.28	1.15	14%
FINLAND	5.9 Other social sciences (Soc sc, Interdisc)	2693.25	15385.50	5.71	4.78	29%	5.29	5.09	2774.17	1.03	1.11	16%
GERMANY	5.9 Other social sciences (Soc sc, Interdisc)	13087.50	63206.00	4.83	4.04	39%	3.61	4.69	12316.18	0.94	0.85	16%
GREAT BRITAIN	5.9 Other social sciences (Soc sc, Interdisc)	51129.50	325001.50	6.36	5.49	25%	5.08	5.39	60665.83	1.19	1.08	14%
NETHERLANDS	5.9 Other social sciences (Soc sc, Interdisc)	11204.50	82724.50	7.38	6.16	24%	5.55	5.01	15416.73	1.38	1.23	17%
SWEDEN	5.9 Other social sciences (Soc sc, Interdisc)	5165.75	34134.25	6.61	5.63	27%	5.15	4.93	6314.62	1.22	1.13	15%
SWITZERLAND	5.9 Other social sciences (Soc sc, Interdisc)	3358.75	18195.50	5.42	4.46	34%	4.30	4.67	3701.13	1.10	1.02	18%
USA	5.9 Other social sciences (Soc sc, Interdisc)	177771.75	1196325.75	6.73	5.97	26%	5.69	5.54	217380.31	1.22	1.17	11%

Appendix III: Scientific Research Profile, FWF Austrian Science Fund Grant Type, 2001-2010/11

Grant type	OECD Category	P	C+sc	CPP+sc	CPP	%Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
F	1.1 Mathematics	295.00	12503.00	42.38	37.26	12%	27.90	13.96	573.25	1.94	1.39	12%
F	1.2 Computer and information sciences	160.00	10475.00	65.47	58.81	25%	45.46	20.73	287.74	1.80	1.51	10%
F	1.3 Physical sciences	879.25	32690.50	37.18	30.67	8%	22.02	11.72	2035.77	2.32	1.66	18%
F	1.4 Chemical sciences	300.00	14488.00	48.29	41.16	5%	34.89	19.24	481.76	1.61	1.47	15%
F	1.5 Earth and related environmental sciences	61.00	9781.00	160.34	144.89	0%	111.13	47.16	173.08	2.84	2.18	10%
F	1.6.1 Biochemistry & Molecular Biology	339.50	10404.25	30.65	24.95	2%	26.52	20.79	441.81	1.30	1.34	19%
F	1.6.2 Biology	98.00	10772.00	109.92	98.17	0%	82.67	36.92	227.83	2.32	2.09	11%
F	1.6.3 Microbiology & Genetics	174.00	7075.50	40.66	34.22	4%	35.45	23.93	258.72	1.49	1.58	16%
F	2 Engineering and Technology	276.00	4248.00	15.39	12.15	16%	12.37	9.59	337.17	1.22	1.22	21%
F	3.1 Basic Medicine	178.25	13297.00	74.60	65.67	2%	55.50	29.97	333.92	1.87	1.68	12%
F	3.2 Clinical Medicine	198.50	5901.25	29.73	23.59	2%	31.29	21.77	248.27	1.25	1.54	21%
F	3.3 Health sciences	60.00	2473.00	41.22	34.47	7%	34.42	17.35	134.60	2.24	2.20	16%
F	4 Agricultural sciences	33.00	833.00	25.24	20.94	9%	23.76	18.05	34.94	1.06	1.31	17%
F	5.1 Psychology	1.00	29.00	29.00	28.00	0%	13.88	12.06	2.47	2.47	1.22	3%
F	5.2 Economics and Business	31.00	386.00	12.45	11.35	10%	12.79	10.51	33.91	1.09	1.19	9%
F	5.9 Other social sciences (Soc sc, Interdisc)	7.00	79.00	11.29	9.43	0%	7.66	8.75	10.59	1.51	1.04	16%
S	1.1 Mathematics	98.00	827.00	8.44	6.56	36%	6.53	3.37	162.03	1.65	1.13	22%
S	1.2 Computer and information sciences	86.00	990.00	11.51	9.48	22%	9.08	4.45	167.79	1.95	1.68	18%
S	1.3 Physical sciences	266.00	4676.00	17.58	12.81	13%	11.76	8.44	401.42	1.51	1.39	27%
S	1.4 Chemical sciences	153.00	2869.00	18.75	13.69	8%	14.83	10.83	179.48	1.17	1.45	27%
S	1.5 Earth and related environmental sciences	8.00	483.00	60.38	53.75	0%	59.55	19.83	18.08	2.26	2.74	11%
S	1.6.1 Biochemistry & Molecular Biology	77.00	3289.00	42.71	34.42	4%	25.78	16.02	137.03	1.78	1.43	19%
S	1.6.2 Biology	23.00	999.00	43.43	37.48	0%	37.18	16.62	45.93	2.00	1.94	14%
S	1.6.3 Microbiology & Genetics	77.00	4166.00	54.10	45.32	3%	35.01	21.18	171.07	2.22	1.62	16%
S	2 Engineering and Technology	138.00	1480.00	10.72	7.78	18%	7.92	5.78	249.69	1.81	1.52	28%
S	3.1 Basic Medicine	95.25	3044.50	31.96	25.52	4%	22.76	18.01	154.18	1.62	1.41	20%
S	3.2 Clinical Medicine	118.00	3431.00	29.08	22.72	7%	19.25	15.04	169.37	1.44	1.31	22%
S	3.3 Health sciences	24.00	877.00	36.54	31.58	13%	16.01	12.08	62.44	2.60	1.52	14%
S	4 Agricultural sciences	11.00	337.00	30.64	26.55	18%	11.03	14.44	16.17	1.47	0.84	13%
S	5.2 Economics and Business	14.00	35.00	2.50	2.36	36%	2.37	1.59	22.85	1.63	1.52	6%
S	5.9 Other social sciences (Soc sc, Interdisc)	1.00	4.00	4.00	4.00	0%	2.39	2.22	1.89	1.89	1.13	0%

Appendix IV: Data underlying the Scientific Cooperation Profile, FWF Austrian Science Fund, 2001-2010/11

Type	P	C+sc	CPP+sc	CPP	% Pnc	JCSm	FCSm	TNCS	MNCS	MNJS	Self Cits
Single Institute	3852.25	73513.75	19.08	14.93	7%	14.86	12.84	4729.25	1.23	1.16	22%
National	2596.25	53185.75	20.49	16.03	5%	16.32	13.32	3384.85	1.30	1.27	22%
International	7230.25	169719.50	23.47	17.45	5%	16.46	12.10	10418.12	1.44	1.34	26%

Appendix V: Algorithm for matching publications

Our algorithm for matching publications is usually based on the following elements:

1) Surname first author.
2) First initial first author.
3) Publication year.
4) Volume number.
5) First page number or electronic publication number [*not available in FWF data*].
6) Journal title. Fuzzy match using Levenstein edit distance metrics, with the first letter a required match. The Levenstein algorithm computes how many changes (additions, character changes, deletes, etc.) are necessary to change one character string into the other.
7) Supplement number, if and when available.

This method is applied using increasing tolerance in a hierarchical way. So the most stringent matches are applied first and removed from the possible matches. This is done in an iteration process that applies small changes to the data we want to match. All data we want to use in this way must in principle be available to allow for this method. However as within the iterative method the page number is at some point left out of the equation, these data could be matched using this system. The lack of the page number imposes stricter requirements on the rest of the information, this meaning that we need to have other elements to ensure a correct matching process. To alleviate this situation, we used the publication titles provided by FWF as new matching input information. However, publication titles can not be put in the place of a full body of information totally. Matching on the basis of publication titles has some severe drawbacks, such as that the title may not be supplied in the same language as the title was formulated in the actual publication. However we were able to draw the title in as a deciding secondary element of decision in the matching procedure.

In the subsequent paragraphs we show the result of the matching process after applying a second selection based on the publication title. The initial number of publications (records) to be matched amounted to 21,217 (i.e. unique records

originally sent by FWF). Publications were required to at least have a viable year of publication otherwise they did not enter at all in the analysis. Of this initial list of records we successfully matched 17,087 publications in three levels of certainty (see summary below).

Certainty	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	16624	97.29	16624	97.29
2	194	1.14	16818	98.43
3	269	1.57	17087	100.00

The first certainty level are matches that also comply in the title within 90% of the difference in the Levenstein edit distance algorithm (the number of changed needed to get from one text string to the other) being equal to or smaller than their difference in length (in other words, that the titles do not differ more than 10% according to the Levenstein distance). The second level is computed by comparing words from one title in the other in which the order is unimportant (which is not the case for Levenstein), when all words from one title except for a maximum of one are retrieved in the other title, then the publication is accepted as a match. The third level is generated on the basis of a manual check on publication titles.

In addition to the previous steps, we have performed a check of data that we could not match (i.e. 4,130 records) on the basis of a sample of 100 publications. Underneath is the overview of the reasons we found why these matches could not be established:

Reason	%
Journal not covered by WoS	27
Journal not included in the FWF data	23
Paper not covered by WoS	32
Wrong original data	18
Total	100

So there are two main aspects to the impossibility to match these publications. First and accounting for some 60% of the non-matches is the fact that the publications were not covered by WoS (e.g. the journal was not covered by the database or the

individual paper did not appear in the database). The second reason is the level of accuracy in the data supplied (missing journals or mistakes in the original data supplied – typos, wrong titles, wrong author names, etc.) were significant and could not be detected by our algorithm. In this point, we would like to stress again that this occurred after we have taken a lot of time to clean and improve the original data.

After this first matching procedure, we detected that the publications supplied are not necessarily unique (duplicates were found, see the *example of a duplicate publication* below). So what went into the analyses were a total of 14,254 unique publications as retrieved from the Web of Science database (summary below).

Certainty	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	13839	97.09	13839	97.09
2	169	1.19	14008	98.27
3	246	1.73	14254	100.00

After excluding Arts and Humanities OECD categories (see chapter 2.3 and Appendix VII) we were left with 14,143 publications. Besides, in the analyses we use database years 2001 – 2010, which reduced the actual number of publications used further to ***13,773*** that is the final number of publications included in the analysis.

Example of a duplicate publication

An example of a publication that we have no choice but to consider a duplicate is the following:

Author	Volume	Journal	Year
Blyth RIR Mittendorfer F	114	JOURNAL OF CHEMICAL PHYSICS	2001
Blyth RIR Mittendorfer F Hafner J	114	JOURNAL OF CHEMICAL PHYSICS	2001

Title
An experimental and theoretical investigation of the thiophene/aluminum interface.
An experimental and theoretical investigation of the thiophene/aluminium interface.

Although there is a small difference in the publication title (Aluminum is spelled differently and the publication author(s) are slightly different), this is to all intends and purposes the same publication. However in the data input file we received they are also different with respect to:

Id_record	Grant_ID	Grant_Type	Grant_Number	Project_leader
10579	10029	S	S 8104-N02	NETZER Falko P.
10605	10032	S	S 8106-N02	REDINGER Josef

We have no handles to differentiate the one from the other and indeed we think it is impossible because they are the same really. “Id record” is a variable we attached as an identification serial number that serves to indicate the line on which the publication is in the excel-file. But the other identification elements are FWF supplied, they’re different but they point to the same publication.

Appendix VI: Short 'exegesis' of the MNCS indicator

The ***MNCS*** is an item-oriented field-year-document type normalized indicator of citation impact. This indicator relates the measured impact of a research group or institute to a worldwide, field-specific reference value. It is the *internationally standardized impact indicator*. This indicator enables us to observe whether the performance of a research group or institute is significantly far below (indicator value < 0.5), below (indicator value 0.5 - 0.8), around (0.8 - 1.2), above (1.2 - 2.0), or far above (>2.0) the international (western world dominated) impact standard of the field. We stress however that the meaning of the numerical value of the indicator is related to the *aggregation level of the entity* under study. The higher the aggregation level, the larger the volume of publications and the more difficult it is to obtain a citation impact significantly above the international level. At the 'meso-level' (e.g., a *whole university*, or a large institute, about 500 – 1,000 publications per year), a ***MNCS*** value above 1.2, means that the institute's impact as a whole is remarkably above (the western-) world average.

Sensitivity of the MNCS indicator to citations to recent publications

Recent publications have a small expected number of citations. In some cases, a relatively small number of citations to a recent publication can therefore be sufficient to get a high value for the ratio of the actual and the expected number of citations of the publication. For this reason, the ***MNCS*** indicator can be very sensitive to citations to recent publications. In some cases, this sensitivity may cause the ***MNCS*** indicator to provide a distorted picture of the citation score of a set of publications.
CWTS calculates the ***MNCS*** indicator only for publications that have had at least one year to earn citations. In this way, the expected number of citations of a publication will never be very small, and the sensitivity of the ***MNCS*** indicator to citations to recent publications will therefore be limited.

Special treatment of publications of the document type 'letter' in the MNCS indicator

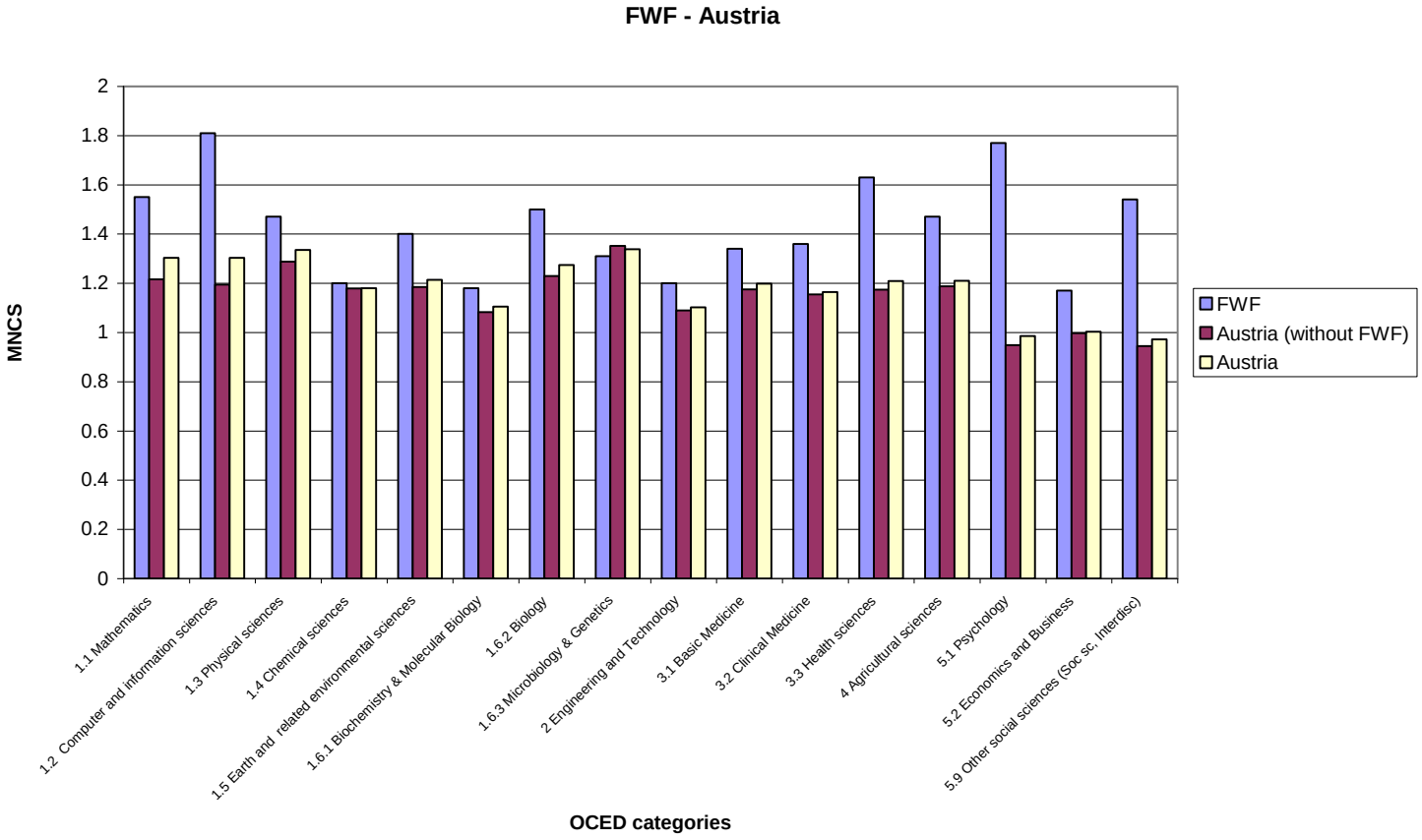
The general idea of the ***MNCS*** indicator is that all publications should have equal weight. However, in the case of publications of the document type *letter*, this principle is difficult to justify. In general, it does not seem fair to give the same weight to a *letter* as to an *article* or *review*. Moreover, since *letters* often have a small expected number of citations, this would cause the MNCS indicator to be highly sensitive to citations to *letters*. For these reasons, *letters* need to be treated in a special way in the MNCS indicator. CWTS chooses to give *letters* a weight of 0.25.

Appendix VII: FWF OECD adapted classification scheme

1.1 Mathematics
1.2 Computer and information sciences
1.3 Physical sciences
1.4 Chemical sciences
1.5 Earth and related environmental sciences
1.6.1 Biochemistry & Molecular Biology
1.6.2 Biology
1.6.3 Microbiology & Genetics
2 Engineering and Technology
3.1 Basic Medicine
3.2 Clinical Medicine
3.3 Health sciences
4 Agricultural sciences
5.1 Psychology
5.2 Economics and Business
5.9 Other social sciences (Soc sc, Interdisc)
6.1 History and Archaeology
6.2 Languages and literature
6.3 Philosophy, Ethics and Religion
6.4 Arts (arts, history of arts, performing arts, music)
6.5 Other humanities

In the previous scheme, categories between 6.1 and 6.5 (i.e. Humanities fields) have been excluded for this study (both in the analysis of the FWF funded output and also the benchmark countries). Category 5.9 "Other social sciences (Soc sc, Interdisc)" includes the merging of the original OECD categories "5.3 Educational sciences", "5.4 Sociology", "5.5 Law", "5.6 Political science", "5.7 Social and economic geography", "5.8 Media and communications" and "5.9 Other social sciences (Soc sc, Interdisc)" itself.

Appendix VIII. Benchmark FWF production vs. Austria (with and without FWF)



Literature

Bornmann, L. (2011). Scientific peer review. Annual Review of Information Science and Technology, 45, 199-245.

FWF (2011). Annual Report 2010. Austria: Federal Ministry of Science and Research. <http://www.fwf.ac.at/de/public_relations/publikationen/jahresberichte/fwf-annual-report-2010.pdf>

Moed, H.F. (2007). The future of research evaluation rests with an intelligent combination of advanced metrics and transparent peer review. Science and Public Policy, 34(8), 575-583.

Moed, H.F., R.E. de Bruin and Th.N. van Leeuwen (1995). New Bibliometric Tools for the Assessment of National Research Performance: Database Description Overview of Indicators and First Applications. Scientometrics, 33, 381-425.

Nederhof, A.J. (1988). The validity and reliability of evaluation of scholarly performance. In: A.F.J. Van Raan (ed.), Handbook of Quantitative Studies of Science and Technology. Amsterdam: North-Holland/Elsevier Science Publishers, pp. 193-228.

Price, D.S. (1963). Little science, big science. New York: Columbia University Press.

Streicher, G., Schibany, A., Dinges, M. and N. Gretzmacher. (2004). Evaluation FWF Impact Analysis. Vienna: Joanneum Research – Institute of Technology and Regional Policy. <http://www.fteval.at/files/evstudien/FWF_Evaluation.pdf>

van Raan, AFJ, Th.N. van Leeuwen, M.S. Visser, N.J.van Eck, and L. Waltman (2010). Rivals for the crown: Reply to Opthof and Leydesdorff, Journal of Informetrics, 2010, 4 (3), 432-435

Waltman, L., van Eck, N.J., van Leeuwen, T.N., Visser, M.S., & van Raan, A.F.J. (2011a). Towards a new crown indicator: Some theoretical considerations. *Journal of Informetrics*, *5*(1), 37–47. Available on http://dx.doi.org/10.1016/j.joi.2010.08.001.

Waltman, L., van Eck, N.J., van Leeuwen, T.N., Visser, M.S., & van Raan, A.F.J. (2011b). Towards a new crown indicator: An empirical analysis. *Scientometrics*, 87(3): 467-481. Available on http://arxiv.org/abs/1004.1632

CWTS II

Country Analysis:

Begin Year	End Year	Cit End Year	Country	P	mcs	tcs	mncs	pp top 10%	pp uncited	prop self cits	int cov	pp collab	pp int collab	Mnjs
2001	2010	2011	Austria	73495	10,83	795624	1,12	11,3%	20%	21%	78%	68%	56%	1,03
2001	2010	2011	FWF	14885	13,56	201832	1,40	15,1%	14%	25%	84%	68%	55%	1,31
2001	2010	2011	Denmark	89835	14,19	1274823	1,41	15,0%	13%	21%	80%	71%	54%	1,22
2001	2010	2011	Finland	83463	11,89	992111	1,17	11,7%	16%	22%	78%	71%	47%	1,13
2001	2010	2011	Germany	728272	11,37	8283492	1,15	11,9%	19%	23%	80%	63%	45%	1,08
2001	2010	2011	Great Britain	735931	13,01	9575714	1,31	13,9%	15%	19%	76%	62%	47%	1,20
2001	2010	2011	Netherlands	229697	14,06	3229181	1,41	15,1%	13%	20%	79%	69%	49%	1,26
2001	2010	2011	Sweden	166090	13,16	2185112	1,26	12,8%	14%	20%	80%	69%	51%	1,17
2001	2010	2011	Switzerland	166078	14,69	2440404	1,47	16,2%	15%	20%	81%	70%	60%	1,26
2001	2010	2011	Usa	2784110	14,45	40219529	1,40	15,2%	15%	17%	79%	56%	27%	1,29

Country Research Profile:

Begin Year	End Year	Cit End Year	Country	Category	p	mcs	tcs	mncs	pp top 10%	pp un-cited	prop self cits	int cov	pp collab	pp int collab	Mnjs
2001	2010	2011	FWF	0.0 Multidisciplinary	273	71,36	19481	6,46	52%	6%	14%	91%	76%	66%	5,48
2001	2010	2011	FWF	1.1 Mathematics	1264	4,67	5905	1,46	16%	35%	30%	58%	60%	53%	1,08
2001	2010	2011	FWF	1.2 Computer and information sciences	689	5,83	4017	1,75	18%	32%	24%	48%	56%	43%	1,34
2001	2010	2011	FWF	1.3 Physical sciences	4417	11,13	49152	1,41	16%	15%	30%	87%	72%	64%	1,27
2001	2010	2011	FWF	1.4 Chemical sciences	2148	9,83	21108	1,04	10%	11%	33%	87%	61%	48%	1,30
2001	2010	2011	FWF	1.5 Earth and related environmental sciences	845	7,99	6755	1,20	12%	15%	34%	70%	73%	64%	1,06
2001	2010	2011	FWF	1.6.1 Biochemistry & Molecular Biology	2036	18,18	37011	1,07	12%	9%	23%	93%	65%	50%	1,13

2001	2010	2011	FWF	1.6.2 Biology	1195	12,97	15504	1,31	15%	10%	26%	80%	66%	55%	1,18
2001	2010	2011	FWF	1.6.3 Microbiology & Genetics	1475	21,45	31644	1,26	16%	5%	21%	92%	71%	57%	1,27
2001	2010	2011	FWF	2 Engineering and Technology	2173	8,02	17434	1,20	12%	21%	28%	77%	64%	48%	1,21
2001	2010	2011	FWF	3.1 Basic Medicine	1397	16,13	22530	1,18	13%	5%	24%	93%	68%	51%	1,20
2001	2010	2011	FWF	3.2 Clinical Medicine	1425	18,72	26682	1,34	16%	5%	23%	94%	75%	53%	1,36
2001	2010	2011	FWF	3.3 Health sciences	472	18,69	8822	1,56	19%	8%	22%	90%	74%	50%	1,44
2001	2010	2011	FWF	4 Agricultural sciences	427	12,44	5313	1,39	16%	14%	24%	83%	66%	46%	1,29
2001	2010	2011	FWF	5.1 Psychology	92	10,96	1008	1,57	21%	11%	23%	72%	51%	37%	1,20
2001	2010	2011	FWF	5.2 Economics and Business	136	7,39	1005	1,16	11%	18%	15%	51%	70%	57%	1,08
2001	2010	2011	FWF	5.9 Other social sciences (Soc sc, Interdisc)	88	7,78	685	1,80	21%	11%	23%	45%	60%	51%	1,17
2001	2010	2011	Austria	0.0 Multidisciplinary	603	48,96	29520	4,56	45%	8%	16%	86%	87%	84%	4,24
2001	2010	2011	Austria	1.1 Mathematics	2736	3,56	9747	1,10	11%	35%	31%	56%	61%	56%	1,00
2001	2010	2011	Austria	1.2 Computer and information sciences	3249	3,43	11150	1,07	11%	42%	24%	39%	56%	45%	0,99
2001	2010	2011	Austria	1.3 Physical sciences	8957	9,45	84664	1,17	11%	23%	29%	83%	82%	77%	1,03
2001	2010	2011	Austria	1.4 Chemical sciences	7523	9,89	74375	1,12	10%	15%	25%	83%	71%	61%	1,11
2001	2010	2011	Austria	1.5 Earth and related environmental sciences	4793	8,67	41578	1,08	11%	17%	27%	61%	79%	69%	0,97
2001	2010	2011	Austria	1.6.1 Biochemistry & Molecular Biology	4837	14,56	70417	1,02	10%	11%	22%	90%	74%	62%	1,05
2001	2010	2011	Austria	1.6.2 Biology	5102	10,15	51795	1,11	11%	14%	23%	74%	73%	64%	1,02
2001	2010	2011	Austria	1.6.3 Microbiology & Genetics	4087	20,65	84403	1,29	14%	8%	19%	91%	80%	68%	1,19
2001	2010	2011	Austria	2 Engineering and Technology	13369	6,93	92624	1,06	10%	28%	23%	68%	70%	56%	0,99
2001	2010	2011	Austria	3.1 Basic Medicine	6823	13,80	94163	1,08	11%	9%	20%	90%	72%	59%	1,01
2001	2010	2011	Austria	3.2 Clinical Medicine	23473	14,12	331326	1,16	12%	13%	17%	88%	62%	45%	1,01
2001	2010	2011	Austria	3.3 Health sciences	4499	12,05	54218	1,14	12%	12%	20%	82%	74%	58%	1,04
2001	2010	2011	Austria	4 Agricultural sciences	4128	8,30	34271	1,17	12%	22%	21%	72%	65%	51%	1,00
2001	2010	2011	Austria	5.1 Psychology	1482	6,82	10109	0,96	9%	26%	22%	63%	58%	47%	0,90
2001	2010	2011	Austria	5.2 Economics and Business	1499	5,18	7758	0,99	10%	28%	15%	49%	60%	51%	0,93

2001	2010	2011	Austria	5.9 Other social sciences (Soc sc, Interdisc)	1772	4,35	7717	0,93	9%	39%	16%	33%	49%	39%	0,89
2001	2010	2011	Denmark	0.0 Multidisciplinary	1191	52,91	63010	5,04	44%	8%	17%	87%	84%	75%	4,32
2001	2010	2011	Denmark	1.1 Mathematics	2283	5,37	12263	1,26	13%	30%	23%	59%	62%	56%	1,19
2001	2010	2011	Denmark	1.2 Computer and information sciences	2635	5,24	13804	1,29	13%	35%	20%	44%	59%	50%	1,11
2001	2010	2011	Denmark	1.3 Physical sciences	10206	11,65	118939	1,43	16%	15%	28%	86%	76%	70%	1,23
2001	2010	2011	Denmark	1.4 Chemical sciences	7405	13,48	99848	1,49	16%	10%	22%	87%	65%	51%	1,37
2001	2010	2011	Denmark	1.5 Earth and related environmental sciences	7324	11,23	82213	1,34	14%	11%	25%	69%	75%	62%	1,16
2001	2010	2011	Denmark	1.6.1 Biochemistry & Molecular Biology	7130	19,22	137017	1,23	13%	7%	20%	93%	74%	58%	1,10
2001	2010	2011	Denmark	1.6.2 Biology	8772	12,01	105351	1,31	15%	10%	23%	78%	72%	59%	1,15
2001	2010	2011	Denmark	1.6.3 Microbiology & Genetics	6985	20,80	145281	1,38	15%	5%	19%	91%	79%	61%	1,17
2001	2010	2011	Denmark	2 Engineering and Technology	14375	10,19	146540	1,46	15%	16%	21%	73%	65%	50%	1,27
2001	2010	2011	Denmark	3.1 Basic Medicine	10834	13,87	150232	1,13	12%	8%	23%	91%	75%	53%	1,03
2001	2010	2011	Denmark	3.2 Clinical Medicine	22186	19,19	425708	1,50	16%	8%	17%	89%	75%	49%	1,24
2001	2010	2011	Denmark	3.3 Health sciences	9593	13,44	128901	1,25	14%	10%	21%	81%	76%	53%	1,12
2001	2010	2011	Denmark	4 Agricultural sciences	7314	11,19	81846	1,43	16%	13%	21%	77%	67%	47%	1,26
2001	2010	2011	Denmark	5.1 Psychology	1530	7,32	11201	1,11	12%	21%	23%	63%	59%	40%	1,01
2001	2010	2011	Denmark	5.2 Economics and Business	2121	6,77	14361	1,13	12%	24%	11%	49%	57%	48%	1,06
2001	2010	2011	Denmark	5.9 Other social sciences (Soc sc, Interdisc)	2698	5,44	14685	1,28	13%	25%	14%	34%	40%	30%	1,15
2001	2010	2011	Finland	0.0 Multidisciplinary	661	48,38	31981	4,90	44%	7%	20%	90%	84%	75%	4,14
2001	2010	2011	Finland	1.1 Mathematics	2343	3,65	8548	1,19	12%	37%	32%	59%	57%	48%	1,04
2001	2010	2011	Finland	1.2 Computer and information sciences	3392	3,75	12716	1,03	10%	41%	21%	43%	49%	34%	1,05
2001	2010	2011	Finland	1.3 Physical sciences	10988	8,01	87987	1,03	10%	20%	33%	85%	75%	66%	1,05
2001	2010	2011	Finland	1.4 Chemical sciences	7648	9,39	71852	1,09	11%	14%	27%	86%	68%	50%	1,20
2001	2010	2011	Finland	1.5 Earth and related environmental sciences	6167	10,15	62582	1,12	11%	12%	29%	69%	74%	52%	1,10
2001	2010	2011	Finland	1.6.1 Biochemistry & Molecular Biology	5384	15,14	81507	1,01	9%	9%	23%	92%	76%	55%	1,04
2001	2010	2011	Finland	1.6.2 Biology	7374	11,95	88115	1,18	12%	11%	23%	78%	70%	48%	1,12

2001	2010	2011	Finland	1.6.3 Microbiology & Genetics	5658	19,36	109544	1,21	12%	6%	21%	92%	80%	59%	1,14
2001	2010	2011	Finland	2 Engineering and Technology	15906	7,13	113405	1,12	11%	23%	24%	69%	61%	39%	1,10
2001	2010	2011	Finland	3.1 Basic Medicine	7971	14,59	116267	1,09	11%	7%	20%	91%	79%	47%	1,06
2001	2010	2011	Finland	3.2 Clinical Medicine	19700	18,10	356577	1,30	13%	8%	16%	89%	80%	42%	1,18
2001	2010	2011	Finland	3.3 Health sciences	8067	12,68	102279	1,15	12%	11%	19%	80%	78%	45%	1,08
2001	2010	2011	Finland	4 Agricultural sciences	5628	9,51	53540	1,27	13%	13%	23%	73%	66%	37%	1,16
2001	2010	2011	Finland	5.1 Psychology	2408	8,67	20877	1,12	11%	17%	19%	65%	65%	36%	1,14
2001	2010	2011	Finland	5.2 Economics and Business	1795	5,12	9184	0,92	9%	26%	14%	48%	53%	35%	0,99
2001	2010	2011	Finland	5.9 Other social sciences (Soc sc, Interdisc)	2742	4,71	12928	1,02	10%	28%	17%	37%	42%	29%	1,12
2001	2010	2011	Germany	0.0 Multidisciplinary	8434	51,35	433054	4,47	45%	6%	16%	91%	79%	66%	4,48
2001	2010	2011	Germany	1.1 Mathematics	26365	3,66	96411	1,08	11%	37%	30%	57%	57%	49%	1,05
2001	2010	2011	Germany	1.2 Computer and information sciences	23336	3,65	85204	1,06	11%	41%	24%	42%	51%	37%	1,00
2001	2010	2011	Germany	1.3 Physical sciences	144346	10,11	1459833	1,21	13%	18%	29%	85%	73%	62%	1,12
2001	2010	2011	Germany	1.4 Chemical sciences	95924	10,90	1045935	1,20	12%	15%	27%	84%	59%	44%	1,23
2001	2010	2011	Germany	1.5 Earth and related environmental sciences	42002	9,76	409929	1,18	13%	15%	27%	69%	71%	56%	1,09
2001	2010	2011	Germany	1.6.1 Biochemistry & Molecular Biology	56172	17,35	974519	1,18	11%	11%	21%	92%	69%	49%	1,10
2001	2010	2011	Germany	1.6.2 Biology	47020	11,77	553473	1,18	13%	12%	23%	79%	67%	51%	1,12
2001	2010	2011	Germany	1.6.3 Microbiology & Genetics	44895	20,36	914202	1,22	13%	6%	20%	93%	73%	53%	1,18
2001	2010	2011	Germany	2 Engineering and Technology	131509	7,26	954915	1,09	11%	28%	24%	72%	60%	42%	1,03
2001	2010	2011	Germany	3.1 Basic Medicine	67529	14,55	982340	1,09	11%	10%	20%	91%	68%	45%	1,04
2001	2010	2011	Germany	3.2 Clinical Medicine	165147	13,15	2171947	1,04	11%	16%	18%	87%	59%	33%	0,93
2001	2010	2011	Germany	3.3 Health sciences	38274	13,04	499198	1,14	12%	13%	20%	83%	68%	44%	1,08
2001	2010	2011	Germany	4 Agricultural sciences	31310	8,94	279856	1,09	11%	21%	22%	76%	60%	40%	1,01
2001	2010	2011	Germany	5.1 Psychology	16616	7,83	130156	1,02	10%	20%	24%	63%	53%	32%	0,96
2001	2010	2011	Germany	5.2 Economics and Business	10105	5,22	52780	1,00	10%	30%	15%	50%	60%	46%	0,93
2001	2010	2011	Germany	5.9 Other social sciences (Soc sc, Interdisc)	13329	4,04	53842	0,94	10%	38%	16%	32%	38%	26%	0,85

2001	2010	2011	Great Britain	0.0 Multidisciplinary	11172	48,50	541868	4,41	42%	8%	15%	87%	72%	62%	4,31
2001	2010	2011	Great Britain	1.1 Mathematics	22999	4,77	109796	1,21	12%	33%	25%	62%	60%	53%	1,10
2001	2010	2011	Great Britain	1.2 Computer and information sciences	25603	4,44	113683	1,19	12%	37%	20%	43%	52%	42%	1,07
2001	2010	2011	Great Britain	1.3 Physical sciences	92075	10,87	1001079	1,27	13%	17%	28%	86%	71%	64%	1,15
2001	2010	2011	Great Britain	1.4 Chemical sciences	63458	12,19	773257	1,33	14%	12%	23%	87%	61%	47%	1,33
2001	2010	2011	Great Britain	1.5 Earth and related environmental sciences	48982	10,63	520496	1,30	14%	13%	24%	69%	70%	57%	1,16
2001	2010	2011	Great Britain	1.6.1 Biochemistry & Molecular Biology	50522	20,53	1037401	1,38	14%	8%	18%	92%	66%	53%	1,19
2001	2010	2011	Great Britain	1.6.2 Biology	58286	13,68	797469	1,35	15%	10%	20%	79%	68%	55%	1,22
2001	2010	2011	Great Britain	1.6.3 Microbiology & Genetics	47812	23,14	1106342	1,38	16%	5%	17%	92%	72%	58%	1,26
2001	2010	2011	Great Britain	2 Engineering and Technology	121025	7,65	925454	1,18	12%	23%	22%	69%	57%	44%	1,13
2001	2010	2011	Great Britain	3.1 Basic Medicine	68872	17,22	1185970	1,28	15%	7%	18%	90%	68%	51%	1,13
2001	2010	2011	Great Britain	3.2 Clinical Medicine	166086	16,50	2739718	1,28	14%	11%	14%	85%	63%	39%	1,16
2001	2010	2011	Great Britain	3.3 Health sciences	67614	12,91	873157	1,22	13%	11%	17%	75%	66%	46%	1,12
2001	2010	2011	Great Britain	4 Agricultural sciences	32802	10,90	357627	1,38	15%	13%	19%	78%	65%	49%	1,23
2001	2010	2011	Great Britain	5.1 Psychology	31353	9,61	301309	1,17	12%	16%	18%	64%	58%	37%	1,10
2001	2010	2011	Great Britain	5.2 Economics and Business	24970	7,50	187201	1,19	12%	21%	12%	46%	59%	46%	1,10
2001	2010	2011	Great Britain	5.9 Other social sciences (Soc sc, Interdisc)	50789	5,52	280471	1,19	12%	24%	14%	31%	36%	23%	1,09
2001	2010	2011	Netherlands	0.0 Multidisciplinary	2571	58,11	149407	5,31	47%	6%	15%	90%	80%	67%	4,51
2001	2010	2011	Netherlands	1.1 Mathematics	6217	4,69	29135	1,10	11%	32%	25%	58%	63%	53%	1,05
2001	2010	2011	Netherlands	1.2 Computer and information sciences	8184	4,80	39274	1,28	14%	35%	21%	44%	58%	43%	1,09
2001	2010	2011	Netherlands	1.3 Physical sciences	26892	12,74	342529	1,47	16%	15%	26%	85%	75%	67%	1,25
2001	2010	2011	Netherlands	1.4 Chemical sciences	19025	14,41	274068	1,56	17%	9%	22%	87%	67%	50%	1,47
2001	2010	2011	Netherlands	1.5 Earth and related environmental sciences	14456	11,06	159904	1,36	15%	12%	24%	67%	74%	59%	1,18
2001	2010	2011	Netherlands	1.6.1 Biochemistry & Molecular Biology	13519	19,45	262882	1,40	14%	7%	20%	93%	72%	54%	1,17
2001	2010	2011	Netherlands	1.6.2 Biology	17054	12,82	218589	1,35	16%	11%	22%	78%	72%	56%	1,19
2001	2010	2011	Netherlands	1.6.3 Microbiology & Genetics	16379	21,21	347470	1,39	16%	5%	19%	92%	78%	58%	1,25

2001	2010	2011	Netherlands	2 Engineering and Technology	36750	9,28	341192	1,35	14%	19%	21%	71%	65%	47%	1,24
2001	2010	2011	Netherlands	3.1 Basic Medicine	23929	15,54	371913	1,19	13%	7%	20%	91%	73%	50%	1,12
2001	2010	2011	Netherlands	3.2 Clinical Medicine	65321	17,77	1160993	1,42	15%	8%	17%	89%	69%	41%	1,27
2001	2010	2011	Netherlands	3.3 Health sciences	21870	13,69	299440	1,29	14%	10%	19%	81%	76%	47%	1,18
2001	2010	2011	Netherlands	4 Agricultural sciences	11881	10,83	128625	1,41	16%	13%	21%	77%	71%	51%	1,23
2001	2010	2011	Netherlands	5.1 Psychology	12566	9,26	116335	1,24	13%	16%	21%	68%	63%	35%	1,20
2001	2010	2011	Netherlands	5.2 Economics and Business	8067	7,49	60442	1,22	13%	21%	14%	54%	64%	46%	1,14
2001	2010	2011	Netherlands	5.9 Other social sciences (Soc sc, Interdisc)	11380	6,27	71319	1,41	15%	23%	17%	41%	50%	30%	1,25
2001	2010	2011	Sweden	0.0 Multidisciplinary	2251	46,58	104855	4,08	40%	7%	17%	91%	79%	71%	3,95
2001	2010	2011	Sweden	1.1 Mathematics	4356	4,53	19727	1,17	11%	36%	26%	61%	58%	47%	1,07
2001	2010	2011	Sweden	1.2 Computer and information sciences	4048	4,65	18803	1,09	10%	39%	20%	44%	55%	41%	1,07
2001	2010	2011	Sweden	1.3 Physical sciences	21709	9,47	205581	1,17	12%	19%	30%	85%	76%	68%	1,13
2001	2010	2011	Sweden	1.4 Chemical sciences	15947	12,41	197847	1,33	14%	11%	23%	87%	66%	50%	1,32
2001	2010	2011	Sweden	1.5 Earth and related environmental sciences	11213	10,61	118959	1,23	13%	12%	25%	68%	72%	57%	1,11
2001	2010	2011	Sweden	1.6.1 Biochemistry & Molecular Biology	13687	18,63	255004	1,16	11%	7%	19%	92%	70%	55%	1,07
2001	2010	2011	Sweden	1.6.2 Biology	13914	14,33	199333	1,34	14%	10%	20%	80%	68%	55%	1,18
2001	2010	2011	Sweden	1.6.3 Microbiology & Genetics	11372	19,79	225026	1,23	13%	5%	20%	92%	76%	61%	1,16
2001	2010	2011	Sweden	2 Engineering and Technology	29128	8,91	259620	1,26	13%	21%	21%	69%	63%	45%	1,20
2001	2010	2011	Sweden	3.1 Basic Medicine	18417	14,66	270066	1,08	11%	7%	20%	92%	73%	54%	1,02
2001	2010	2011	Sweden	3.2 Clinical Medicine	42396	17,23	730323	1,32	13%	8%	17%	88%	73%	47%	1,13
2001	2010	2011	Sweden	3.3 Health sciences	17253	13,31	229594	1,19	12%	11%	18%	78%	74%	47%	1,09
2001	2010	2011	Sweden	4 Agricultural sciences	8471	12,67	107308	1,41	14%	12%	18%	76%	67%	49%	1,22
2001	2010	2011	Sweden	5.1 Psychology	4736	8,58	40637	1,14	11%	16%	18%	64%	63%	32%	1,05
2001	2010	2011	Sweden	5.2 Economics and Business	3413	7,13	24333	1,14	12%	22%	12%	48%	54%	38%	1,09
2001	2010	2011	Sweden	5.9 Other social sciences (Soc sc, Interdisc)	5356	5,60	30017	1,20	12%	26%	15%	37%	44%	28%	1,12
2001	2010	2011	Switzerland	0.0 Multidisciplinary	2750	55,66	153066	5,13	49%	6%	15%	90%	79%	71%	4,86

2001	2010	2011	Switzerland	1.1 Mathematics	4182	4,53	18924	1,28	14%	32%	26%	58%	62%	58%	1,16
2001	2010	2011	Switzerland	1.2 Computer and information sciences	5476	5,82	31858	1,63	17%	34%	19%	43%	60%	53%	1,21
2001	2010	2011	Switzerland	1.3 Physical sciences	29258	11,95	349757	1,46	16%	17%	28%	85%	77%	72%	1,21
2001	2010	2011	Switzerland	1.4 Chemical sciences	20265	12,91	261695	1,42	16%	13%	25%	86%	59%	51%	1,31
2001	2010	2011	Switzerland	1.5 Earth and related environmental sciences	12125	11,59	140476	1,45	17%	11%	26%	70%	76%	64%	1,20
2001	2010	2011	Switzerland	1.6.1 Biochemistry & Molecular Biology	12752	22,45	286290	1,44	16%	7%	18%	93%	72%	61%	1,25
2001	2010	2011	Switzerland	1.6.2 Biology	11849	14,74	174700	1,48	16%	10%	20%	80%	70%	59%	1,23
2001	2010	2011	Switzerland	1.6.3 Microbiology & Genetics	11208	24,20	271195	1,51	18%	5%	18%	93%	78%	67%	1,36
2001	2010	2011	Switzerland	2 Engineering and Technology	27995	9,50	265982	1,44	16%	21%	23%	71%	67%	56%	1,24
2001	2010	2011	Switzerland	3.1 Basic Medicine	17869	17,55	313530	1,33	15%	7%	19%	91%	77%	64%	1,17
2001	2010	2011	Switzerland	3.2 Clinical Medicine	37533	17,55	658579	1,39	15%	11%	16%	88%	72%	56%	1,18
2001	2010	2011	Switzerland	3.3 Health sciences	13150	15,49	203654	1,43	16%	10%	19%	81%	77%	64%	1,23
2001	2010	2011	Switzerland	4 Agricultural sciences	8010	9,65	77258	1,34	14%	20%	21%	78%	63%	47%	1,17
2001	2010	2011	Switzerland	5.1 Psychology	3558	7,03	25008	1,05	11%	21%	25%	67%	68%	56%	1,00
2001	2010	2011	Switzerland	5.2 Economics and Business	2938	7,07	20766	1,31	14%	25%	13%	51%	65%	56%	1,11
2001	2010	2011	Switzerland	5.9 Other social sciences (Soc sc, Interdisc)	3540	4,39	15553	1,09	11%	34%	18%	38%	49%	38%	0,99
2001	2010	2011	Usa	0.0 Multidisciplinary	51849	57,83	2998255	4,52	46%	5%	12%	91%	62%	34%	4,33
2001	2010	2011	Usa	1.1 Mathematics	97832	4,91	480130	1,29	13%	34%	24%	62%	57%	36%	1,17
2001	2010	2011	Usa	1.2 Computer and information sciences	90272	6,13	553779	1,49	15%	33%	15%	43%	55%	29%	1,29
2001	2010	2011	Usa	1.3 Physical sciences	320715	12,62	4045990	1,48	16%	16%	23%	85%	62%	42%	1,26
2001	2010	2011	Usa	1.4 Chemical sciences	233685	15,43	3606454	1,63	18%	11%	19%	88%	46%	26%	1,50
2001	2010	2011	Usa	1.5 Earth and related environmental sciences	166301	11,24	1868513	1,29	14%	12%	21%	71%	65%	34%	1,18
2001	2010	2011	Usa	1.6.1 Biochemistry & Molecular Biology	213267	21,54	4594550	1,28	14%	7%	17%	93%	55%	29%	1,20
2001	2010	2011	Usa	1.6.2 Biology	217210	12,59	2733968	1,19	13%	14%	18%	79%	57%	29%	1,11
2001	2010	2011	Usa	1.6.3 Microbiology & Genetics	188094	24,14	4540416	1,39	16%	5%	16%	93%	62%	33%	1,31
2001	2010	2011	Usa	2 Engineering and Technology	460710	9,29	4279227	1,39	15%	22%	19%	70%	53%	27%	1,24

2001	2010	2011	Usa	3.1 Basic Medicine	309553	17,08	5287580	1,25	14%	7%	17%	91%	58%	27%	1,16
2001	2010	2011	Usa	3.2 Clinical Medicine	653060	17,06	11141589	1,33	15%	10%	14%	87%	59%	22%	1,24
2001	2010	2011	Usa	3.3 Health sciences	261695	14,15	3703981	1,28	14%	12%	15%	79%	61%	24%	1,20
2001	2010	2011	Usa	4 Agricultural sciences	136047	10,50	1429051	1,30	14%	16%	18%	77%	54%	24%	1,22
2001	2010	2011	Usa	5.1 Psychology	137584	10,45	1438229	1,21	13%	16%	15%	65%	53%	15%	1,16
2001	2010	2011	Usa	5.2 Economics and Business	81851	10,21	835552	1,47	16%	20%	9%	56%	58%	25%	1,40
2001	2010	2011	Usa	5.9 Other social sciences (Soc sc, Interdisc)	172357	5,90	1017702	1,22	13%	26%	11%	40%	37%	10%	1,16

Country Collaboration Profile:

Begin Year	End Year	Cit End Year	Country	Cooperation	p	mcs	tcs	mncs	pp top 10%	pp uncited	prop self cits	int cov	Mnjs
2001	2010	2011	Austria	International collaboration	41025	13,10	537550	1,36	14%	17%	23%	79%	1,17
2001	2010	2011	Austria	National collaboration	14775	9,62	142100	0,91	8%	17%	16%	81%	0,93
2001	2010	2011	Austria	No collaboration	17695	6,55	115974	0,74	7%	28%	18%	69%	0,79
2001	2010	2011	Austria Fwf Grant	International collaboration	8187	14,44	118215	1,50	17%	13%	27%	85%	1,39
2001	2010	2011	Austria Fwf Grant	National collaboration	2805	13,94	39104	1,36	14%	13%	22%	86%	1,29
2001	2010	2011	Austria Fwf Grant	No collaboration	3893	11,43	44513	1,22	13%	17%	24%	81%	1,16
2001	2010	2011	Denmark	International collaboration	48732	16,34	796065	1,60	17%	11%	22%	82%	1,33
2001	2010	2011	Denmark	National collaboration	20220	12,60	254688	1,20	13%	11%	18%	84%	1,13
2001	2010	2011	Denmark	No collaboration	20883	10,73	224070	1,16	12%	17%	17%	72%	1,06
2001	2010	2011	Finland	International collaboration	39074	14,70	574208	1,42	15%	14%	23%	82%	1,25
2001	2010	2011	Finland	National collaboration	25364	10,82	274328	0,99	9%	13%	18%	81%	1,06
2001	2010	2011	Finland	No collaboration	19025	7,55	143575	0,93	9%	23%	20%	67%	0,99
2001	2010	2011	Germany	International collaboration	328992	13,75	4523595	1,39	15%	15%	25%	83%	1,26
2001	2010	2011	Germany	National collaboration	169443	10,61	1797791	1,00	10%	18%	20%	83%	0,99

2001	2010	2011	Germany	No collaboration	229837	8,54	1962106	0,91	9%	26%	20%	74%	0,88
2001	2010	2011	Great Britain	International collaboration	322754	15,20	4907231	1,53	17%	14%	22%	80%	1,33
2001	2010	2011	Great Britain	National collaboration	168057	13,11	2202514	1,21	13%	13%	16%	77%	1,17
2001	2010	2011	Great Britain	No collaboration	245120	10,06	2465969	1,08	11%	20%	15%	68%	1,05
2001	2010	2011	Netherlands	International collaboration	113226	16,23	1837612	1,61	18%	12%	22%	81%	1,35
2001	2010	2011	Netherlands	National collaboration	64489	12,91	832765	1,22	13%	11%	17%	82%	1,21
2001	2010	2011	Netherlands	No collaboration	51982	10,75	558804	1,21	12%	18%	17%	71%	1,11
2001	2010	2011	Sweden	International collaboration	84464	15,68	1324101	1,48	15%	13%	22%	83%	1,27
2001	2010	2011	Sweden	National collaboration	40357	11,35	458144	1,06	10%	12%	18%	81%	1,06
2001	2010	2011	Sweden	No collaboration	41269	9,76	402867	1,02	10%	18%	17%	73%	1,05
2001	2010	2011	Switzerland	International collaboration	99010	16,32	1616145	1,64	18%	13%	22%	82%	1,37
2001	2010	2011	Switzerland	National collaboration	24928	13,16	328104	1,26	14%	14%	17%	83%	1,16
2001	2010	2011	Switzerland	No collaboration	42140	11,77	496155	1,20	13%	20%	17%	76%	1,07
2001	2010	2011	Usa	International collaboration	754016	15,50	11690384	1,53	17%	14%	21%	82%	1,35
2001	2010	2011	Usa	National collaboration	1100930	16,30	17944688	1,48	16%	12%	15%	81%	1,35
2001	2010	2011	Usa	No collaboration	929164	11,39	10584457	1,19	12%	19%	14%	73%	1,16

Country Research Collaboration Profile:

Begin Year	End Year	Cit End Year	Country	Collaboration	Category	p	mcs	tcs	mncs	pp top 10%	pp uncited	prop self cits	int cov	Mnjs
2001	2010	2011	Austria	International collaboration	0.0 Multidisciplinary	505	52,04	26282	5,05	49%	6%	17%	86%	4,61
2001	2010	2011	Austria	International collaboration	1.1 Mathematics	1543	3,96	6108	1,29	14%	34%	33%	57%	1,05
2001	2010	2011	Austria	International collaboration	1.2 Computer and information sciences	1475	4,08	6012	1,32	15%	37%	27%	43%	1,11
2001	2010	2011	Austria	International collaboration	1.3 Physical sciences	6884	9,97	68658	1,24	12%	21%	31%	84%	1,07

2001	2010	2011	Austria	International collaboration	1.4 Chemical sciences	4574	10,77	49284	1,23	11%	15%	26%	83%	1,18
2001	2010	2011	Austria	International collaboration	1.5 Earth and related environmental sciences	3321	9,10	30224	1,16	12%	16%	30%	64%	1,00
2001	2010	2011	Austria	International collaboration	1.6.1 Biochemistry & Molecular Biology	3022	16,81	50791	1,16	12%	9%	22%	90%	1,15
2001	2010	2011	Austria	International collaboration	1.6.2 Biology	3289	11,09	36465	1,22	13%	13%	25%	75%	1,07
2001	2010	2011	Austria	International collaboration	1.6.3 Microbiology & Genetics	2793	23,85	66622	1,51	17%	7%	20%	91%	1,32
2001	2010	2011	Austria	International collaboration	2 Engineering and Technology	7482	7,87	58908	1,21	12%	25%	25%	71%	1,07
2001	2010	2011	Austria	International collaboration	3.1 Basic Medicine	4021	16,36	65788	1,29	14%	8%	22%	90%	1,11
2001	2010	2011	Austria	International collaboration	3.2 Clinical Medicine	10671	19,07	203493	1,60	18%	9%	19%	89%	1,24
2001	2010	2011	Austria	International collaboration	3.3 Health sciences	2625	13,80	36233	1,32	14%	11%	22%	82%	1,14
2001	2010	2011	Austria	International collaboration	4 Agricultural sciences	2117	10,39	22006	1,44	15%	17%	22%	75%	1,12
2001	2010	2011	Austria	International collaboration	5.1 Psychology	697	8,26	5757	1,16	12%	23%	23%	67%	1,05
2001	2010	2011	Austria	International collaboration	5.2 Economics and Business	758	5,86	4443	1,16	12%	25%	15%	51%	1,03
2001	2010	2011	Austria	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	696	6,01	4184	1,23	13%	31%	16%	39%	1,07
2001	2010	2011	Austria	National collaboration	0.0 Multidisciplinary	28	24,21	678	1,85	20%	25%	15%	86%	2,08
2001	2010	2011	Austria	National collaboration	1.1 Mathematics	174	2,95	514	1,00	11%	39%	27%	52%	1,02
2001	2010	2011	Austria	National collaboration	1.2 Computer and information sciences	437	3,66	1600	1,05	11%	40%	22%	39%	1,01
2001	2010	2011	Austria	National collaboration	1.3 Physical sciences	626	11,77	7365	1,38	13%	24%	18%	82%	1,05
2001	2010	2011	Austria	National collaboration	1.4 Chemical sciences	1087	8,55	9291	1,06	10%	16%	24%	83%	1,09
2001	2010	2011	Austria	National collaboration	1.5 Earth and related environmental sciences	520	8,50	4418	1,07	9%	16%	17%	56%	0,96
2001	2010	2011	Austria	National collaboration	1.6.1 Biochemistry & Molecular Biology	826	9,12	7537	0,73	6%	14%	24%	90%	0,89
2001	2010	2011	Austria	National collaboration	1.6.2 Biology	669	8,87	5937	1,02	9%	13%	18%	73%	1,02
2001	2010	2011	Austria	National	1.6.3 Microbiology &	716	11,40	8160	0,77	6%	9%	17%	91%	0,90

				collaboration	Genetics									
2001	2010	2011	Austria	National collaboration	2 Engineering and Technology	2365	6,53	15453	0,97	9%	29%	19%	69%	0,98
2001	2010	2011	Austria	National collaboration	3.1 Basic Medicine	1585	10,14	16066	0,80	6%	9%	18%	89%	0,90
2001	2010	2011	Austria	National collaboration	3.2 Clinical Medicine	7756	11,56	89691	0,89	8%	12%	13%	89%	0,91
2001	2010	2011	Austria	National collaboration	3.3 Health sciences	1048	9,44	9891	0,87	7%	11%	16%	86%	0,93
2001	2010	2011	Austria	National collaboration	4 Agricultural sciences	962	5,96	5732	0,95	9%	24%	22%	72%	0,96
2001	2010	2011	Austria	National collaboration	5.1 Psychology	252	6,85	1725	0,76	7%	25%	17%	65%	0,83
2001	2010	2011	Austria	National collaboration	5.2 Economics and Business	171	4,73	809	0,92	9%	33%	13%	47%	0,92
2001	2010	2011	Austria	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	218	3,30	720	0,81	8%	43%	12%	34%	0,85
2001	2010	2011	Austria	No collaboration	0.0 Multidisciplinary	70	36,57	2560	2,10	24%	17%	10%	87%	2,39
2001	2010	2011	Austria	No collaboration	1.1 Mathematics	1019	3,07	3125	0,85	7%	38%	28%	54%	0,91
2001	2010	2011	Austria	No collaboration	1.2 Computer and information sciences	1337	2,65	3538	0,81	7%	49%	20%	34%	0,86
2001	2010	2011	Austria	No collaboration	1.3 Physical sciences	1447	5,97	8641	0,77	7%	30%	26%	78%	0,83
2001	2010	2011	Austria	No collaboration	1.4 Chemical sciences	1862	8,49	15800	0,88	8%	17%	23%	82%	0,96
2001	2010	2011	Austria	No collaboration	1.5 Earth and related environmental sciences	952	7,29	6936	0,84	8%	18%	18%	53%	0,89
2001	2010	2011	Austria	No collaboration	1.6.1 Biochemistry & Molecular Biology	989	12,22	12089	0,84	8%	12%	18%	89%	0,88
2001	2010	2011	Austria	No collaboration	1.6.2 Biology	1144	8,21	9393	0,84	7%	17%	19%	69%	0,86
2001	2010	2011	Austria	No collaboration	1.6.3 Microbiology & Genetics	578	16,65	9621	0,88	9%	11%	15%	91%	0,92
2001	2010	2011	Austria	No collaboration	2 Engineering and Technology	3522	5,19	18263	0,81	8%	35%	19%	59%	0,83
2001	2010	2011	Austria	No collaboration	3.1 Basic Medicine	1217	10,11	12309	0,77	7%	14%	16%	87%	0,81
2001	2010	2011	Austria	No collaboration	3.2 Clinical Medicine	5046	7,56	38142	0,63	5%	22%	12%	85%	0,69
2001	2010	2011	Austria	No collaboration	3.3 Health sciences	826	9,80	8094	0,90	9%	16%	14%	76%	0,86
2001	2010	2011	Austria	No collaboration	4 Agricultural sciences	1049	6,23	6533	0,83	8%	29%	17%	65%	0,78

2001	2010	2011	Austria	No collaboration	5.1 Psychology	533	4,93	2627	0,79	7%	31%	22%	54%	0,75
2001	2010	2011	Austria	No collaboration	5.2 Economics and Business	570	4,40	2506	0,77	7%	31%	15%	46%	0,80
2001	2010	2011	Austria	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	858	3,28	2813	0,71	7%	45%	17%	27%	0,75
2001	2010	2011	FWF	International collaboration	0.0 Multidisciplinary	180	71,54	12878	6,57	53%	4%	16%	91%	5,72
2001	2010	2011	FWF	International collaboration	1.1 Mathematics	664	4,63	3072	1,54	16%	33%	32%	60%	1,09
2001	2010	2011	FWF	International collaboration	1.2 Computer and information sciences	297	7,25	2153	1,96	21%	26%	24%	50%	1,48
2001	2010	2011	FWF	International collaboration	1.3 Physical sciences	2822	11,21	31624	1,43	16%	15%	32%	87%	1,29
2001	2010	2011	FWF	International collaboration	1.4 Chemical sciences	1023	9,41	9626	1,07	10%	12%	36%	88%	1,33
2001	2010	2011	FWF	International collaboration	1.5 Earth and related environmental sciences	543	8,08	4385	1,21	13%	15%	36%	72%	1,08
2001	2010	2011	FWF	International collaboration	1.6.1 Biochemistry & Molecular Biology	1025	19,79	20285	1,17	14%	9%	24%	93%	1,22
2001	2010	2011	FWF	International collaboration	1.6.2 Biology	659	13,94	9185	1,40	17%	10%	28%	80%	1,22
2001	2010	2011	FWF	International collaboration	1.6.3 Microbiology & Genetics	837	23,06	19302	1,40	19%	5%	22%	92%	1,35
2001	2010	2011	FWF	International collaboration	2 Engineering and Technology	1052	8,63	9084	1,30	13%	20%	29%	79%	1,30
2001	2010	2011	FWF	International collaboration	3.1 Basic Medicine	710	18,67	13259	1,35	15%	5%	25%	94%	1,30
2001	2010	2011	FWF	International collaboration	3.2 Clinical Medicine	754	20,85	15720	1,55	21%	4%	24%	94%	1,46
2001	2010	2011	FWF	International collaboration	3.3 Health sciences	236	25,03	5908	2,05	26%	7%	21%	91%	1,74
2001	2010	2011	FWF	International collaboration	4 Agricultural sciences	195	15,66	3054	1,53	17%	14%	23%	85%	1,40
2001	2010	2011	FWF	International collaboration	5.1 Psychology	34	9,35	318	1,71	28%	6%	24%	74%	1,16
2001	2010	2011	FWF	International collaboration	5.2 Economics and Business	77	8,29	638	1,30	15%	22%	17%	52%	1,15
2001	2010	2011	FWF	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	45	9,22	415	2,11	25%	11%	26%	49%	1,26
2001	2010	2011	FWF	National collaboration	0.0 Multidisciplinary	36	92,22	3320	8,76	54%	8%	9%	92%	5,74
2001	2010	2011	FWF	National collaboration	1.1 Mathematics	108	4,28	462	1,41	17%	30%	30%	56%	1,12

2001	2010	2011	FWF	National collaboration	1.2 Computer and information sciences	114	4,89	558	1,52	13%	38%	25%	48%	1,42
2001	2010	2011	FWF	National collaboration	1.3 Physical sciences	561	12,22	6854	1,75	21%	15%	24%	88%	1,37
2001	2010	2011	FWF	National collaboration	1.4 Chemical sciences	475	9,94	4721	1,07	13%	11%	29%	86%	1,35
2001	2010	2011	FWF	National collaboration	1.5 Earth and related environmental sciences	103	7,23	745	1,12	10%	14%	28%	66%	1,01
2001	2010	2011	FWF	National collaboration	1.6.1 Biochemistry & Molecular Biology	479	15,98	7654	0,95	9%	10%	22%	94%	1,01
2001	2010	2011	FWF	National collaboration	1.6.2 Biology	183	11,62	2126	1,33	16%	12%	24%	80%	1,18
2001	2010	2011	FWF	National collaboration	1.6.3 Microbiology & Genetics	289	20,81	6015	1,20	13%	5%	19%	94%	1,22
2001	2010	2011	FWF	National collaboration	2 Engineering and Technology	480	7,48	3590	1,05	11%	20%	29%	78%	1,25
2001	2010	2011	FWF	National collaboration	3.1 Basic Medicine	408	14,37	5863	1,07	10%	4%	23%	94%	1,13
2001	2010	2011	FWF	National collaboration	3.2 Clinical Medicine	494	16,72	8258	1,13	12%	6%	21%	94%	1,30
2001	2010	2011	FWF	National collaboration	3.3 Health sciences	142	13,40	1903	1,13	13%	10%	23%	89%	1,22
2001	2010	2011	FWF	National collaboration	4 Agricultural sciences	112	10,96	1227	1,34	15%	14%	25%	85%	1,24
2001	2010	2011	FWF	National collaboration	5.1 Psychology	16	9,00	144	1,38	15%	6%	24%	72%	1,26
2001	2010	2011	FWF	National collaboration	5.2 Economics and Business	20	4,45	89	0,66	3%	10%	14%	51%	0,87
2001	2010	2011	FWF	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	11	5,18	57	2,09	19%	9%	20%	40%	1,32
2001	2010	2011	FWF	No collaboration	0.0 Multidisciplinary	57	57,60	3283	4,65	47%	11%	11%	88%	4,55
2001	2010	2011	FWF	No collaboration	1.1 Mathematics	492	4,82	2371	1,34	15%	40%	28%	57%	1,04
2001	2010	2011	FWF	No collaboration	1.2 Computer and information sciences	278	4,70	1306	1,61	17%	36%	23%	46%	1,16
2001	2010	2011	FWF	No collaboration	1.3 Physical sciences	1034	10,32	10674	1,16	13%	16%	29%	86%	1,16
2001	2010	2011	FWF	No collaboration	1.4 Chemical sciences	650	10,40	6761	0,99	8%	9%	31%	87%	1,21
2001	2010	2011	FWF	No collaboration	1.5 Earth and related environmental sciences	199	8,17	1625	1,23	12%	14%	28%	64%	1,01
2001	2010	2011	FWF	No collaboration	1.6.1 Biochemistry & Molecular Biology	532	17,05	9072	0,99	11%	7%	21%	93%	1,06

2001	2010	2011	FWF	No collaboration	1.6.2 Biology	353	11,88	4193	1,13	10%	9%	25%	79%	1,10
2001	2010	2011	FWF	No collaboration	1.6.3 Microbiology & Genetics	349	18,13	6327	0,96	11%	7%	20%	91%	1,13
2001	2010	2011	FWF	No collaboration	2 Engineering and Technology	641	7,43	4760	1,14	12%	24%	26%	71%	1,05
2001	2010	2011	FWF	No collaboration	3.1 Basic Medicine	279	12,22	3408	0,92	8%	8%	26%	92%	1,03
2001	2010	2011	FWF	No collaboration	3.2 Clinical Medicine	177	15,28	2704	1,02	10%	5%	22%	93%	1,12
2001	2010	2011	FWF	No collaboration	3.3 Health sciences	94	10,76	1011	0,96	11%	10%	28%	88%	1,01
2001	2010	2011	FWF	No collaboration	4 Agricultural sciences	120	8,60	1032	1,20	14%	13%	28%	78%	1,13
2001	2010	2011	FWF	No collaboration	5.1 Psychology	42	13,00	546	1,54	17%	17%	22%	69%	1,21
2001	2010	2011	FWF	No collaboration	5.2 Economics and Business	39	7,13	278	1,15	9%	13%	12%	50%	1,05
2001	2010	2011	FWF	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	32	6,66	213	1,27	15%	13%	18%	42%	1,01
2001	2010	2011	Denmark	International collaboration	0.0 Multidisciplinary	896	60,40	54114	5,76	49%	6%	18%	86%	4,82
2001	2010	2011	Denmark	International collaboration	1.1 Mathematics	1274	5,42	6902	1,34	15%	30%	26%	60%	1,23
2001	2010	2011	Denmark	International collaboration	1.2 Computer and information sciences	1315	6,03	7933	1,44	15%	33%	20%	46%	1,17
2001	2010	2011	Denmark	International collaboration	1.3 Physical sciences	7179	11,56	83018	1,42	16%	15%	30%	86%	1,24
2001	2010	2011	Denmark	International collaboration	1.4 Chemical sciences	3805	11,60	44134	1,35	14%	10%	27%	87%	1,38
2001	2010	2011	Denmark	International collaboration	1.5 Earth and related environmental sciences	4578	11,67	53443	1,44	16%	10%	28%	71%	1,20
2001	2010	2011	Denmark	International collaboration	1.6.1 Biochemistry & Molecular Biology	4170	21,92	91413	1,41	15%	6%	20%	93%	1,20
2001	2010	2011	Denmark	International collaboration	1.6.2 Biology	5193	12,41	64468	1,40	16%	11%	26%	78%	1,18
2001	2010	2011	Denmark	International collaboration	1.6.3 Microbiology & Genetics	4235	24,33	103048	1,62	18%	5%	20%	92%	1,32
2001	2010	2011	Denmark	International collaboration	2 Engineering and Technology	7161	10,51	75295	1,52	16%	16%	23%	74%	1,31
2001	2010	2011	Denmark	International collaboration	3.1 Basic Medicine	5734	15,05	86320	1,26	14%	7%	25%	91%	1,09
2001	2010	2011	Denmark	International collaboration	3.2 Clinical Medicine	10785	24,50	264183	1,90	21%	6%	19%	90%	1,42
2001	2010	2011	Denmark	International collaboration	3.3 Health sciences	5106	15,38	78510	1,45	17%	9%	22%	82%	1,22

2001	2010	2011	Denmark	International collaboration	4 Agricultural sciences	3406	12,70	43271	1,59	18%	14%	22%	78%	1,30
2001	2010	2011	Denmark	International collaboration	5.1 Psychology	606	8,57	5192	1,35	16%	15%	27%	68%	1,11
2001	2010	2011	Denmark	International collaboration	5.2 Economics and Business	1024	7,47	7654	1,34	16%	23%	13%	53%	1,16
2001	2010	2011	Denmark	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	821	6,91	5671	1,59	17%	24%	17%	39%	1,24
2001	2010	2011	Denmark	National collaboration	0.0 Multidisciplinary	126	36,30	4574	3,60	35%	16%	13%	91%	3,61
2001	2010	2011	Denmark	National collaboration	1.1 Mathematics	185	6,02	1114	1,26	12%	23%	21%	62%	1,24
2001	2010	2011	Denmark	National collaboration	1.2 Computer and information sciences	304	4,62	1405	1,11	11%	27%	22%	50%	1,19
2001	2010	2011	Denmark	National collaboration	1.3 Physical sciences	931	13,20	12289	1,61	17%	14%	23%	87%	1,28
2001	2010	2011	Denmark	National collaboration	1.4 Chemical sciences	1466	12,50	18324	1,51	16%	8%	20%	88%	1,45
2001	2010	2011	Denmark	National collaboration	1.5 Earth and related environmental sciences	1095	10,58	11580	1,24	13%	13%	20%	69%	1,14
2001	2010	2011	Denmark	National collaboration	1.6.1 Biochemistry & Molecular Biology	1493	15,46	23088	1,01	11%	9%	20%	93%	0,95
2001	2010	2011	Denmark	National collaboration	1.6.2 Biology	1475	11,99	17680	1,28	14%	9%	19%	80%	1,17
2001	2010	2011	Denmark	National collaboration	1.6.3 Microbiology & Genetics	1634	14,86	24279	1,02	11%	7%	17%	91%	0,92
2001	2010	2011	Denmark	National collaboration	2 Engineering and Technology	2776	10,49	29132	1,48	16%	14%	20%	76%	1,31
2001	2010	2011	Denmark	National collaboration	3.1 Basic Medicine	3140	12,42	38993	1,00	10%	8%	21%	91%	0,99
2001	2010	2011	Denmark	National collaboration	3.2 Clinical Medicine	8023	14,53	116570	1,16	13%	9%	16%	90%	1,11
2001	2010	2011	Denmark	National collaboration	3.3 Health sciences	2684	11,22	30116	1,04	11%	11%	19%	83%	1,02
2001	2010	2011	Denmark	National collaboration	4 Agricultural sciences	1943	9,84	19121	1,35	16%	11%	20%	78%	1,29
2001	2010	2011	Denmark	National collaboration	5.1 Psychology	349	8,43	2942	1,10	12%	15%	19%	73%	1,09
2001	2010	2011	Denmark	National collaboration	5.2 Economics and Business	243	5,76	1399	0,96	8%	18%	9%	50%	0,99
2001	2010	2011	Denmark	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	315	5,28	1664	1,32	13%	21%	14%	39%	1,25
2001	2010	2011	Denmark	No collaboration	0.0 Multidisciplinary	169	25,57	4322	2,27	21%	12%	14%	92%	2,18

2001	2010	2011	Denmark	No collaboration	1.1 Mathematics	824	5,15	4247	1,14	11%	33%	19%	57%	1,11
2001	2010	2011	Denmark	No collaboration	1.2 Computer and information sciences	1016	4,40	4466	1,15	11%	39%	19%	39%	1,00
2001	2010	2011	Denmark	No collaboration	1.3 Physical sciences	2096	11,27	23632	1,41	16%	18%	22%	86%	1,16
2001	2010	2011	Denmark	No collaboration	1.4 Chemical sciences	2134	17,52	37390	1,73	19%	10%	16%	86%	1,30
2001	2010	2011	Denmark	No collaboration	1.5 Earth and related environmental sciences	1651	10,41	17190	1,14	11%	11%	20%	63%	1,07
2001	2010	2011	Denmark	No collaboration	1.6.1 Biochemistry & Molecular Biology	1467	15,35	22516	0,96	10%	11%	18%	92%	0,96
2001	2010	2011	Denmark	No collaboration	1.6.2 Biology	2104	11,03	23203	1,13	12%	10%	18%	75%	1,06
2001	2010	2011	Denmark	No collaboration	1.6.3 Microbiology & Genetics	1116	16,09	17954	1,01	10%	7%	16%	90%	0,95
2001	2010	2011	Denmark	No collaboration	2 Engineering and Technology	4438	9,49	42113	1,37	14%	17%	19%	69%	1,17
2001	2010	2011	Denmark	No collaboration	3.1 Basic Medicine	1960	12,71	24919	0,99	10%	9%	19%	90%	0,92
2001	2010	2011	Denmark	No collaboration	3.2 Clinical Medicine	3378	13,31	44955	1,03	11%	12%	14%	87%	0,95
2001	2010	2011	Denmark	No collaboration	3.3 Health sciences	1803	11,25	20275	0,98	10%	13%	16%	77%	0,98
2001	2010	2011	Denmark	No collaboration	4 Agricultural sciences	1965	9,90	19454	1,22	13%	14%	18%	75%	1,16
2001	2010	2011	Denmark	No collaboration	5.1 Psychology	575	5,33	3067	0,87	7%	30%	19%	50%	0,85
2001	2010	2011	Denmark	No collaboration	5.2 Economics and Business	854	6,22	5308	0,92	9%	26%	9%	44%	0,96
2001	2010	2011	Denmark	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1562	4,71	7350	1,11	11%	27%	12%	29%	1,09
2001	2010	2011	Finland	International collaboration	0.0 Multidisciplinary	495	59,21	29310	6,03	52%	7%	20%	90%	4,74
2001	2010	2011	Finland	International collaboration	1.1 Mathematics	1135	4,28	4860	1,44	16%	34%	33%	60%	1,10
2001	2010	2011	Finland	International collaboration	1.2 Computer and information sciences	1142	3,98	4543	1,22	13%	36%	24%	45%	1,15
2001	2010	2011	Finland	International collaboration	1.3 Physical sciences	7210	8,42	60681	1,10	11%	19%	36%	85%	1,10
2001	2010	2011	Finland	International collaboration	1.4 Chemical sciences	3806	9,05	34431	1,13	11%	15%	31%	86%	1,21
2001	2010	2011	Finland	International collaboration	1.5 Earth and related environmental sciences	3180	11,02	35058	1,29	13%	12%	32%	73%	1,12
2001	2010	2011	Finland	International collaboration	1.6.1 Biochemistry & Molecular Biology	2943	17,25	50757	1,13	11%	9%	24%	92%	1,12

2001	2010	2011	Finland	International collaboration	1.6.2 Biology	3546	13,06	46302	1,31	15%	10%	24%	79%	1,17
2001	2010	2011	Finland	International collaboration	1.6.3 Microbiology & Genetics	3332	23,03	76734	1,47	16%	5%	22%	92%	1,31
2001	2010	2011	Finland	International collaboration	2 Engineering and Technology	6278	7,70	48324	1,24	13%	23%	28%	73%	1,15
2001	2010	2011	Finland	International collaboration	3.1 Basic Medicine	3743	16,84	63049	1,29	14%	7%	21%	91%	1,14
2001	2010	2011	Finland	International collaboration	3.2 Clinical Medicine	8347	24,61	205454	1,73	19%	6%	17%	90%	1,37
2001	2010	2011	Finland	International collaboration	3.3 Health sciences	3669	15,04	55176	1,37	15%	10%	22%	82%	1,20
2001	2010	2011	Finland	International collaboration	4 Agricultural sciences	2092	11,14	23306	1,53	16%	12%	25%	78%	1,24
2001	2010	2011	Finland	International collaboration	5.1 Psychology	874	10,49	9168	1,36	14%	13%	22%	68%	1,22
2001	2010	2011	Finland	International collaboration	5.2 Economics and Business	626	7,06	4419	1,25	13%	21%	13%	50%	1,18
2001	2010	2011	Finland	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	783	5,76	4511	1,34	15%	25%	20%	42%	1,22
2001	2010	2011	Finland	National collaboration	0.0 Multidisciplinary	85	17,53	1490	1,65	19%	8%	18%	89%	2,31
2001	2010	2011	Finland	National collaboration	1.1 Mathematics	267	4,66	1245	1,42	13%	27%	30%	61%	1,09
2001	2010	2011	Finland	National collaboration	1.2 Computer and information sciences	708	3,56	2518	0,84	8%	40%	22%	45%	1,04
2001	2010	2011	Finland	National collaboration	1.3 Physical sciences	1369	8,11	11100	1,04	10%	23%	27%	84%	1,01
2001	2010	2011	Finland	National collaboration	1.4 Chemical sciences	1826	10,08	18404	1,13	11%	12%	23%	85%	1,24
2001	2010	2011	Finland	National collaboration	1.5 Earth and related environmental sciences	1555	9,54	14838	0,97	9%	12%	27%	68%	1,12
2001	2010	2011	Finland	National collaboration	1.6.1 Biochemistry & Molecular Biology	1597	13,52	21599	0,89	7%	7%	22%	92%	0,93
2001	2010	2011	Finland	National collaboration	1.6.2 Biology	2004	10,59	21221	1,05	10%	11%	22%	78%	1,12
2001	2010	2011	Finland	National collaboration	1.6.3 Microbiology & Genetics	1642	13,97	22938	0,82	7%	6%	18%	92%	0,90
2001	2010	2011	Finland	National collaboration	2 Engineering and Technology	4190	7,09	29714	1,03	10%	22%	22%	70%	1,12
2001	2010	2011	Finland	National collaboration	3.1 Basic Medicine	3378	12,83	43332	0,91	8%	7%	18%	91%	1,00
2001	2010	2011	Finland	National	3.2 Clinical Medicine	9273	13,68	126812	1,01	9%	8%	14%	90%	1,06

				collaboration										
2001	2010	2011	Finland	National collaboration	3.3 Health sciences	3120	10,78	33628	0,96	8%	11%	17%	80%	1,01
2001	2010	2011	Finland	National collaboration	4 Agricultural sciences	2018	8,26	16664	1,13	10%	13%	24%	72%	1,16
2001	2010	2011	Finland	National collaboration	5.1 Psychology	807	8,99	7253	1,11	11%	15%	17%	72%	1,15
2001	2010	2011	Finland	National collaboration	5.2 Economics and Business	381	4,52	1723	0,79	7%	27%	19%	48%	0,92
2001	2010	2011	Finland	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	513	5,14	2638	0,99	9%	27%	18%	44%	1,16
2001	2010	2011	Finland	No collaboration	0.0 Multidisciplinary	81	14,58	1181	1,35	19%	10%	20%	92%	2,33
2001	2010	2011	Finland	No collaboration	1.1 Mathematics	941	2,60	2443	0,82	7%	43%	33%	57%	0,96
2001	2010	2011	Finland	No collaboration	1.2 Computer and information sciences	1542	3,67	5655	0,98	9%	45%	18%	39%	0,98
2001	2010	2011	Finland	No collaboration	1.3 Physical sciences	2409	6,73	16206	0,84	8%	23%	26%	83%	0,94
2001	2010	2011	Finland	No collaboration	1.4 Chemical sciences	2016	9,43	19017	0,98	9%	15%	23%	85%	1,14
2001	2010	2011	Finland	No collaboration	1.5 Earth and related environmental sciences	1432	8,86	12686	0,89	9%	13%	21%	61%	1,04
2001	2010	2011	Finland	No collaboration	1.6.1 Biochemistry & Molecular Biology	844	10,84	9151	0,79	6%	13%	23%	91%	0,94
2001	2010	2011	Finland	No collaboration	1.6.2 Biology	1824	11,29	20592	1,06	10%	13%	20%	75%	1,04
2001	2010	2011	Finland	No collaboration	1.6.3 Microbiology & Genetics	684	14,43	9872	0,88	7%	8%	18%	89%	0,91
2001	2010	2011	Finland	No collaboration	2 Engineering and Technology	5438	6,50	35367	1,04	10%	25%	20%	62%	1,03
2001	2010	2011	Finland	No collaboration	3.1 Basic Medicine	850	11,63	9886	0,90	9%	10%	16%	88%	0,95
2001	2010	2011	Finland	No collaboration	3.2 Clinical Medicine	2080	11,69	24311	0,88	8%	13%	11%	86%	0,90
2001	2010	2011	Finland	No collaboration	3.3 Health sciences	1278	10,54	13475	0,97	8%	14%	16%	72%	0,94
2001	2010	2011	Finland	No collaboration	4 Agricultural sciences	1518	8,94	13570	1,10	11%	15%	20%	68%	1,06
2001	2010	2011	Finland	No collaboration	5.1 Psychology	727	6,13	4456	0,85	7%	23%	18%	54%	1,02
2001	2010	2011	Finland	No collaboration	5.2 Economics and Business	788	3,86	3042	0,72	6%	29%	12%	45%	0,86
2001	2010	2011	Finland	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1446	4,00	5779	0,86	7%	31%	13%	31%	1,04
2001	2010	2011	Germany	International	0.0 Multidisciplinary	5554	58,17	323053	5,23	51%	5%	17%	90%	5,08

				collaboration										
2001	2010	2011	Germany	International collaboration	1.1 Mathematics	12951	4,03	52197	1,23	13%	34%	32%	59%	1,09
2001	2010	2011	Germany	International collaboration	1.2 Computer and information sciences	8731	4,44	38800	1,29	14%	37%	25%	45%	1,11
2001	2010	2011	Germany	International collaboration	1.3 Physical sciences	88832	10,52	934716	1,26	14%	18%	31%	86%	1,15
2001	2010	2011	Germany	International collaboration	1.4 Chemical sciences	42229	10,53	444601	1,22	13%	14%	30%	86%	1,29
2001	2010	2011	Germany	International collaboration	1.5 Earth and related environmental sciences	23713	10,63	252003	1,32	15%	12%	30%	72%	1,15
2001	2010	2011	Germany	International collaboration	1.6.1 Biochemistry & Molecular Biology	27758	18,70	519022	1,22	13%	10%	22%	92%	1,18
2001	2010	2011	Germany	International collaboration	1.6.2 Biology	23866	12,40	295870	1,29	14%	12%	25%	79%	1,18
2001	2010	2011	Germany	International collaboration	1.6.3 Microbiology & Genetics	23932	23,22	555759	1,42	17%	6%	21%	93%	1,33
2001	2010	2011	Germany	International collaboration	2 Engineering and Technology	55143	8,04	443409	1,25	13%	23%	27%	75%	1,17
2001	2010	2011	Germany	International collaboration	3.1 Basic Medicine	30537	17,00	519245	1,30	15%	8%	22%	91%	1,18
2001	2010	2011	Germany	International collaboration	3.2 Clinical Medicine	53829	20,39	1097489	1,62	18%	8%	19%	90%	1,30
2001	2010	2011	Germany	International collaboration	3.3 Health sciences	16794	16,26	273086	1,44	17%	10%	22%	85%	1,29
2001	2010	2011	Germany	International collaboration	4 Agricultural sciences	12478	11,23	140122	1,35	15%	15%	23%	79%	1,19
2001	2010	2011	Germany	International collaboration	5.1 Psychology	5301	10,23	54213	1,37	16%	16%	25%	70%	1,21
2001	2010	2011	Germany	International collaboration	5.2 Economics and Business	4624	6,58	30419	1,29	14%	25%	15%	54%	1,09
2001	2010	2011	Germany	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	3456	6,13	21169	1,46	16%	25%	19%	43%	1,16
2001	2010	2011	Germany	National collaboration	0.0 Multidisciplinary	1381	43,20	59660	3,35	38%	7%	13%	92%	3,57
2001	2010	2011	Germany	National collaboration	1.1 Mathematics	2372	3,78	8971	1,08	11%	33%	31%	57%	1,05
2001	2010	2011	Germany	National collaboration	1.2 Computer and information sciences	3765	3,63	13682	1,02	10%	38%	25%	43%	0,99
2001	2010	2011	Germany	National collaboration	1.3 Physical sciences	19039	9,61	182871	1,24	13%	17%	27%	85%	1,17
2001	2010	2011	Germany	National collaboration	1.4 Chemical sciences	18620	10,97	204174	1,22	13%	14%	26%	84%	1,30

2001	2010	2011	Germany	National collaboration	1.5 Earth and related environmental sciences	7057	8,46	59716	1,02	10%	17%	25%	67%	1,05
2001	2010	2011	Germany	National collaboration	1.6.1 Biochemistry & Molecular Biology	13881	15,01	208368	0,97	9%	10%	21%	92%	1,04
2001	2010	2011	Germany	National collaboration	1.6.2 Biology	9289	10,96	101821	1,10	11%	12%	22%	80%	1,13
2001	2010	2011	Germany	National collaboration	1.6.3 Microbiology & Genetics	11447	16,54	189297	1,00	10%	7%	20%	93%	1,03
2001	2010	2011	Germany	National collaboration	2 Engineering and Technology	28160	7,45	209678	1,04	11%	27%	23%	73%	1,03
2001	2010	2011	Germany	National collaboration	3.1 Basic Medicine	21014	13,03	273861	0,98	9%	10%	19%	91%	0,98
2001	2010	2011	Germany	National collaboration	3.2 Clinical Medicine	63465	11,08	703466	0,88	8%	16%	16%	88%	0,86
2001	2010	2011	Germany	National collaboration	3.3 Health sciences	11798	11,11	131066	0,97	10%	13%	20%	84%	1,00
2001	2010	2011	Germany	National collaboration	4 Agricultural sciences	8061	8,00	64504	1,01	10%	21%	23%	77%	1,01
2001	2010	2011	Germany	National collaboration	5.1 Psychology	4044	7,17	29014	0,97	8%	19%	23%	67%	0,93
2001	2010	2011	Germany	National collaboration	5.2 Economics and Business	1606	3,91	6285	0,83	7%	30%	17%	49%	0,87
2001	2010	2011	Germany	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1926	3,92	7557	1,00	10%	35%	18%	38%	0,94
2001	2010	2011	Germany	No collaboration	0.0 Multidisciplinary	1499	33,58	50341	2,65	29%	9%	12%	89%	3,08
2001	2010	2011	Germany	No collaboration	1.1 Mathematics	11042	3,19	35243	0,92	9%	40%	28%	55%	1,00
2001	2010	2011	Germany	No collaboration	1.2 Computer and information sciences	10840	3,02	32722	0,90	9%	45%	22%	38%	0,91
2001	2010	2011	Germany	No collaboration	1.3 Physical sciences	36475	9,38	342246	1,10	12%	20%	24%	84%	1,03
2001	2010	2011	Germany	No collaboration	1.4 Chemical sciences	35075	11,32	397160	1,16	12%	16%	24%	83%	1,13
2001	2010	2011	Germany	No collaboration	1.5 Earth and related environmental sciences	11232	8,74	98210	0,98	10%	18%	22%	64%	0,97
2001	2010	2011	Germany	No collaboration	1.6.1 Biochemistry & Molecular Biology	14533	17,00	247129	1,29	10%	12%	17%	91%	1,01
2001	2010	2011	Germany	No collaboration	1.6.2 Biology	13865	11,24	155782	1,04	11%	13%	21%	77%	1,03
2001	2010	2011	Germany	No collaboration	1.6.3 Microbiology & Genetics	9516	17,77	169146	0,97	10%	6%	18%	93%	0,99
2001	2010	2011	Germany	No collaboration	2 Engineering and Technology	48206	6,26	301828	0,92	9%	34%	21%	65%	0,87
2001	2010	2011	Germany	No collaboration	3.1 Basic Medicine	15978	11,84	189234	0,84	8%	14%	19%	89%	0,86

2001	2010	2011	Germany	No collaboration	3.2 Clinical Medicine	47853	7,75	370992	0,61	5%	26%	15%	83%	0,61
2001	2010	2011	Germany	No collaboration	3.3 Health sciences	9682	9,82	95046	0,83	8%	19%	18%	79%	0,82
2001	2010	2011	Germany	No collaboration	4 Agricultural sciences	10771	6,98	75230	0,84	8%	29%	20%	71%	0,82
2001	2010	2011	Germany	No collaboration	5.1 Psychology	7271	6,45	46929	0,79	7%	24%	23%	55%	0,80
2001	2010	2011	Germany	No collaboration	5.2 Economics and Business	3875	4,15	16076	0,72	6%	35%	13%	45%	0,77
2001	2010	2011	Germany	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	7947	3,16	25116	0,70	6%	45%	13%	26%	0,69
2001	2010	2011	Great Britain	International collaboration	0.0 Multidisciplinary	6636	59,45	394534	5,52	50%	6%	15%	88%	5,00
2001	2010	2011	Great Britain	International collaboration	1.1 Mathematics	11729	4,96	58233	1,33	14%	32%	27%	63%	1,12
2001	2010	2011	Great Britain	International collaboration	1.2 Computer and information sciences	10177	4,78	48610	1,39	14%	35%	23%	45%	1,13
2001	2010	2011	Great Britain	International collaboration	1.3 Physical sciences	56860	11,76	668735	1,35	14%	16%	30%	86%	1,19
2001	2010	2011	Great Britain	International collaboration	1.4 Chemical sciences	27797	11,53	320529	1,34	14%	12%	27%	87%	1,35
2001	2010	2011	Great Britain	International collaboration	1.5 Earth and related environmental sciences	25919	11,20	290317	1,43	16%	12%	27%	71%	1,20
2001	2010	2011	Great Britain	International collaboration	1.6.1 Biochemistry & Molecular Biology	25325	21,35	540574	1,44	15%	8%	20%	92%	1,25
2001	2010	2011	Great Britain	International collaboration	1.6.2 Biology	29788	13,47	401279	1,41	16%	11%	22%	78%	1,23
2001	2010	2011	Great Britain	International collaboration	1.6.3 Microbiology & Genetics	26141	24,76	647256	1,55	19%	5%	20%	92%	1,38
2001	2010	2011	Great Britain	International collaboration	2 Engineering and Technology	50401	8,10	408083	1,31	14%	22%	25%	72%	1,20
2001	2010	2011	Great Britain	International collaboration	3.1 Basic Medicine	33085	18,20	602026	1,41	17%	7%	20%	90%	1,21
2001	2010	2011	Great Britain	International collaboration	3.2 Clinical Medicine	58374	22,16	1293807	1,76	20%	7%	17%	88%	1,40
2001	2010	2011	Great Britain	International collaboration	3.3 Health sciences	28655	14,65	419778	1,44	16%	10%	20%	80%	1,24
2001	2010	2011	Great Britain	International collaboration	4 Agricultural sciences	14637	11,41	167001	1,49	17%	12%	23%	78%	1,28
2001	2010	2011	Great Britain	International collaboration	5.1 Psychology	10172	10,53	107112	1,34	15%	14%	22%	69%	1,21
2001	2010	2011	Great Britain	International collaboration	5.2 Economics and Business	10532	8,49	89424	1,40	15%	21%	12%	53%	1,21

2001	2010	2011	Great Britain	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	10136	6,41	64954	1,44	16%	22%	18%	40%	1,21
2001	2010	2011	Great Britain	National collaboration	0.0 Multidisciplinary	1901	42,10	80031	3,46	39%	8%	12%	88%	3,88
2001	2010	2011	Great Britain	National collaboration	1.1 Mathematics	2419	5,22	12624	1,17	13%	29%	24%	63%	1,11
2001	2010	2011	Great Britain	National collaboration	1.2 Computer and information sciences	3895	4,79	18663	1,17	11%	33%	19%	45%	1,11
2001	2010	2011	Great Britain	National collaboration	1.3 Physical sciences	10829	10,14	109827	1,22	13%	17%	24%	86%	1,17
2001	2010	2011	Great Britain	National collaboration	1.4 Chemical sciences	14102	12,54	176895	1,34	15%	9%	22%	88%	1,40
2001	2010	2011	Great Britain	National collaboration	1.5 Earth and related environmental sciences	9425	10,09	95125	1,22	13%	11%	22%	67%	1,18
2001	2010	2011	Great Britain	National collaboration	1.6.1 Biochemistry & Molecular Biology	11331	18,93	214474	1,21	13%	7%	17%	93%	1,15
2001	2010	2011	Great Britain	National collaboration	1.6.2 Biology	11930	13,88	165567	1,34	15%	8%	18%	79%	1,25
2001	2010	2011	Great Britain	National collaboration	1.6.3 Microbiology & Genetics	10903	20,72	225955	1,20	14%	5%	15%	92%	1,13
2001	2010	2011	Great Britain	National collaboration	2 Engineering and Technology	23762	8,19	194509	1,13	12%	20%	20%	71%	1,16
2001	2010	2011	Great Britain	National collaboration	3.1 Basic Medicine	18003	17,06	307164	1,22	14%	7%	16%	90%	1,11
2001	2010	2011	Great Britain	National collaboration	3.2 Clinical Medicine	58072	15,12	878058	1,14	12%	10%	12%	85%	1,11
2001	2010	2011	Great Britain	National collaboration	3.3 Health sciences	19406	11,92	231407	1,11	12%	11%	15%	72%	1,09
2001	2010	2011	Great Britain	National collaboration	4 Agricultural sciences	8129	10,84	88124	1,38	15%	12%	18%	79%	1,26
2001	2010	2011	Great Britain	National collaboration	5.1 Psychology	8899	9,98	88768	1,13	11%	14%	17%	66%	1,09
2001	2010	2011	Great Britain	National collaboration	5.2 Economics and Business	4687	7,53	35296	1,13	11%	19%	12%	46%	1,05
2001	2010	2011	Great Britain	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	9407	6,25	58764	1,27	13%	21%	14%	36%	1,14
2001	2010	2011	Great Britain	No collaboration	0.0 Multidisciplinary	2635	25,54	67303	2,31	26%	13%	12%	83%	2,88
2001	2010	2011	Great Britain	No collaboration	1.1 Mathematics	8851	4,40	38939	1,07	10%	36%	21%	60%	1,07
2001	2010	2011	Great Britain	No collaboration	1.2 Computer and information sciences	11531	4,02	46410	1,02	10%	40%	18%	41%	1,01
2001	2010	2011	Great Britain	No collaboration	1.3 Physical sciences	24386	9,12	222517	1,08	11%	20%	22%	84%	1,05

2001	2010	2011	Great Britain	No collaboration	1.4 Chemical sciences	21559	12,79	275833	1,32	14%	13%	19%	87%	1,26
2001	2010	2011	Great Britain	No collaboration	1.5 Earth and related environmental sciences	13638	9,90	135054	1,12	12%	15%	17%	65%	1,07
2001	2010	2011	Great Britain	No collaboration	1.6.1 Biochemistry & Molecular Biology	13866	20,36	282353	1,42	12%	8%	14%	92%	1,11
2001	2010	2011	Great Britain	No collaboration	1.6.2 Biology	16568	13,92	230623	1,26	14%	10%	15%	79%	1,19
2001	2010	2011	Great Britain	No collaboration	1.6.3 Microbiology & Genetics	10768	21,65	233131	1,15	13%	6%	13%	92%	1,11
2001	2010	2011	Great Britain	No collaboration	2 Engineering and Technology	46862	6,89	322862	1,06	11%	26%	19%	65%	1,04
2001	2010	2011	Great Britain	No collaboration	3.1 Basic Medicine	17784	15,56	276780	1,09	11%	9%	15%	90%	1,01
2001	2010	2011	Great Britain	No collaboration	3.2 Clinical Medicine	49640	11,44	567853	0,87	8%	16%	11%	83%	0,92
2001	2010	2011	Great Britain	No collaboration	3.3 Health sciences	19553	11,35	221972	1,02	10%	14%	12%	69%	0,99
2001	2010	2011	Great Britain	No collaboration	4 Agricultural sciences	10036	10,21	102502	1,23	13%	16%	15%	76%	1,13
2001	2010	2011	Great Britain	No collaboration	5.1 Psychology	12282	8,58	105429	1,05	10%	19%	15%	58%	1,01
2001	2010	2011	Great Britain	No collaboration	5.2 Economics and Business	9751	6,41	62481	0,99	9%	23%	10%	40%	1,00
2001	2010	2011	Great Britain	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	31246	5,02	156753	1,09	11%	26%	11%	27%	1,04
2001	2010	2011	Netherlands	International collaboration	0.0 Multidisciplinary	1717	64,52	110775	6,04	54%	5%	16%	90%	5,12
2001	2010	2011	Netherlands	International collaboration	1.1 Mathematics	3295	4,62	15233	1,14	12%	31%	28%	58%	1,09
2001	2010	2011	Netherlands	International collaboration	1.2 Computer and information sciences	3512	5,24	18414	1,39	15%	33%	23%	45%	1,11
2001	2010	2011	Netherlands	International collaboration	1.3 Physical sciences	17979	13,30	239119	1,52	16%	15%	29%	85%	1,26
2001	2010	2011	Netherlands	International collaboration	1.4 Chemical sciences	9518	13,18	125429	1,52	17%	10%	25%	87%	1,46
2001	2010	2011	Netherlands	International collaboration	1.5 Earth and related environmental sciences	8565	11,53	98796	1,49	16%	12%	27%	69%	1,21
2001	2010	2011	Netherlands	International collaboration	1.6.1 Biochemistry & Molecular Biology	7371	20,48	150972	1,35	16%	6%	22%	92%	1,23
2001	2010	2011	Netherlands	International collaboration	1.6.2 Biology	9565	13,12	125508	1,45	17%	10%	24%	78%	1,23
2001	2010	2011	Netherlands	International collaboration	1.6.3 Microbiology & Genetics	9582	23,88	228784	1,60	19%	4%	21%	92%	1,39
2001	2010	2011	Netherlands	International collaboration	2 Engineering and Technology	17265	9,43	162863	1,43	15%	19%	23%	72%	1,26

2001	2010	2011	Netherlands	International collaboration	3.1 Basic Medicine	12094	17,33	209594	1,34	15%	6%	22%	91%	1,19
2001	2010	2011	Netherlands	International collaboration	3.2 Clinical Medicine	26888	23,37	628468	1,83	21%	7%	19%	89%	1,43
2001	2010	2011	Netherlands	International collaboration	3.3 Health sciences	10406	15,52	161450	1,49	17%	9%	21%	82%	1,26
2001	2010	2011	Netherlands	International collaboration	4 Agricultural sciences	6012	11,50	69149	1,54	17%	12%	23%	76%	1,28
2001	2010	2011	Netherlands	International collaboration	5.1 Psychology	4351	10,45	45473	1,45	16%	15%	23%	70%	1,27
2001	2010	2011	Netherlands	International collaboration	5.2 Economics and Business	3742	8,29	31006	1,42	16%	20%	15%	57%	1,24
2001	2010	2011	Netherlands	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	3413	7,22	24638	1,67	19%	20%	19%	44%	1,31
2001	2010	2011	Netherlands	National collaboration	0.0 Multidisciplinary	467	49,83	23269	3,96	36%	9%	11%	92%	3,33
2001	2010	2011	Netherlands	National collaboration	1.1 Mathematics	807	6,19	4993	1,13	12%	28%	21%	60%	1,01
2001	2010	2011	Netherlands	National collaboration	1.2 Computer and information sciences	1513	4,26	6450	1,15	12%	35%	23%	47%	1,13
2001	2010	2011	Netherlands	National collaboration	1.3 Physical sciences	3101	12,76	39555	1,52	18%	15%	20%	85%	1,33
2001	2010	2011	Netherlands	National collaboration	1.4 Chemical sciences	4307	15,25	65674	1,62	18%	8%	19%	87%	1,55
2001	2010	2011	Netherlands	National collaboration	1.5 Earth and related environmental sciences	2422	9,81	23754	1,22	13%	12%	20%	64%	1,19
2001	2010	2011	Netherlands	National collaboration	1.6.1 Biochemistry & Molecular Biology	3564	16,35	58269	1,07	11%	7%	19%	93%	1,05
2001	2010	2011	Netherlands	National collaboration	1.6.2 Biology	3627	12,61	45749	1,34	15%	10%	20%	81%	1,21
2001	2010	2011	Netherlands	National collaboration	1.6.3 Microbiology & Genetics	4567	16,75	76518	1,09	11%	6%	17%	93%	1,05
2001	2010	2011	Netherlands	National collaboration	2 Engineering and Technology	8524	9,69	82569	1,31	14%	16%	19%	74%	1,29
2001	2010	2011	Netherlands	National collaboration	3.1 Basic Medicine	8082	13,82	111720	1,06	11%	7%	18%	91%	1,09
2001	2010	2011	Netherlands	National collaboration	3.2 Clinical Medicine	28733	14,28	410384	1,18	12%	8%	16%	89%	1,20
2001	2010	2011	Netherlands	National collaboration	3.3 Health sciences	7920	12,20	96606	1,13	12%	10%	17%	81%	1,14
2001	2010	2011	Netherlands	National collaboration	4 Agricultural sciences	3225	10,25	33056	1,36	15%	12%	19%	79%	1,26
2001	2010	2011	Netherlands	National	5.1 Psychology	4208	9,02	37968	1,16	11%	14%	20%	71%	1,21

				collaboration										
2001	2010	2011	Netherlands	National collaboration	5.2 Economics and Business	1754	6,85	12020	1,07	11%	21%	15%	55%	1,07
2001	2010	2011	Netherlands	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	2842	6,03	17129	1,31	14%	22%	17%	47%	1,31
2001	2010	2011	Netherlands	No collaboration	0.0 Multidisciplinary	387	39,70	15363	3,67	33%	6%	10%	91%	3,23
2001	2010	2011	Netherlands	No collaboration	1.1 Mathematics	2115	4,21	8909	1,01	10%	34%	23%	57%	1,01
2001	2010	2011	Netherlands	No collaboration	1.2 Computer and information sciences	3159	4,56	14410	1,22	13%	37%	18%	41%	1,04
2001	2010	2011	Netherlands	No collaboration	1.3 Physical sciences	5812	10,99	63855	1,32	14%	18%	19%	83%	1,16
2001	2010	2011	Netherlands	No collaboration	1.4 Chemical sciences	5200	15,95	82965	1,59	18%	10%	18%	86%	1,42
2001	2010	2011	Netherlands	No collaboration	1.5 Earth and related environmental sciences	3469	10,77	37354	1,14	12%	12%	18%	63%	1,11
2001	2010	2011	Netherlands	No collaboration	1.6.1 Biochemistry & Molecular Biology	2584	20,76	53641	2,00	11%	8%	14%	92%	1,15
2001	2010	2011	Netherlands	No collaboration	1.6.2 Biology	3862	12,26	47332	1,13	12%	12%	18%	77%	1,08
2001	2010	2011	Netherlands	No collaboration	1.6.3 Microbiology & Genetics	2230	18,91	42168	1,08	12%	6%	16%	92%	1,02
2001	2010	2011	Netherlands	No collaboration	2 Engineering and Technology	10961	8,74	95760	1,26	13%	22%	17%	66%	1,17
2001	2010	2011	Netherlands	No collaboration	3.1 Basic Medicine	3753	13,48	50599	1,00	10%	9%	17%	90%	0,97
2001	2010	2011	Netherlands	No collaboration	3.2 Clinical Medicine	9700	12,59	122141	0,99	10%	12%	15%	88%	1,02
2001	2010	2011	Netherlands	No collaboration	3.3 Health sciences	3544	11,68	41384	1,03	11%	13%	16%	77%	1,02
2001	2010	2011	Netherlands	No collaboration	4 Agricultural sciences	2644	9,99	26420	1,19	13%	17%	17%	74%	1,07
2001	2010	2011	Netherlands	No collaboration	5.1 Psychology	4007	8,21	32894	1,08	11%	19%	20%	63%	1,12
2001	2010	2011	Netherlands	No collaboration	5.2 Economics and Business	2571	6,77	17416	1,04	11%	23%	13%	48%	1,05
2001	2010	2011	Netherlands	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	5125	5,77	29552	1,29	13%	25%	14%	35%	1,18
2001	2010	2011	Sweden	International collaboration	0.0 Multidisciplinary	1591	56,26	89504	4,91	46%	5%	17%	91%	4,56
2001	2010	2011	Sweden	International collaboration	1.1 Mathematics	2063	4,97	10243	1,39	14%	33%	28%	61%	1,12
2001	2010	2011	Sweden	International collaboration	1.2 Computer and information sciences	1659	5,45	9035	1,24	12%	36%	21%	47%	1,11
2001	2010	2011	Sweden	International	1.3 Physical sciences	14768	9,74	143794	1,22	12%	19%	32%	86%	1,14

				collaboration										
2001	2010	2011	Sweden	International collaboration	1.4 Chemical sciences	8022	11,27	90386	1,33	14%	12%	27%	87%	1,31
2001	2010	2011	Sweden	International collaboration	1.5 Earth and related environmental sciences	6403	11,10	71053	1,35	15%	11%	28%	71%	1,15
2001	2010	2011	Sweden	International collaboration	1.6.1 Biochemistry & Molecular Biology	7592	21,82	165663	1,35	12%	7%	20%	92%	1,13
2001	2010	2011	Sweden	International collaboration	1.6.2 Biology	7658	16,13	123549	1,50	16%	10%	20%	80%	1,22
2001	2010	2011	Sweden	International collaboration	1.6.3 Microbiology & Genetics	6899	22,63	156114	1,44	16%	5%	21%	92%	1,31
2001	2010	2011	Sweden	International collaboration	2 Engineering and Technology	13199	10,22	134905	1,40	14%	21%	22%	74%	1,23
2001	2010	2011	Sweden	International collaboration	3.1 Basic Medicine	9882	16,09	159038	1,22	13%	7%	21%	92%	1,08
2001	2010	2011	Sweden	International collaboration	3.2 Clinical Medicine	19739	22,54	444959	1,70	18%	7%	18%	89%	1,32
2001	2010	2011	Sweden	International collaboration	3.3 Health sciences	8105	16,76	135870	1,44	15%	10%	19%	81%	1,20
2001	2010	2011	Sweden	International collaboration	4 Agricultural sciences	4162	15,75	65565	1,62	16%	12%	17%	78%	1,26
2001	2010	2011	Sweden	International collaboration	5.1 Psychology	1508	9,83	14818	1,35	14%	14%	22%	68%	1,16
2001	2010	2011	Sweden	International collaboration	5.2 Economics and Business	1312	9,49	12445	1,53	18%	19%	11%	52%	1,28
2001	2010	2011	Sweden	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1483	7,78	11538	1,57	17%	21%	16%	42%	1,21
2001	2010	2011	Sweden	National collaboration	0.0 Multidisciplinary	277	29,23	8096	2,40	32%	9%	15%	92%	2,86
2001	2010	2011	Sweden	National collaboration	1.1 Mathematics	521	5,64	2937	1,14	9%	35%	20%	61%	1,14
2001	2010	2011	Sweden	National collaboration	1.2 Computer and information sciences	667	4,90	3270	0,96	8%	37%	19%	47%	1,06
2001	2010	2011	Sweden	National collaboration	1.3 Physical sciences	2267	9,08	20586	1,10	11%	17%	25%	84%	1,18
2001	2010	2011	Sweden	National collaboration	1.4 Chemical sciences	3337	13,20	44052	1,34	14%	9%	20%	86%	1,38
2001	2010	2011	Sweden	National collaboration	1.5 Earth and related environmental sciences	1983	11,19	22194	1,20	12%	11%	20%	65%	1,13
2001	2010	2011	Sweden	National collaboration	1.6.1 Biochemistry & Molecular Biology	2931	13,48	39520	0,87	8%	7%	21%	92%	0,97
2001	2010	2011	Sweden	National collaboration	1.6.2 Biology	2436	11,91	29002	1,19	13%	8%	20%	80%	1,19

2001	2010	2011	Sweden	National collaboration	1.6.3 Microbiology & Genetics	2429	14,45	35091	0,90	9%	6%	18%	92%	0,93
2001	2010	2011	Sweden	National collaboration	2 Engineering and Technology	6321	8,36	52856	1,18	12%	19%	21%	69%	1,21
2001	2010	2011	Sweden	National collaboration	3.1 Basic Medicine	5163	12,74	65790	0,95	9%	8%	18%	91%	0,95
2001	2010	2011	Sweden	National collaboration	3.2 Clinical Medicine	15956	12,84	204836	1,02	10%	9%	15%	87%	0,99
2001	2010	2011	Sweden	National collaboration	3.3 Health sciences	5885	10,10	59413	0,98	9%	11%	17%	75%	1,00
2001	2010	2011	Sweden	National collaboration	4 Agricultural sciences	2022	9,08	18354	1,22	12%	11%	20%	76%	1,22
2001	2010	2011	Sweden	National collaboration	5.1 Psychology	1736	7,80	13543	1,02	9%	15%	18%	66%	1,00
2001	2010	2011	Sweden	National collaboration	5.2 Economics and Business	630	6,18	3891	1,04	10%	23%	13%	47%	0,99
2001	2010	2011	Sweden	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1059	6,11	6466	1,25	12%	23%	15%	43%	1,18
2001	2010	2011	Sweden	No collaboration	0.0 Multidisciplinary	383	18,94	7255	1,81	20%	9%	16%	90%	2,23
2001	2010	2011	Sweden	No collaboration	1.1 Mathematics	1772	3,69	6547	0,91	8%	39%	24%	60%	0,99
2001	2010	2011	Sweden	No collaboration	1.2 Computer and information sciences	1722	3,77	6498	0,99	10%	43%	17%	40%	1,02
2001	2010	2011	Sweden	No collaboration	1.3 Physical sciences	4674	8,81	41201	1,05	11%	21%	24%	83%	1,08
2001	2010	2011	Sweden	No collaboration	1.4 Chemical sciences	4588	13,82	63409	1,33	13%	10%	19%	87%	1,31
2001	2010	2011	Sweden	No collaboration	1.5 Earth and related environmental sciences	2827	9,10	25712	0,95	8%	13%	18%	62%	1,03
2001	2010	2011	Sweden	No collaboration	1.6.1 Biochemistry & Molecular Biology	3164	15,75	49821	0,98	10%	7%	17%	93%	1,01
2001	2010	2011	Sweden	No collaboration	1.6.2 Biology	3820	12,25	46782	1,12	12%	11%	17%	78%	1,11
2001	2010	2011	Sweden	No collaboration	1.6.3 Microbiology & Genetics	2044	16,55	33821	0,92	9%	5%	16%	92%	0,96
2001	2010	2011	Sweden	No collaboration	2 Engineering and Technology	9608	7,48	71859	1,12	11%	23%	18%	62%	1,16
2001	2010	2011	Sweden	No collaboration	3.1 Basic Medicine	3372	13,42	45238	0,91	8%	8%	17%	91%	0,94
2001	2010	2011	Sweden	No collaboration	3.2 Clinical Medicine	6701	12,02	80528	0,91	9%	11%	14%	86%	0,92
2001	2010	2011	Sweden	No collaboration	3.3 Health sciences	3263	10,52	34311	0,97	9%	13%	15%	74%	1,00
2001	2010	2011	Sweden	No collaboration	4 Agricultural sciences	2287	10,23	23389	1,18	13%	12%	17%	72%	1,17

2001	2010	2011	Sweden	No collaboration	5.1 Psychology	1492	8,23	12276	1,07	9%	21%	14%	58%	1,00
2001	2010	2011	Sweden	No collaboration	5.2 Economics and Business	1471	5,44	7997	0,84	8%	23%	11%	44%	0,96
2001	2010	2011	Sweden	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	2814	4,27	12013	1,00	9%	30%	14%	32%	1,05
2001	2010	2011	Switzerland	International collaboration	0.0 Multidisciplinary	1963	59,03	115883	5,71	54%	4%	16%	91%	5,33
2001	2010	2011	Switzerland	International collaboration	1.1 Mathematics	2436	5,12	12482	1,44	16%	28%	26%	59%	1,23
2001	2010	2011	Switzerland	International collaboration	1.2 Computer and information sciences	2926	6,58	19242	1,87	18%	32%	19%	44%	1,26
2001	2010	2011	Switzerland	International collaboration	1.3 Physical sciences	21029	12,38	260337	1,51	17%	16%	29%	86%	1,24
2001	2010	2011	Switzerland	International collaboration	1.4 Chemical sciences	10347	12,54	129714	1,47	16%	12%	27%	86%	1,36
2001	2010	2011	Switzerland	International collaboration	1.5 Earth and related environmental sciences	7825	11,40	89201	1,51	18%	11%	28%	71%	1,23
2001	2010	2011	Switzerland	International collaboration	1.6.1 Biochemistry & Molecular Biology	7792	23,16	180439	1,49	17%	7%	20%	93%	1,29
2001	2010	2011	Switzerland	International collaboration	1.6.2 Biology	7022	13,89	97537	1,51	17%	10%	23%	80%	1,27
2001	2010	2011	Switzerland	International collaboration	1.6.3 Microbiology & Genetics	7508	25,23	189415	1,61	19%	4%	19%	92%	1,44
2001	2010	2011	Switzerland	International collaboration	2 Engineering and Technology	15617	9,26	144559	1,47	16%	21%	26%	72%	1,24
2001	2010	2011	Switzerland	International collaboration	3.1 Basic Medicine	11454	18,46	211491	1,43	17%	7%	20%	91%	1,22
2001	2010	2011	Switzerland	International collaboration	3.2 Clinical Medicine	21032	21,91	460780	1,73	19%	8%	17%	88%	1,36
2001	2010	2011	Switzerland	International collaboration	3.3 Health sciences	8422	16,76	141132	1,57	19%	8%	20%	81%	1,31
2001	2010	2011	Switzerland	International collaboration	4 Agricultural sciences	3772	11,03	41591	1,58	17%	13%	24%	80%	1,30
2001	2010	2011	Switzerland	International collaboration	5.1 Psychology	2004	8,27	16576	1,24	14%	18%	27%	70%	1,11
2001	2010	2011	Switzerland	International collaboration	5.2 Economics and Business	1644	7,60	12500	1,47	17%	22%	14%	55%	1,24
2001	2010	2011	Switzerland	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1362	5,35	7293	1,37	14%	25%	19%	44%	1,17
2001	2010	2011	Switzerland	National collaboration	0.0 Multidisciplinary	295	49,30	14543	3,74	37%	13%	11%	89%	3,54
2001	2010	2011	Switzerland	National collaboration	1.1 Mathematics	192	4,48	860	1,26	14%	28%	27%	57%	1,14

2001	2010	2011	Switzerland	National collaboration	1.2 Computer and information sciences	487	5,83	2840	1,55	15%	33%	19%	46%	1,26
2001	2010	2011	Switzerland	National collaboration	1.3 Physical sciences	1899	10,94	20778	1,44	17%	17%	23%	85%	1,25
2001	2010	2011	Switzerland	National collaboration	1.4 Chemical sciences	2402	13,50	32434	1,47	17%	11%	23%	87%	1,36
2001	2010	2011	Switzerland	National collaboration	1.5 Earth and related environmental sciences	1653	11,90	19672	1,43	16%	10%	23%	67%	1,20
2001	2010	2011	Switzerland	National collaboration	1.6.1 Biochemistry & Molecular Biology	1902	20,85	39659	1,43	16%	7%	16%	93%	1,25
2001	2010	2011	Switzerland	National collaboration	1.6.2 Biology	1660	15,21	25254	1,53	17%	11%	16%	78%	1,23
2001	2010	2011	Switzerland	National collaboration	1.6.3 Microbiology & Genetics	1704	20,71	35288	1,32	16%	6%	15%	93%	1,27
2001	2010	2011	Switzerland	National collaboration	2 Engineering and Technology	3823	11,05	42259	1,52	17%	17%	21%	73%	1,31
2001	2010	2011	Switzerland	National collaboration	3.1 Basic Medicine	3249	15,41	50051	1,15	13%	8%	17%	92%	1,14
2001	2010	2011	Switzerland	National collaboration	3.2 Clinical Medicine	9201	12,90	118679	1,04	11%	13%	13%	89%	1,04
2001	2010	2011	Switzerland	National collaboration	3.3 Health sciences	2303	13,16	30302	1,21	13%	13%	16%	84%	1,17
2001	2010	2011	Switzerland	National collaboration	4 Agricultural sciences	1928	8,25	15900	1,22	13%	22%	19%	77%	1,13
2001	2010	2011	Switzerland	National collaboration	5.1 Psychology	511	5,58	2853	0,89	8%	23%	24%	70%	0,94
2001	2010	2011	Switzerland	National collaboration	5.2 Economics and Business	314	7,02	2205	1,23	13%	25%	14%	52%	1,11
2001	2010	2011	Switzerland	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	466	4,85	2261	1,22	13%	34%	20%	41%	1,06
2001	2010	2011	Switzerland	No collaboration	0.0 Multidisciplinary	492	46,02	22640	3,65	36%	11%	10%	89%	3,75
2001	2010	2011	Switzerland	No collaboration	1.1 Mathematics	1554	3,59	5582	1,03	10%	37%	24%	56%	1,06
2001	2010	2011	Switzerland	No collaboration	1.2 Computer and information sciences	2063	4,74	9776	1,31	15%	38%	19%	40%	1,11
2001	2010	2011	Switzerland	No collaboration	1.3 Physical sciences	6330	10,84	68642	1,31	15%	20%	22%	83%	1,07
2001	2010	2011	Switzerland	No collaboration	1.4 Chemical sciences	7516	13,24	99547	1,32	15%	14%	22%	86%	1,21
2001	2010	2011	Switzerland	No collaboration	1.5 Earth and related environmental sciences	2647	11,94	31603	1,31	15%	13%	21%	65%	1,11
2001	2010	2011	Switzerland	No collaboration	1.6.1 Biochemistry & Molecular Biology	3058	21,65	66192	1,31	14%	8%	14%	92%	1,15

2001	2010	2011	Switzerland	No collaboration	1.6.2 Biology	3167	16,39	51909	1,38	14%	11%	16%	79%	1,14
2001	2010	2011	Switzerland	No collaboration	1.6.3 Microbiology & Genetics	1996	23,29	46492	1,28	14%	5%	14%	92%	1,17
2001	2010	2011	Switzerland	No collaboration	2 Engineering and Technology	8555	9,25	79164	1,35	15%	22%	19%	69%	1,19
2001	2010	2011	Switzerland	No collaboration	3.1 Basic Medicine	3166	16,42	51988	1,18	13%	9%	15%	90%	1,01
2001	2010	2011	Switzerland	No collaboration	3.2 Clinical Medicine	7300	10,84	79120	0,84	8%	18%	12%	85%	0,83
2001	2010	2011	Switzerland	No collaboration	3.3 Health sciences	2425	13,29	32220	1,12	11%	16%	15%	79%	1,01
2001	2010	2011	Switzerland	No collaboration	4 Agricultural sciences	2310	8,56	19767	1,05	11%	28%	18%	75%	0,97
2001	2010	2011	Switzerland	No collaboration	5.1 Psychology	1043	5,35	5579	0,76	7%	26%	22%	60%	0,82
2001	2010	2011	Switzerland	No collaboration	5.2 Economics and Business	980	6,18	6061	1,06	10%	30%	12%	45%	0,89
2001	2010	2011	Switzerland	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	1712	3,50	5999	0,84	9%	40%	15%	31%	0,84
2001	2010	2011	Usa	International collaboration	0.0 Multidisciplinary	17478	58,82	1028019	5,10	50%	5%	15%	90%	4,79
2001	2010	2011	Usa	International collaboration	1.1 Mathematics	35217	4,89	172053	1,39	15%	32%	28%	63%	1,18
2001	2010	2011	Usa	International collaboration	1.2 Computer and information sciences	26689	5,69	151836	1,50	15%	33%	19%	46%	1,27
2001	2010	2011	Usa	International collaboration	1.3 Physical sciences	133681	12,47	1667654	1,44	16%	16%	28%	86%	1,25
2001	2010	2011	Usa	International collaboration	1.4 Chemical sciences	61222	12,60	771155	1,47	16%	12%	25%	87%	1,42
2001	2010	2011	Usa	International collaboration	1.5 Earth and related environmental sciences	56594	11,24	636287	1,39	16%	12%	26%	73%	1,20
2001	2010	2011	Usa	International collaboration	1.6.1 Biochemistry & Molecular Biology	62667	22,30	1397378	1,39	15%	7%	20%	93%	1,23
2001	2010	2011	Usa	International collaboration	1.6.2 Biology	62119	13,59	844100	1,34	15%	13%	21%	79%	1,16
2001	2010	2011	Usa	International collaboration	1.6.3 Microbiology & Genetics	61735	25,07	1547703	1,52	18%	5%	19%	93%	1,38
2001	2010	2011	Usa	International collaboration	2 Engineering and Technology	125542	8,75	1098324	1,41	15%	22%	23%	72%	1,25
2001	2010	2011	Usa	International collaboration	3.1 Basic Medicine	83086	17,78	1477136	1,35	15%	7%	20%	91%	1,21
2001	2010	2011	Usa	International collaboration	3.2 Clinical Medicine	145483	20,66	3005251	1,61	18%	8%	17%	89%	1,37
2001	2010	2011	Usa	International collaboration	3.3 Health sciences	61790	15,99	988241	1,45	17%	10%	19%	82%	1,30

2001	2010	2011	Usa	International collaboration	4 Agricultural sciences	32634	11,62	379242	1,45	16%	14%	21%	79%	1,26
2001	2010	2011	Usa	International collaboration	5.1 Psychology	20415	11,07	225914	1,38	16%	14%	20%	68%	1,25
2001	2010	2011	Usa	International collaboration	5.2 Economics and Business	20238	9,58	193945	1,51	17%	19%	11%	58%	1,38
2001	2010	2011	Usa	International collaboration	5.9 Other social sciences (Soc sc, Interdisc)	17937	6,83	122582	1,45	16%	22%	17%	45%	1,27
2001	2010	2011	Usa	National collaboration	0.0 Multidisciplinary	22179	65,49	1452492	4,80	49%	4%	10%	92%	4,44
2001	2010	2011	Usa	National collaboration	1.1 Mathematics	23417	6,26	146697	1,48	15%	29%	20%	64%	1,26
2001	2010	2011	Usa	National collaboration	1.2 Computer and information sciences	27772	7,23	200927	1,67	17%	29%	14%	44%	1,42
2001	2010	2011	Usa	National collaboration	1.3 Physical sciences	89645	14,20	1272952	1,68	19%	14%	20%	85%	1,37
2001	2010	2011	Usa	National collaboration	1.4 Chemical sciences	74211	17,17	1273908	1,83	21%	9%	18%	88%	1,64
2001	2010	2011	Usa	National collaboration	1.5 Earth and related environmental sciences	61722	11,63	717554	1,31	15%	11%	20%	71%	1,21
2001	2010	2011	Usa	National collaboration	1.6.1 Biochemistry & Molecular Biology	90383	22,68	2050210	1,32	15%	6%	16%	94%	1,23
2001	2010	2011	Usa	National collaboration	1.6.2 Biology	83111	12,91	1072576	1,21	13%	13%	18%	79%	1,14
2001	2010	2011	Usa	National collaboration	1.6.3 Microbiology & Genetics	81063	25,30	2050842	1,44	17%	5%	15%	93%	1,34
2001	2010	2011	Usa	National collaboration	2 Engineering and Technology	160249	10,67	1709524	1,51	16%	19%	18%	72%	1,32
2001	2010	2011	Usa	National collaboration	3.1 Basic Medicine	145918	17,72	2584943	1,28	15%	6%	17%	91%	1,19
2001	2010	2011	Usa	National collaboration	3.2 Clinical Medicine	335505	17,77	5962429	1,37	16%	9%	13%	87%	1,29
2001	2010	2011	Usa	National collaboration	3.3 Health sciences	127845	14,86	1899203	1,34	15%	11%	14%	79%	1,24
2001	2010	2011	Usa	National collaboration	4 Agricultural sciences	58504	10,90	637616	1,33	14%	15%	18%	77%	1,26
2001	2010	2011	Usa	National collaboration	5.1 Psychology	59831	11,29	675532	1,29	14%	13%	15%	67%	1,20
2001	2010	2011	Usa	National collaboration	5.2 Economics and Business	29682	12,59	373637	1,76	20%	16%	8%	59%	1,60
2001	2010	2011	Usa	National collaboration	5.9 Other social sciences (Soc sc, Interdisc)	53803	7,21	387829	1,43	15%	21%	12%	48%	1,28
2001	2010	2011	Usa	No collaboration	0.0 Multidisciplinary	12192	42,47	517744	3,20	34%	8%	10%	90%	3,47

2001	2010	2011	Usa	No collaboration	1.1 Mathematics	39198	4,12	161380	1,10	11%	37%	22%	61%	1,12
2001	2010	2011	Usa	No collaboration	1.2 Computer and information sciences	35811	5,61	201016	1,34	14%	36%	13%	40%	1,21
2001	2010	2011	Usa	No collaboration	1.3 Physical sciences	97389	11,35	1105384	1,34	14%	19%	19%	83%	1,18
2001	2010	2011	Usa	No collaboration	1.4 Chemical sciences	98252	15,89	1561391	1,56	18%	12%	16%	88%	1,45
2001	2010	2011	Usa	No collaboration	1.5 Earth and related environmental sciences	47985	10,73	514672	1,15	12%	14%	17%	69%	1,13
2001	2010	2011	Usa	No collaboration	1.6.1 Biochemistry & Molecular Biology	60217	19,05	1146962	1,11	12%	7%	15%	93%	1,12
2001	2010	2011	Usa	No collaboration	1.6.2 Biology	71980	11,35	817292	1,04	11%	15%	16%	78%	1,04
2001	2010	2011	Usa	No collaboration	1.6.3 Microbiology & Genetics	45296	20,79	941871	1,11	12%	6%	14%	93%	1,16
2001	2010	2011	Usa	No collaboration	2 Engineering and Technology	174919	8,41	1471379	1,27	13%	25%	17%	67%	1,15
2001	2010	2011	Usa	No collaboration	3.1 Basic Medicine	80549	15,21	1225501	1,09	11%	9%	15%	91%	1,06
2001	2010	2011	Usa	No collaboration	3.2 Clinical Medicine	172072	12,63	2173909	1,01	10%	14%	11%	85%	1,05
2001	2010	2011	Usa	No collaboration	3.3 Health sciences	72060	11,33	816537	1,03	11%	16%	12%	74%	1,03
2001	2010	2011	Usa	No collaboration	4 Agricultural sciences	44909	9,18	412193	1,14	12%	18%	16%	74%	1,13
2001	2010	2011	Usa	No collaboration	5.1 Psychology	57338	9,36	536783	1,08	11%	18%	13%	60%	1,09
2001	2010	2011	Usa	No collaboration	5.2 Economics and Business	31931	8,39	267970	1,17	12%	24%	7%	51%	1,23
2001	2010	2011	Usa	No collaboration	5.9 Other social sciences (Soc sc, Interdisc)	100617	5,04	507291	1,07	11%	29%	9%	35%	1,09

APPENDIX: Description indicators

1 Bibliometric Indicators

1.1 Database Structure

At CWTS, we calculate our indicators based on our in-house version of the Web of Science (WoS) database of Thomson Reuters. WoS is a bibliographic database that covers the publications of about 12,000 journals in the sciences, the social sciences, and the arts and humanities. Each journal in WoS is assigned to one or more subject categories. We note that our in-house version of the WoS database includes a number of improvements over the original WoS database. Most importantly, our database uses a more advanced citation matching algorithm and an extensive system for address unification. Our database also supports a hierarchically organized field classification system on top of the WoS subject categories. We note that at the moment conference proceedings are not covered by our database. In the future, however, our database will also include them.

To determine the appropriateness of our indicators for assessing a particular research entity, we often look at the internal WoS coverage of the entity. The internal WoS coverage of an entity is defined as the proportion of the references in its oeuvre that points to publications (also) covered by WoS. The lower the internal WoS coverage of an entity's output, the more careful one should be in the interpretation of our indicators.

The rest of this chapter provides an in-depth discussion of the bibliometric indicators that we use in this report.

Overview of the bibliometric indicators discussed in this chapter.

Indicator	*Dimension*	*Definition*
P	Output	Total number of publications of a unit.
Int_cov	Output	Internal coverage. Proxy of oeuvre being covered by Web of Science. Measured by the proportion of cited references in the oeuvre linking to other WoS publications.
MCS	Impact	Average number of citations of the publications of a unit (self-citations not included).
MNCS	Impact	Average normalized number of citations of the publications of a unit (self-citations not included).
$PP_{top\ 10\%}$	Impact	Proportion publications of a unit belonging to the top 10% most frequently cited publications in their field (self-citations not included).
MNJS	Journal impact	Average normalized citation score of the journals in which a unit has published (self-citations not included).

1.2 Indicators of Output

To measure the total publication output of a unit, we use a very simple indicator. This is the number of publications indicator, denoted by P. This indicator is calculated by counting the total number of publications of a research unit.

1.3 Indicators of Impact

A number of indicators are available for measuring the average scientific impact of the publications of a unit. These indicators are all based on the idea of counting the number of times the publications of a unit have been cited. Citations can be counted using either a fixed-length citation window or a variable-length citation window. In the case of a fixed-length citation window, only citations received within a fixed time period (e.g., three years) after the appearance of a publication are counted. In the case of a variable-length citation window, all citations received by a publication up to a fixed point in time are counted, which means that older publications have a longer citation window than more recent publications. An advantage of a variable-length window over a fixed-length window is that a variable-length window usually yields higher citation counts, which may be expected to lead to more reliable impact measurements. A disadvantage of a variable-length window is that citation counts of older and more recent publications cannot be directly compared with each other. Using a variable-length window, older publications on average have higher citation

counts than more recent publications, making direct comparisons impossible. This difficulty does not occur with a fixed-length window. At CWTS, we mostly work with a variable-length window, where citations are counted up to and including the most recent year fully covered by our database.

In the calculation of our impact indicators, we disregard author self citations. We classify a citation as a self citation if the citing publication and the cited publication have at least one author name (i.e., last name and initials) in common. We disregard self citations because they have a somewhat different nature than ordinary citations. Many self citations are given for good reasons, in particular to indicate how different publications of a researcher build on each other. However, sometimes self citations can serve as a mechanism for self promotion rather than as a mechanism for indicating relevant related work. This is why we consider it preferable to exclude self citations from the calculation of our impact indicators. By disregarding self citations, the sensitivity of our impact indicators to manipulation is reduced. Disregarding self citations means that our impact indicators focus on measuring the impact of the work of a researcher on other members of the scientific community. The impact of the work of a researcher on his own work is ignored.

As we mention previously each journal in WoS is assigned to one or more subject categories. These subject categories can be interpreted as scientific fields. There are about 250 subject categories in WoS. Publications in multidisciplinary journals such as *Nature*, *Proceedings of the National Academy of Sciences*, and *Science* were individually allocated, if it was possible, to subject fields on the basis of their references. The reassignment was done proportionally to the number of references pointing to a subject category. It is important to highlight that the impact indicators are calculated based on this assignment. Each publication in WoS has a document type. The most frequently occurring document types are article, book review, correction, editorial material, letter, meeting abstract, news item, and review. In the calculation of bibliometric indicators, we only take into account publications of the

document types article, letter, and review. Publications of other document types usually do not make a significant scientific contribution

Our most straightforward impact indicator is the mean citation score indicator, denoted by MCS. This indicator simply equals the average number of citations of the publications of a unit. Only citations within the relevant citation window are counted, and author self citations are excluded. Also, only citations to publications of the document types: article, letter, and review are taken into account. In the calculation of the indicators, articles and reviews have a weight of one while letters have a weight of 0.25.

A major shortcoming of the MCS indicator is that it cannot be used to make comparisons between scientific fields. This is because different fields have very different citation characteristics. For instance, using a three-year fixed-length citation window, the average number of citations of a publication of the document type article equals 2.0 in mathematics and 19.6 in cell biology. So it clearly makes no sense to make comparisons between these two fields using the MCS indicator. Furthermore, when a variable-length citation window is used, the MCS indicator also cannot be used to make comparisons between publications of different ages. In the case of a variable-length citation window, the MCS indicator favors older publications over more recent ones because older publications tend to have higher citation counts.

Our mean normalized citation score indicator, denoted by MNCS, provides a more sophisticated alternative to the MCS indicator. The MNCS indicator is similar to the MCS indicator except that it performs a normalization that aims to correct for differences in citation characteristics between publications from different scientific fields, between publications of different ages (in the case of a variable-length citation window), and between publications of different document types (i.e., article,

letter, and review[1]). To calculate the MNCS indicator for a unit, we first calculate the normalized citation score of each publication of the unit. The normalized citation score of a publication equals the ratio of the actual and the expected number of citations of the publication, where the expected number of citations is defined as the average number of citations of all publications in WoS that belong to the same field and that have the same publication year and the same document type. The field (or the fields) to which a publication belongs is determined by the WoS subject categories of the journal in which the publication has appeared. The MNCS indicator is obtained by averaging the normalized citation scores of all publications of a unit. Like in the case of the MCS indicator, letters have a weight of 0.25 in the calculation of the average while articles and reviews have a weight of one. If a unit has an MNCS indicator of one, this means that on average the actual number of citations of the publications of the unit equals the expected number of citations. In other words, on average the publications of the unit have been cited equally frequently as publications that are similar in terms of field, publication year, and document type. An MNCS indicator of, for instance, two means that on average the publications of a unit have been cited twice as frequently as would be expected based on their field, publication year, and document type. We refer to Waltman, Van Eck, Van Leeuwen, Visser, and Van Raan (2011) for more details on the MNCS indicator.

To illustrate the calculation of the MNCS indicator, we consider a hypothetical research group that has only five publications. **Table 1** provides some bibliometric data for these five publications. For each publication, the table shows the scientific field, to which the publication belongs, the year in which the publication appeared, and the actual and the expected number of citations of the publication. (For the moment, the last column of the table can be ignored.) The five publications are all of them document type article. Citations have been counted using a variable-length

[1] We note that the distinction between the different document types is sometimes based on somewhat arbitrary criteria. This is especially the case for the distinction between the document types *article* and *review*. One of the main criteria used by WoS to distinguish between these two document types is the number of references of a publication. In general, a publication with fewer than 100 references is classified as *article* while a publication with at least 100 references is classified as *review*. It is clear that this criterion does not yield a very accurate distinction between ordinary articles and review articles.

citation window. As can be seen in the table, publications 1 and 2 have the same expected number of citations. This is because these two publications belong to the same field and have the same publication year and the same document type. Publication 5 also belongs to the same field and has the same document type. However, this publication has a more recent publication year, and it therefore has a smaller expected number of citations. It can further be seen that publications 3 and 4 have the same publication year and the same document type. The fact that publication 4 has a larger expected number of citations than publication 3 indicates that publication 4 belongs to a field with a higher citation density than the field in which publication 3 was published. The MNCS indicator equals the average of the ratios of actual and expected citation scores of the five publications. Based on Table 1, we obtain

$$\mathrm{MNCS} = \frac{1}{5}\left(\frac{7}{6.13} + \frac{37}{6.13} + \frac{4}{5.66} + \frac{23}{9.10} + \frac{0}{1.80}\right) = 2.08$$

Hence, on average the publications of our hypothetical research group have been cited more than twice as frequently as would be expected based on their field, publication year, and document type.

Table 1: Bibliometric data for the publications of a hypothetical research group.

Publication	*Field*	*Year*	*Actual citations*	*Expected citations*	*Top 10% threshold*
1	Surgery	2007	7	6.13	15
2	Surgery	2007	37	6.13	15
3	Clinical neurology	2008	4	5.66	13
4	Hematology	2008	23	9.10	21
5	Surgery	2009	0	1.80	5

In addition to the MNCS indicator, we have another important impact indicator. This is the *proportion top 10% publications indicator*, denoted by $PP_{top\ 10\%}$. For each publication of a research group, this indicator determines whether based on its number of citations the publication belongs to the top 10% of all WoS publications

in the same field (i.e., the same WoS subject category) and the same publication year and of the same document type. The $PP_{top\ 10\%}$ indicator equals the proportion of the publications of a research group that belong to the top 10%. Analogous to the MCS and MNCS indicators, letters are given less weight than articles and reviews in the calculation of the $PP_{top\ 10\%}$ indicator. If a research group has a $PP_{top\ 10\%}$ indicator of 10%, this means that the actual number of top 10% publications of the group equals the expected number. A $PP_{top\ 10\%}$ indicator of, for instance, 20% means that a group has twice as many top 10% publications as expected. Of course, the choice to focus on top 10% publications is somewhat arbitrary. Instead of the $PP_{top\ 10\%}$ indicator, we can also calculate for instance a $PP_{top\ 1\%}$, $PP_{top\ 5\%}$, or $PP_{top\ 20\%}$ indicator. In this study, however, we use the $PP_{top\ 10\%}$ indicator. On the one hand this indicator has a clear focus on high impact publications, while on the other hand the indicator is more stable than for instance the $PP_{top\ 1\%}$ indicator.

To illustrate the calculation of the $PP_{top\ 10\%}$ indicator, we use the same example as we did for the MNCS indicator. **Table 1** shows the bibliometric data for the five publications of the hypothetical research group that we consider. The last column of the table indicates for each publication the minimum number of citations needed to belong to the top 10% of all publications in the same field and the same publication year and of the same document type.[2] Of the five publications, there are two (i.e., publications 2 and 4) whose number of citations is above the top 10% threshold. These two publications are top 10% publications. It follows that the $PP_{top\ 10\%}$ indicator equals

$$PP_{top\ 10\%} = \frac{2}{5} = 0.4 = 40\%$$

In other words, top 10% publications are four times overrepresented in the set of publications of our hypothetical research group.

[2] If the number of citations of a publication is exactly equal to the top 10% threshold, the publication is partly classified as a top 10% publication and partly classified as a non-top-10% publication. This is done in order to ensure that for each combination of a field, a publication year, and a document type we end up with exactly 10% top 10% publications.

To assess the impact of the publications of a unit, our general recommendation is to rely on a combination of the MNCS indicator and the $PP_{top\ 10\%}$ indicator. The MCS indicator does not correct for field differences and should therefore be used only for comparisons of groups that are active in the same field. An important weakness of the MNCS indicator is its strong sensitivity to publications with a very large number of citations. If a unit has one very highly cited publication, this is usually sufficient for a high score on the MNCS indicator, even if the other publications of the group have received only a small number of citations. Because of this, the MNCS indicator may sometimes seem to significantly overestimate the actual scientific impact of the publications of a unit. The $PP_{top\ 10\%}$ indicator is much less sensitive to publications with a very large number of citations, and it therefore does not suffer from the same problem as the MNCS indicator. A disadvantage of the $PP_{top\ 10\%}$ indicator is the artificial dichotomy it creates between publications that belong to the top 10% and publications that do not belong to the top 10%. A publication whose number of citations is just below the top 10% threshold does not contribute to the $PP_{top\ 10\%}$ indicator, while a publication with one or two additional citations does contribute to the indicator. Because the MNCS indicator and the $PP_{top\ 10\%}$ indicator have more or less opposite strengths and weaknesses, the indicators are strongly complementary to each other. This is why we recommend taking into account both indicators when assessing the impact of a unit's publications.

It is important to emphasize that the correction for field differences that is performed by the MNCS and $PP_{top\ 10\%}$ indicators is only a partial correction. As already mentioned, the field definitions on which these indicators rely are based on the WoS subject categories. It is clear that, unlike these subject categories, fields in reality do not have well-defined boundaries. The boundaries of fields tend to be fuzzy, fields may be partly overlapping, and fields may consist of multiple subfields that each have their own characteristics. From the point of view of citation analysis, the most important shortcoming of the WoS subject categories seems to be their heterogeneity in terms of citation characteristics. Many subject categories consist of research areas that differ substantially in their density of citations. For instance,

within a single subject category, the average number of citations per publication may be 50% larger in one research area than in another. The MNCS and $PP_{top\ 10\%}$ indicators do not correct for this within-subject-category heterogeneity. This can be a problem especially when using these indicators at lower levels of aggregation, for instance at the level of departments or individuals.

1.4 Indicators of journal impact

In addition to the average scientific impact of the publications of a unit, it may also be of interest to measure the average scientific impact of the journals in which the unit has published. In general, high-impact journals may be expected to have stricter quality criteria and a more rigorous peer review system than low-impact journals. Publishing a scientific work in a high-impact journal may therefore be seen as an indication of the quality of the work.

We use the mean normalized journal score indicator, denoted by MNJS, to measure the impact of the journals in which a unit has published. To calculate the MNJS indicator for a unit, we first calculate the normalized journal score of each publication of the group. The normalized journal score of a publication equals the ratio of on the one hand the average number of citations of all publications published in the same journal and on the other hand the average number of citations of all publications published in the same field (i.e., the same WoS subject category). Only publications in the same year and of the same document type are considered. The MNJS indicator is obtained by averaging the normalized journal scores of all publications of a unit. Analogous to the impact indicators discussed in Section 1.3, letters are given less weight than articles and reviews in the calculation of the average. The MNJS indicator is closely related to the MNCS indicator. The only difference is that instead of the actual number of citations of a publication the MNJS indicator uses the average number of citations of all publications published in a particular journal. The interpretation of the MNJS indicator is analogous to the interpretation of the MNCS indicator. If a unit has an MNJS indicator of one, this

means that on average the group has published in journals that are cited equally frequent as would be expected based on their field. An MNJS indicator of, for instance, two means that on average a group has published in journals that are cited twice as frequently as would be expected based on their field.

In practice, journal impact factors reported in Thomson Reuters' Journal Citation Reports are often used in research evaluations. Impact factors have the advantage of being easily available and widely known. The use of impact factors is similar to the use of the MNJS indicator in the sense that in both cases publications are assessed based on the journal in which they have appeared. However, compared with the MNJS indicator, impact factors have the important disadvantage that they do not correct for differences in citation characteristics between scientific fields. Because of this disadvantage, impact factors should not be used to make comparisons between fields. The MNJS indicator, on the other hand, does correct for field differences (albeit with some limitations; see the discussion at the end of Section 1.3). When between-field comparisons need to be made, the use of the MNJS indicator can therefore be expected to yield significantly more accurate journal impact measurements than the use of impact factors.