The Research Council of Norway

Economic research in Norway

– Bibliometric analysis

Evaluation
Division for Science

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Preface

This report presents a bibliometric analysis of the institutions/institutes included in the evaluation of economics research in Norway. The report is written on the commission of the Research Council of Norway by senior researcher Dag W. Aksnes at NIFU STEP - Studies in Innovation, Research and Education.

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1 Introduction: Bibliometric indicators

Publication and citation data have increasingly been applied as performance indicators in the context of science policy and research evaluation. The basis for the use of bibliometric indicators is that new knowledge – the principal objective of basic and applied research – is disseminated to the research community through publications. Publications can thereby be used as indirect measures of knowledge production. Data on how much the publications have been referred to or cited in the subsequent scientific literature can in turn be regarded as an indirect measure of the scientific impact of the research.

This report presents the results of a bibliometric study of the institutions/institutes included in the evaluation of economics research in Norway. It focuses on the publication output during the 10 year period 01.07.1996-30.06.2006. Both the overall level (i.e. all articles published by the researchers involved in the study) and the institution/department level are analysed.

The analysis is based on two data sources: Publication lists submitted by the researchers encompassed by the evaluation (i.e. self-reported publication data) and data provided by Institute for Scientific Information (ISI), the producer of the most important database for bibliometric purposes (now Thomson Scientific). In this first chapter we will provide a general introduction to bibliometric indicators, particularly focusing on analyses based on the ISI-database.[1]

1.1 The ISI-database

The ISI database covers a large number of specialised and multidisciplinary journals within the natural sciences, medicine, technology, the social sciences and the humanities. The coverage varies between the different database products. According to the website of the Thomson Scientific company, the most well-known product the *Science Citation Index* today covers 3,700 journals, and the expanded version of this publication database (Science Citation Index Expanded) 5,800 journals. The online product *Web of Science* covering the three citation indexes *Science Citation Expanded, Social Sciences Citation Index,* and *Arts & Humanities Citation Index* includes 8,500 journals. Compared to the large volume of scientific and scholarly journals that exist today, this represents a limited part. The selection of journals is based on a careful examination procedure in which a journal must meet particular requirements in order to be included (Testa, 1997). Even of its coverage is not

[1] This introduction is a based on Aksnes (2005).

complete, the ISI database will include all major journals within the sciences, medicine and technology and is generally regarded as constituting a satisfactory representation of international mainstream scientific research (Katz & Hicks, 1998). With respect to the social sciences and humanities the coverage is more limited, and this issue will be further discussed below.

From a bibliometric perspective, a main advantage of the ISI database is that it fully indexes the journals that are included. Moreover, all author names, author addresses and references are indexed. Through its construction it is also well adapted for bibliometric analysis. For example, country names and journal names are standardised, controlled terms. It is also an advantage that it is multidisciplinary in contrast to most other similar databases which cover just one or a few scientific disciplines.

1.2 Citation indicators

Citations represent an important component of scientific communication. Already prior to the 19th century it was a convention that scientists referred to earlier literature relating to the theme of the study (Egghe & Rousseau, 1990). The references are intended to identify earlier contributions (concepts, methods, theory, empirical findings, etc.) upon which the present contribution was built, and against which it positions itself. Thus, it is a basic feature of the scientific article that it contains a number of such references and that these references are attached to specific points in the text.

This ISI-database was originally developed for information retrieval purposes, to aid researchers in locating papers of interest in the vast research literature archives (Welljams-Dorof, 1997). As a subsidiary property it enabled scientific literature to be analysed quantitatively. Since the 1960s the *Science Citation Index* and similar bibliographic databases have been applied in a large number of studies and in a variety of fields. The possibility for citation analyses has been an important reason for this popularity. As part of the indexing process, ISI systematically registers all the references of the indexed publications. These references are organised according to the publications they point to. On this basis each publication can be attributed a citation count showing how many times each paper has been cited by later publications indexed in the database. Citation counts can then be calculated for aggregated publications representing, for example, research units, departments, or scientific fields.

1.3 What is measured through citations?

Because citations may be regarded as the mirror images of the references, the use of citations as indicators of research performance needs to be justified or grounded in the referencing behaviour of the scientists (Wouters, 1999). If scientists cite the work they find useful,

frequently cited papers are assumed to have been more useful than publications which are hardly cited at all, and possibly be more useful and thus important in their own right. Thus, the number of citations may be regarded as a measure of the article's usefulness, impact, or influence. The same reasoning can be used for aggregated levels of articles. The more citations they draw, the greater their influence must be. Robert K. Merton has provided the original theoretical basis for this link between citations and the use and quality of scientific contribution. In Merton's traditional account of science, the norms of science oblige researchers to cite the work upon which they draw, and in this way acknowledge or credit contributions by others (Merton, 1979). Such norms are upheld through informal interaction in scientific communities and through peer review of manuscripts submitted to scientific journals.

Empirical studies have shown that the Mertonian account of the normative structure of science covers only part of the dynamics. For the citation process, this implies that other incentives occur, like the importance of creating visibility for one's work, and being selective in referencing to create a distance between oneself and others. Merton himself already pointed out the ambivalence of the norms, for example that one should not hide one's results from colleagues in one's community, but also not rush into print before one's findings are robust. Merton also identified system level phenomena like the "Matthew effect": to whom who has shall be given more. Clearly, a work may be cited for a large number of reasons including tactical ones such as citing a journal editor's work as an attempt to enhance the chances of acceptance for publication. Whether this affects the use of citations as performance indicators is a matter of debate (Aksnes, 2003b).

The concept of quality has often been used in the interpretation of citation indicators. Today, however, other concepts – particularly that of "impact" – are usually applied. One reason is that quality is often considered as a diffuse or at least multidimensional concept. For example, the following description is given by Martin and Irvine (1983): "'Quality' is a property of the publication and the research described in it. It describes how well the research has been done, whether it is free from obvious 'error' […] how original the conclusions are, and so on." Here, one sees reference to the craft of doing scientific research, and to the contribution that is made to the advance of science.

The impact of a publication, on the other hand, is defined as the "actual influence on surrounding research activities at a given time." According to Martin and Irvine it is the impact of a publication that is most closely linked to the notion of scientific progress – a paper creating a great impact represents a major contribution to knowledge at the time it is published. If these definitions are used as the basis it is also apparent that impact would be a more suitable interpretation of citations than quality. For example, a 'mistaken' paper can nonetheless have a significant impact by stimulating further research. Moreover, a paper by a

recognised scientist may be more visible and therefore have more impact, earning more citations, even if its quality is no greater than those by lesser known authors (Martin, 1996).

1.4 Some basic citation patterns

De Solla Price showed quite early that recent papers are more cited than older ones (Price, 1965). Nevertheless, there are large individual as well as disciplinary differences. The citation counts of an article may vary from year to year. Citation distributions are extremely skewed. This skewness was also early identified by Solla Price (Price, 1965). The large majority of the scientific papers are never or seldom cited in the subsequent scientific literature. On the other hand some papers have an extremely large number of citations (Aksnes, 2003a; Aksnes & Sivertsen, 2004).

Citation rates vary considerably between different subject areas. For example, on average papers in molecular biology contain many more references than mathematics papers (Garfield, 1979b). Accordingly, one observes a much higher citation level in molecular biology than in mathematics. Generally, the average citation rate of a scientific field is determined by different factors, most importantly the average number of references per paper. In addition, the percentage of these references that appears in ISI-indexed journals, the average age of the references, and the ratio between new publications in the field and the total number of publications, are relevant.

1.5 Limitations

In addition to the fundamental problems related to the multifaceted referencing behaviour of scientists, there are also more specific problems and limitations of citation indicators. Some of these are due to the way the ISI database is constructed. First of all, it is important to emphasis that only references in ISI-indexed literature count as “citations”. For example, when articles are cited in non-indexed literature (e.g. a trade journal) these are not counted. This has important consequences. Research of mainly national or local interest, for example, will usually not be cited in international journals. Moreover, societal relevance, such as contributions of importance for technological or industrial development, may not be reflected by such counts. Because it is references in (mainly) international journals which are indexed, it might more appropriate to restrict the notion of impact in respect to citation indicators to impact on international or “mainstream” knowledge development

There is also a corresponding field dimension. For example, LePair (1995) has emphasised that “In technology or practicable research bibliometrics is an insufficient means of evaluation. It may help a little, but just as often it may lead to erroneous conclusions.” For similar reasons the limitations of citation indicators in the social sciences and humanities are generally more severe due to a less centralised or a different pattern of communication. For example, the role of international journals is less important and publishing in books is more

common: older literature has a more dominant role and many of the research fields have a "local" orientation. In conclusion, citation analyses are considered to be most fair as an evaluation tool in the scientific fields where publishing in the international journal literature is the main mode of communication.

Then there are problems caused by more technical factors such as discrepancies between target articles and cited references (misspellings of author names, journal names, errors in the reference lists, etc.), and mistakes in the indexing process carried out by Thomson Scientific (see Moed, 2002; Moed & Vriens, 1989). Such errors affect the accuracy of the citation counts to individual articles but are nevertheless usually not taken into account in bibliometric analyses (although their effect to some extent might "average out" at aggregated levels).

While some of the problems are of a fundamental nature, inherent in any use of citations as indicators, other may be handled by the construction of more advanced indicators. In particular, because of the large differences in the citation patterns between different scientific disciplines and subfields, it has long been argued by bibliometricians that relative indicators and not absolute citation counts should be used in cross-field comparisons (Schubert & Braun, 1986; Schubert & Braun, 1996; Schubert, Glänzel, & Braun, 1988; Vinkler, 1986). For example, it was early emphasised by Garfield that: "Instead of directly comparing the citation counts of, say, a mathematician against that of a biochemist, both should be ranked with their peers, and the comparison should be made between rankings" (Garfield, 1979a). Moed et al. (1985) similarly stressed that: "if one performs an impact evaluation of publications from various fields by comparing the citation counts to these publications, differences between the citation counts can not be merely interpreted in terms of (differences between) impact, since the citation counts are partly determined by certain field-dependent citation characteristics that can vary from one field to another".

A fundamental limitation of citation indicators in the context of research assessments is that a certain time window is necessary for such indicators to be reliable, particularly when considering smaller number of publications. Frequently, in the sciences a three-year period is considered as appropriate (see e.g. Moed et al., 1985). But for the purpose of long-term assessments a longer period is required. At the same time, an excessively long period makes the results less usable for evaluation purposes. This is because one then only has citation data for articles published many years previously. Citation indicators are not very useful when it comes to publications published very recently, a principal limitation of such indicators being that they cannot provide an indication of present or future performance except indirectly: past performance correlates with future performance (Luukkonen, 1997). It should be added, however, that this time limitation does not apply to the bibliometric indicators based on publication counts.

1.6 Bibliometric indicators versus peer reviews

Over the years a large number of studies have been carried out to ascertain the extent to the number of citations can be regarded as a measure of scientific quality or impact. Many studies have also found that citation indicators correspond fairly well, especially in the aggregate, with various measures of research performance or scientific recognition which are taken as reflecting quality. On the other hand, there have been several studies challenging or criticising such use of citations.

One approach to the question is represented by studies analysing how citations correlate with peer reviews. In these studies judgements by peers have been typically regarded as a kind of standard by which citation indicators can be validated. The idea is that one should find a correlation if citations legitimately can be used as indicators of scientific performance (which assumes that peer assessment can indeed identify quality and performance without bias – a dubious assumption). Generally, most of the studies seem to have found an overall positive correspondence although the correlations identified have been far from perfect and have varied among the studies (see e.g. Aksnes & Taxt, 2004, Aksnes, 2006).

Today most bibliometricians emphasise that a bibliometric analysis can never function as a substitute for a peer review. Thus, a bibliometric analysis should not replace an evaluation carried out by peers. First a peer-evaluation will usually consider a much broader set of factors than those reflected through bibliometric indicators. Second, this is due to the many problems and biases attached to such analyses. As a general principle, it has been argued that the greater the variety of measures and qualitative processes used to evaluate research, the greater is the likelihood that a composite measure offers a reliable understanding of the knowledge produced (Martin, 1996).

At the same time, it is generally recognised that peer reviews also have various limitations and shortcomings (Chubin & Hackett, 1990). For example, van Raan (2000) argues that subjectivity is a major problem of peer reviews: The opinions of experts may be influenced by subjective elements, narrow mindedness and limited cognitive horizons. An argument for the use of citation indicators and other bibliometric indicators is that they can counteract shortcomings and mistakes in the peers' judgements. That is, they may contribute to fairness of research evaluations by representing "objective" and impartial information to judgements by peers, which would otherwise depend more on the personal views and experiences of the scientists appointed as referees (Sivertsen, 1997). Moreover, peer assessments alone do not provide sufficient information on important aspects of research productivity and the impact of the research activities (van Raan, 1993).

Citations and other bibliometric indicators have been applied in various ways in research evaluation. For example, such indicators are used to provide information on the performance of research groups, departments, institutions or fields. According to van Raan

(2000), "the application of citation analysis to the work – the oeuvre – of a group as a whole over a longer period of time, does yield in many situations a strong indicator of scientific performance, and, in particular, of scientific quality". As a qualifying premise it is emphasised, however, that the citation analysis should adopt an advanced, technically highly developed bibliometric method. In this view, a high citation index means that the assessed unit can be considered as a scientifically strong organisation with a high probability of producing very good to excellent research.

In this way a bibliometric study is usually considered as complementary to a peer evaluation. Van Raan has accordingly suggested that in cases where there is significant deviation between the peers' qualitative assessments and the bibliometric performance measures, the panel should investigate the reasons for these discrepancies. They might then find that their own judgements have been mistaken or that the bibliometric indicators did not reflect the unit's performance (van Raan, 1996).[2]

In sum, the use of citations as performance measures have their limitations, as all bibliometric indicators have. But a citation analysis when well designed and well interpreted will still provide valuable information in the context of research evaluation. Performance, quality and excellence can also be assessed through peer review, but in spite of their widespread use, these have problems as well. A combination of methods, or better, mutual interrogation on the basis of findings of each of the methods, is more likely to provide reliable evaluation results.

1.7 Co-authorship as an indicator of collaboration[3]

The fact that researchers co-author a scientific paper reflects collaboration and co-authorship may be used as an indicator of such collaboration. Computerised bibliographic databases make it possible to conduct large-scale analyses of scientific co-authorship. Of particular importance for the study of scientific collaboration is the fact that the ISI (Thomson Scientific) indexes all authors and addresses that appear in papers, including country as a controlled term.

By definition a publication is co-authored if it has more than one author, internationally co-authored if it has authors from more than one country. Compared to other methodologies, bibliometrics provides unique and systematic insight into the extent and structure of scientific collaboration. A main advantage is that the size of the sample that can

[2] Van Raan (1996) suggests that in cases were conflicting results appear, the conclusion may depend on the type of discrepancy. If the bibliometric indicators show a poor performance but the peer's judgement is positive, then the communication practices of the group involved may be such that bibliometric assessments do not work well. By contrast, if the bibliometric indicators show a good performance and the peers' judgement is negative, then it is more likely that the peers are wrong.

[3] This section is based on Wendt, Slipersæter, & Aksnes (2003).

be analysed with this technique can be very large and render results that are more reliable than those from case studies. Also, the technique captures non-formalised types of collaboration that can be difficult to identify with other methodologies.

Still, there are limitations. Research collaboration sometimes leads to other types of output than publications. Moreover, co-authorship can only be used as a measure of collaboration if the collaborators have put their names on a joint paper. Not all collaboration ends up in co-authorship and the writing of co-authored papers does not necessarily imply close collaboration (Katz & Martin, 1997; Luukkonen, Persson, & Sivertsen, 1992; Melin & Persson, 1996). Thus, international co-authorship should only be used as a partial indicator of international collaboration (Katz and Martin 1997). As described above there are also particular limitations with the ISI database, represented by the fact that regional or domestic journals, books, reports etc. are not included.

Smith (1958) was among the first to observe an increase in the incidence of multi-authored papers and to suggest that such papers could be used as a rough measure of collaboration among groups of researchers (Katz and Martin 1997). In a pioneering work, Derek de Solla Price also showed that multiple authorship had been increasing (Price, 1986). These findings that have later been confirmed by a large number of similar studies (e.g. (Merton & Zuckerman, 1973; National Science Board, 2002). In the natural sciences and medicine the single-author paper is, in fact, becoming an exception to the norm. In the case of Norway, 86 per cent of ISI-indexed papers were co-authored in 2000, compared to 66 per cent in 1981.

Scientific collaboration across national borders has also significantly increased over the last decades. According to Melin and Persson (1996) the number of internationally co-authored papers has doubled in about fifteen years. In Norway every second paper published by Norwegian researchers now has foreign co-authors compared to 16 per cent in 1981. Similar patterns can be found in most countries. Bibliometric analysis thus provides evidence to the effect that there is a strong move towards internationalisation in science and that the research efforts of nations are becoming more and more entwined.

The move toward internationalisation is also reflected in the publishing practices of scientists: English has increasingly become the lingua franca of scientific research, and publishing in international journal is becoming more and more important, also in the areas of social science and the humanities.

As might be expected, nations with big scientific communities have far more collaborative articles than have smaller countries (Luukkonen, Tijssen, Persson, & Sivertsen, 1993), though one finds a trend to the effect that the proportion of internationally co-authored papers increases along with decreasing national volume of publications (see e.g. Luukkonen, Persson et al. 1992, National Science Board 2002), hence international collaboration is

relatively more important in smaller countries. This is probably a consequence of researchers from small countries often having to look abroad for colleagues and partners within their own speciality. Size is, however, not the only factor with bearing on the extent of international collaboration; access to funding, geographical location, and cultural, linguistic and political barriers are other important factors (Luukkonen, Persson et al. 1992, Melin and Persson 1996).

Bibliometric techniques allow analysis of structures of international collaboration. For almost all other countries, the United States is the most important partner country; this reflects this country's pre-eminent role in science. In 1999, 43 per cent of all published papers with at least one international co-author had one or more U.S. authors. For Western Europe the share of U.S. co-authorship ranged from 23 per cent to 35 per cent of each country's internationally co-authored papers (National Science Board 2002). Generally, one also finds that most countries have much collaboration with their neighbouring countries (e.g. collaboration among the Nordic countries). Over the last decade we find a marked increase in co-authorship among western European countries; this probably mainly reflects the EU framework programmes.

1.7 Bibliometrics indicators and economic research

Bibliometric analyses drawing on ISI-data have more limitations in the social sciences and the humanities. First the literature differs from the sciences with more emphasis on books, anthologies and publication in national journals. Second the ISI-coverage of the journal literature is not as good as in the sciences. In the humanities referencing is archival and citations accumulate very slowly. In the social sciences referencing mixes archival and current patterns and the referencing pattern is quite scattered, lacing focus. A core literature is less clearly delineated (Hicks, 2004).

However, there are large differences between the disciplines. Analyses based on ISI data will work reasonable well in economics, whose literature share many characteristics with science, and less well in for example sociology with a typical social science literature. In economics books figure less prominently and the international journal is an important communication channel. In general citations in economics reach a peak during the third year after publication (Nederhof & van Raan, 1993).

2 Data and methods

This chapter gives an overview of the data and the methodology applied in the study.

2.1 Data

The study is based on two sources of data: Publication lists (provided by the researchers themselves) and ISI-data.

2.1.1 Publication lists

As part of the evaluation procedure the researchers submitted their publications lists/CVs to the Research Council of Norway. The tenured academic employee and post doc fellows included in the evaluation (in total 345 persons) were asked to list their publications for the past ten years, i.e. 30 June 1996 – 30 June 2006. The following instructions were given by the Research Council (in letter dated 1 June 2006):

> The list to be submitted should only include publications in the following categories:
>
> a) Books published by publishing houses (editorship *not* included, separate chapters in the editorship of books to be included under b)
> b) Articles in anthologies published by publishing houses (chapters in books)
> c) Articles in scientific journals (including review articles but not book reviews, editorial material, contributions to discussions and similar)
> d) Papers/reports published by the employing institution
> e) Papers/reports published by other institutions
> f) Ph.D. dissertations
>
> Publications not covered by any of the above categories must not be included in the lists (material such as popular science articles, feature articles, book reviews and conference papers not published in written form are clearly outside the scope of the categories given above).
>
> Please do not include publications issued outside the stated period (for example publications in the categories "submitted", "forthcoming" and "in press"). A full list of references is required for a publication to be included in the evaluation and to be assigned a category (including year, author and all co-authors [if any], title, publisher, name of journal/anthology where an article was published, volume number and pages when relevant).

These guidelines have also been used when structuring the publication analysis. The different categories a-f were used in the classification of the listed publication, and material such as popular science articles, feature articles, book reviews and conference papers not published in written form were not included (despite the guidelines such contributions were often included in the publication lists, these "publications" cannot really be considered as scientific contributions – for example, although an abstract may contain interesting original information, it will usually soon be superseded by more extensive papers). It would have been desirable to have information also on edited books (in a separate category) but because these contributions by the Research Council were requested to be omitted, they are accordingly not included here.

The submitted publication lists often appeared to be defective in respect to the guidelines given. A time consuming cleaning process therefore had to be carried out. For example, we deleted submitted or forthcoming publications, unpublished manuscripts, conference papers not published in written form, and newspaper articles. It was also necessary to introduce a few additional criteria in the classification procedure. As reports only items being publicly available were included (i.e. not manuscript in the desk drawer, mimeos, notes and confidential contract reports – which gladly were included as publications by many researchers). Operationally this means that a "report" needs to be published in an organisation's official publication series (usually having an ISSN-number) in order to be counted. Similarly as conference articles, only papers which in full have been printed in conference-proceedings were included (however, in the guidelines it was unfortunately not obvious whether such contributions should be included or not).

It should be noted that the analysis relies entirely on the information given by the researchers. No doubt there are errors in this information (e.g. in the name of the journal, publication year, etc.) but it would have been an insurmountable job to check the correctness of the data. This also means that a publication may be deleted if the researchers have given defective information, for example forgot to include information about the publication of a report in an institution's report series. We are justified in doing such kind of data processing considering that the researchers have been given detailed guidelines on what information the publication lists should contain.

In the guidelines there was no distinction between national and international journals. When processing the data we nevertheless decided to classify the journal articles in two such categories. These literatures form distinct, yet partially overlapping worlds, each serving a different purpose. The international journals comprise internationally oriented, largely English language peer reviewed articles. National journals communicate with a local scholarly community. The national publications were in turn classified in two categories: scientific journals (journals credited as scientific journals by UHR's National Councils (ref. 1.1.2007)) and other journals (i.e. non-scholarly national journals and magazines (fagtidsskrift) representing research in interaction with contexts of application.

For the books and book chapters we classified each publication according to their publication language. The publications written in English were counted as international scientific publications while the Norwegian and other language publications were counted as national publications.

In the guidelines there were separate categories for reports published by the employing institution and reports published by other institutions. However, only a minority of the researchers applied these categories when reporting their publication data. It was considered as too laborious and not worth the effort to maintain this distinction and all reports as well as

articles in edited reports have been lumped together in one report category. However, the reports were classified according to their publication language.

As described above the analysis is based on the self-reported publication data. Some publications were multiply reported. The reason is that when a publication is written by several authors it will appear on the publication lists of all the authors, and will accordingly occur more than one time. In order to handle this problem the following principles were applied: Within each unit we removed all the multiply reported items, i.e. only unique publications were left. For the non-scientific literature and the grey literature it was, however, considered as too laborious and not worth the effort to remove publication being multiply reported. Thus these numbers represent the number of co-authorships and not the "real" number of publications.

2.1.2 ISI-data

From the Research Council of Norway we obtained information on the name of the persons encompassed by the evaluation. Based on this list we searched for publications on the Web of Knowledge (week 2 and 3, 2007). We used each researcher's submitted publication lists as a reference standard for the inclusion and deletion at articles. Various search techniques had to be applied in order to identify the correct articles, although most of them were identified by simple searches based on author names. The bibliographic details of the articles were downloaded, including the number of citations. We considered only publications classified as *regular articles* and *reviews*. Editorials, meeting abstracts, letters, corrections are *not* included.

In some of the analyses we also applied other ISI-databases which NIFU STEP has purchased from Thomson Scientific. One basic database is the *National Citation Report* (NCR) for Norway, containing bibliographic information for all Norwegian articles (articles with at least one Norwegian author address). Data for each paper include all author names, all addresses, article title, journal title, document type (article, review, editorial, etc.), field category, year by year and total citation counts and expected citation rates (based on the journal title, publication year and document type). The 2007 edition of NCR, with data covering 1981-2006 was used.

In addition, the *National Science Indicators* (NSI) database containing aggregated bibliometric data at country and field/subfield level was used. This database was mainly applied for the purpose of creating reference standards.

2.2 Methods

In the study the individual researcher represents the basic unit, and the data were subsequently aggregated to the level of departments/unit. In other words, we have applied a personnel based definition. A department is defined as its tenured scientific staff, and post doc fellows who are included in the evaluation. For most of the units, there are additional personnel who are not included, tenured personnel working outside the evaluated research areas as well as non-tenured personnel. We have included all publications of the individuals examined, even if it included work done before they became affiliated at the respective departments.

2.2.1 Publication output

Scientific productivity can in principle be measured relatively easy by the quantification of published material. In practice it is more difficult, since a number of issues have to be faced. In particular the choice and weighting of publication types and the attribution of author credit are important questions to consider. Many publications are multi-authored, and are the results of collaborative efforts involving more than one researcher or institution. There are different principles and counting methods that are being applied in bibliometric studies. The most usual is "whole" counting, i.e. with no fractional attribution of credit (everyone gets full credit). A second alternative is "adjusted counting" where the credit is divided equally between all the authors (Seglen, 2001). For example, if an article has five authors and two of them represent the department being analysed, the department is credited 2/5 article (0.4). One can argue that these counting methods are complementary: The whole or integer count gives the number of papers in which the unit "participated". A fractional count gives the number of papers "creditable" to the unit, assuming that all authors made equal contributions to a co-authored paper, and that all contributions add up to one (Moed, 2005). As described above in this study possible double occurrences of articles have been excluded within each unit. This means that papers co-authored by several researchers belonging to the same department are counted only once (but when fractionalised publication counts have been calculated, each persons is credited their publication share).

2.2.2 Citation indicators

It is the individual articles and their citation counts that represent the basis for the citation indicators. As described above citation counts are only available (at least in a systematically way) for the ISI-indexed articles. In the citation indicators we have used accumulated citation counts and calculated an overall (total) indicator for the whole period. This means that for the articles published in 1997, citations are counted over a 10-year period, while for the articles published in 2005, citations are counted over a 2-year period (or more precisely a 1-2 year period: the year of publication and 2006). It is generally not advisable to use citation windows

of only one or two years. Nevertheless, we have also included the recently published articles in the citation analysis. It is "expected" that the articles then are uncited or very poorly cited. It is worth noting that in the citation indicators the oldest publications will have relatively more weight than the recent publications. This is due to the fact that the 1997 publications, for example, will have assembled citations over a longer time period than articles published in 2004. Nevertheless, our method has some advantages compared to the alternatives. In particular, it reduces the problem of the poor reliability of citations as indicators when very short time periods are considered. It is, however, important to notice that the citation indicators presented here hardly reflect the citation rate of the more recent publications. The method adopted here is commonly applied in similar bibliometric performance analyses (see for example Moed & Velde, 1993; van Raan, 1996).

The problem of crediting citation counts to multi-authored publications is identical to the one arising in respect to publication counts. In this study the research groups and departments have received full credit of the citations – even when for example only one of several authors represents the respective research groups or department. This is also the most common principle applied in international bibliometric analyses. There are however arguments for both methods. A researcher will for example consider a publication as "his/her own" even when it has many authors. In respect to measuring contribution, on the other hand, (and not participation) it may be more reasonable to fractionalise the citations, particularly when dealing with publications with a very large number of authors.

As described above the average citation rate varies a lot between the different scientific disciplines. As a response, various reference standards and normalisation procedures have been developed. The most common is the average citation rates of the journal or field in which the particular papers have been published. An indicator based on the field as a reference standard is the *Relative citation index – field.* Here the citation count of each paper is matched to the mean citation rate per publication of the particular fields.

As a reference value we used the mean citation rate of the subfields in which the department has published. This reference value was calculated using the bibliometric data from the NSI-database.[4] Using this database it is possible to construct a rather fine-tuned set of subfield citation indicators.[5] The departments are usually active in more than one subfield (i.e. the journals they publish in are assigned to different subfields). For each department we

[4] The NSI-database applied (2006 version) includes citations up to and including 2005 while citations received up to January 2007 have been included in the set of analysed publications. The one year "time lag" has been adjusted for in the calculations.

[5] The following example can illustrate the principle for calculating relative citation indexe: A researcher has published a journal article in *Scandinavian Journal of Economics* in 1997. This article has been cited 7 times. The world-average citation rate for the field Economics which this journal is assigned to is, however, 8.7 for articles published this year. In other words, the article obtains a lower score compared to the field average. The Relative citation index – field is: (7/8.7)*100 = 80. The example is base on a single publication. The principle is, however, identical when considering several publications. In these cases, the sum of the received citations is divided by the sum of the "expected" number of citations.

therefore calculated weighted averages with the weights being determined by the total number of papers published in each subfield/year. In ISI's classification system some journals are assigned to more than one subfield. In order to handle this problem we used the average citation rates of the respective subfields as basis for the calculations for the multiple assigned journals. The indicator was then calculated as the ratio between the average citation rate of the department's articles and the average subfield citation rate. In this way, the indicator shows whether the department's articles are cited below or above the world average of the subfield(s) in which the department is active. For example, an index value of 110 would mean that the department's articles are cited 10% more frequently than "expected" for articles published in the corresponding fields.

The following guide can be used when interpreting the *Relative citation index – field*:

Citation index: > 150: Very high citation level

Citation index: 120-150: High citation level, significant above the world average.

Citation index: 80-120: Average citation level. On a level with the international average of the field (= 100).

Citation index: 50-80: Low citation level**.**

Citation index: < 50: Very low citation level.

It should be emphasised once more that the indicators cannot replace an assessment carried out by peers. In the cases where a research group or department is poorly cited, one has to consider the possibility that in this case the citation indicators do not give a representative picture of the research performance (for example due to limited coverage of the publication literature). Moreover, the unit may have good and weak years. Citations have highest validity in respect to high index values. But similar precautions should be taken also here. For example, in some cases one highly cited researcher or one highly cited publication may strongly improve the citation record of a group or even a department.

2.2.3 Journal profiles

We also calculated the journal profile of the departments. As basis for one of the analyses we used the so called "impact factor" of the journals. The journal impact factor is probably the most widely used and well-known bibliometric product. It was originally introduced by Eugene Garfield as a measure of the frequency with which the average article in a journal has been cited. In turn, the impact factor is often considered as an indicator of the significance and prestige of a journal. In the standard product the impact factor is calculated as the mean number of citations in a given year, to journal items published during the preceding two years. This time period used as basis for the calculation of impact factor is however often considered

to be too short. In this analysis we have therefore instead used a five-year period. There are large differences in the average citation rates between fields. This means that journals in fields with high average citation rates tend to dominate the top of the ranking lists. In order to avoid this problem we have compared the impact factor of the journal with the corresponding average citation rates of fields they represent (i.e. economics, management, mathematics, public health). The journals have then been divided in four categories: a) journals with very high impact factors (impact factor: 100% or more above field average), b) journals with high to medium impact factors (impact factor: 0-100% above field average), c) journals with low to medium impact factors (impact factor: 0-50% below field average), d) journals with low impact factors (impact factor: 50% or more below field average).

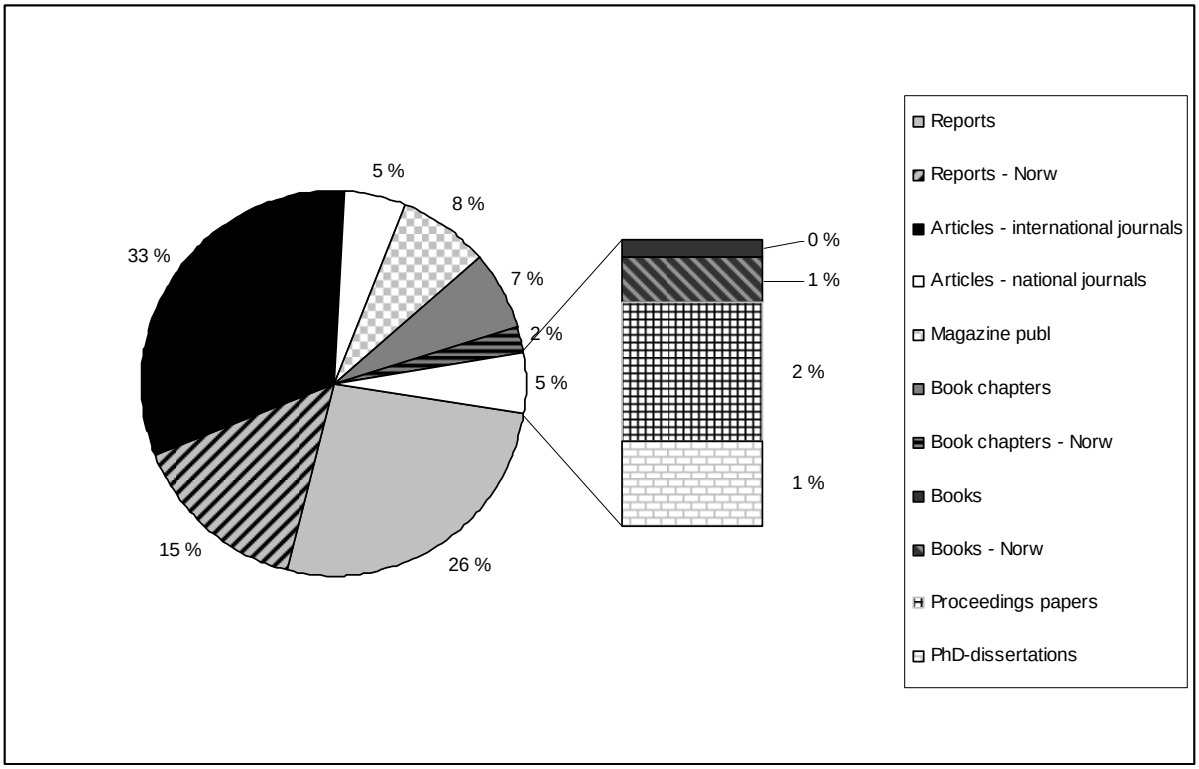
3 Results

This chapter describes the results of the publication analysis.

3.1 Overall publication profile

In total the researchers reported 7103 publications (some being multiply reported). Figure 3.1 shows the distribution on the different publication types. The report category is the largest one accounting for 42 per cent of the publications. Then follow international and national journal articles with proportions of 32 and 13 per cent, respectively. Articles in anthologies published by publishing houses (chapters in books) account for 9 per cent of the publications, while books represent a proportion of only 1 per cent.

Figure 3.1 National publication profile – distribution according to publication category (all units included)



N=7103

It is interesting that reports have this significant position within the publication profile of the Norwegian economic research institutes. Apparently, report publishing is applied for a variety of purposes. For example, an article is often published as a report (e.g. as a working paper)

prior to its submission to a journal, or it is published as an offprint-report afterwards. For example, there is generally a long time lag between the submission of a paper and its appearance in print (often 2-3 years) and because of this it is very common to publish the articles also as working papers in reports series. Moreover, reports are an important channel for presenting the results of contract and applied research. Reports also represent the main channel for disseminating the results of various surveys and statistics, carried out on a regular routine basis or as part of research projects. Finally, the report category might occasionally be applied when the research does not reach the standard for being publishable in international (or national) journals or anthologies.

Within the report category we accordingly find a mixture of quite different types of publications, being published in Norwegian or English language. Of the reports 64 per cent were written in English. Assumingly, the large majority of these are working papers that will later appear as journal articles. The Norwegian language reports, on the other hand, probably mainly represent publications representing contract research or surveys/statistics presented for a national public. Representing the "grey" literature, the reports generally have a rather limited circle of readers – although this is not always the case. Considering these factors and the mandate of the evaluation it is reasonable to give this category of publications a limited weight in the analysis.

3.2 International scientific publications

In this section we will focus on the international scientific contributions. As such contributions we have included international journal articles, English language books and articles in such books. The large majority represent international journal articles, and only very few are books/monographs[6] cf. Fig 3.1.

Table 3.1 gives the publication details for each of the units included in the evaluation. The Department of Economics at the University of Oslo is the largest unit in terms of such contributions, with 329 publications (13%), followed by the two departments at the Norwegian School of Economics and Business Administration (NHH). At the bottom we find Bodø Graduate School of Business, Institute for Social Research, and Norges Bank.

There are considerable differences between the units in terms of size and we have also have calculated the average number of publications per person included in the evaluation. The productivity has been calculated for two periods: the entire 10 years period and the most recent three year period (2003-2005). In both periods the highest number of publications per person is found at the Institute of Health Management and Health Economics at the University of Oslo, with a ratio almost twice as high as number two. However, their publications have a much higher average number of authors than the publications from the

[6] In a more sophisticated analysis these contributions should have be given more weight than the articles. But because only a very few English language books have been published this has not been done.

other units (cf. Table 3.14). This factor is inflating the per capita measure. Number two and three on the list for the most recent period are Department of Economics at the University of Oslo and the Department of Economics at the Norwegian University of Science and Technology with approx. 4 international scientific publications per person. At the other end we find Department of Financial Economics at the Norwegian School of Management – BI, Statistics Norway, Norges Bank, and Institute for Social Research with 1.6 or less publications per person.

Table 3.1 Number of international scientific publications per institute/unit*

Instituttion/institute	Department	Number of persons	Number of publications	Share of publications	Number of publications per person all years	Number of publications per person 2003-05 (standard deviation in bracets)
University of Oslo	Department of Economics	30	329	13 %	11.0	4.0 (3.7)
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	28	258	10 %	9.2	3.4 (3.0)
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	40	240	10 %	6.0	1.9 (3.0)
Statistics Norway		48	188	7 %	3.9	1.3 (1.7)
Norwegian University of Life Sciences	Department of Economics and Resource Management	19	177	7 %	9.3	3.0 (3.8)
University of Bergen	Department of Economics	23	165	7 %	7.2	2.2 (2.7)
Norwegian University of Science and Technology	Department of Economics	15	153	6 %	10.2	3.8 (2.3)
University of Stavanger		15	133	5 %	8.9	2.9 (4.0)
The Frisch Centre		10	110	4 %	11.0	3.4 (3.0)
University of Oslo	Institute of Health Management and Health Economics	5	104	4 %	20.8	7.8 (6.7)
Agder University College		12	101	4 %	8.4	3.3 (4.4)
Molde University College		16	98	4 %	6.1	1.7 (2.3)
Institute for Research in Business Administration (SNF)		14	92	4 %	6.6	2.6 (3.1)
Institute of Transport Economics		18	80	3 %	4.4	1.7 (2.8)
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	8	70	3 %	8.8	2.3 (2.3)
Norwegian School of Management - BI	Department of Financial Economics	12	58	2 %	4.8	1.0 (1.2)
Norwegian School of Management - BI	Department of Economics	9	56	2 %	6.2	1.7 (1.6)
Norges Bank		13	44	2 %	3.4	1.6 (2.3)
Institute for Social Research		5	32	1 %	6.4	1.6 (2.2)
Bodø Graduate School of Business		5	31	1 %	6.2	2.8 (2.1)
TOTAL		345	2518	100 %	7.3	2,5

As the latter figures reflect there are large differences among the units in the productivity of international publications per person. Also *within* the units there are large productivity variations among the staff (cf. the standard deviation, Table 3.1). When interpreting these figures it is however important to realize that the units have very different functions within the Norwegian research system. Some are traditional university departments, some represent units with strong teaching obligations and some are applied units mainly involved in contract research or analyses related to policy. Generally, the major part of the activity at the units within the "institute sector (governmental and private research institutes) is based on external grants, accordingly the research is usually applied and based on contracts. In such contexts the report is often the most appropriate publication channel. The universities, on the other hand, have a special responsibility for long term basic research, and the possibilities for doing research publishable through international channels are usually (much) better.

The analysis has not been adjusted for external parameter such as increase in personnel, change in research focus, maternity leave, etc. that will affect the units differently and explain some of the observed differences. Accordingly there are several limitations attached to this analysis and one should be careful with attaching too much weight to the figures.

Table 3.2 shows the number of international publications per year. In this table the numbers for 1996 and 2006 have been removed because only half-year counts are available for these years. As can be seen there is a general increase in the production during the period, but this increase can partly be explained by the fact that not all researchers have been active during the whole period (particularly relevant for post docs). It should be noted that Norges Bank and Bodø Graduate School of Business have increased their publishing significantly during the period.

Table 3.2 Number of international scientific publications per institute/unit and year

Instituttion/institute	Department	1997	1998	1999	2000	2001	2002	2003	2004	2005
University of Oslo	Department of Economics	25	28	20	18	28	42	45	33	41
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	23	25	28	23	17	23	30	27	37
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	16	14	25	20	26	31	23	34	19
Statistics Norway		15	13	16	16	18	20	21	23	19
Norwegian University of Life Sciences	Department of Economics and Resource Management	20	15	16	8	23	14	14	21	22
University of Bergen	Department of Economics	13	11	12	17	11	24	21	13	17
Norwegian University of Science and Technology	Department of Economics	15	13	15	7	12	15	17	17	23
University of Stavanger		7	8	11	11	14	18	12	17	14
The Frisch Centre		8	9	6	14	6	18	14	14	6
University of Oslo	Institute of Health Management and Health Economics	7	4	7	8	8	17	13	11	15
Agder University College		6	10	2	5	15	10	15	10	14
Molde University College		4	8		14	14	14	8	7	12
Institute for Research in Business Administration (SNF)		6	9	4	9	5	13	14	14	8
Institute of Transport Economics		3	6	5	9	8	8	9	16	5
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	7	11	3	4	9	7	7	7	4
Norwegian School of Management - BI	Department of Financial Economics	13	9	2	5	3	4	3	6	3
Norwegian School of Management - BI	Department of Economics	6	8	5	3	4	6	7	5	3
Norges Bank		1	1	1	1	5	8	5	4	12
Bodø Graduate School of Business		1	1	1	2	4	3	6	7	1
Institute for Social Research		1	3	1	5	2	1	1	4	3
TOTAL		197	206	180	199	232	296	285	290	278

In total 1327 of the articles in international journals were identified as indexed by Thomson Scientific (ISI)[7], compared to the overall number of 2060 journal articles.[8] This means that 65 per cent of the international journals production have been indexed by ISI. Most of the major economic journals are indexed, and the majority of the non-indexed journals represent more periphery journals or journals of less importance. However, there are also some major

[7] Some articles (158) involve co-authorship between researchers included in the evaluation from different of the units (counting these articles only time we end up 1169 articles).

[8] On the other hand there are a significant number of articles within the field of economics that have been produced by other Norwegian researchers than those encompassed by the evaluation. In total we find 70 per cent of the Norwegian article production within the field of economics (defined as the article production in a predefined set of journals devoted to economic research) in the period included in the analysis.

international journals that are not indexed. Among the non-indexed journals Norwegian economists frequently publish in are: *Marine Resource Economics* (40 entries) *Nordic Journal of Political Economy* (38 entries) and *European Journal of Political Economy* (24 entries).

3.3 National scientific publications

In this section we will give an overview of the national scientific contributions of the units. Articles in Norwegian journals, Norwegian language books and articles in such books are included, in addition to contributions in other Norwegian language journals (i.e. non-scholarly national journals and magazines (fagtidsskrift)). The results are shown in Table 3.3.

Table 3.3 Number of national publications per institute/unit

Institution/institute	Department	Scientific journals*	Books	Book chapters	Magazines etc.	TOTAL
Statistics Norway		56	1	15	188	260
University of Oslo	Department of Economics	35	9	19	36	99
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	29	6	23	40	98
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	8	9	12	49	78
Norwegian School of Management - BI	Department of Economics	14	8	15	26	63
The Frisch Centre		39		4	20	63
Institute for Social Research		50	1	7	1	59
University of Oslo	Institute of Health Management and Health Economics	36	2	9	12	59
University of Bergen	Department of Economics	18	4	19	12	53
Institute for Research in Business Administration (SNF)		19	1	11	18	49
University of Stavanger		9	3	3	29	44
Norges Bank		7		2	17	26
Agder University College		3	4	3	14	24
Bodø Graduate School of Business					24	24
Norwegian University of Life Sciences	Department of Economics and Resource Management	4		4	14	22
Norwegian School of Management - BI	Department of Financial Economics	3	6	5	6	20
Institute of Transport Economics				5	11	16
Molde University College		1	2		9	12
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	1		1	2	4
Norwegian University of Science and Technology	Department of Economics	–	–	–	–	–
TOTAL		332	56	157	528	1073

*) Articles in journals accredited as scientific journals by UHR's National Councils (ref. 1.1.2007).
–) Missing data.

As can be seen, Statistics Norway is the unit with the highest number of national publications, the majority being published in their own series *Økonomiske analyser*.

Of the scientific journals *Økonomisk Forum* is by far the most important one, followed by *Søkelys på arbeidsmarkedet* (now *Søkelys på arbeidslivet*). The third important journal is *Norsk Økonomisk Tidsskrift*. Statistics Norway and Institute for Social Research (ISF) have the highest number of articles in such journals. The latter institute is also the one issuing the journal *Søkelys på arbeidsmarkedet*.

Overall, there are not many books being published. Usually, these books represent text books or books on popular issues for a non-scientific public.

3.4 "Grey" literature - other publications

As described above the reports represent the largest category of the publications. Focusing on the reports in Norwegian, Statistics Norway is by far the largest unit accounting for approximately one fourth of these publications. Then follow Institute for Research in Business Administration (SNF) and Institute of Transport Economics. Thus, we here find applied institutes using reports for the submission of statistics and/or results of contract research.

Table 3.4 "Grey" literature. Number of publications* per institute/unit

Instituttion/institute	Department	Reports - English	Reports - Norwegian	Proceedings papers	PhD-dissertations	Total
Statistics Norway		380	251	8	18	657
University of Oslo	Department of Economics	225	67	5	10	307
Institute of Transport Economics		169	94	9	4	276
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	126	78	3	6	213
The Frisch Centre		138	71		3	212
Norwegian University of Life Sciences	Department of Economics and Resource Management	142	43	8	4	197
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	93	33	50	8	184
Institute for Research in Business Administration (SNF)		40	121		6	167
University of Bergen	Department of Economics	89	54	1	7	151
University of Stavanger		87	36	2	6	131
Agder University College		58	15	42	6	121
Molde University College		62	24	29	5	120
Norges Bank		83	4		11	98
Institute for Social Research		25	57		4	86
University of Oslo	Institute of Health Management and Health Economics	28	46		2	76
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	35	6	11	4	56
Bodø Graduate School of Business		10	36	4	1	51
Norwegian School of Management - BI	Department of Economics	20	25	2		47
Norwegian University of Science and Technology	Department of Economics	38	–		3	41
Norwegian School of Management - BI	Department of Financial Economics	26	3		5	34
Total		1874	1064	174	113	3225

*) Some publications have been multiply reported and are counted more than one time
–) Missing data.

The majority of the reports are written in English. As noted above we here find a large number of "working papers" being published in reports prior to their submission to journals. However, also the results of contract research are increasingly being published in English. On the basis of our data it is not possible to distinguish between the different kinds of reports. Statistics Norway is also the largest institute in terms of such publications. Then follow Department of Economics at the University of Oslo and Institute of Transport Economics.

Table 3.4 also shows the number of PhD-dissertation per unit. It is important to realise that these numbers represent the number of dissertation produced by the persons included in the evaluation. The figures accordingly suggest that 113 of the persons have obtained their PhD during the period.

Combining the results of the Tables 3.1-3.4, the following institutes have a publication profile dominated by reports (50 per cent or more of their publications): Institute of Transport Economics, Statistics Norway , Institute for Research in Economics and Business Administration (SNF), The Frisch Centre, and Norges Bank.

3.5 Journal profiles

We have also calculated the frequencies of the different international and national journals. Table 3.5 shows the most frequent journals and the number of articles/co-authorships for each of them. On the top of the list we find *Scandinavian Journal of Economics* with 60 entries, followed by *Environmental & Resources Economics* (50) and *Marine Resource Economics* (39). From the list of journals one gets an impression of the overall research profile of Norwegian economic research. Although we find a large number of general economic journals on the list, a striking pattern is the strong incidence of journals devoted to environmental and resource economics and marine resource economics. This means that Norway has a particular specialisation in economic research related to its natural resources, representing the principal industries of the Norwegian economy. This research profile does not only characterise economic research but is a general characteristics of Norway as a research nation (Sivertsen & Aksnes, 2000a, 2000b).

Table 3.5 The most frequent used journals, number of articles

Journal	Num. of articles	Journal	Num. of articles
Scandinavian Journal of Economics	60	International Tax and Public Finance	14
Environmental & Resource Economics	50	FinanzArchiv	13
Marine Resource Economics	39	Economic Journal	13
Nordic Journal of Political Economy	32	Oxford Bulletin of Economics and Statistics	13
Applied Economics	32	Labour	13
European Economic Review	28	Journal of Productivity Analysis	13
Journal of Public Economics	27	Forum for Development Studies	12
Accident Analysis and Prevention	24	Aquaculture Economics and Management	12
Land Economics	23	Journal of Economic Dynamics and Control	12
Journal of Population Economics	23	Marine Policy	11
European Journal of Political Economy	23	Economic Modelling	11
Resource and Energy Economics	22	Applied Financial Economics	11
European Journal of Operational Research	22	European Review of Agricultural Economics	11
Annals of Operations Research	21	Journal of Labor Economics	11
Environment and Development Economics	19	Econometrics Journal	11
Economics Letters	18	Social Choice and Welfare	11
Energy Policy	17	Journal of Development Economics	11
Energy Economics	16	Journal of International Economics	11
Public Choice	16	Journal of Economics	11
International Journal of Industrial Organization	16	International Economic Review	10
Natural Resource Modeling	16	Applied Economics Letters	10
Journal of Environmental Economics and Management	16	Economic Theory	10
Ecological Economics	15	Mathematical Social Sciences	10
Energy Journal	15	Annales d'Economie et de Statistique	10
Journal of Economic Behavior and Organization	15	Norwegian	
Health Economics	15	Økonomisk Forum	139
Journal of Health Economics	14	Søkelys på arbeidsmarkedet	75
Empirical Economics	14	Norsk Økonomisk Tidsskrift	56
American Journal of Agricultural Economics	14	Tidsskrift for Den norske Lægeforening	21

In table 3.6 the ranking list of the journals has been broken down at the level of institute/unit. Only journals with more than 5 entries are shown. As can be seen, a specialisation towards energy and resource economics characterises quite a few of the institutes.

Table 3.6 Journals with more than 5 articles* by institute/unit

Institution/institute	Department	Journal	Num. of articles
Institute for Social Research		Søkelys på arbeidsmarkedet	44
Institute of Transport Economics		Accident Analysis and Prevention	21
		Transportation Research Record	8
Molde University College		Annals of Operations Research	10
		European Journal of Operational Research	6
Norges Bank		Norsk Økonomisk Tidsskrift	6
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	Scandinavian Journal of Economics	11
		Økonomisk Forum	11
		Journal of Public Economics	8
		Norsk Økonomisk Tidsskrift	8
		European Economic Review	7
		Nordic Journal of Political Economy	6
		International Tax and Public Finance	6
		Journal of Population Economics	6
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	European Journal of Operational Research	13
Norwegian School of Management - BI	Department of Economics	Økonomisk Forum	11
Norwegian University of Life Sciences	Department of Economics and Resource Management	Forum for Development Studies	7
		Agricultural Economics	6
		Land Economics	6
		Environment and Development Economics	6
		European Review of Agricultural Economics	6
Norwegian University of Science and Technology	Department of Economics	Applied Economics	6
SNF		Økonomisk Forum	13
		Marine Resource Economics	7
Statistics Norway		Økonomisk Forum	39
		Norsk Økonomisk Tidsskrift	12
		Environmental & Resource Economics	10
		Energy Policy	7
		Review of Income and Wealth	7
The Frisch Centre		Søkelys på arbeidsmarkedet	15
		Økonomisk Forum	15
		Environmental & Resource Economics	6
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	Marine Resource Economics	8
University of Bergen	Department of Economics	Scandinavian Journal of Economics	9
		Økonomisk Forum	9
		International Journal of Industrial Organization	6
University of Oslo	Department of Economics	Økonomisk Forum	19
		Scandinavian Journal of Economics	19
		Environmental & Resource Economics	13
		European Economic Review	8
		Resource and Energy Economics	7
		Søkelys på arbeidsmarkedet	7
		Norsk Økonomisk Tidsskrift	7
		Nordic Journal of Political Economy	7
		Journal of Public Economics	7
		Journal of Productivity Analysis	6
University of Oslo	Institute of Health Management and Health Economics	Tidsskrift for Den norske Lægeforening	20
		Økonomisk Forum	7
University of Stavanger		Marine Resource Economics	10
		Økonomisk Forum	7
		International Journal of Global Energy Issues	6

In the self-evaluation the units were asked which journals they considered as "top 5" within their research areas. Both field journals and general economic journals were listed here. For the general economic journals most often listed as "top 5" (*American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics, Review of Economic Studies*) we identified the number of articles per institute/unit. Only a few of the units had published in these journals, an overview is given in Table 3.7. It should be noted, however, that these journals may be of varying relevance for the units included in the evaluation. A finance department, for example, will typically have other journals as their most esteemed or highly ranked.

Table 3.7 Number of articles in "top 5" general economic journals* by institute/unit

Institution/institute	Department	Number of articles
University of Oslo	Department of Economics	6
Norwegian School of Management - BI	Department of Economics	3
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	3
Statistics Norway		2
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Sci	2
University of Bergen	Department of Economics	1
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	1
Norwegian School of Management - BI	Department of Financial Economics	1

*) *American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics, Review of Economic Studies*

The Department of Economics at the University of Oslo is by far the unit with most articles in these journals.

In order to get a better view of the journal profile of the units we classified the production according to journal impact factors (cf. Chapter 2). The results are given in Table 3.8. Impact factors are only available for journals indexed by Thomson Scientific (ISI) and we have also shown the proportion of the journal production in non-indexed journals and Norwegian journals.

Tab 3.8 Distribution of articles in scientific journals.

Institution/institute	Department	Impact factor				Non-indexed international journals	Norwegian journals	n
		Very high	High-medium	Low-medium	Low			
Agder University College		0 %	16 %	15 %	18 %	48 %	4 %	80
Bodø Graduate School of Business		7 %	10 %	23 %	33 %	27 %	0 %	30
Institute for Social Research		0 %	6 %	7 %	3 %	14 %	70 %	71
Institute of Transport Economics		0 %	6 %	45 %	7 %	42 %	0 %	69
Molde University College		2 %	8 %	35 %	7 %	46 %	1 %	84
Norges Bank		2 %	10 %	31 %	12 %	29 %	17 %	44
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	2 %	17 %	28 %	8 %	33 %	12 %	244
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	5 %	17 %	26 %	12 %	36 %	4 %	212
Norwegian School of Management - BI	Department of Economics	6 %	13 %	21 %	10 %	27 %	23 %	62
Norwegian School of Management - BI	Department of Financial Economics	17 %	7 %	17 %	11 %	43 %	6 %	54
Norwegian University of Life Sciences	Department of Economics and Resource Management	0 %	20 %	29 %	8 %	40 %	3 %	115
Norwegian University of Science and Technology	Department of Economics	2 %	13 %	32 %	17 %	36 %	0 %	133
Institute for Research in Business Administration (SNF)		2 %	11 %	23 %	9 %	34 %	20 %	96
Statistics Norway		2 %	10 %	28 %	8 %	24 %	27 %	204
The Frisch Centre		1 %	16 %	28 %	11 %	16 %	29 %	133
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	2 %	8 %	26 %	15 %	48 %	2 %	61
University of Bergen	Department of Economics	1 %	19 %	39 %	10 %	20 %	11 %	165
University of Oslo	Department of Economics	5 %	20 %	29 %	11 %	23 %	12 %	282
University of Oslo	Institute of Health Management and Health Economics	7 %	10 %	26 %	7 %	22 %	29 %	125
University of Stavanger		1 %	9 %	36 %	10 %	37 %	7 %	129
TOTAL		3 %	14 %	28 %	10 %	31 %	14 %	2392

Overall we find that 38 per cent of the articles appear in journals with lower impact factors than average, and 17 per cent in journals with a higher than average impact factor. In other words, Norwegian economists tend to publish in journals with a low impact factors. On reason for this is the numerous articles in *Scandinavian Journal of Economics* which is cited below average.

In table 3.9 a similar distribution has been shown, but here only for the ISI-indexed articles.

Tab 3.9 Distribution of articles according to impact factor

Institution/institute	Department	Impact factor				n
		Very high	High-medium	Low-medium	Low	
Agder University College		0 %	33 %	31 %	36 %	39
Bodø Graduate School of Business		9 %	14 %	32 %	45 %	22
Institute for Social Research		0 %	36 %	45 %	18 %	11
Institute of Transport Economics		0 %	10 %	78 %	13 %	40
Molde University College		5 %	16 %	66 %	14 %	44
Norges Bank		4 %	17 %	57 %	22 %	23
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	4 %	31 %	51 %	14 %	134
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	9 %	28 %	43 %	20 %	127
Norwegian School of Management - BI	Department of Economics	13 %	26 %	42 %	19 %	31
Norwegian School of Management - BI	Department of Financial Economics	32 %	14 %	32 %	21 %	28
Norwegian University of Life Sciences	Department of Economics and Resource Management	0 %	35 %	51 %	14 %	65
Norwegian University of Science and Technology	Department of Economics	4 %	20 %	51 %	26 %	85
Institute for Research in Business Administration (SNF)		5 %	25 %	50 %	20 %	44
Statistics Norway		4 %	21 %	58 %	17 %	99
The Frisch Centre		1 %	29 %	51 %	19 %	73
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	3 %	16 %	52 %	29 %	31
University of Bergen	Department of Economics	2 %	27 %	57 %	14 %	114
University of Oslo	Department of Economics	7 %	31 %	45 %	17 %	183
University of Oslo	Institute of Health Management and Health Economics	15 %	19 %	52 %	15 %	62
University of Stavanger		1 %	17 %	64 %	18 %	72
TOTAL		5 %	25 %	51 %	19 %	1 327

Based on Table 3.8 and 3.9 the following conclusions can be drawn: The two departments at Norwegian School of Management – BI, the two departments at the University of Oslo and the two department of the Norwegian School of Economics and Business Administration (NNH) have all very strong journal records with high proportion of articles in high impact journals. At the other end we find Institute of Transport Economics with a particular low proportion of articles in such journals. It is also interesting to note that Institute for Social Research differs from the other units in the way of mainly publishing in Norwegian journals.

Norway has recently implemented a bibliometric model for performance based budgeting of research institutions. The funding of the higher education institutions is now partially based on the measurement of their scientific and scholarly publishing (see Sivertsen, 2006). In this system journals are divided into two levels. The highest level (level 2) is giving extra weight and includes only the leading and most selective international journals (accounts for about 20 per cent of the world's publications). The national councils in each discipline

Table 3.10 The number of articles in leading journals – "level 2".**

Institution/institute	Department	1996*	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*	Total
University of Oslo	Department of Economics	9	9	8	6	3	9	7	14	13	13	3	94
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	8	7	3	5	6	7	6	4	12	7	4	69
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	3	6	4	11	6	1	2	8	5	12	6	64
University of Bergen	Department of Economics	2	3	3	7	3	2	7	6	1	5	7	46
Norwegian University of Science and Technology	Department of Economics		3	1	3	4	2	5	2	4	6	4	34
The Frisch Centre		1	3	3		3	1	6	7	3	2	4	33
Statistics Norway		1	2	2	3	3	2	4	4	5	2	1	29
University of Stavanger		2	2	3	2	2	2	4	4	3	2	1	27
University of Oslo	Inst of Health Management and Health Economics	1	4	1	1	4	1	2	1	2	2	3	22
Norwegian School of Management - BI	Department of Economics	1	3	2	1	2		1	5	1	1	1	18
Molde University College		1		1		4	5	2		1	2		16
Agder University College			1	1	1	1	2	1	3	2	1	2	15
Norwegian University of Life Sciences	Department of Economics and Resource Management			1	3		4	1	1	2	2	1	15
Norwegian School of Management - BI	Department of Financial Economics	0	4	2	0	2	0	1	1	0	2	2	14
Institute for Research in Business Administration (SNF)		1	1		3	2			1	3		3	14
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	1	2	2		1	1					2	9
Norges Bank		1					2	1	1		2	1	8
Institute for Social Research			1			1				1	1	2	6
Bodø Graduate School of Business						1	1			1			3
Institute of Transport Economics			1	1									2
Total		32	52	38	46	48	42	50	62	59	62	47	538

*) Half-year counts only.

**) Cf. the guidance of the Norwegian Association of Higher Education Institutions.

participate annually in determining and revising the highest level under the guidance of the Norwegian Association of Higher Education Institutions.

In our analysis we identified the journal production in this highest level of journals. Table 3.10 shows the results of this analysis.

We also calculated the proportion of the article production appearing in these leading, level 2 journals. The results are given in Table 3.11. As can be seen, some of the units have a very strong journal profile with more than a third of their international journal production appearing in leading journals. Clearly, these institutes have high ambitions when selecting journals for publication. Furthermore, in order to appear in these journals it can reasonably be assumed that the quality of the research is generally very good.

Table 3.11 Proportion of articles in leading journals – "level 2"*.

Institution/institute	Department	Number of articles - level 2	Share - level 2 of international journal articles	Share - level 2 of all journal articles
University of Oslo	Department of Economics	94	38 %	33 %
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	69	34 %	33 %
Norwegian School of Management - BI	Department of Economics	18	38 %	29 %
University of Bergen	Department of Economics	46	31 %	28 %
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	64	30 %	26 %
Norwegian School of Management - BI	Department of Financial Economics	14	27 %	26 %
Norwegian University of Science and Technology	Department of Economics	34	26 %	26 %
The Frisch Centre		33	35 %	25 %
University of Stavanger		27	23 %	21 %
Norges Bank		8	23 %	18 %
Molde University College		16	19 %	19 %
Agder University College		15	19 %	19 %
University of Oslo	Inst of Health Management and Health Economics	22	25 %	18 %
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	9	15 %	15 %
Institute for Research in Business Administration (SNF)		14	18 %	15 %
Statistics Norway		29	20 %	14 %
Norwegian University of Life Sciences	Department of Economics and Resource Management	15	14 %	13 %
Bodø Graduate School of Business		3	10 %	10 %
Institute for Social Research		6	29 %	8 %
Institute of Transport Economics		2	3 %	3 %
Total		538	26 %	23 %

*) Cf. the guidance of the Norwegian Association of Higher Education Institutions.

3.6 Citation indicators

Table 3.12 gives the number of ISI-indexed articles for each institute/unit (1996-2006). We have also shown how many citations these articles have received within the same time period (i.e. counting citations from year of publications to present). As can be seen, the ranking list is quite similar to the one presented in Table 3.2, column 4 (international journal articles), albeit at a lower level, as would be expected. The Department Economics at the University of Oslo is the largest producer of journal articles followed by the two departments at the Norwegian School of Economics and Business Administration (NHH).

The articles have in total received more than 5000 citations. Generally, the more articles one has published the more citations one will receive. But as can be seen from Table 4.1 there are large variations in the relationship among the different units. The Department of Economics at the University of Oslo has by far received the highest number of citations, 730.

Table 3.12 Total number of ISI-indexed articles and citations, by institute/unit

Instituttion/institute	Department	Total number of articles	Total number of citations
University of Oslo	Department of Economics	183	730
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	134	425
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	127	467
University of Bergen	Department of Economics	114	373
Statistics Norway		99	328
Norwegian University of Science and Technology	Department of Economics	85	213
The Frisch Centre		73	296
University of Stavanger		72	264
Norwegian University of Life Sciences	Department of Economics and Resource Management	65	482
University of Oslo	Institute of Health Management and Health Economics	62	339
Institute for Research in Economics and Business Administration (SNF)		44	90
Molde University College		44	212
Institute of Transport Economics		40	163
Agder University College		39	99
Norwegian School of Management - BI	Department of Economics	31	144
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	31	89
Norwegian School of Management - BI	Department of Financial Economics	28	213
Norges Bank		23	127
Bodø Graduate School of Business		22	24
Institute for Social Research		11	21
TOTAL ALL UNITS		1327	5099

As described above the average citation rate varies a lot between the different scientific and scholarly disciplines and the relative citation index indicator has been developed to adjust for these differences. Below we have calculated a relative citation index for each institute and unit. The Department of Economics and Resource Management at Norwegian University of Life Sciences (UMB) has obtained the highest citation index and their publications have received 80 per cent more citations than the corresponding world average (see Figure 3.2), then follows Norges Bank with 55 per cent more citations than "expected". In other words, the publications of these two institutes have been very highly cited. It should be added, however, that both institutes have published one particularly highly cited paper (see below) which contributes significantly to their high citation index.

The Department of Financial Economics at the Norwegian School of Management - BI and the Molde University College have also obtained citation levels clearly above the world average, with citation indexes of 133 and 113, respectively. All other institutes have not reached the world average level. Then we find two institutes with a citation level slightly below the world average: Department of Economics at the Norwegian School of Management – BI, and the Department of Economics at the University of Oslo. When interpreting these results it is important to be aware that the USA contributed to almost half (45 %) of the publications within the ISI-field "Economics" in the period 1996-2005 and that the US publications were cited 34 per cent above the world average. The average citation levels of all other countries were significantly below the US- which plays in its own division. As an example, the average citation index for the EU-countries was 78. In other words, to be cited below the world – US dominated – average is the norm for other countries.

Figure 3.2 Relative citation index by institute/unit

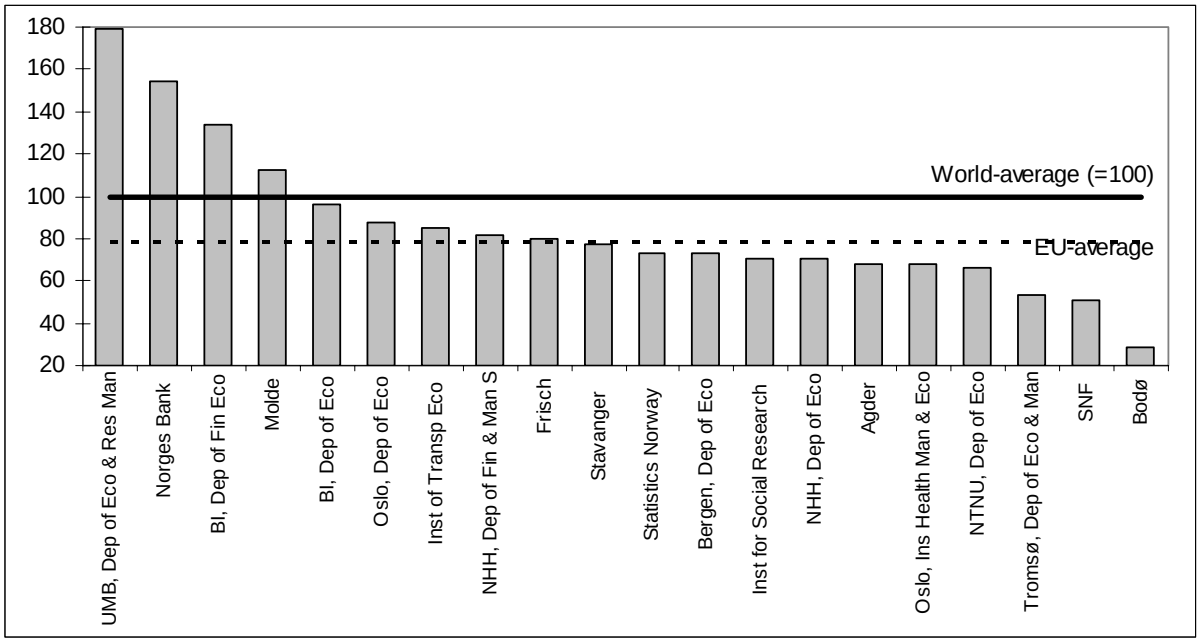


Table 3.13 shows the articles (ISI-indexed) that have received the highest number of citations. Only the publications with more than 40 citations have been shown. As can be expected, the list is dominated by articles from the first years of the period, since these articles have being available for a longer time for receiving citations. Some of the researchers have also published in medical journals, and there are two such articles on the list. It should be emphasised that the average citation level is generally much higher in medicine than in economics.

Table 3.13 The articles receiving the highest number of citations*

Total cites	Title	Journal	Year	Instituttion/institute	Department
104	The causes of land-use and land-cover change: moving beyond the myths	GLOBAL ENVIRONMENTAL CHANGE-HUMAN AND POLICY DIMENSIONS	2001	Norwegian University of Life Sciences	Department of Economics and Resource Management
68	Testing the adequacy of smooth transition autoregressive models	JOURNAL OF ECONOMETRICS	1996	Norges Bank	
58	Competitive search equilibrium	JOURNAL OF POLITICAL ECONOMY	1997	Norwegian School of Management - BI	Department of Economics
51	The hazard of war: Reassessing the evidence for the democratic peace	JOURNAL OF PEACE RESEARCH	1997	Statistics Norway	
51	Rethinking the causes of deforestation: Lessons from economic models	WORLD BANK RESEARCH OBSERVER	1999	Norwegian University of Life Sciences	Department of Economics and Resource Management
48	International asset pricing and portfolio diversification with time-varying risk	JOURNAL OF FINANCE	1997	Norwegian School of Management - BI	Department of Financial Economics
47	Agricultural expansion and deforestation: modelling the impact of population, market forces and property rights	JOURNAL OF DEVELOPMENT ECONOMICS	1999	Norwegian University of Life Sciences	Department of Economics and Resource Management
44	Which groups of patients benefit from helicopter evacuation?	LANCET	1996	University of Oslo	Institute of Health Management and Health Economics
42	Radiology services for remote communities: Cost minimisation study of telemedicine	BRITISH MEDICAL JOURNAL	1996	University of Oslo	Institute of Health Management and Health Economics
41	Seasoned public offerings: resolution of the 'new issues puzzle'	JOURNAL OF FINANCIAL ECONOMICS	2000	Norwegian School of Management - BI	Department of Financial Economics
41	How big is the premium for currency risk?	JOURNAL OF FINANCIAL ECONOMICS	1998	Norwegian School of Management - BI	Department of Financial Economics

*) One frequently cited article within clinical medicine has been excluded.

3.7 Collaboration indicators

For each of the institutes we have calculated the average number of authors for the article production. Two institutes have a much higher average number than the others: Institute of Health Management and Health Economics at the University of Oslo and Department of Economics and Resource Management at the Norwegian University of Life Sciences with 4.2

and 3.7 authors per article, respectively. The other departments have an average of approximately two authors per article, ranging from 1.7 to 2.6 authors. It is reasonable to conclude that with exception of the two mentioned units (which partly can be explained by their research profile and the inclusion of articles in other fields, e.g. medicine), there are not large differences in the extent of research collaboration.

Table 3.14 Average number of authors per article

Institution/institute	Department	Num of articles	Avg. num. of authors
University of Oslo	Department of Economics	183	2.0
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	134	2.0
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	127	2.1
University of Bergen	Department of Economics	114	2.2
Statistics Norway		99	2.3
Norwegian University of Science and Technology	Department of Economics	85	2.2
The Frisch Centre		73	2.3
University of Stavanger		72	2.2
Norwegian University of Life Sciences	Department of Economics and Resource Management	65	3.7
University of Oslo	Institute of Health Management and Health Economics	62	4.2
Inst for Research in Economics and Business Administration (SNF)		44	2.6
Molde University College		44	2.5
Institute of Transport Economics		40	1.7
Agder University College		39	2.3
Norwegian School of Management - BI	Department of Economics	31	1.9
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	31	2.2
Norwegian School of Management - BI	Department of Financial Economics	28	2.2
Norges Bank		23	2.1
Bodø Graduate School of Business		22	2.0
Institute for Social Research		11	1.9

Table 3.15 shows the distribution of the articles according to co-authorship. The column to the left shows the proportion of the articles that are non-collaborative, i.e. having only one author. Here we find large variations that partly are disguised in the average numbers shown in Table 3.14. The majority of the units have between one fifth and one third of their papers being singled authored. At the one end we find Molde University College with only 5 per cent of their papers being singled authored, at the other Institute of Transport Economics with 65 per cent of their production authored by only one person.

The column to the right shows the proportion of the papers that involve international co-authorship, i.e. have author addresses from other countries than Norway. There are also large variations in the extent the institutes are involved in international research collaboration, at least as reflected in these figures. Again we find Institute of Transport Economics at the one

end with only 5 per cent of their papers being co-authored with researchers from other countries. Several of the institutes have very extensive international collaboration: The Department of Financial Economics at the Norwegian School of Management - BI, Agder University College, Institute of Health Management and Health Economics at the University of Oslo, and Bodø Graduate School of Business have all 50 cent or more of their production being internationally co-authored. At the overall national level the proportion of international co-authorship in Economics increased from 27 per cent for the period 1994-96 to 38 per cent for the period 2003-2005 (Aksnes, Slipersæter, & Frølich, Forthcoming)

We have also shown the proportion of papers that only have Norwegian co-authors (note: the papers involving international co-authorship may also have other Norwegian co-authors). Here we also find quite large variations ranging from 23 per cent to 59 per cent.

Table 3.15 Distribution of articles according to co-authorship, per cent

Instituttion/institute	Department	Singel authored papers	National co-authorship	International co-authorship	N
University of Oslo	Department of Economics	33	34	32	183
Norwegian School of Economics and Business Administration (NHH)	Department of Economics	30	40	30	134
Norwegian School of Economics and Business Administration (NHH)	Department of Finance and Management Science	25	29	46	127
University of Bergen	Department of Economics	22	48	30	114
Statistics Norway		26	57	17	99
Norwegian University of Science and Technology	Department of Economics	34	51	15	85
The Frisch Centre		12	58	30	73
University of Stavanger		25	50	25	72
Norwegian University of Life Sciences	Department of Economics and Resource Management	23	48	29	65
University of Oslo	Institute of Health Management and Health Economics	10	39	52	62
Molde University College		5	59	36	44
Inst for Research in Economics and Business Administration (SNF)		30	36	34	44
Institute of Transport Economics		65	30	5	40
Agder University College		21	23	56	39
Norwegian School of Management - BI	Department of Economics	29	39	32	31
The Norwegian College of Fishery Science, University of Tromsø	Department of Economics and Management	35	32	32	31
Norwegian School of Management - BI	Department of Financial Economics	18	25	57	28
Norges Bank		26	35	39	23
Bodø Graduate School of Business		23	27	50	22
Institute for Social Research		45	27	27	11

Table 3.16 shows the number of co-authored papers between the researchers included in the evaluation. Quite a few of the units – but far from all – have strongest collaborative links with colleges working at the same department – as would be expected. There is a particular strong link between the Department of Economics at the Norwegian School of Economics and Business Administration (NHH) and the Department of Economics at the University of Bergen. It should be noted, however, that there may be additional collaborative links between the units, i.e. with persons not encompassed by the evaluation.

Table 3.16 Collaboration between the researchers included in the evaluation, number of co-authored papers

		Agder	Bodø	ISF	ITØ	Molde	Nor Bank	NHH	NHH	BI	BI	UMB	NTNU	SNF	Stat Norw	Frisch	Bergen	Oslo	Oslo	Stavanger	Tromsø
								Dep of Eco	Dep Fin & Mgt S	Dep of Eco	Dep of Fin Econ	De of E & R Mgt	Dep of Eco				Dep of Eco	Dep of Eco	Health		Dep Ec & Mgt
Agder		1																			
Bodø		#	4			2		1						1			1				2
ISF		#	#	1												3					
ITØ		#	#	#	2	2						2			1			2			
Molde		#	#	#	#	4			1												
Norges Bank		#	#	#	#	#	1	1		1	3		2					1			
NHH	Dep Eco	#	#	#	#	#	#	14	2	1			2	3	1	1	23	10		6	1
NHH	Dep Fin & Mgt Sci	#	#	#	#	#	#	#	7			1		9			4			4	
BI	Dep of Eco	#	#	#	#	#	#	#	#	2			1			1		2			5
BI	Dep of Fin Econ	#	#	#	#	#	#	#	#	#	2										
UMB	De of E & R Mgt	#	#	#	#	#	#	#	#	#	#	9						1		2	
NTNU	Dep of Eco	#	#	#	#	#	#	#	#	#	#	#	22	1	1	1		7			2
SNF		#	#	#	#	#	#	#	#	#	#	#	#	1			10			1	1
Stat Nor		#	#	#	#	#	#	#	#	#	#	#	#	#	21	13	1	8		1	
Frisch		#	#	#	#	#	#	#	#	#	#	#	#	#	#	13		8	2	2	
Bergen	Dep of Eco	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	20	1	1		1
Oslo	Dep of Eco	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	12	2		
Oslo	Health	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#			
Stavanger		#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	7	1
Tromsø	Dep Ec & Mgt	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	

We have also analysed the geographical distribution of the internationally co-authored papers. The results are given in Table 3.17. The USA is by far the most important country in terms of foreign co-authorship, 142 articles were co-authored with researchers from the USA, then follow UK, Denmark, Sweden, and Germany. At the level of the individual institute the picture is heterogeneous, and quite a few of the institutes do not have the USA as their most important collaborative country.

Table 3.17 International co-authorship, number of co-authored papers by country.

	Oslo	NHH	NHH	Bergen	Stat Nor	NTNU	Frisch	Stavanger	UMB	Oslo	Molde	SNF	ITØ	Agder	BI	Tromsø	BI	Nor Bank	Bodø	ISF	TOT
	Dep of Eco	Dep of Eco	D Fin & Mgt S	Dep of Eco		Dep of Eco			D E & R Mgt	Health					Dep of Econ	Dep Ec & Mgt	D of Fin Eco				
USA	29	6	18	6	4	7	18	10	11		7	5		4		5	6	2	2	2	142
Denmark	2	1	4	4	3	1	1	2	2	32		1	2	6			1		7		69
UK	8	6	9	7	2	2	3		3		1	4		7	3	3	8	1	3	1	71
Sweden	20	3	20	1	6		1	2	4	1	1		1	2	3		1	2			68
Germany	5	17	3	8	1	2	1	4						7		1					49
Canada		3	1		1			1	3		2	5				2	1				19
Australia	1	1	7			3			1			3				1					17
Netherlands	3		2		2	1			4		1			1		1					15
Italy	4			2	4				2		1			1	1						15
Finland	1		1		2		2		4			3	1								14
New Zealand		1	11								1	1									14
China		1			2	1		1	2		1				1				2		11
France				4	1	2			3												10
Belgium		2		1	1	2			2									1			9
Israel		1	1														1	4	1		8
Iceland	2	1	1						2			2									8
Spain	1			1	1				2					1				1			7
Austria				3					2					1							6
Indonesia									5												5
Russia		1		3																	4
Macao											2								2		4
South Africa									1			2				1					4
Portugal	1								1					1							3
India						1			2												3
Estonia		3																			3
Chile						1						1			1						3
Japan															3						3
Switzerland			1								1										2
Greece			1														1				2
Czech Republic				1							1										2
Pakistan							2														2
Honduras	1																				1
Tanzania						1															1
Nicaragua					1																1
Ethiopia									1												1
Mexico									1												1
Nigeria									1												1
Brazil									1												1
Poland										1											1
TOTAL	78	47	80	41	31	24	28	20	60	34	19	27	4	31	12	14	19	11	17	3	600

Appendix – “Level 2” journals

List of ”level 2” journals within economics and administration (samfunnsøkonomi og økonomisk-administrative fag)*

Academy of Management Journal	Journal Labor Economics	Journal of organizational behavior management (Print)
Academy of Management Review	Journal of Accounting & Economics	Journal of Political Economy
Accounting Review	Journal of Accounting Research	Journal of public administration research and theory
Accounting, Organizations and Society	Journal of applied econometrics (Chichester, England)	Journal of Public Economics
Administrative Science Quarterly	Journal of business & economic statistics	Journal of Retailing
Advances in Economic Analysis & Policy	Journal of Business Research	Journal of Risk and Insurance
Advances in Macroeconomics	Journal of Business Venturing	Journal of Risk and Uncertainty
Advances in Theoretical Economics	Journal of consumer research	Journal of the Academy of Marketing Science
British Journal of Industrial Relations	Journal of Corporate Finance	Journal of the European Economic Association
Canadian Journal of Economics	Journal of Development Economics	Land Economics
Decision Sciences	Journal of Econometrics	Leadership Quarterly
Econometric Theory	Journal of Economic Behavior and Organization	Management Accounting Research
Econometrica	Journal of Economic Dynamics and Control	Management science
Economic Inquiry	Journal of Economic Literature	Marketing science (Providence, R.I.)
Economic Journal	Journal of Economic Perspectives	Omega : The International Journal of Management Science
Economic Theory	Journal of Economic Theory	Organization science (Providence, R.I.)
European Economic Review	Journal of Environmental Economics and Management	Organization Studies
European journal of industrial relations	Journal of Finance	Oxford Bulletin of Economics and Statistics
European Journal of Marketing	Journal of financial and quantitative analysis	Quarterly Journal of Economics
Financial Management	Journal of Financial Economics	Review of Economics and Statistics
Frontiers of Economic Analysis and Policy	Journal of Financial Intermediation	Scandinavian Journal of Economics
Frontiers of Macroeconomics	Journal of financial markets	Sloan management review
Futures : The journal of policy, planning and futures studies	Journal of International Business Studies	Social Choice and Welfare
Games and Economic Behavior	Journal of International Economics	Strategic Management Journal
Harvard Business Review	Journal of International Marketing	Technological forecasting & social change
Human Relations	Journal of management	The American Economic Review
Human Resource Management	Journal of Management Accounting Research	The Journal of human resources
Industrial & labor relations review	Journal of Management Studies	The Rand Journal of Economics
International Business Review	Journal of marketing	The Review of Economic Studies
International Economic Review	Journal of Marketing Research	The Review of financial studies
International Journal of Research in Marketing	Journal of Mathematical Economics	World Development
International labour review (Print)	Journal of Monetary Economics	

*) Journals accredited as level 2 journals by UHR’s National Councils (ref. 1.1.2007). In the analysis also “level 2” journals in other subjects are included.

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- Economic research in Norway – An Evaluation, report submitted by the Panel.
- Bibliometric analysis – Economic Research in Norway, supplementary report written by Dag W. Aksnes.

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