



Vetenskapsrådet

A BIBLIOMETRIC SURVEY OF SWEDISH SCIENTIFIC PUBLICATIONS BETWEEN 1982 AND 2004



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A BIBLIOMETRIC SURVEY OF SWEDISH SCIENTIFIC PUBLICATIONS BETWEEN 1982 AND 2004

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DEPARTMENT FOR RESEARCH POLICY ANALYSIS

A bibliometric survey of Swedish scientific publications between 1982 and 2004

Summary of the report

“Hur mycket citeras svenska publikationer? Bibliometrisk översikt över Sveriges vetenskapliga publicering mellan 1982 och 2004” Vetenskapsrådets rapportserie 13:2006¹

This paper presents bibliometric statistics for Swedish scientific publications during the last 22 years. Swedish figures regarding volumes and citation rates are compared with those of a number of other countries. Variations between Swedish universities and university colleges and between areas of research as regards publication volume and citation rates are also studied.

The results presented here are based on the Science Citation Index Expanded (Thomson Scientific)². Publication numbers presented in this paper are fractionalised, i.e. the publications are split among the contributing countries or institutions in proportion to their fraction of all addresses given on the publications in question. The citation analysis is based on field normalised mean citation rates of articles and reviews. Self citations have been excluded from the analysis³. Field normalisation means that citation rates are expressed in relation to the world average in each of the 252 scientific fields into which the data base is divided (a field average is computed for each field, year and type of publication, i.e. article or review)⁴. All citation rates are based on the number of citations during the publication year and the following two years.

In an international comparison, Swedish publications have been cited at a relatively constant rate during the last 20 years, 10±5 % above the world average (field normalised mean 1.10). Citation of Swedish publications has become more even, i.e. the proportion of not cited publications as well as the proportion of highly cited publications has decreased.

In contrast to Swedish publications, publications from several other European countries, such as Denmark, the Netherlands and Germany, have been cited at increasing rates during the last 10 years. Dutch and Danish publications received around 22 % more citations than the world average during 2000-2002 whereas

¹ Can be found on www.vr.se.

² Certain data included herein are derived from the Science Citation Index Expanded® prepared by Thomson Scientific®, Philadelphia, Pennsylvania, USA© Copyright Thomson Scientific® 2006. All rights reserved.

³ Self citations have been identified through the names of the authors and have been removed if there is any overlap between author names in cited and citing author lists.

⁴ Our field normalised citation rates are closely related to the crown indicator developed by van Raan and colleagues (e.g. van Raan 2004).

Swedish publications received 13 % more citations than the world average during the same period. Since several European countries have received increasing citations to their publications, the European average citation rate has increased compared to the rest of the world. In comparison with the European mean value a negative trend can thus be observed for Swedish publications during the entire period studied, i.e. 1982-2004.

Agronomy, natural sciences (including biology), engineering and technical sciences are fields where Swedish citation rates are relatively high (25-30 % above world average during 2000-2002). In contrast to this, Swedish publications in medical journals received 3 % less citations than the world average during the same period.

The various Swedish universities and university colleges have relatively similar average citation rates. Of the 18 universities and university colleges that had produced 20 publications or more per year during 1998-2002, 14 had a mean citation rate above the world average.

In this paper figures and tables from the original report are presented in English. A few figures (1 and 3-5) in the original report have been omitted since they have been judged to be of marginal interest without the full text of the original report. The original report was divided into three main sections: a general background, an international overview and finally an analysis focused on Sweden. The present paper is divided in the same way,

General background

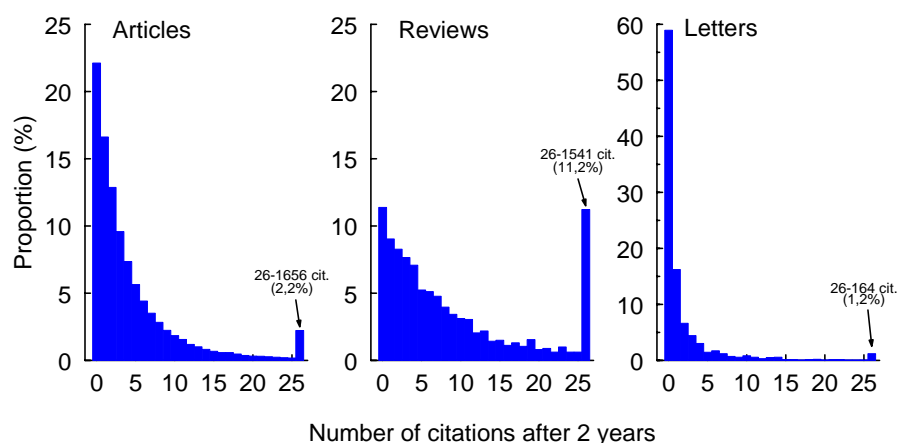
Table 1. Swedish publications 1998-2002 and their citation, by type

Type of publication	Proportion (%)	Number of citations 2 years after publication		
		Mean	Median	Maximum
Articles	83.5	4.9	2	1 656
Meeting abstracts*	8.4	0.2	0	16
Reviews	2.9	12.0	6	1 541
Editorial material	1.8	2.2	0	126
Letters	1.8	2.1	0	164
Other	1.5	0.2	0	32

Note: The table is based on all citations, including self citations, and the proportion are based on whole counts (not fractionalised).

* Thomson Scientific collects proceedings in a separate database ("ISI Proceedings") which does not include citations. Proceedings are therefore not included in this paper.

Figure 2. Citations to Swedish articles, reviews and letters two years after publication



Note: The figure is based on publications 1998-2002 with at least one Swedish address. Mean values and medians for the same data are shown in table 1. Based on all citations, including self citations. The bar to the extreme right in each panel shows the proportion of publications with 26 or more citations.

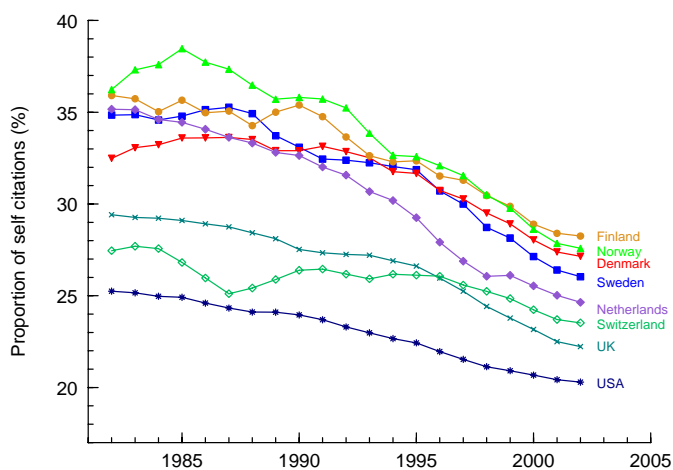
Table 2. Proportion (%) of highly cited Swedish publications, by type of publication

Definition of highly cited	Articles		Reviews		Letters	
	Prop. of publications	Prop. of citations	Prop. of publications	Prop. of citations	Prop. of publications	Prop. of citations
25+	2.2	24.1	11.2	53.1	1.2	29.5
Top 5 %	5.1*	35.2	5.1*	28.9	5.1*	38.0

Note: Two definitions have been used for “highly cited”, namely 25 or more citations (25+) and publications cited as much or more than the 95th percentile of the world output (top 5 %). Based on all citations, including self citations.

*The reason for these being larger than 5 % is that there are many publications at the 95th percentile.

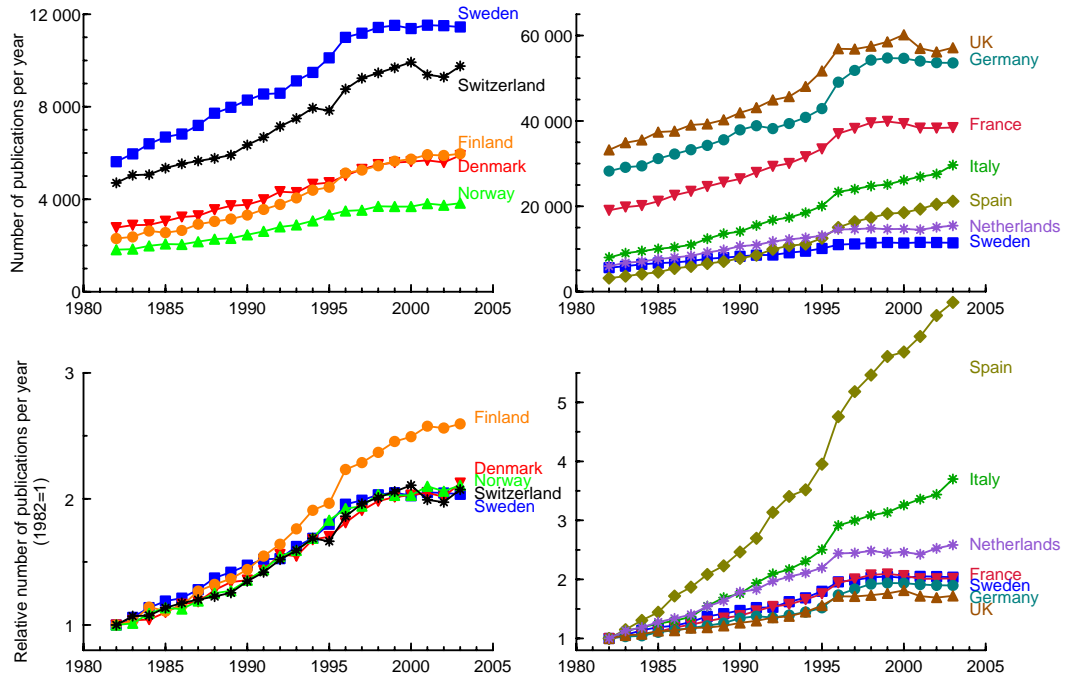
Figure 6. Variations in the proportion of self citations in publications from selected countries



Note: The figure is based on the number of citations two years after publication.

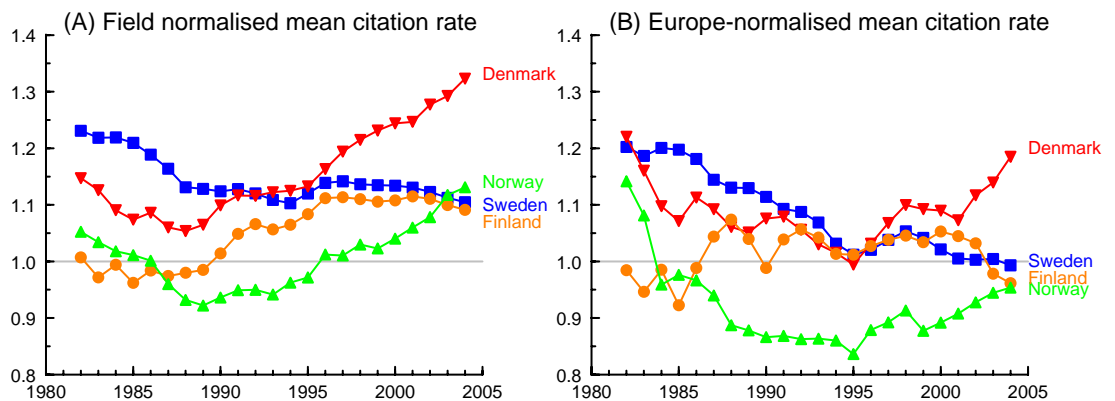
International overview

Figure 7. Variations in the number of Swedish publications compared to the number in some other European countries



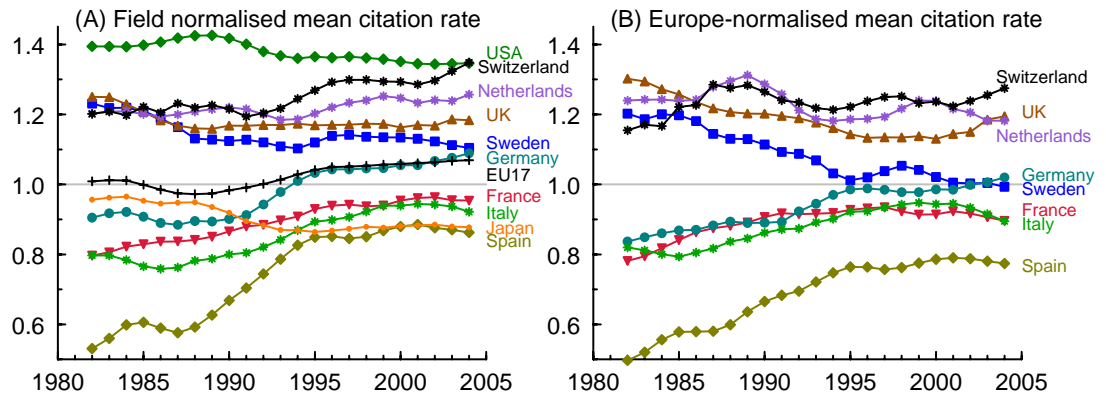
Note: The two upper panels show the number of publications per year and the lower panels the relative publication rate (volume in 1982=1). Publications with addresses from several countries are fractionalised among countries.

Figure 8. Mean citation rate of Swedish publications compared to that of publications from the other Nordic countries



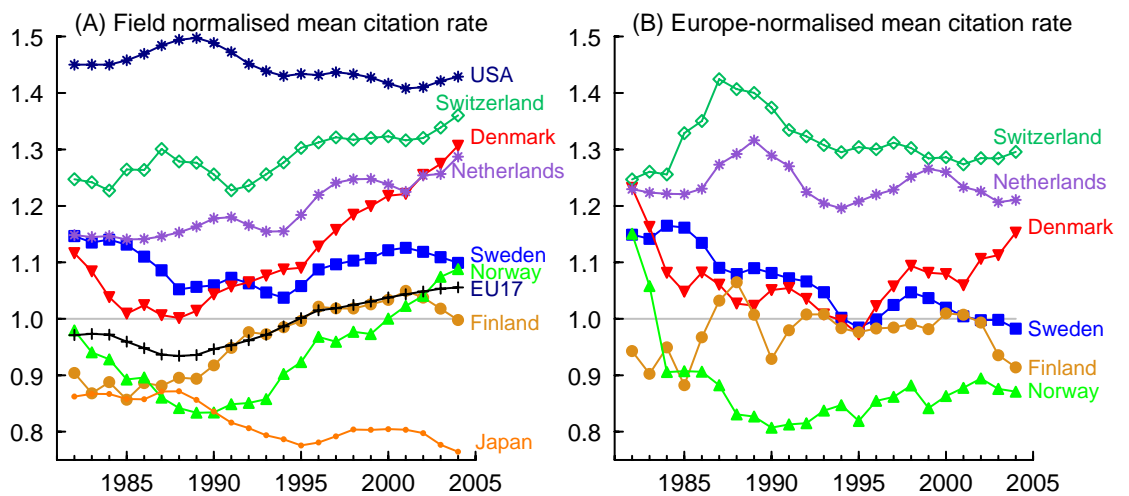
Note: Panel A shows citation rates that are globally field normalised. In panel B the normalisation is relative to the mean of 17 European countries. All curves show 3-year moving averages. The values for 2003 and 2004 are preliminary since citations for two full years were not available when the calculations were made. Self citations have *not* been removed. Mean values without self citations are presented in figure 10.

Figure 9. Mean citation rate of Swedish publications and of publications from other European countries, USA and Japan



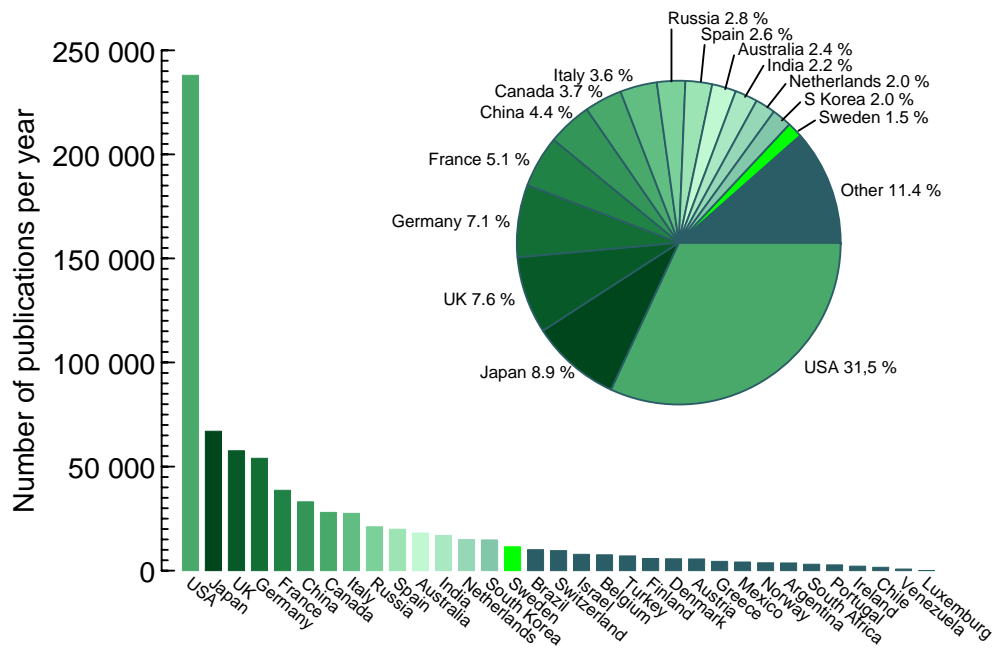
Note: Panel A shows citation rates that are globally field normalised. In panel B the normalisation is relative to the mean of 17 European countries. All curves show 3-year moving averages. The values for 2003 and 2004 are preliminary since citations for two full years were not available when the calculations were made. Self citations have *not* been removed. USA and Japan are not included in panel B. Mean values without self citations are presented in figure 10.

Figure 10. Mean citation rates with self citations removed: Sweden and selected other countries



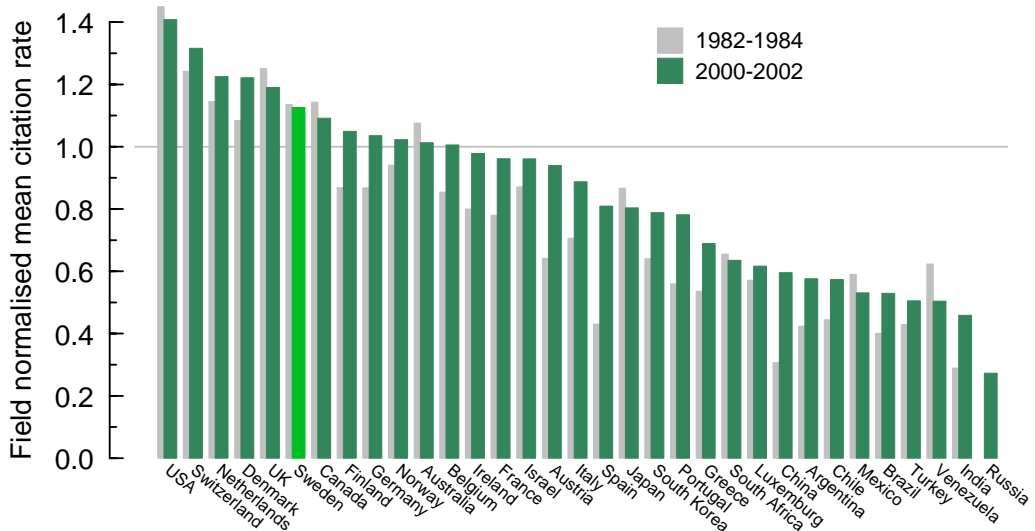
Note: Panel A shows citation rates that are globally field normalised. In panel B the normalisation is relative to the mean of 17 European countries. All curves show 3-year moving averages. The values for 2003 and 2004 are preliminary since citations for two full years were not available when the calculations were made. Corresponding data with self citations included are shown in figures 8 and 9.

Figure 11. International comparison of the annual publication volume



Note: The figure show the number of articles and reviews per year during 2000-2003. The publications are fractionalised. The 33 countries included in the figure contribute to 99 % of the world publication volume.

Figure 12. International comparison of field normalised mean citation rates two years after publication



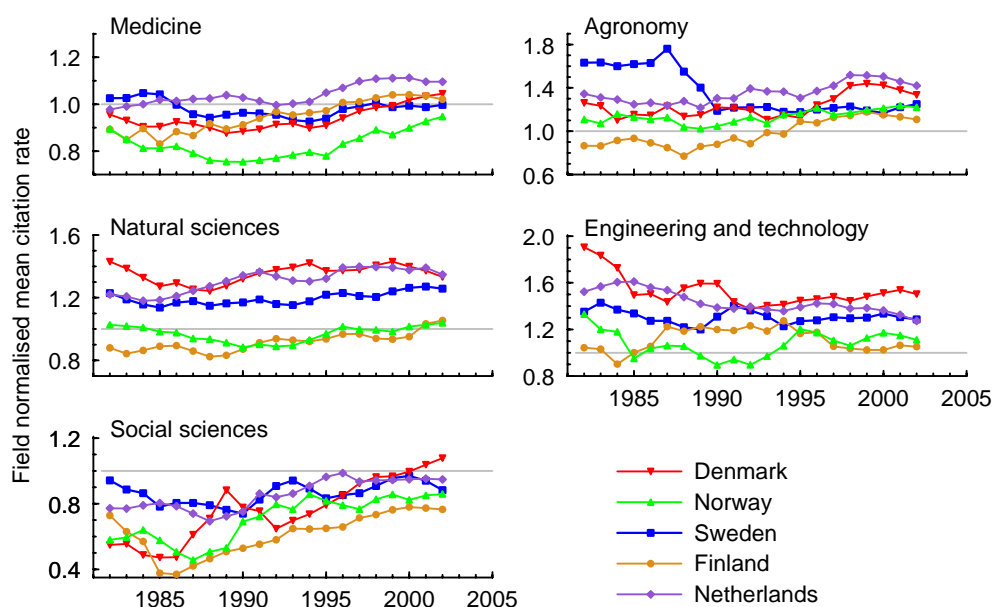
Note: Mean values for two periods are presented: grey bars 1982-1984 and green bars 2000-2002. Based on articles and reviews; self citations have been removed. The horizontal grey line indicates the world average (1.0).

Table 3. Proportions (%) of publications in different areas of research in the Nordic countries and the Netherlands

Area of research	Sweden	Denmark	Finland	Norway	Netherlands
2000-2002					
Humanities	1.1	1.7	1.5	2.2	2.1
Medicine	50.5	49.0	48.4	42.7	47.7
Natural sciences	25.3	26.0	23.6	26.4	24.2
Social sciences	4.1	3.9	4.2	7.6	7.4
Agronomy	6.4	10.5	9.2	10.5	6.7
Engineering and techn. sciences	11.7	8.2	12.7	9.9	11.2
Other	0.8	0.7	0.4	0.7	0.7
1982-1984					
Humanities	2.1	1.6	1.6	2.2	2.4
Medicine	49.6	63.1	59.8	53.6	44.8
Natural sciences	30.8	22.1	20.2	23.4	29.9
Social sciences	4.1	2.9	3.6	7.0	5.9
Agronomy	4.7	5.2	6.6	6.6	8.5
Engineering and techn. sciences	6.6	4.4	7.9	6.5	7.7
Other	2.1	0.6	0.4	0.6	0.9

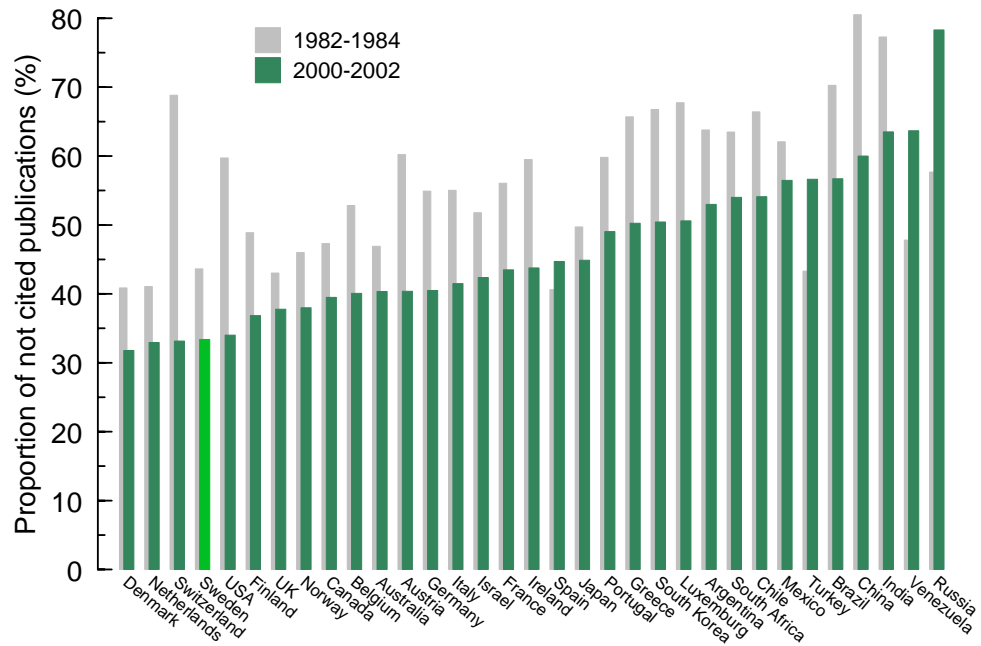
Note: The numbers show the proportion of fractionalised publications within each area (mean for 2000-2002 and 1982-1984). Agronomy includes agricultural, forestry and veterinary sciences and landscape planning.

Figure 13. Field normalised mean citation rates for the Nordic countries and the Netherlands in different areas of research



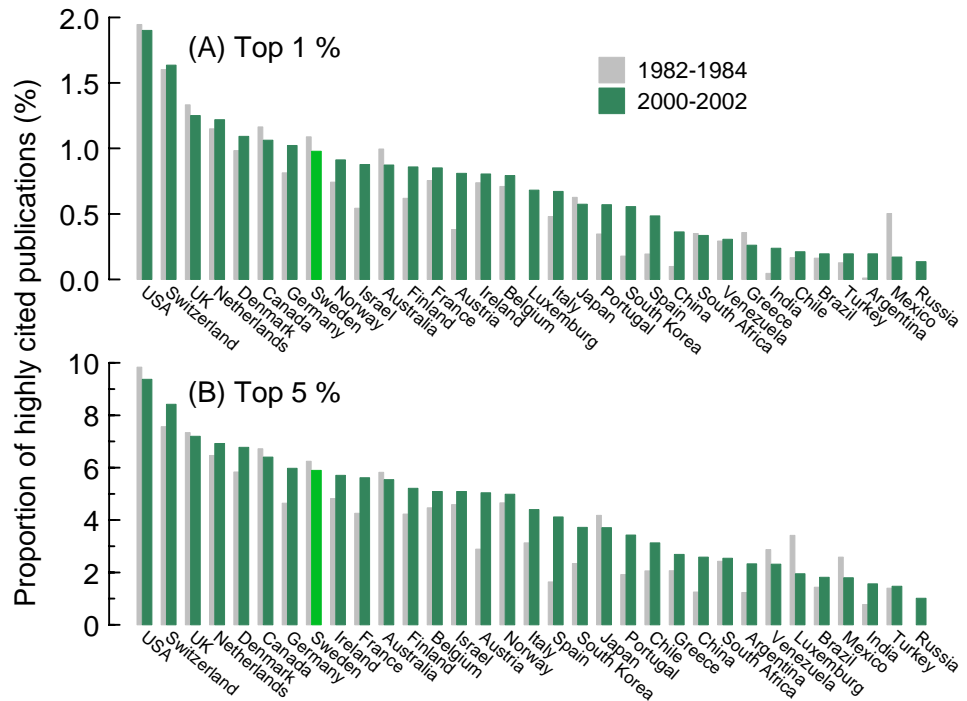
Note: Values for 2003 and 2004 are preliminary. Self citations have been removed.

Figure 14. International comparison of the proportion of publications not cited during the first two years after publication



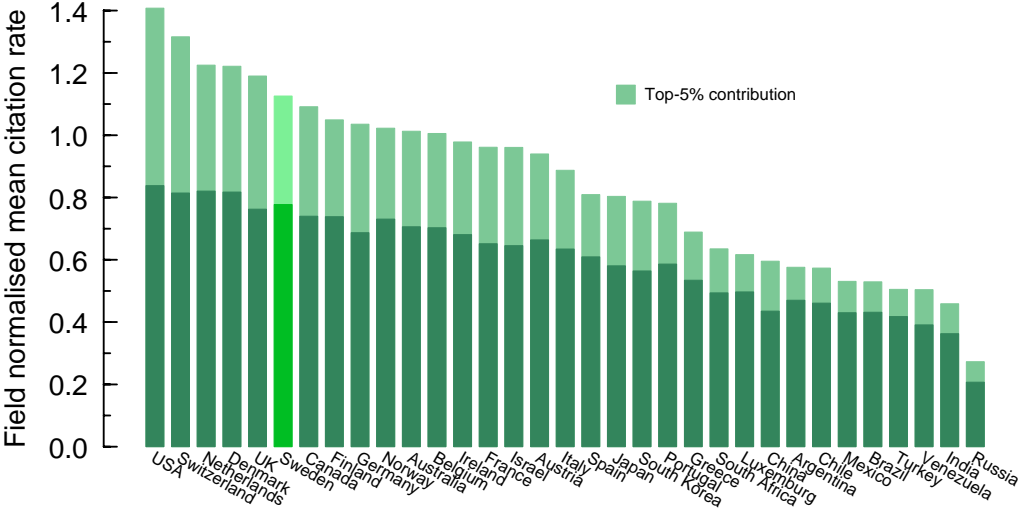
Note: Mean values for the periods 1982-1984 (grey bars) and 2000-2002 (green bars). Self citations have been removed.

Figure 15. Proportion of selected countries' publications belonging to the top 1 % or 5 % most highly cited publications in the world



Note: The figure is based on field normalised citations two years after publication. Self citations have been removed.

Figure 16. International comparison of the contribution of highly cited papers to the field normalised mean citation rate



Note: The contribution of highly cited publications (top 5 %) to the national mean value is indicated by the upper light green part of the bars. Based on articles and reviews published 2000-2002. Self citations have been removed.

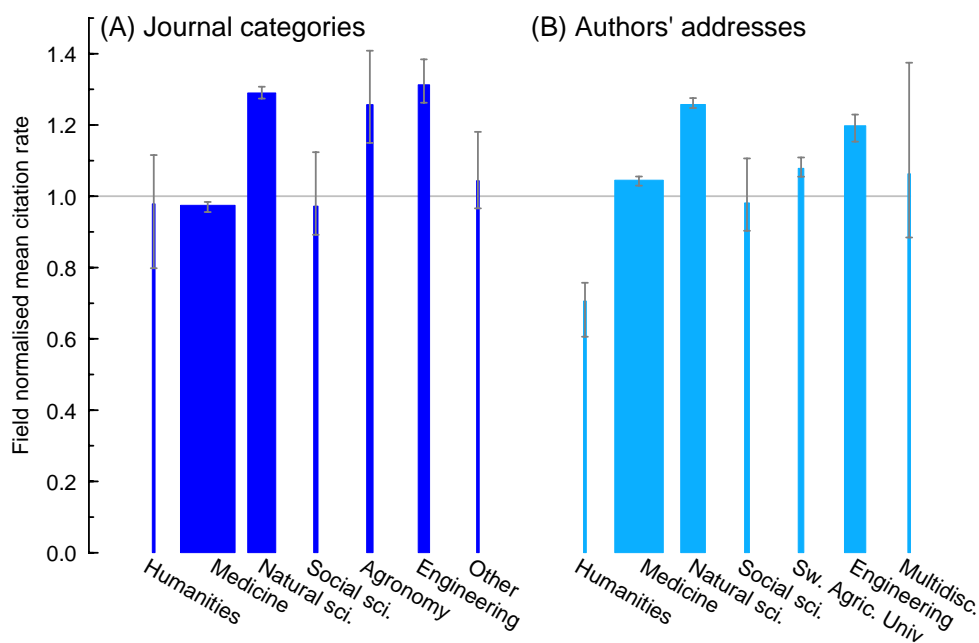
Variations among areas of research and Swedish universities and university colleges

Table 4. Swedish publications distributed among the journal subject categories and research areas where the authors are to be found (according to their addresses)

Research Area	Journal subject categories							Sum
	Humanities	Medicine	Natural sciences	Social sciences	Agron.	Engineering and techn.	Other	
Humanities	0.80	0.03	0.02	0.07	0.01	0.02	0.00	1.0
Medicine	0.05	40.56	1.47	0.73	0.64	0.54	0.44	44.4
Natural sci.	0.02	5.86	13.22	0.18	1.93	1.66	0.27	23.2
Social sciences	0.10	1.05	0.23	2.83	0.08	0.28	0.01	4.6
Agronomy	0.01	1.00	1.12	0.07	2.74	0.18	0.03	5.2
Engineering & Technical sci.	0.07	1.88	9.35	0.31	0.56	7.83	0.08	20.1
Multidisciplinary	0.00	0.25	1.12	0.03	0.06	0.17	0.01	1.6
Sum	1.1	50.6	26.5	4.2	6.0	10.7	0.8	100.0

Note: All figures are percentages of Sweden's output of fractionalised publications and refer to the period 2000-2002. Addresses belonging to more than one research area are called "Multidisciplinary" (fakultetsövergripande); these are mainly technical-natural science departments at Lund University and medical-natural science departments at Uppsala University.

Figure 17. Field normalised mean citation rates for Swedish publications in different areas of research

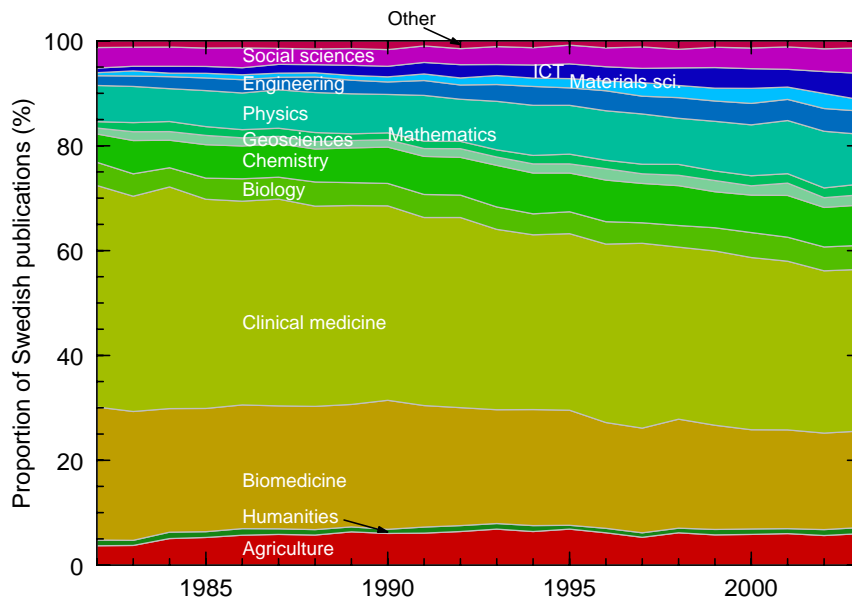


Note: In panel A the journal subject category has determined the distribution of publications among the different areas of research. In panel B the distribution has been determined by the authors' addresses. Mean values for 2000-2002. Agronomy includes agriculture, forestry and veterinary sciences and landscape planning. Engineering includes technical sciences. The width of the bars is proportional to the publication volume (although with a minimum width; the categories humanities and other as well as multidisciplinary are smaller than indicated by the bars, see table 5 for exact numbers. "Multidisciplinary" includes addresses belonging to more than one research area (fakultetsövergripande).

Table 5. Number of publications on which figure 17 is based

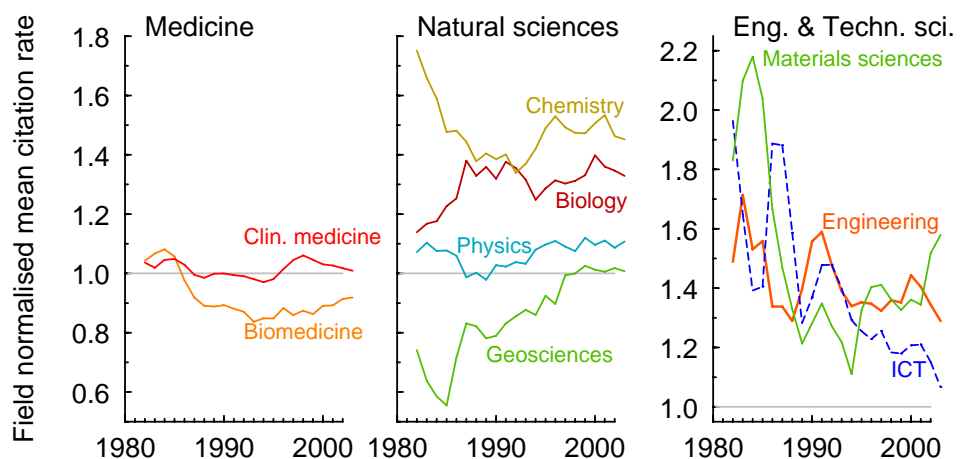
	Hum.	Med.	Natural sci.	Social sciences	Agronomy	Technical sciences	Other /multi disc.
Authors' addresses	94	4 492	2 285	444	517	1 983	173
Journal subj. categ.	103	5 059	2 592	411	584	1 046	84

Figure 18. Distribution of Swedish publications among areas of research (based on journal subject categories)



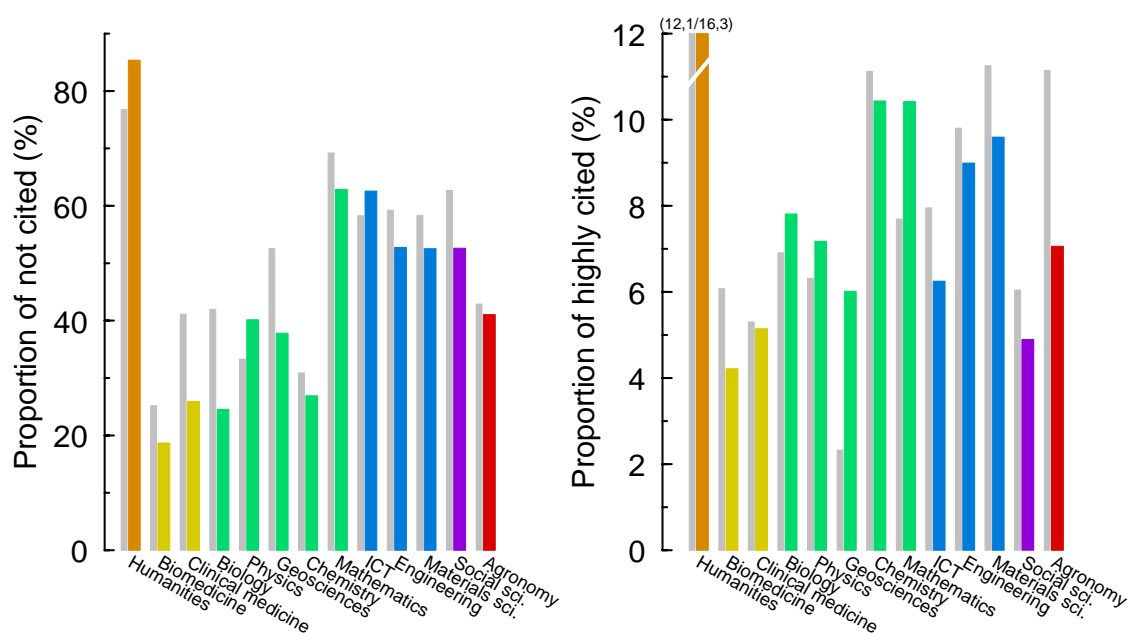
Note: Agronomy includes agriculture, forestry and veterinary sciences and landscape planning. Engineering includes technical sciences. ICT stands for Information and communication technology.

Figure 19. Variations in field normalised mean citation rates for Swedish publications in selected subject fields within different areas of research



Note: ICT stands for Information and communication technology. Moving 3-year averages. Self citations have been removed.

Figure 20. Proportions of not cited and highly cited Swedish publications: variations between disciplines

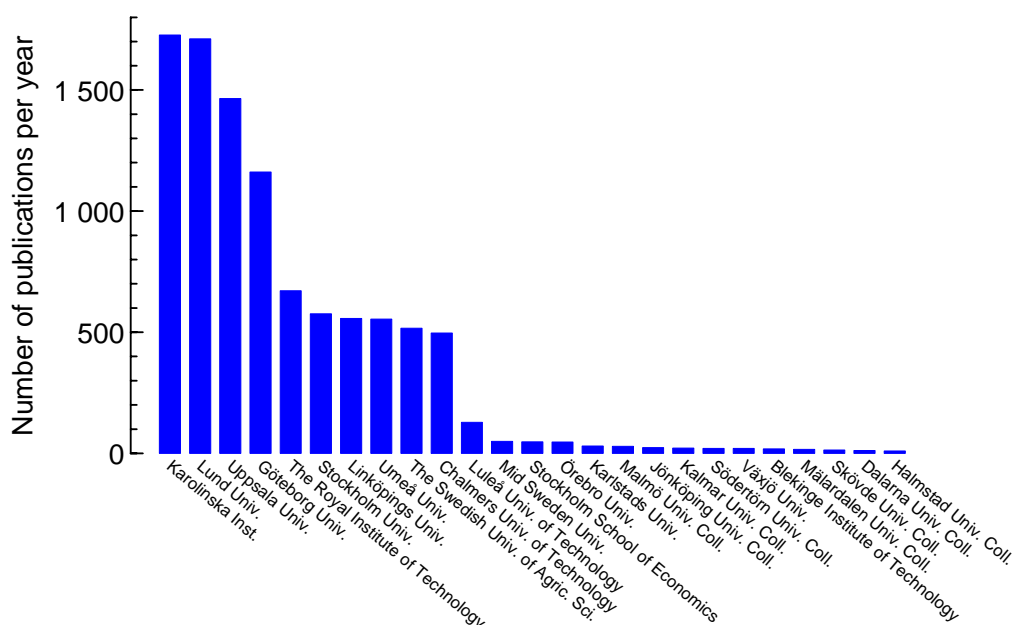


Note: The highly cited are those belonging to the top 5 % of world output. Grey bars show mean values for publications from 1982-84 and coloured bars mean values for publications from 2000-2002. Agronomy stands for agricultural, forestry and veterinary sciences and landscape planning. Self citations have been removed. The number of publications on which each bar is based is shown in table 6. Due to low citation rates in humanities all cited publications in this discipline are highly cited according to our definition.

Table 6. Number of fractionalised publications that the statistics in figure 20 are based on (mean for 2000-2002)

Discipline	Number of publications
Humanities	103
Biomedicine	1 836
Clinical medicine	3 137
Biology	453
Physics	1 003
Geosciences	196
Chemistry	741
Mathematics	183
Information and communication technology	369
Engineering and technical sciences	406
Material sciences	265
Social sciences	411
Agronomy	570

Figure 21. Number of publications per year from Swedish universities and university college



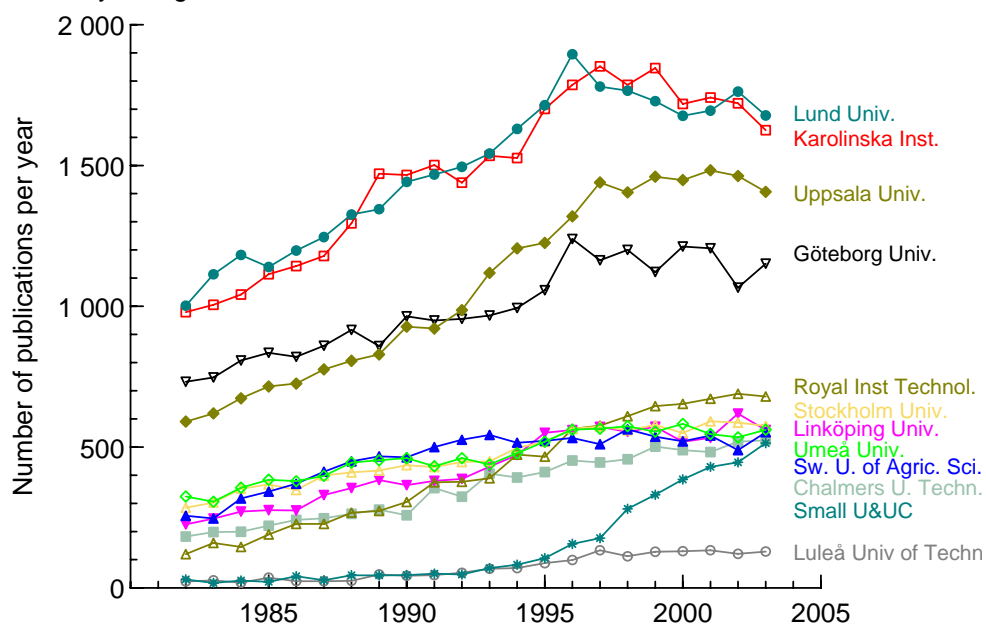
Note: Means for 2000-2002. The figure is based on fractionalised publications. Only universities and university colleges with a mean volume of at least 10 fractionalised publications per year are included in the figure. The volume of all institutions with less than 100 publications per year is presented in table 7.

Table 7. Number of publications per year from small Swedish universities and university colleges (<100 publications per year)

University/univ. college	Number of publications	University/univ. college	Number of publications
Mid Sweden University	48	Mälardalen University College	16
Stockholm School of Economics	47	Skövde University College	14
Örebro University	46	Dalarna University College	11
Karlstad University	29	Halmstad University College	10
Malmö University College	28	Gävle University College	9
Jönköping University College	23	Kristianstad University College	7
Kalmar University College	21	University College West	6
Växjö University	20	Borås University College	6
Södertörn University College	20	Gotland University College	1
Blekinge Inst. of Technology	19		

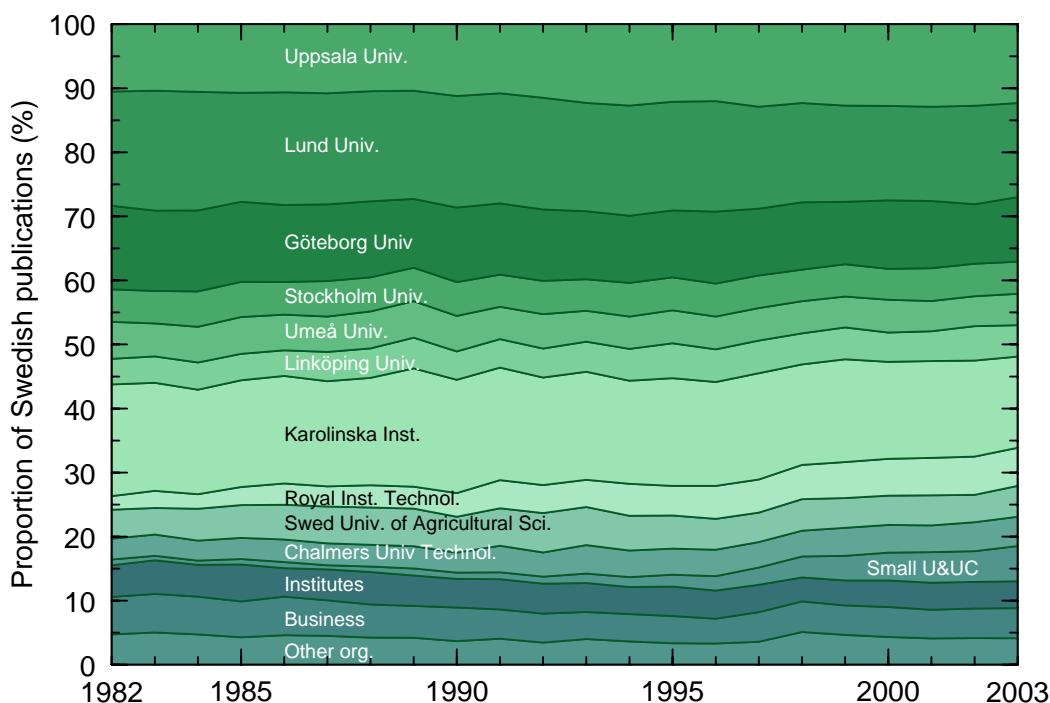
Note: The universities and university colleges listed in the table are merged into the group "Small U&UC" in figures 23 and 24. The numbers in the table are the mean numbers of fractionalised publications per year during the period 2000-2002.

Figure 22. Number of publications produced per year by Swedish universities and university colleges



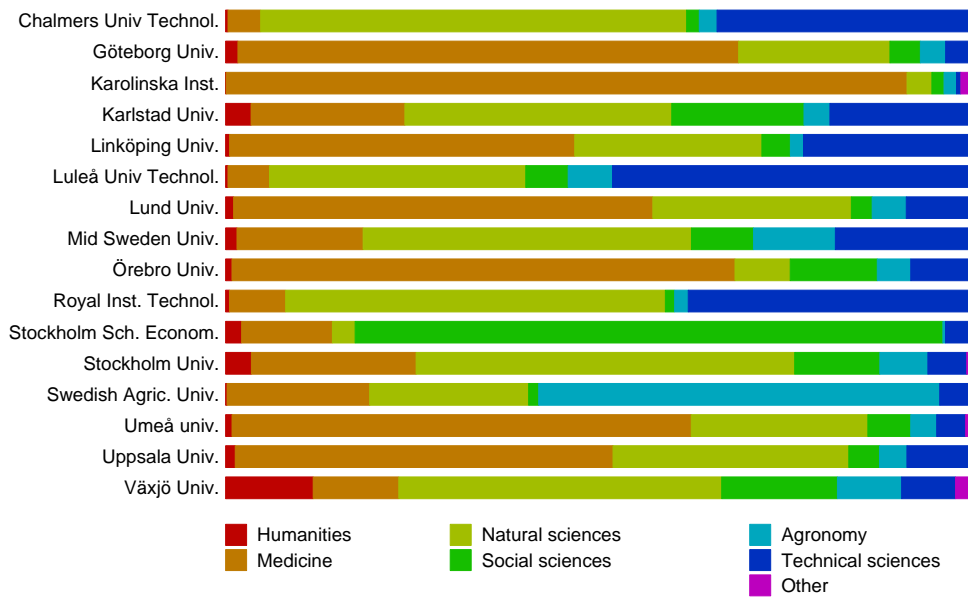
Note: The publications are fractionalised. All institutions with an average of less than 50 publications per year have been put together in the group “Small U & UC” (c.f. table 7).

Figure 23. The relative contribution of universities /university colleges, businesses, institutes and other organisations to the total volume of Swedish scientific publications



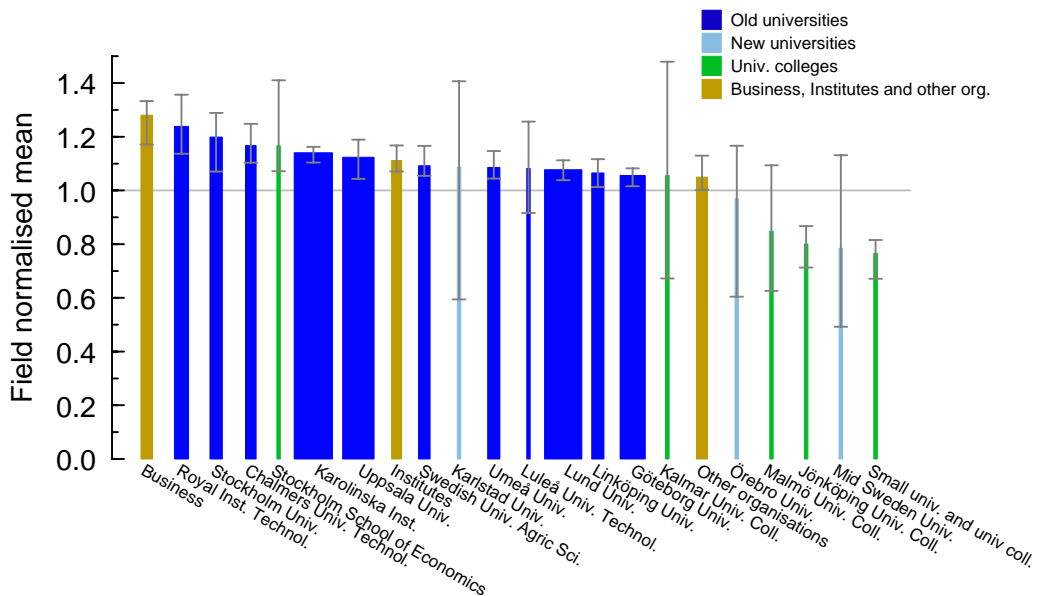
Note: The figure is based on fractionalised publications 1982 - 2004. SLU stands for the Swedish Agricultural University. “Small U&UC” are universities and university colleges with a volume of less than 150 publications per year. The group “Other org.” consists mainly of hospitals (about 75 % of the group’s publications), local authorities (8 %) and museums (3 %).

Figure 24. Research area profiles of Swedish universities, Chalmers and Stockholm School of Economics



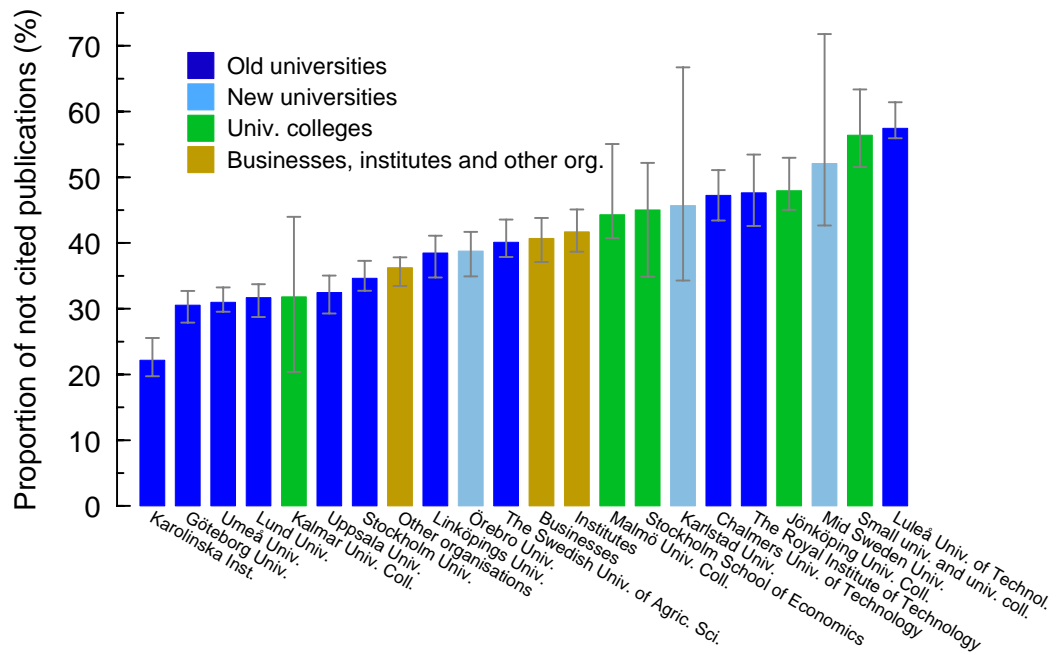
Note: Agronomy includes agricultural, forestry and veterinary sciences and landscape planning. Based on fractionalised publications 2000-2002. The group "Other" contains mainly multidisciplinary journals. The subject classification is based on the journal subject categories.

Figure 25. Field normalised mean citation rates for Swedish universities/university colleges, businesses, institutes and other organisations



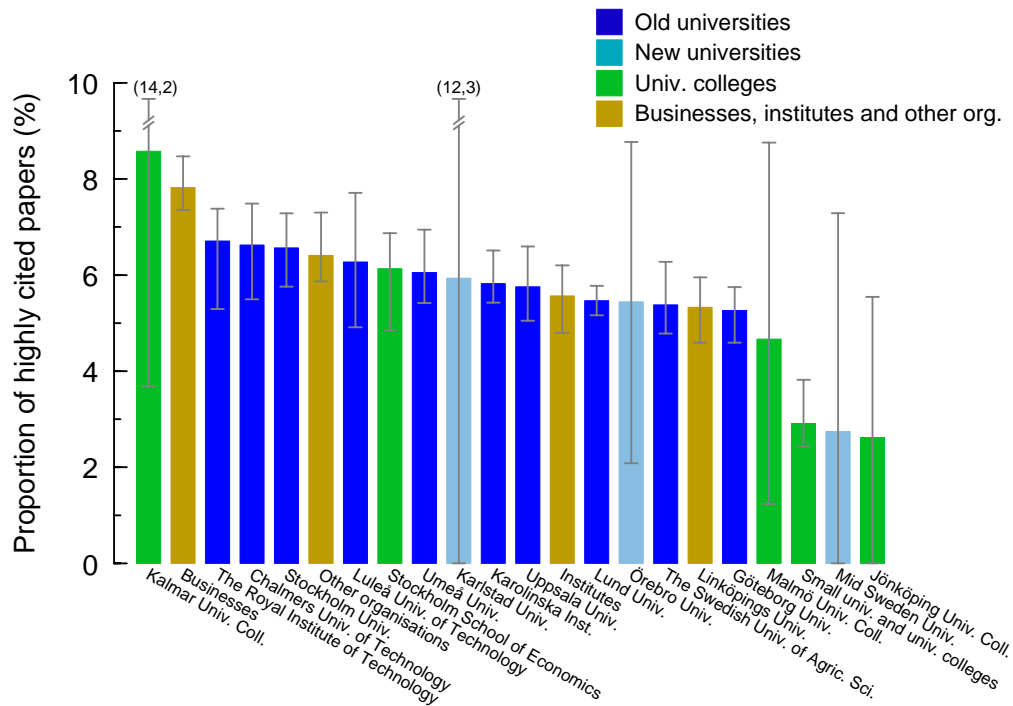
Note: The horizontal grey line indicates the world average (1.0) and the vertical grey lines in each bar indicate the lowest and highest value during the five years on which the mean values are based (1998-2002). Institutions with less than 100 publications during these years (<20 publications per year) have been put together in the group "Small univ. and univ. colleges" (c.f. table 7). The width of the bars is proportional to the publication volume. Self citations have been removed. The group "Other organisations" consists mainly of hospitals.

Figure 26. Proportion of publications from Swedish universities/university colleges, businesses, institutes and other organisations that did not receive any citations during the first two years after publication



Note: The figure gives mean values based on citations to publications 1998-2002. The vertical grey lines in each bar indicate the lowest and highest value during the five years on which the mean values are based. Institutions with less than 100 publications during these years (<20 publications per year) have been put together in the group "Small univ. and univ. colleges" (c.f. table 7). Self citations have been removed. The group "Other organisations" consists mainly of hospitals.

Figure 27. Proportion of highly cited publications from Swedish universities/university colleges, businesses, institutes and other organisations



Note: Highly cited is defined as the top 5 % of the world output each year. The figure is based on citations to publications 1998-2002. The vertical grey lines in each bar indicate the lowest and highest value during the five years on which the mean values are based. Institutions with less than 100 publications during these years (<20 publications per year) have been put together in the group "Small univ. and univ. colleges" (c.f. table 7). Self citations have been removed. The group "Other organisations" consist mainly of hospitals.

Table 8. The five largest universities in terms of publication volume in different areas of research (according to the journal subject categories)

Area of research	University	Field normalised mean	Prop. highly cited	Prop. not cited	Number of publications per year
Humanities	Stockholm University	0.83	24.0	85.3	20
	Göteborg University	0.22	1.9	93.2	19
	Lund University	0.83	17.1	84.9	19
	Uppsala University	1.65	16.4	85.2	18
	Umeå University				4
Medicine	Karolinska Institute	1.10	6.1	21.4	1 581
	Lund University	0.91	3.9	25.0	958
	Göteborg University	1.00	5.0	25.7	763
	Uppsala University	0.95	4.6	24.4	736
	Umeå University	0.93	4.7	25.9	338
Natural sciences	Lund University	1.42	9.7	31.3	447
	Uppsala University	1.27	7.8	35.6	436
	The Royal Inst. of Technology	1.27	8.2	42.4	326
	Stockholm University	1.28	7.7	31.5	273
	Chalmers Univ. of Technology	1.12	7.6	44.4	263
Social sciences	Stockholm University	1.14	5.2	49.0	65
	Uppsala University	1.12	5.4	53.0	61
	Göteborg University	0.70	3.8	57.7	44
	Lund University	0.87	4.1	52.3	43
	Stockholm School of Economics	1.26	7.3	47.9	38
Agronomy	The Swedish Univ. of Agric. Sci.	1.21	7.5	45.4	284
	Lund University	1.17	6.5	40.4	79
	Uppsala University	1.00	5.6	41.9	51
	Stockholm University	1.96	9.7	34.5	36
	Göteborg University	1.15	7.1	36.3	32
Technical sciences	The Royal Inst. of Technology	1.32	7.8	59.4	245
	Chalmers Univ. of Technology	1.35	8.0	56.0	164
	Lund University	1.26	7.2	59.1	140
	Linköping University	1.30	9.3	55.4	118
	Uppsala University	1.60	10.8	51.7	113

Note: Citation statistics are only presented for universities with a publication volume of approx. 20 publications per year or more. Based on fractionalised publications. Self citations have been removed.

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