Bibliometrics of Bibliometrics: A Research Topic in the Mirror of Bibliometric Indicators

Victor Rodriguez
Department of Applied Economics
Katholieke Universiteit Leuven, Belgium
victor.rodriguez@econ.kuleuven.be

Abstract

This exploratory study tries to get insights on one way of exteriorising the publication activity of bibliometricians and how such activity is taken into consideration within the scientific community. As we thought in advance, the evidence shows that the USA is the most productive, most cited and most collaborative publisher. The neighbourhood is a ground to collaborate, like Canada or Mexico with the USA, and Belgium with the Netherlands. The most visible topics are small-world networks and webometrics.

Keywords: bibliometrics; publication activity; citation impact; research collaboration

Resumen

Este estudio exploratorio intenta echar un vistazo sobre una forma de exteriorización de publicaciones de bibliometristas y cómo tal actividad es considerada dentro de la comunidad científica. Como lo pensamos de antemano, la evidencia muestra que los EEUU son los más productivos, el más citado y el más colaborador en bibliometría. Los vecinos son buenos colaboradores, como Canadá o México con los EEUU y Bélgica con los Países Bajos. Los temas más visibles son las redes de pequeño mundo y webometrics.

Palabras claves: bibliometría; publicación científica; impacto de citas; colaboración científica

I. Introduction

The main objective of this paper is to determine bibliometric indicators for the publications contained in the sample. By using quantitative techniques, we try to get insights on one way of exteriorising the (single or collaborative) activity of scientists and how such activity is taken into consideration within the scientific community.

First, the working database was constructed retrieving information concerning the 2001 publications in all languages in journals recorded in the three databases of the *ISI Web of Knowledge*^SM (*viz.,* science, social sciences, and arts and humanities). Second, the analysis was restricted to four types of documents, namely article, letter, note, and review, because they have references. Third, the terms searched in the title, keywords, or abstract of the documents were "bibliometr* OR scientometr* OR citation* analy* OR co-citation OR cocitation OR (impact factor* same journal) OR coauthorship* OR co-authorship* OR scientific collaboration OR collaboration in science OR publication activ* OR research performance." Finally, citations were counted until 2004.

The database fields that were included in our own tables were author(s), title, source, language, document type, keywords, addresses, cited references count, times cited, publisher information, ISSN, source abbreviation, page count, and IDS number. The retrieved information was exported into an MS-Excel File, where noise was removed.

The remainder of this paper is organized as follows. Section II deals with publication activity. Section III describes citation impact. Section IV analyses collaboration. Finally, Section V points out some concluding remarks.

II. Publication Activity

From a dynamic point of view, publication activity is the amount of documents published by a selected unit (author, university, and country) in a period. This indicator is thus a flow variable.

The full or integer counting scheme was used in the three levels of analysis: micro (author), meso (university), and macro (country). If a unit of analysis appears twice or more in the same publication, that unit was

considered only once. Thus, a copublication was fully assigned to each contributing non-repeated unit.

If we take into account the total number of publications by authors (Table 1), Van Raan published the most. But, if we consider single (Table 2) and collaborative (Table 3) documents separately, Van Raan and Newman published the most individually, while Ingwersen and Kostoff published the most in collaboration. None of the authors had a heavy relative weight in the sample; even the top publishers had a low share.

Table 1
Top Publication Activity by Authors

#	Author	Single	%	Accum.	Collab.	%	Accum.	Total	%	Accum.
1	Van Raan, AFJ	4	4%	4%	2	1%	1%	6	1%	1%
2	Ingwersen, P	1	1%	5%	4	1%	2%	5	1%	2%
3	Lewison, G	3	3%	8%	2	1%	2%	5	1%	4%
4	Glanzel, W	1	1%	9%	3	1%	3%	4	1%	4%
5	Kostoff, RN	0	0%	9%	4	1%	4%	4	1%	5%
6	Newman, MEJ	4	4%	13%	0	0%	4%	4	1%	6%
7	White, HD	4	4%	17%	0	0%	4%	4	1%	7%

Table 2
Top Single Publication Activity by Authors

#	Author	Single	%	Accum.
1	Newman, MEJ	4	4%	4%
2	Van Raan, AFJ	4	4%	8%
3	White, HD	4	4%	12%
4	Lewison, G	3	3%	15%
5	Small, H	3	3%	18%

Table 3
Top Collaborative Publication Activity by Authors

#	Author	Collaborations	%	Accum.
1	Ingwersen, P	4	1%	1%
2	Kostoff, RN	4	1%	2%
3	Bordons, M	3	1%	3%
4	Brahler, E	3	1%	4%
5	Glanzel, W	3	1%	5%
6	Gomez, I	3	1%	6%
7	Larsen, B	3	1%	7%
8	Van Leeuwen, TN	3	1%	8%
9	Wormell, I	3	1%	8%

With regard to the total number of publications by institutions (Table 4), Leiden University published the most. If we consider single (Table 5) and collaborative (Table 6) documents separately, again, Leiden University published the most. However, the Hungarian Academy of Science, Indiana University, Office of Naval Research, and Research Association of Scientific Communication and Information were on an equal footing with Leiden University as publishers of the greatest number of papers written in collaboration. None of the institutions had a heavy relative weight in the sample; even the top publishers had a low share.

Table 4
Top Publication Activity by Institutions

#	Institution	Single	%	Accum.	Collab.	%	Accum.	Total	%	Accum.
1	Leiden Univ.	8	6%	6%	3	2%	2%	11	4%	4%
2	Drexel Univ.	5	4%	9%	1	1%	3%	6	2%	6%
3	Royal Sch. Lib. & Informat. Sci.	4	3%	12%	2	1%	4%	6	2%	8%
4	Indiana Univ.	2	1%	13%	3	2%	6%	5	2%	9%
5	Inst. Sci. Informat.	4	3%	16%	0	0%	6%	4	1%	11%
6	Long Isl. Univ.	4	3%	19%	0	0%	6%	4	1%	12%
7	Off. Naval Res.	1	1%	20%	3	2%	8%	4	1%	13%

Table 5
Top Single Publication Activity by Institutions

#	Institution	Single	%	Accum.
1	Leiden Univ.	8	6%	6%
2	Drexel Univ.	5	4%	9%
3	Inst. Sci. Informat.	4	3%	12%
4	Long Isl. Univ.	4	3%	15%
5	Royal Sch. Lib. & Informat. Sci.	4	3%	18%
6	CSIC	3	2%	20%

Table 6
Top Collaborative Publication Activity by Institutions

#	Institution	Collaborations	%	Accum.
1	Hungarian Acad. Sci.	3	2%	2%
2	Indiana Univ.	3	2%	4%
3	Leiden Univ.	3	2%	6%
4	Off. Naval Res.	3	2%	8%
5	Res. Assoc. Sci. Commun. & Informat.	3	2%	9%

Regarding the total number of publications by country (Table 7), the United States of America (USA) published the most. If we consider single (Table 8) and collaborative (Table 9) documents separately, again the USA published the most. However, Germany, the Netherlands, Belgium, and the People's Republic of China were on an equal footing with the USA as publishers of the greatest number of papers written in collaboration. The USA had, by far, a dominant relative position.

Table 7
Top Publication Activity by Countries

#	Country	Single	%	Accum.	Collab.	%	Accum.	Total	%	Accum.
1	USA	72	40%	40%	12	22%	22%	84	36%	36%
2	UK	16	9%	49%	3	5%	27%	19	8%	44%
3	The Netherlands	13	7%	56%	5	9%	36%	18	8%	51%
4	Germany	12	7%	62%	5	9%	45%	17	7%	58%
5	Spain	13	7%	70%	0	0%	45%	13	6%	64%

Table 8
Top Single Publication Activity by Countries

#	Country	Single	%	Accum.
1	USA	72	40%	40%
2	UK	16	9%	49%
3	The Netherlands	13	7%	56%
3	Spain	13	7%	70%
4	Germany	12	7%	62%

Table 9
Top Collaborative Publication Activity by Countries

| #	Country	Collaborations	%	Accum.
1	USA	12	22%	22%
2	Germany	5	9%	31%
2	The Netherlands	5	9%	40%
3	Belgium	4	7%	47%
3	People's Rep. China	4	7%	55%

The core journals that publish documents most frequently turn out to be *Scientometrics* and the *Journal of the American Society for Information Science and Technology* (Figure 1). The former is represented geographically mainly by the Netherlands and Germany. The latter basically publishes American documents.

Figure 1
Geographical Representation of Core Journals
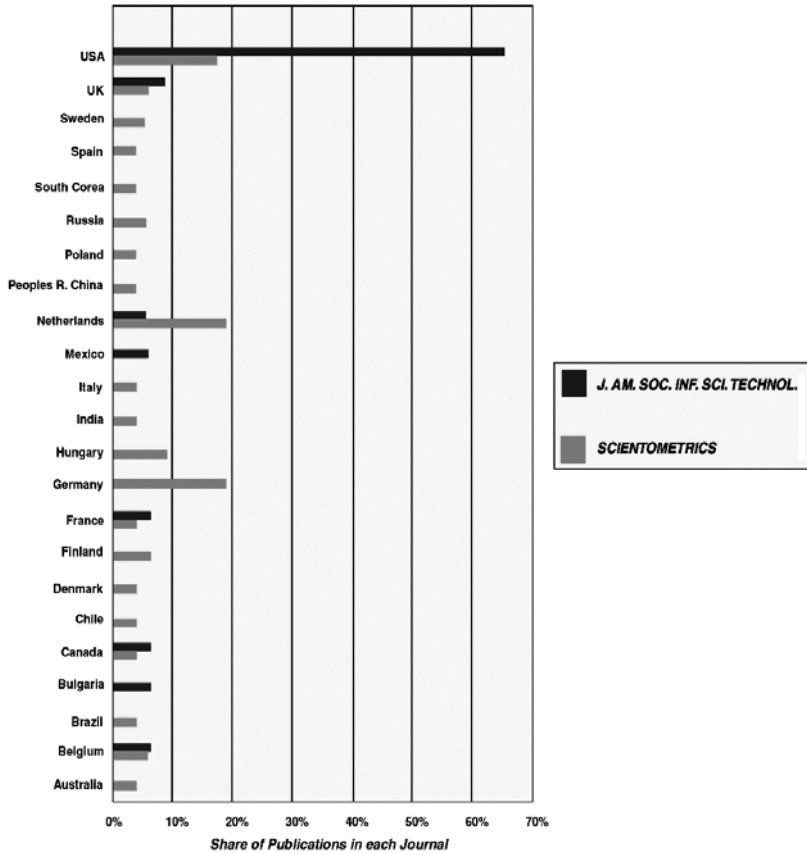
Among the other literature (Figure 2), we found three representative journals of the topic: the *Journal of Information Science*, *Research Evaluation*, and the *Monograph Series* of the American Society for Information Science and Technology (ASIST). The first is publishing American and British documents. The second publishes authors from Australia, Austria, Italy, Mexico, the Netherlands, the People's Republic of China, and the United Kingdom. The third publishes American authors mainly.

Figure 2
Geographical Representation of Other Literature
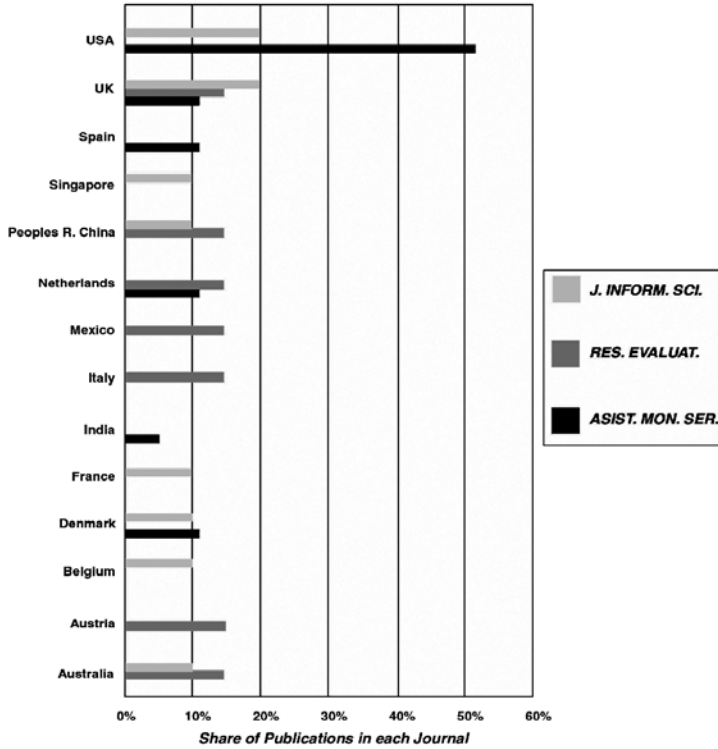
III. Citation Impact

With respect to documents (Table 10), the average citation rate was above 4 and the highly cited documents were those in which the number of citations exceeds 28, when *s* equals 7. The topics of these documents were *small-world networks* and *webometrics.*

Table 10
Most Cited Documents

Citations	Authors	Title	Source	Keywords
105	Newman, MEJ	The structure of scientific collaboration networks	Proc. Natl. Acad. Sci. U. S. A.	Small-World Networks
58	Newman, MEJ	Scientific collaboration networks. I. Network construction and fundamental results	Phys. Rev. E	Small-World Networks
54	Newman, MEJ	Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality	Phys. Rev. E	Small-World Networks
38	Thelwall, M	Extracting macroscopic information from Web links	J. Am. Soc. Inf. Sci. Technol.	Webometrics
35	Bjorneborn, L and Ingwersen, P	Perspectives of webometrics	Scientometrics	Webometrics

With respect to authors (Table 11), the average citation rate was above 4. The most highly cited authors were Newman, Thelwall, Cronin, Ingwersen, and Bjorneborn. For each of these authors, the number of citations exceeds 33, when s equals 7. Authors were more cited when they published in collaboration (Table 12).

Table 11
Most Visible Authors

#	Author	Single	Collaborations	Times Cited
1	Newman, MEJ	240		240
2	Thelwall, M	38		38
3	Cronin, B	37		37
4	Ingwersen, P		37	37
5	Bjorneborn, L		35	35

Table 12
Frequency of Cited Authors

Number of Authors	Times Cited	%	Average
1	489	27%	6
2	428	24%	4
3	249	14%	3
4	252	14%	5
5	85	5%	2
6	24	1%	2
7	28	2%	4
8	32	2%	4
9	0	0%	
10	200	11%	20
Total	1787	100%	

With respect to institutions (Table 13), the average citation rate was above 6. The most highly cited institutions were Santa Fe Institute, Cornell University, and Indiana University. For each of these institutions, the number of citations exceeds 47, when s equals 7. Institutions were more cited when they published in collaboration (Table 14).

Table 13
Most Visible Institutions

#	Institution	Single	Collaborations	Times Cited
1	Santa Fe Inst.	128	112	240
2	Cornell Univ.	11	112	123
3	Indiana Univ.	37	21	58

Table 14
Frequency of Cited Institutions

Number of Authors	Times Cited	%	Average
1	526	38%	5
2	580	42%	6
3	132	9%	5
4	104	7%	13
5	20	1%	4
6	0	0%	
7	28	2%	4
Total	1390	100%	7

With respect to countries (Table 15), the average citation rate was above 31. The most highly cited country was the USA. The number of citations exceeds 219, when *s* equals 7. Countries were less cited when they published in collaboration (Table 16).

Table 15. Most Visible Country

#	Country	Single	Collaborations	Times Cited
1	USA	448	53	501

Table 16. Frequency of Cited Countries

Number of Authors	Times Cited	%	Average
1	800	80%	26
2	188	19%	12
3	14	1%	4
Total	1002	100%	31

IV. COLLABORATION

As collaboration patterns can be examined at different levels of aggregation, we proceed as follows. First, we analyze cooperation among individual authors; i.e. at the microlevel. Second, we focus on cooperation among institutions; i.e. at the mesolevel. Finally, we assess the importance of international scientific collaboration; i.e. at the macrolevel.

We created frequency tables with the number of documents for each number of units. Considering occurrence, 54% of documents were published in collaboration by authors (Table 17). Furthermore, 30% of the total documents were published in collaboration by institutions (Table 18) and 12% by countries (Table 19).

Table 17
Frequency of Collaboration by Authors

Number of Authors	Observed Frequency	%
10	1	0%
9	0	0%
8	1	0%
7	1	0%
6	2	1%
5	8	4%
4	14	6%
3	34	16%
2	55	25%
1	100	46%
Total	216	

Table 18
Frequency of Collaboration by Institutions

Number of Institutions	Observed Frequency	%
7	1	0%
6	0	0%
5	1	0%
4	3	1%
3	10	5%
2	51	24%
1	142	66%
0	8	4%
Total	216	

Table 19
Frequency of Collaboration by Countries

Number of Countries	Observed Frequency	%
3	2	1%
2	24	11%
1	182	84%
0	8	4%
Total	216	

We derived figures of intramural and extramural collaborations (Table 20) from the frequency of number of authors and institutions. Basically, four possible scenarios arise. In the first scenario, there is one author and one institution (85 observations). In this subset, we assume that collaboration based in coauthorship does not exist because there is only one author. In the second one, there is one author and two or more institutions (7 observations). In this subset, we assume that collaboration based in coauthorship does not exist because there is only one author, despite the fact that the author is affiliated to more than one institution. In the third scenario, there are two or more authors and one institution (148 observations). In this subset, we assume there was intramural collaboration. In the fourth and last scenario, there is more

than one author and more than one institution (197 observations). In this subset, we assume there was extramural collaboration, despite the fact that intramural collaboration can also be found in this subset.

In particularly, when a document has been published by three authors and two institutions, we do not know how to assign the affiliation among the three authors. Maybe two authors work for one institution and the third author works for the second one. But, it could also be the case of two authors who work for one institution, while the third is affiliated to both institutions. Other possibilities can be considered. That is why we ruled intramural collaboration out when there is more than one institution.

Table 20
Intra/Extra Mural Collaboration

		Number of Institutions		
		One	Two or More	Total
Number of Institutions	One	85	7	92
	Two or More	148	197	345
	Total	233	204	437

Intramural collaboration represents 53% of the total and extramural, 47%. So, we can say that collaboration inside an institution is as important as collaboration beyond the institution. Besides, documents published by one author are more likely to be documents coming from only one institution. Furthermore, documents published by multiple authors are more likely to be documents coming from multiple institutions.

A first indicator of the importance of collaboration in the three levels is the amount of collaborative documents and their share in the total publication output of the unit. The most productive units published less in collaboration (Tables 21, 22, and 23).

Moreover, the more aggregated the level of analysis was, the less collaborative the most productive units were, on average. If the whole sample is considered; i.e. not only the top publishers, authors published averagely 79% of their publications in collaboration; institutions, 56%; and countries, 34%.

Table 21
Collaborations in Top Publication Activity by Authors

#	Author	Single	%	Collaborations	%	Total
1	Van Raan, AFJ	4	67%	2	33%	6
2	Ingwersen, P	1	20%	4	80%	5
3	Lewison, G	3	60%	2	40%	5
4	Glanzel, W	1	25%	3	75%	4
5	Kostoff, RN	0	0%	4	100%	4
6	Newman, MEJ	4	100%	0	0%	4
7	White, HD	4	100%	0	0%	4
	Average		53%		47%	

Table 22
Collaborations in Top Publication Activity by Institutions

#	Institution	Single	%	Collab.	%	Total
1	Leiden Univ.	8	73%	3	27%	11
2	Drexel Univ.	5	83%	1	17%	6
3	Royal Sch. Lib. & Informat. Sci.	4	67%	2	33%	6
4	Indiana Univ.	2	40%	3	60%	5
5	Inst. Sci. Informat.	4	100%	0	0%	4
6	Long Isl. Univ.	4	100%	0	0%	4
7	Off. Naval Res.	1	25%	3	75%	4
8	Santa Fe Inst.	2	50%	2	50%	4
9	Wellcome Trust	3	75%	1	25%	4
	Average		68%		32%	

Table 23
Collaborations in Top Publication Activity by Countries

#	Country	Single	%	Collaborations	%	Total
1	USA	72	86%	12	14%	84
2	UK	16	84%	3	16%	19
3	The Netherlands	13	72%	5	28%	18
4	Germany	12	71%	5	29%	17
5	Spain	13	100%	0	0%	13
	Average		83%		17%	

Table 24
Transaction Matrix: Number of International Copublications

	AUS	AUT	BEL	CAN	CHL	DEN	FIN	GER	HGK	HUN	ISR	MEX	NLD	POL	PRC	RUS	UKD	USA	ZAF	Total
AUS													1		1			2		4
AUT																		1		1
BEL								1					2		1					4
CAN																		3		3
CHL																		1		1
DEN													1							1
FIN																	1			1
GER			1							3								1		5
HGK															1					1
HUN								3												3
ISR																		1	1	2
MEX																		1		1
NLD	1		2		1												1			5
POL															1					1
PRC	1		1					1										2		5
RUS														1						1
UKD						1							1					1		3
USA	2	1		3	1			1			1	1			2		1		1	14
ZAF											1							1		2
Total	4	1	4	3	1	1	1	5	1	3	2	1	5	1	5	1	3	14	2	58

In order to calculate the strengths of coauthorship links, we constructed a bidimensional transaction matrix (Table 24) where rows and columns represent the countries that collaborate. Particularly, if a document has been published by three countries (A, B, and C), this is

considered as published in our bidimensional matrix by A-B, A-C, B-C, B-A, C-A, and C-B (Luukkonen *et al.* 1993, 17). Thus, the analysis is based on the number of coauthorship links and not on the number of copublications.

The matrix shows that the USA has, by far, the highest amount of links, followed by Germany, The Netherlands, and China. Moreover, there is a research cluster located in the Northern Hemisphere, mainly in the USA and Western Europe.

Regarding publication productivity, the USA stands out by far, followed by the United Kingdom, the Netherlands, and Germany (Table 25).

Table 25
Indicators for Collaborating Countries

Country	Abbreviation	Number of Publications	MOCR	% Domestic
Australia	AUS	7	2.57	14%
Austria	AUT	2	2.50	50%
Belgium	BEL	6	6.00	0%
Canada	CAN	8	4.25	38%
Chile	CHL	2	0.00	50%
Denmark	DEN	6	6.67	67%
Finland	FIN	3	3.33	33%
Germany	GER	17	3.35	53%
Hong Kong	HGK	1	4.00	0%
Hungary	HUN	4	6.50	25%
Israel	ISR	2	2.50	0%
Mexico	MEX	3	1.33	33%
The Netherlands	NLD	18	3.39	44%
People's R. China	PRC	5	2.60	20%
Poland	POL	1	0.00	0%
Russia	RUS	4	0.25	25%
South Africa	ZAF	1	4.00	0%
United Kingdom	UKD	19	6.47	42%
United States	USA	84	5.96	32%

The highest mean observed citation rates (MOCR), whose values are six or more, can be found in Denmark, Hungary, the United Kingdom, and Belgium (Table 25). The share of publications without any foreign coauthors in the country's total is half or more in Denmark, Germany, and Chile (Table 25).

Figure 3
Mean Citation Rate of Domestic and Internationally
**Coauthored Publications**
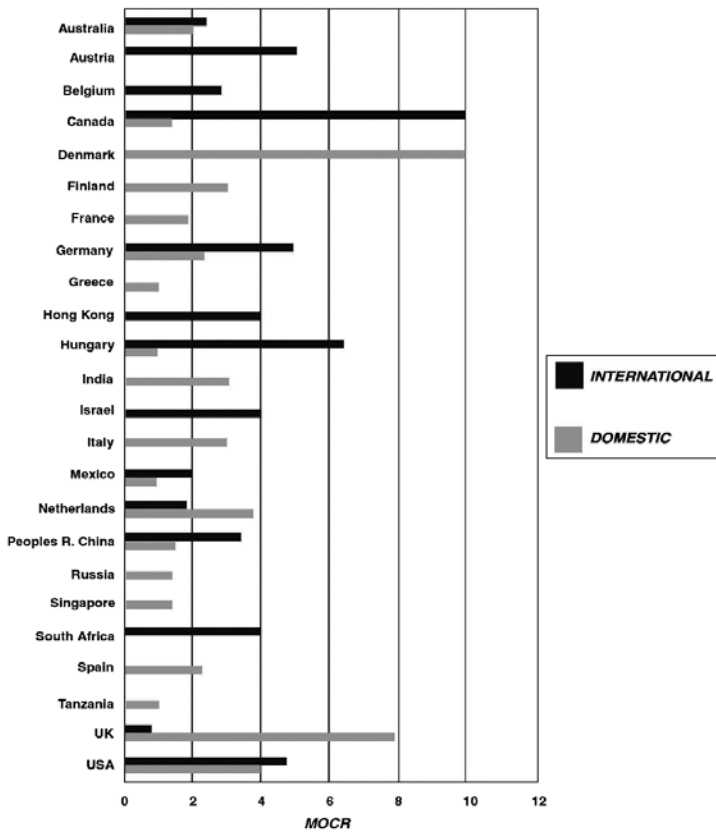
The citation behaviour of domestic and internationally coauthored papers is illustrated in Figure 3 by comparing their respective MOCRs. As we can see, the citation impact of internationally coauthored publications

is higher than that of the domestic coauthored publications in Australia, Austria, Belgium, Canada, Germany, Hong Kong, Hungary, Israel, Mexico, the People's Republic of China, South Africa, and the USA. On the contrary, the citation impact of domestic coauthored publications is higher than that of the internationally coauthored publications in Denmark, Finland, France, Greece, India, Italy, the Netherlands, Russia, Singapore, Spain, Tanzania, and the United Kingdom.

Then, we plot the foreign coauthorship ratio (Figure 4), which is the ratio of international collaborative papers as a percentage of total publications to the size of the country, which is the number of publications. Some small countries, like Hong Kong, Poland, and South Africa, published only international collaborations. While others, like Japan, Singapore, South Korea, India, Greece, and Tanzania, publish only domestic collaborations. Scientists from larger countries can much easily find partners for their research in their own country than their colleagues from smaller countries (Schubert and Braun 1990, 6).

Figure 4
Plot of Size of the Country and Foreign Coauthorship Ratio
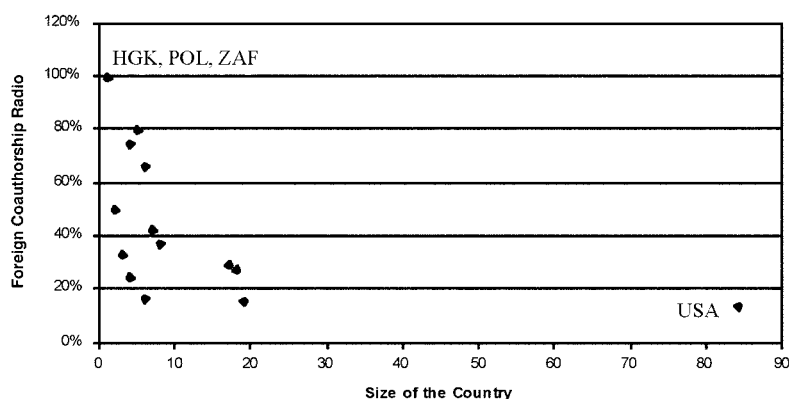
The strength of coauthorship links can be captured by symmetric bilateral measures of Jaccard and Salton. The strongest Jaccard links are Russia-Poland, and South Africa-Israel. Unlike Salton's measures, Jaccard's give weaker links.

Table 26
Measures of relatedness: Salton (in plain print)
**and Jaccard (in italics)**

	AUS	AUT	BEL	CAN	CHL	DEN	FIN	GER	HGK	HUN	ISR	MEX	NLD	POL	PRC	RUS	UKD	USA	ZAF
AUS		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,00	0,09	0,00	0,00	0,02	0,00
AUT	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00
BEL	0,00	0,00		0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,00	0,00	0,09	0,00	0,10	0,00	0,00	0,00	0,00
CAN	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,00
CHL	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00
DEN	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
FIN	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,00
GER	0,00	0,00	0,10	0,00	0,00	0,00	0,00		0,00	0,17	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00
HGK	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,20	0,00	0,00	0,00	0,00
HUN	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,36	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
ISR	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,50
MEX	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,01	0,00
NLD	0,09	0,00	0,19	0,00	0,00	0,10	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,03	0,00	0,00
POL	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,25	0,00	0,00	0,00
PRC	0,17	0,00	0,18	0,00	0,00	0,00	0,00	0,00	0,45	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,02	0,00
RUS	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,50	0,00		0,00	0,00	0,00
UKD	0,00	0,00	0,00	0,00	0,00	0,00	0,13	0,00	0,00	0,00	0,00	0,00	0,05	0,00	0,00	0,00		0,01	0,00
USA	0,08	0,08	0,00	0,12	0,08	0,00	0,00	0,03	0,00	0,00	0,08	0,06	0,00	0,00	0,10	0,00	0,03		0,01
ZAF	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,71	0,00	0,00	0,00	0,00	0,00	0,00	0,11	

The map on Figure 5 reveals that worldwide collaboration generates two coauthorship clusters of very unequal size. There is a big cluster, represented by the USA, the United Kingdom, Mexico, China, Germany, Austria, Israel, and Australia, with Salton's measures among 10% and 20%, Canada and South Africa, with Salton's measures of 10% or less. There is also a smaller cluster formed by mainland Europe. As we also see, the major nodal centres of international collaboration are the USA, the United Kingdom and the Netherlands.

In Figure 5, the lines represent Salton's measures which vary among the three following ranges: (0%, 10%], (10%, 20%], (20%, 100%]. The thicker the lines are, the stronger the links are. The strongest links are found between Poland and Russia, China and Hong Kong, Germany and Hungary.

However, a country may be extremely important for another country, while the latter may have a minimal marginal importance for the former as a partner in science. Glänzel and Schubert (2001, 2005) have studied this phenomenon.

Figure 5
Mapping of International Collaboration
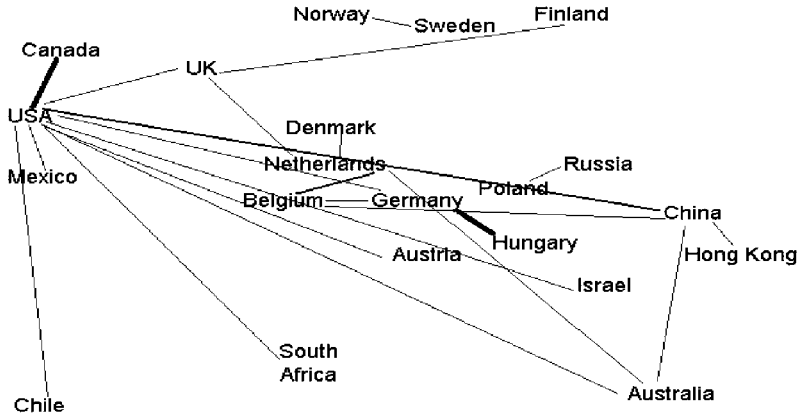
V. Concluding Remarks

First of all, we would like to remark that we have been working with publications that came out within the same year. Thus, the results found here should be interpreted with caution because no time analysis has been carried out.

As we thought in advance, the evidence shows that the USA is the most productive, most cited and most collaborative publisher. The neighbourhood is a ground to collaborate, like Canada or Mexico with the USA, and Belgium with the Netherlands.

The core journals are *Scientometrics* in Europe and the *Journal of the ASIST* in the USA. The geographical representation of other literature is rather blurred.

The most visible topics are small-world networks and webometrics. There is another caveat: bibliometric indicators cannot capture the creativity of the publication when scientists iterate methodologies on different data sets.

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