BIBLIOMETRIC REPORT

Netherlands Bureau for Economic Policy Analysis (CPB) research performance analysis (2007–2014)

October 6th, 2015

Netherlands Bureau for Economic Policy Analysis (CPB) research performance analysis (2007–2014)

CPB – Netherlands Bureau for Economic Policy Analysis (CPB)

Dr. Edwin van de Haar

Directiesecretaris

Tel.   070 338 33 80

E-mail E.R.van.de.Haar@cpb.nl

Project team

Alfredo Yegros-Yegros PhD, *Project leader*

CWTS B.V.

P.O. Box 905

2300 AX Leiden, The Netherlands

Tel.   +31 71 527 7737

Fax   +31 71 527 3911

E-mail a.yegros@cwts.leidenuniv.nl

Table of contents

1. Introduction

In 2009, CWTS conducted an evaluation of the performance from a bibliometric perspective, using the publication set of the Netherlands Bureau for Economic Policy Analysis (CPB) in the years 2003-2008 and the world's output as covered in the Web of Science (WoS). The results of this analysis showed an increasing output of publications indexed by the WoS, meaning greater visibility in the international scholarly communication. CPB performed below the worldwide average in terms of normalised citation impact.

CPB follows the Standaard Evaluatie Protocol (SEP) in terms of its evaluation. For this reason a new bibliometric performance analysis is requested, after a period of six years, to be used as input for the self-evaluation. In this report, we present a bibliometric performance analysis similar to that conducted in 2009, with the same bibliometric dimensions considered.

The structure of this report is as follows. Chapter 2, provides a general introduction to the data collection, the methodology and an overview of the bibliometric indicators that were calculated in the study. Chapter 3, presents the results of the performance analysis and Chapters 4 briefly presents the conclusions from this study.

2. Data and methods

In this chapter, we discuss the methods underlying the bibliometric analyses presented in this report [1].

2.1. Database structure

At CWTS, we calculate our indicators based on our in-house version of the Web of Science (WoS) database of Thomson Reuters. WoS is a bibliographic database that covers the publications of about 12,000 journals in the sciences, the social sciences, and the arts and humanities. Each journal in WoS is assigned to one or more subject categories. We note that our in-house version of the WoS database includes a number of improvements over the original WoS database. Most importantly, our database uses a more advanced citation matching algorithm and an extensive system for address unification. Our database also supports a hierarchically organized field classification system on top of the WoS subject categories.

2.2. Data collection

In general, bibliometric performance analyses can be conducted in two ways. One approach is to collect the publications produced by a research unit in the past and to analyze these publications. The other approach is to start with the researchers currently affiliated with a research unit and to collect and analyze their past publications, irrespective of whether researchers produced these publications when they were affiliated with the research unit of interest or not. The first approach leads to an analysis that is completely backward looking. The second approach has a more forward looking focus, since it does not include publications produced by researchers who are no longer affiliated with a research unit. CPB has requested CWTS to take the first approach in the performance analysis presented in this report. Hence, we analyze the past publications of CPB.

The performance analysis presented in this report focuses on publications from the period 2007-2014. Only WoS indexed publications are considered. This means that books, book chapters, journal publications not indexed in WoS, conference proceedings publications, working papers, etc. are not included in the analysis. Each publication in WoS has a document type, such as 'article', 'book

---

[1] We refer to Moed (2005) for a general introduction into the use of bibliometrics and citation analysis for research evaluation.

review', 'editorial material', 'letter', or 'review'. In our analysis, although we first show all the publication counts for all types of document, we only take into account publications of the document types 'article' and 'review' to conduct the main analyses. In general, these two document types cover the most significant publications.

The publications of CPB were collected searching the name of the Netherlands Bureau for Economic Policy Analysis in the 'address' field of the Web of Science. This field contains the name of the organization/s where the author/s are affiliated. To ensure the retrieval of all the relevant publications, a number of name variants were considered:

- Netherlands Bur Econ Policy Anal
- CPB
- Planbureau

Besides the publications collected from the WoS using this search strategy, CPB also asked for the inclusion of 16 additional publications (see Appendix I). Some of these publications are erroneously registered in the WoS (9 publications). In other 7 publications, CPB researchers did not indicate they were actually affiliated to the Netherlands Bureau for Economic Policy Analysis.

2.3. Bibliometric indicators

Three key aspects of CPB's research performance are considered in our performance analysis: publication output, citation impact, and scientific collaboration.

2.3.1. Indicators of output

To measure the total publication output produced by CPB, we use a very simple indicator. This is the number of publications indicator, denoted by P. This indicator is calculated by counting the total number of publications of a research unit. Only publications of the document types article and review are taken into account.

2.3.2. Indicators of impact

Citation impact focuses on the number of times the publications of CPB have been cited. Citation impact does not directly reflect the scientific quality of the work of CPB, but it can be regarded as a proxy for the scientific impact of this work.

As already mentioned in Section 2.2, the period of analysis is 2007-2014. Only publications from this period are considered in our performance analysis, however the citation analysis considers publications up to 2013 and citations until 2014 as at least one complete year to receive citations is needed to calculate robust indicators. In addition, as indicated previously, only publications of the WoS document types 'article' and 'review' are taken into account. Hence, book reviews, editorials, letters to the editor, etc. are not included in the analysis. It is important to note that in this report we distinguish between two different concepts of citation impact:

- **Total citation impact (TCS)**. The overall citation impact of the publications of a research unit. Other things equal, a research unit with a larger number of publications will have a higher total citation impact. Hence, total citation impact is partly determined by the size of a research unit.

- **Average citation impact per publication (MCS)**. The average citation impact of the publications of a research unit. Average citation impact per publication equals total citation impact divided by the number of publications of a research unit. Average citation impact per publication makes it possible to compare research units of different size. Research units with a selective publication strategy (favoring 'quality' over 'quantity') are the ones that tend to perform best when looking at average citation impact per publication.

To measure the total or average citation impact of a set of publications, we start by counting for each publication the number of times it has been cited. Since our analysis is based on WoS data, only citations from WoS indexed publications are counted. We normally do not count author self citations. A citation is considered an author self citation if the citing and the cited publication have at least one author name in common. For each publication, all citations received until the end of 2014 are taken into account. This means that older publications have had more time to receive citations and may therefore be expected to have higher citation counts than more recent publications.

After counting the number of times publications have been cited, we calculate the following indicators, considering both aspects, the total citation impact of a set of publications as well as the average citation impact:

- **TCS** The total number of citations of the publications, excluding self-citations. This is a very straightforward indicator that does not correct for the field and the year in which publications have appeared. The indicator

therefore provides only a very rough indication of the total citation impact of a set of publications.

- **Number of top 10% publications (PP(top 10%))**. The number of publications that compared with all other WoS indexed publications in the same field and the same year belong to the top 10% most frequently cited. We refer to these publications as top 10% publications.
- **MCS**: Average number of citations per publication, excluding self–citations.
- **Pnc**: Percentage of publications not cited by others (in the given time period)
- **MNCS**: Average normalized number of citations of the publications of a unit, excluding self–citations.
- **Total normalized journal score (MNJS)**. Average normalized citation score of the journals in which a research group has published
- **Mean field normalized citation score (MNCS)** in the traditional way; the actual number of citations (without self–citations) is divided by the expected number of citations on a paper basis. Here, the expected number of citations is based on the world–wide average citation score without self–citations of all similar papers belonging to the same field (journal subject category).
  In this way, a field normalized score is calculated for each paper. Next, the MNCS indicator is computed for each unit of analysis, by taking the average of these field normalized citation scores for individual papers. A value above 1 indicates that the mean impact for the unit is above world average whereas a value below 1 indicates the opposite.
- **The mean normalized journal score (MNJS)** indicates the average citation impact of the journals in which the papers appeared that were published by the unit of analysis. The indicator is calculated based on the same principles as the MNCS. It shows whether the publications originating from the unit of analysis were published in top or in sub–top (in terms of citation impact) journals.
- **Number of highly cited publications (Ptop10%)** in international journals of the unit of analysis in the period;
- **Percentage of highly cited publications. (PPtop10%)** The percentage of publications published by the unit that are among the upper top 10% percentile of the citation distribution for similar papers belonging to the same fields (journal subject categories).

All the indicators of citation impact have been calculated applying fractional counting at the level of organisation.

2.3.3. Indicators of scientific collaboration

Collaboration is measured according to the degree to which the publications of CPB indicate multiple research institutes, from the Netherlands or abroad. Collaboration is measured then analyzing the affiliations indicated by the authors in their publications.

We first identified publications authored by a single institution ('no collaboration'). We then identified publications that have been produced by institutions from different countries ('international collaboration') and publications that have been produced by institutions from the same country (i.e. 'national collaboration'). These types of collaboration are mutually exclusive. Publications involving both national and international collaboration are classified as international collaboration.

3. Performance analysis: Netherlands Bureau for Economic Policy Analysis

3.1. Publication output

According to the information included in the Web of Science, CPB published 209 documents between 2007 and 2014.

On average, CPB published 26 documents per year in the period under analysis. Figure 1 represents the evolution over time of the CPB publications. 2008 is the year with the highest number of documents published (34), while in 2013 we observe the lowest number of publications (19). Indeed, in 2012 there was already a drop in the number of publications compared to the previous years. However, in the most recent year in the period we observe a new increase in the number of publications.

Figure1. Development over time of the publication output
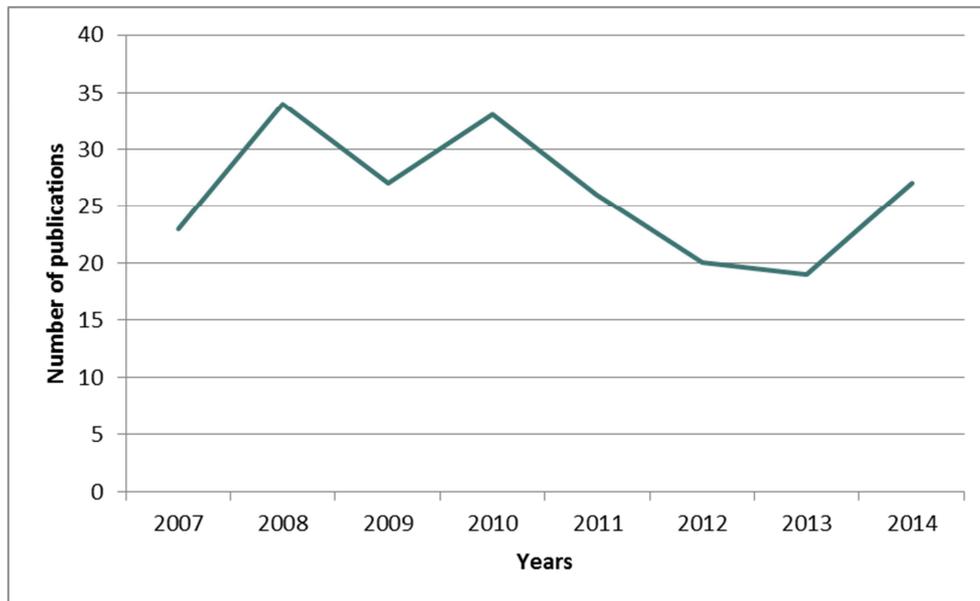
Roughly, 95% of all publications are articles and only a few publications belong to other document types. It is important to keep in mind that for the rest of the analyses included in this report, only articles and reviews will be considered. Together these two types of documents represent the whole of CPB's publications covered in the WoS. Table 1 provides an overview of the by document type.

Table 1. Breakdown of CPB output in the WoS by document type

Publication year	Article	Book review	Editorial Material	Review
2007	23	0	0	0
2008	30	1	3	0
2009	27	0	0	0
2010	30	2	0	1
2011	25	0	0	1
2012	19	0	1	0
2013	18	0	0	1
2014	26	0	0	1
Total	198	3	4	4

3.2. Citation impact

We now look at the citation impact of the publications produced by the CPB. To analyze the citation impact we will consider the publication output up to 2013 and citations until 2014, as it is necessary to consider at least one full year between the publication year and the citation count in order to make robust calculations of citation impact indicators.

As described in section 2.3.2, these indicators have been calculated applying fractional counting at the level of organization. Only the second row (P_full) reports the CPB output applying full counting.

Table 3 provides a number of indicators of citation impact, related to both, the total citation impact of the publications as well as the average citation impact per publication. The Appendix II contains a table with the score of these indicators in each year of the period 2007–2013.

Table 3. Indicators of citation impact of the publications of CPB (2007–2013/14)

Indicator	Score
P_full	175
P_frac	100.6
TCS	497.2
MCS	4.9
MNCS	0.84
MNJS	0.88
PPtop10%	7%
Ptop10%	6.8
Pnc	28.7%
Int_cov[2]	50.7%

We first look at the citation impact of all publications produced by CPB in WoS indexed journals in the period 2007–2013. The average normalized citation score (MNCS) of 0.84 indicates that on average publications produced by CPB are cited below the average of their field and publication year.

It is important to highlight that this is a world average value, based on all the publications contained in the WoS. Organisations contributing to these publications are heterogeneous, not only in terms of their geographic location, but also in terms

---

[2] Percentage of references in CPB publications that are also covered by the WoS.

of their institutional settings, goals and the scope of the research they conduct. This may explain why CPB does not exhibit a performance above this reference value given that the global scientific landscape is dominated by universities[3] and big public research organisations.

Considering all the publications produced by CPB, 7 (7%) belong to the top 10% of their field and publication year in terms of their number of citations. The actual percentage top 10% publications (7%), is then slightly below the value that would be expected for an organization performing at the worldwide average level. In addition, the average normalized journal score of 0.88 shows that CPB tend to publish in journals with a citation impact somewhat below the average of their field.

We now look at the development over time of the citation impact of publications produced by CPB. Figure 2 shows the development of the total mean normalized citation score and Figure 3 shows the percentage of top 10% publications over time.

The highest scores in the mean normalized citation score correspond to publications of 2008, 2010 and 2012, with a normalized citation impact above the world average. We see in the years 2010 and 2012 the highest scores of the Pptop10% indicators, around 14% of the publications are among the top 10% most cited publications in their field. According to these two figures there is not a clear trend in terms of citation impact of CPB publications.

---

[3] The 750 most important research universities worldwide included in the Leiden Ranking (http://www.leidenranking.com) were involved in 85% of the scientific publications during the period 2007–2014.

Figure 2. Evolution of the Mean Normalized Citation Score
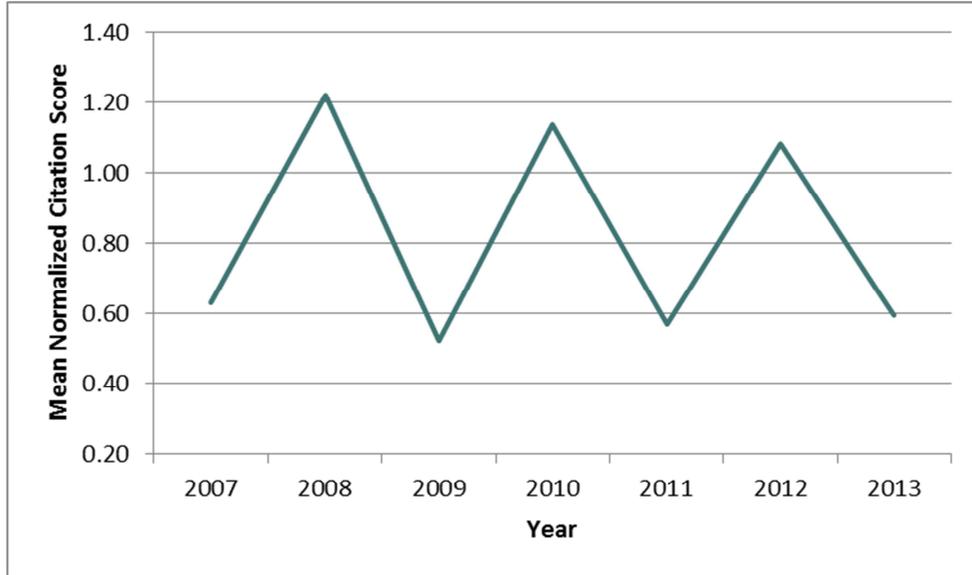
Figure 3. Evolution of the percentage of top 10% most cited publications
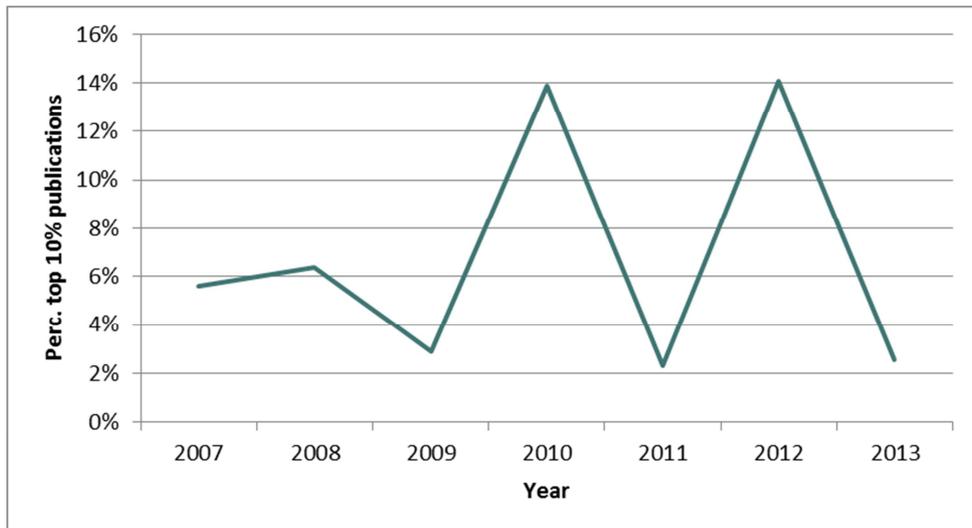
3.3. Special indicators

3.3.1. Research profile analysis

CPB has published documents in 41 of the 250 fields considered in the WoS. Figure 4 shows the percentage of publications in the WoS fields where the CPB has been especially active, together with the corresponding mean normalized citation impact.

It is not surprising that we found a high concentration of CPB publications[4] in the field of 'Economics'. Almost 70% of the publications are categorized in this field while the remaining 30% is scattered over 40 fields, each of which represent a very low percentage of publications.

According to the mean normalized citation score, CPB is performing below the world average in its main field of activity in terms of citation impact (0.78). But it is important to bear in mind that this world average, as explained before, is strongly determined by the research activity of universities and big public research organisations and not by organisations as CPB.

In the rest of the fields, the number of publications is too low to consider them representative enough of CPB activity, thus the citation scores for these fields must be interpreted with caution.

---

[4] Publication output per field is reported applying full counting.

Figure 4. Distribution of publications over WoS fields
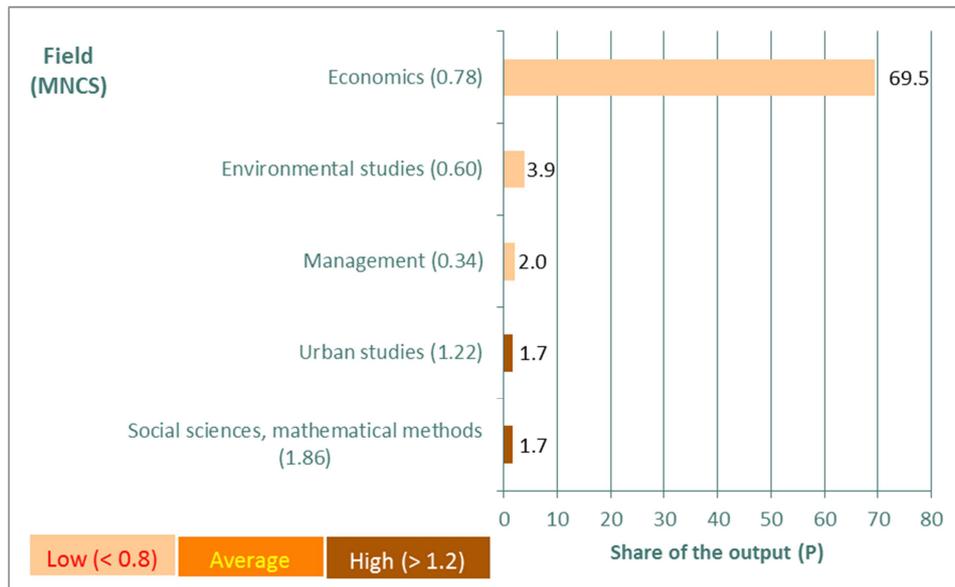
A table showing all the WoS fields in which CPB has been active as well as the mean normalized citation score for each of them, has been included in Appendix III.

3.3.2. Collaboration analysis

We now analyze the degree to which CPB is involved in scientific collaboration, based on the affiliations indicated by the authors in their publications during the period 2007–2013. To do so, three types of publications are distinguished: publications that do not involve inter–institutional collaboration ('No collaboration'), publications that do involve inter–institutional collaboration but that do not involve international collaboration ('national collaboration'), and publications that involve both inter–institutional collaboration and international collaboration ('international collaboration').

About 70.3% of the publications involve inter–institutional collaboration (either national or international). About 31.4% of the publications involve collaboration not only between multiple institutes, but also with other countries. Figure 5 shows the percentage of documents published by type of collaboration.

Figure 5. Percentage of publications according to the type of collaboration
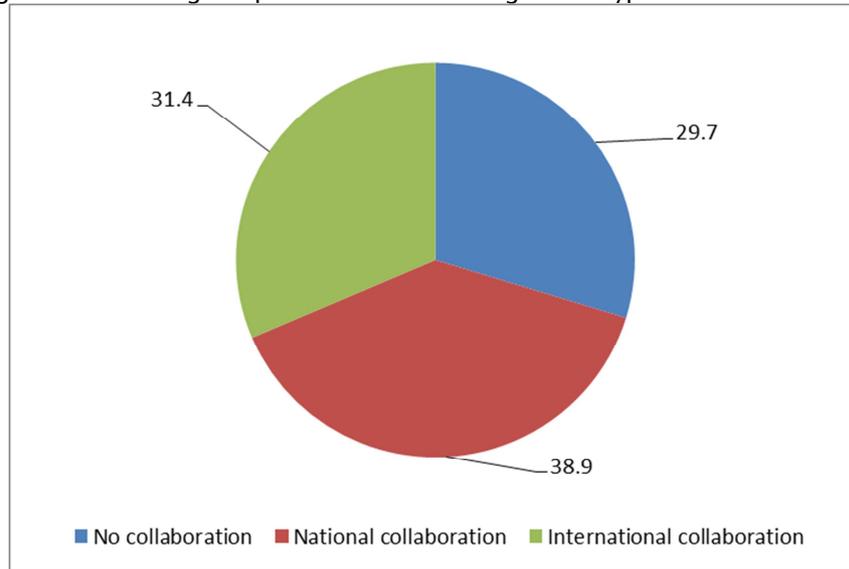
Figure 6 shows the development over time of the percentage of documents according to the type of collaboration. No clear trends can be observed, especially for documents published in national or international collaboration. The percentage of documents published without the collaboration with other institutions dropped significantly between 2009 and 2011, while in 2012 and 2013 there is a slight increase in non-collaborative publications.

Figure 6. Development over time of publications according to the type of collaboration
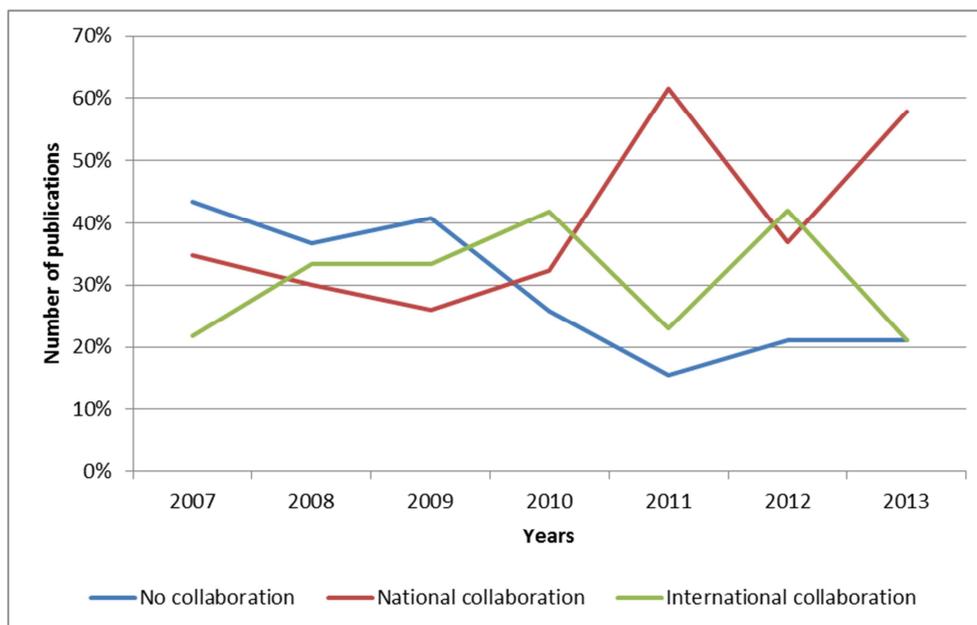
Do collaborative publications have a higher citation impact? In order to provide an answer for this question, we computed the mean normalized citations score of CPB publications according to the type of collaboration. Figure 7 shows that on average international collaborative publications had a significant higher citation impact than publications that do not involve international collaboration. Citation impact of documents published in national collaboration or without collaboration have the same citation impact.

Figure 7. Output and impact per collaboration type
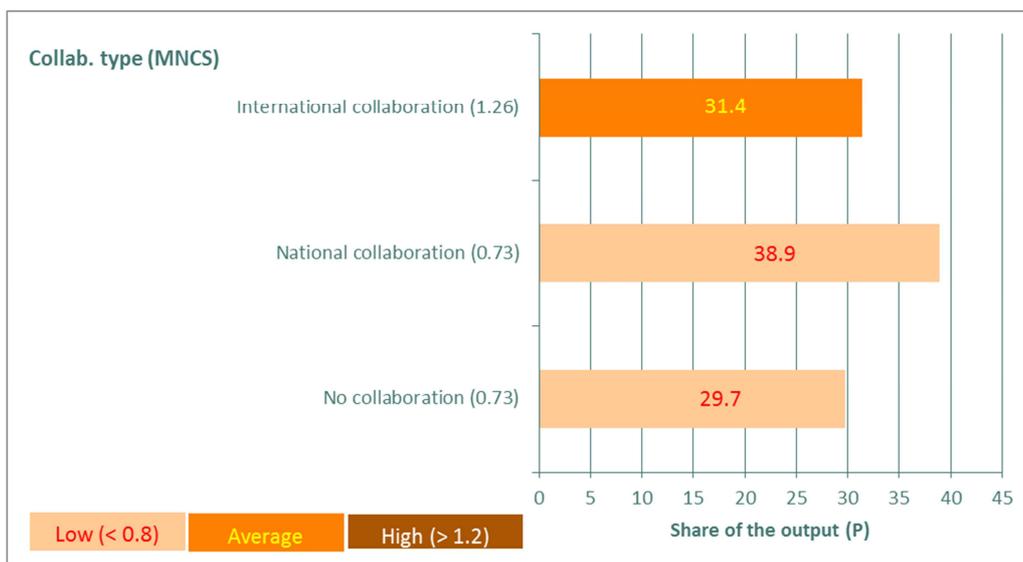
To get some insight into the research institutes with which CPB has collaborated, Table 4 lists institutes co-publishing at least three documents with CPB. It should be noted that there could be all kinds of inconsistencies in the way in which the name of a research institute is reported in the address lists of different publications. At CWTS, we partially clean address data in order to correct for such inconsistencies. However, this cleaning is not always perfect. Because of this, there may be some inaccuracies in the data underlying Table 4.

We observe that the most frequent research partners of CPB are Dutch universities like Tilburg University, University of Amsterdam or Erasmus University Rotterdam. These strong linkages with other Dutch organisations also reflect a special type of collaboration, when a researcher has multiple appointments. For instance, some researchers are appointed to a university and to the CPB at the same time, and they indicate both addresses in the scientific publications.

Table 4. Most frequently occurring research institutes co-publishing with CPB

Research institute	No. Pubs.	Research institute	No. Pubs.
Tilburg univ	21	Univ Augsburg	6
Vrije univ Amsterdam	20	CESifo Group Munich	5
Univ Amsterdam	18	Queensland inst med res	5
Erasmus univ	18	CEPR	4
Maastricht univ	10	European Comm.	3
Univ Utrecht	8		
Tinbergen inst	7		
Univ Groningen	6		
Delft univ technol	5		
IZA	4		

3.3.3. Knowledge users analysis

In this section we provide an analysis of the publications that cite the research output of CPB. This analysis gives an overview of the reach of the impact of CPB's publications. In this regard, we look at the origin of citations to CPB's output. A knowledge user analysis can help to explore the subsequent impact that the publications of a unit have had on, for instance, other research units. Therefore, these results can highlight interesting fields, partners or benchmarks.

Use of CPB's publications can be analyzed from the point of view of the institutes that cite them. This analysis is very interesting from the point of view of spotting individual institutions that have shown interest in CPB's publications and as such, they could be regarded as potential partners or perhaps also benchmarks. Table 5 shows the research institutes that most frequently cited CPB's publication output.

Vrije University Amsterdam is the frequent knowledge user (10.5% of the citations), followed by Erasmus University Rotterdam (4.7% citations). Among the top knowledge users, there are also other Dutch universities, like Tilburg University or the University of Groningen. But institutes interested in the knowledge created by CPB are not only Dutch, the lists includes some European universities as well as institutions from the United States.

Table 5 Knowledge user profile for the CPB by citing research unit

Citing research institute	% citations
Vrije Univ Amsterdam	10.5
Erasmus Univ	4.7
IZA	4.2
Maastricht Univ	4.1
Tilburg Univ	4.1
Univ Chicago	2.8
Univ Melbourne	2.8
Yale Univ	2.7
Univ Penn	2.6
Univ Coll Dublin	2.6
Univ Castilla La Mancha	2.4
Univ Nottingham	2.4
Univ Mannheim	2.4
Univ Groningen	2.3
Tinbergen Inst	2.3
Univ Autonoma Barcelona	2

3. Comparison with the previous bibliometric study

In 2009, CWTS conducted an evaluation of the performance from a bibliometric perspective, using the publication set of the Netherlands Bureau for Economic Policy Analysis (CPB) in the years 2003–2008 and the world's output as covered in the WoS.

In this previous study two sets of publications were analyzed, those covered by the Web of Science and also the publications not covered in the WoS. In the current study only CPB publications included in the WoS have been considered, therefore some comparisons can be made for the CPB research output indexed by the WoS.

Some other methodological differences must be taken into account in order to interpret properly the comparisons between the former study and the results presented in this report. The main differences can be summarized as follows:

- **Time period:** The previous study analyzed the period 2003–2008 while in this study we cover the most recent years (2007–2014). Therefore there is an overlap of two years.
- **Document types:** although in the current study we provided an overview of the CPB scientific outputs included in the WoS considering all document types, for most of the analyses (e.g. citation impact or especial indicators) we have analyzed only considered the document types 'articles' and 'review'. In the previous study, besides these two document types, also 'letters' and 'notes'[5] were considered.
- **Citation impact indicators:** CWTS standard indicators for the measurement of the citation impact have changed (i.e. the old CPP/FCSm has been replaced by the MNCS). Appendix IV explains in detail these changes, how these two indicators are calculated and the differences between them.

In terms of research outputs, figure 8 shows that despite the methodological differences, the rise of publications by CPB during the last years of the previous study is also captured by the present study. This comparison indicates that CPB has

---

[5] This document type is not currently used in the WoS. Only papers before mentioning or making remarks on a published paper on a specific subject were classified under this category.

improved in recent years in terms of publication output, by publishing on average 26 papers per year between 2007 and 2014, while in the previous period this average is considerably lower (15 publications per year).

Figure 8. Comparison of the development over time of the publication output
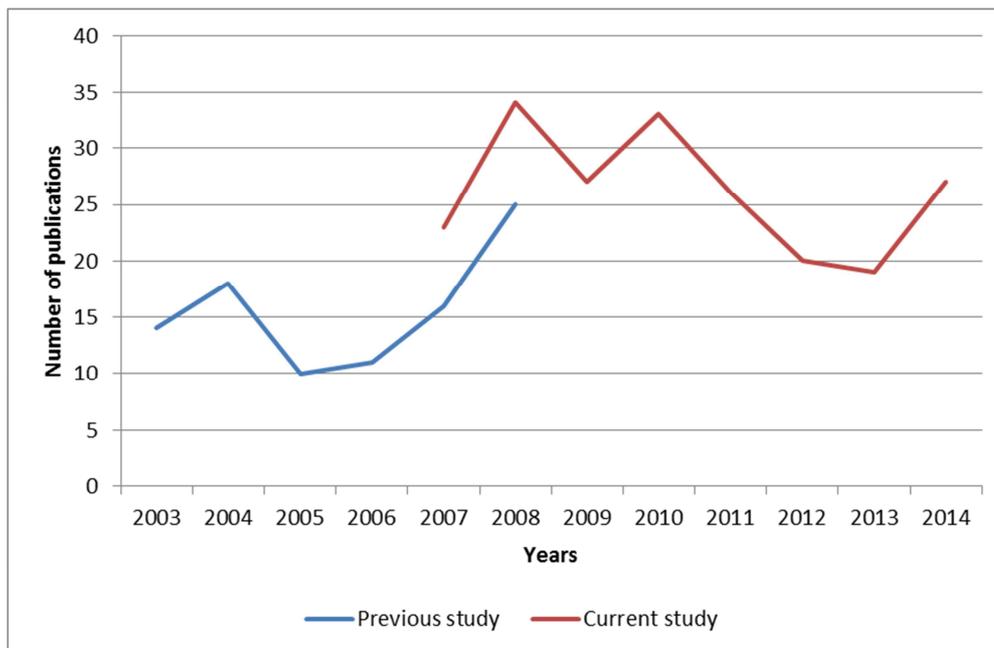
In terms of the research orientation both studies show that CPB publications has a clear focus, as expected, on the field of Economics. However, comparing both studies we observe that this focus is much more marked in the first study, as 81 out of the 95 papers analyzed were published in that field (85%), while in the most recent years the concentration of publications in Economics has decreased (roughly 70%), which could be reflecting a slight change in the areas of interest for CPB.

Research collaboration between the period 2003–2008 and 2007–2014 can be only compared in terms of organisations collaborating with CPB as this is the aspect of collaboration that was analyzed in the previous study. In this sense, Dutch organisations are the most frequent partners of CPB in publishing scientific papers in both periods. Universities like Erasmus University Rotterdam, VU University Amsterdam or the Tinbergen Institute are some examples. The strong linkages with these organisations might be partially caused by those researchers with an appointment in both, the university and the CPB.

In terms of citation impact, the comparison of the old report with the present report is not straightforward. Some indicators cannot be really compared (e.g. the mean

citation score) given the different time periods covered in the two studies and the fact that the indicator does not normalize by year and scientific field.

One possible comparison could be made using the normalized indicators, but even then it is difficult to compare the scores of the CPP/FCSm indicator with those obtained using the new MNCS, due to the differences in their calculation. Table 6 shows the scores for these two indicators, indicating that the overall MNCS is higher compared to the CPP/FCSm corresponding to the first period, however we cannot conclude that this slight increase in the score reflects a real improvement of the citation impact of CPB as the higher value of the MNCS might be caused by the way in which the MNCS is calculated as compared to the CPP/FCSm, as explained in the appendix IV.

Table 6 Comparison of the citation impact of CPB

Year	CPP/FCSm	MNCS
2003	0.8	
2004	0.69	
2005	0.45	
2006	0.82	
2007	0.55	0.63
2008		1.22
2009		0.52
2010		1.13
2011		0.57
2012		1.08
2013		0.60
Overall	0.69	0.84

4. Conclusions

In this report, we have presented a bibliometric performance analysis of CPB's research output. The analysis is based on WoS indexed publications from the period 2007–2014. This means that our results do not refer to all the scientific outputs of CPB, given that other publications not included in the WoS such as reports, books, book chapters, etc., were not analyzed.

In the period of interest, CPB published 209 documents covered by the WoS, more than 95% of which were articles or reviews. There was a drop in the publication output from 2011 to 2013, however the number of publications in 2014 increased slightly, perhaps indicating a positive trend in the publication output. This however remains to be confirmed from 2016 onwards, once more recent publication years can be analysed.

One of the most striking characteristics of CPB's research profile is the relatively high concentration of publications in a single WoS field (70% of publications), while the rest of publications are distributed quite evenly over 40 fields. Less surprising is the field concentrating most of CPB's publications: 'Economics'.

Most of CPB documents are published in collaboration, with Dutch or foreign institutions. CPB seem to benefit for international collaborations in terms of citation impact, as the impact achieved through international collaborations is significantly higher than in other types of collaboration. Publications with no collaboration have been decreasing over the analysed period. The analysis institutions that most frequently co-published papers with CPB suggest that Dutch universities are the main research partners.

The citation impact analysis indicates that the performance of CPB is slightly below the world average. In three years, 2008, 2010 and 2012 CPB performed well above the world average, especially in papers published in 2008. However, it is important to bear in mind that such world average is strongly determined by the research activity of universities and big public research organisations, which perhaps are not fully comparable with CPB given the differences in their organizational settings, objectives and the scope of the research conducted.

Therefore it is hard to provide a qualitative assessment on the performance of CPB using a worldwide average as a reference value. Another possibility that

probably would lead to more informative results is to assess the performance of CPB using as a benchmark a set of similar organization active in different countries.

A closer look to the institutes that use the knowledge generated by CPB suggest that the scientific impact of CPB goes beyond Dutch borders as an important number of foreign organisations cite its publications. However, the 'impact' analysed in this report refers only to the scientific environment, while the actual impact of CPB's research activities could have been much broader, for instance influencing economic policies in the Netherlands or even elsewhere. This broader impact could be proxied by analysing policy documents rather than in scientific publications.

The comparability of these results with those reported in the previous study is quite limited, mainly due to the methodological differences in both studies. However, those aspects that could be compared suggest an increase of the scientific output in the period 2007–2014 compared to 2003–2008, although we cannot conclude that this is an increase in productivity as we cannot compare these publications, for instance, with the number of researchers appointed to the CPB. Collaborations seem to follow the same patterns, with Dutch universities as a main research partners. The comparison in terms on citation impact does not allow us to make any conclusive assessment because of the differences in the calculation of the impact indicators in both reports.

Appendix I Additional publications suggested by CPB

Aalbers, RFT; Vollebergh, HRJ (2008). An economic analysis of mixing wastes. Environmental & Resource Economics, 39(3): 311–330

Andersson, O; Galizzi, MM; Hoppe, T; Kranz, S; van der Wiel, K; Wengstrom, E (2010). Persuasion in experimental ultimatum games. Economics Letters, 108(1): 16–18

Bettendorf, L; Devereux, MP; van der Horst, A; Loretz, S; de Mooij, RA (2010). Corporate tax harmonization in the EU. Economic Policy, 63: 537–590

Bijlsma, M; Boone, J; Zwart, G (2014). Competition leverage: how the demand side affects optimal risk adjustment. Rand Journal of Economics, 45(4): 792–815

Borghans, L; Duckworth, AL; Heckman, JJ; ter Weel, B (2008). The Economics and Psychology of Personality Traits. Journal of Human Resources, 43(4): 972–1059

Borghans, L; Meijers, H; Ter Weel, B (2008). The role of noncognitive skills in explaining cognitive test scores. Economic Inquiry, 46(1): 2–12

Borghans, L; ter Weel, B (2007). The diffusion of computers and the distribution of wages. European Economic Review, 51(3): 715–748

de Meijer, C; Wouterse, B; Polder, J; Koopmanschap, M (2013). The effect of population aging on health expenditure growth: a critical review. European Journal of Ageing, 10(4): 353–361

Dubovik, A; Parakhonyak, A (2014). Drugs, guns, and targeted competition. Games and Economic Behavior, 87: 497–507

Faber, RP; Stokman, ACJ (2009). A Short History of Price Level Convergence in Europe. Journal of Money Credit and Banking, 41(42038): 461–477

Koning, P; van der Wiel, K (2013). RANKING THE SCHOOLS: HOW SCHOOL-QUALITY INFORMATION AFFECTS SCHOOL CHOICE IN THE NETHERLANDS. Journal of The European Economic Association, 11(2): 466–493

Ter Rele, H; Labanca, C (2012). Lifetime Generational Accounts for the Netherlands. Fiscal Studies, 33(3): 399–427

van der Wiel, K (2010). Better protected, better paid: Evidence on how employment protection affects wages. Labour Economics, 17(1): 16–26

van Vuuren, D (2014). Flexible retirement. Journal of Economic Surveys, 28(3): 573–593

Vermeulenwz, W; van Ommerenz, J (2009). Compensation of Regional Unemployment in Housing Markets. Economica, 76(301): 71–88

Wouterse, B; Huisman, M; Meijboom, BR; Deeg, DJH; Polder, JJ (2013). Modeling the relationship between health and health care expenditures using a latent Markov model. Journal of Health Economics, 32(2): 423–439

Appendix II: Citation indicators

Table A2: Indicators of citation impact of the publications of CPB (2007–2013/2014)

Period	P_full	P_frac	TCS	MCS	MNCS	MNJS	PPtop10%	Ptop10%	Pnc	Int_cov
2007–2013	175	100.6	497.2	4.9	0.84	0.88	7%	6.8	28.7%	50.7%
2007	23	14.9	109.4	7.3	0.63	0.64	6%	0.8	13.4%	43.4%
2008	30	18.3	171.2	9.3	1.22	0.91	6%	1.2	24.5%	49.3%
2009	27	17.5	60.5	3.5	0.52	0.86	3%	0.5	25.8%	45.3%
2010	31	16.8	101.9	6.1	1.13	0.91	14%	2.3	23.8%	52.4%
2011	26	13.5	28.0	2.1	0.57	0.87	2%	0.3	38.2%	55.1%
2012	19	9.8	20.7	2.1	1.08	0.99	14%	1.4	33.6%	55.5%
2013	19	9.8	5.6	0.6	0.60	1.04	3%	0.3	55.7%	57.0%

Appendix III: Complete research profile

Table A3: Research profile of the CPB

WoS field	% P	MNCS
Economics	69.52	0.78
Environmental studies	3.86	0.60
Management	2.00	0.34
Urban studies	1.71	1.22
Social sciences, mathematical methods	1.67	1.86
Business, finance	1.52	0.55
Education & educational research	1.43	1.05
Statistics & probability	1.29	0.23
Energy & fuels	1.14	0.57
Health policy & services	1.14	0.61
Environmental sciences	1.10	0.91
Business	1.05	2.05
Geography	0.95	0.25
Health care sciences & services	0.95	0.60
Mathematics, interdisciplinary applications	0.90	2.90
Mathematics, applied	0.86	1.07
Astronomy & astrophysics	0.57	0.32
Gerontology	0.57	0.69
Industrial relations & labor	0.57	15.21
Law	0.57	0.65
Planning & development	0.57	0.00
Psychology, multidisciplinary	0.57	0.43
International relations	0.48	0.53
Communication	0.38	1.19
Information science & library science	0.38	1.52
Telecommunications	0.38	1.57
Computer science, interdisciplinary applications	0.29	0.00
Demography	0.29	1.13
Education, scientific disciplines	0.29	0.00
Engineering, electrical & electronic	0.29	0.00
Genetics & heredity	0.29	0.07
Mathematics	0.29	0.00
Obstetrics & gynecology	0.29	0.16
Operations research & management science	0.29	0.43

WoS field	% P	MNCS
Social sciences, interdisciplinary	0.29	1.35
Pharmacology & pharmacy	0.19	0.39
Public administration	0.19	1.30
Social issues	0.19	1.36
Social work	0.19	1.23
Transportation	0.19	1.29
Transportation science & technology	0.19	2.14

Appendix IV: Changes of bibliometric indicators of CWTS

This appendix provides a short summary of the changes in the bibliometric indicators of CWTS. These changes are the result of internal discussions within CWTS and also of recent insights in the bibliometric literature. The emphasis is on the CPP/FCSm indicator and the MNCS indicator. For a long time, CWTS has been using the CPP/FCSm indicator, but this indicator has been replaced by the MNCS indicator. Both indicators will be discussed and the advantages and disadvantages of the MNCS indicator compared with the CPP/FCSm indicator will be summarized. Some other changes in the bibliometric indicators of CWTS will be mentioned briefly.

Definitions of the CPP/FCSm indicator and the MNCS indicator

The CPP/FCSm (citations per publication / mean field citation score) indicator is defined as

$$\text{CPP/FCSm} = \frac{(c_1 + c_2 + \ldots + c_n)/n}{(e_1 + e_2 + \ldots + e_n)/n},$$

where n denotes the number of publications, c_i denotes the actual number of citations of publication *i*, and e_i denotes the expected number of citations of publication *i*. The expected number of citations of a publication is given by the average number of citations of all publications that appeared in the same field and the same year and that have the same document type (*article, letter, or review*).

The MNCS (mean normalized citation score) indicator is defined as

$$\text{MNCS} = \frac{1}{n}\left(\frac{c_1}{e_1} + \frac{c_2}{e_2} + \ldots + \frac{c_n}{e_n}\right).$$

As can be seen from the above formulas, the essential difference between the CPP/FCSm indicator and the MNCS indicator is that the former indicator is defined as a ratio of averages while the latter indicator is defined as an average of ratios.

The following example illustrates the calculation of both indicators. Suppose there are three publications, and suppose these publications have the following characteristics:

Publication	Field	Year	Actual citations	Expected citations
1	Psychiatry	2005	25	10
2	Surgery	2005	20	20
3	Surgery	2008	15	5

This yields the following indicators:

$$\text{CPP/FCSm} = \frac{(25 + 20 + 15)/3}{(10 + 20 + 5)/3} = 1.71,$$

$$\text{MNCS} = \frac{1}{3}\left(\frac{25}{10} + \frac{20}{20} + \frac{15}{5}\right) = 2.17.$$

Advantages and disadvantages of the MNCS indicator

The MNCS indicator has two important advantages compared with the CPP/FCSm indicator:

- All publications have equal weight in the MNCS indicator, while in the CPP/FCSm indicator older publications and publications from fields with a lot of citation traffic have more weight.
- The MNCS indicator is consistent, while the CPP/FCSm indicator is not. Consistency means that the way in which researchers, departments, or universities are being ranked satisfies certain logical conditions.

The MNCS indicator has two disadvantages compared with the CPP/FCSm indicator:

- The MNCS indicator can be very sensitive to citations to recent publications.
- Publications of the document type *letter* need to be treated in a special way in the MNCS indicator.

These advantages and disadvantages are discussed in more detail below.

Equal weighing of publications in the MNCS indicator

Older publications and publications from fields with a lot of citation traffic on average have a relatively large number of citations. These publications also have a large expected number of citations. In the numerator of the CPP/FCSm indicator, citations to publications from different fields and different publication years are added together. In the denominator, the same is done with expected citations. This causes older publications and publications from fields with a lot of citation traffic to

have a relatively high weight in the CPP/FCSm indicator. In the MNCS indicator, the number of citations of a publication is compared directly with the expected number of citations of the publication, without first aggregating over publications. In this way, all publications have equal weight in the indicator. CWTS regards equal weighing of publications from different fields and different publication years as the most natural way to determine the citation score of a set of publications.

The numerical example given in the previous section illustrates the difference between the CPP/FCSm indicator and the MNCS indicator. In this example, publications 1 and 3 have many more citations than expected. Publication 2 has exactly the expected number of citations. Publication 2 originates from a field in which there is much more citation traffic than in the field of publication 1. Furthermore, publication 2 is much older than publication 3. For these reasons, publication 2 has a larger expected number of citations than publications 1 and 3, and consequently publication 2 has more weight in the CPP/FCSm indicator. Since publication 2 has a lower citation impact than publications 1 and 3 (after correcting for field and publication year), giving more weight to this publication leads to a lower citation score. This explains why the MNCS indicator, which gives equal weight to all publications, yields a higher citation score than the CPP/FCSm indicator.

Consistency of the MNCS indicator

Suppose there are two universities (or departments or researchers), A and B, which have the same number of publications. Suppose the citation score of A exceeds the citation score of B. Suppose next that A and B jointly produce a new publication. Since it is a joint publication and, consequently, A and B make the same improvement, it is natural to expect that with the new publication included the citation score of A still exceeds the one of B. An indicator that guarantees this is called consistent. The CPP/FCSm indicator is not consistent. In certain cases, the way in which this indicator ranks two units relative to each other changes in a counter-intuitive manner. The MNCS indicator is consistent and therefore does not have this problem.

Sensitivity of the MNCS indicator to citations to recent publications

Recent publications have a small expected number of citations. In some cases, a relatively small number of citations to a recent publication can therefore be sufficient to get a high value for the ratio of the actual and the expected number of citations of the publication. For this reason, the MNCS indicator can be very sensitive to citations to recent publications. In some cases, this sensitivity may cause the

MNCS indicator to provide a distorted picture of the citation score of a set of publications.

CWTS has two ways of dealing with this disadvantage of the MNCS indicator. First, CWTS calculates the MNCS indicator only for publications that have had at least one year to earn citations. In this way, the expected number of citations of a publication will never be very small, and the sensitivity of the MNCS indicator to citations to recent publications will therefore be limited. Second, confidence intervals can be added to the MNCS indicator. When the MNCS indicator is heavily influenced by citations to recent publications, this will translate into wide confidence intervals.

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

The general idea of the MNCS indicator is that all publications should have equal weight. However, in the case of publications of the document type *letter*, this principle is difficult to justify. In general, it does not seem fair to give the same weight to a *letter* as to an *article* or *review*. Moreover, since *letters* often have a small expected number of citations, this would cause the MNCS indicator to be highly sensitive to citations to *letters*. For these reasons, *letters* need to be treated in a special way in the MNCS indicator. CWTS chooses to give *letters* a weight of 0.25 in the MNCS indicator. To illustrate this, let's consider the numerical example given earlier. If publication 3 in this example is of the document type *letter*, the MNCS indicator is calculated as

$$\text{MNCS} = \frac{1}{2.25}\left(\frac{25}{10} + \frac{20}{20} + 0.25 \times \frac{15}{5}\right) = 1.89 \,.$$

Practical differences between the CPP/FCSm indicator and the MNCS indicator

CWTS has extensively investigated how the CPP/FCSm indicator and the MNCS indicator differ from each other in practice. At the level of universities or large parts of universities (e.g., large faculties), the differences are typically small. Differences of more than five percent are highly exceptional at this level. At the level of departments or research groups, the differences are somewhat larger. Although also at this level there is a strong correlation between the CPP/FCSm indicator and the MNCS indicator, differences up to twenty percent are not exceptional. The main cause of differences seems to be that the MNCS indicator gives more weight to recent publications than the CPP/FCSm indicator.

Other changes in the bibliometric indicators of CWTS

In addition to the change from the CPP/FCSm indicator to the MNCS indicator, several other changes are going to take place in the bibliometric indicators of CWTS. Important changes are:

- The JCSm/FCSm (mean journal citation score / mean field citation score) indicator, which indicates the average citation score of the journals in which one has published, will be replaced by the MNJS (mean normalized journal score) indicator.

- The CPP/JCSm (citations per publication / mean journal citation score) indicator, which indicates the journal–normalized citation score of a set of publications, will be replaced by an indicator that is based on similar principles as the MNCS and MNJS indicators.

- Indicators based on counting highly cited publications are going to play a more prominent role.

- The stability of indicators is going to get more attention, for instance through the use of confidence intervals.

More information

More information on the changes in the bibliometric indicators of CWTS is available in the publications listed below. In these publications, the decision to move from the CPP/FCSm indicator to the MNCS indicator is discussed in more detail. References to other relevant literature[6,7].

---

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

[7] Waltman, L., van Eck, N.J., van Leeuwen, T.N., Visser, M.S., & van Raan, A.F.J. (in press). Towards a new crown indicator: An empirical analysis. Scientometrics. Available on http://arxiv.org/abs/1004.1632.