Quality & Quantity journal: a bibliometric snapshot

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Abstract

This article analyzes the Quality & Quantity journal from the point of view of some bibliometric indicators: the Hirsch (*h*) and the *g*-index for journals, the total number of citations, the *h*- and the *g*-spectrum. Journal time evolution is also studied and discussed in detail. As a final point, an interesting issue about how to objectively evaluate the journal popularity in the professional world – rather than the scientific/academic – is presented and left open.

Keywords: Hirsch index, *g*-index, citations, Hirsch spectrum, journal authors, academics, professionals, bibliometrics, "professionalmetrics".

1. Introduction

There is no doubt that Quality & Quantity (Q&Q) is a prestigious and popular journal in the Quality engineering and Quality management area. Owing to the novelty of the contents and their practical interest, Q&Q has an enviable diffusion. For the same reason, a peculiarity of Q&Q is to reach a large audience, consisting not only of academics of different disciplines, such as mathematics, statistics and social sciences, but also Quality practitioners/managers. Thus, Q&Q can be considered as both a scientific journal (with academic interdisciplinary vocation) and a professional journal (with professional and/or practical vocation), representing a point of contact between these two complementary worlds [Onwegbuzie et al., 2008]. The subdivision concerning the readers of Q&Q can be reasonably extended to its authors.

This article analyses Q&Q and investigates how it is changing over time from the point of view of some bibliometric indicators. Some of them – i.e. Hirsch (*h*) index, *g*-index and total number of citations (C) – are relatively diffused and others – i.e. *h*- and *g*-spectrum – are introduced for the first time to enrich the analysis.

2. Bibliometric indicators

There are many ways of monitoring a journal and to study how it changes over the years, like considering the circulation, the reputation/prestige of the editorial board or the presence of articles submitted by eminent authors [Akkerman et al., 2008]. However, these evaluations are often subjective and not very reliable. For this reason, we base the Q&Q analysis on a set of objective bibliometric indicators, which are

defined in the following subsections. Although bibliometric indicators can show some weak points, most of the time they seem to be the main way for analysing scientific journals [Leydesdorff, 2009]. Citation statistics for our analysis are collected using the Google Scholar (GS) search engine because of the greater coverage and the easy access through specially designed software interfaces (for example Publish or Perish) [Harzing and van der Wal, 2008].

h-index

The *h*-index is a relatively recent bibliometric indicator for evaluating the productivity and diffusion of one author in terms of publications and citations respectively. *h* is defined as the number such that, for one author's publications, *h* publications received at least *h* citations while the other publications received no more than *h* citations [Hirsch, 2005]. The first two columns of the table in Fig. 1 illustrates the calculation of *h* for a fictitious author. In general, the larger *h*, the larger the diffusion and prestige of one author in the scientific/professional community. Ever since its introduction, *h* received much attention and also some criticism; in any case it has the unquestionable merit of being simple, synthetic and robust [Glänzel, 2006; Franceschini et al., 2007; Franceschini and Maisano, 2009a]. Owing to these characteristics, Braun et al. (2006) proposed using the *h*-index for evaluating and comparing scientific journals. Precisely, the *h* of a journal is the number such that, for the group of articles published by the journal in a precise time period (e.g. one year), *h* articles received at least *h* citations while the others received no more than *h* citations. Thus, the way of calculation is the same as that one shown in Fig. 1, with the only exception that the articles are related to a journal (in a specific period) and not to an author. *h* is generally calculated taking into account the citations accumulated up to the moment of the analysis (in our case, July 2009).

	citations for each publication	rank	cumulative no. of citations	rank^2	
h-core	30	1	30	1	
	20	2	50	4	
	18	3	68	9	
	12	4	80	16	
	9	5	89	25	
	8	6	97	36	*g*-core
	8	**7**	105	49	
	6	8	111	64	
	6	9	117	81	
	5	10	122	100	
	4	**11**	126	121	
	3	12	129	144	
	2	13	131	169	
	2	14	133	196	
	1	15	136	225	
	1	16	137	256	
	…	…	…	…	

Fig. 1 – Example of calculation of the *h*-index and *g*-index for a (fictitious) author. Publications are sorted in descending order with respect to the citation number. In this case *h*=7 since seven publications received at least seven citations each. On the other hand, *g*=11 since the eleven most cited publications received at least 11^2 citations. It can be noticed that *h* and *g* correspond to the size of two particular subsets of the most cited publications (*h*- and *g*-core).

g-index

A variant of *h* is the *g*-index, defined as the largest number (*g*) for which the *g* most cited publications have a total of at least g^2 citations [Egghe, 2006]. Similarly to *h*, *g* is based on a comparison between number of publications and number of citations and corresponds to the size of a particular subset of the most cited

publications. The calculation of *g* is exemplified in the three right columns of the table in Fig. 1. *g* – as well as *h* – can be used for evaluating and comparing journals, but is more sensitive to highly cited publications.

Total number of citations

C is the total number of citations so far received by the journal issue(s) published in a specific period (e.g. in one year). This information is immediately available from the most diffused search engines (e.g. GS, Web of Science, Scopus) and does not require any calculation [Harzing and Van der Wal, 2008].

h- and g-spectrum

h-spectrum is defined as the distribution representing the *h*-indexes associated to the authors (and co-authors) of a specific journal, in a specific time period [Franceschini and Maisano, 2009b; Franceschini and Maisano, 2009c]. The term "spectrum" is originated from the fact that this distribution provides an image of the journal author population in a period of interest. Advantages of this new indicator are discussed later on. Finally, *g*-spectrum is analogous to *h*-spectrum but based on *g* instead of *h*.

3. Q&Q bibliometric analysis

h, g and C viewpoint

Fig. 2, and represent the values of *h, g* and C for Q&Q and two other diffused journals of the same area – i.e. Journal of Quality in Maintenance Engineering (JQME) and Quality Management Journal (QMJ) – in twenty consecutive years (from 1989 to 2008). For example, in the year 1998 *h*=10, meaning that the 10 most cited articles published in Q&Q have received at least 10 citations each. *g* values are slightly larger than *h* values, but they look rather correlated. Also, the C pattern is similar to those of *h* and *g*. In the year 1990, we can observe a peak in the Q&Q indicators' values due to the presence of a relatively large number of highly cited publications. However, indicator values show apparently random fluctuations from 1989 to 2003. Profiles of QMJ and JQME are not complete since these journals appeared for the first time after 1993 and 1995.

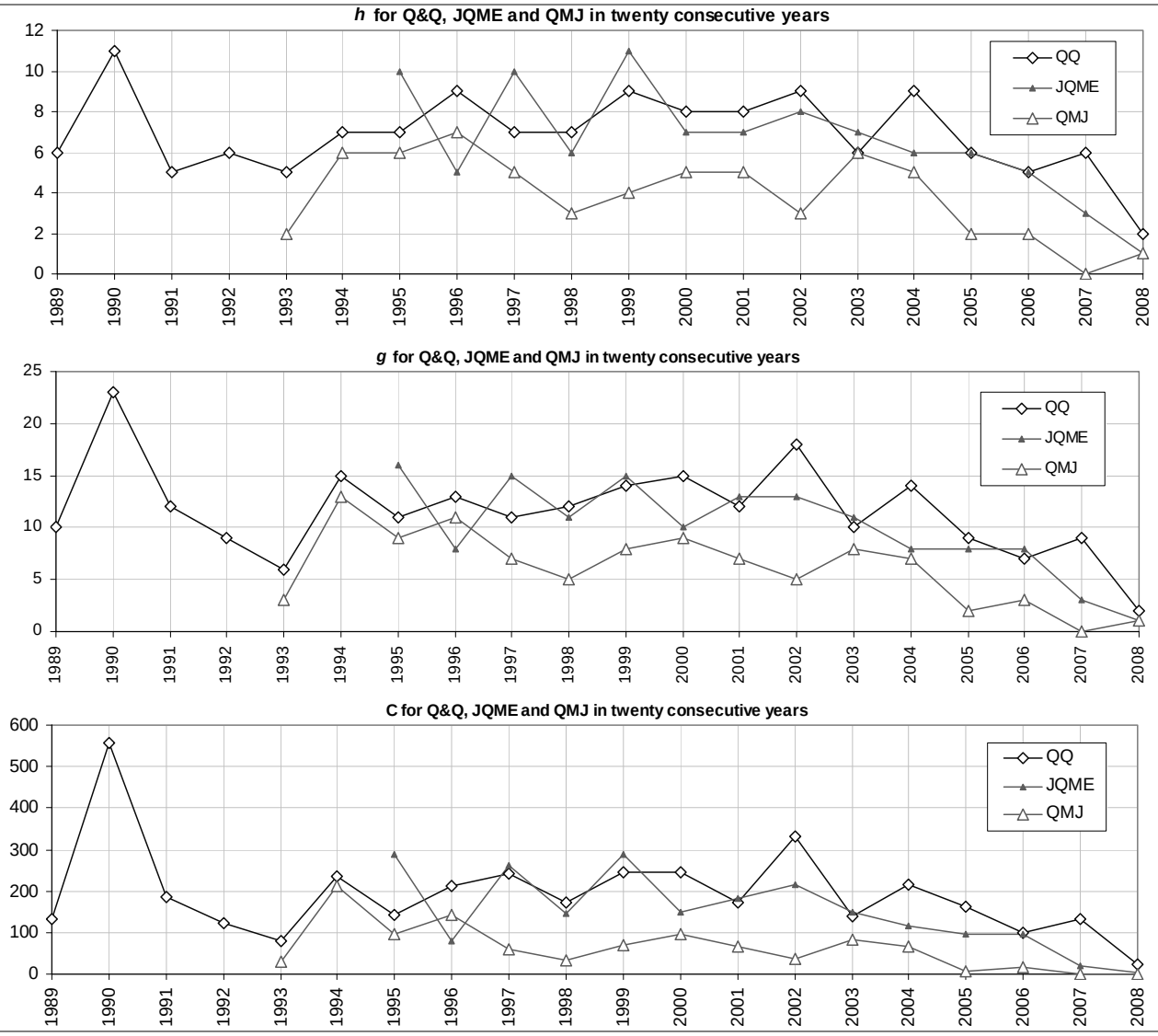


Fig. 2 − Values of *h*, *g* and C for Q&Q, Journal of Quality in Maintenance Engineering (JQME) and Quality Management Journal (QMJ), in twenty consecutive years (from 1989 to 2008). Indicators are calculated taking into account the citations accumulated up to the moment of the analysis (July 2009).

It must be point out that citation accumulation of one article requires a certain amount of time to become stable. According to some authors, about five years for journals in the management/engineering field [Amin and Mabe, 2000]. This "physiological" behaviour is well represented in Fig. 2 and applies to most of the journals: in the last years (from 2004 to 2008), *h*, *g* and C values tend to decrease and are significantly smaller than in the previous years.

h- and g-spectrum viewpoint

Fig. 3 shows the *h*- and the *g*-spectrum of Q&Q with respect to the year 2008. The number (N) of authors considered in the analysis is 84 and corresponds to the number of authors that published one (ore more) paper on Q&Q during 2008.

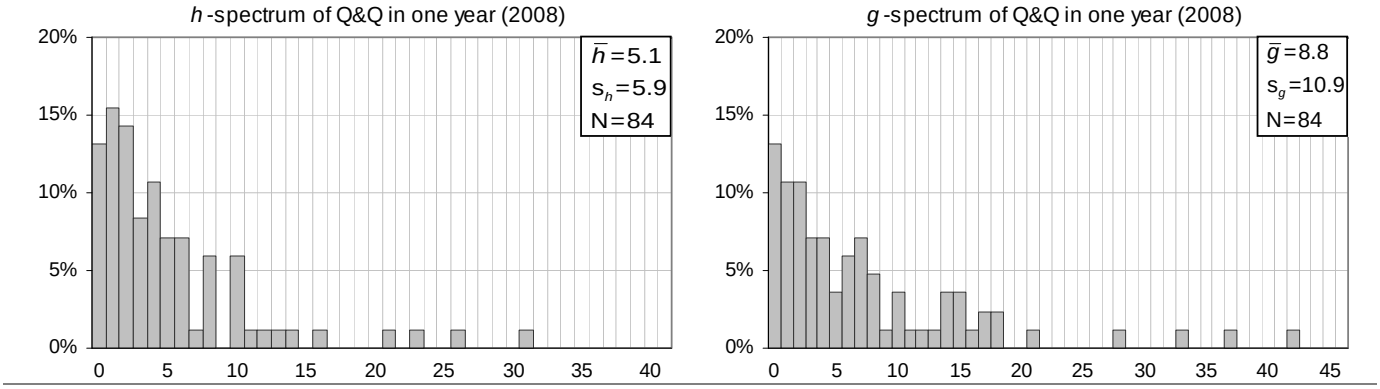


Fig. 3 − *h*- and *g*-spectrum related to Q&Q, in the year 2008. The authors' *h* and *g*-index average values ($\bar{h}$ and $\bar{g}$), the corresponding standard deviations (s_h and s_g) and the number of authors (N) are reported.

At a first glance, this distribution is right-skewed with an approximately decreasing characteristic profile. Analysing the distributions in more detail, it can be noticed that the *h*-index average ($\bar{h}$) and the standard deviation (s_h) are not very different, and s_h is slightly larger than $\bar{h}$. The same can be said for the *g*-spectrum. On the basis of this behaviour, which is also confirmed by the additional spectra contained in Fig. 4 and Fig. 5, it seems quite appropriate using $\bar{h}$ and $\bar{g}$ as a synthetic indicators to quickly evaluate and compare different spectra. *h*- and *g*-spectrum may have many different practical utilizations, such as:

- providing a "snapshot" of the author population of a specific journal, representing a reference for other (potential) authors. For example, assuming that a (potential) author with *h*=2 compares himself with the Q&Q authors in 2008, he will fall on the 43rd percentile of the corresponding *h*-spectrum, or another author with *h*=1 will fall on the 28th percentile. Of course, the same goes for *g*-spectrum. In short, *h*- and *g*-spectrum can be interpreted as a kind of "identity card" for scientific/professional journals.
- helping a journal's editorial board to periodically monitor the effect of the article selection policy and to observe the practical effects from the point of view of the population of the journal authors. In this sense, *h*- and *g*-spectrum may be interpreted as signals of editorial strategy. For example, if $\bar{h}$ increases significantly from one year to the next, it probably means that – among authors – the portion of academics tends to increase with respect to the portion of Quality professionals/managers.
- providing a rough indication on the bibliometric positioning of a journal on the scientific/professional community.

h- and *g*-spectrum can be reliable tools for evaluating a journal at the very moment of the publication, despite the fact that they are based on the publications/citations accumulated before the publication itself. There are empirical proofs of the fact that the citations received by a new article are generally consistent with the citations received by previous articles of the same author, that is to say the *author's reputation* [Castillo et al., 2007]. Being the number of authors per journal quite large (typically more than 60-70 authors per year), it is reasonable to assume that the authors' reputation will be generally respected.

The second part of our study with *h*- and *g*-spectra is aimed at finding how the Q&Q profile changes over time. To this purpose, the construction of the *h*- and *g*-spectrum is extended to the period of five consecutive years (from 2004 to 2008). Fig. 4 and Fig. 5 report the resulting spectra.

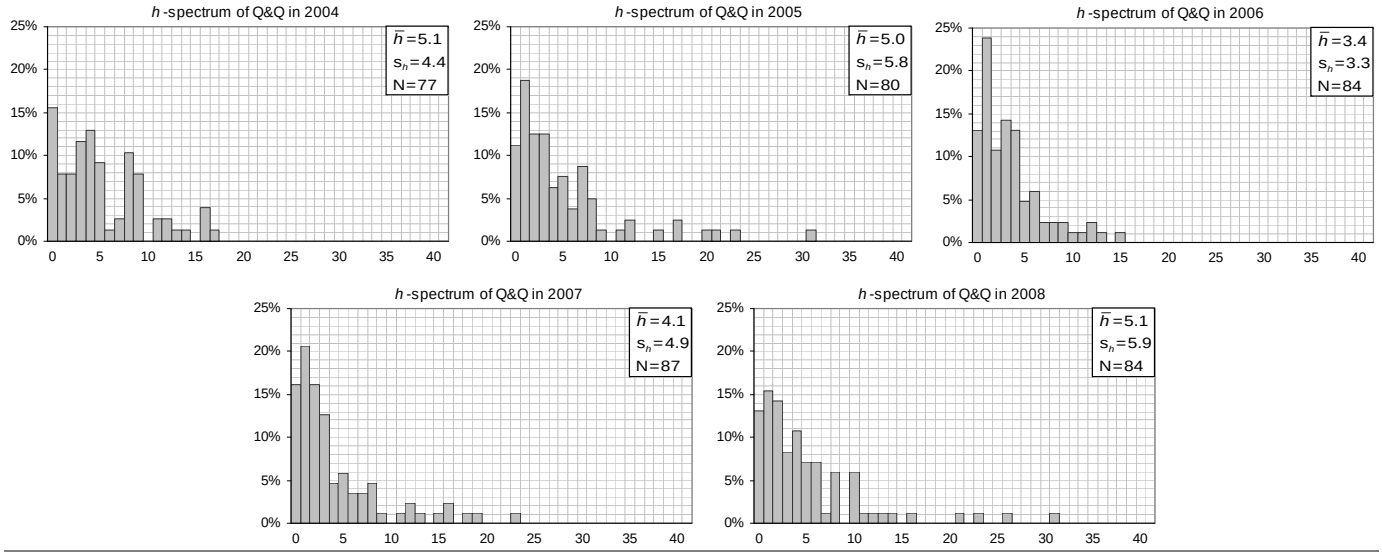


Fig. 4 – *h*-spectra for Q&Q in five consecutive years (from 2004 to 2008). Each chart reports the authors' *h*-index average value ($\bar{h}$), the corresponding standard deviation (s_h) and the number of authors (N).

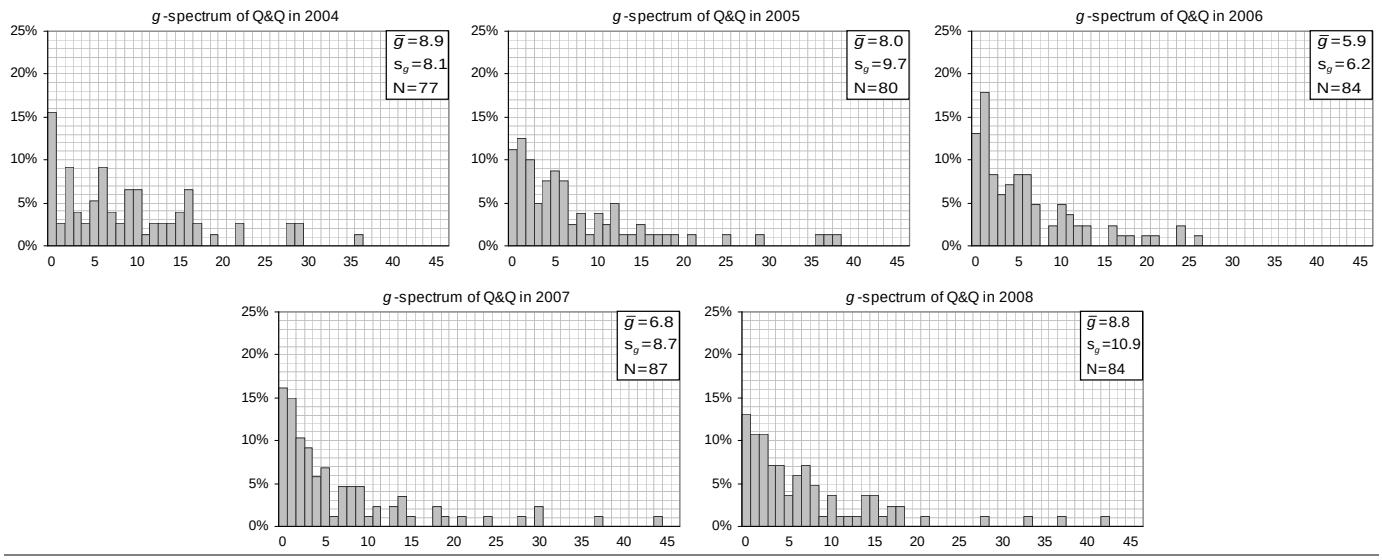
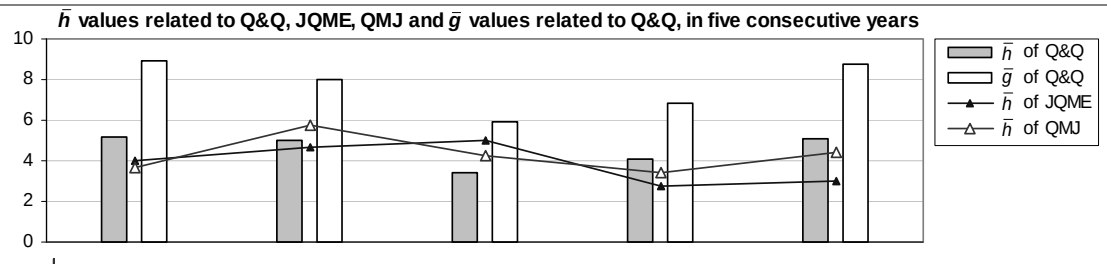


Fig. 5 – *g*-spectra for Q&Q in five consecutive years (from 2004 to 2008). For each spectrum, $\bar{g}$, s_g and N values are reported.

The shape of distributions is relatively steady over the five examined years (see Fig. 4 and Fig. 5). Two possible reasons of this general relative stability can be:

- authors of a particular journal tend to be "attracted" to it over the years;
- the editorial board policy tends to be consistent over time.

Fig. 6 shows the $\bar{h}$ and $\bar{g}$ values for Q&Q and the $\bar{h}$ for two other diffused Quality journals (JQME and QMJ).



	2004	2005	2006	2007	2008	year
$\bar{h}$ of QQ	5.1	5.0	3.4	4.1	5.0	
$\bar{g}$ of QQ	8.9	8.0	5.9	6.8	8.8	
$\bar{h}$ of JQME	4.0	4.6	5.0	2.7	3.0	
$\bar{h}$ of QMJ	3.7	5.8	4.3	3.4	4.4	

Fig. 6 – Representation of the $\bar{h}$ values related to Q&Q, JQME, QMJ and $\bar{g}$ value related to Q&Q in five consecutive years (from 2004 to 2008).

In 2006 we can observe a little reduction in the $\bar{h}$ value related to Q&Q. However, in the next two years it returns to be larger. This behaviour is amplified by the $\bar{g}$ indicator.

Since, there can be small variations from one year to the next, we noticed that the characteristic shape of a journal's *h*- and *g*-spectrum becomes more and more consolidated by increasing the reference time period. This aspect is shown in Fig. 7, reporting the *h*- and *g*-spectra of Q&Q for three different periods of interest (one year, three years and five years, respectively).

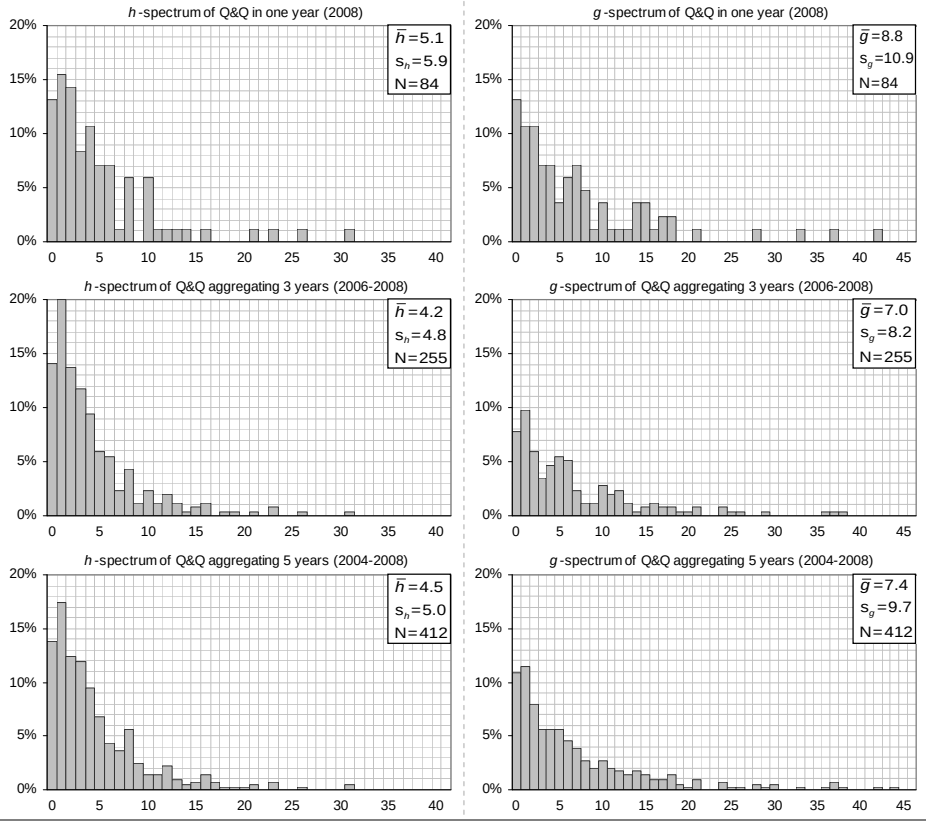


Fig. 7 – *h*- and *g*-spectrum for Q&Q, considering three different reference time periods (respectively, one year, three years and five years). For each spectrum, $\bar{h}$ - $\bar{g}$, s_h - s_g and N values are reported. It can be seen that the larger the time period, the more consolidated the journal's *h*- and *g*-spectrum.

3. An open issue for the future

The choice of *h*- and *g*-spectra has some advantages. *h* – as well as *g* – is objective, synthetic, robust and easy to calculate using data that are available from public databases. These indicators, which are based on citation statistics, were originally devised for evaluating authors from the academic world. On the other hand, it must be noticed that – in the professional and industrial world – the tendency to publish and cite other publications is smaller. In other words, the axiom: "diffusion equals citations" is not so well founded as in the academic world. For this reason, it would be a good thing to complement the *h*- and *g*-spectrum with other indicators, which make it possible to evaluate the position and the popularity of one author in the industrial and professional world as well: a kind of *p*-spectrum, being *p* an indicator for evaluating the reputation of an author in the professional world. However, finding an indicator (*p*) that is robust, synthetic and easy to calculate – like *h* and *g* – is an open issue. For example, it could be related to the number of companies in which one professional worked, the current position, the level of popularity among other professionals, etc.

In conclusion, our opinion is that bibliometric indicators have to be integrated with a new generation of "professionalmetric" indicators in order to better characterize the impact of journals.

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