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The 100 most prolific economists using the *p*-index

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Abstract In this paper, a new indicator called the performance index (*p*-index) is used to rank a 100 most prolific economists. The *p*-index strikes the best balance between activity (total citations *C*) and excellence (mean citation rate *C/P*). The surprise is that the *h*-index, which is now universally accepted almost as a canonical tool for research assessment of individuals, research faculties and institutions and even for comparing performance of journals and countries, is actually a poor indicator of performance.

Keywords Bibliometrics · *h*-index · *g*-index · *p*-index

Introduction

The *h*-index (Hirsch 2005, 2007) has rapidly captured the imagination of scientometricians and bibliometricians. It was presumed to be an easy to compute composite indicator which attempted to combine in a single number, the quality/excellence and quantity/activity of an individual (or at higher levels of aggregation, of journals, groups of scientists, institutions and even countries).

Along with acceptance, its shortcomings have also been discussed and this has led to an alphabet soup of new variants which have tried to improve on the original (Liu and Rousseau 2009). However, what has been established so far, in a self-fulfilling prophetic way, is that all these new variations correlate well with the *h*-index. Recently, a mock *h*-index has been proposed (Prathap 2009), which appears to be an ideal performance indicator. It is clear now that what one looks for in an ideal single number indicator that can capture the multi-dimensionality of the problem (i.e. evaluating activity/quantity and excellence/quality), is that it must be intuitive (Tol 2009), and must increase when the quantity (total papers *P* or total citations *C*) increases and the quality increases (mean citation rate *C/P*). It must not discount highly-cited papers, and must be sensitive to the number of uncited papers (Tol 2009). Also, it must be allowed even to exceed the number

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of papers, which the *h*-index cannot (Vinkler 2007). Another recent stipulation was that the new index must be "strictly monotonic", being able to "assign a positive score to each new citation as it occurs" (Anderson et al. 2008).

A new performance indicator

Glänzel (2008) showed that h could be related to traditional bibliometric measures like publication activity (total number of papers P), citation impact (total citations C) and quality expressed as a mean citation rate ($x = C/P$), there being a strong correlation between h and $x^{a/(a+1)}P^{1/(a+1)}$ (Schubert and Glänzel 2007). Much earlier, a similar composite indicator for journal impact was already suggested (Lindsey 1978), which allowed a reconciliation between the number of publications P and the received citations C by using a geometric mean as the balancing correction factor for the mean citation rate (C/P). The *Corrected Quality Ratio* (CQ) is then defined as $\mathrm{CQ} = (C/P) \cdot (C \cdot P)^{1/2} = (C^3/P)^{1/2}$. However, using dimensional analysis (Prathap 2009) showed that the composite indicator $(C^3/P)^{1/2}$ will then have the dimensions of $h^{5/2}$. Since CQ thus defined does not have the dimensionality of h, it can be brought back to the dimensionality of h by introducing a transformation $CQ \rightarrow CQ^{0.4}$ (Glanzel 2008) leading to the indicator $(C^3/P)^{1/5}$. An alternative approach to this based also on a Glanzel model has been offered (Csajbók et al. 2007), connecting the h-index with the number of papers and the mean citation rate per paper: $h = cn^{1/3}x^{2/3}$. The composite indicator in this case will be $(C^2/P)^{1/3}$. This is seen immediately to have the dimensions of h. Note that c is a constant of proportionality that has to be empirically determined from a fit of data and would therefore vary from case to case. Indeed, when applied to the research performance of countries in all fields (Csajbók et al. 2007), the relationship $h = 0.932n^{1/3}x^{2/3}$ ($= 0.932\ (C^2/P)^{1/3}$) is obtained with $R^2 = 0.988$.

The composite indicator $(C^2/P)^{1/3}$ has interesting properties, yet there is a cautious warning (Glanzel 2008) not to use it as a substitute the h-index. Prathap (2009) proposes that Glanzel's well meaning caveat should be disregarded and instead the indicator should be treated as a substitute or mock h, say $h_m = (C^2/P)^{1/3}$. The ratio (h_m/h) now reflects the sensitivity to the citation numbers in the tall core (citations for each paper significantly exceeding h) and the long tail (P much larger than h, and significantly, where there is a lot of uncitedness) that h by itself fails to capture. Many examples of a theoretical and empirical nature showed that while h alone permits no discrimination for many cases, h_m allows ranking to be done on a more rational basis. Indeed, it appears to deserve a legitimacy as an ideal performance index (perhaps, adding to the alphabet soup of indicators, as a p-index).

We can now re-examine the performance of this new p-index using the example of the hundred most prolific economists (Tol 2009). What is remarkable now is that Robert F. Engle rises effortlessly to the top (Table 1). The h-index is not able to do this because his output of 83 papers restricts his h-index to a low value although his mean citation rate is the highest in this list. Only the p-index captures this well. Similarly, Robert Barro benefits from this new classification, rising to third place.

Tables 2 and 3 reveal the correlation matrix connecting the various indices. It appears that the main contenders are h, g and p while the others are only of academic interest, "adding work but no insight" (Tol 2009). The p-index gives the best balance between quality (C/P) and quantity (C). This is not surprising because by definition, the performance index is based on the substitute or mock index, $p = h_m = (C \cdot (C/P))^{(1/3)}$ and has the significance of a "geometric mean" that is consistent with the dimensions of h, and

Table 1 The number of the papers, cited papers and citations; the average number of citations per paper; and the *h*-, *g*-, *f*-, *t*- and *r*-numbers of the 100 most prolific economists according to IDEAS/REPEC in May 2007

S. no.	Name	*P*	*CitedP*	*C*	*C/P*	*h*	*g*	*f*	*t*	*r*	*p*
1	Robert F. Engle	83	73	10373	125	32	83	45	55	52	109.04
2	Joseph E. Stiglitz	190	183	13565	71.4	53	113	75	85	77	98.94
3	Robert J. Barro	97	83	9501	97.9	40	97	55	65	62	97.63
4	Andrei Shleifer	111	107	10022	90.3	52	100	70	79	72	96.72
5	James J. Heckman	138	116	10081	73.1	41	100	57	66	64	90.30
6	Clive W. J. Granger	136	104	8792	64.6	36	93	50	59	58	82.83
7	Peter C. B. Phillips	160	128	7405	46.3	34	85	45	55	54	69.98
8	Lawrence H. Summers	110	96	5644	51.3	39	74	53	60	54	66.16
9	Jean Tirole	120	112	5068	42.2	46	69	60	63	56	59.82
10	Olivier Blanchard	75	64	3566	47.5	28	59	39	45	41	55.35
11	Avinash Kamalakar Dixit	91	84	3891	42.8	27	61	37	43	41	55.00
12	Martin S. Feldstein	186	164	5473	29.4	40	69	56	60	53	54.41
13	Thomas J. Sargent	84	76	3516	41.9	27	58	38	44	40	52.80
14	Alan B. Krueger	67	62	3024	45.1	27	54	38	42	38	51.49
15	Eric S. Maskin	74	70	3169	42.8	28	55	39	44	39	51.39
16	David F. Hendry	93	82	3534	38	26	58	36	42	39	51.21
17	Paul A. Samuelson	204	152	4848	23.8	33	66	46	52	47	48.66
18	Alberto Alesina	72	61	2832	39.3	27	53	37	42	38	48.12
19	James Tobin	103	63	3133	30.4	22	55	30	35	35	45.68
20	Richard B. Freeman	96	80	2757	28.7	27	51	39	43	37	42.94
21	Stephen John Nickell	78	70	2467	31.6	25	48	35	39	35	42.73
22	Walter Erwin Diewert	62	57	2195	35.4	20	46	28	33	30	42.67
23	W. Kip Viscusi	163	146	3394	20.8	31	51	43	46	40	41.34
24	Rudiger Dornbusch	96	71	2552	26.6	22	50	29	34	33	40.78
25	Jeffrey Alexander Frankel	69	62	2125	30.8	24	45	32	36	33	40.30
26	J. Scott Armstrong	74	65	2146	29	19	45	25	29	29	39.63
27	Lars E. O. Svensson	94	84	2397	25.5	23	46	37	40	33	39.39
28	M. Hashem Pesaran	92	85	2361	25.7	25	46	35	39	34	39.28
29	William A. Brock	60	53	1904	31.7	21	43	29	34	30	39.24
30	Jean-Jacques Laffont	160	135	2838	17.7	29	48	38	42	37	36.92
31	Wolfgang Karl Haerdle	86	74	2057	23.9	24	43	33	36	32	36.64
32	Ray C. Fair	59	54	1586	26.9	21	39	28	31	29	34.93
33	David B. Audretsch	81	68	1851	22.9	19	42	26	31	28	34.84
34	Daron Acemoglu	59	54	1559	26.4	22	39	29	32	29	34.54
35	Bruno S. Frey	140	123	2216	15.8	27	42	35	38	34	32.73
36	Bennett McCallum	83	69	1706	20.6	24	39	31	34	31	32.73
37	Andrew Rose	64	56	1476	23.1	22	37	28	32	29	32.41
38	Mark P. Taylor	99	91	1815	18.3	24	40	31	34	31	32.16
39	Laurence J. Kotlikoff	58	49	1370	23.6	18	36	25	28	25	31.87
40	Timothy J. Besley	62	54	1390	22.4	22	36	28	31	28	31.47
41	Lester Ingber	52	41	1266	24.3	19	35	24	27	26	31.35
42	John M. Hartwick	66	52	1335	20.2	15	36	20	23	23	30.00

Table 1 continued

S. no.	Name	*P*	*CitedP*	*C*	*C/P*	*h*	*g*	*f*	*t*	*r*	*p*
43	Richard J. Arnott	73	67	1311	18	22	34	28	30	27	28.66
44	Jere Richard Behrman	113	99	1617	14.3	24	34	30	32	29	28.50
45	Stephen J. Turnovsky	169	150	1972	11.7	24	33	30	31	28	28.44
46	David Neumark	94	78	1444	15.4	20	34	27	29	26	28.10
47	Christian S. Gourieroux	56	45	1075	19.2	14	32	20	24	21	27.43
48	Sebastian Edwards	78	63	1202	15.4	18	33	24	27	24	26.46
49	Andre de Palma	92	71	1203	13.1	19	32	26	28	25	25.06
50	Jeffrey Marc Wooldridge	39	30	765	19.6	13	27	18	20	19	24.67
51	William Arnold Barnett	58	39	920	15.9	18	29	23	25	23	24.44
52	Daniel Hamermesh	103	80	1219	11.8	18	31	26	28	24	24.34
53	John Whalley	130	92	1335	10.3	17	33	22	25	24	23.93
54	John C. Quiggin	119	94	1217	10.2	16	32	21	23	23	23.17
55	Jason Shogren	154	119	1360	8.8	19	30	25	27	24	22.90
56	Bruce D. Smith	114	89	1129	9.9	18	28	23	25	22	22.36
57	Robert D. Tollison	182	137	1412	7.8	18	31	24	26	24	22.21
58	Martin Shubik	149	103	1205	8.1	17	32	24	27	23	21.36
59	Werner Gueth	79	48	853	10.8	11	28	15	18	18	20.96
60	Robin W. Boadway	68	61	778	11.4	15	24	20	22	19	20.72
61	David M. Newbery	53	44	642	12.1	12	24	17	19	17	19.81
62	Stijn Claessens	42	34	568	13.5	13	22	16	18	17	19.73
63	Eric Ghysels	59	46	669	11.3	15	24	20	22	19	19.65
64	Stephen P. Jenkins	56	49	628	11.2	14	23	19	20	18	19.17
65	Carl Walsh	52	44	605	11.6	12	23	16	18	17	19.16
66	William Poole	44	27	551	12.5	8	23	12	14	14	19.04
67	Murray C. Kemp	129	98	917	7.1	16	25	21	23	20	18.68
68	Dermot James Hayes	62	39	635	10.2	13	24	18	20	18	18.67
69	Barry Julian Eichengreen	101	78	800	7.9	15	24	20	21	19	18.50
70	Olivia S. Mitchell	35	25	442	12.6	14	20	18	19	17	17.74
71	John Roemer	77	60	648	8.4	15	22	20	21	18	17.60
72	Ronald MacDonald	92	69	696	7.6	14	23	19	20	18	17.40
73	James Poterba	12	12	250	20.8	8	12	11	12	10	17.33
74	Bruce Alan Babcock	40	34	449	11.2	14	19	18	18	16	17.15
75	Myrna Wooders	45	37	458	10.2	11	20	16	17	15	16.70
76	Stephen M. Miller	76	57	586	7.7	12	22	17	19	16	16.53
77	Richard S.J. Tol	64	48	525	8.2	13	21	18	19	17	16.27
78	Michael McAleer	123	87	708	5.8	15	23	18	19	19	15.97
79	Frederick (Rick) van der Ploeg	80	68	567	7.1	12	19	16	17	15	15.90
80	Philip Hans Franses	142	105	695	4.9	14	19	17	18	16	15.04
81	Gilles Saint-Paul	34	23	338	9.9	9	18	12	14	13	14.98
82	David A. Peel	189	121	769	4.1	11	21	16	18	15	14.63
83	Jaime A.P. de Melo	52	48	398	7.7	10	16	14	15	13	14.50
84	Ping Wang	52	42	371	7.1	10	17	13	14	13	13.83
85	Michael David Bordo	63	45	400	6.3	9	18	14	15	13	13.64

Table 1 continued

S. no.	Name	*P*	*CitedP*	*C*	*C/P*	*h*	*g*	*f*	*t*	*r*	*p*
86	Walter Bossert	69	56	415	6	11	16	14	15	13	13.56
87	Rik Hafer	40	32	304	7.6	10	15	12	13	12	13.22
88	Joshua Aizenman	64	50	364	5.7	10	16	13	14	13	12.75
89	Philippe Michel	86	60	398	4.6	10	17	13	14	13	12.26
90	Marcel Boyer	39	31	243	6.2	8	13	11	12	10	11.48
91	Daniel L. Thornton	35	26	219	6.3	7	14	8	9	10	11.11
92	Ngo Van Long	94	56	319	3.4	9	14	12	13	11	10.27
93	Philip Arestis	62	40	237	3.8	8	12	10	11	10	9.68
94	David A. Hennessy	61	28	196	3.2	6	12	9	10	8	8.57
95	John Christopher Beghin	39	26	153	3.9	8	10	9	9	9	8.44
96	David Matthew Levinson	41	24	142	3.5	7	10	8	9	8	7.89
97	Carl Chiarella	55	29	162	2.9	7	11	9	10	9	7.81
98	Christopher F. Baum	28	15	104	3.7	5	9	7	8	7	7.28
99	Helen H. Jensen	26	16	99	3.8	7	9	8	9	8	7.22
100	Andrew Hughes Hallett	27	17	60	2.2	5	6	5	6	5	5.11

The economists are ordered according to the number of publications counted in IDEAS/REPEC (from TOL (2009)). The *p*-index now joins this list

Table 2 Correlation matrix for the various indices

	P	*CitedP*	*C*	*C/P*	*h*	*g*	*f*	*t*	*r*	*p*
P	1	0.966	0.501	0.228	0.591	0.525	0.587	0.572	0.562	0.419
CitedP		1	0.599	0.345	0.723	0.634	0.718	0.698	0.684	0.537
C			1	0.908	0.888	0.954	0.898	0.919	0.933	0.961
C/P				1	0.802	0.895	0.813	0.844	0.862	0.965
h					1	0.951	0.996	0.991	0.986	0.914
g						1	0.960	0.978	0.989	0.979
f							1	0.997	0.989	0.924
t								1	0.996	0.947
r									1	0.960
p										1

Table 3 Correlation matrix emphasizing that *p* gives the best balance between quantity (*C*) and quality (*C/P*) and that *h* is the worst of the three main contenders

	h	*g*	*p*
C	0.888	0.954	0.961
C/P	0.802	0.895	0.965

therefore should give the best balance between C and C/P for any non-linear process governed by random multiplicative processes.

Conclusions

In this paper, a corrected quality measure leading to a performance index derived from a substitute or mock h_m index which can be easily computed from traditionally compiled bibliometric indicators is used to rank a list of 100 leading economists. The newly proposed p-index should be more versatile than the h-index in that it gives the best balance between quantity and quality; indeed perhaps better than all the other variants proposed so far (Liu and Rousseau 2009).

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