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Working Paper No. 224

January 2008

A Hirsch Measure for the Quality of Research Supervision, and an Illustration with Trade Economists

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Subsequently published in "A Hirsch Measure for the Quality of Research Supervision, and an Illustration with Trade Economists", Scientometrics, Vol 80 No 3, 2009, pp.615–626.

Abstract: There is a growing literature measuring research excellence in economics. The h-index is noteworthy in combining quantity and research quality in a single measure of researcher excellence, and its ability to be extended to measure the quantity and quality of the researchers in a department. We extend the use of the first successive h-index further to measure the quality of graduate education, specifically excellence in research supervision, based on publication and citation data for individual researchers ascribed to their graduate supervisors.

Key words: h-index, international trade, PhD students
JEL Classification: A10, Z00

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1. Introduction

There is a long tradition in measuring research excellence (e.g., Kalaitzidakis *et al*., 2003). The recent introduction of the *h*-index was somewhat of a break through, combining quantity and research quality in a single measure of the excellence of a researcher (Hirsch, 2005). A successive *h*-index can readily be defined for university departments, measuring the quantity and quality of the researchers in that department (Prathap, 2006; Schubert, 2006).

Academics are supposed to do more than just research, however. Their contribution to student education is important too. Success in *undergraduate* education can be measured by the ease with which graduating students find suitable employment and their starting salaries, in the short-term, and life-time earnings and highest position reached, in the long-term. We do not study that. Instead, we introduce a measure for the quality of *graduate* education, and in particular excellence in research supervision.

A measure for the quality of research supervision is of obvious importance to prospective PhD students. It is also important to department heads in the assessment of the performance of faculty members. Recognition of excellence in research supervision may induce professors to put more effort into supervision. While it is common to refer to supervisor productivity in term of the numbers of students supervised to PhD levels, this takes no account of the quality of the graduating PhDs. Academics are of course proud of the success of some of their former PhD students, and young academics are proud to be linked to highly-regarded advisors. We measure the quality of the research supervisor by the subsequent productivity of the supervisee.[1]

Our measure is based on publication and citation data for the PhD students of a professor. One may also measure the quality of research supervision by the rank of the department that hires a PhD student, as is done by Amir and Knauff (2005). However, Combes *et al*.

[1] A less extreme assumption might be the productivity of the supervisee in the first decade following graduation. This approach applies only to PhD graduates who continue in research and ignores those increasing numbers of graduates who apply their PhD skills in government and international agencies, and in business.

(2006) show that hiring decisions are as much about networks as about quality, at least in France, and consequently hiring may not measure quality of a PhD student.

Excellence in research is a necessary but not a sufficient condition for excellence in research supervision, but recognised researchers of course also have first choice among prospective PhD students. The data do not allow us to separate these causes, but we can estimate the correlation between research quality and research-supervision quality.

We apply our new measure of excellence in research supervision to trade economists, using Deardorff's family tree,[2] which contains data on 519 people, 1,104 student-professor combinations. There are 65 professors with more than four PhD students, for a total of 356 students, and 785 student-professor combinations. As Deardorff's data may be biased (see below), the numerical results illustrate the method – rather than prove definitely who is the "best supervisor" in international trade.

Section 2 presents the methods and the data. Section 3 shows the main results. Section 4 discusses co-authorship between PhD student and supervisor. Section 5 concludes.

2. Methods and Data

The *h*-index of a researcher is the highest *h* for which holds that s/he has *h* publications that are cited at least *h* times (Hirsch, 2005). The h_1-index of a department is the highest h_1 for which holds that it has h_1 researchers with an *h*-index of at least h_1 (Prathap, 2005; Schubert, 2006).

We define research supervision quality analogously. A professor has an h_1-index for excellence in research supervision if h_1 is the highest number for which it is true that s/he has h_1 PhD students who have a *h*-index of at least h_1.

This is the successive h_1-index of Prathap (2006) and Schubert (2007), but with a different interpretation.[3] We calculate both the *h*-index and *h*-rate, i.e., the *h*-index divided by the years since the PhD was obtained. The former is a measure of life-time

[2] The only alternative to Deardorff's data that we could find is the Mathematics Genealogy project (http://genealogy.math.ndsu.nodak.edu). However, this was unsuitable as we would be unable to check the data or interpret the results. Over 100,000 mathematicians are included, and some 4,000 with more than five students.

[3] For illustration, we also show the h_2-index. A professor has an h_2-index if h_2 is the highest number for which holds that s/he has h_2 PhD students who became professors and have a h_1-index of at least h_2. Note that the historical record is not deep enough to place much weight on these data; furthermore, our data are for trade economists only, while "families" disperse into other fields.

achievement, while the second corrects for the fact that some are further along in their careers than others. Similarly, we show the h_1-index, and the h_1-rate, i.e., h_1-index divided by the years since the supervisor's first PhD student graduated.[4]

Ruane and Tol (forthcoming) use the distance from the next *h*-index value – equal to the number of additional citations needed divided by the maximum distance between index values, $2h+1$ – to define a rational *h**-index. This increases the discriminatory power of the natural *h*-index, which can be poor at low values. The *h*-index is the *h**-index rounded down to the nearest natural number. Therefore, the *h**-index varies more gradually and is therefore more robust to errors in the data, and to exclusion of papers on the basis of co-authorship, the purpose to which it is put here.

The researchers are taken from the family tree of trade economists maintained by Alan Deardorff (http://www-personal.umich.edu/~alandear/tree/INDEX.HTM). This tree has trade economists from all over the world, their supervisors and their PhD students. The data are self-reported, with quality control by Deardorff. US-based trade economists are more likely to register than researchers in other countries. Deardorff's interpretation of "trade economics" may not be universally shared.[5] Some economists have invested more time in keeping their family profile up to date than have others.[6] Note that the students identified their supervisors and teachers. In most cases, these are the formal PhD supervisors, but prominent members of the PhD committee are also listed. In a number of cases, people with a significant influence were listed as "supervisor" even if they had no formal involvement. For this paper, we use all supervisors, formal or not, to increase the sample size but also because perceived supervision is probably more important than formal supervision.

One advantage of the h_1-index is that it is robust to the number of PhD students. The h_1-index only counts the students that publish and are cited. The family tree may omit some less successful researchers, but not the top ones (by reputation). The omission of less successful PhD students does not affect the h_1-index. We do not have data on the number of PhD students per professor, so we cannot test whether there is a trade-off between the quantity of PhD students and their quality as academic researchers. We restrict our

[4] We recognize that academics vary in the points of their careers that they begin to supervise PhD students.
[5] In particular, CGE modelers are notably under-represented in the dataset.
[6] This difference seems to be most marked as between US and non-US economists.

attention to those 65 professors with 4 or more PhD students in Deardorff's family tree. See Table 1.

Data on publications, citations, and *h*-indices were taken from the *Web of Science* in September to November 2007. This is a standard database for this type of analysis. Unlike its main competitor, *Scopus*, *Web of Science* has a reasonable coverage of older journals. Many of the economists included in our data have had a long career. Almost all of the journals in the *Web of Science* databases are published in English, and this means that the publications by academics in non-English language journals are not taken into account. Publication numbers are not adjusted for co-authorship. Citation numbers are not corrected for self-citations, but the share of self-citations is necessarily low for papers that are often cited. The *h*-index only counts often cited papers and it is therefore robust to self-citations. PhD students with more than one supervisor are fully attributed to each supervisor.[7]

Table A1 shows selected characteristics of the PhD students in our sample, grouped by the university that granted the degree. Only universities with four PhD graduates or more are included; this gives us a total number of 27 universities that account for 293 of the 356 PhD students in the data set. Only three of the universities (LSE, Oxford, UC Louvain) are in Europe, and two (SFU, UBC) are in Canada; the other 22 are in the USA. Although there is some degree of bias towards North America in the Deardorff data, this also re-confirms the dominance of the USA in economics (as in many other disciplines). The h_1-index and the average *h*-index confirm the status of some of the top universities (Chicago, Harvard, MIT, Oxford, Yale) but not others (Columbia, Cornell, Princeton, Stanford). Because different schools started their PhD programmes at different times, Table A1 ranks the university by the average *h*-rate. This suggests that at least in international trade, UC LA, LSE and UC Louvain are challenging the well-established schools. However, as the data were collected and censored by professor rather than by school, these results are incomplete.

[7] We recognize that this is a limitation of the data. It will tend to overstate the productivity of supervisors who work(ed) in departments with large PhD committees.

3. Results

Table 1 contains the main results for excellence in research supervision. It shows, for each of the 65 trade professors, the number of PhD students (in Deardorff's tree), the h_1-index and the h_1-rate. The number of PhD students varies between 4 (the cut-off point) and 25 (Bhagwati). Seven of the 65 have an h_1-index that is equal to the number of included students. This is true for 1 (Robert Solow) out of 46 professors with 5 or more students. Our measure of excellence in research supervision is thus censored in the lower ranges of Table 1.

The h_1-index varies between 2 and 9. Harry Johnson is the only one with an h_1-index of 9, closely followed by Jagdish Bhagwati with 8. Five trade professors have an h_1-index of 7, and another five score h_1=6.

The h_1-index is a measure of lifetime achievement, and thus biased towards older professors. The year of first graduation ranges between 1941 and 1999; some of Gottfried Haberler's students have had 6 decades more to prove themselves than any of Scott Taylor's students. Figure 1 shows the h_1-index against the year of first graduation. Figure 1 suggests that the h_1-index increases by a fixed amount per year. Table 1 therefore shows the h_1-rate, which is the h_1-index divided by the number of years since the first graduation.

The h_1-rate varies between 0.05 and 0.31, with an average of 0.14 and a standard deviation of 0.05. Three professors stand out, having an h_1-rate that is two standard deviations (or more) above the mean: Ron Findlay, Gene Grossman and Tony Venables. Figure 2 shows the h_1-index against the h-index. Surprisingly, there is no relationship between research quality and research-supervision quality, as measured in this way.[8] There are relatively poor researchers[9] who are good professors, and good researchers who are poor professors; some individuals are both good researchers and good professors.

Figure 3 shows the h_1-rate against the h-rate. Here we do see a positive correlation between research quality and research supervision quality. However, the correlation is weak, explaining only 17% of the variance. It may be genuine, but it may also be caused

[8] This is robust against exclusion of Joe Stiglitz.

[9] Really poor researchers are unlikely to become professors, and really poor professors are unlikely to attract PhD students.

by the construction of the data set, which is biased towards those with an energetic career start and those with a long career.

We regressed the h_1-index and -rate against professorial maturity, here measured as the number of years between first publication and the first PhD graduation. There is no relationship between the h_1-index and maturity, and a weak positive one (R=0.06) between the h_1-rate and maturity. That is, researchers who start supervising at a later stage of their career, may have PhD students that progress faster. There is no apparent relationship between the *h*-index or –rate and maturity. That is, postponing supervisory duties has no effect on one's standing as a researcher.

Table 2 shows the h_2-index of grand professors of international trade – professors who have PhD students who are professors themselves and have their PhD students included in Deardorff's family tree. The data do not have sufficient historical depth and topical width to put a lot of faith in these numbers, but it is striking that Harry Johnson again comes out on top. The results suggest that he was an excellent researcher, he taught his students how to do excellent research, and he demonstrated to his students how to become excellent research advisors.[10] Johnson shares the top position with Charles Kindleberger and James Meade.

For illustration, Table 2 also shows the third to sixth successive indices.[11] There are 15 great grand professors in our data, with h_3-indices of one or two, in most cases because that is the number of their students who are grand professors. Table 2 has two great great great great grand professors: Gottfried Haberler (h_6=1) and John Maynard Keynes (h_6=1).

4. Co-authorship

In some areas, professors work directly on research with their PhD students and this serves to increase their number of publications. For the purposes of this paper, the concern is the other way around. A PhD student's publication and citation count may be

[10] See Corden *et al*. (2001) for a discussion of the personal and academic contribution of Harry Johnson to international trade.

[11] The academic family tree does not thin as rapidly as a human family tree, because there are many instances of co-supervision by professor and student. That is, one's student can be one's grand student, and one's professor can be one's grand professor. This is the case in almost 5% (17 out of 356) of our sample. Daniel Traca is Jagdish Bhagwati's student and great grand student, through Gene Grossman and Dani Rodrik. "Academic incest" has no discernable impact on performance. Splitting the sample, we find an average *h*-rate of 0.30 (0.14) for the students from student-professor committees, and an average *h*-rate of 0.31 (0.21) for other students.

inflated by co-authorship with her/his professor, which in turn inflates the h_1-index of the professor. We can test this concern.

We assessed 785 student-professor combinations. On average, 0.3 papers were published with professor and PhD student as co-authors, and these papers were cited on average 3.5 times. If these joint supervisor-supervisee publications are excluded, publications numbers of students fall on average by 2.6%, and citation numbers by 3.7%. That means that papers written together with the PhD supervisor are quoted more often than other papers. Excluding joint publications, the *h*-index falls by 0.06 points on average, or 1.7%. Figure 4 shows the *h**-index for all papers against the *h**-index for all papers published without the supervisor. Differences are small: 0.07 points or 1.9%.

In some cases, however, the supervisor does have a large effect on the publication and citation record of the PhD student. In the most extreme cases, all (cited) papers are jointly with the supervisor. In most cases, the h_1-index is not affected, however. The reason is that the *h*-indices of the relevant PhD students are either much higher or much lower than the h_1-indices of their professors, and so do not affect the latter.

Drusilla Brown is one exception, for whom h=6 for all papers, and h=5 for all papers without Alan Deardorff (or Robert Stern). One may argue that, for Alan Deardorff, h_1=5 rather than h_1=6. (For Robert Stern, h_1=5.) However, the first joint paper appeared eight years after Brown submitted her PhD; and five years after her first paper was published. We would argue that this paper was a cooperation of equals, not a co-production of PhD student and supervisor. The same cannot be said of Robert Feenstra, who significantly contributed to the oeuvre of two of his PhD students; correcting for this, Feenstra's h_1=1.

5. Discussion and conclusion

We have introduced a measure of excellence in research supervision. The measure, a successive *h*-index, combines the number of PhD students, the number of their publications, and the number of citations to their papers. We test our h_1-index for excellence in research supervision to professors of international trade. Assuming that the Deardorff data, however imperfect, are not misleading, the results confirm reputations, and make them more rigorous and objective. Using this approach, Harry Johnson was the 'best' research supervisor in international trade. Jagdish Bhagwati is the 'best' supervisor

alive when measured over a lifetime, while Tony Venables scores highest on an annual basis.

We find only weak evidence that good researchers are good supervisors or attract good students. We cannot separate these two hypotheses. We cannot control for the quality of the department either, as such data are only available for recent years.[12] We find no evidence that professors systematically neglect their PhD students to focus on their own research, or postpone such duties. However, older supervisors may be better. The assessment of research excellence is not affected by co-authorship between PhD students and supervisors. These empirical regularities are limited by the amount of data, however.

The above findings should be tested with a much larger dataset (which will need to be compiled first, for example through IDEAS/RePEc; see Zimmermann, 2007). The data used here are biased towards the USA, and limited to a narrow sub-discipline. A larger data-set would allow for more rigorous econometrics, and for more hypotheses to be tested – including the hypothesis that the h_1-index is a good indicator for research supervision quality. A larger data-set would also allow for the computation of the second successive *h*-index, which would measure the research supervision excellence of a department, which is important given the collective nature of graduate education, and because many PhD students are at first undecided as to their exact area of specialisation.

Acknowledgements

Alan Deardorff gracefully shared the data behind his family tree. Alan Deardorff, Tom Hertel, Ron Jones, Jim Markusen, Peter Neary and Iulia Traistaru-Siedschlag had useful comments on an earlier draft.

[12] Our methodology ignores the fact that graduate students may be more concentrated than researchers, for example in graduate schools. Researchers at larger graduate schools may attract better students. Hence, our measure may overstate the 'productivity' of those economists based at larger centres.

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Table 1. Selected characteristics of professors of trade economics: *h*-index (h), year of first publication (yfp), *h*-rate (hr = h/(2008-yfp)), number of PhD students, h_1-index (h_1), year of first graduation (yfg), and h_1-rate ($h_1r = h_1/(2008-yfg)$).

Name	h	yfp	hr	# PhD	h_1	yfg	h_1r
Johnson, Harry G.	18	1956	0.346	14	9	1956	0.173
Bhagwati, Jagdish N.	25	1957	0.490	25	8	1969	0.205
Findlay, Ronald	11	1959	0.224	13	7	1981	0.259
Baldwin, Robert E.	12	1966	0.286	16	7	1969	0.179
Jones, Ronald W.	19	1956	0.365	22	7	1962	0.152
Kindleberger, Charles P.	8	1956	0.154	11	7	1956	0.135
Samuelson, Paul A.	33	1942	0.500	8	7	1956	0.135
Grossman, Gene M.	28	1978	0.933	13	6	1985	0.261
Deardorff, Alan V.	12	1970	0.316	24	6	1978	0.200
Krugman, Paul R.[a]	31	1976	0.969	10	6	1974	0.176
Ethier, Wilfred J.	13	1970	0.342	11	6	1973	0.171
Haberler, Gottfried	3	1956	0.058	10	6	1941	0.090
Dixit, Avinash K.	28	1969	0.718	11	5	1984	0.208
Staiger, Robert W.	13	1985	0.565	16	5	1984	0.208
Leamer, Edward E.	19	1968	0.475	6	5	1980	0.179
Dornbusch, Rudiger	22	1971	0.595	8	5	1975	0.152
McKinnon, Ronald E.	13	1962	0.283	6	5	1971	0.135
Stern, Robert M.	9	1959	0.184	13	5	1970	0.132
Cooper, Richard N.	6	1963	0.133	6	5	1965	0.116
Mundell, Robert A.	12	1957	0.235	8	5	1961	0.106
Meade, James	10	1956	0.192	8	5	1956	0.096
Solow, Robert M.	27	1956	0.519	5	5	1956	0.096
Venables, Anthony J.	17	1982	0.654	10	4	1995	0.308
Krishna, Kala	7	1987	0.333	8	4	1989	0.211
Markusen, James	25	1975	0.758	9	4	1986	0.182
Sachs, Jeffrey D.	29	1979	1.000	5	4	1986	0.182
Neary, J. Peter	17	1972	0.370	4	4	1985	0.174
Srinivasan, T.N.	18	1962	0.391	5	4	1985	0.174
Batra, Raveendra	13	1968	0.325	4	4	1976	0.125
Richardson, J. David	8	1970	0.211	11	4	1974	0.118
Mirrlees, James	16	1962	0.348	4	4	1973	0.114
Bardhan, Pranab	13	1965	0.302	4	4	1971	0.108
Chang, Winston W.	5	1976	0.156	5	4	1971	0.108

Name	h	yfp	hr	# PhD	h_1	yfg	h_1r
Ingram, James	3	1956	0.058	4	4	1967	0.098
Chipman, John	15	1956	0.288	5	4	1966	0.095
Balassa, Bela	16	1959	0.327	5	4	1965	0.093
Caves, Richard	22	1957	0.431	8	4	1964	0.091
Corden, W. Max	13	1957	0.255	4	4	1962	0.087
Baldwin, Richard E.	11	1987	0.524	4	3	1994	0.214
Gabscewicz, Jean Jaskold	11	1971	0.297	5	3	1990	0.167
Levinsohn, James	11	1988	0.550	7	3	1990	0.167
Copeland, Brian R.	12	1989	0.632	5	3	1989	0.158
Grinols, Earl	7	1976	0.219	5	3	1983	0.120
Helpman, Elhanan	27	1974	0.794	7	3	1983	0.120
Stiglitz, Joseph E.	54	1966	1.286	4	3	1981	0.111
Sapir, Andre	9	1974	0.265	4	3	1980	0.107
Brecher, Richard	14	1974	0.412	5	3	1979	0.103
Tower, Edward	7	1965	0.163	5	3	1979	0.103
McCulloch, Rachel	6	1973	0.171	4	3	1978	0.100
Kreinin, Mordechai E.	10	1956	0.192	5	3	1969	0.077
Kemp, Murray C.	17	1957	0.333	4	3	1961	0.064
Leontief, Wassily	10	1947	0.164	5	3	1941	0.045
Taylor, M. Scott	10	1993	0.667	5	2	1999	0.222
Greenaway, David	18	1978	0.600	5	2	1996	0.167
McLaren, John E.	6	1989	0.316	4	2	1995	0.154
Rodrik, Dani	20	1981	0.741	4	2	1995	0.154
Onida, Fabrizio	0	1969	0.000	5	2	1994	0.143
Rauch, James	11	1986	0.500	4	2	1994	0.143
Feenstra, Robert C.	18	1980	0.643	4	2	1993	0.133
Panagariya, Arvind	12	1979	0.414	5	2	1988	0.100
Maskus, Keith E.	9	1981	0.333	5	2	1986	0.091
Whalley, John	17	1973	0.486	5	2	1984	0.083
Grubel, Herbert	11	1961	0.234	4	2	1974	0.059
Krueger, Anne O.	17	1961	0.362	7	2	1971	0.054

[a] Kwan Koo Yun graduated three years before one of his identified ‘supervisor’, Paul Krugman.

Table 2. Successive *h*-indices of grand professors (professors who have at least four PhD students who are professors with at least four PhD students themselves).

Name	h	h_1	h_2	h_3	h_4	h_5	h_6
Johnson, Harry G.	18	9	4	2	1	1	
Kindleberger, Charles P.	8	7	4	2	1	1	
Meade, James	10	5	4	1	1	1	
Haberler, Gottfried	3	6	3	2	2	1	1
Keynes, John Maynard[a]	3	2	2	2	1	1	1
Solow, Robert M.	27	5	3	2	1		
Mundell, Robert A.	12	5	3	1	1		
Bhagwati, Jagdish N.	25	8	3	1			
Jones, Ronald W.	19	7	3	1			
Grossman, Gene M.	28	6	3				
Dixit, Avinash K.	28	5	3				
Samuelson, Paul A.	33	7	2	2	1		
Mirrlees, James	16	4	2	1			
Krugman, Paul R.	31	6	2				
Stern, Robert M.	9	5	2				
Caves, Richard	22	4	2				
Leontief, Wassily	10	3	1	1	1	1	
Dornbusch, Rudiger	22	5	1	1			
Balassa, Bela	16	4	1	1			
Corden, W. Max	13	4	1	1			
Baldwin, Robert E.	12	7	1				
Deardorff, Alan V.	12	6	1				
McKinnon, Ronald E.	13	5	1				
Cooper, Richard N.	6	5	1				
Markusen, James	25	4	1				
Srinivasan, T.N.	18	4	1				
Neary, J. Peter	17	4	1				
Stiglitz, Joseph E.	54	3	1				
Sapir, Andre	9	3	1				

[a] Keynes has only two PhD students (Johnson, Meade) in Deardorff's family tree, and was therefore excluded from Table 1.

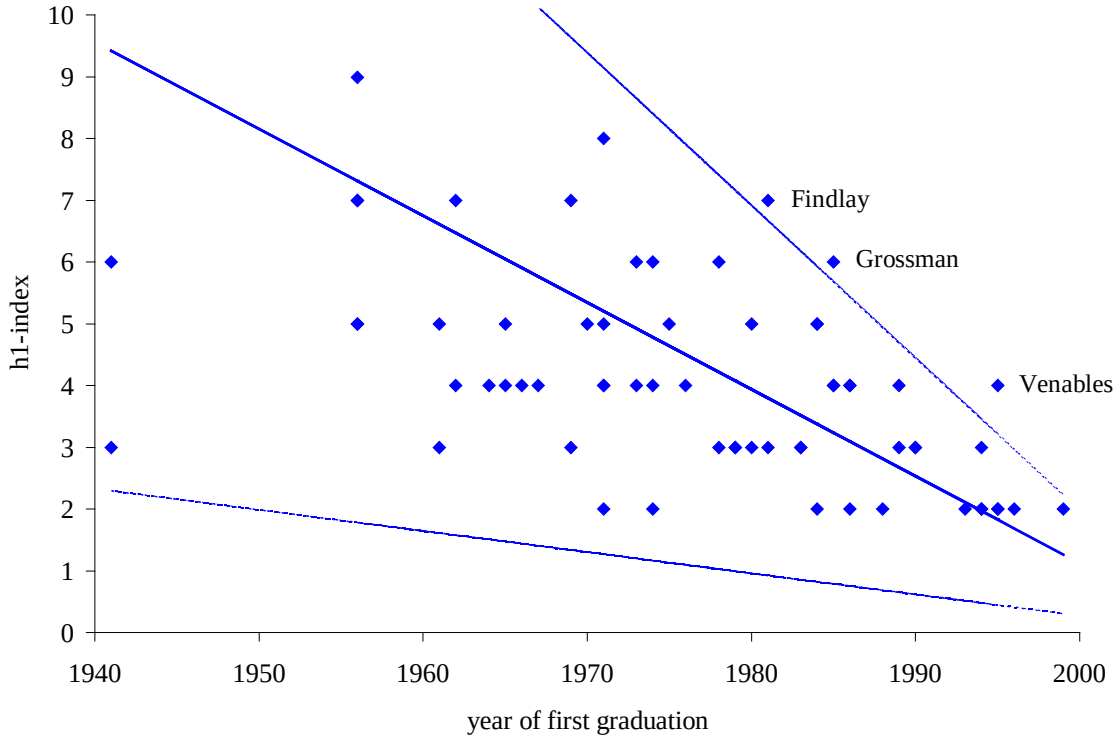

Figure 1. The h_1-index of excellence in research supervision as a function of the year that the first PhD student graduated. The lines represent the mean, and the mean plus or minus twice the standard deviation.

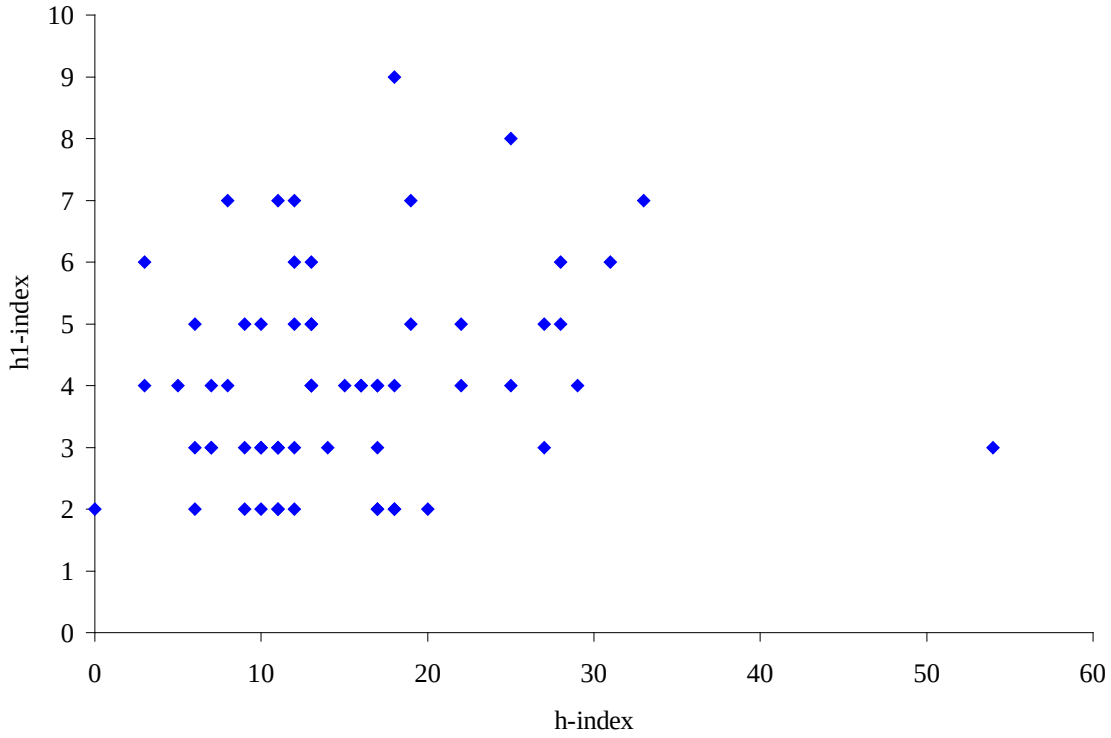

Figure 2. The h_1-index of excellence in research supervision as a function of the h-index of excellence in research.

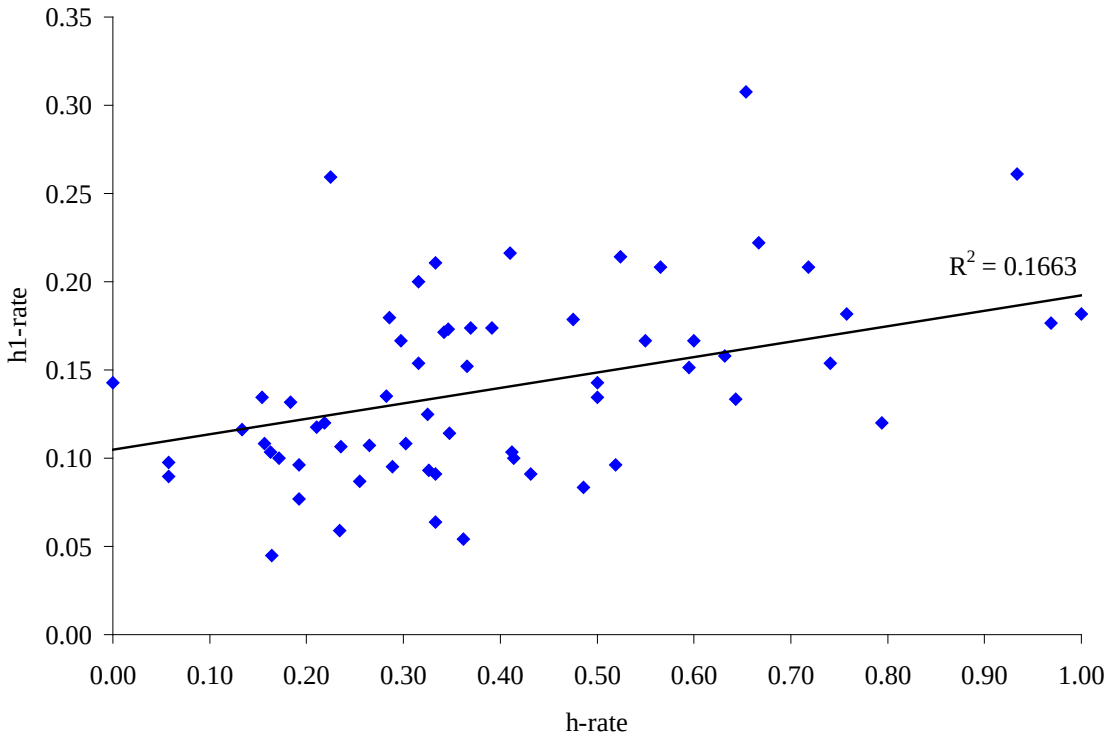

Figure 3. The h_1-rate of excellence in research supervision as a function of the h-rate of excellence in research.

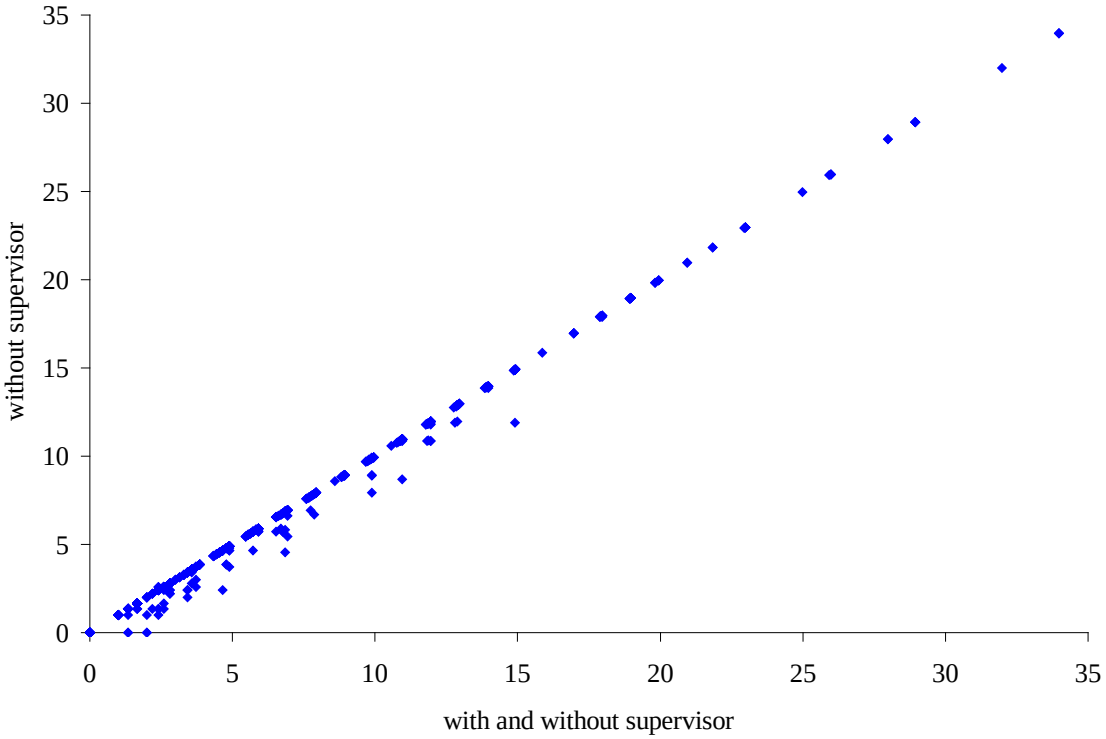

Figure 4. The *h**-index of excellence in research supervision for all papers written without the PhD supervisor as a function of the *h**-index for all papers.

Table A1. Selected characteristics of the degree-granting universities: number of PhD students, average year of graduation, h_1-index, average h-index, and average h-rate.

University	#PhD	year	h_1	avg h	h-rate
UC LA	6	1989	5	8.7	0.48
MIT	28	1979	12	12.6	0.48
Yale	12	1978	8	10.3	0.41
Stanford	18	1988	8	7.2	0.39
UC Louvain	5	1997	3	3.6	0.36
LSE	7	1988	3	6.0	0.36
Chicago	6	1973	5	11.7	0.35
Columbia	20	1991	7	5.3	0.34
Princeton	16	1991	6	5.8	0.34
Oxford	8	1974	6	10.0	0.32
Wisconsin	25	1988	7	5.4	0.32
British Columbia	4	1993	3	3.5	0.32
Michigan	33	1989	8	5.1	0.31
Harvard	31	1975	10	8.3	0.28
Johns Hopkins	6	1972	4	9.7	0.27
Colorado (Boulder)	5	1994	2	3.4	0.27
UC San Diego	4	1997	2	2.0	0.26
Pennsylvania	10	1988	2	4.5	0.26
Minnesota	5	1975	4	7.0	0.24
Michigan State	6	1983	3	5.2	0.24
Buffalo	5	1984	4	4.4	0.21
North Carolina	4	1978	4	6.0	0.20
Cornell	4	1978	4	6.0	0.20
Rochester	12	1977	5	6.0	0.19
Duke	4	1984	2	4.8	0.19
Simon Fraser	4	1979	2	5.0	0.15
Maryland	5	1993	2	1.4	0.09

Year	Number	Title/Author(s) ESRI Authors/Co-authors Italicised
2008	223	Environmental Accounts for the Republic of Ireland: 1990-2005 *Seán Lyons, Karen Mayor* and *Richard S.J. Tol*
2007	222	Assessing Vulnerability of Selected Sectors under Environmental Tax Reform: The issue of pricing power *J. Fitz Gerald,* M. Keeney and *S. Scott*
	221	Climate Policy Versus Development Aid *Richard S.J. Tol*
	220	Exports and Productivity – Comparable Evidence for 14 Countries The International Study Group on Exports and Productivity
	219	Energy-Using Appliances and Energy-Saving Features: Determinants of Ownership in Ireland *Joe O'Doherty, Seán Lyons* and *Richard S.J. Tol*
	218	The Public/Private Mix in Irish Acute Public Hospitals: Trends and Implications *Jacqueline O'Reilly* and *Miriam M. Wiley*
	217	Regret About the Timing of First Sexual Intercourse: The Role of Age and Context *Richard Layte*, Hannah McGee
	216	Determinants of Water Connection Type and Ownership of Water-Using Appliances in Ireland *Joe O'Doherty, Seán Lyons* and *Richard S.J. Tol*
	215	Unemployment – Stage or Stigma? Being Unemployed During an Economic Boom *Emer Smyth*
	214	The Value of Lost Load *Richard S.J. Tol*
	213	Adolescents' Educational Attainment and School Experiences in Contemporary Ireland *Merike Darmody, Selina McCoy, Emer Smyth*

212 Acting Up or Opting Out? Truancy in Irish Secondary Schools
Merike Darmody, Emer Smyth and *Selina McCoy*

211 Where do MNEs Expand Production: Location Choices of the Pharmaceutical Industry in Europe after 1992
Frances P. Ruane, Xiaoheng Zhang

210 Holiday Destinations: Understanding the Travel Choices of Irish Tourists
Seán Lyons, Karen Mayor and *Richard S.J. Tol*

209 The Effectiveness of Competition Policy and the Price-Cost Margin: Evidence from Panel Data
Patrick McCloughan, *Seán Lyons* and William Batt

208 Tax Structure and Female Labour Market Participation: Evidence from Ireland
Tim Callan, A. Van Soest, *J.R. Walsh*

207 Distributional Effects of Public Education Transfers in Seven European Countries
Tim Callan, Tim Smeeding and Panos Tsakloglou

206 The Earnings of Immigrants in Ireland: Results from the 2005 EU Survey of Income and Living Conditions
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Seán Lyons, Karen Mayor and *Richard S.J. Tol*

204 The Adoption of ICT: Firm-Level Evidence from Irish Manufacturing Industries
Stefanie Haller and *Iulia Traistaru-Siedschlag*

203 EU Enlargement and Migration: Assessing the Macroeconomic Impacts
Ray Barrell, *John Fitz Gerald* and Rebecca Riley

202 The Dynamics of Economic Vulnerability: A Comparative European Analysis
Christopher T. Whelan and *Bertrand Maître*