

Electronic journals: modeling journal spend, use and research outcomes

Ian Rowlands
CIBER Group
University College London

IX Workshop Rebuin sobre Proyectos Digitales
Universidad de Salamanca, 2 October 2009

Study aims and objectives

RESEARCH QUESTIONS

How have researchers responded to the unprecedented levels and convenience of access to scholarly journals?

Has enhanced access to the literature led to greater productivity, research quality and other outcomes?

RESEARCH OBJECTIVES

- ★ investigate researchers' information-seeking behaviour;
- ★ ascertain whether researchers' behaviours vary by subjects and disciplines, or in relation to the institutions in which they work;
- ★ consider any evidence of relationships between researchers' behaviours and usage, and institutional expenditure on e-journals;
- ★ consider any evidence of relationships between researchers' behaviours on the one hand and research productivity.

Research design

top down



database of UK university indicators

bottom up



deep log analysis of UK university departments

Case study institutions

University of Aberdeen
Bangor University
University of Cambridge
Centre for Ecology & Hydrology (CEH)
University of Edinburgh
University of Manchester
Rothamsted Research
University of Strathclyde
University of Wales Swansea
University College London

Case study subjects

Chemistry and chemical engineering
Earth and environmental sciences
Economics and econometrics
History
Life sciences and agriculture
Physics

The study in context

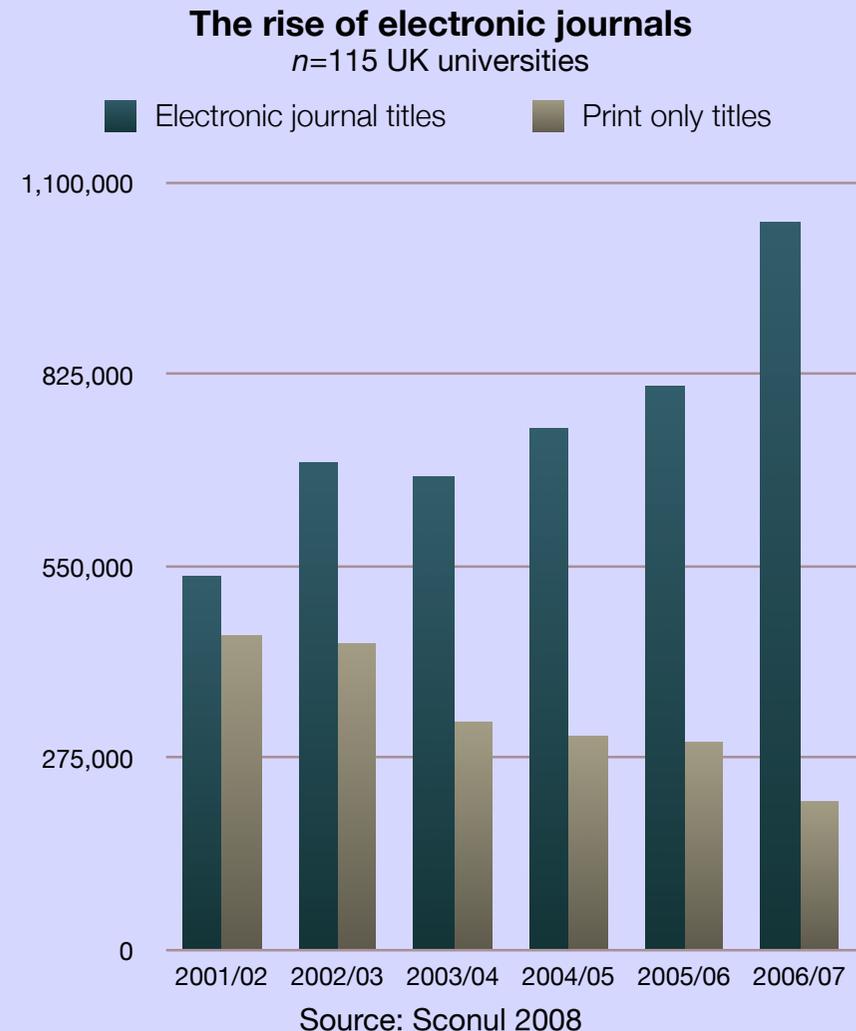
The rise of e-journal provision

It is now estimated that 96.1 per cent of journal titles in science, technology and medicine, and 86.5 per cent of titles in the arts, humanities and social sciences are now available online¹.

The scale of the e-journals enterprise is now enormous:

- ★ UK universities and colleges spent nearly £80 million licensing electronic journals in 2006/07;
- ★ we estimate that university researchers and students downloaded almost 102 million articles during that period;
- ★ downloads cost, on average, 80 pence.

¹John Cox Associates for ALPSP, *Scholarly Publishing Practice Survey 2008*).



Rapid consumer take-up

UK universities have taken full advantage of the enhanced provision of e-journals over the past five years.

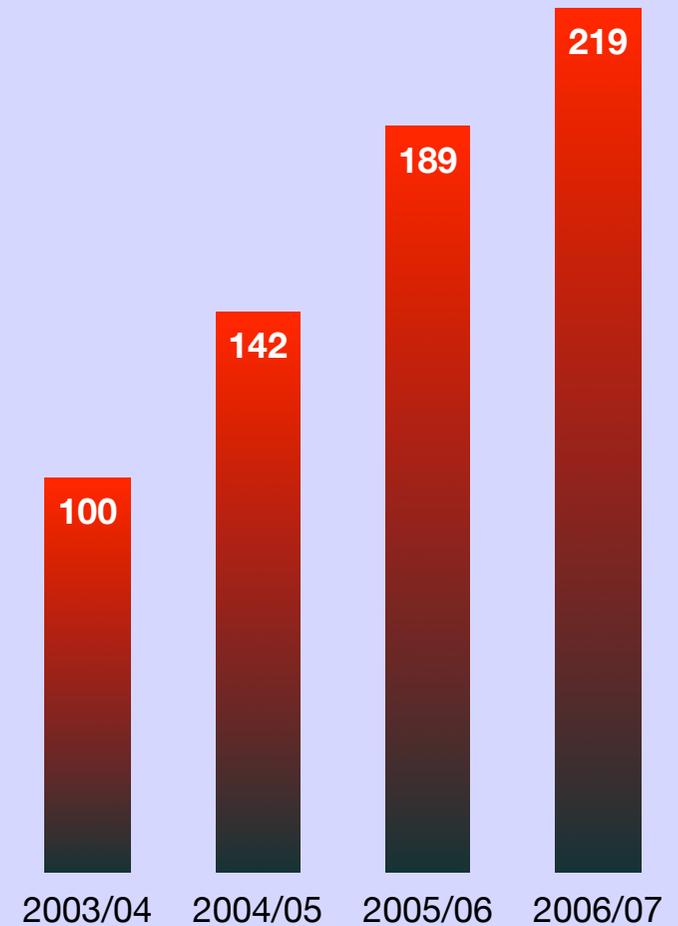
The graph opposite shows the number of full text article downloads (from all publishers). Downloads are indexed to 100 for the academic year 2003/04 for ease of comparison.

In just three years:

- ★ total use more than doubled
- ★ ... at a staggering compound annual growth rate (CAGR) of 21.7 per cent per annum.

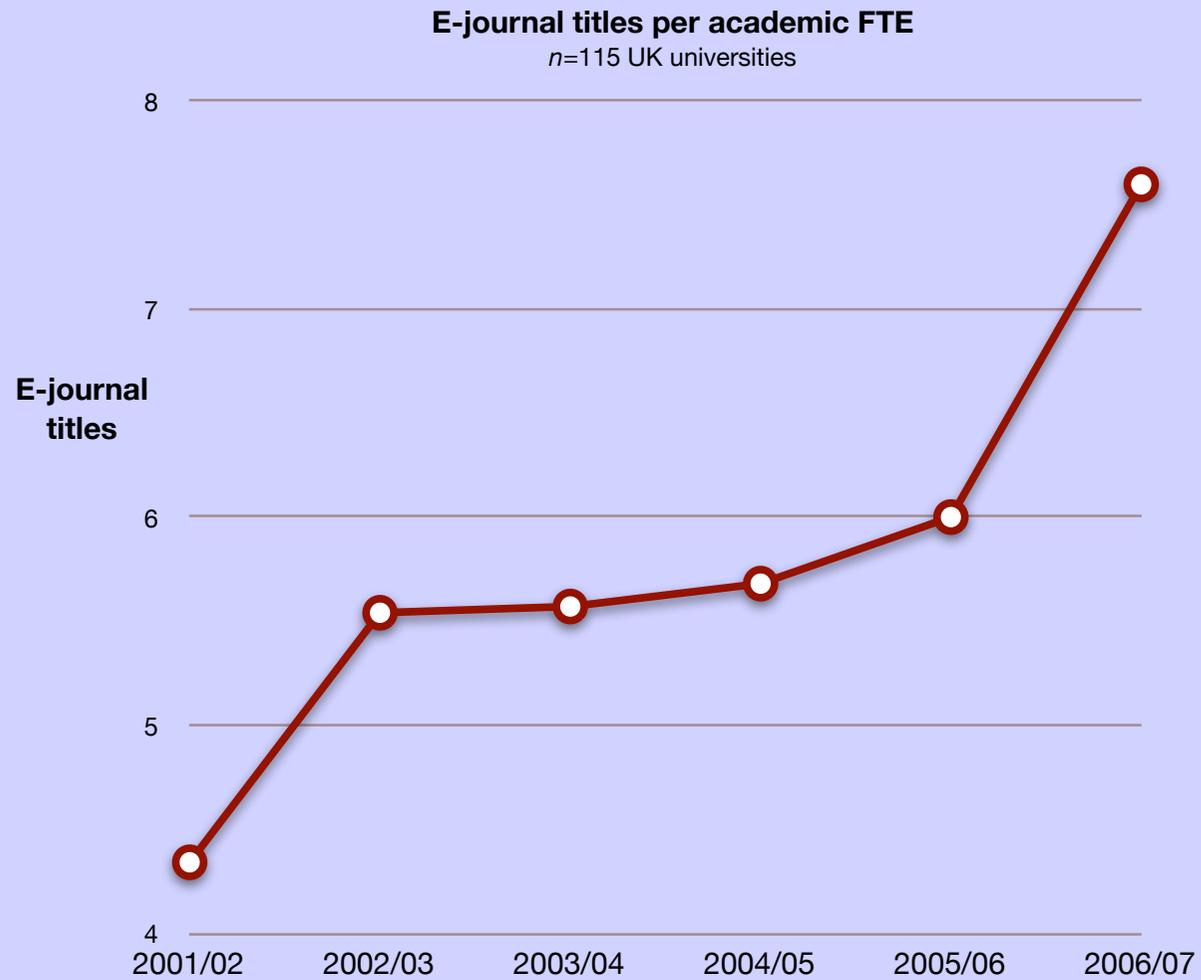
The growth in article downloads

n=67 UK universities



Source: Sconul / COUNTER 2008

Massive expansion of choice



Source: Sconul / COUNTER 2008

Intense activity across all subjects

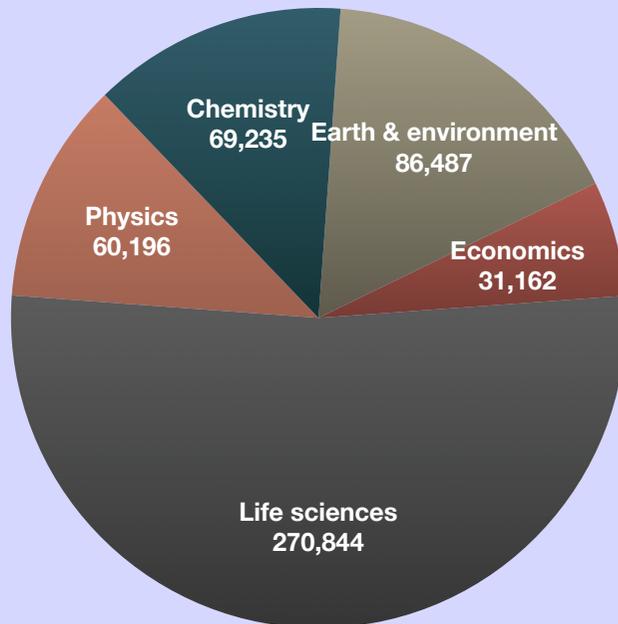
Deep log analysis of ScienceDirect

Deep log analysis offers unique insights into user behaviour.

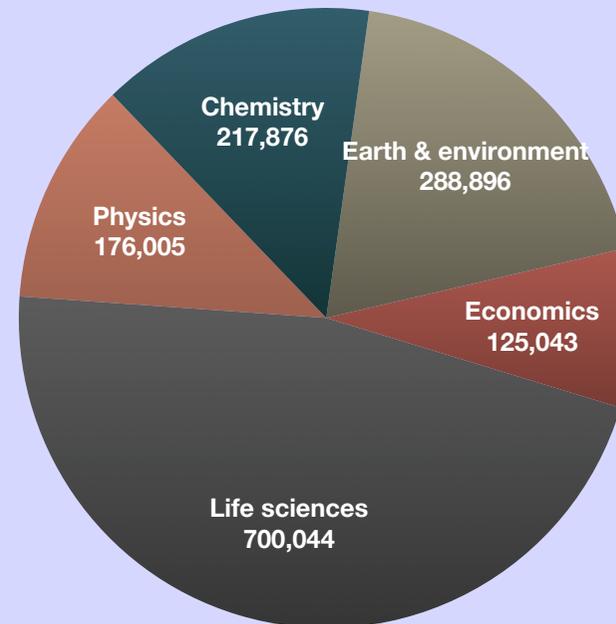
These pie charts convey something of the sheer scale and intensity of use made of e-journals.

The numbers are mind-boggling: and all this activity at just ten institutions over the first four months of 2008.

Sessions



Page views



Information-seeking behaviour

Google is hugely popular and influential

Deep log analysis of ScienceDirect and Oxford Journals



Once journal content is opened up to Google for indexing, Google is then used by large numbers of even the most proficient and informed information seekers.

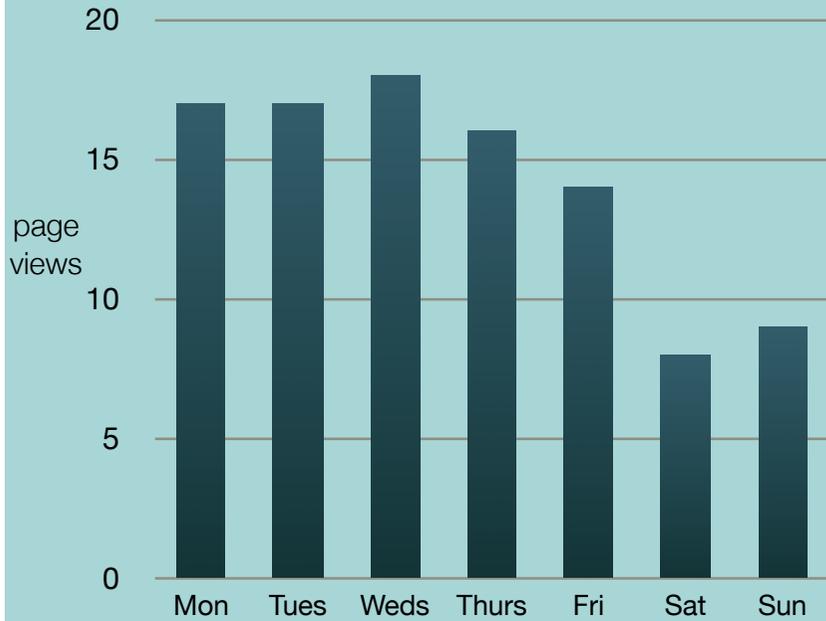
Just four months after ScienceDirect content in physics was opened up to Google, more than a third of all traffic arrived via this route. This is particularly notable in a field richly endowed with online information resources.

Google's popularity is also shown in the case of Oxford Journals where Google has had access for some years: over half of their traffic comes via Google, especially in the case of 'super-users'.

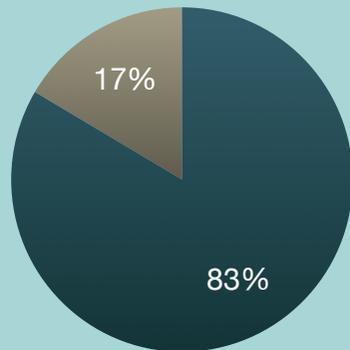
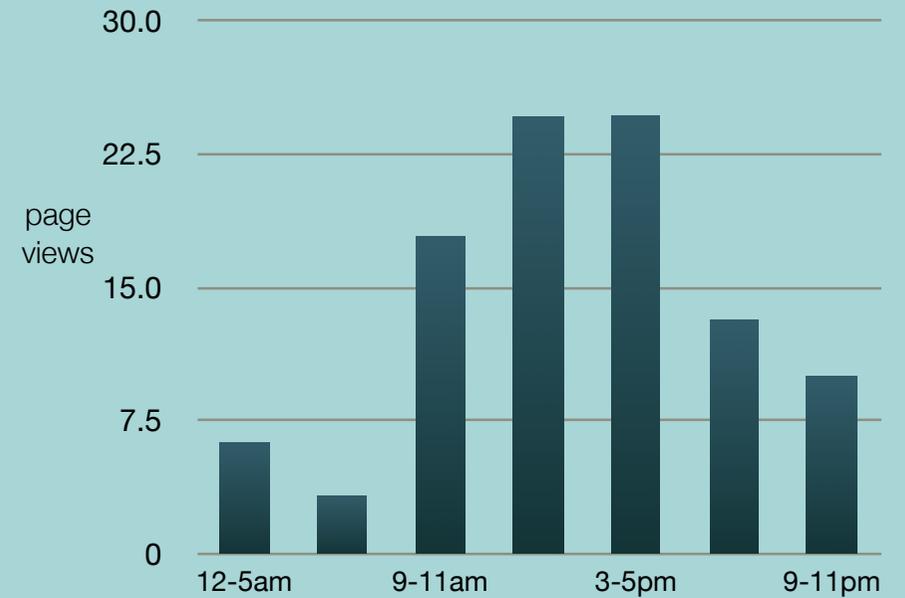
UK readers burn the candle at both ends

Deep log analysis of ScienceDirect

A working week in economics

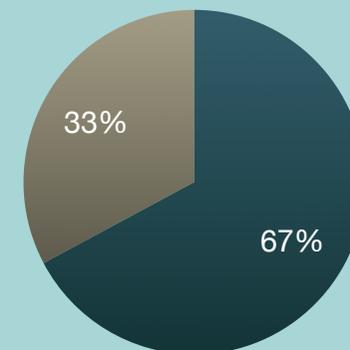


A working day in economics



Monday to Friday Weekends

Users are making the fullest possible use of e-journals.



Office hours Outside 9-5

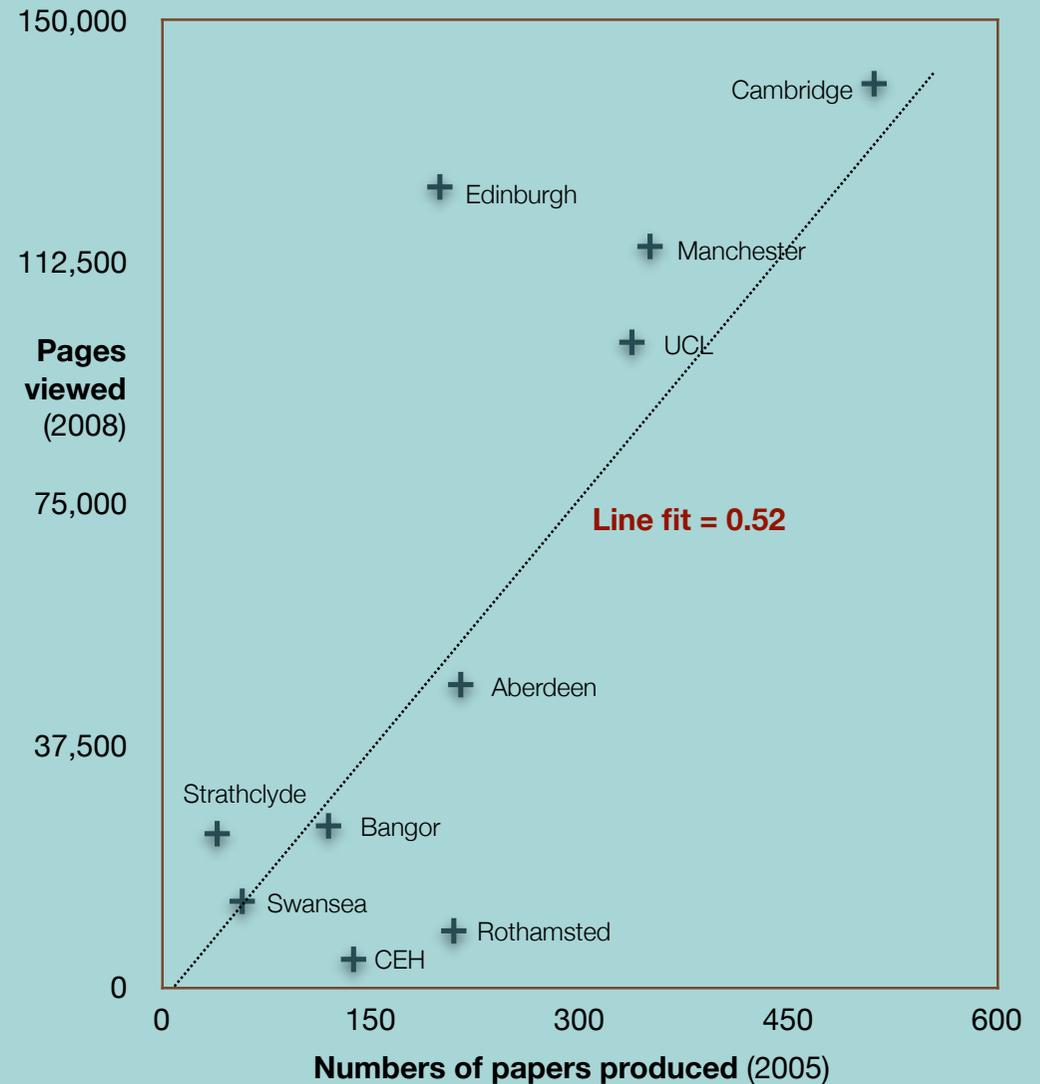
Page views and publications: a link?

Deep log analysis of ScienceDirect

Life sciences

This chart shows a strong correlation between page views and articles published at each institution.

Does this mean that information consumption and production are in some way related to each other?



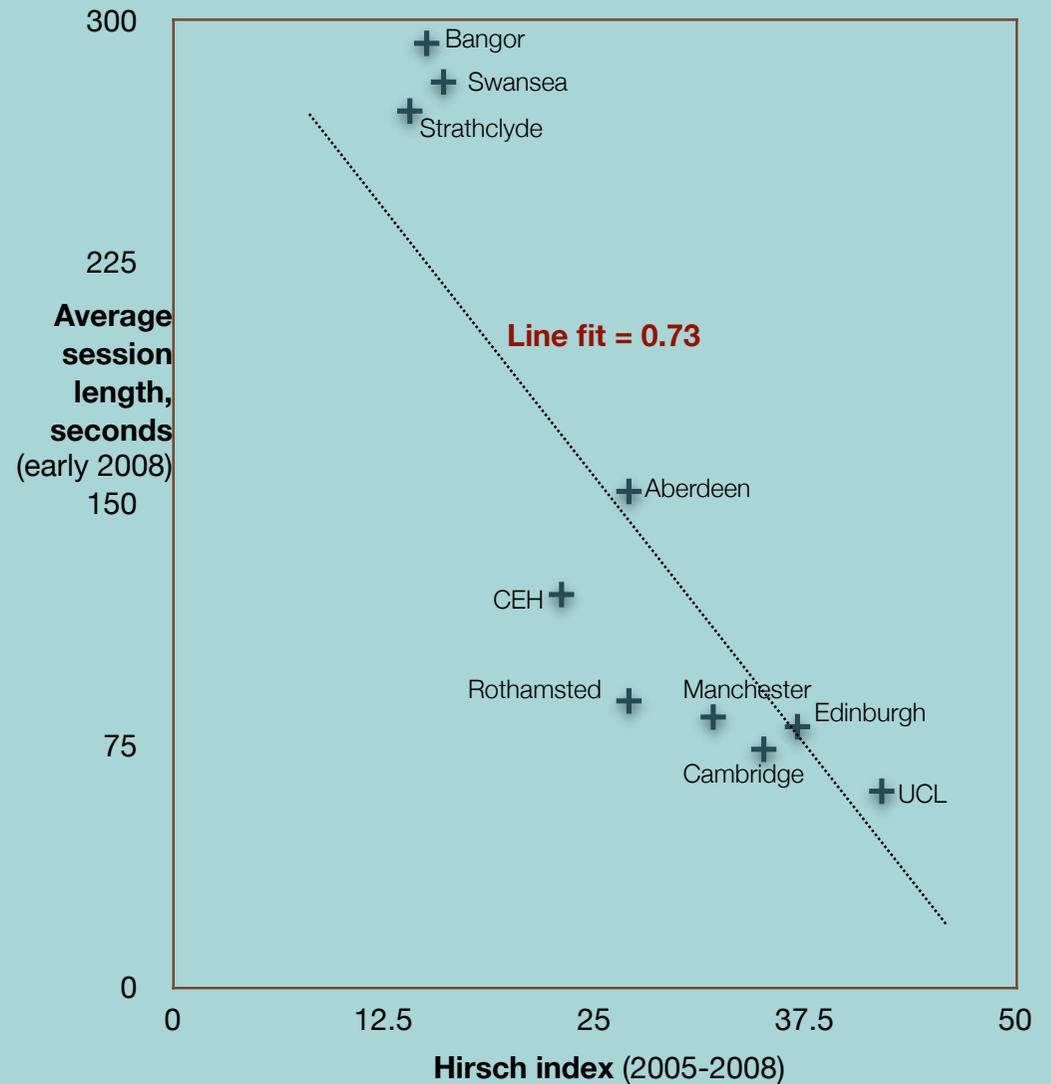
Efficient search = successful research??

Deep log analysis of ScienceDirect

Life sciences

This chart shows a strong negative correlation between the research rating of life scientists in each institution, as measured by the Hirsch index, and the length of their sessions in ScienceDirect (measured in seconds).

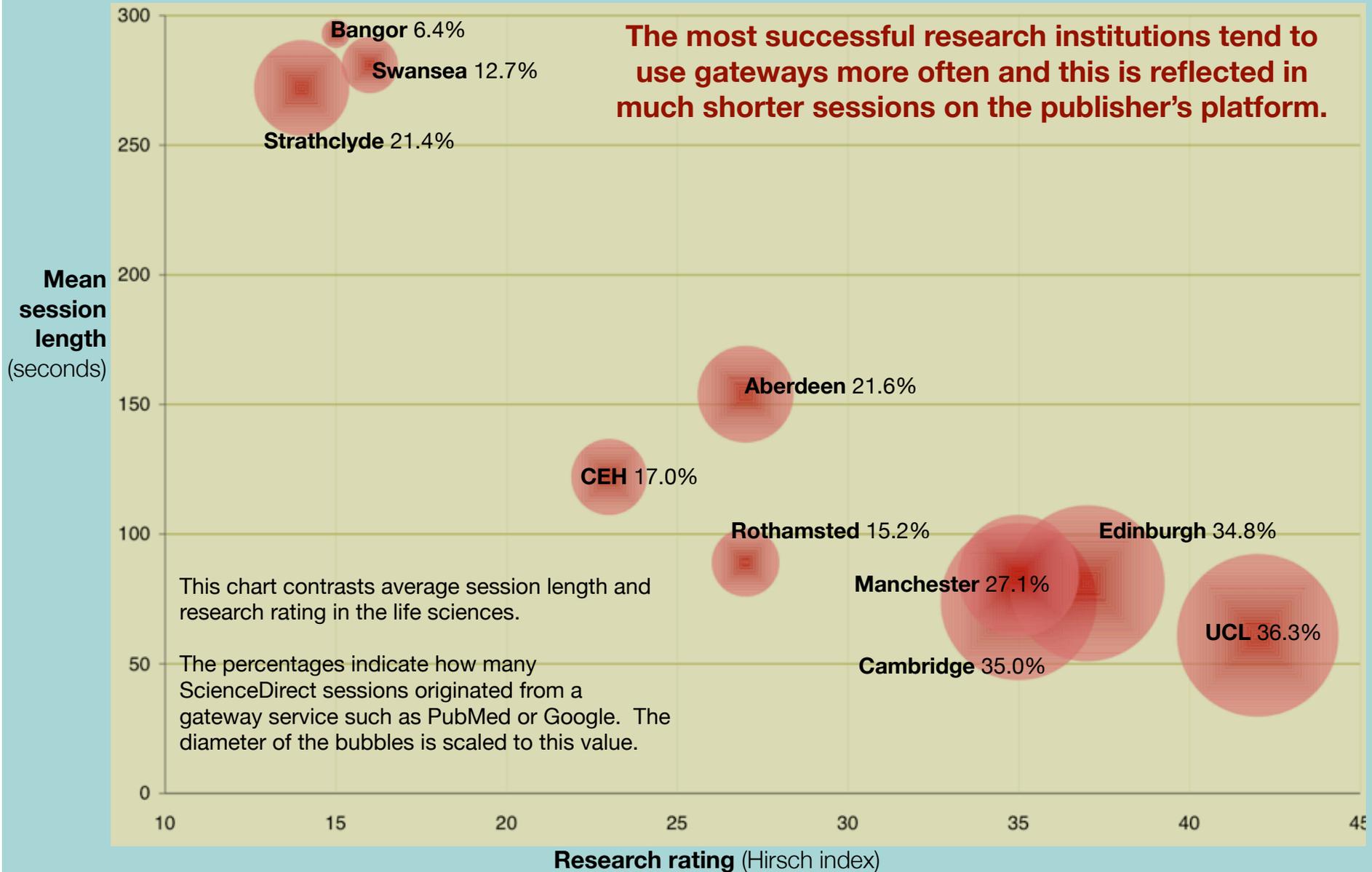
**Is there a link between efficient search and successful research?
We need to find out.**



Session length and gateways

Deep log analysis of ScienceDirect

The most successful research institutions tend to use gateways more often and this is reflected in much shorter sessions on the publisher's platform.



Journal spend, use, and research outcomes

Journal spend and journal use

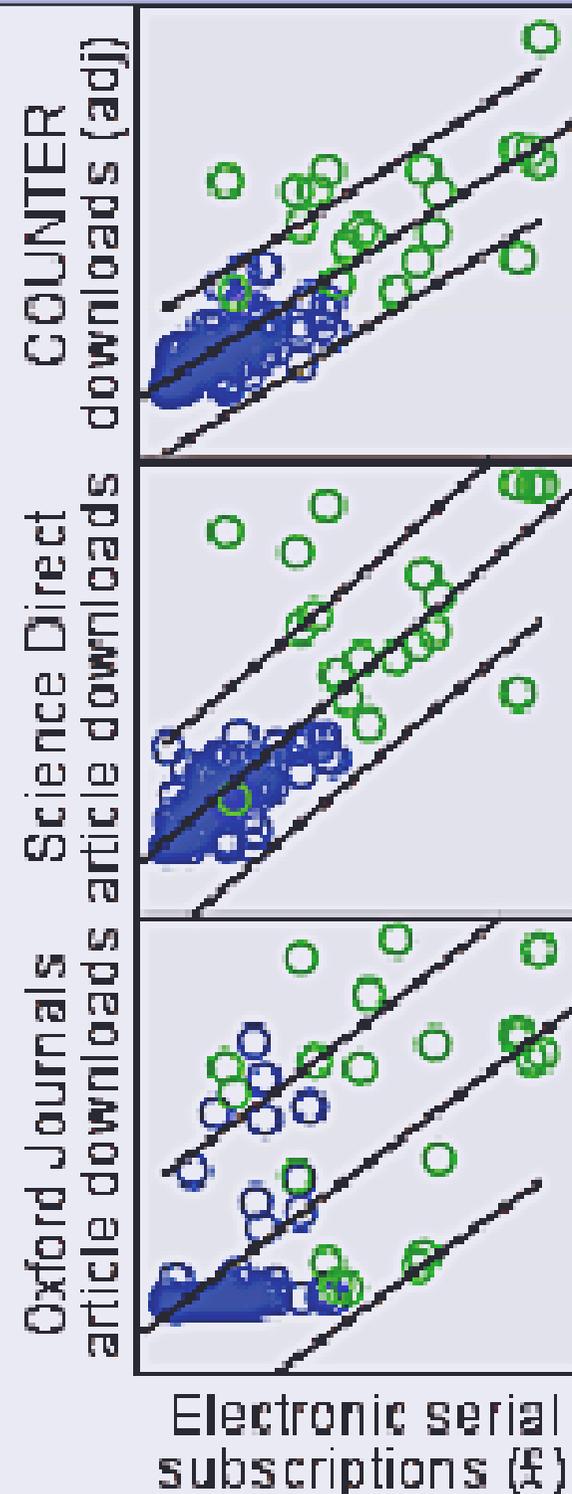
CIBER institutional indicators

Surprisingly, no one seems to have explored the relationship between UK spending on electronic journals and levels of actual use.

The chart opposite illustrates highly-credible correlations between electronic serials spend and downloads: whether for COUNTER-compliant sources (the vast majority of journals), or for Elsevier or Oxford Journals titles.

This suggests that levels of usage are closely related to levels of expenditure, and that money is being spent efficiently at the UK level.

Note: The green dots represent Russell Group universities.



Are super-users also super-producers?

CIBER institutional indicators

We have identified three groups of universities in terms of downloading volume: moderate, high and super users. In the table below, we match these usage groups with research outcome measures:

	Moderate users (n=80)	High users (n=25)	Super users (n=10)
Research papers per academic	0.4	0.8	1.0
Research grants and contracts per academic (£000s)	12.7	29.0	39.7
PhD awards per 100 academics	9.1	17.5	17.4
Cost per download	£0.89	£0.74	£0.60

The evidence provided here suggests a **tentative link between e-journal consumption and research outcomes**. The differences between the three groups are statistically very significant with respect to research outcomes, but there is no such difference in terms of average cost per download.

Journal use and research outcomes: PhD awards

CIBER institutional indicators

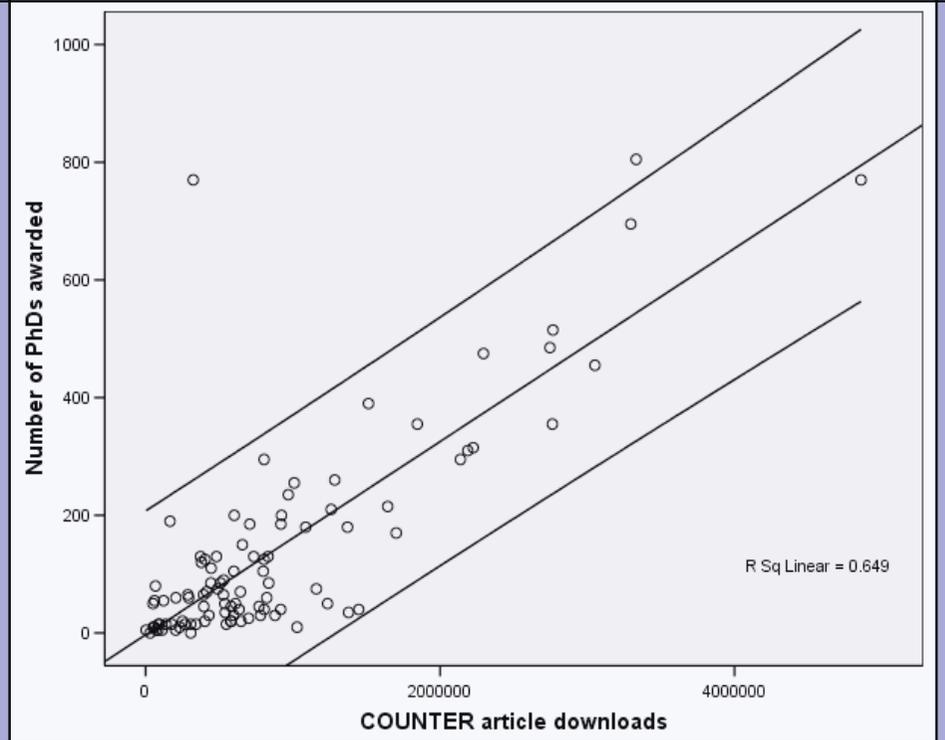
This is the first of three slides that demonstrate strong statistical associations between journal use and research outcomes.

The diagram plots numbers of article downloads (as recorded by institutions using the COUNTER standards) against PhD awards for 2006/07. The outer lines are 95 per cent confidence intervals.

The model shows a good fit with few outliers.

PhD awards and article downloads, 2006/07

$n=112$ UK universities



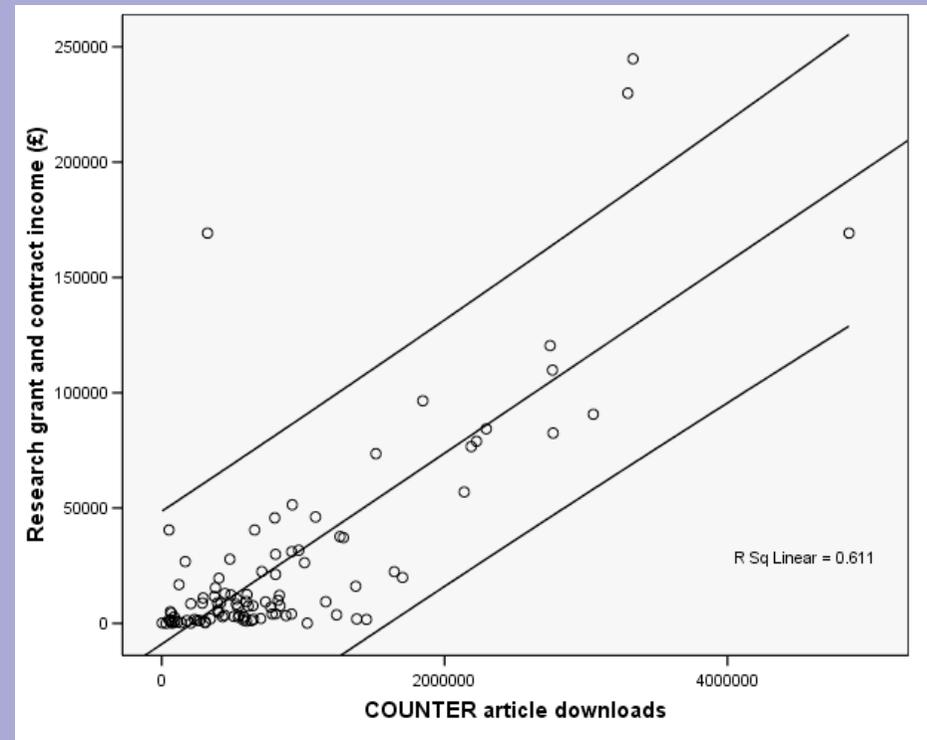
Journal use and research outcomes: RGC income

CIBER institutional indicators

This slide shows a similar association between numbers of article downloads and success in securing research grants and contracts (RGC) income.

The model shows a good fit with few outliers.

RGC income and article downloads, 2006/07
n=112 UK universities



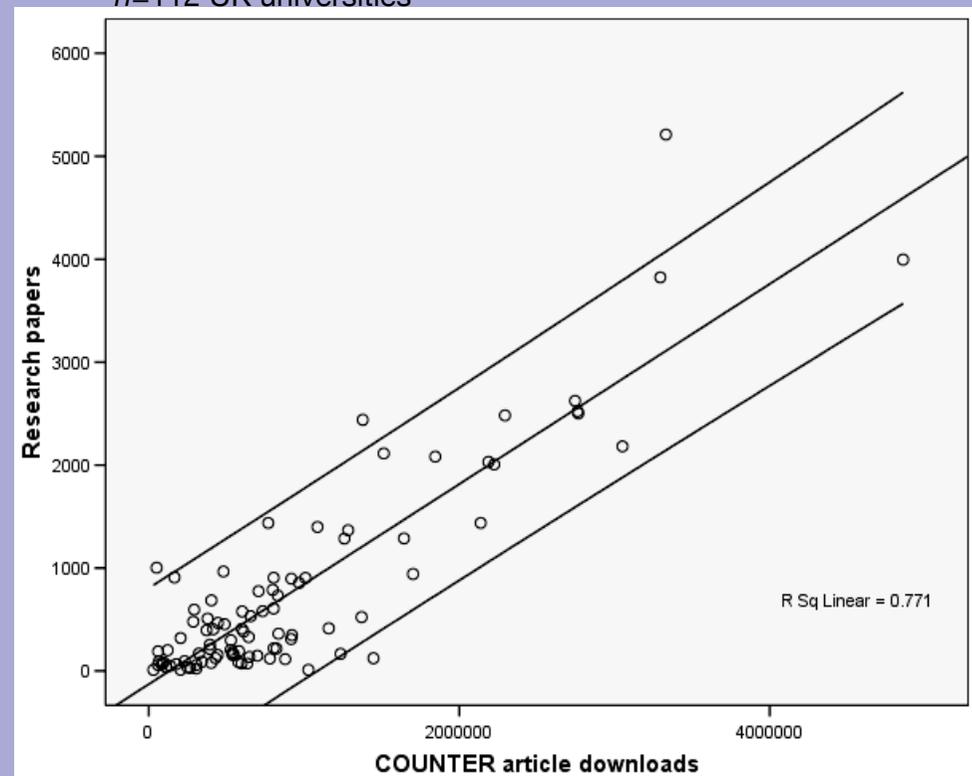
Journal use and research outcomes: publications

CIBER institutional indicators

Finally, we see a powerful statistical association between numbers of article downloads and numbers of papers published in scholarly journals.

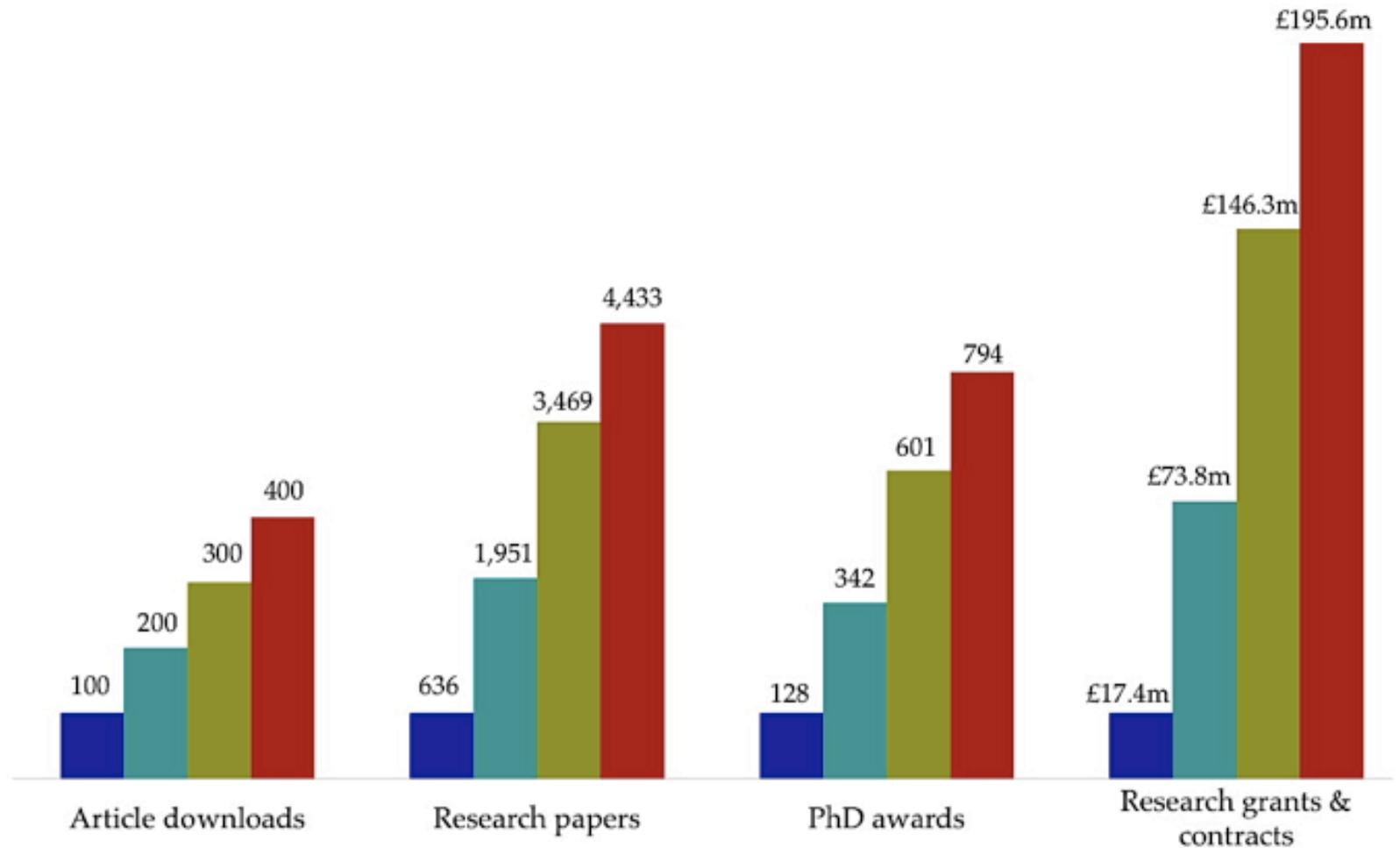
The model shows a good fit with few outliers.

Papers published and article downloads, 2006/07
n=112 UK universities



Journal use and research outcomes: a thought experiment

CIBER institutional indicators



- 1 million downloads
- 2 million downloads
- 3 million downloads
- 4 million downloads

100
200
300
400

100
307
545
697

Indices

100
268
471
622

100
424
841
1,124

In conclusion