Comparative scientometric assessment of the results of ERC funded projects

Bibliometric assessment report (D5)

European Research Council
Established by the European Commission

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Comparative scientometric assessment of the results of ERC-funded projects

Bibliometric assessment report (D5)

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Preface

This document, prepared by Observatoire des sciences et des technologies (OST) and RAND Europe serves as the Final Bibliometric Assessment Report (deliverable: D5) for the study "Comparative scientometric assessment of the results of ERC funded projects" for the European Research Council Executive Agency (ERCEA).

In addition to this report, other analysis and findings from this study are reported in:

- D3: Field classification report
- D4: Data coverage report
- D6: Patent analysis report
- D7: Alternative metrics report
- D8: Peer-review evaluation of highly ranked publications from scientometric assessment
- D11: Final synthesis report

The authors would like to acknowledge the support of ERCEA, in particular Boris Kragelj, members of the ERC Scientific Council and other ERC staff members who have provided useful feedback, data and advice throughout the study. We would also like to thank our quality assurance reviewers, Yves Gingras, Susan Guthrie and David Kryl, for their constructive comments and timely review.

This document has been peer reviewed in accordance with RAND Europe's quality assurance standards.

Table of Contents

Figures

Tables

1. Introduction and aims

This document is the Final Bibliometric Assessment Report (deliverable: D5) for the study "Comparative scientometric assessment of the results of ERC funded projects" for the European Research Council Executive Agency (ERCEA). In this study RAND Europe and Observatoire des sciences et des technologies (OST) have been working to deliver high quality research, incorporating state of the art and innovative scientometric techniques, including bibliometrics, patent analysis and alternative metric analysis.

The scope of the current scientometric assessment can be summarised by the three following evaluation questions:

1. Is the ERC peer review process successful in selecting the best candidates among those who have submitted a proposal?
2. Does the funding provided by the ERC help grantees improve their scientific output and impact?
3. Do ERC grantees perform better than researchers funded by other European and American funding agencies?

The first question is addressed through a comparison between the publication output of the successful applicants (or the ERC-funded researchers) and that of the unsuccessful ones (non-funded researchers) for the period prior to the competition. The second is answered by comparing the publication files of funded researchers for the period prior to their grant to their publication files for the grant period. With regards to the third question, the publication output of ERC-funded researchers for the grant period is benchmarked against that of researchers funded by other European and American agencies. In each case, the assessment of scientific output for each group of researchers was performed by using productivity indicators as well as scientific impact and interdisciplinarity indicators. In other words, the efficiency of the ERC funding programme is assessed here in a quantitative as well as qualitative way.

The next chapter presents the method components: the studied group, the process for the reconstitution of each researcher's publication files, the data sources and the calculation of the bibliometric indicators. Chapter 3 presents, for each of the evaluation questions, the results of the bibliometric assessment broken down by competition year (call year), seniority (call schema), disciplinary domain and ERC panel. The last three subsections are devoted respectively to international collaboration, to the analysis of the subset of papers acknowledging ERC and to the publications files reconstituted using Google Scholar.

2. Methods

2.1. Studied Population of ERC Researchers and Benchmark Samples

The studied population includes 2,556 researchers selected for funding by the ERC between 2007 and 2011. The researchers are distributed across three large domains (Life Sciences (LS), Physical Science and Engineering (PE), and Social Sciences and Humanities (SH)) and 25 disciplinary panels, each including two categories of grants or “call schemas”: starting grants (StG) awarded to young scientists and advanced grants (AdG) intended for senior researchers. Table 2-1 below shows their distribution.

Table 2-1. ERC Funded Researchers by Panel and Project type

Panel		1_StG	3_AdG	Total
LS01	Molecular and Structural Biology and Biochemistry	60	42	102
LS02	Genetics, Genomics, Bioinformatics and Systems Biology	67	44	111
LS03	Cellular and Developmental Biology	64	40	104
LS04	Physiology, Pathophysiology and Endocrinology	55	43	98
LS05	Neurosciences and neural disorders	70	55	125
LS06	Immunity and infection	51	44	95
LS07	Diagnostic tools, therapies and public health	53	58	111
LS08	Evolutionary, population and environmental biology	54	46	100
LS09	Applied life sciences and biotechnology	40	27	67
PE01	Mathematics	86	71	157
PE02	Fundamental constituents of matter	80	62	142
PE03	Condensed matter physics	74	53	127
PE04	Physical and Analytical Chemical sciences	69	45	114
PE05	Materials and Synthesis	84	63	147
PE06	Computer science and informatics	77	43	120
PE07	Systems and communication engineering	42	35	77
PE08	Products and process engineering	54	47	101
PE09	Universe sciences	48	35	83
PE10	Earth system science	50	45	95
SH01	Individuals, institutions and markets	51	40	91
SH02	Institutions, values, beliefs and behaviour	67	35	102
SH03	Environment, space and population	24	14	38
SH04	The Human Mind and its complexity	70	44	114
SH05	Cultures and cultural production	28	22	50
SH06	The study of the human past	41	44	85
Grand Total		**1 459**	**1 097**	**2 556**

Source: European Research Council, List of applicants provided in September 2014, compiled by OST.

The following samples were used for the benchmarking of funded researchers' performance:

- 2,556 ERC non-funded applicants;
- 1,000 EU FP7 collaborative projects/cooperation funded researchers;
- 1,000 US National Science Foundation (NSF) funded researchers;
- 400 US National Institutes of Health (NIH) funded researchers;
- 100 Howard Hughes Medical Institutes (HHMI) funded researchers;
- 237 US National Endowment for Humanities (NEH) funded researchers.

ERC non-funded applicants

As requested by the study's Steering Committee, the ERC non-funded applicants sample has the same structure as the group of funded applicants (distribution across the panels and call schemas) but it also includes:

- 1,304 applicants rejected at step 1;
- 1,252 applicants rejected at step 2, of whom 175 were rejected just below the threshold for funding.

A sample representative of the balance between step 1 and step 2 in the population of rejected applicants (88.4% vs 11.6%) was drawn from these two sub-samples. It comprises 1,304 Step 1 and 172 Step 2 researchers to give a total of 1,476 non-funded researchers. In each sample, the balance between senior and junior researchers is fairly representative of the proportions measured in the target populations. We also ensured that the balance of genders and the average age of researchers included in the samples reflect those found in their respective target populations.

From the population of funded researchers and the sample of non-funded applicants, another subgroup of 350 researchers was selected for a pair-wise analysis. It consists of 175 applicants rejected at step 2 with the highest scores below the funding threshold of each panel, competition year and call schema. The other 175 researchers are the funded applicants who obtained the lowest scores from the same panels, competition years and call schema. By comparing each of those funded researchers with their counterparts from the group of non-funded, we sought to analyse the effect of funding on their scientific production. Indeed, assuming that at the time of the application, these two groups comprised researchers of (almost) equal quality, we can postulate that the differences of scientific output between them will be the effect of ERC funding.

EU FP7 funded researchers

The European Union's Seventh Framework Programme (EU FP7) is divided into ten" level 1 project programme descriptions" related to broad research areas in the natural sciences and engineering, 68 "level 2 project programme descriptions" and, within those, 1,254 specific "themas". As requested by ERCEA representatives, the sample of 1,000 EU FP7 collaborative projects includes, for each of the ten level 1 project programme descriptions, 100 researchers, each one being the most funded in their respective thema. Given that (1) we had to select 100 researchers per level 1 project programme description, (2) we had to cover the maximum number of themas within each level 1 project programme description, and (3) some level 1 programme project descriptions comprise fewer than 100 themas, the sample covers the highest possible number of themas, which is 878. For the level 1 project programme descriptions comprising fewer than 100 themas, we also selected as needed the second, third and fourth most funded researchers until 100 funded researchers were included in the sample. Given this selection process, the average amount of funding of selected researchers is more than twice that of the whole population of funded researchers, at €833,000 compared with €411,000. Hence, this is not a sample representative of the whole population of EU FP7 collaborative projects, but a sample made up of the most funded projects in each thema. It should be noted that no distinction is made in this sample between junior and senior researchers, since the information was not available for the population.

US comparison groups

For the NSF, NIH and HHMI samples of funded researchers, the Steering Committee also requested a profile of senior and junior researchers similar to ERC (at 3/5 compared with 2/5). Thus, the group of NSF-funded junior researchers comprises a random sample of 570 scientists who received a CAREER grant between 2007 and 2011, and the senior group comprises a random sample of 430 researchers who were funded between 2007 and 2011 and who also received at least one CAREER grant between 1992 and 2002.

The group of NIH junior researchers is made up of 217 scientists who received at least one DP2 grant between 2007 and 2011, while the group of senior researchers comprises 183 researchers who received at least one R01 grant during the same period. For HHMI, the group of juniors is comprised of 57 researchers randomly selected from HHMI early career scientists, international early career scientists and Janella Junior Fellows, while the group of seniors is randomly drawn from all other HHMI researchers.

A last sample of 237 researchers funded by NEH was also selected for the benchmarking of the three ERC panels devoted to the humanities, namely SH02, SH05 and SH06. The following table summarises the composition of the studied groups of researchers.

Table 2-2. Number of Researchers by Agency and Large Disciplinary Domain

Agency	Life Sciences	Phy. Sc. & Engineering	Soc. Sc. & Humanities	TOTAL
ERC Funded	913	1,163	480	**2,556**
ERC Non-Funded	913	1,163	480	**2,556**
European Union's FP7 (EU FP7)	100	800	100	**1,000**
US National Sciences Foundation (NSF)	87	837	76	**1,000**
US National Institutes of Health (NIH)	400			**400**
Howard Hughes Medical Institute (HHMI)	100			**100**
US National Endowment for the Humanities (NEH)			237	**237**
TOTAL	**2,513**	**3,963**	**1,373**	**7,849**

2.2. Author Disambiguation

All bibliometric data sources require cleaning in order to be reliable. Author and institution names come in many different forms, including first names and initials, abbreviations and department names; they may include spelling errors or change over time (synonymy problem). On the other hand, the same name might refer to more than one person or department (homonymy problem). Disambiguation and the cleaning of author names and institutions is fundamental to computing meaningful bibliometric indicators for use in research evaluation. In the current study, this was done through a two-step method:

- First, we performed an automatic matching of researchers' names contained in the list of ERC-funded researchers and all control groups with authors' names contained in the bibliometric database.
- Second, to avoid overestimates as a result of the (numerous) namesakes, a manual review and validation of each individual publication file was performed. It should be noted that this manual validation is also the stage at which we can check the publication files which remain empty after the automatic matching. This can be due to the fact that those researchers actually published nothing or to an error in the list of researchers' names. For

a variety of reasons, the names of several researchers in the lists of funding agencies are not recorded identically in the bibliometric databases. In such cases, only a manual search allows us to identify and correct the issue.

2.3. Data Sources

The production of the bibliometric indicators presented here was based on two data sources:

- Thomson Reuters' Web of Science;
- Google Scholar.

Web of Science (WoS) 1980-2013*:* The *Observatoire des sciences et technologies* (OST) maintains a bibliometric database of all WoS records since 1980. Along with the Science Citation Index Expanded, Social Science Citation Index and Arts and Humanities Citation Index, the database includes the Conference Proceedings Citation Index (from 1990) and the Book Citation Index (from 2005). At each annual update, OST structures WoS records into a relational database, and then standardises and codifies all institutional addresses—all operations contributing to the unique reliability and precision of the bibliometric indicators it produces. As part of the update process, OST also computes the various citation indicators used to assess the scientific impact of publications.

It is worth mentioning that WoS indexes the most important journals of each disciplinary field based on the number of citations received by their published papers and that its coverage of scientific literature is consistent over time. Of course, statistics produced from WoS do not include all documents published by researchers, since some works are disseminated through scientific media not indexed by the WoS (e.g. highly specialised journals, national journals, grey literature and, particularly, conference proceedings not published in journals). What these statistics do measure, however, is the share of researchers' scientific output that is the most visible around the world, and therefore the most likely to be cited. In short, it provides reliable indicators for the international benchmarking of research. It should be noted that the following WoS databases are used here:

- Science Citation Index Expanded (SCIE);
- Social Sciences Citation Index (SSCI);
- Arts & Humanities Citation Index (AHCI);
- Conference Proceedings Citation Index, for Science and Social Sciences (CPCI); and
- Books Citation Index (BKCI).

Google Scholar*:* As shown in the coverage report for this study (D4), the coverage of humanities literature by the WoS is far from comprehensive and thus does not provide a reliable measurement of the written production in those disciplines. In order to compensate for this gap, we reconstituted the publication files of the affected groups by using Google Scholar records retrieved with the Publish or Perish tool[1] during the period from 13 March to 7 April 2015. This was done for ERC-funded researchers from the panels SH02, SH05 and SH06, as well as for the NEH researchers.

2.4. Indicators

Using the publication files, the following indicators were generated and used for the assessment of ERC researchers.

Number of papers and mean annual number of papers. Although the OST database includes all types of documents published in indexed journals, only articles, research notes and review

[1] www.harzing.com/pop.htm

papers were included for this study, as these are the primary means of disseminating new knowledge.

In order to assess the productivity of each group of researchers and to compare the results obtained from observation windows of different length we computed the mean annual number of papers. This is calculated by dividing the total number of papers published by a given researcher in a given period (observation window) by the number of years in said period. At the level of a given group of researchers, the mean annual number of papers is simply the average of the mean annual numbers of papers of all individual researchers from this group. Since the distribution of the mean annual number of papers is skewed, we performed Mann-Whitney U statistical tests or Wilcoxon signed ranks tests in order to probe the statistical significance of observed differences.

The Average Relative Impact Factors (ARIF) provides a measure of the scientific impact of the journals in which a group of researchers publishes. Each journal in the WoS database has an impact factor (IF), which is calculated annually by counting the number of citations the journal receives relative to the number of papers it publishes. In calculating the ARIF, the value of a journal's IF is first assigned to each paper it publishes. In order to account for different citation patterns across fields and sub-fields (e.g. there are more citations in biomedical research than mathematics), each paper's IF is then divided by the average IF of the papers in its particular discipline —as defined by the Essential Science Indicators journals classification[2]— in order to obtain a Relative Impact Factor (RIF). The ARIF of a given group of researchers is computed using the average RIF of all papers it published. An ARIF greater than 1.00 means that a group of researchers score better than the world average; when it is below 1.00, the group publishes in journals that are not cited as often as the world average. In short, this indicator reveals if the journals in which the group of researchers publishes have (or do not have) good visibility in the scientific community. It should also be noted that this indicator is set to non-significant (n.s.) when the number of publications involved is below 30. Also, since the distribution of the relative impact factors is skewed, we performed Mann-Whitney U statistical tests or Wilcoxon signed ranks tests in order to probe the statistical significance of observed differences.

$$ARIF = \frac{\sum_{p=1}^{n} \frac{X_{pfy}}{\bar{X}_{fy}}}{N}$$

Where:

X_{psy} = Impact factor of the paper (p) of the field (f) published in a given year (y);

$\bar{X}_{sy}$ = Average impact factors of papers of the field (f) published in the same year (y);

N = Total number of papers (of a given country or institution).

The Average of Relative Citations (ARC) is based on the number of citations received by papers from their publication time until 2013. Thus, for papers published in 2004, citations received between 2004 and 2013 are counted. Self-citations are included. Citations are counted until the end of 2013, meaning that 2012 papers' citation window is only one year. The number of citations received by each paper is normalised by the average number of citations received by all papers of the same year of publication and the same subfield—as defined by the Essential Science Indicators journals classification—therefore taking into account the fact that citation practices are different for each subfield. As for the ARIF, when the ARC is greater than 1.00, it means that a

[2] This classification was chosen by ERC representatives and was preferred to the WoS's categories because the latter assigns more than one class to a specific journal or article.

paper or a group of papers scores better than the world average of its specialty and domain; when it is below 1.00, those publications are not cited as often as the world average. This indicator reveals if the papers have (or do not have) a high citation impact. It should also be noted that this indicator is set to non-significant (n.s.) when the number of publications involved is below 30. Also, since the distribution of relative citations is skewed, we performed Mann-Whitney U statistical tests or Wilcoxon signed ranks tests in order to probe the statistical significance of observed differences.

$$ARC = \frac{\sum_{p=1}^{n} \frac{X_{pfy}}{\bar{X}_{fy}}}{N}$$

Where:

X_{psy} = Number of citations received by the paper (p) of the field (f) published in a given year (y);

$\bar{X}_{sy}$ = Average number of citations by papers of the field (f) published in the same year (y);

N = Total number of papers (of a given country or institution).

The number of highly cited papers is computed using the ARC, more specifically, by counting the papers in the top 5% and 1% according to their respective relative citations. Results are presented as a percentage of each group of papers belonging to the top 1% or 5% most cited. Since the expected normal percentages are respectively 5% and 1%, proportions measured above these percentages for a given group of papers indicate that they have an above world average scientific impact.

International collaboration is an indicator of the relative intensity of scientific collaboration between countries. A paper is considered to be written in international collaboration when it bears institutional addresses from at least two different countries; for example, a French researcher co-authoring a paper with a researcher from the United Kingdom or Germany.

In addition to the simple definition of international collaboration, which involves the collaboration of at least two countries (regardless of location), three other types of international collaboration were computed for the European researchers in the current study: 1) intra-European international collaboration involving the participation of researchers from at least two European countries;[3] 2) extra-European international collaboration involving the participation of at least one researcher from Europe and at least one researcher from a non-European country; and 3) international collaboration with the United States involving the participation of at least one American researcher and at least one researcher from outside the United States.

Average of Interdisciplinarity Index (AII). Each paper has an interdisciplinarity index (II) that is the share of references (in its bibliography) belonging to fields different than its own—as defined by the Essential Science Indicators journal classification. As an example, for a chemistry paper citing ten papers, out of which four belong to chemistry and six to other disciplinary fields (physics, mathematics, biology, etc.), the interdisciplinarity index is calculated as follows: 6/10 = 0.6. For a given set of papers, the AII is the average of their individual II. AII ranges from 0.0 (no interdisciplinarity) to 1.0 when all references are made to papers from other disciplinary field.

[3] At ERC request, the following countries are considered here as belonging to Europe: those of the EU28, plus Norway, Turkey, Switzerland, Israel, Iceland, Liechtenstein, Macedonia, Serbia, Albania, Montenegro, Bosnia & Herzegovina, Faroe Islands and Moldova.

$$AII = \frac{\sum_{p=1}^{n} \frac{X_p}{R_p}}{N}$$

Where:

X_p = Number of references cited by the paper (p) not belonging to its own disciplinary field;

R_p = Total number of references cited by the paper (p);

N = Total number of papers (of a given group of researchers or country).

Average of Interdisciplinarity Relative Index (AIRI). For each paper's interdisciplinarity index, an interdisciplinarity relative index (IRI) can be calculated by dividing (normalising) it by the average interdisciplinarity index (AII) of all papers from the same disciplinary field —as defined by the Essential Science Indicators journal classification— published the same year. For a given set of papers, the AIRI is the average of their individual IRI. The world average value of IRI is 1.0. An AIRI above 1.0 means that the references of the group of papers are more interdisciplinary than the world average and an AIRI below 1.0 means the contrary.

$$AIRI = \frac{\sum_{p=1}^{n} \frac{X_{pfy}}{\overline{X}_{fy}}}{N}$$

Where:

X_{pfy} = Interdisciplinarity index of the paper (p) of the disciplinary field (f) published in year (y);

$\overline{X}_{fy}$ = Average of interdisciplinarity index of all papers of the disciplinary field (f) published in year (y);

N = Total number of papers (of a given group of researchers or country).

Research Level is an indicator of how basic or applied research is. It is assigned to each journal by the firm CHI Research (now The Patent Board), based on the type of research it publishes. It has four levels: i) clinical observation or applied technology; ii) clinical mix or engineering-technological mix; iii) clinical investigation or applied research; and iv) basic research.

3. Results

The results of the bibliometric assessment presented below aim to answer the three evaluation questions listed in the Introduction. In each case, indicators are broken down by competition year (call year), seniority (call schema), disciplinary domain and ERC panel. The last three subsections are devoted respectively to the analysis of international collaboration, of the subset of papers acknowledging ERC and other agencies, and to the publication files reconstituted using Google Scholar.

3.1. Selection of ERC-Funded Researchers

In order to assess the capacity of the ERC peer review committees to select the best candidates, we compared the publication files of funded and non-funded researchers for the period before the competition year. It should be noted, however, that in the case of junior researchers only the three years before the competition year are counted, since it is unlikely that they have published for many years before the competition. For example, the publications of 2004-2006 are counted for junior researchers of the 2007 cohort, the publications of 2006-2008, for those who applied in 2009, and so on.

Two samples of non-funded researchers are analysed: a first one representative of the whole population of non-funded applicants (NF ALL) and a second representative of researchers who were scored relatively highly by the peer review committees, but who were rejected for funding at the second step of selection (NF Step2). It should be noted that no competition occurred in 2008 for juniors and in 2007 for seniors.

Figure 3-1 presents productivity indicators for the groups of researchers for each of the five competition years. It shows that, globally, the productivity of the senior researchers is higher than that of juniors and that, within each two groups, this productivity is fairly constant from one competition year to another. More importantly, it demonstrates a strong and constant relationship between the productivity of the researchers and the decision of the peer review committees. Indeed, for each competition year and each seniority status, the funded researchers show a higher productivity than the applicants rejected at step 2, while the latter show a higher productivity than the whole group of non-funded applicants. While most of the differences observed in Figure 3-1 are statistically significant, it should be noted, however, that the differences between junior funded researchers and junior applicants rejected at step 2 are non-significant.[4]

[4] See Appendix B for the results of the statistical tests performed on the bibliometric indicators of each figure.

Figure 3-1. Mean Annual Number of Papers per ERC Applicant Prior to Competition Year by Seniority, Competition Year and Funding Status

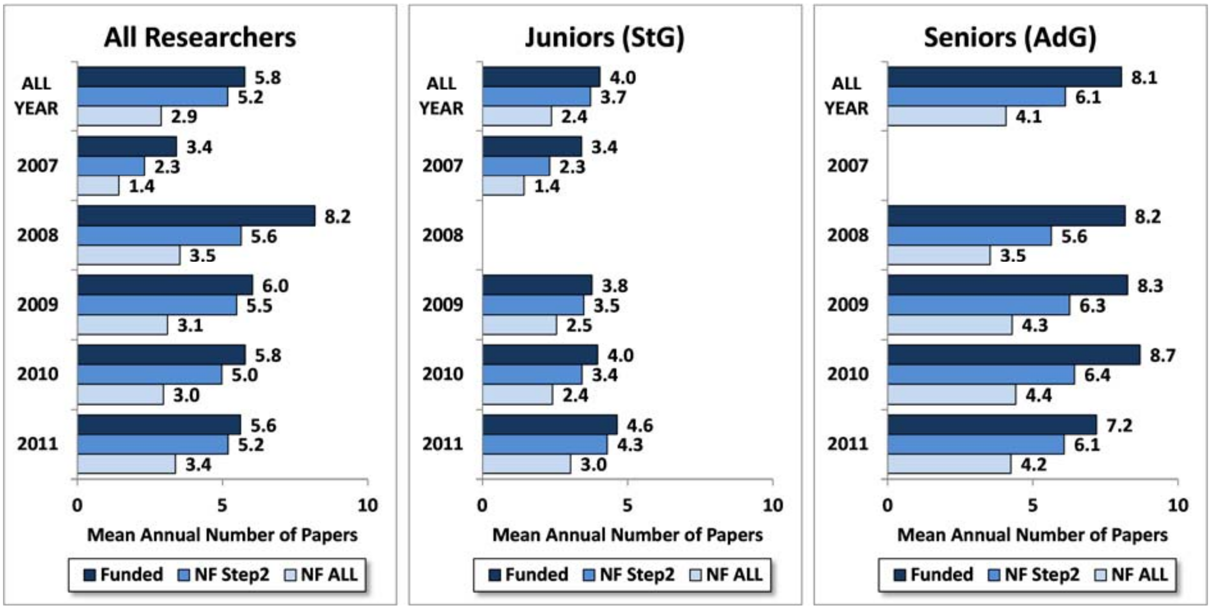


Figure 3-2 shows the same results as Figure 3-1, but broken down by domain and ERC panel. In all cases, the funded researchers and the applicants rejected at step 2 demonstrate a higher productivity than the whole group of non-funded researchers. In some cases, the group of applicants rejected at step 2 shows a productivity that is on a par (or almost) with that of funded researchers (LS01, LS06, LS08, PE01, PE03, PE04 and PE10). In other cases, the productivity of researchers rejected at Step 2 is even higher than that of the funded ones (LS02, LS03, LS04 and LS05). However, one should take into account that the differences observed between funded researchers and applicants rejected at step 2 are statistically significant for only five panels of the 25 shown in Figure 3-2 (LS07, PE02, PE06, PE07 and PE09). Nevertheless, differences with respect to the representative sample of non-funded applicants (NF ALL) are statistically significant for all panels, except four (LS05, SH01, SH05 and SH06).

The productivity of the researchers of Social Sciences and Humanities appears globally lower than that of Physical Sciences and Engineering and Life Sciences researchers, but one should take into account the fact that the bibliometric database does not offer a complete coverage of the written production in those disciplines, particularly for panels SH02, SH05 and SH06. That said, the indicators show that funded researchers and the applicants rejected at step 2 have a higher productivity than the average non-funded researchers.

Figure 3-2. Mean Annual Number of Papers per ERC Applicant Prior to Competition Year by Domain, Panel and Funding Status

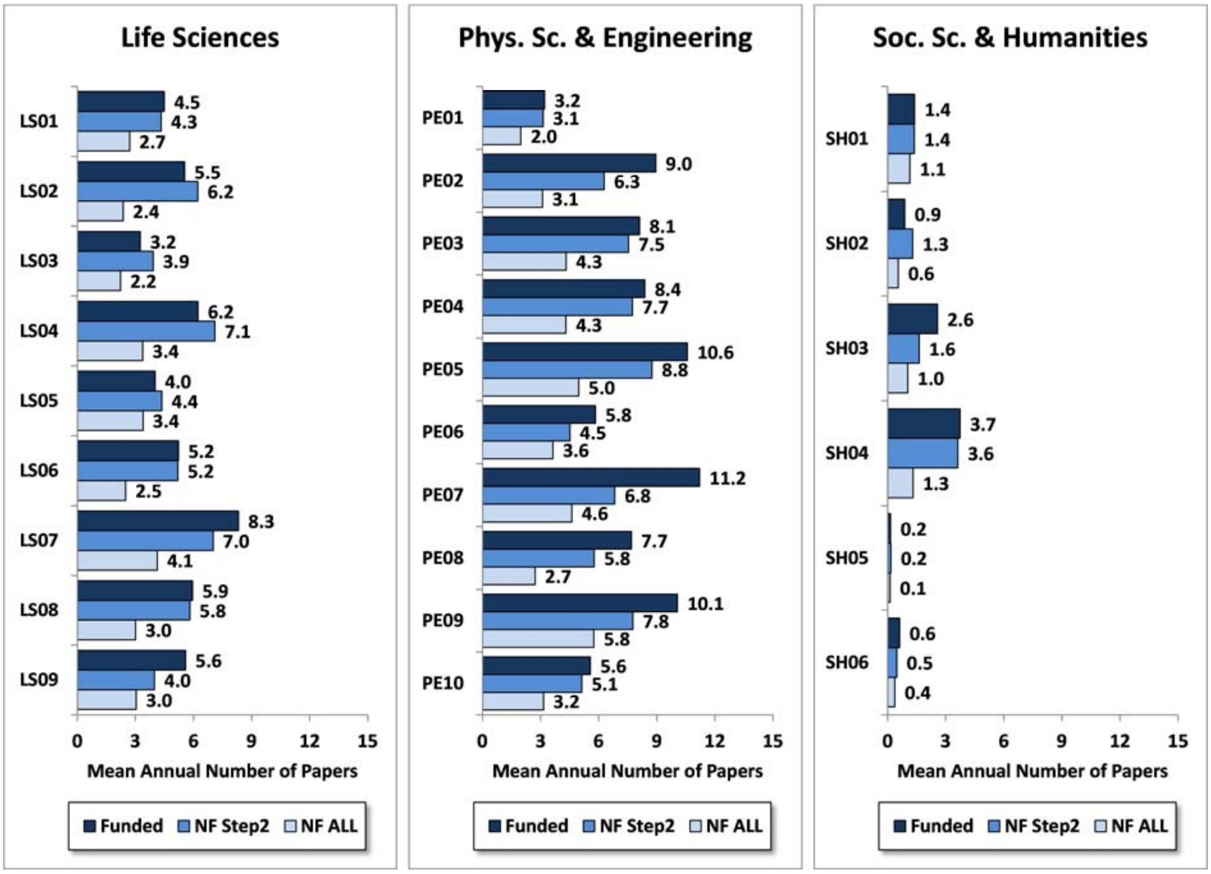


Figure 3-3 shows that, prior to the competition year, the funded researchers published their papers in journals with higher impact factors than the journals in which the applicants rejected at step 2 and the whole group of non-funded researchers published. This is quite clear and statistically significant for the senior researchers, but less so for junior researchers of the 2009 and 2011 cohorts. For the junior 2009 cohort, the ARIF of applicants rejected at step 2 is significantly higher than that of the funded ones while for the 2011 junior cohort, there is no significant difference between the two groups. However, in every cohort, the ARIF of funded researchers is significantly above that of the whole group of non-funded researchers (NF ALL).

It should also be noted that the ARIFs of all groups of researchers, even those of the non-funded ones, are clearly above the world average (1.0), which is an indication of the capacity of the ERC to attract researchers who have excellent publication records.

Figure 3-3. Average of Relative Impact Factors (ARIF) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status

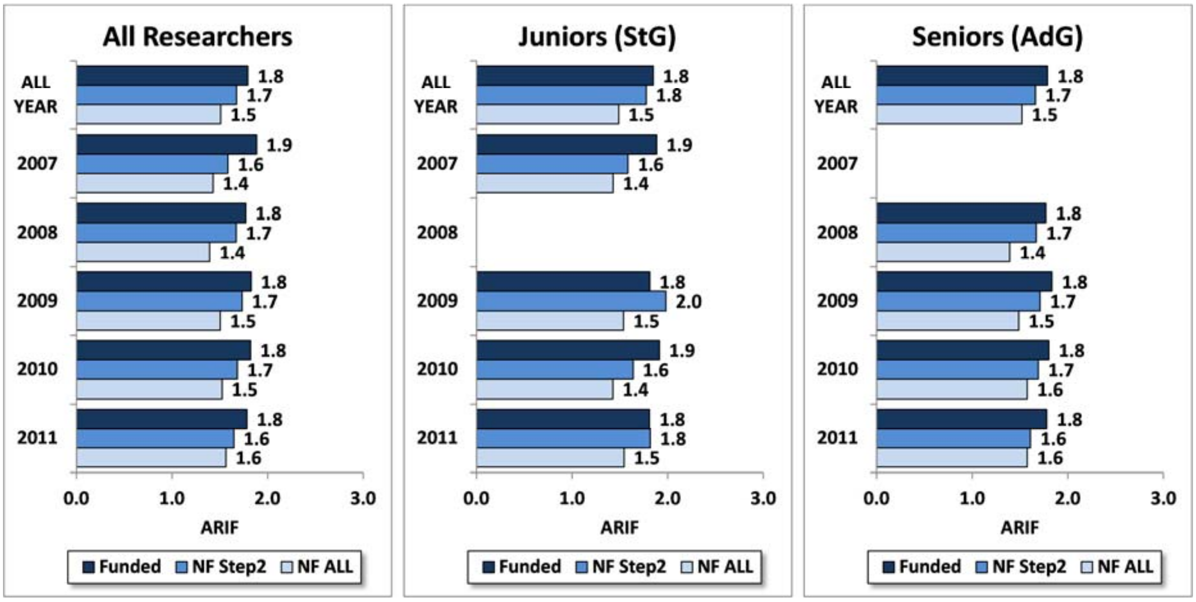


Figure 3-4 presents the ARIF broken down by panel. It shows that in every Life Sciences panel, the three groups of researchers are ranked as expected: the funded ones show higher scores than the rejected applicants at step 2, and the latter show higher scores than the average non-funded researchers. All the observed differences are statistically significant.

In Physical Sciences and Engineering, the trends are less clear, since in four panels out of ten, the ARIF of the applicants rejected at step 2 is equal to or higher than that of the funded researchers (PE01, PE07, PE08 and PE10), but the difference is significant only for panel PE01. Conversely, in four panels out of ten (PE02, PE03, PE04 and PE05), the ARIF of funded researchers is significantly higher than that of applicants rejected at step 2. Compared to the representative sample of non-funded applicants (NF ALL), the funded researchers from six Physical Sciences and Engineering panels have significantly higher ARIF, and one has a significantly lower ARIF (PE06), while the observed differences are not significant for the three remaining cases (PE02, PE07 and PE09).

As for the Social Sciences and Humanities panels, the only significant difference of ARIF between funded researchers and rejected applicants at step 2 is observed for SH01. Between funded researchers and the representative sample of non-funded applicants, the only significant difference is observed for the panel SH04. Once again, given the incomplete coverage of those disciplines offered by the bibliometric database, one should be cautious with the interpretation of such results. They are presented here for information purposes only.

Figure 3-4. Average of Relative Impact Factors (ARIF) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding Status

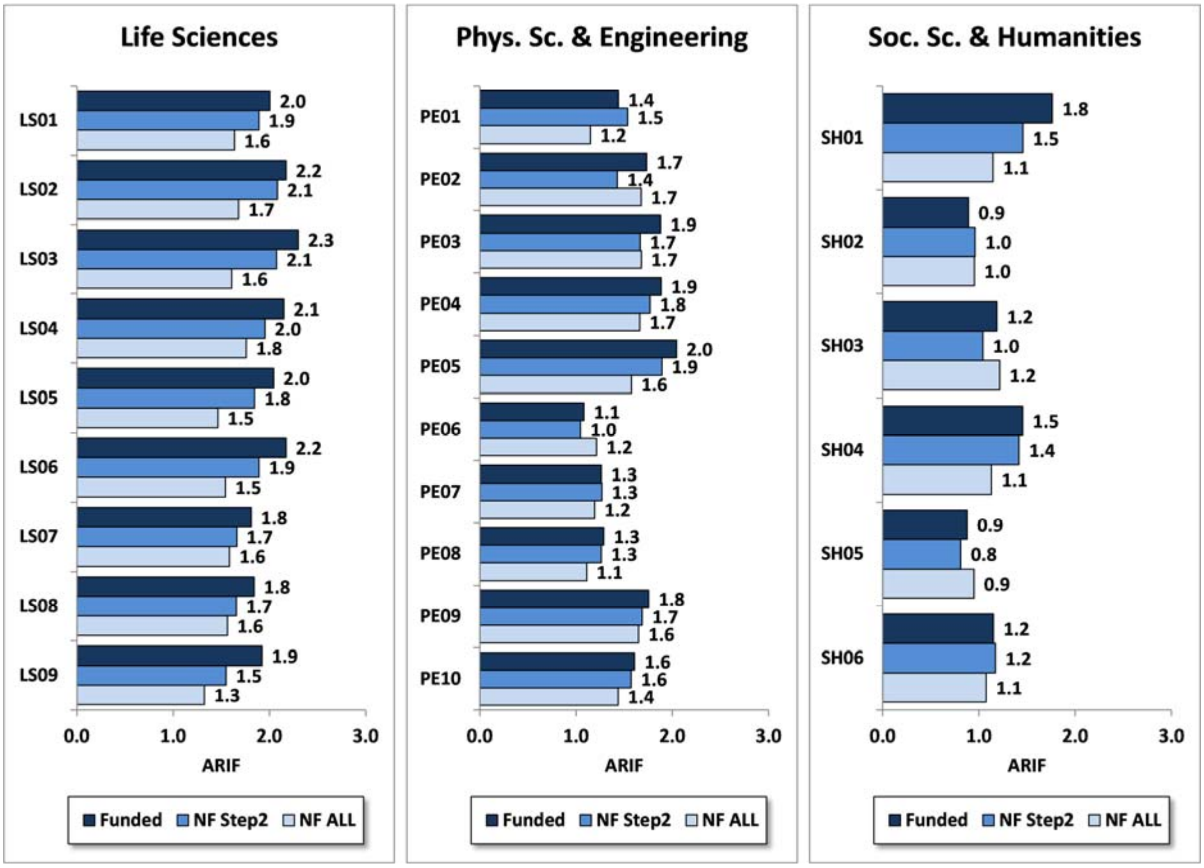
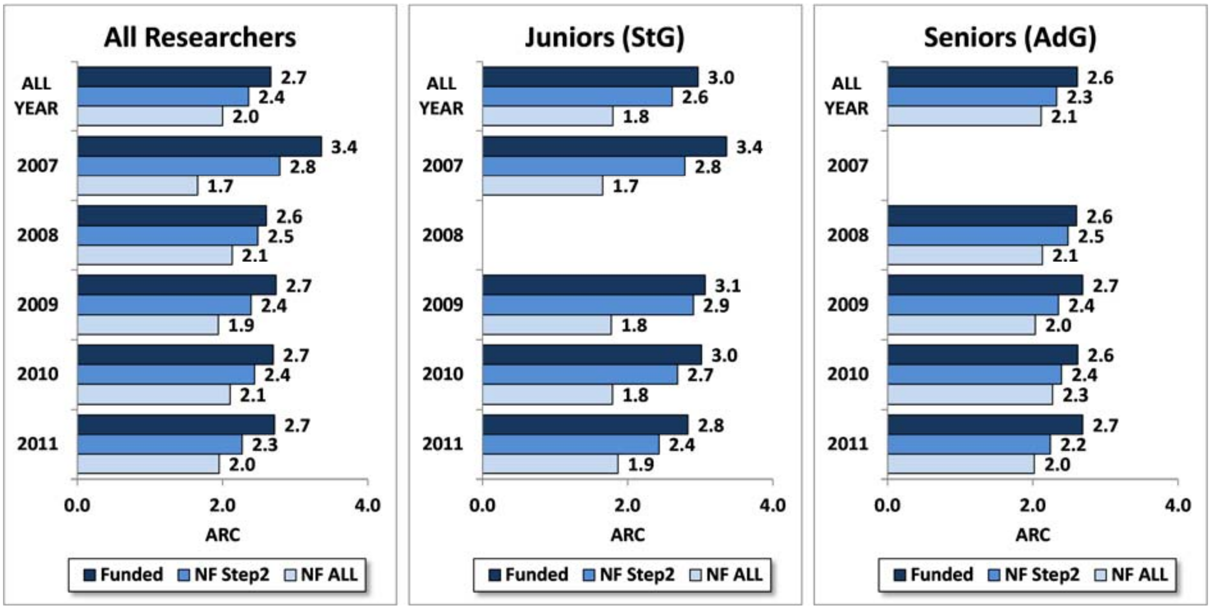


Figure 3-5 shows that the papers published by the funded researchers are, on average, more cited than the papers of the applicants rejected at step 2, and that the latter are more cited than the papers of the whole group of rejected applicants (NF ALL). This is true for all cohorts of junior and senior researchers from 2007 to 2011 and these results are also statistically significant for all, except for the 2007 junior cohort (funded vs step 2).

It should be noted that the ARCs for all groups of researchers, even the non-funded ones, are quite high with values that are often two or three times higher than the world average (1.0). Once again, this shows that ERC attracts applicants with high profile publication records. It should also be noted that the scientific impact of junior funded researchers tends to be higher than that of senior funded researchers.

Figure 3-5. Average of Relative Citations (ARC) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status



The data in Figure 3-6 shows that in each panel, the scientific impact of funded researchers is above that of the whole group of non-funded applicants (NF ALL), with the exception of SH05. These results are statistically significant for almost all panels, with only five showing non-significant results (LS08, PE06, SH02, SH03 and SH06).

In most cases, the ARC of funded researchers is also higher than that of the applicants rejected at step 2, expect for two panels of Life Sciences (LS02 and LS03) and two panels of Physical Sciences and Engineering (PE09 and PE10) and one Social Sciences and Humanities panel (SH03).

It should be noted, however, that differences between funded researchers and applicants rejected at step 2 are statistically significant in only 9 cases out of 25 (LS05, LS06, LS07, PE02, PE03, PE04, PE05, PE08 and SH01).

The ARCs concerning the Social Sciences and Humanities should be interpreted with caution given the relatively small number of papers involved and the gaps in the coverage of the publications in those fields (notably for SH02, SH05 and SH06). That said, except for the SH05 panel, the data suggests that the funded researchers have a higher impact than the average non-funded researchers.

Figure 3-6. Average of Relative Citations (ARC) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding Status

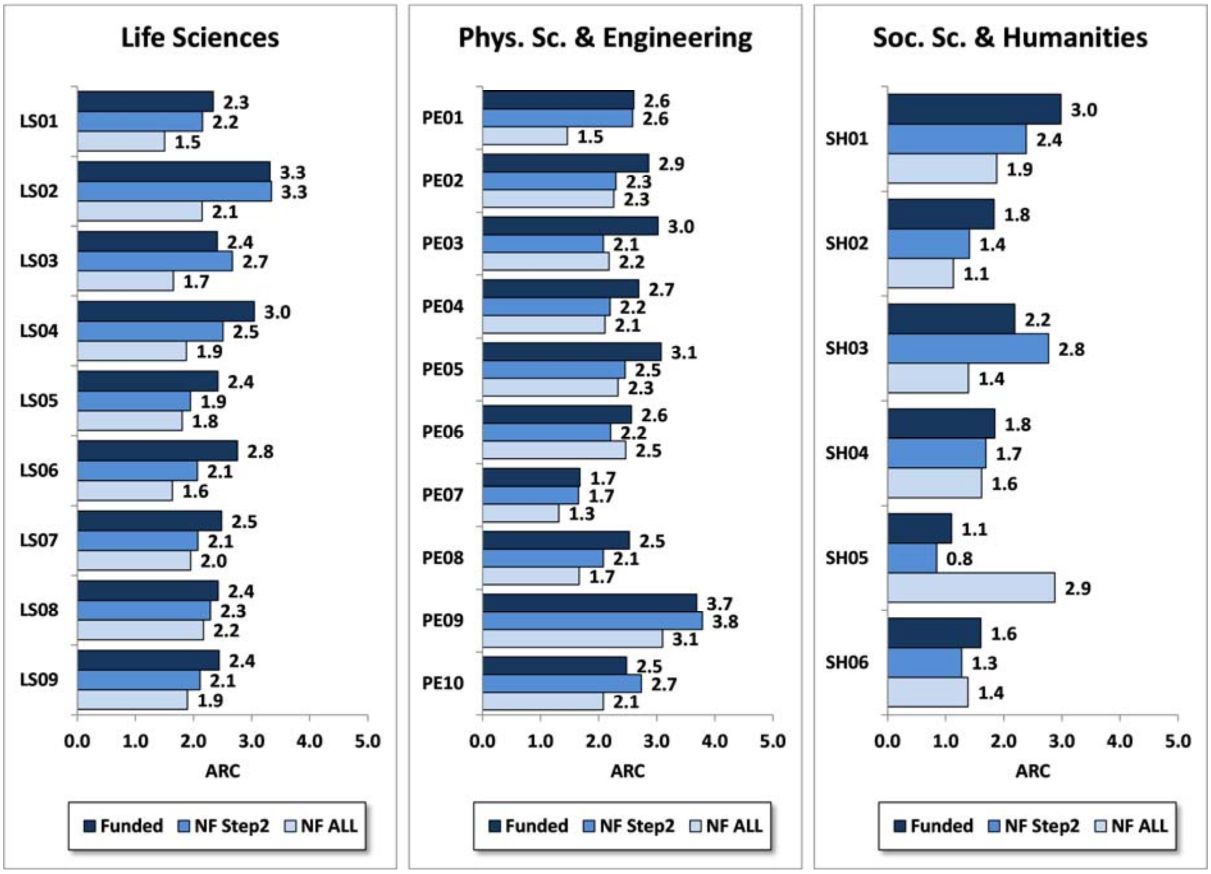


Figure 3-7 presents, for each group of researchers, the share of their publications which are among the top 5% of the most cited papers in their respective fields. Hence, a share higher than 5% indicates, from this point of view, a higher performance than the world average. The data shows that for all cohorts except one (2007 juniors), the funded researchers have a higher proportion of highly cited papers than those rejected at step 2 and those of the whole group of non-funded applicants. As for the junior researchers of the 2007 cohort, it may seem odd that the applicants rejected at step 2 show a higher proportion (25.1%) of top 5% papers than the funded researchers (20.85%), especially as the latter have a higher ARC score (see Figure 3-5). However this is explained by the fact that the applicants rejected at step 2 have several papers with fairly high impact, while the funded researchers have fewer papers in this category (top 5%), but some of very high impact. This is confirmed below by the proportion of their papers in the top 1% (Figure 3-9).

Figure 3-7. Percentage of ERC Applicants' Papers in the Top 5% of the Most Cited Papers by Seniority, Competition Year and Funding Status

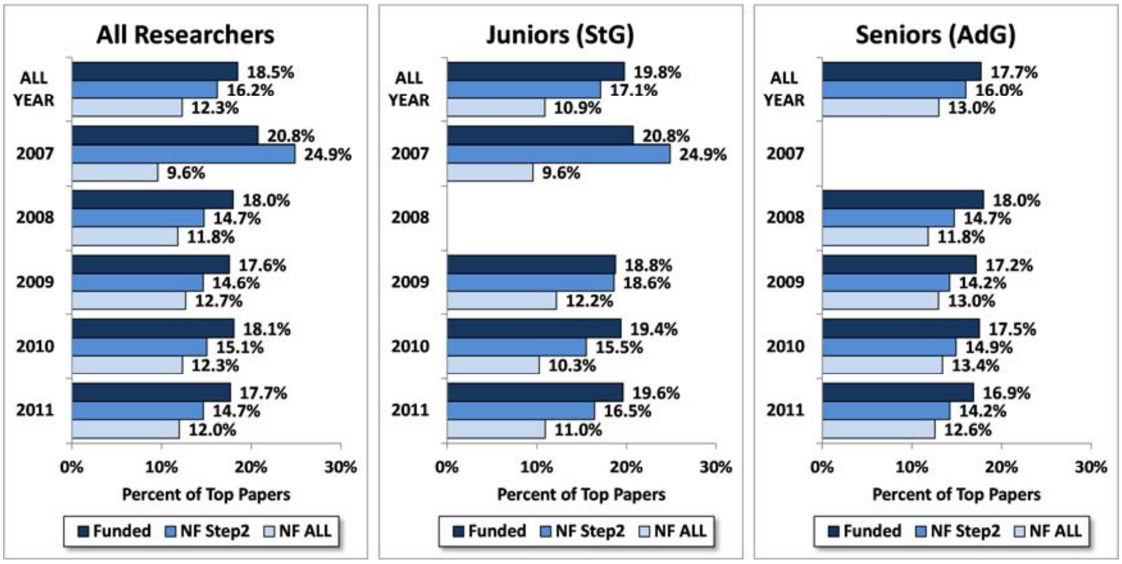


Figure 3-8 presents the breakdown of the top 5% by domain and panel. It shows that the funded researchers of every panel have a higher percentage of their publications in the top 5% most cited than the whole group of non-funded applicants, except for the panel PE06. It should also be noted that the applicants rejected at step 2 from some panels show a share of top 5% papers as high as, or even higher, than that of the funded researchers (LS02, LS03, PE06, PE07, PE09, PE10 and SH03).

Figure 3-8. Percentage of ERC Applicants' Papers in the Top 5% of the Most Cited Papers by Domain, Panel and Funding Status

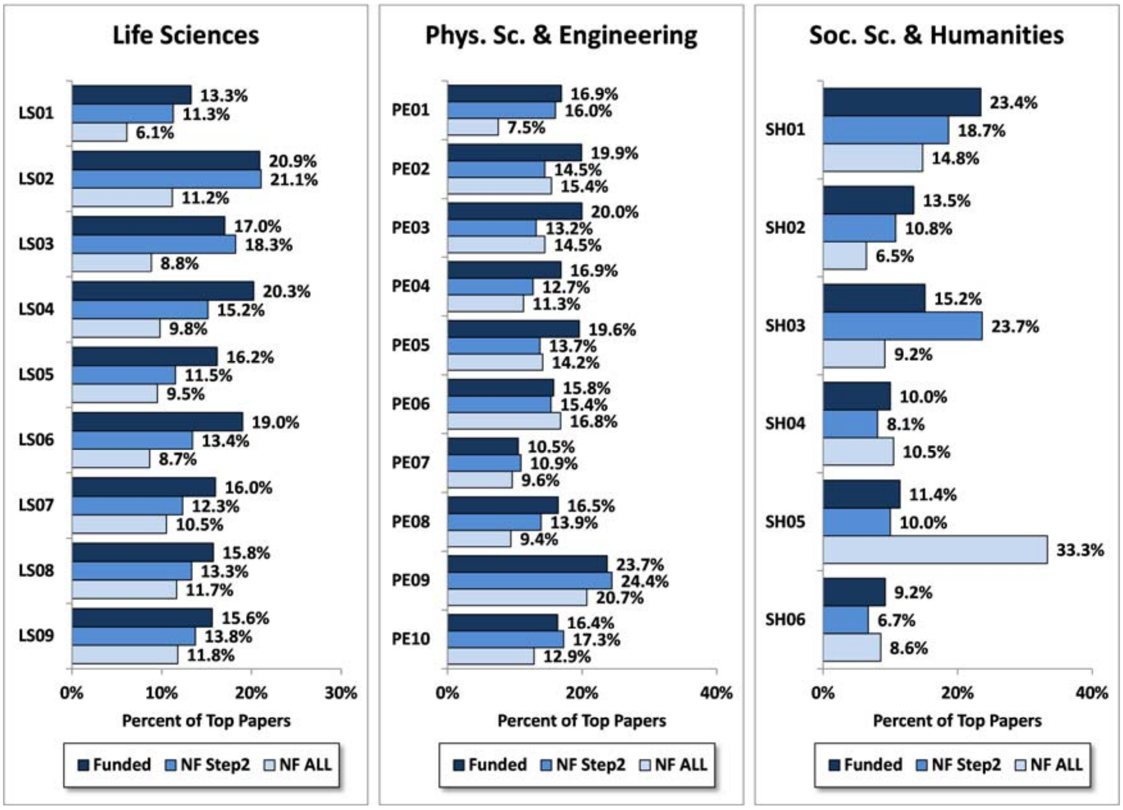


Figure 3-9 presents the share of researchers' papers in the top 1% most cited. According to this indicator, the three groups of researchers are ranked once again following the assessment of the peer review committees: the funded researchers show a higher percentage of top papers, followed by the applicants rejected at step 2 and then by the whole group of unsuccessful applicants. However, an exception to this rule is the 2009 cohort of junior researchers where the rejected applicants at step 2 show a share of top papers slightly higher than that of funded researchers.

Figure 3-9. Percentage of ERC Applicants' Papers in the Top 1% of the Most Cited Papers by Seniority, Competition Year and Funding Status

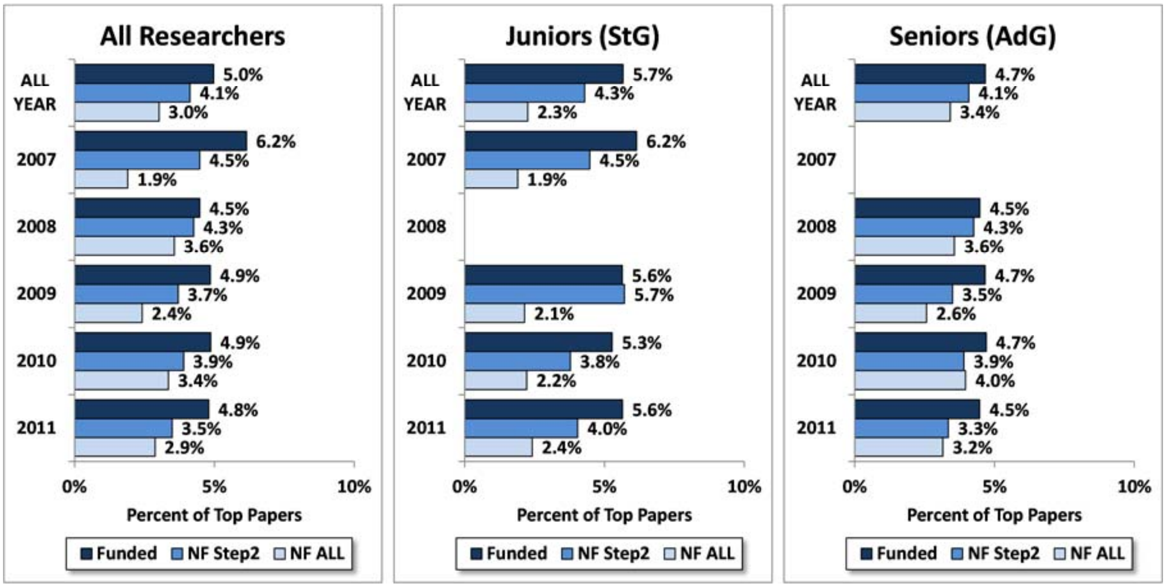
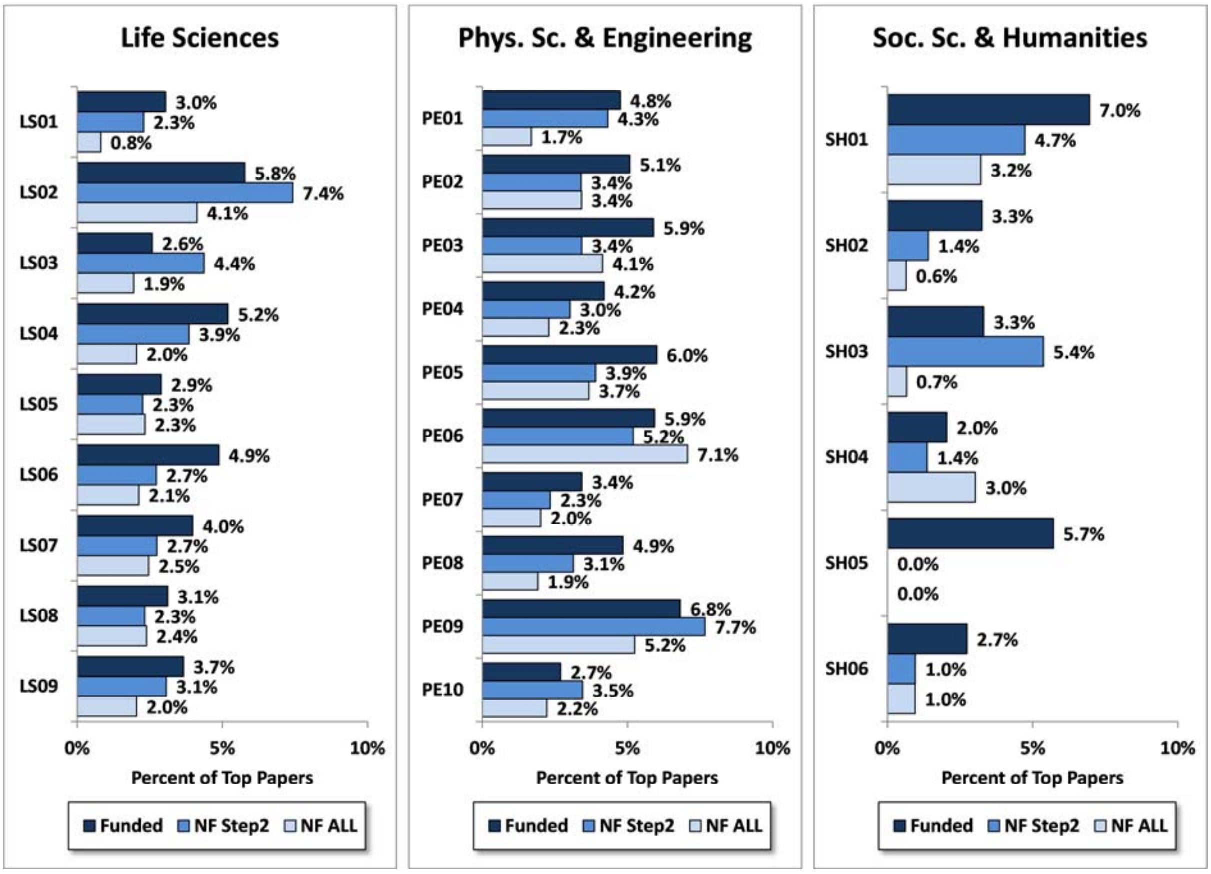


Figure 3-10 shows that the funded researchers of every panel (except PE06 and SH04) have a higher proportion of their papers in the top 1% most cited than the whole group of non-funded applicants. In four panels, the applicants rejected at step 2 have a larger share of highly cited papers than funded researchers (LS02, LS03, PE09 and SH03).

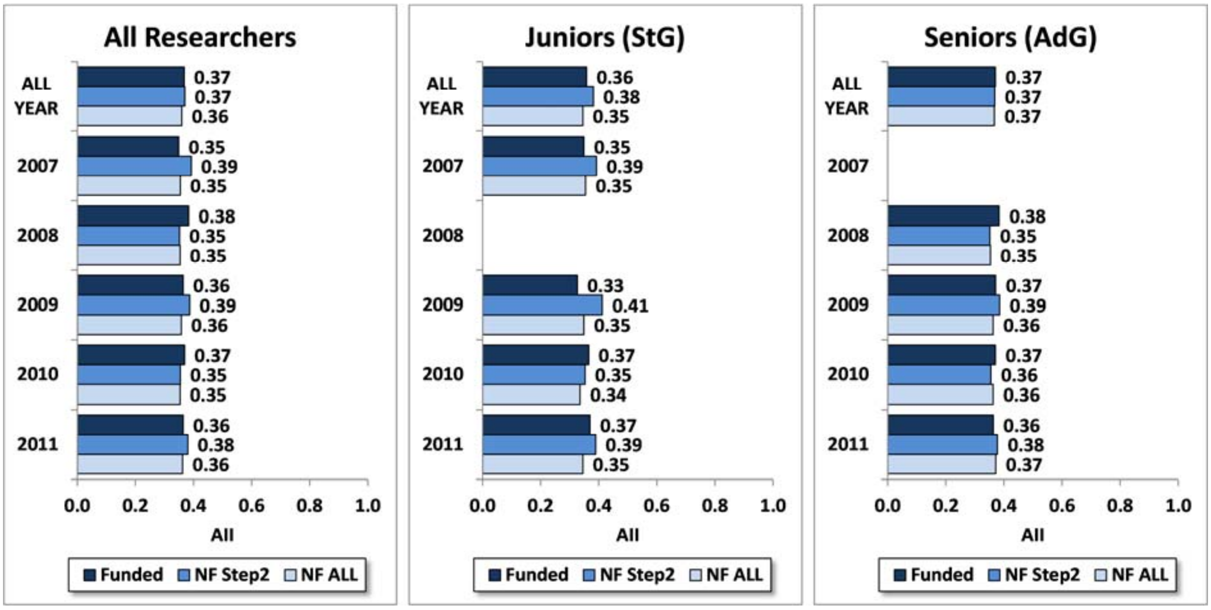
Figure 3-10. Percentage of ERC Applicants' Papers in the Top 1% of the Most Cited Papers by Domain, Panel and Funding Status



Interdisciplinarity is one of the major characteristics of the frontier research promoted by the ERC funding programme. The following figures present two bibliometric indicators to shed some light on the interdisciplinary nature of the works performed by ERC applicants before the competition. These indicators are based on references cited in those researchers' papers. We assume that references made to articles belonging to fields that are different than that of the papers citing them represent evidence of borrowing from other fields, hence, of a multidisciplinary or interdisciplinary approach. Of course, such bibliometric indicators do not cover all the different dimensions of interdisciplinary research, but they nonetheless provide objective and relevant measurements of one of its essential components.

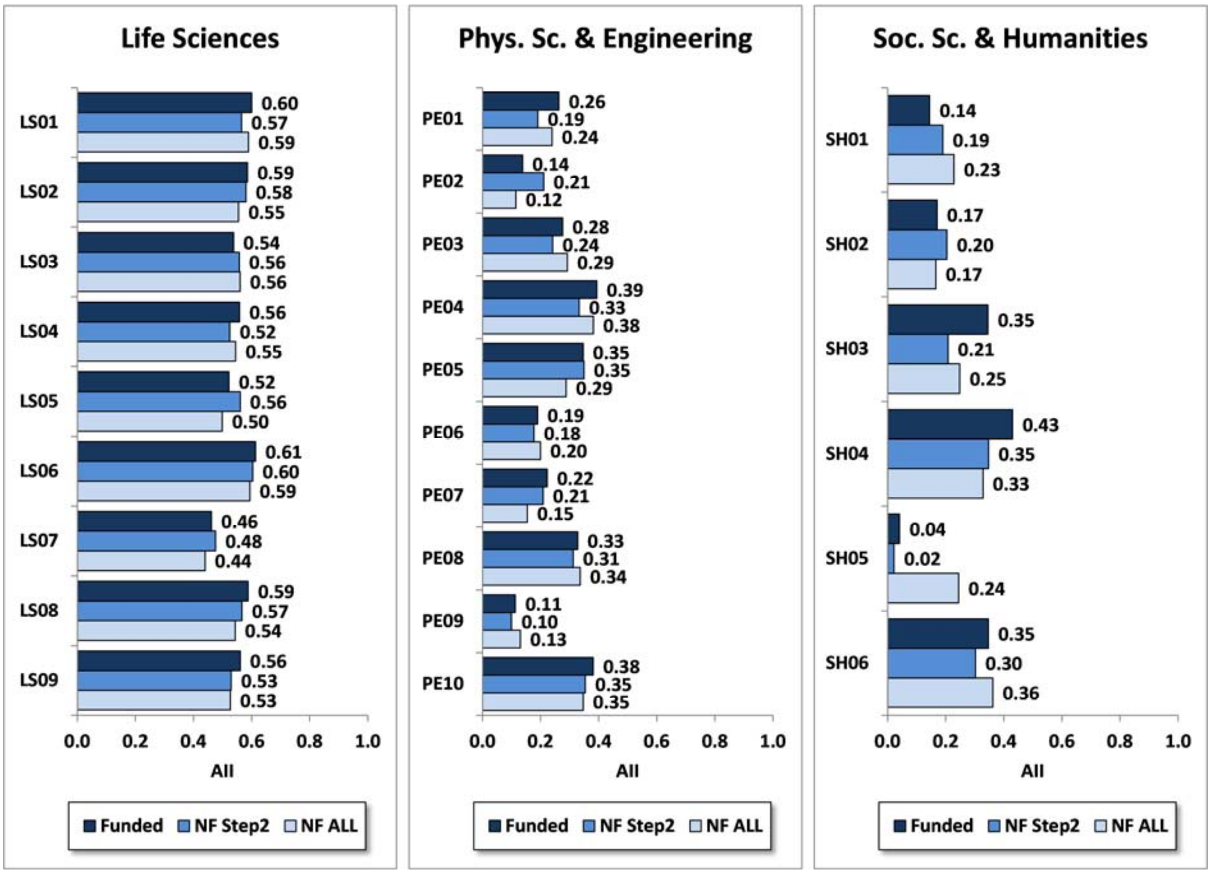
Figure 3-11 presents the average of interdisciplinarity index (AII) of papers produced by ERC applicants prior to the competition year. In other words, it represents the average share of those papers' references belonging to disciplinary fields other than their own. Thus, an AII of 0.37 for all funded researchers for all competition years means that in those papers, an average of 37% of references are from fields other than their own and conversely, that 63% of references are made to articles from their own field. It should be noted that differences between funded and non-funded applicants are not very large, ranging from a low of 0.33 to a high of 0.41, and that funded researchers are not necessarily those showing the highest AII scores.

Figure 3-11. Average of Interdisciplinarity Index (AII) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status



On the other hand, the breakdown of AII by panel (Figure 3-12) clearly shows that the level of interdisciplinarity (as measured by references made to papers from other fields) is largely determined by the domain of research, with Life Sciences panels having the highest AII scores and Physical Sciences and Engineering panels having the lowest. Also, within each panel, the scores of the three categories of applicants tend to be close and, once again, the highest scores do not necessarily belong to the funded researchers. Thus, the ERC peer review process does not seems to select the researchers with the highest interdisciplinary profile, at least as it is measured by AII.

Figure 3-12. Average of Interdisciplinarity Index (AII) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding Status



The average of interdisciplinary relative index (AIRI) presented in Figure 3-13 is a normalisation of AII by the field and bibliographical year of each paper. An AIRI above 1.00 indicates that a group of papers is more interdisciplinary (as measured by their references) than the world average of publications from the same field and year. The data presented in Figure 3-13 indicates that the publications of ERC applicants are on average slightly more interdisciplinary than the world average. On the other hand, it also shows that the applicants selected for funding are not always those who have the highest AIRI scores.

Figure 3-13. Average of Interdisciplinarity Relative Index (AIRI) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status

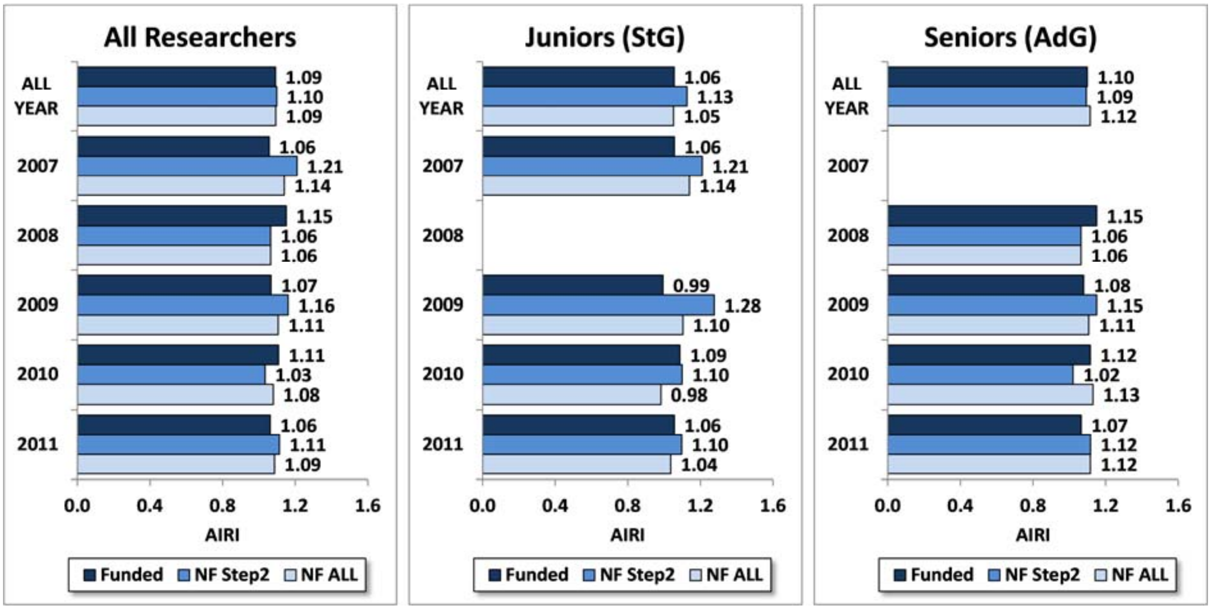
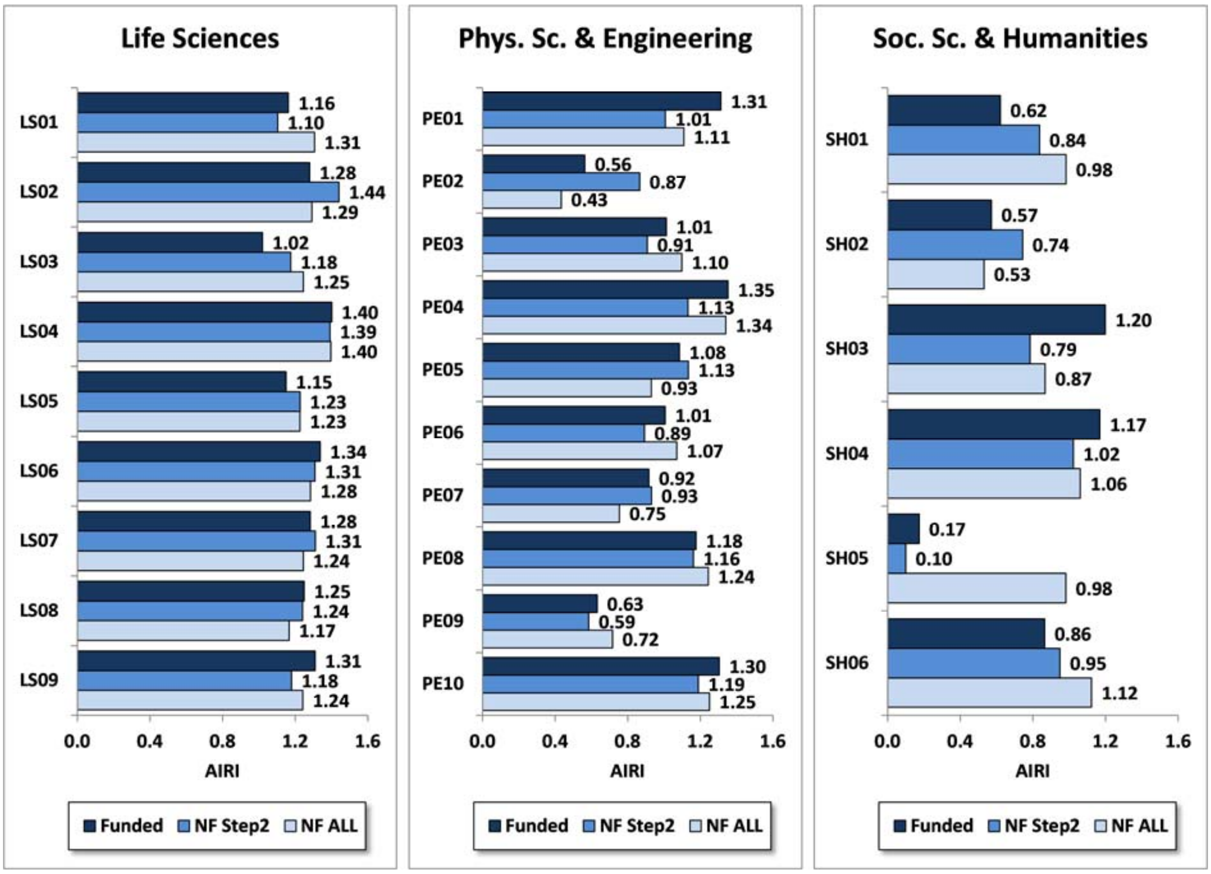


Figure 3-14 shows that the applicants from Life Sciences panels are those who have, generally speaking, the highest AIRI, and that those from four Physical Sciences and Engineering panels out of ten (PE01, PE04, PE08 and PE10) also have high interdisciplinary profile according to their AIRI. Social Sciences and Humanities show a completely different pattern: except for SH3 and SH4, the funded applicants are generally those who are the least interdisciplinary. This suggests that reviewers tend to evaluate using traditional disciplinary criteria, but once again, data for Social Sciences and Humanities should be interpreted with caution, given their problematic coverage in the databases.

Overall, Figure 3-14 data confirms that the ERC programme does attract applicants dedicated to interdisciplinarity. However, those who are selected for funding are not necessarily those who have the highest AIRI.

Figure 3-14. Average of Interdisciplinarity Relative Index (AIRI) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding Status



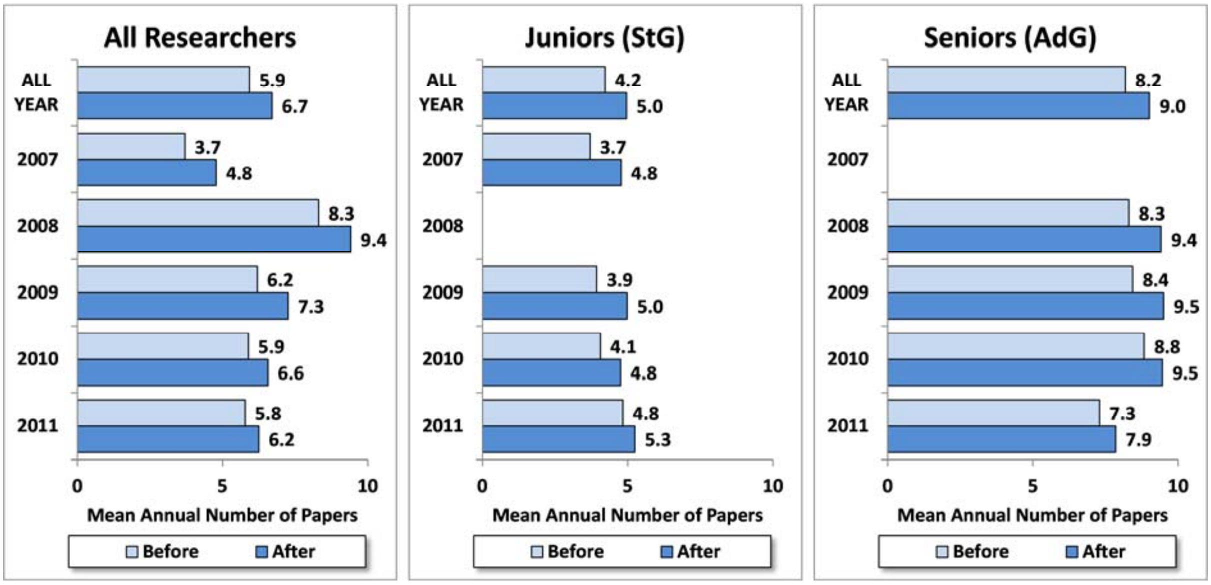
In summary, the data presented in this subsection demonstrates that the ERC competitions do attract high profile researchers and that the assessment of its peer review committees tends to select those who have published numerous high impact scientific publications in recent years, but not necessarily those who are the most committed to interdisciplinarity.

3.2. Effect of Funding

In order to assess the 'effect' of ERC funding on researchers' performance, the output and impact indicators are compiled for the pre-award period and compared to the same indicators for the post-award period. More specifically, papers are counted as post-award from the grant-starting year to the end of the period covered by the publication files (funded papers). They are counted as pre-award from the years before the grant-starting year to the beginning of the period covered by the publication files (2002). It should be noted, however, that in the case of junior researchers only the three years before the grant-starting year are counted in the pre-award period, since it is unlikely that they have published for many years before the competition. For example, the publications of 2005-2007 are counted for junior researchers who received their grant in 2008, the publications of 2006-2008, for those who received their grant in 2009, and so on. As is the case for the other indicators, this is compiled at different levels: annual cohorts, ERC domain, panel and funding schemes. This analysis is performed for ERC-funded researchers only.

As shown in Figure 3-15, the publication output of funded researchers increases noticeably after the grant start year; this is true for all junior and senior cohorts and it is statistically significant for all cohorts except those of 2011.[5] From one cohort to another, the increase ranges from 0.4 to 1.1 papers per year. However, given that the funded researchers were already quite productive before the grant start year, this increases on average by a relatively modest 14% (from 5.9 to 6.7).

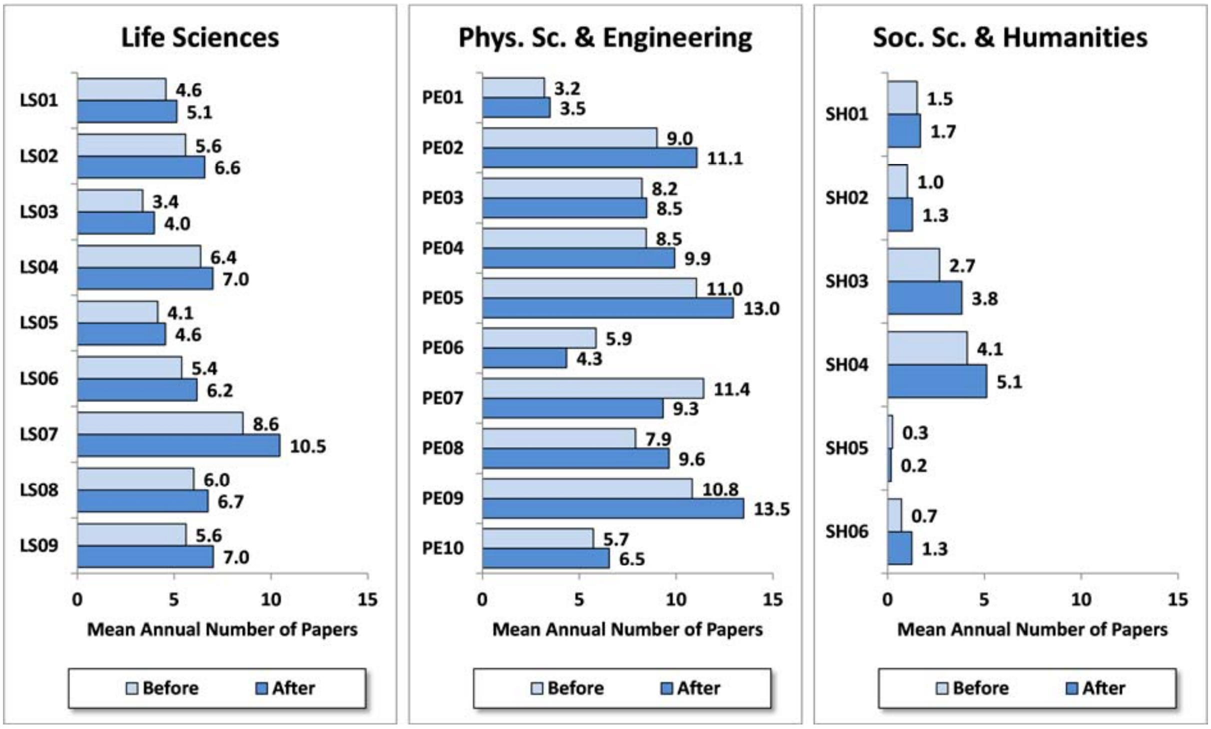
Figure 3-15. Mean Annual Number of Papers per ERC-Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year



A growth in publication output is found for almost all panels, exceptions being PE06 and PE07 where it decreased significantly (Figure 3-16). In absolute numbers, the greatest increases are for the panels LS07, PE05 and PE09, with about two additional papers per year. For 13 panels out of 25, the observed increases in productivity prove to be statistically significant.

[5] Since the comparisons presented here involved paired data, the statistical test performed for the before/after differences is the Wilcoxon signed-rank test.

Figure 3-16. Mean Annual Number of Papers per ERC-Funded Researcher Before and After the Grant Start Year by Domain and Panel



Similar to the slight productivity growth of funded researchers after the grant start year, their scientific impact as measured by ARIF also tends to increase marginally. As shown in Figure 3-17, senior researchers tend to publish their results in journals with slightly higher impact factors during their funding period; the 0.1 increase is indeed statistically significant.[6] On the other hand, this trend does not extend to the junior researchers. While the 2009 cohort experiences a similar increase, the ARIF of the 2007 and 2011 cohorts remain unchanged and that of the 2010 cohort decreases slightly.

[6] See Appendix B

Figure 3-17. Average of Relative Impact Factors (ARIF) of ERC-Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

Figure 3-18 shows that the vast majority of panels experience slight increases in their ARIF with the exceptions of PE01 PE06, PE09 and PE10; these increases are statistically significant for seven panels. That said, one should notice that the ARIFs of all cohorts and panels are significantly higher than the world average (1.0). In Social Sciences and Humanities, the trends are less clear and it should be remembered that the impact measurements are not very reliable in these fields.

Figure 3-18. Average of Relative Impact Factors (ARIF) of ERC Funded Researcher Before and After the Grant Start Year by Domain and Panel

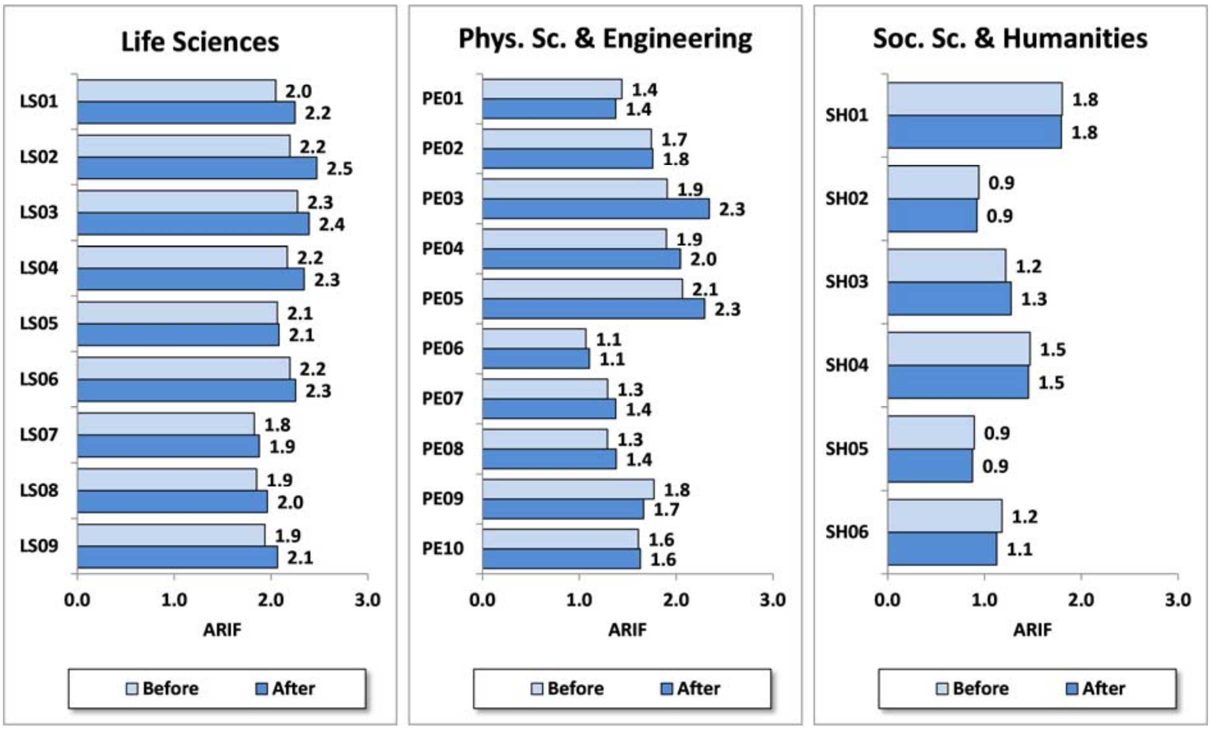


Figure 3-19 shows that the ARC of ERC-funded researchers tends to decrease slightly during the funding period and that this is primarily due to the cohorts of junior researchers. It should also be noted that all differences observed in the figure are statistically significant. One might argue that, given the very high scores obtained before receiving ERC funding, it was much more difficult for the funded researchers to achieve additional impact and even to maintain such performance. That said, one should also note that, despite the decrease of their ARC, the scientific impact of junior and senior ERC researchers is quite a bit higher than the world average (1.0). From one panel to another, Figure 3-20 shows that those from life sciences generally tend to increase their scientific impact during the funding period, while the majority of those from Physical Sciences and Engineering and Social Sciences and Humanities tend to decrease.

Figure 3-19. Average of Relative Citations (ARC) of ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

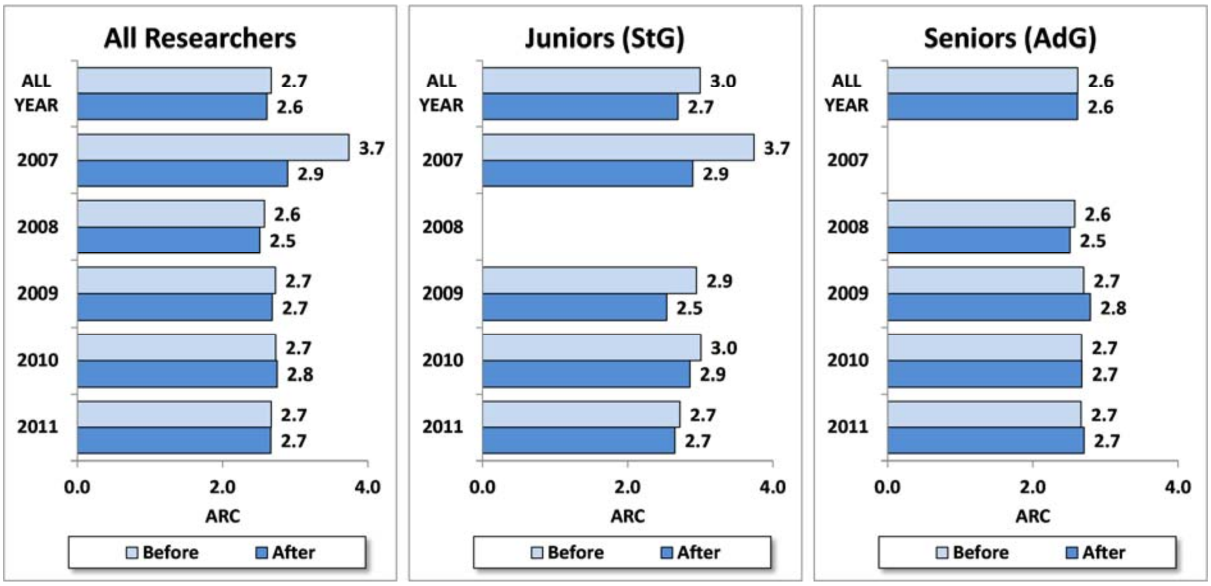
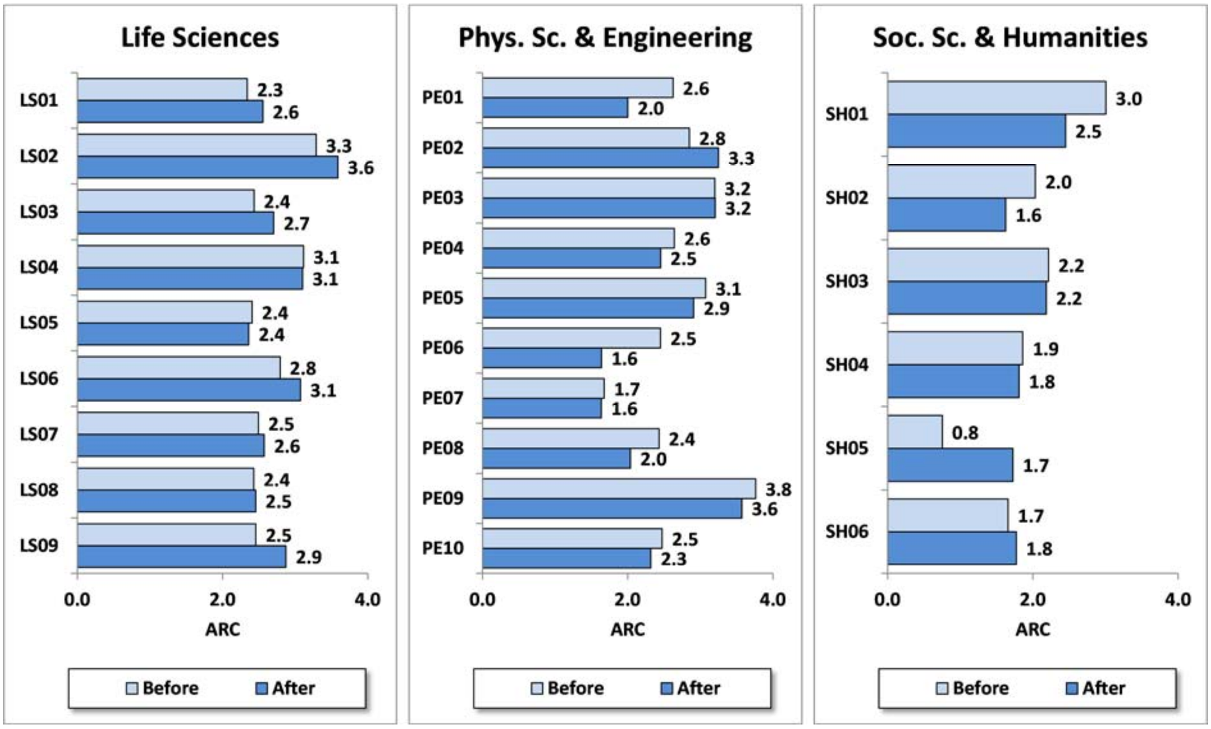


Figure 3-20. Average of Relative Citations (ARC) of ERC-Funded Researcher Before and After the Grant Start Year by Domain and Panel



On the whole, the share of top cited papers (Figure 3-21) tends to increase slightly (from 18.6% to 19.8%) during the funding period, but this trend is due primarily to the senior researchers from the three last cohorts (2009 to 2011). Results of Figure 3-22 show that about a half of the panels increase their share of highly cited papers (among the top 5%) during the funding period (notably those of Life Sciences), while the other panels experience a decrease. It should be noted however that all groups of researchers maintain a share of highly cited papers clearly above 10%, which is double the expected value of 5%, and several panels have even higher shares.

Figure 3-21. Percentage of ERC-Funded Researchers' Papers in the Top 5% of the Most Cited Papers Before and After the Grant Start Year by Seniority and Competition Year

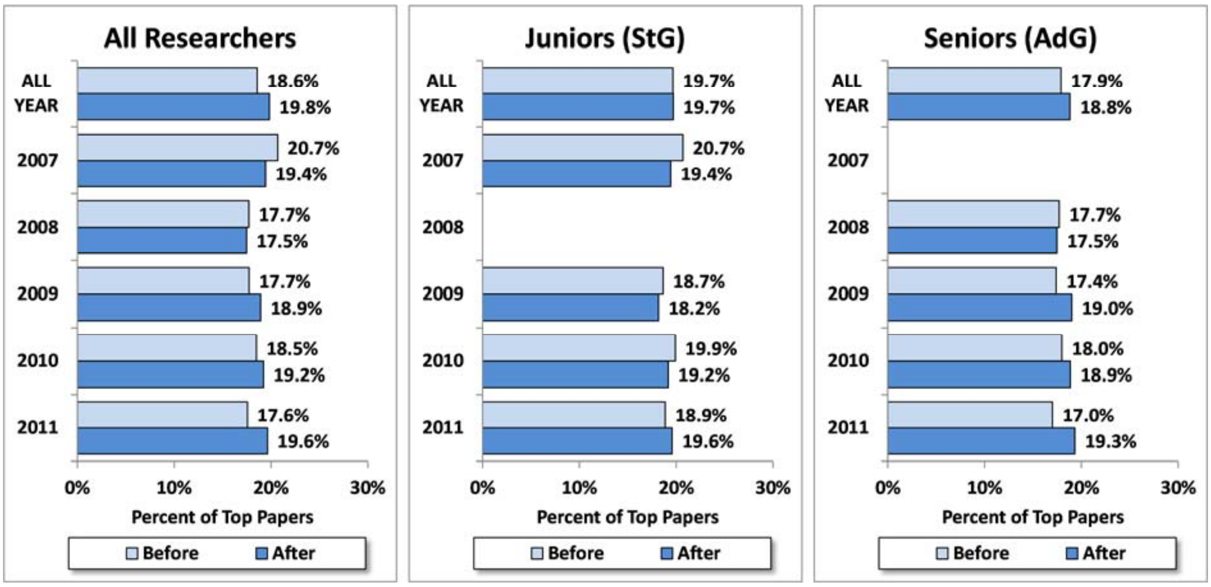
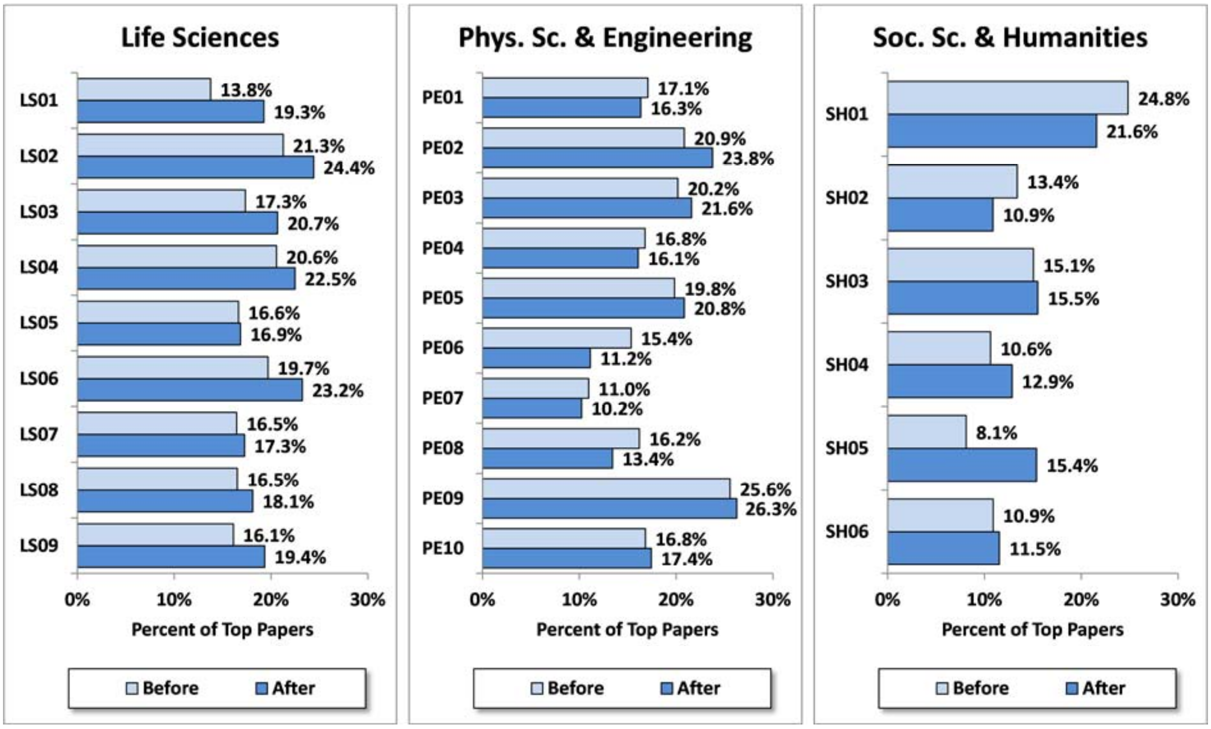


Figure 3-22. Percentage of ERC-Funded Researchers' Papers in the Top 5% of the Most Cited Papers Before and After the Grant Start Year by Domain and Panel



Data for the top 1% of papers (Figure 3-23 and Figure 3-24) shows essentially the same trends: on the whole, the funded researchers slightly increased their shares of highly cited papers, but this is due mainly to the 2009-2011 cohorts of senior researchers and to the Life Sciences panels.

Figure 3-23. Percentage of ERC-Funded Researchers' Papers in the Top 1% of the Most Cited Papers Before and After the Grant Start Year by Seniority and Competition Year

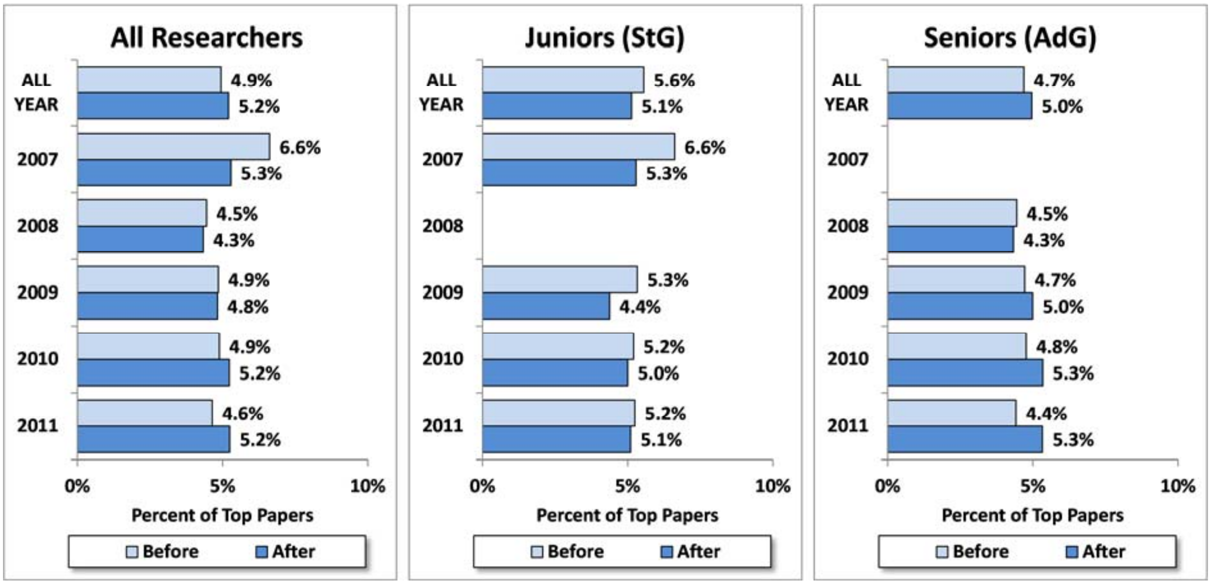


Figure 3-24. Percentage of ERC-Funded Researchers' Papers in the Top 1% of the Most Cited Papers Before and After the Grant Start Year by Domain and Panel

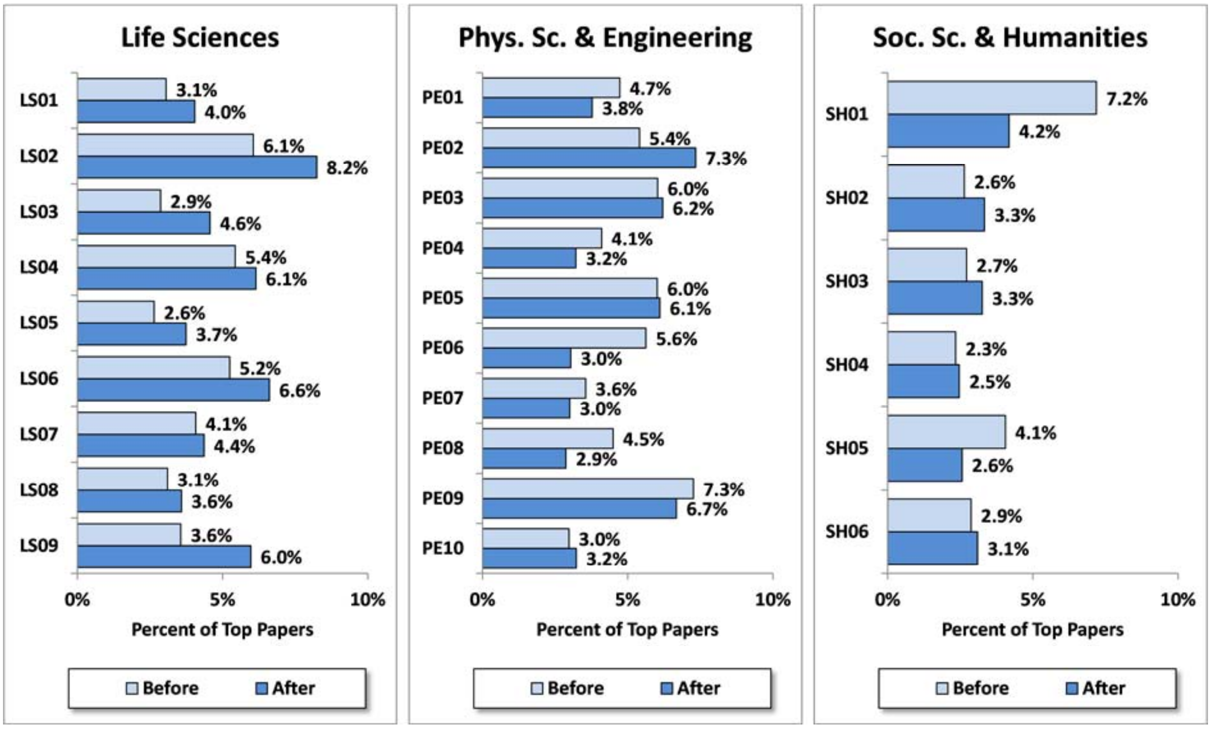


Figure 3-25 shows that, compared to the pre-funding period, the level of interdisciplinarity of papers produced by the ERC researchers tends to increase during funding period and this is true for all cohorts. Figure 3-26 shows that it is also true for every panel.

Figure 3-25. Average of Interdisciplinarity Index (AII) of ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

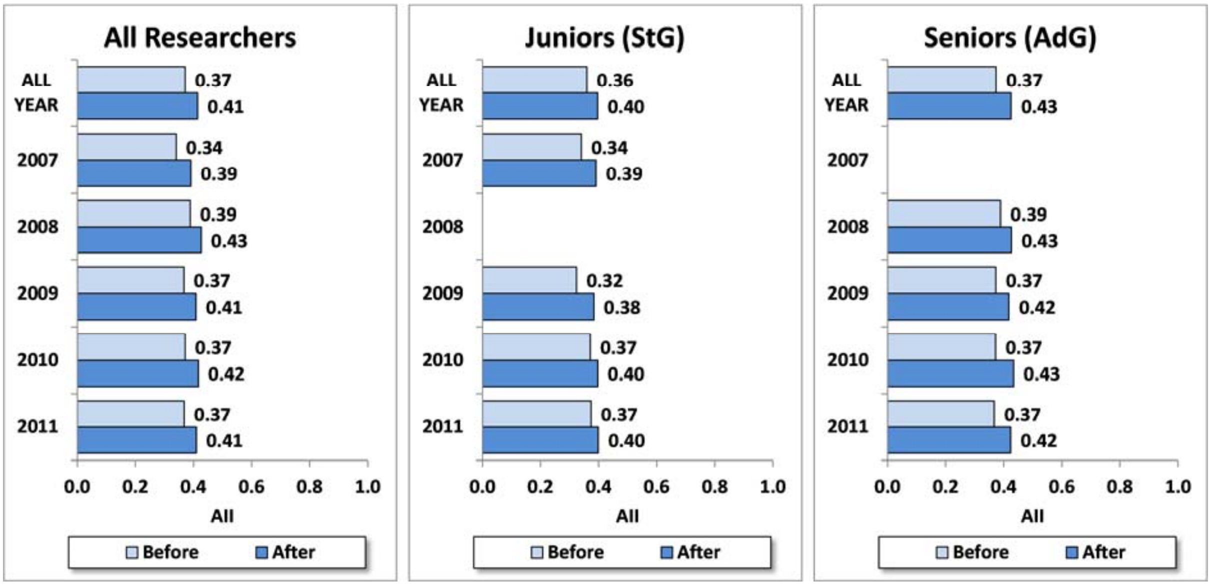
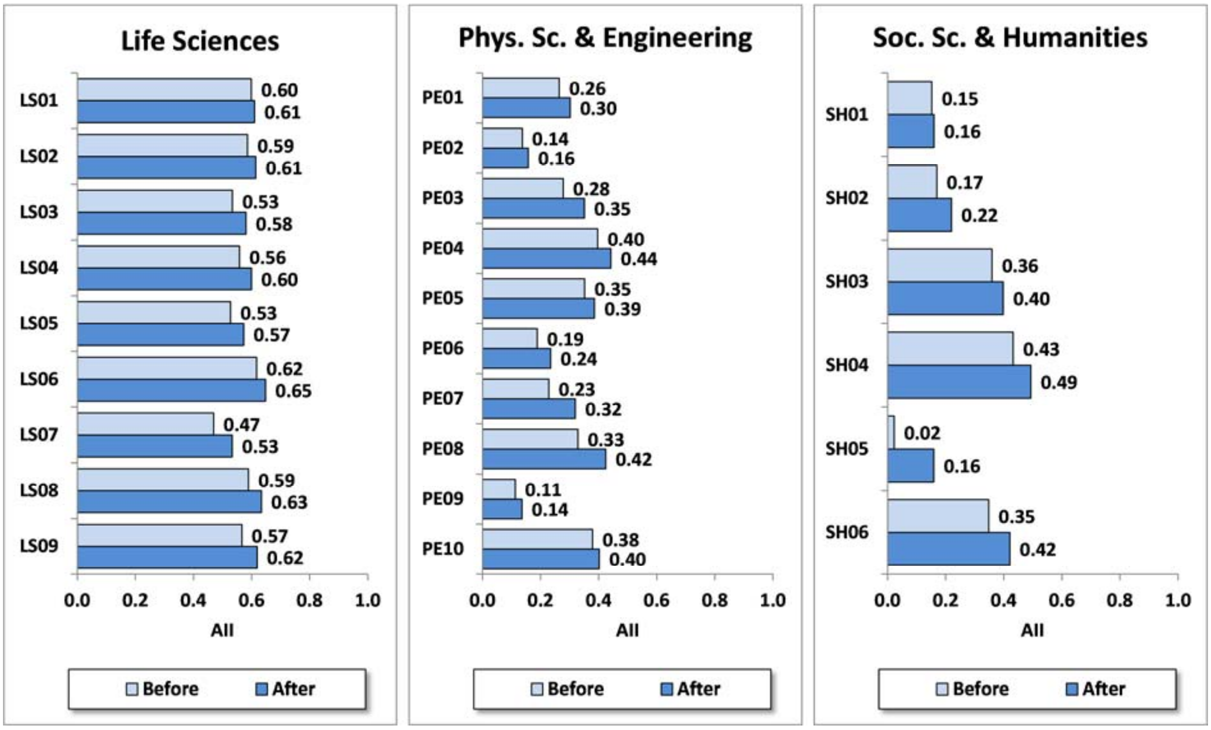


Figure 3-26. Average of Interdisciplinarity Index (AII) of ERC Funded Researcher Before and After the Grant Start Year by Domain and Panel



However, one should also take into account the fact that, during the recent years, the world value of AII has tended to increase for almost every discipline. In other words, the interdisciplinarity as measured by the bibliographic references of scientific papers has tended to increase. Thus normalised by publication years and fields (through AIRI), the data for ERC researchers provide a different picture. As shown in Figure 3-27 and Figure 3-28, while the level of interdisciplinarity of ERC researchers' publications tended to remain slightly above world average during the funding period, it nonetheless tended to decrease when compared to the world average.

Figure 3-27. Average of Interdisciplinarity Relative Index (AIRI) of ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

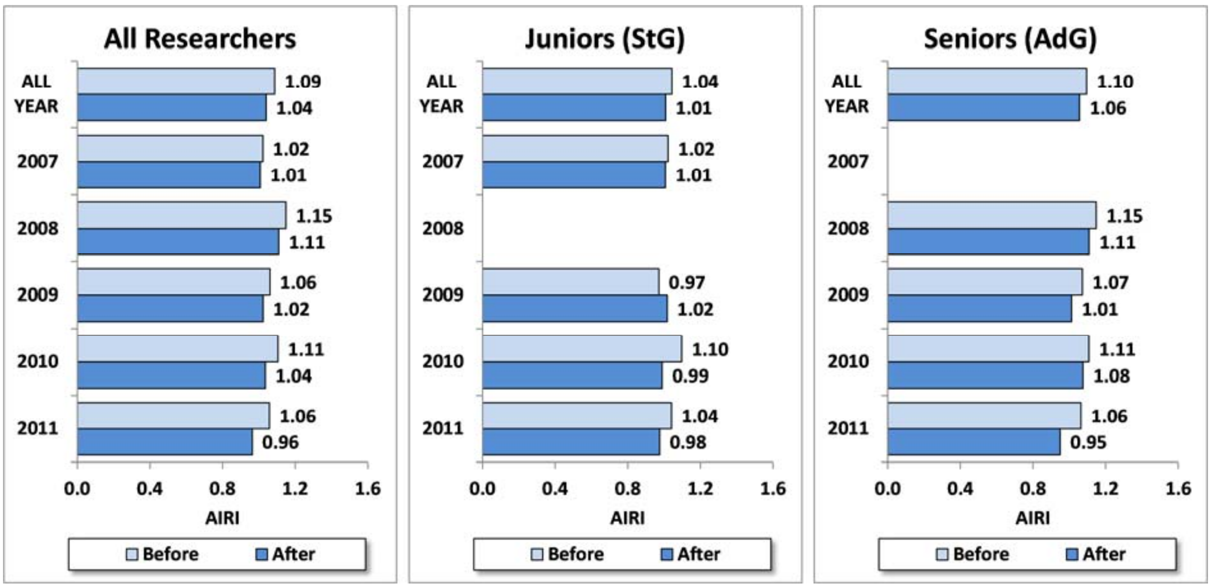
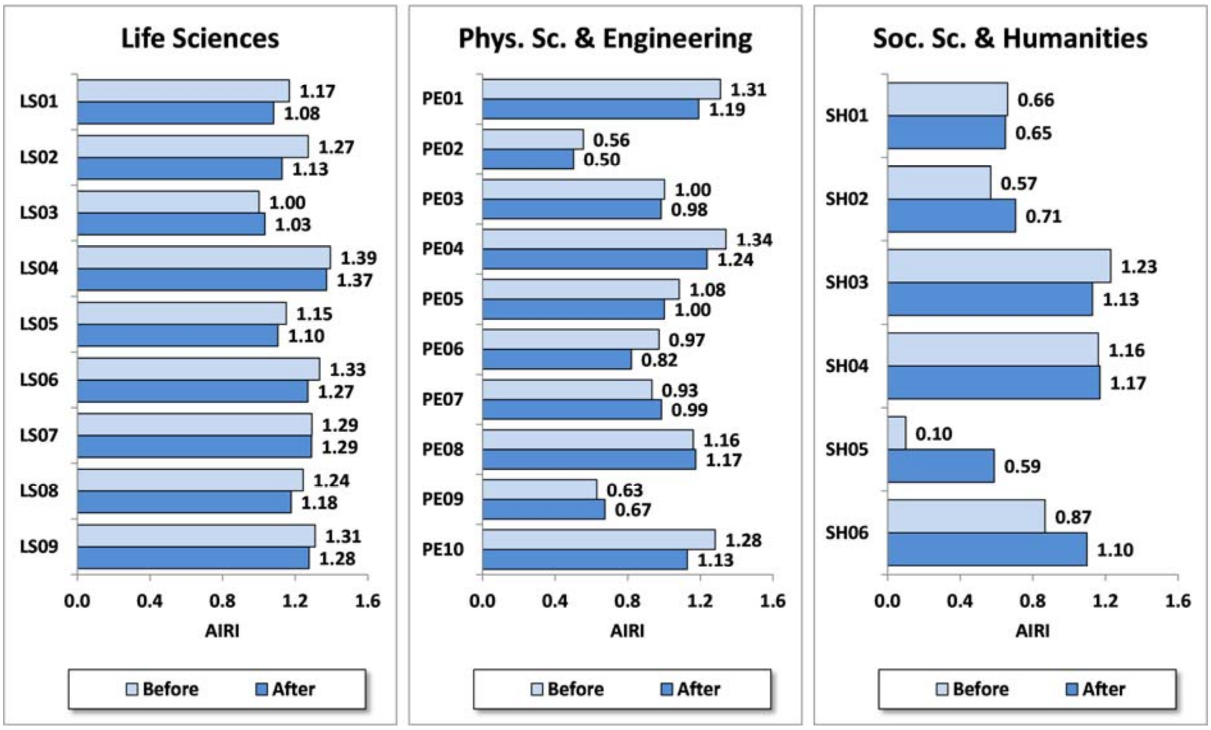


Figure 3-28. Average of Interdisciplinarity Relative Index (AIRI) of ERC Funded Researcher Before and After the Grant Start Year by Domain and Panel



In short, the comparison between the publication output of researchers for the pre-funding and funding periods suggests that ERC grants do not lead to a very significant improvement of their productivity and scientific impact. Neither does it seem to lead to the adoption of more intense interdisciplinary practices than those observed in the global research landscape.

Another way to measure the impact of ERC funding on the publication output of researchers is to compare two groups of applicants, the first one funded and the second not funded, who received very similar scores from ERC peer review committees; in other words, groups of candidates which were judged to be of (almost) equal merit, but separated only by the competition funding threshold. Specifically, the first group comprises 175 funded applicants who obtained the lowest scores in each panel, competition year and call schema (seniority), while the second group comprises 175 applicants rejected at step 2 with the highest scores below the funding threshold of the same panel. Accordingly, these researchers are referred to as “borderline applicants”. By comparing those funded researchers with their counterparts from the group of non-funded, we sought to analyse the effect of funding on their scientific production. Indeed, assuming that at the time of the application these two groups were comprised of researchers of (almost) equal quality, we can postulate that the differences in scientific output between them after the competition year are the effects of ERC funding.

Figure 3-29 presents the productivity of the two groups of researchers for the period prior to the competition. It shows that, for all domains and levels of seniority, the productivity of the two groups is almost equal at about 5.5 papers per year. The productivity of funded senior researchers seems slightly above that of the non-funded ones, while that of funded junior researchers seems slightly below that of non-funded ones. None of the observed differences are statistically significant. Broken down by large disciplinary domains, this indicator shows that in Life Sciences, non-funded researchers are slightly more productive than the funded ones and that the reverse is true in Physical Sciences and Engineering.

Figure 3-29. Mean Annual Number of Papers per ERC Borderline Applicant Before the Competition Year by Seniority, Domain and Funding Status

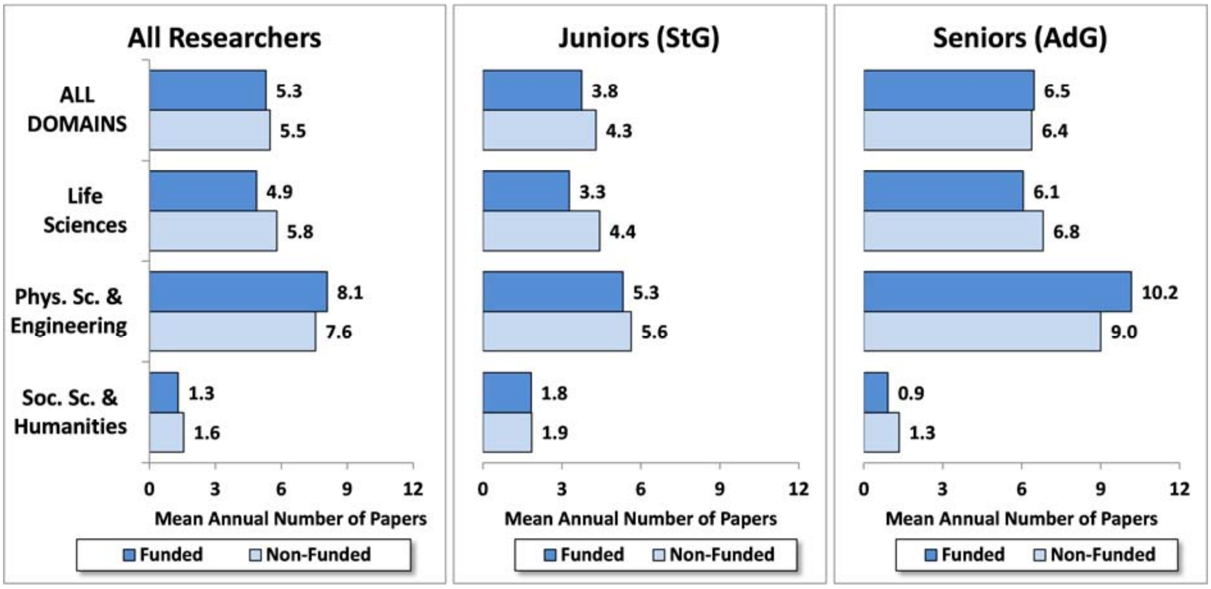


Figure 3-30 shows that the productivity of both groups increases following the competition year, but surprisingly it is the non-funded group which improves most. As was the case before the competition year, the sole group of funded researchers which is more productive than its non-funded counterpart is that of the senior researchers in Physical Sciences and Engineering. That said, it should be noted that none of the observed differences are statistically significant.

Figure 3-30. Mean Annual Number of Papers per ERC Borderline Applicant After the Competition Year by Seniority, Domain and Funding Status

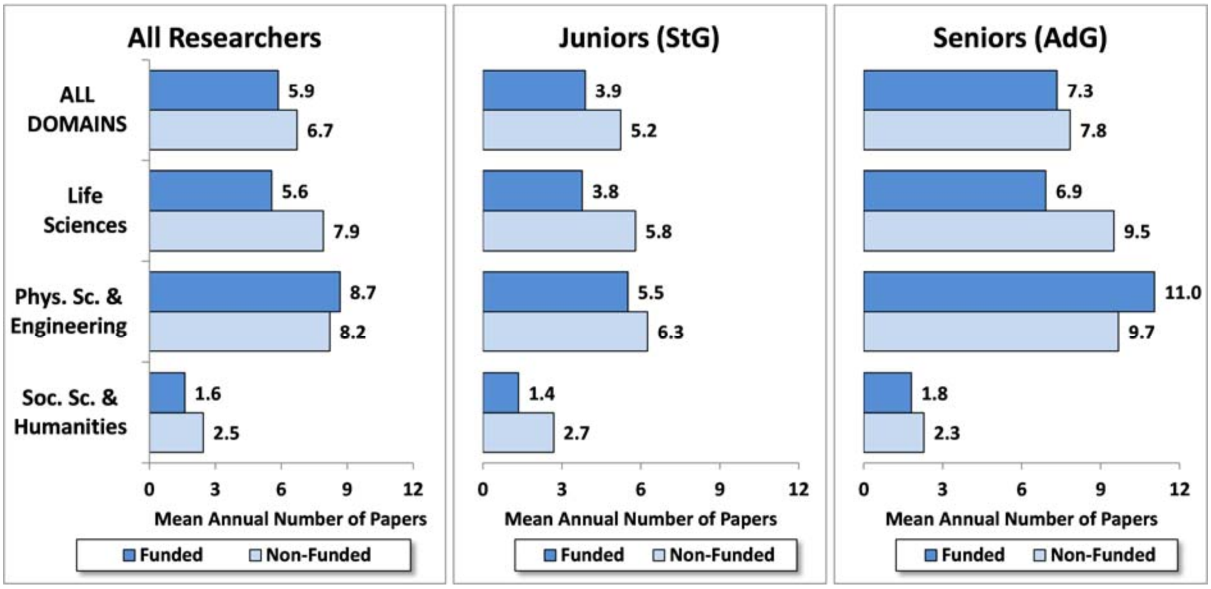
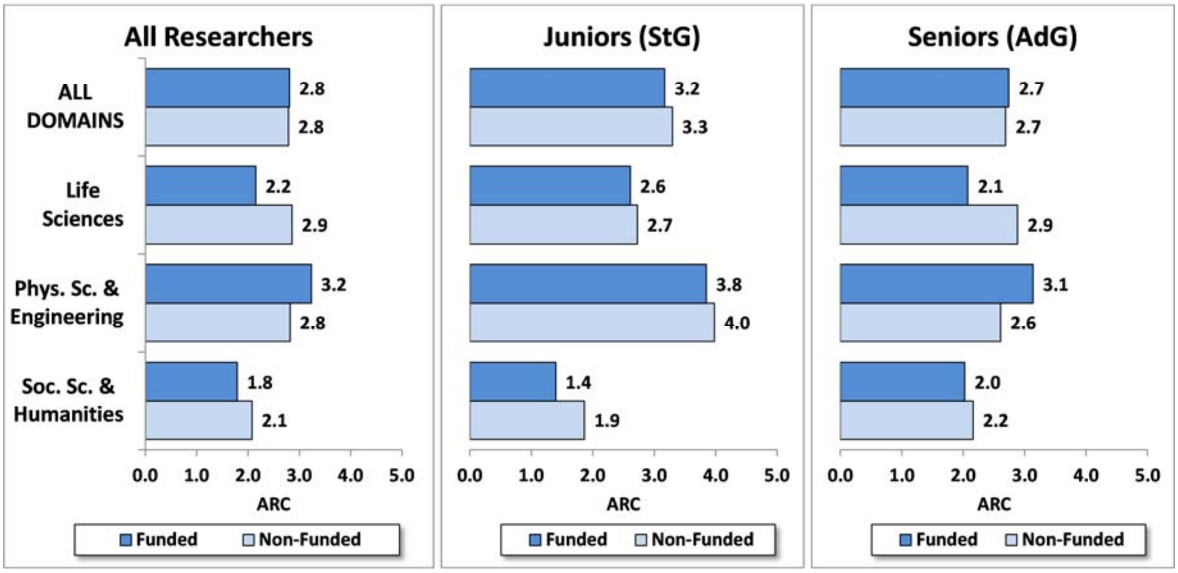


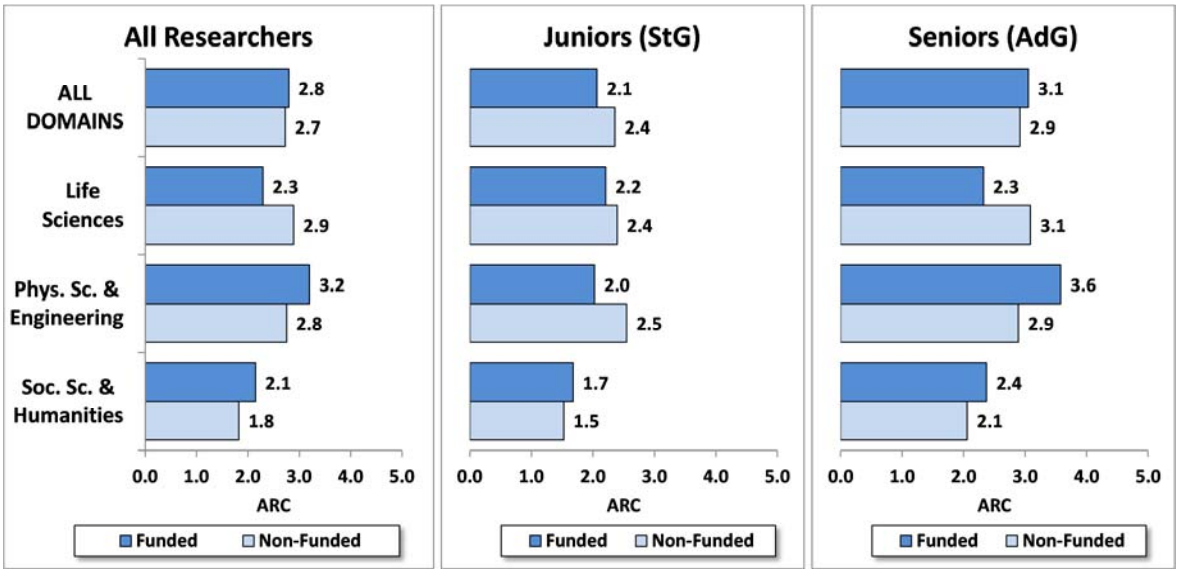
Figure 3-31 presents the scientific impact of the two groups of applicants for the period before the competition year. It shows that the two groups are globally on par, with ARC score of 2.8 each. Broken down by large domains, it shows that the funded senior life scientists have a significantly lower scientific impact than their non-funded counterparts. In Physical Sciences and Engineering, the junior funded researchers also have a significantly lower impact than their non-funded colleagues, while the reverse is true for the seniors. In Social Sciences and Humanities, the impact of the funded junior and senior researchers seems lower than that of their non-funded counterparts, but the differences are not statistically significant. As stated repeatedly in this report, the bibliometric indicators regarding Social Sciences and Humanities should be interpreted with caution.

Figure 3-31. Average of Relative Citations (ARC) of ERC Borderline Applicants Before the Competition Year by Seniority, Domain and Funding Status



Following the competition year (Figure 3-32), both groups (funded and non-funded) of senior researchers improved their scientific impact, while both groups of junior researchers experienced a decrease in their ARC scores. By domain and seniority level, however, the relative position of funded and non-funded researchers remains almost unchanged between the first (Figure 3-31) and the second (Figure 3-32) periods. Non-funded researchers in Life Sciences still have a higher ARC score than funded ones. In Physical Sciences and Engineering the funded senior researchers outpace the non-funded, while the junior non-funded have a greater impact than their funded counterparts. In Social Sciences and Humanities however, the relative position of funded and non-funded researchers changed during the funded period and the former now seem to out-perform the latter, but it should also be mentioned that the observed differences are not statistically significant.

Figure 3-32. Average of Relative Citations (ARC) of ERC Borderline Applicants After the Competition Year by Seniority, Domain and Funding Status



In short, the bibliometric data compiled for the two groups of borderline applicants does not provide any evidence for a significant impact of ERC funding on the publication output of the grantees, either from a quantitative point of view or from a qualitative one. This finding is consistent with those drawn for the comparison for the grantees between the funding period and the pre-funding period.

3.3. International Benchmarking

This subsection presents a benchmarking analysis of the publication output of the ERC-funded researchers against some chosen samples of other European and US-funded researchers. It should be mentioned that these samples are not necessarily representative of the whole populations of researchers funded by these agencies, but were rather selected to match the essential characteristics of the group of ERC-funded researchers. As far as possible, they include researchers who received large grants and, when the information was available from the agency, they also include junior and senior researchers in proportions equal to those found in the group of ERC grantees. These samples include the three large disciplinary domains covered by the ERC panels and consist of researchers who received at least one grant following a competition held between 2007 and 2011.

Figure 3-33 presents the mean annual number of papers produced by each group broken down by large domain and seniority level. It shows that the junior and senior ERC researchers are clearly more productive than almost all of their counterparts from the other agencies. The sole exception is the group of EU FP7 researchers in Life Sciences who are, on average, more productive than the whole group of ERC researchers from the same domain. It should be mentioned that there is no distinction between junior and senior researchers in the EU FP7 group and that the group of ERC senior researchers in Life Sciences is more productive than the EU FP7 group (9.0 papers against 8.3). In addition, all the differences observed in Figure 3-33 between ERC researchers and those from other agencies are statistically significant, expect for that between ERC junior researchers in Life Sciences and their counterparts from NSF, NIH and HHMI.

Figure 3-33. Mean Annual Number of Papers per Funded Researcher After the Grant Start Year by Seniority, Domain and Agency

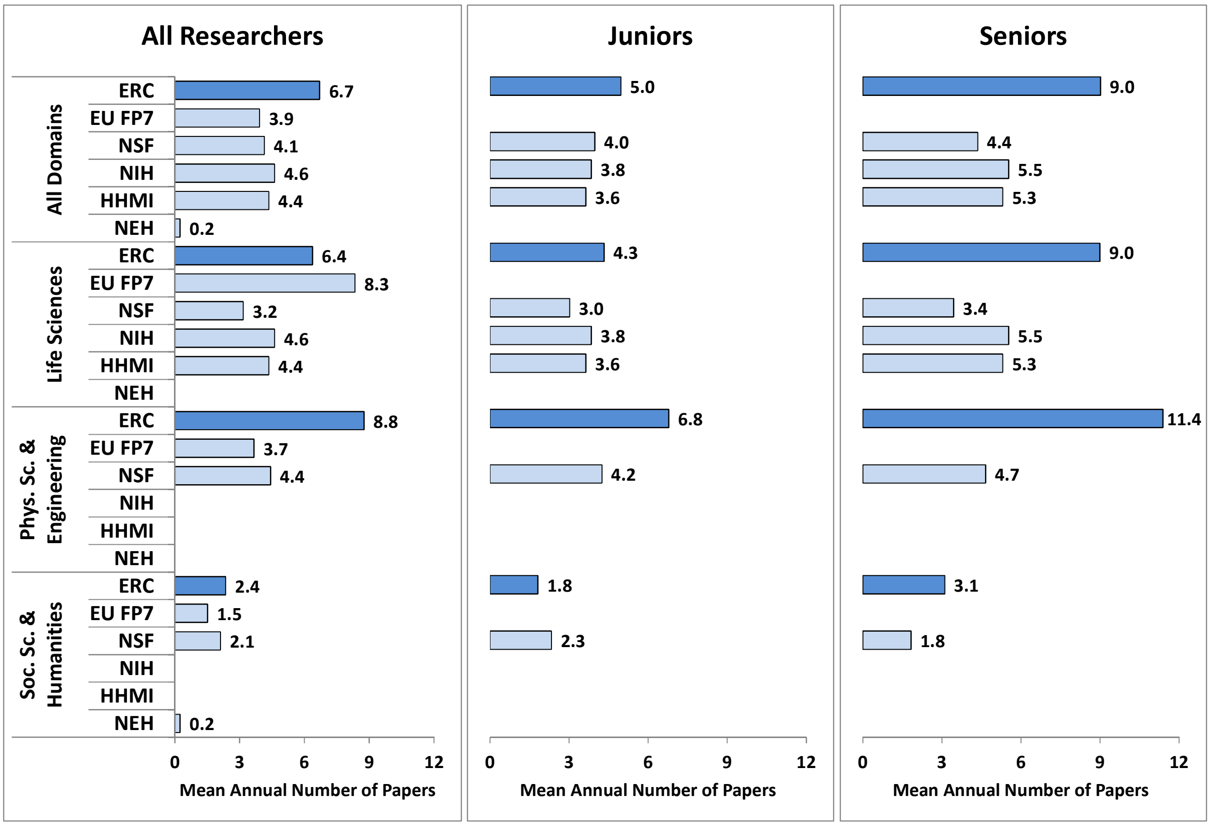


Figure 3-34 shows that, on average, ERC researchers publish their results in journals endowed with higher impact factors than those publishing the results of the grantees from EU FP7, NSF and NEH. These differences are statistically significant. In Life Sciences the senior ERC researchers also have a significantly higher score than that of their counterparts funded by the NIH. By contrast, all ERC researchers have a significantly lower ARIF than that of the HHMI funded researchers.

Figure 3-34. Average of Relative Impact Factors (ARIF) of Funded Researcher After the Grant Start Year by Seniority, Domain and Agency

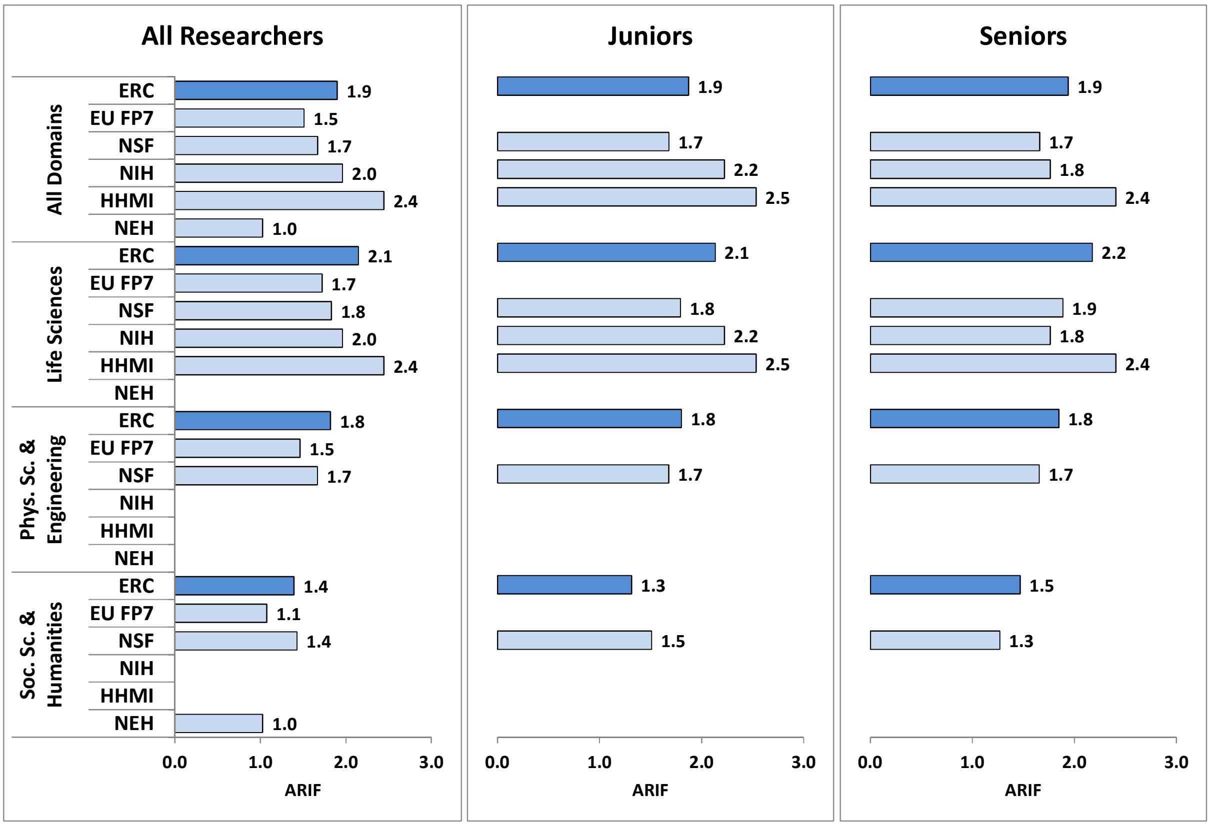
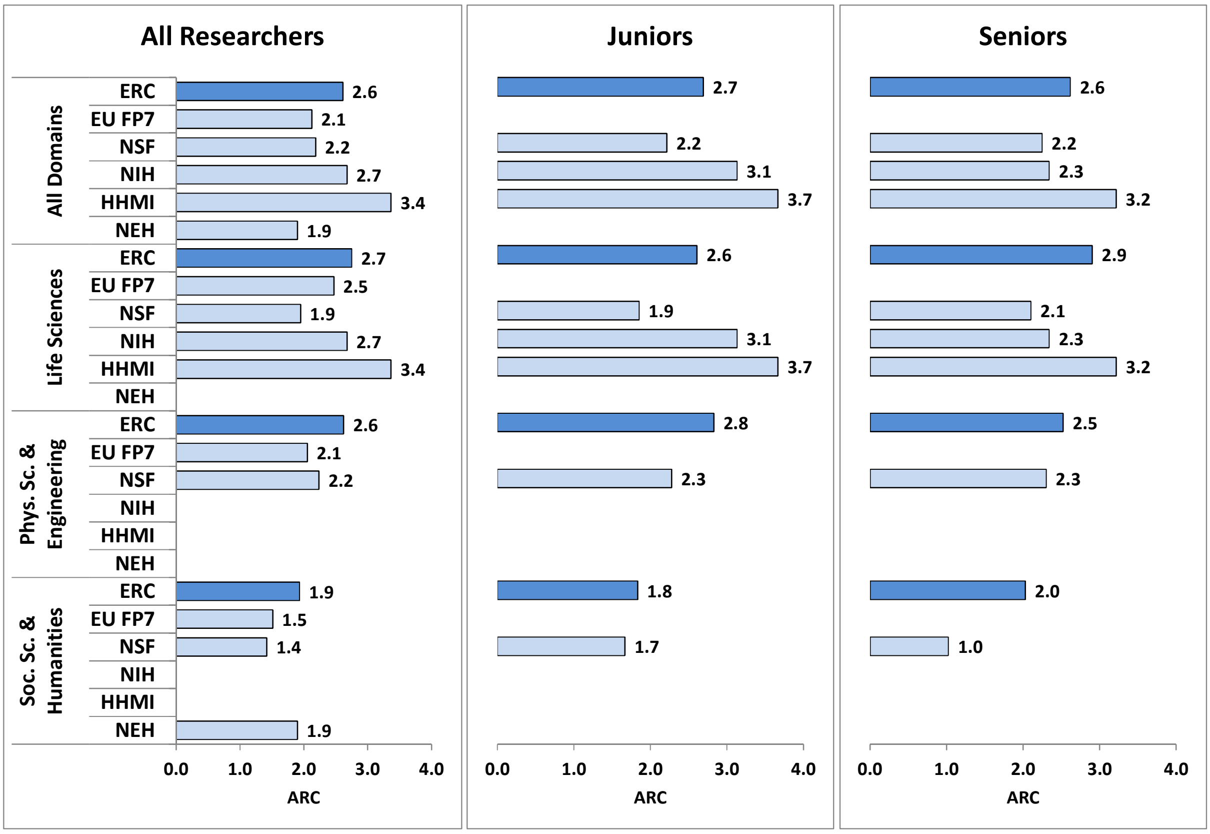


Figure 3-35 shows that ERC junior and senior researchers have a greater scientific impact than the EU FP7 and NSF grantees. However, while the ERC senior researchers from the Life Sciences outpace their counterparts from the NIH, the junior NIH researchers have a higher ARC score than their ERC counterparts. The highest ARCs of all comparable groups are those of HHMI researchers from both junior and senior groups, but the largest difference between HHMI and ERC is for the junior researchers. Finally, the ARCs of ERC researchers from Social Sciences and Humanities are higher than those of their counterparts from NSF, but on par with those of NEH grantees. All observed differences in Figure 3-35 are statistically significant.

Figure 3-35. Average of Relative Citations (ARC) of Funded Researcher After the Grant Start Year by Seniority, Domain and Agency



The data regarding the top 5% and 1% most cited papers presented in Figure 3-36 and Figure 3-37 show essentially the same trends as the ARCs shown in Figure 3-35. The ERC researchers outpace their counterparts from EU FP7 and NSF. The ERC has a higher scientific impact than that of NIH for its senior researchers, but a lower one for its juniors. Compared to the HHMI researchers, the ERC grantees have lower scientific impact.

Figure 3-36. Percentage of Funded Researchers' Papers in the Top 5% of the Most Cited Papers After the Grant Start Year by Seniority, Domain and Agency

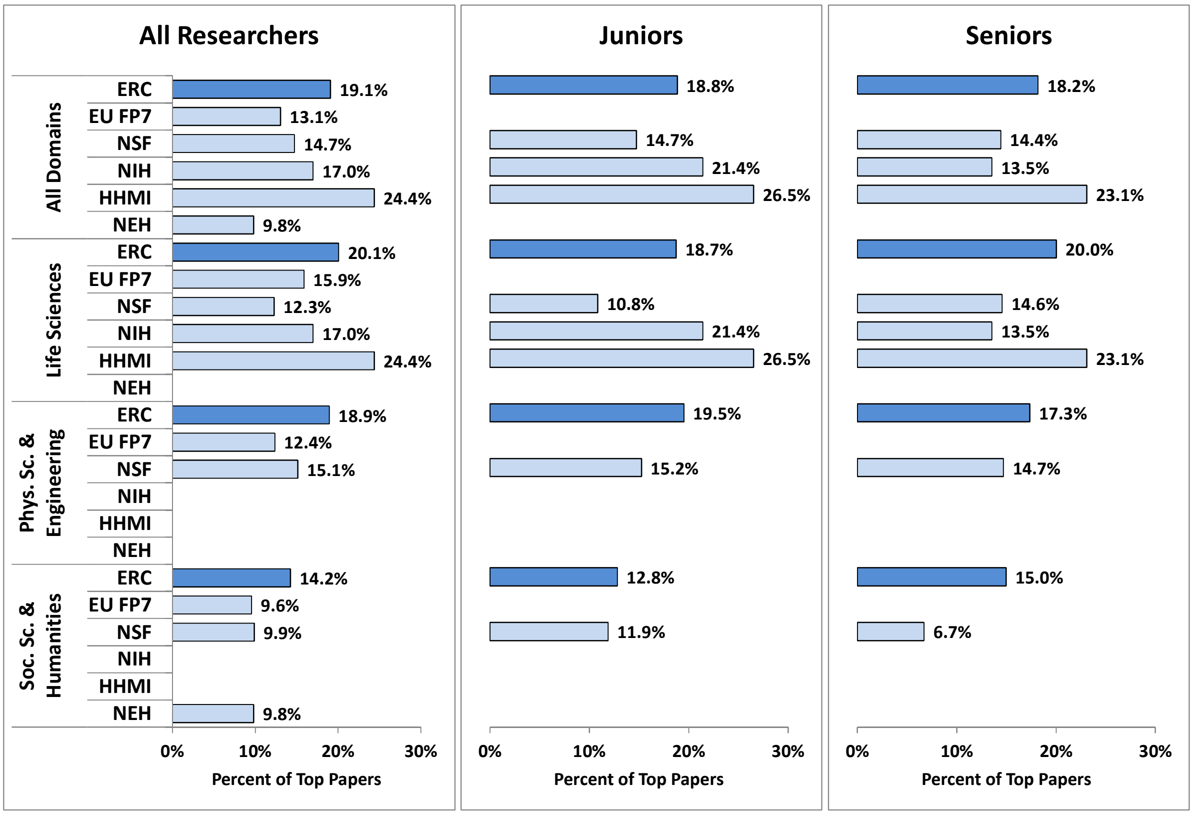
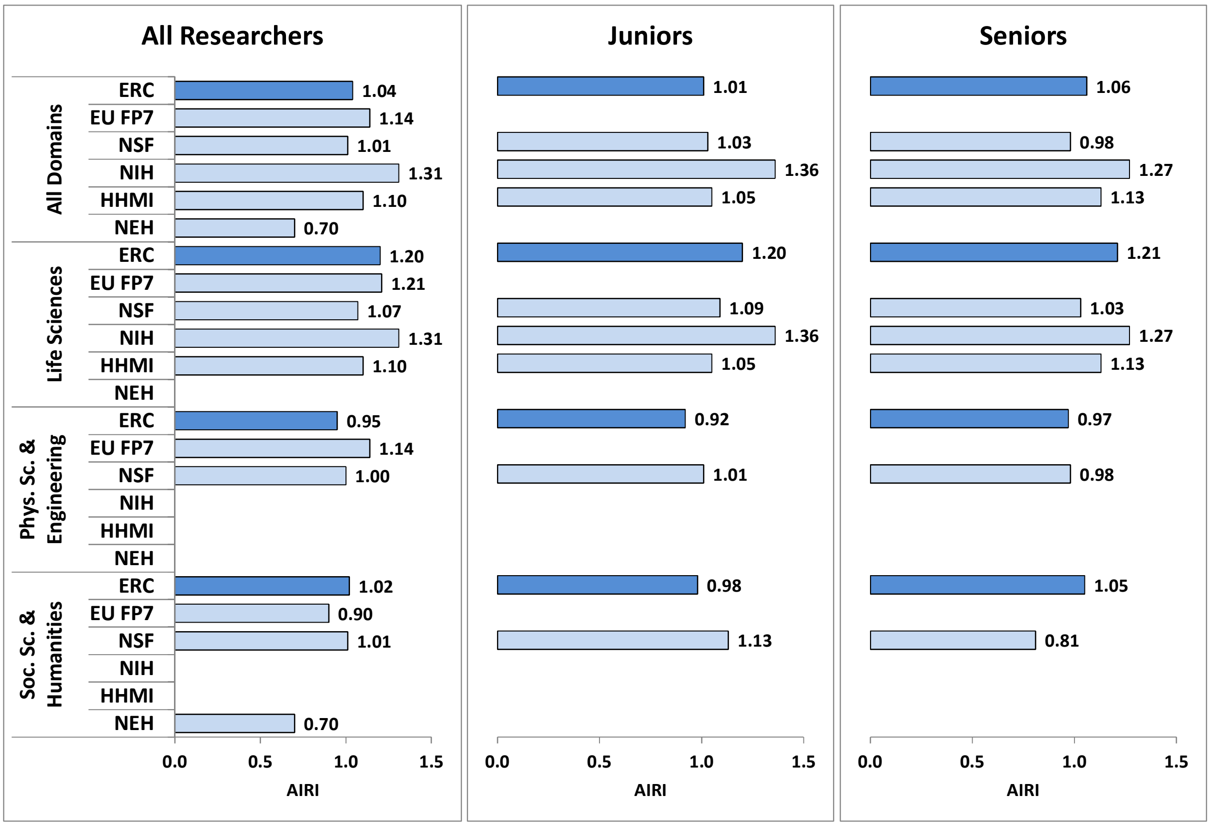


Figure 3-37. Percentage of Funded Researchers' Papers in the Top 1% of the Most Cited Papers After the Grant Start Year by Seniority, Domain and Agency

Data on interdisciplinarity presented in Figure 3-38 shows that, generally speaking, the publications of ERC funded researchers are more interdisciplinary than those of NSF and NEH funded researchers, but less than those of EU FP7, HHMI and NIH. This is true for almost all seniority levels and domains, but there are two notable exceptions. The first is Physical Sciences and Engineering, where ERC researchers' publications are slightly less interdisciplinary that those of NSF grantees and the second is Social Sciences and Humanities, where ERC junior researchers' publications are slightly less interdisciplinary than those of their counterparts from the NSF.

Figure 3-38. Average of Interdisciplinarity Relative Index (AIRI) of Funded Researchers After the Grant Start Year by Seniority, Domain and Agency



In short, this benchmarking of ERC-funded researchers provides strong evidence that their publication output is among the best of those analysed in the current study, in terms of both productivity and scientific impact. It outpaces that of EU FP7 and NSF, and in Life Sciences, the senior ERC researchers also have a better output than that of their counterparts from the NIH. On the other hand, even if the NIH junior researchers in Life Sciences and the whole group of researchers from HHMI do not produce as many papers as their counterparts from ERC, they nonetheless obtain a higher scientific impact.

3.4. International Collaboration

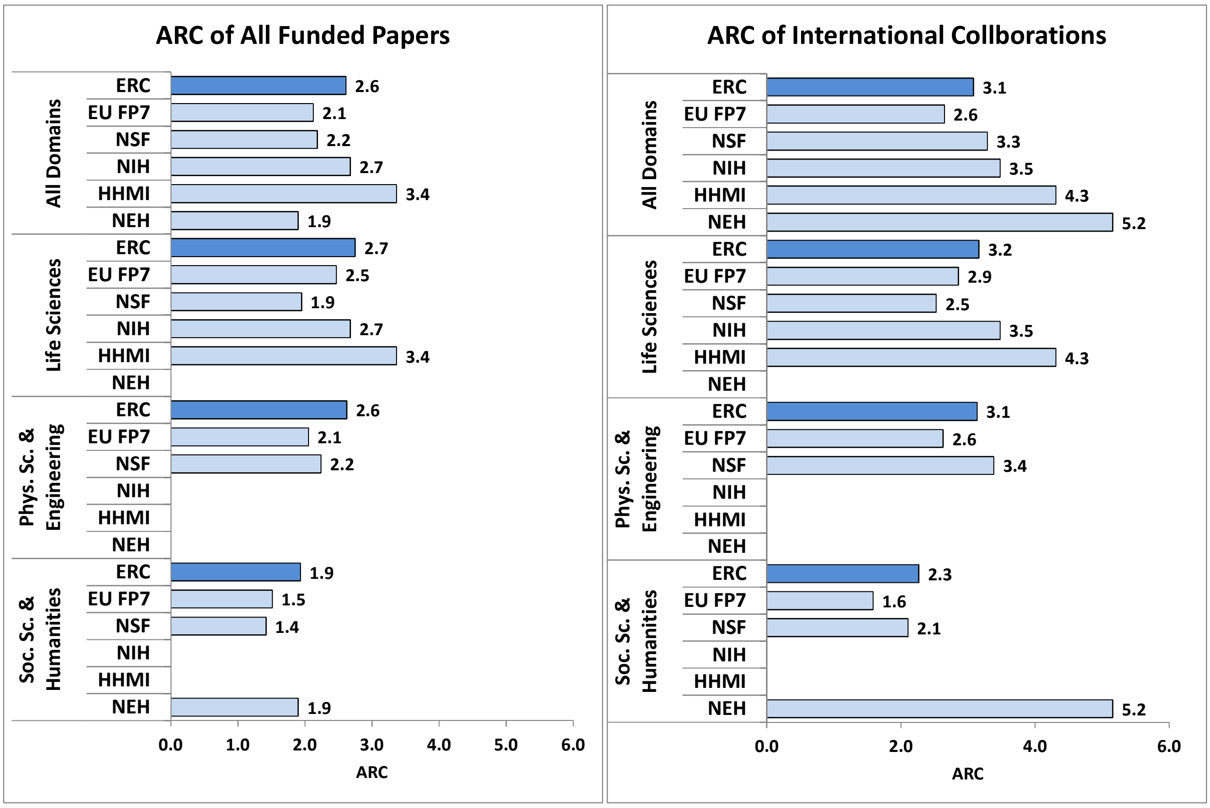
Figure 3-39 presents the international collaboration rate for ERC funded researchers and the groups of comparable researchers. It shows that ERC researchers are much more involved in such collaboration than their American counterparts. However, the comparison is not really valid at this level because the United States is a very large country offering more national collaboration opportunities than any individual European country can offer to its own researchers. In this sense, the highest frequency of international collaboration is expected in a European context. On the other hand, the comparison with EU FP7 grantees is much more valid. It shows that, while ERC researchers' collaboration rate is almost on par with that of EU FP7 researchers in Life Sciences, it is significantly higher in Physical Sciences and Engineering and in Social Sciences and Humanities.

Figure 3-39. International Collaboration Rate of Funded Researchers After the Grant Start Year by Seniority, Domain and Agency

It is well known that, generally speaking, publications with international collaborations obtain higher scientific impact than those produced by researchers from a single country.[7] This phenomenon is clearly illustrated in Figure 3-40, which compares the impact all papers funded by each agency with the impact of the subset of papers written in an international collaboration. It shows that the latter have an ARC score about 40% higher than the former.

[7] Larivière, V., Sugimoto, C. R., Tsou, A., & Gingras, Y. (2014). Team size matters: Collaboration and scientific impact since 1900. Journal of the American Society for Information Science and Technology. Volume: 66 Issue: 7 Pages: 1323-1332 Published: July 2015

Figure 3-40. Average of Relative Citations (ARC) of International Collaboration for Funded Researcher After the Grant Start Year by Seniority, Domain and Agency



That said, is the increase in scientific impact the same for all types of international collaboration, or do some types of collaboration bring more advantage than others? Table 3-1 presents, for the studied European groups of researchers (ERC and EU FP7), four types of international collaboration: 1) collaborations involving at least two distinct countries, regardless of where they are located, 2) intra-European collaborations involving researchers from at least two different European countries, 3) extra-European collaborations involving at least one European and one non-European country, and 4) collaborations involving at least two distinct countries, one of which is the United States. The data shows that ERC funded researchers have higher collaboration rates for all types of collaboration and for all domains. On the other hand, the structures of those collaborations are quite similar form one group to the other: the overall international collaboration is (of course) the most frequent, followed by intra-European, extra-European and the collaboration with the United States. Also, in both groups, the various types of collaborations are more frequent for the Life Sciences, followed by the Physical Sciences and Engineering, and the Social Sciences and Humanities.

Table 3-1. International Collaboration of ERC and EU FP7 Funded Researchers After the Grant Start Year by Domain and Type of Collaboration

	Number of Papers				Collaboration Rate			
Agency / Type of Collaboration	**LS**	**PE**	**SH**	**TOTAL**	**LS**	**PE**	**SH**	**TOTAL**
European Research Council (ERC)	**19,536**	**35,466**	**3,867**	**58,650**				
International Collaboration (all)	11,072	19,811	1,858	**32,576**	57%	56%	48%	**56%**
Intra-European International Collaboration	7,350	14,113	1,177	**22,493**	38%	40%	30%	**38%**
Extra-European International Collaboration	6,664	12,032	1,110	**19,716**	34%	34%	29%	**34%**
International Collaboration with USA	4,614	7,853	761	**13,151**	24%	22%	20%	**22%**
European Union's Seventh Framework Programme (EU FP7)	**3,543**	**11,804**	**649**	**15,971**				
International Collaboration (all)	1,984	5,414	278	**7,659**	56%	46%	43%	**48%**
Intra-European International Collaboration	1,491	3,796	199	**5,469**	42%	32%	31%	**34%**
Extra-European International Collaboration	1,136	2,694	102	**3,925**	32%	23%	16%	**25%**
International Collaboration with USA	729	1,255	62	**2,040**	21%	11%	10%	**13%**

Table 3-2 presents the impact (ARIF and ARC) for the four types of collaboration. It shows that, for both agencies and for all domains, papers produced in international collaboration have more impact than the whole set of funded papers. For example, while the total of ERC funded papers has an ARC of 2.6, the papers with international collaboration have an ARC of 3.1. The data also shows that the impact varies significantly from one type of collaboration to another: intra-European collaboration has more impact than overall international collaboration, extra-European has an impact slightly above that, and the highest impact of all is found in collaborations with the United States.

Table 3-2. Average of Relative Impact Factors (ARIF) and Average of Relative Citations (ARC) of ERC and EU FP7 Funded Researchers After the Grant Start Year by Domain and Type of Collaboration

	ARIF				ARC			
Agency / Type of Collaboration	**LS**	**PE**	**SH**	**TOTAL**	**LS**	**PE**	**SH**	**TOTAL**
European Research Council (ERC)	**2.1**	**1.8**	**1.4**	**1.9**	**2.7**	**2.6**	**1.9**	**2.6**
International Collaboration (all)	2.3	1.9	1.6	**2.0**	3.2	3.1	2.3	**3.1**
Intra-European International Collaboration	2.3	1.9	1.6	**2.0**	3.3	3.2	2.3	**3.2**
Extra-European International Collaboration	2.4	1.9	1.8	**2.1**	3.5	3.5	2.5	**3.4**
International Collaboration with USA	2.6	1.9	1.9	**2.2**	3.9	3.9	2.8	**3.8**
European Union's Seventh Framework Programme (EU FP7)	**1.7**	**1.5**	**1.1**	**1.5**	**2.5**	**2.1**	**1.5**	**2.1**
International Collaboration (all)	2.0	1.6	1.1	**1.7**	2.9	2.6	1.6	**2.6**
Intra-European International Collaboration	2.1	1.6	1.0	**1.7**	3.2	2.6	1.5	**2.8**
Extra-European International Collaboration	2.2	1.7	1.3	**1.9**	3.4	3.0	1.5	**3.1**
International Collaboration with USA	2.6	1.9	1.4	**2.1**	4.3	3.1	1.7	**3.5**

3.5. Papers Acknowledging ERC and Other Agencies

Since 2008, the WoS has included in its bibliographic records the acknowledgments to research funding agencies made by the authors of indexed papers. This allows for the retrieval of papers acknowledging the ERC. Since we have reconstituted the complete publication files of all researchers who succeeded at the ERC competitions from 2007 to 2011, it is possible to compare those two methods for the assessment of ERC contributions to the production of new knowledge.

Table 3-3 presents the total number of papers included in the publication files reconstituted for the period covering the grant start year onwards (funded papers), as well as the subset of papers acknowledging ERC. It shows that, from one panel to another, the share of acknowledging papers ranges from a high of 43% in mathematics (PE01) to a low of 2% for the panel dedicated to "Institutions, values, beliefs and behavior (SH02)". Since the ERC is not necessarily the sole source of funding for its grantees, it is expected that a good share of their papers do not mention the ERC as a funding source. However, in the case of Social Sciences and Humanities panels (SH01 to SH06), the shares of acknowledging papers are so low that we reserve some doubt as to the reliability of the data. In this sense, the reconstituted publication files probably provide a more accurate picture of the effects of funding. Generally speaking, it seems also plausible, given the amounts involved, that ERC funding has a greater impact on grantees' production than that suggested by the share of acknowledging papers.

Table 3-3. Total Number of Funded Papers in ERC Researchers' Publication Files and Number of Papers Acknowledging ERC by Panel, 2008-2013

Panel		Papers in Publication Files	Papers Acknow-ledging ERC	Share of Acknow-ledgments
LS01	Molecular and Structural Biology and Biochemistry	1 930	694	36%
LS02	Genetics, Genomics, Bioinformatics and Systems Biology	2 524	743	29%
LS03	Cellular and Developmental Biology	1 576	567	36%
LS04	Physiology, Pathophysiology and Endocrinology	2 326	588	25%
LS05	Neurosciences and neural disorders	1 899	652	34%
LS06	Immunity and infection	2 027	548	27%
LS07	Diagnostic tools, therapies and public health	3 757	724	19%
LS08	Evolutionary, population and environmental biology	2 314	914	39%
LS09	Applied life sciences and biotechnology	1 674	415	25%
PE01	Mathematics	2 172	929	43%
PE02	Fundamental constituents of matter	4 742	1 856	39%
PE03	Condensed matter physics	3 963	1 406	35%
PE04	Physical and Analytical Chemical sciences	4 226	1 529	36%
PE05	Materials and Synthesis	6 824	2 027	30%
PE06	Computer science and informatics	1 973	437	22%
PE07	Systems and communication engineering	2 561	550	21%
PE08	Products and process engineering	3 409	996	29%
PE09	Universe sciences	3 700	1 187	32%
PE10	Earth system science	2 386	736	31%
SH01	Individuals, institutions and markets	598	43	7%
SH02	Institutions, values, beliefs and behaviour	450	11	2%
SH03	Environment, space and population	522	33	6%
SH04	The Human Mind and its complexity	1 904	402	21%
SH05	Cultures and cultural production	39	1	3%
SH06	The study of the human past	355	44	12%

Source : Observatoire des sciences et des technologies (Thomson Reuters Web of Science) - CBD Current as of July 2014.

Table 3-4 presents the scientific impact for both sets of papers. It shows that the scientific impact of papers acknowledging ERC is generally higher than that of the average papers produced by the grantees. In most cases, however, the differences do not exceed 30% and there is a good correlation between the impact scores of the two datasets. Hence, the papers acknowledging ERC provide some good indications regarding the whole publication output of its grantees.

Table 3-4. Average of Relative Citations of Funded Papers in ERC Researchers' Publication Files and of Papers Acknowledging ERC by Panel, 2008-2013

Panel		Papers in Publication Files	Papers Acknow-ledging ERC	Difference Acknow/Files
LS01	Molecular and Structural Biology and Biochemistry	2,6	3,0	15%
LS02	Genetics, Genomics, Bioinformatics and Systems Biology	3,6	4,2	17%
LS03	Cellular and Developmental Biology	2,7	2,8	4%
LS04	Physiology, Pathophysiology and Endocrinology	3,1	3,3	6%
LS05	Neurosciences and neural disorders	2,4	2,9	23%
LS06	Immunity and infection	3,1	3,5	15%
LS07	Diagnostic tools, therapies and public health	2,6	2,7	4%
LS08	Evolutionary, population and environmental biology	2,5	2,9	17%
LS09	Applied life sciences and biotechnology	2,9	2,5	-13%
PE01	Mathematics	2,0	2,1	3%
PE02	Fundamental constituents of matter	3,3	4,1	25%
PE03	Condensed matter physics	3,2	3,6	11%
PE04	Physical and Analytical Chemical sciences	2,5	2,6	5%
PE05	Materials and Synthesis	2,9	3,3	14%
PE06	Computer science and informatics	1,6	1,7	3%
PE07	Systems and communication engineering	1,6	2,9	74%
PE08	Products and process engineering	2,0	2,8	36%
PE09	Universe sciences	3,6	3,1	-14%
PE10	Earth system science	2,3	2,5	8%
SH01	Individuals, institutions and markets	2,5	2,3	-7%
SH02	Institutions, values, beliefs and behaviour	1,6	2,2	38%
SH03	Environment, space and population	2,2	2,6	17%
SH04	The Human Mind and its complexity	1,8	1,6	-9%
SH05	Cultures and cultural production	1,7	-	-
SH06	The study of the human past	1,8	2,1	16%

Source : Observatoire des sciences et des technologies (Thomson Reuters Web of Science) - CBD Current as of July 2014.

The two following tables (Table 3-5 and Table 3-6) show the same data but are broken down by the disciplinary fields of the Essential Science Indicators (ESI). They show once again that the share of acknowledging papers varies from one category to another and that the average scientific impact of acknowledging papers is higher than that of the publication files for almost all disciplinary fields.

Table 3-5. Total Number of Funded Papers in ERC Researchers' Publication Files and Number of Papers Acknowledging ERC by ESI Disciplinary Fields, 2008-2013

Panel	Papers in Publication Files	Papers Acknow-ledging ERC	Share of Acknow-ledgments
AGRICULTURAL SCIENCES	145	31	21%
ARTS & HUMANITIES	112		0%
BIOLOGY & BIOCHEMISTRY	3 655	1 143	31%
CHEMISTRY	8 843	2 747	31%
CLINICAL MEDICINE	3 684	584	16%
COMPUTER SCIENCE	2 039	428	21%
ECONOMICS & BUSINESS	677	33	5%
ENGINEERING	3 100	589	19%
ENVIRONMENT/ECOLOGY	1 244	364	29%
GEOSCIENCES	1 734	531	31%
IMMUNOLOGY	1 018	254	25%
MATERIALS SCIENCE	2 450	644	26%
MATHEMATICS	1 549	651	42%
MICROBIOLOGY	718	188	26%
MOLECULAR BIOLOGY & GENETICS	4 378	1 568	36%
MULTIDISCIPLINARY	3 584	1 465	41%
NEUROSCIENCE & BEHAVIOR	1 965	610	31%
PHARMACOLOGY & TOXICOLOGY	428	87	20%
PHYSICS	10 502	3 993	38%
PLANT & ANIMAL SCIENCE	1 294	376	29%
PSYCHIATRY/PSYCHOLOGY	786	76	10%
SOCIAL SCIENCES, GENERAL	1 124	65	6%
SPACE SCIENCE	3 621	1 092	30%

Source : Observatoire des sciences et des technologies (Thomson Reuters Web of Science) - CBD Current as of July 2014.

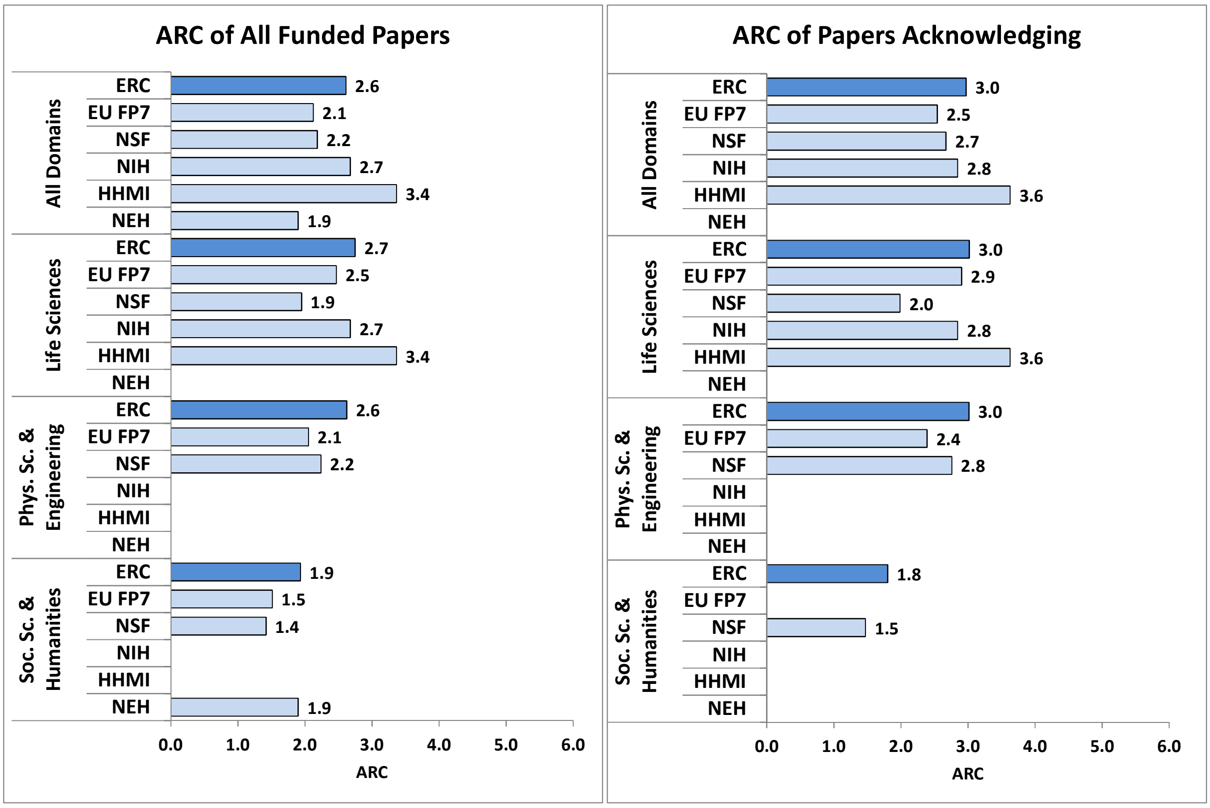
Table 3-6. Average of Relative Citations of Funded Papers in ERC Researchers' Publication Files and of Papers Acknowledging ERC by ESI Disciplinary Fields, 2008-2013

Panel	Papers in Publication Files	Papers Acknow-ledging ERC	Difference Acknow/Files
AGRICULTURAL SCIENCES	2,8	3,5	25%
ARTS & HUMANITIES	2,9		
BIOLOGY & BIOCHEMISTRY	2,2	2,4	5%
CHEMISTRY	2,4	2,8	14%
CLINICAL MEDICINE	3,2	3,0	-4%
COMPUTER SCIENCE	2,1	4,2	100%
ECONOMICS & BUSINESS	2,4	2,7	12%
ENGINEERING	1,7	2,6	51%
ENVIRONMENT/ECOLOGY	2,6	2,7	6%
GEOSCIENCES	2,3	2,4	6%
IMMUNOLOGY	2,5	2,8	10%
MATERIALS SCIENCE	4,2	5,1	22%
MATHEMATICS	2,1	2,3	6%
MICROBIOLOGY	2,4	3,1	27%
MOLECULAR BIOLOGY & GENETICS	2,4	2,6	9%
MULTIDISCIPLINARY	3,0	3,5	17%
NEUROSCIENCE & BEHAVIOR	2,0	2,5	24%
PHARMACOLOGY & TOXICOLOGY	2,1	2,8	36%
PHYSICS	2,7	3,1	14%
PLANT & ANIMAL SCIENCE	3,0	3,1	1%
PSYCHIATRY/PSYCHOLOGY	1,9	2,5	33%
SOCIAL SCIENCES, GENERAL	2,5	4,4	76%
SPACE SCIENCE	3,3	2,8	-14%

Source : Observatoire des sciences et des technologies (Thomson Reuters Web of Science) - CBD Current as of July 2014.

Figure 3-41 allows for the comparison of the impact of all funded papers and the impact of the subset of papers acknowledging each funding agency. It shows that papers with acknowledgments systematically have a higher impact. One should also note that the relative position of agencies remained unchanged whether the impact was calculated for all funded papers or for the subset of papers with acknowledgments. Once again, this suggests that papers acknowledging funding agencies provide some good indications regarding the whole publication output of their grantees.

Figure 3-41. Average of Relative Citations (ARC) of Papers Acknowledging each Agency by Seniority, Domain and Agency



3.6. Assessment of Humanities Using Google Scholar

Given the weak coverage of humanities literature by traditional bibliometric databases such as the WoS, we performed an experiment using Google Scholar. This tool has two advantages over the WoS and Scopus when it comes to analysing output in the humanities. First, its coverage is much larger—it indexes almost all scholarly documents found online— and, second, it indexes documents—and thus citations received—much faster. However, it does have some disadvantages: 1) its indexing policy is not transparent, 2) the quality and breadth of the indexation is much lower than that of WoS and Scopus, which limits the types of indicators that can be compiled, and 3) the documents indexed are quite heterogeneous, and range from papers and books published in top venues to work-in-progress manuscripts found on various academic-related webpages, including research notes, preprints and non-peer reviewed documents.

The names of all ERC applicants from panels poorly covered by WoS data and highlighted in the data coverage report (D4),[8] as well as those of the sample of NEH researchers, were searched on Google Scholar using the Publish or Perish tool[9] during the period from 13 March to 7 April 2015, resulting in a total of 45,789 documents. This list included many documents authored by homonyms and all researchers' publication files were manually disambiguated in Excel. A substantial portion of the documents retrieved were thus discarded (39.2%, N=17,962). Documents without a publication date or published before 2002 were also excluded (1,845), as they could not be assigned an appropriate publication and citation window. Overall, 25,982

[8] SH2 (Institutions, values, beliefs and behaviour), SH5 (Cultures and cultural production), and SH6 (The study of the human past)

[9] Harzing, A.W. (2007) Publish or Perish, available from http://www.harzing.com/pop.htm

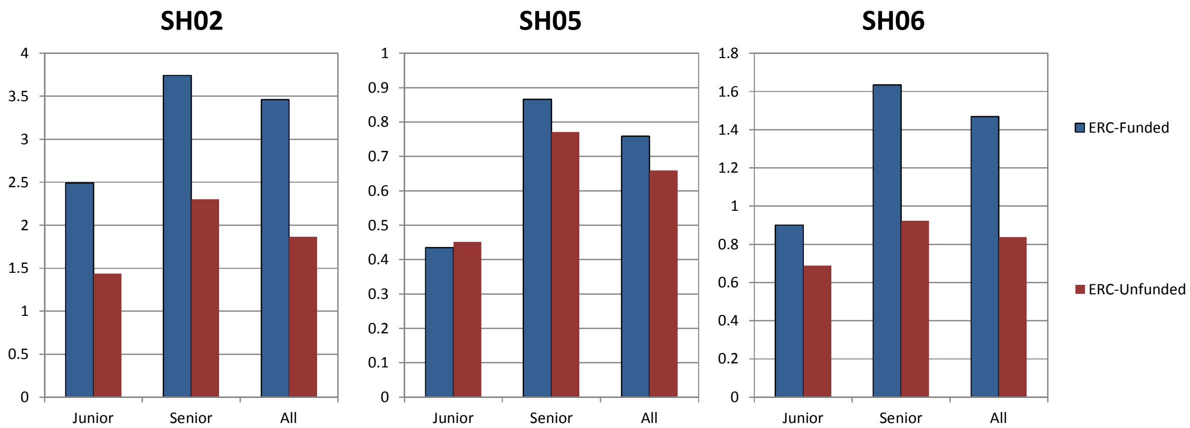
documents published by the three groups of researchers during the 2002-2013 period are analysed here.

Two indicators were compiled for this set of papers: the mean annual number of papers and mean annual numbers of citations. The results of this analysis can be found below for ERC applicants as well as for the sample of NEH researchers. In total, scientific documents could be found on Google Scholar for the 236 ERC-funded researchers, for 235 unsuccessful ERC applicants and 218 NEH researchers. Given the low number of papers involved, the results are only presented by panel and funding status.

Figure 3-42 presents the mean annual number of papers of ERC applicants, by panel. For all three panels and level of seniority—except for senior researchers of panel SH05—successful applicants have published more papers than their unsuccessful colleagues. This difference is much greater for panels SH02 and SH06 than for panel SH05. In terms of annual citations received, a gap in favour of successful applications is observed across all three panels and seniority, except for the juniors researchers of panel SH05, and is also greater for panels SH02 and SH06 than for SH05 (Figure 3-43).

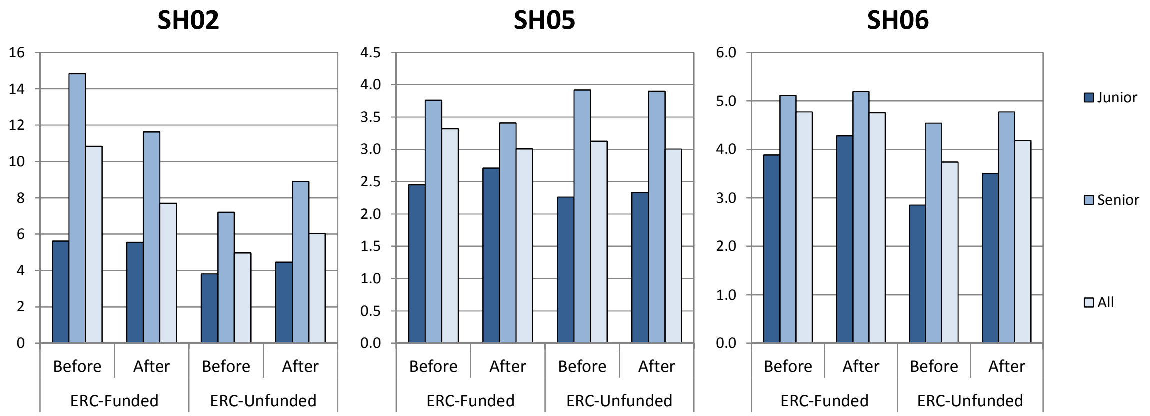
Figure 3-42. Mean Annual Number of Google Scholar Papers per ERC Applicant Prior to Competition Year, by Funding Status

Figure 3-43. Mean Annual Number of Citations of Google Scholar Papers authored by ERC Applicant Prior to Competition Year, by Funding Status



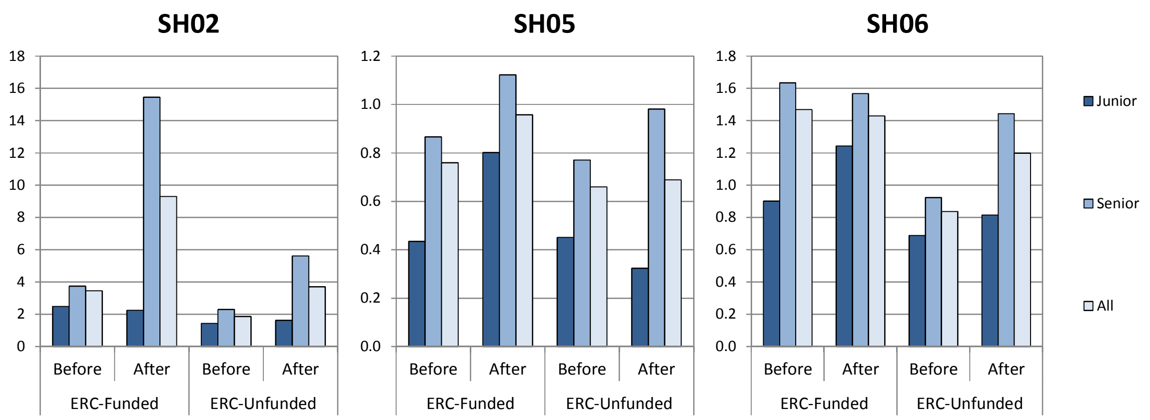
The comparison of the evolution of funded and unfunded researchers' scientific productivity (Figure 3-44) pre- and post-funding shows more contrasting results. For senior researchers—whose productivity is, already prior to funding, quite high—funding is not related to any increase, and for panels SH02 and SH05 a decrease in annual number of papers is even observed. While for panels SH02 and SH06, funded researchers' productivity is greater than that of unfunded researchers, for panel SH05, unsuccessful applicants publish a higher number of papers before and after the competition. For junior researchers, a small increase in annual productivity is observed for SH05 and SH06 following the allocation of the funding, which is not observed for panel SH02. For all three panels and seniority levels, however, funded researchers publish more papers following the competition year than their unsuccessful peers, with the exception of SH05 senior researchers.

Figure 3-44. Mean Annual Number of Google Scholar Papers per ERC Applicant Before and After the Grant Start Year by Seniority and Funding Status



In terms of mean citations rates (Figure 3-45), the trends are much clearer. For all groups except junior SH02 and senior SH06 researchers, the post-funding period is associated with an increase in citations. However, this is not specific to funded researchers: papers published by unsuccessful applicants after the competition also obtained higher annual citation rates than those published before the competition. For all three panels and seniority level, funded researchers' papers published after the competition obtained higher mean citation rates than those of unfunded researchers.

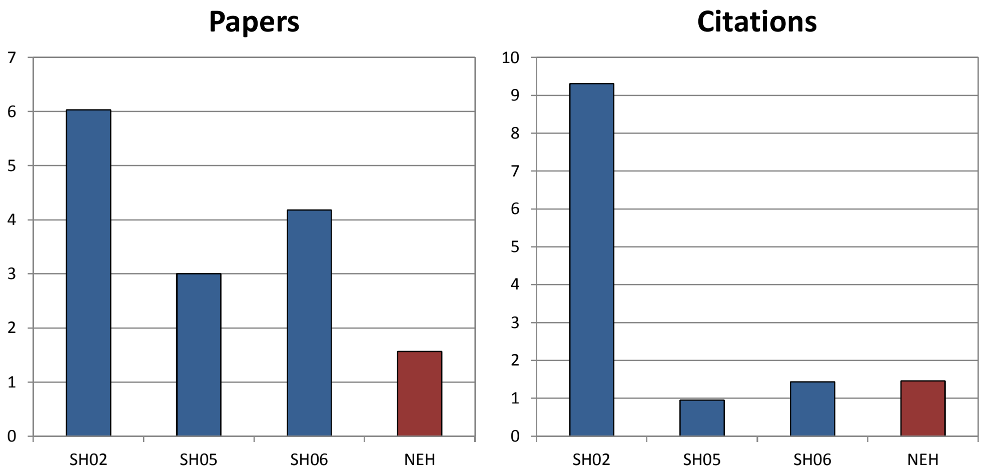
Figure 3-45. Mean Annual Number of Citations of Google Scholar Papers authored by ERC Applicant Before and After the Grant Start Year by Seniority and Funding Status



Compared with NEH researchers, ERC-funded researchers of all three panels published more papers following funding (Figure 3-46). However, in terms of citation rates, only researchers of panel SH02 obtained higher citation rates than NEH researchers. Citation rates of papers authored by SH06 researchers are on par with NEH, while those of SH05 researchers are below.

Little can be inferred from these results, as citations from Google Scholar could not be field normalised—contrary to all other citation measures provided in this report—and, hence, differences between ERC and NEH researchers' citation rates might simply be due to the different fields in which they are active.

Figure 3-46. Mean Annual Number of Google Scholar Papers and Citations of ERC-funded Researchers and NEH Comparable After the Grant Start Year



4. Conclusion

Using bibliometric indicators, the current study provided conclusive answers to the three evaluation questions set forth in the introduction.

1. Is the ERC peer review process successful in selecting the best candidates among those who have submitted a proposal?
2. Does the funding provided by the ERC help grantees improve their scientific output and impact?
3. Do ERC grantees perform better than researchers funded by other European and American funding agencies?

With respect to the first question, the data clearly indicates that the ERC competitions do attract high profile researchers and that the assessment of its peer review committees tends to select those who have published numerous high impact scientific papers in recent years. Moreover, the scores attributed by the committees match well the performances of applicants as measured by bibliometric indicators: funded applicants have the highest scores, followed by those who were scored relatively highly but rejected for funding at the second step of selection, and lastly the rejected applicants. On the other hand, data on interdisciplinarity shows that the applicants selected for funding are not necessarily those who are the most dedicated toward interdisciplinarity.

As to the effect of ERC funding, the bibliometric data does not provide any evidence for a major impact on the publication output of grantees, either from a quantitative point of view, or from a qualitative one. While the ERC researchers slightly increase their productivity during the funding period, their scientific impact remains essentially unchanged. Along the same lines, ERC funding does not seem to lead to the adoption of more intense interdisciplinary practices than those observed in the global research landscape. However, one should note that the publication output of ERC grantees is already outstanding at the moment they submit their applications. Improving such performances is therefore not an easy task.

Finally, the international benchmarking of ERC-funded researchers provides strong evidence that their publication output is among the best of those analysed in the current study, in terms of productivity as well as in terms of scientific impact.

Appendix A — Supplementary data

Appendix Table 1. Percentage of ERC Funded Papers by Language and Panel

Domain / Agency	English	German	French	Spanish	Other	ALL
Life Sciences						
LS01	99.8%		0.2%	0.1%		100%
LS02	99.9%		0.1%			100%
LS03	99.8%	0.1%	0.1%	0.1%		100%
LS04	99.6%	0.2%	0.2%			100%
LS05	99.6%	0.1%	0.3%		0.1%	100%
LS06	99.3%	0.2%	0.5%			100%
LS07	99.6%	0.2%	0.2%			100%
LS08	99.9%	0.1%		0.1%		100%
LS09	99.9%	0.1%				100%
Phys. Sc. & Engineering						
PE01	99.8%		0.1%		0.1%	100%
PE02	99.9%	0.0%	0.0%			100%
PE03	100.0%					100%
PE04	99.8%	0.1%	0.1%			100%
PE05	99.9%	0.1%	0.0%			100%
PE06	100.0%					100%
PE07	99.7%	0.1%	0.1%			100%
PE08	99.3%	0.5%		0.3%		100%
PE09	100.0%					100%
PE10	99.8%		0.1%			100%
Soc. Sc & Humanities						
SH01	99.6%	0.2%		0.2%		100%
SH02	96.4%	1.8%	0.5%		1.3%	100%
SH03	99.5%			0.5%		100%
SH04	99.7%		0.2%		0.1%	100%
SH05	87.5%	3.1%	3.1%	3.1%	3.1%	100%
SH06	97.4%	1.6%	0.7%		0%	100%

Appendix Table 2. Percentage of Funded Papers by Language, Domain and Agency

Domain / Agency	English	German	French	Spanish	Other	ALL
Life Sciences						
ERC	99.7%	0.1%	0.2%	0.0%		100%
EU FP7	98.7%	1.0%	0.3%	0.1%		100%
NSF	100.0%					100%
NIH	100.0%			0.0%		100%
HHMI						100%
NEH	100.0%					100%
Phys. Sc. & Engineering						
ERC	99.8%	0.1%	0.0%	0.0%		100%
EU FP7	99.2%	0.4%	0.2%	0.1%	0.1%	100%
NSF	100.0%					100%
NIH						100%
HHMI						100%
NEH						100%
Soc. Sc & Humanities						
ERC	98.9%	0.4%	0.2%	0.1%	0.3%	100%
EU FP7	97.4%	2.0%	0.5%		0.0%	100%
NSF	99.8%	0.2%			0.0%	100%
NIH						100%
HHMI	99.2%			0.4%	0.4%	100%
NEH						100%

Appendix Table 3. Number of Funded Papers by Agency and Field

Field	ERC	EU FP7	NSF	NIH	HHMI	NEH
ALL	58,650	15,971	19,150	8,918	2,245	296
AGRICULTURAL SCIENCES	145	366	43	23	1	2
ARTS & HUMANITIES	112	8	8		1	81
BIOLOGY & BIOCHEMISTRY	3,655	917	824	1,097	335	12
CHEMISTRY	8,843	2,003	3,183	801	75	7
CLINICAL MEDICINE	3,684	1,503	397	1,925	140	39
COMPUTER SCIENCE	2,039	784	2,730	27	9	8
ECONOMICS & BUSINESS	677	298	129	1	3	3
ENGINEERING	3,100	2,021	2,966	74	4	8
ENVIRONMENT/ECOLOGY	1,244	726	578	23	20	1
GEOSCIENCES	1,734	722	337		1	1
IMMUNOLOGY	1,018	274	16	529	135	1
MATERIALS SCIENCE	2,450	972	1,252	229	27	2
MATHEMATICS	1,549	44	376	7	2	1
MICROBIOLOGY	718	335	88	285	133	2
MOLECULAR BIOLOGY & GENETICS	4,378	690	441	1,230	650	4
MULTIDISCIPLINARY	3,584	634	545	891	417	6
NEUROSCIENCE & BEHAVIOR	1,965	475	219	823	152	1
PHARMACOLOGY & TOXICOLOGY	428	325	143	190	47	1
PHYSICS	10,502	1,015	3,511	225	15	2
PLANT & ANIMAL SCIENCE	1,294	618	371	41	33	2
PSYCHIATRY/PSYCHOLOGY	786	155	231	266	42	9
SOCIAL SCIENCES, GENERAL	1,124	836	243	226	2	103
SPACE SCIENCE	3,621	250	519	5	1	

Appendix Table 4. Number of Papers and Average of Relative Citations (ARC) by Research Level and Agency

Domain / Agency	Clinical observation or applied technology	Clinical mix or engineering-technological mix	Clinical investigation or applied research	Basic research	N/A	ALL
Number of papers						
ERC	1,219	4,277	8,311	26,490	18,353	58,650
EU FP7	942	2,166	2,911	3,111	6,841	15,971
NSF	1,153	1,985	2,600	6,030	7,382	19,150
NIH	497	1,004	1,736	3,000	2,681	8,918
HHMI	31	68	329	1,311	506	2,245
NEH	12	15	18	16	235	296
Percentage						
ERC	3.0%	10.6%	20.6%	65.7%	--	100%
EU FP7	10.3%	23.7%	31.9%	34.1%	--	100%
NSF	9.8%	16.9%	22.1%	51.2%	--	100%
NIH	8.0%	16.1%	27.8%	48.1%	--	100%
HHMI	1.8%	3.9%	18.9%	75.4%	--	100%
NEH	19.7%	24.6%	29.5%	26.2%	--	100%
Average of relative Cita						
ERC	2.53	3.08	2.41	3.11	1.88	--
EU FP7	2.50	2.50	1.98	3.14	1.55	--
NSF	2.58	2.77	1.98	2.97	1.40	--
NIH	2.20	3.55	2.50	3.32	1.83	--
HHMI	5.01	4.64	3.21	3.79	2.09	--
NEH	n.s.	n.s.	n.s.	n.s.	1.62	--

Appendix Table 5 Average of Relative Citations of European and American Papers by ESI Disciplinary Fields, 2008-2013

Panel	European Papers	American Papers
AGRICULTURAL SCIENCES	1,2	1,3
ARTS & HUMANITIES	1,3	1,7
BIOLOGY & BIOCHEMISTRY	1,1	1,4
CHEMISTRY	1,1	1,5
CLINICAL MEDICINE	1,1	1,4
COMPUTER SCIENCE	1,3	1,8
ECONOMICS & BUSINESS	1,1	1,6
ENGINEERING	1,2	1,2
ENVIRONMENT/ECOLOGY	1,1	1,3
GEOSCIENCES	1,2	1,4
IMMUNOLOGY	1,1	1,3
MATERIALS SCIENCE	1,2	2,0
MATHEMATICS	1,1	1,2
MICROBIOLOGY	1,2	1,4
MOLECULAR BIOLOGY & GENETICS	1,1	1,4
MULTIDISCIPLINARY	1,1	1,5
NEUROSCIENCE & BEHAVIOR	1,1	1,3
PHARMACOLOGY & TOXICOLOGY	1,2	1,3
PHYSICS	1,2	1,6
PLANT & ANIMAL SCIENCE	1,2	1,3
PSYCHIATRY/PSYCHOLOGY	1,0	1,2
SOCIAL SCIENCES, GENERAL	1,1	1,4
SPACE SCIENCE	1,3	1,8

Source : Observatoire des sciences et des technologies (Thomson Reuters Web of Science) - CBD Current as of July 2014.

Appendix Table 6 Number of Papers and Average of Relative Citations (ARC) for Funded Papers and Papers Acknowledging each Agency by Domain of Research Project and Agency

	All Funded Papers		Papers with Acknowlegment to Agency	
Domain / Agency	**N. Papers**	**ARC**	**N. Papers**	**ARC**
All Domains				
ERC	58,650	2.6	17,519	3.0
EU FP7	15,971	2.1	241	2.5
NSF	19,150	2.2	8,744	2.7
NIH	8,918	2.7	3,045	2.8
HHMI	2,245	3.4	521	3.6
NEH	296	1.9		
Life Sciences				
ERC	19,536	2.7	5,639	3.0
EU FP7	3,543	2.5	52	2.9
NSF	1,303	1.9	701	2.0
NIH	8,918	2.7	3,045	2.8
HHMI	2,245	3.4	521	3.6
NEH				
Phys. Sc. & Engineering				
ERC	35,466	2.6	11,422	3.0
EU FP7	11,804	2.1	189	2.4
NSF	17,077	2.2	7,872	2.8
NIH				
HHMI				
NEH				
Soc. Sc & Humanities				
ERC	3,867	1.9	534	1.8
EU FP7	649	1.5	1	*n.s.*
NSF	779	1.4	179	1.5
NIH				
HHMI				
NEH	296	1.9		

Appendix B — Statistical tests

FIGURE 3.01 Mean Annual Number of Papers per ERC Applicant Prior to Competition Year by Seniority, Competition Year and Funding Status

	ALL RESEARCHERS					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0,.05	p. < 0,.05	p. < 0.001	n.s.	n.s.	p. < 0,.05
Funded vs NF ALL	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
	JUNIORS (StG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	n.s.	n.s.		n.s.	n.s.	n.s.
Funded vs NF ALL	p. < 0.001	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001
	SENIORS (AdG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001		p. < 0.001	p. < 0.01	p. < 0.01	p. < 0.01
Funded vs NF ALL	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001

FIGURE 3.02 Mean Annual Number of Papers per ERC Applicant Prior to Competition Year by Domain, Panel and Funding Status

	Life Sciences									
	LS01	**LS02**	**LS03**	**LS04**	**LS05**	**LS06**	**LS07**	**LS08**	**LS09**	
Funded vs NF Step2	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	p. < 0.05	n.s.	n.s.	
Funded vs NF ALL	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.01	
	Phys. Sc. & Engineering									
	PE01	**PE02**	**PE03**	**PE04**	**PE05**	**PE06**	**PE07**	**PE08**	**PE09**	**PE10**
Funded vs NF Step2	n.s.	p. < 0.01	n.s.	n.s.	n.s.	p. < 0.05	p. < 0.01	n.s.	p. < 0.05	n.s.
Funded vs NF ALL	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
	Soc. Sc. & Humanities									
	SH01	**SH02**	**SH03**	**SH04**	**SH05**	**SH06**				
Funded vs NF Step2	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.				
Funded vs NF ALL	n.s.	p. < 0.01	p. < 0.01	p. < 0.001	n.s.	n.s.				

FIGURE 3.03 Average of Relative Impact Factors (ARIF) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status

	ALL RESEARCHERS					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
Funded vs NF ALL	p.< 0.001	p.< 0.001	p.< 0.001	p.< 0.001	p.< 0.001	p.< 0.001
	JUNIORS (StG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001	p. < 0.001		p. < 0.01	p. < 0.001	n.s.
Funded vs NF ALL	p.< 0.001	p.< 0.001		p.< 0.001	p.< 0.001	p.< 0.001
	SENIORS (AdG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
Funded vs NF ALL	p .< 0.001		p.< 0.001	p.< 0.001	p. < 0.001	p.< 0.001

FIGURE 3.04 **Average of Relative Impact Factors (ARIF) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding**

	Life Sciences									
	LS01	**LS02**	**LS03**	**LS04**	**LS05**	**LS06**	**LS07**	**LS08**	**LS09**	
Funded vs NF Step2	p. < 0.05	p. < 0.01	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	
Funded vs NF ALL	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	
	Phys. Sc. & Engineering									
	PE01	**PE02**	**PE03**	**PE04**	**PE05**	**PE06**	**PE07**	**PE08**	**PE09**	**PE10**
Funded vs NF Step2	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	n.s.	n.s	n.s.	n.s.
Funded vs NF ALL	p. < 0.001	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.01	n.s.	p. < 0.001	n.s.	p. < 0.001
	Soc. Sc. & Humanities									
	SH01	**SH02**	**SH03**	**SH04**	**SH05**	**SH06**				
Funded vs NF Step2	p. < 0.001	n.s.	n.s.	n.s.	n.s.	n.s.				
Funded vs NF ALL	n.s.	n.s.	n.s.	p. < 0.001	n.s.	n.s.				

FIGURE 3.05 **Average of Relative Citations (ARC) of ERC Applicants Prior to Competition Year by Seniority, Competition Year and Funding Status**

	ALL RESEARCHERS					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001	n.s.	p. < 0.001	p. < 0.01	p. < 0.001	p. < 0.001
Funded vs NF ALL	p.< 0.001	p.< 0.001	p.< 0.001	p.< 0.001	p. < 0.001	p.< 0.001
	JUNIORS (StG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001	n.s.		p. < 0.001	p. < 0.001	p. < 0.001
Funded vs NF ALL	p.< 0.001	p.< 0.001		p.< 0.001	p. < 0.001	p.< 0.001
	SENIORS (AdG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
Funded vs NF Step2	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
Funded vs NF ALL	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001

FIGURE 3.06 **Average of Relative Citations (ARC) of ERC Applicants Prior to Competition Year by Domain, Panel and Funding Status**

	Life Sciences									
	LS01	**LS02**	**LS03**	**LS04**	**LS05**	**LS06**	**LS07**	**LS08**	**LS09**	
Funded vs NF Step2	n.s.	n.s.	n.s.	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	n.s.	
Funded vs NF ALL	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	p. < 0.01	
	Phys. Sc. & Engineering									
	PE01	**PE02**	**PE03**	**PE04**	**PE05**	**PE06**	**PE07**	**PE08**	**PE09**	**PE10**
Funded vs NF Step2	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	n.s.	p. < 0.05	p. < 0.05	n.s.
Funded vs NF ALL	p. < 0.001	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	p. < 0.01	p. < 0.001	p. < 0.01	p. < 0.001
	Soc. Sc. & Humanities									
	SH01	**SH02**	**SH03**	**SH04**	**SH05**	**SH06**				
Funded vs NF Step2	p. < 0.001	n.s.	n.s.	n.s.	n.s.	n.s.				
Funded vs NF ALL	p. < 0.001	n.s.	n.s.	p. < 0.001	p. < 0.001	n.s.				

FIGURE 3.15 **Mean Annual Number of Papers per ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year**

	ALL RESEARCHERS					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
After vs Before	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	n.s.
	JUNIORS (StG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
After vs Before	p. < 0.001	p. < 0.001		p. < 0.001	p. < 0.05	n.s.
	SENIORS (AdG)					
	ALL YEAR	**2007**	**2008**	**2009**	**2010**	**2011**
After vs Before	p. < 0.001		p. < 0.001	p. < 0.01	p. < 0.05	n.s.

FIGURE 3.16 Mean Annual Number of Papers per ERC Funded Researcher Before and After the Grant Start Year by Domain and Panel

					Life Sciences					
	LS01	LS02	LS03	LS04	LS05	LS06	LS07	LS08	LS09	
Before vs After	p. < 0.01	p. < 0.01	p. < 0.01	n.s.	n.s.	p. < 0.01	p. < 0.001	n.s.	p. < 0.01	
					Phys. Sc. & Engineering					
	PE01	PE02	PE03	PE04	PE05	PE06	PE07	PE08	PE09	PE10
Before vs After	n.s.	n.s.	n.s.	p. < 0.01	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.01
					Soc. Sc. & Humanities					
	SH01	SH02	SH03	SH04	SH05	SH06				
Before vs After	n.s.	n.s.	p. < 0.01	p. < 0.01	n.s.	n.s.				

FIGURE 3.17 Average of Relative Impact Factors (ARIF) of ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

			ALL RESEARCHERS			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	n.s.	p. < 0.001	n.s.	n.s.	n.s.	n.s.
			JUNIORS (StG)			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	p. < 0.001	p. < 0.001		n.s.	p. < 0.001	n.s.
			SENIORS (AdG)			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	p. < 0.01		n.s.	n.s.	n.s.	n.s.

FIGURE 3.18 Average of Relative Impact Factors (ARIF) of ERC Funded Researcher Before and After the Grant Start Year by Domain and

					Life Sciences					
	LS01	LS02	LS03	LS04	LS05	LS06	LS07	LS08	LS09	
Before vs After	p. < 0.05	p. < 0.001	n.s.	p. < 0.01	n.s.	n.s.	n.s.	n.s.	n.s.	
					Phys. Sc. & Engineering					
	PE01	PE02	PE03	PE04	PE05	PE06	PE07	PE08	PE09	PE10
Before vs After	p. < 0.05	p. < 0.001	p. < 0.01	n.s.	p. < 0.001	n.s.	n.s.	p. < 0.01	p. < 0.001	p. < 0.001
					Soc. Sc. & Humanities					
	SH01	SH02	SH03	SH04	SH05	SH06				
Before vs After	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.				

FIGURE 3.19 Average of Relative Citations (ARC) of ERC Funded Researcher Before and After the Grant Start Year by Seniority and Competition Year

			ALL RESEARCHERS			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
			JUNIORS (StG)			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	p. < 0.001	p. < 0.001		p. < 0.01	p. < 0.001	p. < 0.001
			SENIORS (AdG)			
	ALL YEAR	2007	2008	2009	2010	2011
After vs Before	p. < 0.001		p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001

FIGURE 3.20 Average of Relative Citations (ARC) of ERC Funded Researcher Before and After the Grant Start Year by Domain and Panel

	Life Sciences									
	LS01	LS02	LS03	LS04	LS05	LS06	LS07	LS08	LS09	
Before vs After	n.s.	n.s.	n.s.	p. < 0.001	p. < 0.001	p. < 0.05	p. < 0.001	p. < 0.001	p. < 0.001	
	Phys. Sc. & Engineering									
	PE01	PE02	PE03	PE04	PE05	PE06	PE07	PE08	PE09	PE10
Before vs After	p. < 0.001	n.s.	n.s.	p. < 0.001	p. < 0.001	p. < 0.001	n.s.	p. < 0.001	n.s.	p. < 0.001
	Soc. Sc. & Humanities									
	SH01	SH02	SH03	SH04	SH05	SH06				
Before vs After	p. < 0.001	p. < 0.01	p. < 0.01	p. < 0.001	n.s.	n.s.				

FIGURE 3.29 Mean Annual Number of Papers per ERC Borderline Applicant Before the Competition Year by Seniority, Domain and Funding Status

	ALL RESEARCHERS			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.
	JUNIORS (StG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.
	SENIORS (AdG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.

FIGURE 3.30 Mean Annual Number of Papers per ERC Borderline Applicant After the Competition Year by Seniority, Domain and Funding Status

	ALL RESEARCHERS			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.
	JUNIORS (StG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.
	SENIORS (AdG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	n.s.	n.s.	n.s.

FIGURE 3.31 Average of Relative Citations (ARC) of ERC Borderline Applicants Before the Competition Year by Seniority, Domain and Funding Status

	ALL RESEARCHERS			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	p. < 0.01	p. < 0.001	p. < 0.001
	JUNIORS (StG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	p. < 0.001	n.s.	p < 0.05	p. < 0.001
	SENIORS (AdG)			
	ALL DOMAIN	LS	PE	SH
Funded vs Non-Funded	n.s.	p. < 0.001	p. < 0.01	n.s.

FIGURE 3.32 **Average of Relative Citations (ARC) of ERC Borderline Applicants After the Competition Year by Seniority, Domain and Funding Status**

	ALL RESEARCHERS			
	ALL DOMAIN	**LS**	**PE**	**SH**
Funded vs Non-Funded	n.s.	p. < 0.01	p. < 0.001	n.s.
	JUNIORS (StG)			
	ALL DOMAIN	**LS**	**PE**	**SH**
Funded vs Non-Funded	p. < 0.01	n.s.	p. < 0.001	n.s.
	SENIORS (AdG)			
	ALL DOMAIN	**LS**	**PE**	**SH**
Funded vs Non-Funded	p. < 0.001	p. < 0.01	p. < 0.001	n.s.

FIGURE 3.33 **Mean Annual Number of Papers per Funded Researcher After the Grant Start Year by Seniority, Domain and Agency**

	All Researchers				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.01	p. < 0.001
LS - ERC vs…	p. < 0.01	p. < 0.001	p. < 0.001	p. < 0.01	
PE - ERC vs…	p. < 0.001	p. < 0.001			
SH - ERC vs…	n.s.	p. < 0.01			p. < 0.001
	Juniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…		p. < 0.01	n.s.	n.s.	
LS - ERC vs…		n.s.	n.s.	n.s.	
PE - ERC vs…		p. < 0.001			
SH - ERC vs…		p. < 0.001			
	Seniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…		p. < 0.001	p. < 0.001	p. < 0.01	
LS - ERC vs…		p. < 0.001	p. < 0.001	p. < 0.001	
PE - ERC vs…		p. < 0.001			
SH - ERC vs…		n.s.			

FIGURE 3.34 **Average of Relative Impact Factors (ARIF) of Funded Researcher After the Grant Start Year by Seniority, Domain and Agency**

	All Researchers				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…	p. < 0.001	p. < 0.001	n.s.	p. < 0.001	p. < 0.001
LS - ERC vs…	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	
PE - ERC vs…	p. < 0.001	p. < 0.001			
SH - ERC vs…	p. < 0.001	n.s.			p. < 0.001
	Juniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…		p. < 0.001	p. < 0.001	p. < 0.001	
LS - ERC vs…		p. < 0.001	n.s.	p. < 0.001	
PE - ERC vs…		p. < 0.001			
SH - ERC vs…		p. < 0.01			
	Seniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs…		p. < 0.001	p. < 0.001	p. < 0.001	
LS - ERC vs…		p. < 0.001	p. < 0.001	p. < 0.001	
PE - ERC vs…		p. < 0.001			
SH - ERC vs…		p. < 0.05			

FIGURE 3.35 **Average of Relative Citations (ARC) of Funded Researcher After the Grant Start Year by Seniority, Domain and Agenc**

	All Researchers				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs...	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001	p. < 0.001
LS - ERC vs...	p. < 0.001	p. < 0.001	p. < 0.01	p. < 0.001	
PE - ERC vs...	p. < 0.001	p. < 0.001			
SH - ERC vs...	p. < 0.001	p. < 0.01			p. < 0.001
	Juniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs...		p. < 0.001	p. < 0.001	p. < 0.001	
LS - ERC vs...		p. < 0.001	p. < 0.001	p. < 0.001	
PE - ERC vs...		p. < 0.001			
SH - ERC vs...		p. < 0.001			
	Seniors				
	EU FP7	**NSF**	**NIH**	**HHMI**	**NEH**
ALL Domain - ERC vs...		p. < 0.001	p. < 0.05	p. < 0.001	
LS - ERC vs...		p. < 0.001	p. < 0.001	p. < 0.001	
PE - ERC vs...		p. < 0.001			
SH - ERC vs...		p. < 0.001			

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The European Research Council Executive Agency (ERCEA) asked RAND Europe and the Observatoire des sciences et des technologies (OST) to use innovative scientometric techniques, including bibliometrics, patent analysis and alternative metric analysis, in carrying out a comparative assessment of European Research Council funded projects. The four interrelated objectives of the study were: (i) to provide a systematic overview and assessment of results stemming from ERC-funded projects; (ii) benchmark results of ERC-funded research and researchers against European and US control groups; (iii) conduct a qualitative peer-review assessment to explore the kinds of contributions made by ERC-funded research; and (iv) provide a scientometric framework and consolidated database for future assessment of ERC funded research.

This document is the bibliometric assessment report for the study.

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