

SCIENTIFIC COLLABORATION IN FINANCE DOES NOT LEAD TO BETTER QUALITY RESEARCH

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The study reports an empirical comparison of quality of collaborative research with the quality of individual research. Quality of a paper is measured by the citation rate over the four years following the year of publication. Papers published in fourteen Finance journals between 1987–1991 are sampled. There is no significant difference between the quality of collaborative and individual research. Decision-makers should hesitate in interpreting collaborative research as a definitive sign of ability to produce better research.

Introduction

The main purpose of this paper is to empirically compare the quality of collaborative research with the quality of individual research in the discipline of Finance. In this context, collaborative research is defined as research papers written by two or more people.

In the Twentieth Century, we have witnessed a rapid growth in collaborative research.^{1–4} The tendency for collaborative research will probably continue as research content and methodology becomes more sophisticated, and academic survival becomes more dependent on publishing.^{5–9} Hence, the principal motivation for this paper is to probe whether rising scientific collaboration is leading to better quality research. Another motivation for this paper is the question of how much emphasis should be placed on collaborative research in academic appointments¹⁰ and allocation of research funds.

The study also fills a research gap in the discipline of Finance by implementing a citation analysis that probes the question of quality in research papers. Citations are recorded from the *Social Sciences Citation Index (SSCI)*, which is an international multidisciplinary index. The results indicate that scientific collaboration in the discipline of Finance does not lead to better quality research, as measured by citation rates.

Conceptual framework

Collaboration is defined as "a process of functional interdependence between scholars in their attempt to coordinate skills, tools, and rewards".¹¹ In developing a theory of scientific collaboration, it is postulated that collaboration started in response to professionalisation of science in Napoleonic France and continues today in response to the same stimulus.^{12,13} For example, various types of collaboration such as collaboration among scientists *with* division of labour, *without* division of labour usually between individuals of equal standing, and between master and student can be observed.¹⁴ In this study, no attempt has been made to distinguish between different types of collaboration since such information was not available. However, a brief discussion of the advantages and disadvantages of collaborative research is provided next.

Some of the advantages of collaborative research can be the time saved as a result of work division, generation of a larger pool of ideas on the research topic, enhanced motivation as a result of team discussions, and improved chances of publishing the final product.¹⁵⁻¹⁷ Another strength of collaborative research is the inclusion of multiple perspectives in the process.^{18,19}

There are also some disadvantages of collaborative research that intending co-authors should heed. Actual collaboration and co-ordination of the authors' inputs may not be a smooth process. If a collaborative paper that ultimately attracts more citations takes considerably more time to produce, then some of the synergies of teamwork are lost.²⁰ Some of the other potential problems of collaboration are the difficulty of research design and final write up when co-authors are from different disciplinary backgrounds.^{21,22} "Collaborative relationships necessitate flexibility in thinking and a willingness to have one's ideas expanded on and transformed. This may represent too high a cost to some individuals".²³ In their cognitive study of research collaboration, *Chen, Lynch and Himler*²⁴ state that there is a need for an environment that accommodates differences among members of a team. Collaboration can potentially restrict the creativity of individuals.²⁵

The question of whether collaborative research leads to better quality research papers has been partially addressed in a small number of publications. An investigation of the relationship between number of authors and number of citations in astronomical journals reveals a positive correlation.²⁶ *Abt* also investigated the question of whether more active research fields can distort the observed relationship between citation rates and number of authors, concluding that there is no such distortion. "Co-authored research [in Physics] tends to be of higher quality than singly-authored research".²⁷ Yet another example is the work of *Crow, Levine and Nager*²⁸ who report their reflections

on conducting a collaborative and interdisciplinary study. The subjective conclusion they reach states that collaborative and interdisciplinary studies do enhance research;²⁹ it should, however, be noted that the background of the three researchers are from different disciplines. Hence, the same conclusion cannot be extended to collaborating researchers from the same discipline. Collaborative research can be expected to result in higher quality work due to the collective experience and the pre-submission refereeing that normally takes place in joint efforts.³⁰

While it is possible to find authors contending that collaboration leads to better quality research, the evidence from the citation analysis literature is not conclusive. For example, there is no significant difference between citation rates for single- and multiple-authored papers in sociology.³¹ A study by *Lindsey*³² also fails to find any significant overall difference between citation rates across six disciplines. Study of the *Journal of Marriage and Family* shows no correlation between number of citations and number of authors.³³ Investigation of three separate fields of applied research reveals that only the field of Management Science indicates a statistically significant correlation.³⁴ The inconclusive results are further confounded when comparisons are made across disciplines.³⁵

In this study, the quality of a research paper is measured by the number of times a paper is cited. In using number of citations as a measure of quality, we inherently assume that published research is cited in proportion to the extent the reported findings contribute to the advancement of knowledge.³⁶ In this context, quality is not defined in any absolute sense against a set of criteria. Instead, high-quality research is defined as "socially determined...which is currently thought useful by one's colleagues".³⁷ Interpreted in its social sense, a citation count will distinguish between what is currently fashionable and what is yet to be recognised by the scientific community as making a contribution.

While it is possible to conceptualise other ways of measuring the quality of a paper, such as the standing of the author in a particular discipline or the standing of the journal, these are indirect measures that require subjective judgment and are difficult to scale. On the other hand, the proposed proxy measure of quality, namely, number of citations, is an objective ratio scale that permits parametric testing and statistical inferences to be made (normality of the sampling distribution is tested in the results and analysis section). Citation count is regarded as a robust and comparable method of assessing academic quality and performance that has been applied widely in North America.³⁸ Citation rates have been demonstrated to be closely related to other indicators of quality such as number of scientific awards received and choices of expert panels.³⁹⁻⁴¹

The number of citations as a measure of quality has two key potential problems. The authors could cite their own work, that is, a self-citation, or other authors could cite a paper to point out a shortcoming of the study, that is, a negative or critical citation. Both instances could lead to an artificial inflation of the total number of citations for a given paper. In this study, self-citations are omitted from the citations count by perusing the Citation Index of SSCI. Regarding negative citations, which is considered more of a theoretical problem than a real problem,⁴² it is not practical to filter the sample for such occurrences. Nevertheless, the comparative nature of this study, that is, single-author versus multiple-author papers, means that such errors need not be a source of concern since there is no reason to expect a significantly different proportion of negative citations in these groups. Furthermore, a paper that is frequently cited due to errors in the research reported, that is, a negative citation, can also be considered as making a contribution. "It is unlikely...that work which is valueless will be deemed significant enough to merit extensive criticism".⁴³

Research design

Compilation of the papers published between 1987–1991, that is, construction of the study population, was achieved by the help of the electronic data bases ABI/Inform and EconLit. Selection of journals to include in the citation analysis was restricted to the periodicals that are monitored in the SSCI. Therefore, the starting point was the subject category 'Business, Finance' as listed in the SSCI *Journal Citation Reports*. The list was then shortened by excluding accounting, auditing, and tax journals. The final step involved perusal of the complete list of source publications provided as part of the SSCI for other Finance journals that may not have been listed under the subject category 'Business, Finance', resulting in a total of 14 journals (see Table 1 for a listing of the journal titles).

The pivotal concern in choice of sample size is to be resource effective without sacrificing the validity of conclusions inferred from the data collected. "...try to select an economic sample – one that includes enough subjects to ensure a valid survey, and no more".⁴⁴ Mindful of parsimony, four papers are selected from each of the fourteen Finance journals identified from SSCI for each of the years under study. A quick calculation leads us to expect a total of 560 papers, composed of 280 (4×14×5) multiple-author papers and 280 single-author papers. The actual sample size was 540 (19.34% of the population) due to the JFR starting publication in September 1987, and the RFS being listed as of 1989 (volume 2) on the EconLit data base used for collection of published papers.

Table 1
List of fourteen finance journals and number of papers in the study population (1987–1991) sorted by mean citation rate

Journal title and abbreviation	Study population	Mean citation rate
Journal of Financial Economics (JFE)	197	13.83
Review of Financial Studies (RFS)	70	9.42
Journal of Monetary Economics (JME)	217	6.63
Journal of Finance (JFI)	408	5.75
Journal of Money, Credit and Banking (JMB)	212	4.58
Journal of Financial and Quantitative Analysis (JFQ)	176	3.35
Journal of International Money and Finance (JMF)	174	2.63
Journal of Futures Markets (JFU)	243	2.35
Journal of Financial Services Research (JFS)	145	2.11
Financial Management (FMG)	160	1.95
Journal of Banking and Finance (JBA)	246	1.65
Journal of Portfolio Management (JPO)	261	1.63
Public Finance Quarterly (PFQ)	130	1.03
Journal of Financial Research (JFR)	153	0.80
Total Population	2,792	

Randomly selecting four papers from each journal for each of the years in the study period constitutes stratified sampling (probability sampling). This method is an efficient alternative to simple random sampling. For example, if we take JBA, 246 papers were published between 1987–1991. On an annual basis, this is an average of 49 papers. Since the study design requires equal representation of single-author and multiple-author papers in a given year for the comparison of mean number of citations, simple random sampling can only be applied at the annual level. Therefore, a subsample is drawn from each year (stratum) using a table of random numbers and summed to arrive at the test samples.⁴⁵ Stratified sampling allows an accurate representation of the population, whereas simple random sampling could result in some journals having a disproportionate representation.

The sampling period chosen was 1987–1991 inclusive. This allows an investigation of the research question over a five year period, thus enhancing the validity of findings. The methodology calls for identification of a research paper, say, in 1991, citations of which are then summed for the years 1992, 1993, 1994 and 1995. The four year citation span is maintained with all papers to control for differences in number of citations due to time.

There are two samples in this study, namely, multiple-author papers (1987–1991) and single-author papers (1987–1991). In the analysis stage, the *mean* number of

citations from each sample is compared to see if there is any significant difference. A 95 per cent level of confidence and a 5 per cent degree of error are adopted. The null hypothesis is:

H_0 : There is no significant difference between the mean number of citations for multiple-author and single-author papers, or, $\mu_1 = \mu_2$.

If the null hypothesis is rejected where the mean number of citations for multiple-author papers is higher, then the implied conclusion is that collaborative research in Finance *does* lead to better quality papers.

A number of descriptive statistics were calculated on the basis of individual journals and the overall sample, as well as across the study period of 1987–1991.

Results and analysis

As the first step of testing the data, descriptive statistics were generated for the variables CITED# (number of citations of a paper over the four year period), AUTHOR# (number of authors of a paper), and PAGES# (length of a paper in number of pages). The measure of skewness for CITED# was recorded at 3.53 for the combined samples, and 3.59 and 3.45 for single-author and multiple-author samples respectively. This high skewness is a violation of the normal distribution assumption, indicating that results from parametric tests may not be reliable. With this concern in mind, it was decided to initially run a nonparametric test of equality of means ($\mu_1 = \mu_2$), that is, Mann-Whitney U Test. The two-tailed probability of 0.4249 leads us to the conclusion that we cannot reject the null hypothesis, that is, collaborative research in Finance *does not* lead to better quality papers. A t-test was also run to further examine the skewed data set. The result was even stronger in not rejecting the null hypothesis at a two-tailed probability of 0.946. Either way, the results are quite unambiguous in lending support to the hypothesis that there is no significant difference between the mean number of citations from multiple-author and single-author papers.

Descriptive statistics reveal that 25.6% of the papers in the sample have not been cited at all (as per SSCI) over the four years following their publication, 22.2% have been cited only once, and 13.3% cited twice, with the rest spread over 3–52 citations. While there is no way of explaining this observation within the scope of this study, it can be speculated that it is due to a substantial proportion of Finance papers being of empirical nature. The implied lack of development of new theories in this field could explain the low citation rates which averaged at 3.98, with a median of 2. Amongst the fourteen journals studied, the JFE has the highest mean citation rate at 13.83, with the JFR coming in last at 0.80 citations (see Table 1 for more citation rates).

In search of further evidence of possible relationships between citation rates and number of authors, a chi-square test was run. Cross-tabulation of number of authors against citation rates is depicted in Table 2, where citation rates are grouped into 0 (no citation), 1 (single citation), and 2 (two or more citations). The test returns a chi-square value of 5.74 at an observed significance level of 0.4534. Thus, the null hypothesis that the two variables are independent cannot be rejected, lending support to the tests for difference of means reported earlier.

Table 2
Cross-tabulation of number of authors against citation rates indicates independence of variables

Number of authors	Grouped citation rates			Row total
	0	1	2	
1	72* 68.7	61 59.8	136 140.5	269 49.8%
2	55 50.9	43 44.2	101 103.9	199 36.9%
3	11 17.4	15 15.1	42 35.5	68 12.6%
4	0 1.0	1 0.9	3 2.1	4 0.7%
Column total	138 25.6%	120 22.2%	282 52.2%	540 100%

* Cell numbers indicate observed counts on top and expected counts on the bottom.

Other structural characteristics of Finance papers such as the length in pages was also investigated. A Pearson's r correlation matrix for the three key variables in this study, namely, citation rate, number of authors, and number of pages is shown in Table 3. The only noteworthy correlation is between citation rate and number of pages at 0.3752. A similar finding was made in examining characteristics of psychology papers,⁴⁶ and with the *Journal of Marriage and Family*.⁴⁷

Table 3
Pearson's r correlation matrix between citation rate, number of authors, and number of pages

	AUTHOR#	CITED#	PAGES#
AUTHOR#	1.0000	0.0162	0.0573
CITED#		1.0000	0.3752
PAGES#			1.0000

However, in the absence of any theory to explain this observation, it is proposed that manuscript length is controlled by journal editors who are inclined to allow larger journal space for those manuscripts expected to result in greater impact.⁴⁸ Inspection of the scatter plot in Fig. 1 lends support to Bayer's speculation. A simpler explanation of the above observation is that longer papers present more material that can generate interest.

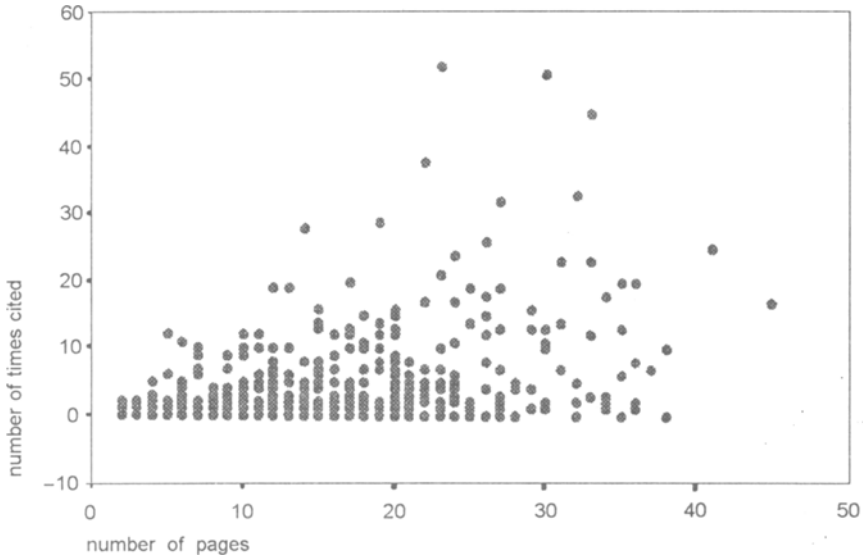


Fig. 1. Scatter plot of citation rate versus number of pages shows a positive relationship

Figure 2 summarises the trend in mean citation rates, number of authors, and number of pages for Finance papers published from 1987 to 1991. The paper length and author numbers are stable, while there is a rise in citation rates in 1991. Without data over a longer period of time, it is impossible to tell whether the rise in citation rate in 1991 is a one-off observation or part of an emerging trend in this field.

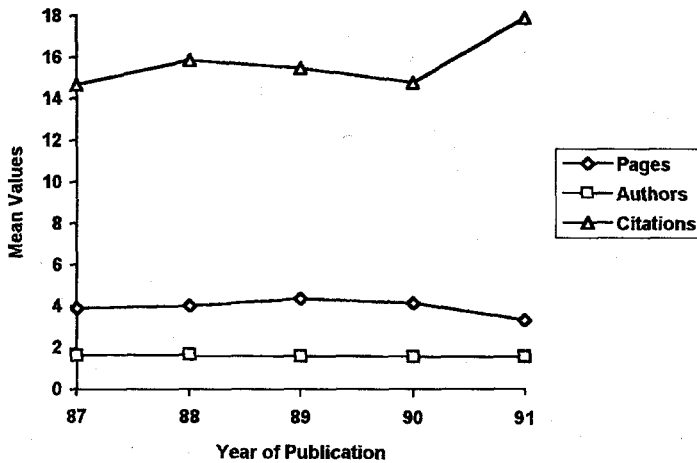


Fig. 2. Chart of mean values for citation rate, number of authors, and number of pages 1987–1991

Conclusion and discussion

The empirical results in this study do not lend support to the contention that scientific collaboration leads to better quality research. While the results should be interpreted within the limitations of the Finance journals examined and the source of data (that is, SSCI), the principal conclusion is to urge caution in rewarding collaborative research.

In the introduction of this paper, it was mentioned that certain emphasis is placed on collaborative research in academic appointments and allocation of research funds. The empirical results of this study should make the decision-makers hesitate in interpreting collaborative research as a definitive sign of ability to produce better research. Nevertheless, there may well be other arguments that would place collaborative research in a favourable light, such as the teamwork it fosters or efficient allocation of scarce research funds. At the same time, a résumé that is dominated by collaborative research publications can raise the question whether that person is capable of

implementing the full research process without assistance. "...in support of salary increases and advancement, the lead author should produce sufficient evidence of singularly produced research and publication".⁴⁹ In conclusion, academic appointments and allocation of research funds should place less rather than more emphasis on presence of collaborative research.

Further research

This study can be expanded to investigate possible relationships between the citation frequency and the theoretical/empirical focus of a paper. Once the main theorists in Finance are identified, an index can be devised based on the references to these theorists in a paper. Examination of the correlation between such an index and the citation frequency could provide further insight to quality of published research papers. The extent a paper is based on theory is positively correlated with the impact of the paper in its field.⁵⁰

Other directions for further research are investigating relationships between quality of research papers and type of collaboration, and authorship patterns over a longer study period, say, 20 years. I have made a conscious effort in this study to use CD-ROM data bases and various computing software applications whenever possible. As more of the journal publications are provided in the electronic format, bibliometric studies should become less cumbersome. Nevertheless, in this study, data collection proved to be tedious since the SSCI was perused manually in establishing the citation counts.

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