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Is peer review duration shorter for attractive manuscripts?

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Abstract
Authors often ask how long the peer review process takes. Peer review duration has attracted much attention in academia in recent years. Existing research focuses primarily on the statistical characteristics of peer review duration, with few studies considering the potential influence of manuscripts' attractiveness. This study aims to fill this research gap by employing attention economy theory. By analysing the peer review history of articles published in *The British Medical Journal* and 16 information and library science journals, we find a significant negative relationship between peer review duration and the Altmetric Attention Score. Overall, our study offers a new perspective on peer review behaviour and bridges the divide between peer reviews and altmetrics.

Keywords
Altmetrics; attractiveness of manuscripts; peer review duration; peer review

1. Introduction

Peer review is a fundamental part of scholarly publishing, designed to assess the validity, quality, significance, and originality of research considered for publication. The purposes of peer review include maintaining the integrity of science

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by filtering out invalid or inferior quality articles, and improving the quality of manuscripts deemed suitable for publication [1,2]. Scientists can benefit from peer review practices, for instance, by obtaining their reputation via reviews [3], gratitude from editors [4], and being appointed to a journal's editorial board [5,6].

However, reviewing manuscripts is hard work. Scientists experiencing excessive work stress have become a common phenomenon in academia [7–11]. The time and effort needed to conduct peer reviews further increase this burden. Nowadays, 'the growth in scientific production may threaten the capacity for the scientific community to handle the ever-increasing demand for peer review of scientific publications' [12]. This situation has aroused ever wider attention with the worsening reviewer crisis in recent years. Several studies of working conditions have revealed that reviewing manuscripts is now a serious burden for scientists [9,13,14]. Peer review increases scientists' total working hours and even erodes their leisure time [10].

Some studies suggest that a manuscript can be reviewed in less than a day, and may even take as little as 5 h [15]. However, according to Publons' *Global State of Peer Review* report (2018) [16], it takes reviewers a median of 16.4 days to complete a review. It is also common for reviewers to receive multiple simultaneous invitations to review manuscripts for different journals. Given that many reviewers have a heavy workload conducting their own research, devoting at least 5 h to reviewing a manuscript requires a trade-off of their limited available time [17,18].

Prior research of peer review duration contains several gaps. One unresolved issue is whether peer review duration is related to the characteristics of a manuscript. We use attention economy theory to investigate whether the Altmetric Attention Score (AAS) of a manuscript could affect peer review duration. This potential association has not been investigated previously, so that, our research is somewhat innovative and should yield findings that form the basis for further research of understanding peer review endeavour in the future.

We use the AAS to measure the attractiveness of a manuscript because altmetrics reflect online attention, general interest or even public engagement [19–21].[1] Specifically, we predict that more attractive manuscripts will have a shorter peer review duration. Using the peer review history of articles published in *The British Medical Journal (BMJ)* and 16 information and library science (ILS) journals[2], we investigate the relationship between peer review duration and the AAS. The rest of this article is organised as follows. The next section briefly reviews extant research on peer review duration. We then construct the relationship between peer review duration and manuscript attractiveness by drawing on attention economy theory. The following section describes the data sources and study methods. The results of regression and robustness tests are then reported. Finally, the article concludes by discussing the findings and acknowledging the study's limitations.

2. Background

2.1. Practical background

2.1.1. Peer review duration. Peer review duration somewhat reflects reviewers' behaviours. For scientists, it is often important to publish their discoveries quickly in reputable journals, achieving publication before their competitors in the same field. Consequently, peer review duration is a key concern. Prior studies mainly focus on how peer review duration varies under different conditions. For instance, at the journal level, higher impact factor journals tend to be significantly quicker in progressing from submission to acceptance [22]. At the disciplinary level, differences are apparent between scientific fields. In particular, peer review duration tends to be shorter in the natural sciences than in humanities and social sciences [18]. The editing process also affects peer review duration. Although duration is similar for all of reviewers, those reviewers known personally by the editor have a higher completion rate [17]. In addition, duration is also related to the number of review rounds [18]. Some studies have specifically provided work to automatically extract peer review duration data and thereby help researchers find journals' average response times [23]. García et al. [24], Johnson et al. [25] and García et al. [26,27] have studied models to improving review quality and duration, including a payment model [24], co-opetition in scholarly publishing [26], and introducing the concepts of sensitivity and specificity of the peer review process [27]. Overall, prior studies of peer review duration focus primarily on the statistical characteristics of peer review duration. Very few researchers have considered peer review duration from the perspective of scientometrics.

2.1.2. Peer review and the influences of bibliometrics. Numerous studies have investigated peer review and the influences of bibliometrics, but most focus on citations impact. Several studies have investigated the fate of manuscripts initially rejected by a journal. Their results suggest that most initially rejected manuscripts are eventually published in journals with a lower impact factor than that of the original target journal [28,29], and that they are cited significantly less [30]. On this basis, some researchers contend that peer review plays a part in quality control. However, Siler points out that peer review can sometimes lead to excellent papers being rejected [31]. Researchers can analyse the citations of papers to reveal whether certain groups of authors are favoured or disadvantaged [32,33]. Other studies have explored the relationship between peer review progress and citations. Sikdar et al. [34] found that papers undergoing fewer review rounds before publication tended to receive higher numbers of citations once accepted. However, this result was not confirmed by Wolfram et al. [35]. Meanwhile, Shideler and Araújo [36] showed that reviewers' interest in a manuscript may predict its future citation potential. It is clear from the available literature that the perspective of altmetrics has received little academic attention.

2.2. Theoretical background

2.2.1. Attention economy theory. Attention economy theory considers the costs and benefits of searching for useful information [37]. The main cost paid by authors who consume information is their attention. As the amount of available information continues to rise rapidly, people's limited attention becomes increasingly precious. The same is true for scientists: the amount of information faced by modern scientists far exceeds their cognitive abilities. They must, therefore, find ways to effectively manage and protect their attention. While scientists want to maximise the attention they receive from other scientists, they seek to devote as little attention as possible to screening information.

Some studies use attention economy theory to analyse scientists' behaviour on social media platforms. For instance, after analysing the actions of over 3 million Twitter users, one study characterised the social media environment as an attention market where people produce information to attract attention and contribute attention by consuming information [38]. Attention economy theory can also be used to evaluate the novelty and popularity of authors in social networks [39]. The attention level of an audience depends on the total amount of available attention and the total volume of signals [40].

Other empirical studies recognise that peer reviewers' cognitive processing capacity is limited [41,42]. Given the competing demands on their time, peer reviewers are more probable to prioritise their own research activities [4]. Studies have confirmed that scientists can choose how much effort to apply in reviewing manuscripts [43,44]. Although reviewing a manuscript may take a day, it is uncertain to decide when to devote their attention to a manuscript [45]. In addition, Serra-Garcia and Gneezy [46] reported that for more interesting papers, reviewers may adopt lower standards regarding reproducibility. Attention economy theory may explain these behaviours to a certain extent: as manuscripts often compete for reviewers' attention, attractive research may be reviewed more quickly. According to the Publons' [47] report, reviewers spend less time on manuscripts that are either very poor or very good.

3. Methods

3.1. Data

This study uses two data sets: *The BMJ* and 16 ILS journals published by Elsevier and Wiley. *The BMJ* is our main data source because it uniquely provides detailed peer review records [48]. For research papers submitted to *The BMJ* after September 2014, the prepublication history is usually posted on the journal's website (bmj.com) after acceptance [49]. In addition, we sourced supplementary data from Web of Science and altmetric.com. We collected up-to-date citation data on 5 March 2022.

Based on the previous studies of Brigham [50], Andersen and Haustein [51] and Wei et al. [52], we call the feature that attracts people's attention or raises readers' interest the attractiveness of a manuscript, and measure this feature using the AAS. Although the AAS represents a paper's attractiveness at the community level, instead of for a single researcher, attractive papers are more probable than unattractive papers to arouse the interest of researchers, especially scientific gatekeepers with many years of expertise in their respective fields.

Regarding peer review duration, we primarily focus on the time from submission to first decision, as the first review round is probably the most important for authors [53,54]. Some of the latest studies [55], define publication delay for an article as the number of days from submission date to acceptance date. However, this definition may be unreliable (too long), so that, we define peer review duration as the number of days between submission of an original manuscript and the first decision. We then collected data for 690 articles published in *The BMJ* between March 2015 and April 2020 from bmj.com.[3] The relationship between manuscript attractiveness and peer review duration is admittedly only one aspect of the peer review, as peer review is a very complex process involving many factors. To date, however, only the peer review history provided by bmj.com has enabled accurate discussion of this relationship. Accordingly, the peer review duration data available on bmj.com are the best choice for empirical analysis in our research.

Although *The BMJ* has accurate data, we are concerned that conclusions drawn from a small sample may lack robustness. Journals published by Elsevier and Wiley show the received date and revised date in the electronic versions of

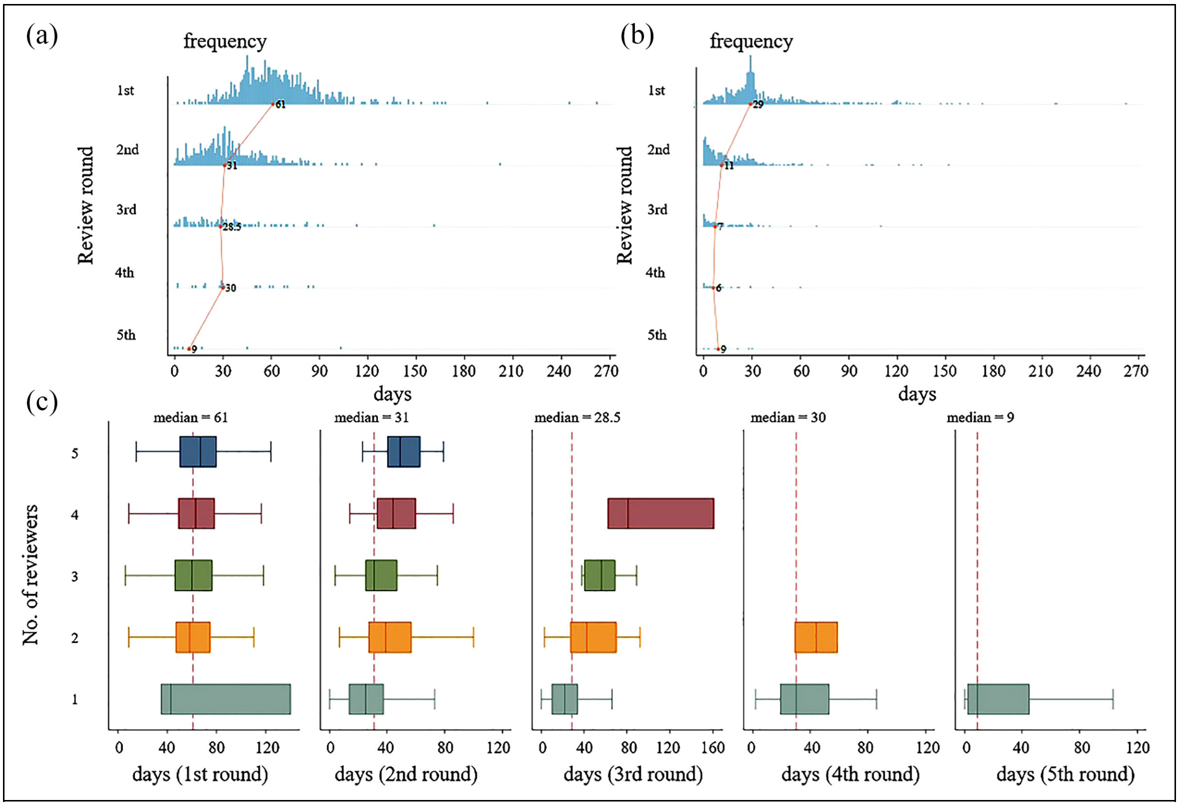

Figure 1. (a) Peer review duration in different rounds. (b) Revision duration in different rounds. (c) Peer review duration for different numbers of reviewers.

published papers (though not the full peer review history as in *The BMJ*). Therefore, after analysing data from *The BMJ*, we test our initial conclusions using a larger sample of publication history data from ILS journals. It is important to note that revised date refers to the date of the last revision [9]. We employed following steps for data retrieval. First, we ran a search with 'Elsevier' or 'Wiley' as the publisher in the Web of Science Core Collection, setting the publication time span from 2013 to 2019. We then refined the 'Web of Science Categories' and set document type to 'Article'. This step identified 6891 articles. We next removed journals with fewer than 30 articles, such as *Library Collections Acquisitions & Technical Services*, *Serials Review*, and *Journal of Computer-Mediated Communication*. After excluding the missing variables, 5124 observations from 16 ILS journals were retained for regression analysis. For all these articles, we collected the received, revised, and available online dates from sciencedirect.com and Wiley Online Library, then calculated the peer review duration as the number of days between the received and revised dates. In addition, we obtained the AAS and other literature indicators for each article from altmetric.com and Web of Science in March 2022.

4. Analysis of results

4.1. Basic description

Figure 1 shows the distribution of peer review duration in different rounds and for different numbers of reviewers. The orange line in Figure 1(a) connects the median duration values for the first five rounds of peer review. As the number of rounds increases, the peer review duration generally shows a decreasing trend with the increase in number of review rounds. We find similar results for the distribution of revision duration (days between receipt of a decision and next submission of manuscript) in different rounds, as shown in Figure 1(b). With each progressive round in the review process, problems in manuscripts will be clarified and the interaction duration between journals and authors will shorten. Figure 1(c) shows the distribution of peer review duration for different numbers of reviewers, focusing only on articles with fewer than six reviewers (accounting for 93.59% of the final sample). In different review rounds, peer review

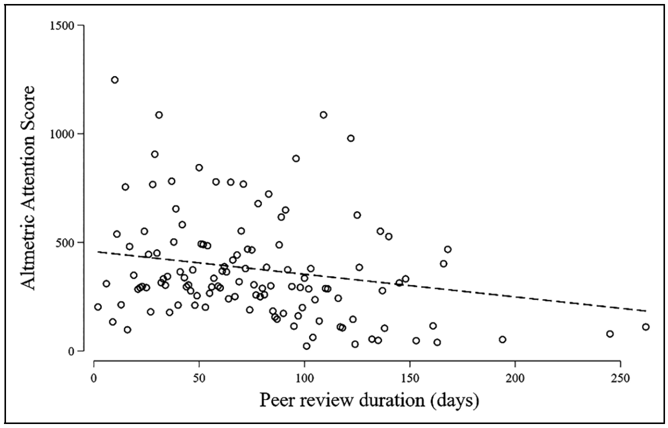

Figure 2. Binned scatterplot of peer review duration (days) and the Altmetric Attention Score.

duration is also related to the number of reviewers. Generally, the more reviewers there are, the longer the peer review duration. This duration depends, of course, on the speed of the slowest reviewer.

Figure 2 visualises the relationship between peer review duration and the AAS using scatterplots. To overcome over-crowding, we use a binned scatterplot [56]: x-axis variable values are grouped into equal-sized bins, the mean of x-axis and y-axis variable values is computed within each bin, and a scatterplot with a trend line is created using these data points. This approach enables a clear depiction of the relationship between the variables.

4.2. Statistical regression

The descriptive statistics suggest there is a negative relationship between peer review duration and the AAS. We next test whether this relationship holds when controlling for confounding factors. Our null hypothesis is straightforward:

H_0: There is no statistical relationship between peer review duration and manuscript attractiveness.

The alternative hypothesis is thus:

H_1: Manuscripts with a shorter peer review duration are more attractive.

The regression model is as follows:

$$Y_i = \beta X_i + \varepsilon_i (i = 1, \ldots, n)$$

where Y_i represents the attractiveness of a manuscript, X_i denotes the independent variables and control variables impacting Y_i, and ε_i is an error term. Table 1 defines and describes all variables used in this study.

4.3. Measures

4.3.1. Dependent variable. We measure the attractiveness of manuscripts (AT) using the AAS.

4.3.2. Independent variables. Our main explanatory variable is the peer review duration of a manuscript (DU), calculated as the number of days between submission of an original manuscript and the first decision being made. The alternative explanatory variable is the number of days between submission of an original article and submission of the revised manuscript (DU_E).

4.3.3. Control variables. Guided by the previous studies of Haustein [57], Onodera and Yoshikane [58] and Tahamtan et al. [59], we include as control variables several author- and paper-related factors that may be associated with the AAS. We also control for the impact of papers to rule out the alternative explanation that higher-quality papers are reviewed

Table 1. Variable descriptions.

Construct	Variable	Type	Description
Dependent (Attractiveness)	*AT*	Count	Altmetric Attention Score
Independent (peer review duration)	*DU*	Count	Days between submission of original manuscript and receipt of first decision
	DU_E	Count	Days between submission of original manuscript and submission of revised manuscript
Control	*TI*	Count	Title length
	AU	Count	Number of coauthors
	PU	Count	Number of prior publications by corresponding author
	AF	Count	Number of affiliations
	PG	Count	Number of pages
	NR	Count	Number of references
	FU	Dummy	1 if the reported study was funded; 0 otherwise
	YM	Dummy	Online publication year and month
	RE	Count	Number of reviewers (*BMJ* data set)
	TC	Count	Article citations
	OA	Dummy	1 if the article is open access; 0 otherwise (ILS data set)
	SO	Dummy	Journal fixed effect (ILS data set)
	JIF	Count	Journal impact factor from Journal Citation Reports (ILS data set)

Table 2. Summary of descriptive statistics (N = 582).

Variable	Mean	Median	SD	Min.	Max.
AT	384.42	193.50	638.85	3.00	7102.00
DU	64.61	61.00	27.46	9.00	262.00
TC	74.27	50.00	85.11	0.00	806.00
TI	17.63	17.00	4.94	8.00	36.00
AU	11.24	8.00	19.31	1.00	294.00
PU	128.02	70.50	178.11	0.00	1313.00
AF	7.98	6.00	9.96	1.00	158.00
PG	10.00	10.00	2.65	4.00	27.00
NR	47.26	41.00	25.42	0.00	268.00
FU	0.89	1.00	0.31	0.00	1.00
RE	3.37	3.00	1.00	2.00	5.00

faster. Accordingly, the study's control variables comprise title length (*TI*), number of coauthors (*AU*), number of publications by the corresponding author before submitting the manuscript[4] (*PU*), number of affiliations (*AF*), number of pages (*PG*), number of references (*NR*), funding (*FU*) and article citations (*TC*).

In addition, to account for the possibility of differences in AASs in different months of the year, we included a dummy variable for the year and month of online publication (*YM*) to control the time fixed effect. We also included a reviewer dummy variable (*RE*) to control the reviewer fixed effect. In addition, we consider the open access status of manuscripts (*OA*), the journal fixed effect (*SO*), and journal impact factor (*JIF*) in further exploration.

We focused on articles published before 2020 to get reliable AAS and reviewed by less than six people to avoid the influence of unusually high numbers of reviewers. We also removed the three articles with only one reviewer. Summary descriptive and pairwise correlation statistics (Tables 2 and 3, respectively) indicate no significant issues for the regression.

As *AT* is a discrete variable consisting of non-negative integers, we adopted *ln(AT)* and *ln(DU)* as the dependent and independent variables, respectively, instead of *AT* and *DU*. After excluding observations with missing data for the variables, 582 observations were included in the regression. We adopted the ordinary least squares (OLS) regression and used Stata version 15.1 to run the analysis.

4.4. Regression results

We used OLS to test the relationship between peer review duration and the AAS and to check whether coefficients changed when adding the control variables into the model. As Table 4 shows, only the independent variable *ln(DU)* is

Table 3. Spearman correlation matrix.

Variable	1	2	3	4	5	6	7	8	9	10	11
1. *AT*	1										
2. *DU*	− 0.08	1									
3. *TC*	0.24	− 0.01	1								
4. *TI*	− 0.11	0.00	− 0.07	1							
5. *AU*	− 0.16	0.02	0.08	0.06	1						
6. *PU*	0.00	0.03	− 0.02	0.01	0.04	1					
7. *AF*	− 0.11	0.01	0.02	0.01	0.71	0.04	1				
8. *PG*	− 0.01	0.06	0.27	0.13	0.23	0.02	0.12	1			
9. *NR*	0.06	0.12	0.34	0.01	0.08	− 0.02	0.05	0.54	1		
10. *FU*	0.00	0.08	0.09	0.01	0.14	0.03	0.10	0.02	0.09	1	
11. *RE*	0.03	0.10	0.06	− 0.08	0.01	0.04	0.04	0.07	0.04	0.05	1

Table 4. Regression results.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Basic	*RE*	*YM*	*RE* & *YM*	Controls	All variables
ln(*DU*)	− 0.265**	− 0.282***	− 0.252**	− 0.263**	− 0.283***	− 0.298***
	(0.104)	(0.105)	(0.112)	(0.113)	(0.105)	(0.115)
TI					− 0.022**	− 0.013
					(0.010)	(0.011)
AU					0.000	− 0.002
					(0.002)	(0.002)
PU					0.000	0.000
					(0.000)	(0.000)
AF					− 0.010	− 0.007
					(0.006)	(0.007)
PG					− 0.007	− 0.020
					(0.022)	(0.023)
NR					0.005**	0.007***
					(0.002)	(0.002)
FU					0.012	− 0.114
					(0.164)	(0.165)
Constant	6.344***	6.335***	5.748***	5.744***	6.683***	6.057***
	(0.430)	(0.433)	(0.556)	(0.555)	(0.479)	(0.611)
N	582	582	582	582	582	582
Adj. R^2	0.007	0.007	0.073	0.071	0.023	0.089
YM	No	No	Yes	Yes	No	Yes
RE	No	Yes	No	Yes	No	Yes

Standard errors in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

included in Model 1. Models 2, 3 and 4 are, respectively, formed by adding *RE*, *YM* and both *RE* and *YM* to Model 1. Model 5 adds the other control variables to Model 1, while Model 6 also adds *RE* and *YM* to thus include all the variables. There is clearly a significant negative relationship between peer review duration and the AAS in all six models, significant at either the 5% or 1% level.

4.5. Robustness tests

Following the steps shown in Figure 3, we ran a series of robustness tests using different models. In Model 7, we changed the time point for measuring the dependent variable. As an article's AAS changes over time, we wanted to verify that our conclusion remained valid when using a different time point for the AAS, specifically 27 June 2020. We did not collect AAS for two observations on that date. So, we had to omit them.

Models 1–6 used data for all articles in the final sample. However, Siler et al. [31] have pointed out that peer review does not change the core part of the paper, and that reviewers prioritise novel ideas in manuscripts. Manuscripts

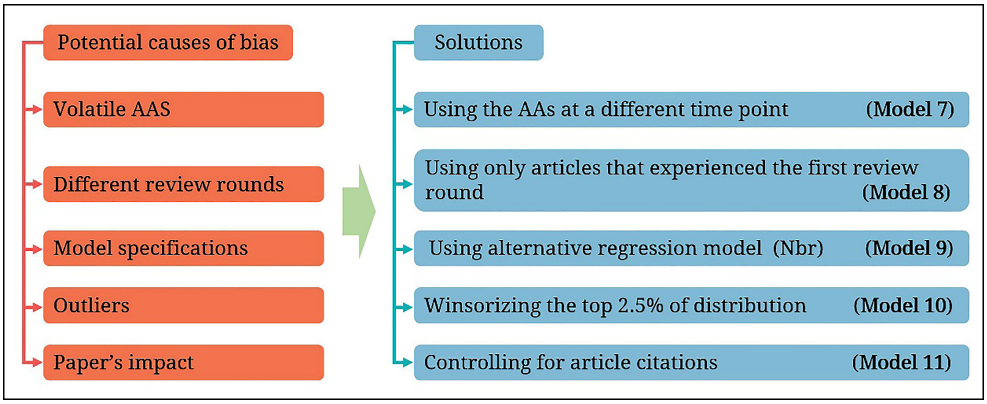

Figure 3. Steps of robustness tests.

Table 5. Regression results for robustness tests.

	Model 7		Model 8		Model 9		Model 10		Model 11	
	Change_time		First_round		Nbr		Winsorized		Citations	
ln(DU)	−0.296**	(0.115)	−0.503***	(0.171)	−0.233**	(0.105)	−0.298***	(0.112)	−0.243**	(0.108)
TC'									−0.401***	(0.056)
TI	−0.013	(0.011)	0.014	(0.017)	−0.010	(0.010)	−0.013	(0.010)	−0.006	(0.010)
AU	−0.002	(0.002)	−0.002	(0.002)	−0.005***	(0.002)	−0.002	(0.002)	−0.003	(0.002)
PU	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)	0.000	(0.000)
AF	−0.007	(0.007)	−0.001	(0.006)	−0.003	(0.005)	−0.007	(0.007)	−0.008	(0.007)
PG	−0.021	(0.023)	−0.043	(0.039)	−0.016	(0.022)	−0.020	(0.022)	−0.047**	(0.023)
NR	0.006**	(0.002)	0.006	(0.005)	0.007***	(0.002)	0.007***	(0.002)	0.003	(0.002)
FU	−0.134	(0.165)	−0.270	(0.250)	−0.021	(0.156)	−0.133	(0.156)	−0.055	(0.159)
Constant	6.129***	(0.632)	6.603***	(0.816)	6.003***	(0.584)	6.052***	(0.604)	4.489***	(0.599)
N	580		260		582		582		581	
Adj. R^2	0.091		0.055				0.091		0.183	
Ll	−841.588		−346.809		−3947.516		−833.971		−815.618	
AIC	1821.177		823.618		8035.032		1805.941		1771.237	
BIC	2122.226		1055.062		8340.685		2107.228		2076.769	
YM	Yes		Yes		Yes		Yes		Yes	
RE	Yes		Yes		Yes		Yes		Yes	

Notes: Ll is the maximum loglikelihood estimate value Standard errors in parentheses, AIC is Akaike information criterion and BIC is Bayesian Information Criterion.
$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

undergoing different numbers of peer review rounds may have heterogeneity. For instance, Sikdar et al. [34] found an inverse relationship for accepted papers between the number of review rounds and the number of citations. In addition, while the AAS is only accumulated after a manuscript has been finalised and published, peer reviewers read a much earlier version. Therefore, we devised Model 8 to include only articles that experienced the first review round.

To eliminate the potential influence of model specification, we specified Model 9 as a negative binomial regression (Nbr) to cater for the count data nature of the AAS. Because the AAS is prone to right-biased distribution, in Model 10, we winsorized the top 2.5% as outliers. Finally, we added *TC'*, which equals −*ln(TC)*, to exclude the effect of citations in Model 11. As shown by the results in Table 5, the coefficient of *ln(DU)* was significant at the 5% or 1% level in all the robustness models.

4.6. Further exploration

The analysis results for data from *The BMJ* verify our alternative hypothesis. We next used the ILS journals sample to explore whether our findings hold in a broader context and with a larger sample size. As stated above, this further exploration measures peer review duration by the number of days between submission of an original manuscript and the date the journal received the final revision. We calculated the correlation coefficients between peer review duration (first decision) and peer

Table 6. Regression results (ILS journals).

	Model 12	Model 13	Model 14	Model 15	Model 16	Model 17
	AAS	Twitter	Mendeley	Citations	*AAS*-Citations	*AAS*-Citations-JIF
ln(DU_E)	− 1.656***	− 1.207**	− 9.467***	3.743***	− 1.208***	− 2.040***
	(0.472)	(0.475)	(3.141)	(0.824)	(0.413)	(0.361)
TC"					− 0.120***	− 0.110***
					(0.026)	(0.024)
JIF						− 1.544***
						(0.263)
TI	− 0.059	− 0.060	− 0.151	− 0.070	− 0.068	− 0.124
	(0.098)	(0.071)	(0.451)	(0.125)	(0.096)	(0.089)
AU	0.859**	0.578	2.486	− 0.991**	0.740*	0.552
	(0.412)	(0.385)	(1.750)	(0.450)	(0.403)	(0.396)
PU	− 0.006	− 0.011**	0.026	− 0.021**	− 0.008	− 0.005
	(0.005)	(0.005)	(0.026)	(0.008)	(0.005)	(0.005)
AF	− 0.070	0.224	2.300	− 0.534	− 0.134	0.115
	(0.393)	(0.332)	(2.025)	(0.660)	(0.382)	(0.383)
PG	− 0.016	− 0.024	− 0.440	0.095	− 0.005	0.066
	(0.095)	(0.063)	(0.459)	(0.133)	(0.093)	(0.088)
NR	0.016	0.003	0.509***	− 0.184***	− 0.006	− 0.031***
	(0.010)	(0.006)	(0.092)	(0.025)	(0.011)	(0.010)
FU	− 0.350	0.378	− 7.116*	0.747	− 0.261	− 0.353
	(0.718)	(0.667)	(3.782)	(1.058)	(0.706)	(0.759)
OA	4.865***	4.310***	32.552***	− 4.101***	4.374***	5.822***
	(0.844)	(0.764)	(4.452)	(1.182)	(0.804)	(0.842)
Constant	8.866**	8.077**	17.947	− 0.357	8.823***	21.522***
	(3.446)	(3.357)	(18.250)	(3.990)	(3.383)	(4.035)
N	5124	5124	5124	5124	5124	5008
Adj. R^2	0.041	0.065	0.105	0.104	0.074	0.054
SO	Yes	Yes	Yes	Yes	Yes	Yes
YM	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

review duration (final revision) to show their similarity. The Spearman correlation coefficient was highest for the first round of peer review, at 0.768. When the second round was added, the correlation coefficient decreased to 0.555.

We again controlled for *TI*, *AU*, *PG*, *NR*, *FU*, *OA*, *SO* and *YM* in the regression models. As this data set has too many zero values in AAS, we did not take the logarithm of the dependent variable to avoid loss of data. Model 12 shows a negative relationship between *ln(DU_E)* and AAS, significant at the 1% level. We disaggregated the AAS by separately examining Twitter and Mendeley as the dependent variable in Models 13 and 14, respectively. The significance of coefficients did not change. To check for the confounding influence of an article's number of citations, we first made citation count the dependent variable in Model 15 and then added citation count ($TC'' = -\mathrm{TC}$) as a control variable to Model 12, thereby forming Model 16. Finally, we added *JIF* to Model 16 as another control variable to form Model 17. In analysis reported in the Supplemental Information, we used *ln(AAS)* as the dependent variable instead of *AAS* and specified an Nbr to cater for the count data nature of the AAS. These results are consistent with our previous findings (Table 6).

5. Discussion and conclusion

5.1. Discussion

Compared with previous studies that reveal how citation count is related to peer review rounds [34,35] and journals' publication speed [60], our research makes several new discoveries, most notable of which is that attractive manuscripts have a shorter peer review duration.

Our aim was to reveal the relationship between manuscript attractiveness and peer review duration, rather than focusing on the factors influencing peer review duration [55,60]. Since peer review duration precedes formation of the AAS, we consider it logical for the former to be an independent variable and the latter a dependent variable. In additional analysis, swapping the independent and dependent variables did not change the direction and significance of independents' coefficients (see Supplemental Information Tables A7 and A8).

Although the ILS journals give only a rough insight into peer review duration, this data set served to improve the credibility of our results using a larger sample. We also tested alternatives to the AAS as a proxy for attractiveness but found no change in the results.

Our research has several implications for academic communities. First, in terms of scientific publishing, it is important to understand reviewers' behaviour, especially their trade-off in devoting time to manuscript review. As quality control is a major function of peer review, scientists usually devote considerable time and effort to reviewing. Reviewers need to apply objective selection criteria, even when encountering especially interesting manuscripts. As an important dimension of reviewers' behaviour, the attention they pay to a manuscript could be incorporated into the peer review model to better understand the process [27,61–63].

Second, manuscript attractiveness is a primary consideration for some journals, especially high-quality journals, such as *Nature* and Nature-branded journals. Their editors seek to publish attractive research that is important for the discipline and/or of interdisciplinary interest and/or with real-world implications [64]. Authors that submit papers need to keep in mind that manuscript attractiveness may influence the speed of the review process.

Third, reviewers' work is a contribution to the scientific community. Reviewers are generally not paid for their review work, and most reviews are made anonymously. There are, thus, few incentives to give high priority to peer reviewing manuscripts [53,65]. However, one implicit reward from reviewing an interesting paper is the broadening of one's horizons; as Engers and Gans explain [66], peer reviewing enables scholars 'to keep up with current ideas and new results'. Peer review is also a path for scholars to update their knowledge without incurring financial expense [6].

Finally, quantitative social science is entering the era of open science [67]. Journals, such as *The BMJ* and *Nature Communications*, make available abundant peer review data. Meanwhile the large-scale publishing time data provided by publishers, such as Elsevier and Wiley, offer valuable insights for analysing scientists' behaviour. Such information could enable much more effective quantitative research in the sociology of science [68,69]. This article provides a preliminary discussion and sets foundations for more in-depth future exploration.

5.2. Conclusion

This study contributes to revealing the relationship between peer review duration and a paper's attractiveness. Manuscripts often compete for the attention of busy reviewers. By combining insights from existing research with attention economy theory, this study predicted a negative relationship between peer review duration and manuscript attractiveness. Through analysing the peer review history of articles published in *The BMJ* and 16 ILS journals, the proposed relationship was supported.

5.3. Limitations and future research directions

We acknowledge that our research has several limitations. First, we adopted a cross-sectional design analysing peer review history information from bmj.com and AAS data from altmetric.com. Although we found a binary relation between peer review duration and paper attractiveness, diachronic data should be analysed to draw causal inferences. Second, reviewers' behaviour is influenced by multiple factors, and peer review duration may vary with the complexity of topics, quality of manuscripts, and the experience of reviewers [16]. Because we did not measure various potential confounding variables, the potential impact of other bias could not be investigated statistically. If relevant data become available in the future, they should be included in further research. Finally, although we sought further support for our main findings using data from Elsevier and Wiley, caution should be exercised in interpreting the results from this approach.

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Supplemental material

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Notes

1. For a more detailed rationale and interpretations of the measure, please see the Supplemental Information.
2. Sixteen ILS journals include *Journal of Informetrics*, *Information & Management*, *Journal of The Association for Information Science and Technology*, *Information Systems Journal*, *Health Information and Libraries Journal*, *Learned Publishing, International Journal of Information Management*, *Journal of Academic Librarianship*, *Information Processing & Management*, *Library & Information Science Research*, *Government Information Quarterly*, *Telecommunications Policy, Journal of Strategic Information Systems, Telematics and Informatics*, *Information and Organization*, *World Patent Information*.
3. Details are provided in the Supplementary Information.
4. If there are multiple corresponding authors, we will choose the one with the maximum number of publications among them.

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