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The citation trap: Papers published at year-end receive systematically fewer citations

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ABSTRACT

The present research reveals that academic papers published at year-end on average receive systematically fewer citations than papers published at other times in the year. Using more than 200,000 papers in economics published between 1956 and 2010, the results of our analysis show that papers published between October and December on average get as much as 18.5% fewer citations than those published in the other months in the year. We refer to this phenomenon as *the citation trap* as there is no evidence that papers published at different times in the year differ in their academic quality. We propose that the current effect could arise because of the time window options in most online academic search engines: the specific setting of those options leads papers published at year-end to appear in the engines' search results for a systematically shorter period of time as compared to papers published at other months in the year. Our analysis reveals evidence that is consistent with the proposed mechanism and that rules out several alternative explanations. Implications of the current research for academia and possible solutions to mitigate the citation trap are discussed.

1. Introduction

The number of citations an academic paper receives is a straightforward index of its impacts on subsequent research and is thus often considered a reliable measure of the quality of the paper (Hamermesh et al., 1982; Hirsch, 2005; Smart and Waldfogel, 1996). As a result, number of citations or indices based on citations (e.g., the H-index [Hirsch, 2005]) often serves as a key determinant of many decisions in academia (Huang, 2015), including the hiring, pay, and promotion of scholars (Diamond 1986; Ellison, 2013; Hilmer et al., 2015) and the conferment of scholarships and research funds (Berger, 2016; Garfield, 1999; Hamermesh et al., 1982; Smart and Waldfogel, 1996). As an example demonstrating the high impact of number of citations, relevant authorities in the United Kingdom have recently announced their intention to transform the Research Assessment Exercise (RAE) from a process that relies on peer reviews to one that is based on bibliometric

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data (Ellison, 2013). Recent evidence, however, suggests that the number of citations a paper receives could be affected by factors exogenous to its academic quality. For example, the positions of papers within a journal could affect the frequency with which they are cited by others (Coupé et al., 2010). Papers with a first author whose surname initial is earlier in the alphabet get cited more frequently because they appear earlier in a reference list in many journals (Huang, 2015). Furthermore, longer titles of research articles increase the chance that the papers be found by academic search engines and thus lead to more citations of the papers (Guo et al., 2018).

In this research, we investigate the unexplored relationship between the number of citations that academic papers receive and their timing of publication in the year. Our findings indicate that papers published at year-end (e.g., October, November, and December) on average get significantly fewer citations than those published at other months in the year. Because the length of the review process and hence the exact timing of publication are beyond the control of most scholars, it is highly unlikely that the phenomenon we document here reflects a relationship between the academic quality of the papers and their timing of publication in the year. Therefore, timing of publication in the year could constitute a systematic bias when it comes to recognizing the quality of academic papers and the professional attainments of scholars. We hence refer to the current effect as *the citation trap*.

We suggest that the citation trap may stem from the time window options in most online academic search engines (e.g., *Web of Science, Jstor, ScienceDirect, Springer*, and *Google Scholar*). Online search engines constitute a major avenue via which scholars seek references for their research and thus have important influences on academic citations (Guo et al., 2018; Kousha and Thelwall, 2007). To narrow the returned search results, most search engines offer their users the option to search articles published within certain time windows, usually in units of years. For example, *Springer* allows their users to search papers published between two particular years (e.g., between 2015 and 2019); *Google Scholar* allows their users to search papers published after a particular year (e.g., since 2015; see Appendix A for more examples). Importantly, when users of search engines choose to impose time windows on their searches, the engines will return relevant articles published on or after *the first day* of the beginning year. For example, if a scholar searches for papers published "between 2015 and 2019" or "since 2015" on July 1st, 2019, the search engines will return papers that are published on or after January 1st, 2015, rather than on or after July 1st, 2015.

To see the effect of this specific setting on papers published at year-end (versus those published at other times in the year), suppose that a scholar always searches for papers published in the recent five years (e.g., in 2019 his searches shall be "between 2015 and 2019" or "since 2015"). Then a paper published in December 2015 shall appear in the scholar's search results during the period between December 2015 and December 2019 (49 months) while a paper published in January 2015 shall appear in the scholar's search results during the period between January 2015 and December 2019 (60 months). Therefore, when the time window options in the search engines are used, papers published at year-end suffer a disadvantage relative to papers published at other times in the year in terms of the duration in which they appear in the engines' search results. Importantly, this disadvantage does not require that the year-end papers be published temporally after the non-year-end papers. For example, a paper published in January 2016 shall also appear in the above scholar's search results for a total of 60 months (between January 2016 and December 2020). More generally, if the time window is set to be n years (n equals to 5 in the above example), then papers published in the m^{th} ($m \in [1, 12]$) month in the year shall appear in the engines' search results for $12(n-1)+(12-m+1)=12n-m+1$ months. It is clear that as m increases (i.e., publishing papers in later months in the year), the length of time during which the papers appear in the engines' search results decreases. We propose that this disadvantage of papers published at year-end with regard to the duration in which they appear in the engines' search results could potentially drive the citation trap.

In the current research, we document the citation trap and provide evidence that supports the proposed mechanism. Using more than 200,000 SSCI papers in economics, we show that papers published between October and December on average get as much as 18.5% fewer citations than those published in the other months in the year. We demonstrate the effect after controlling for the influences of several attributes of the paper, including paper length, number of authors, number of references cited, and title length, and we show that the results remain robust across different model specifications and identification strategies. Moreover, our analyses provide evidence that supports the time window options in search engines as the underlying mechanism of the current effect. First, our results show that there is a mitigating effect of journal quality on the citation trap. Specifically, the effect is less pronounced for papers published in top-tier journals than for papers published in lower-tier journals. Because top-tier journals have much greater and more engaged readership, scholars rely much less on search engines to access papers published in those journals. Therefore, if the time window options in search engines drive the citation trap, the effect should be attenuated for papers published in top-tier journals.

Second, the results show that there is a mitigating effect of the length of time that has passed since the paper was published. The effect is more pronounced for papers published in the more recent years when the use of online academic search engines became prevalent. Importantly, our mechanism does not require that the papers be published after the emergence of the online engines. That is, the citation trap might affect papers as long as they can be found using the time window options in online search engines. Nevertheless, the moderating effect of time is consistent with the current mechanism because the purpose of using the time window options is to narrow the returned search results and therefore the majority of the engine users should choose to impose relatively short time windows in their searches (i.e., search for papers that were published in the recent past). Moreover, because papers get more citations over time, it is also consistent with the current mechanism that the effect of the citation trap becomes proportionally smaller in the long term. Finally, we provide further evidence that rules out several alternative explanations of the current effect. Our results suggest that the effect is unlikely

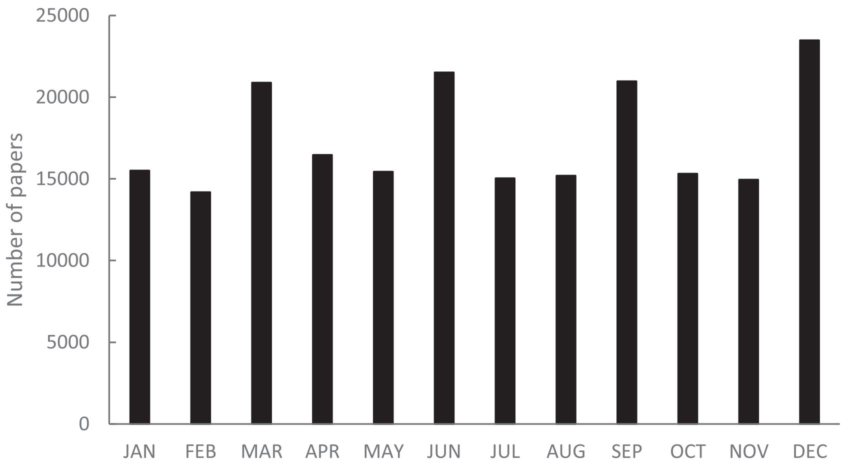

Fig. 1. The total number of papers published in each calendar month.
Notes: The dataset was retrieved from the *Web of Science* and consists of papers in economics published between 1956 and 2010.

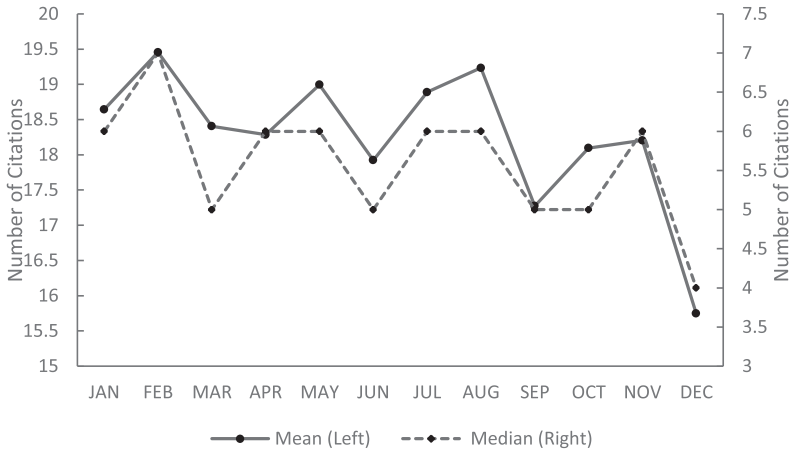

Fig. 2. The mean and the median of number of citations of papers published in each calendar month.
Notes: The dataset was retrieved from the *Web of Science* and consists of papers in economics published between 1956 and 2010.

to arise because of (1) strategic submissions by high ability scholars, (2) plausible influences of journal editors at year-end, or (3) the ordering of papers by the search engines.

The reminder of the paper is organized as follows. We describe the data and specify our empirical model in Section 2. We report our results and provide evidence that supports our proposed mechanism and rules out alternative accounts in Section 3. Finally, we conclude in Section 4.

2. Data and model specification

We retrieved information of published papers in economics from the *Web of Science* (*WoS*) database. The papers were published between 1956 and 2010. We excluded from our analyses papers of which the publication date could not be identified and papers that were published in special issues of the journals, in which the overall quality of the papers is often a concern (Coupé et al., 2010; Hudson, 2007). The final dataset consists of 208,977 papers.

Fig. 1 shows the total number of papers published in each calendar month over the years. While substantially more papers were published in March, June, September, and December due to the arrangement of quarterly journals, there was no substantial difference in the number of papers published in the other months. For each paper in our dataset, we recorded its total number of citations received before December 2012. The mean and the median number of citations of papers in our dataset were 18.12 ($SD = 69.83$) and 5, respectively. Fig. 2 shows the mean and the median of number of citations of papers published in each calendar month over the years. As can be seen from the figure, papers published at year-end (October to December), particularly those published in December, had substantially fewer citations than those published at other months in the year. Furthermore, Fig. 3 depicts the distributions of number of citations of papers published between October and December and of papers published in the other months. As can be seen, papers published at year-end (between

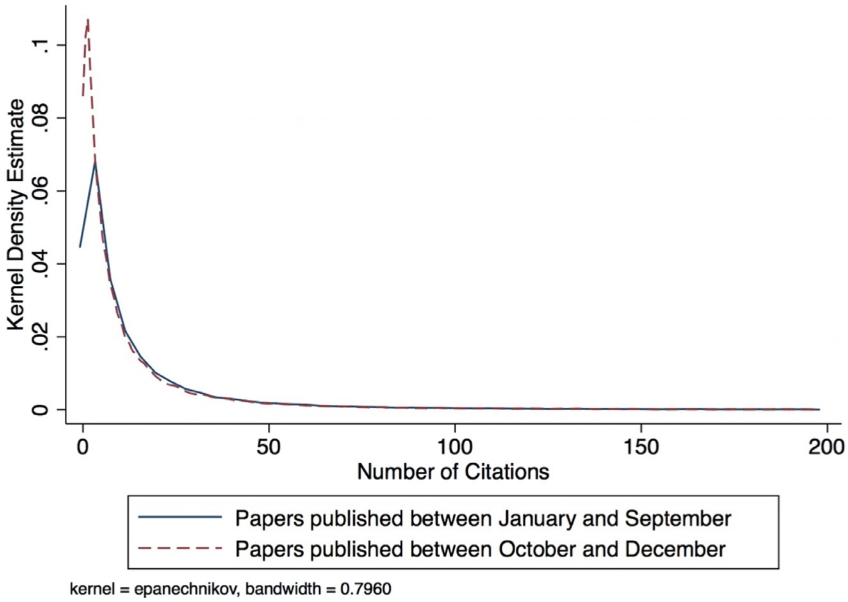

Fig. 3. Distributions of number of citations of papers published between October and December and of papers published between January and September. *Notes*: The dataset was retrieved from the *Web of Science* and consists of papers in economics published between 1956 and 2010.

October and December) had noticeably higher density values in regions of smaller numbers of citations. The results of Epps-Singleton two-sample test (Goerg and Kaiser, 2009) confirmed that the two distributions were significantly different, $p < 0.001$. Therefore, the findings from Figs. 2 and 3 suggested that papers published at year-end overall received fewer citations than papers published at other times in the year.

To formally examine the relationship between the number of citations of academic papers and their timing of publication in the year, we constructed the following benchmark model:

$$ln(citation)_{ijt} = \beta yr\_end_{ijt} + \emptyset X_{ijt} + year_t + journal_j + \varepsilon_{ijt} \quad (1)$$

where $ln(citation)_{ijt}$ is the natural logarithm of the number of citations of paper i published in journal j in year t (we added 0.0001 to the number of citations of each paper before taking the logarithm transformation to include papers with zero citation in our model). yr_end_{ijt} is a dummy variable that indicates whether the paper was published at year-end. In our benchmark model, year-end was defined to include October, November, and December. Therefore, yr_end_{ijt} equals 1 if the corresponding paper was published between October and December and it equals 0 if the paper was published in the other months in the year. Among the papers in our dataset, 53,707 (25.7%) of them were published in year-end according to the current definition. $year_t$ and $journal_j$ represent the fixed effects of the year and the journal in which the paper was published, respectively. ε_{ijt} is the error term.

We included in our model a set of control variables X that may correlate with the number of citations a paper receives. These included (1) the number of pages of the paper (Card and Della Vigna, 2014; Vieira, 2008); (2) the number of authors of the paper (Di Vaio et al., 2012; Freeman and Huang, 2015; Sauer, 1988; Vieira, 2008); (3) the alphabetical order of the first author's surname initial (Huang, 2015)–we used a dummy variable to represent the place of the first author's surname initial in the alphabet: the variable equals 1 if the surname initial is between A and M in the alphabet (146,075 [69.9%] of the papers in our dataset fell in this category) and it equals 0 if the surname initial is between N and Z in the alphabet; (4) the number of references that were cited in the paper (Vieira and Gomes 2010; Webster et al., 2009); (5) a dummy variable indicating whether the paper was a leading article (Berger, 2016; Coupé et al., 2010; Hudson, 2007; Pinkowitz, 2002): the variable equals 1 if it was and 0 if it was not (24,868 [11.9%] of the papers in our dataset were leading articles); (6) the number of letters in the paper's title (Bramoullé and Ductor, 2018; Guo et al., 2018; Letchford et al., 2015); and (7) the number of papers in the same issue of the journal in which the paper was published (King, 2004). See Table 1 for a summary of the descriptive statistics of these control variables. In Appendix B, we demonstrate the means of these variables for papers published in each calendar month. Importantly, there was no substantial difference between the means in different calendar months.

In all cases we were interested in the estimation of β, which represents the effect of publishing at year-end relative to other times in the year on the number of citations a paper receives. We reported robust standard errors clustered at the journal-year level.

Table 1
Descriptive statistics for some of the control variables in the model.

Variables	Obs	Mean	SD	Median	Min	Max
Number of pages	208,977	17.105	8.736	16	3	100
Number of authors	208,977	1.726	0.895	2	1	10
Number of references cited	208,977	26.016	18.721	23	0	680
Number of letters in title	208,977	9.511	3.777	9	1	45
Number of papers in the same issue	208,977	11.097	7.710	9	1	122
Author team ability	208,977	4.625	6.824	2	0	188
Author team degree of multidiscipline	208,977	2.536	2.651	2	0	33

Notes: Number of pages is the number of pages of the paper; *Number of authors* is the number of authors of the paper; *Number of references cited* is the number of references that were cited in the paper; *Number of letters in title* is the number of letters in the title of the paper; *Number of papers in the same issue* is the number of papers in the same issue of the journal in which the paper was published; *Author team ability* is the total number of academic papers published by all the members in the author team of the paper during the last five years before the paper was published; *Author team degree of multidiscipline* is the sum of the number of disciplines in which each member in the author team of the paper had published at least one paper during the last five years before the paper was published.

Table 2
Model estimation results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Year-end	−0.242***	−0.255***	−0.268***	−0.191***	−0.189***	−0.185***
	(0.020)	(0.019)	(0.044)	(0.033)	(0.043)	(0.021)
Number of pages		0.0689***	0.0664***	0.0558***	0.0451***	0.0563***
		(0.001)	(0.006)	(0.003)	(0.004)	(0.002)
Number of authors		0.456***	0.552***	0.314***	0.337***	0.306***
		(0.010)	(0.018)	(0.021)	(0.018)	(0.010)
Place of surname initial		0.115***	0.126***	0.0205	0.0255	0.0347**
		(0.019)	(0.027)	(0.020)	(0.021)	(0.017)
Number of references cited		0.0315***	0.0381***	0.0244***	0.0279***	0.0251***
		(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Leading article		0.164***	0.135***	0.423***	0.417***	0.410***
		(0.027)	(0.038)	(0.029)	(0.030)	(0.022)
Number of letters in title		−0.0272***	−0.0247***	0.00802*	0.00148	−0.00495**
		(0.002)	(0.003)	(0.004)	(0.003)	(0.002)
Number of papers in the same issue		0.0269***	0.0361***	−0.0279***	−0.0167*	−0.0250***
		(0.001)	(0.011)	(0.006)	(0.008)	(0.004)
Year fixed effects	NO	NO	YES	NO	YES	NO
Journal fixed effects	NO	NO	NO	YES	YES	NO
Journal-year fixed effects	NO	NO	NO	NO	NO	YES
N	208,977	208,977	208,977	208,977	208,977	208,946
R^2	0.000682	0.0777	0.119	0.269	0.298	0.324

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. *Year-end* is a dummy variable that equals 1 if the paper was published between October and December and equals 0 if otherwise; *Number of pages* is the number of pages of the paper; *Number of authors* is the number of authors of the paper; *Place of surname initial* is a dummy variable that equals 1 if the surname initial of the first author of the paper is between A and M in the alphabet and equals 0 if the surname initial of the first author of the paper is between N and Z in the alphabet; *Number of references cited* is the number of references that were cited in the paper; *Leading article* is a dummy variable that equals 1 if the paper was a leading article in the issue and equals 0 if was not; *Number of letters in title* is the number of letters in the title of the paper; *Number of papers in the same issue* is the number of papers in the same issue of the journal in which the paper was published. The standard errors in parentheses in column (3), (4), (5), and (6) are clustered at their corresponding fixed-effect level(s). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

3. Results

3.1. Benchmark models

We presented the estimation results of our benchmark model and several alternative model specifications in Table 2. Column 1 shows the results when only the yr_end_{ijt} variable was included in the model. The regression coefficient of the variable was negative and significant at the 0.01 level, providing initial evidence that publishing at year-end has negative effects on the number of citations that the papers receive. The magnitude of this coefficient did not change significantly when we added the control variables and the fixed effects into the model (see Columns 2 to 6, Table 2). In Column 6, we controlled for systematic differences at the journal-year level by adding the interaction effect between the $year_t$ and the $journal_j$ variables in the model. The model specification in Column 6 had the largest adjusted R^2, suggesting that the explanatory power of the model was enhanced by adding the journal-year fixed effect. Therefore, we adopted the estimates in Column 6 as the benchmark results, which suggested that, ceteris paribus, the number of citations of papers published at year-end was on average 18.5% smaller than that of papers published in the other months in the year. The signs of the

Table 3
Model estimation results with data trimming and alternative model specifications.

Variables	(1) Excluding Zero	(2) Excluding Top 5%	(3) Excluding December	(4) Nb-reg	(5) Inv-sine
Year-end	−0.0651***	−0.186***	−0.157***	−0.0907***	−0.0788***
	(0.007)	(0.021)	(0.025)	(0.009)	(0.007)
Control variables	YES	YES	YES	YES	YES
Journal-year fixed effects	YES	YES	YES	YES	YES
N	180,644	198,593	185,469	208,977	208,946
R^2	0.383	0.296	0.324	N/A	0.444

Notes: The dependent variable in Column 1 is the natural logarithm of the number of citations of the paper and thereby Column 1 shows the model estimation results when papers with zero citation were excluded. The dependent variable in Columns 2 to 4 is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. Column 2 shows the results when papers with citation numbers that were at the 95th percentile were excluded. Column 3 shows the results when papers published in December were excluded. Column 4 shows the results of the negative binomial model. Column 5 shows the results when the dependent variable is the number of citations of the paper transformed by the inverse hyperbolic sine function. *Year-end* is a dummy variable that equals 1 if the paper was published between October and December and equals 0 if otherwise. The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

coefficients of the control variables were consistent with implications of previous research (Bramoullé and Ductor, 2018; Card and Della Vigna, 2014; Coupé et al., 2010; Di Vaio et al., 2012; Freeman and Huang, 2015; Hudson, 2007; Vieira, 2008).

3.2. Robustness checks

3.2.1. Data trimming and alternative model specifications

We conducted several robustness checks to provide further evidence of the validity of the current effect. First, we excluded papers that had zero or extremely large numbers of citations and ran the benchmark model (model specification as shown in Column 6, Table 2) again. Column 1 and Column 2 of Table 3 list the results when papers with zero citation and when papers with citation numbers that were at the 95th percentile in our dataset were excluded, respectively. The coefficients of the yr_end_{ijt} variable remained negative and significant in both cases. The results thus suggested that the citation trap was not driven by papers with extreme numbers of citations. Moreover, it was clear from Fig. 2 that papers published in December on average received particularly fewer citations. To check if the year-end effect still holds if the impacts of those papers are removed, we ran the benchmark model with all papers published in December being excluded from our analysis. The results (Column 3, Table 3) confirmed that the citation trap remained robust.

Further, we used alternative model specifications to account for the non-linearity inherent in our data. We specified a negative binomial regression to cater for the count data nature of number of citations. In addition, to examine the robustness of our findings under alternative transformation, we applied the inverse hyperbolic sine transformation to the number of citations of the papers. Column 4 and Column 5 of Table 3 present the estimation results of the above two model specifications respectively. The coefficients of the yr_end_{ijt} variable were negative and significant in both columns, therefore suggesting that the current effect was robust under these alternative model specifications.

3.2.2. Alternative definitions of year-end

To eliminate the concern that the citation trap is specific to our definition of year-end in the benchmark model (i.e., October to December), we varied the operationalization of the yr_end_{ijt} variable and re-ran our benchmark model. Specifically, we adopted the following alternative definitions of year-end to include (1) December, (2) November and December, (3) September to December, (4) August to December, and (5) July to December, respectively. Importantly, the estimation results (see Table 4) of our model with these alternative definitions of year-end confirmed that the citation trap was robust across all the definitions.

3.2.3. Alternative definitions of year

As discussed above, the citation trap does not arise merely because the year-end papers were published temporarily after the non-year-end papers. To more clearly address this concern, we re-defined a year in our model to enable us to compare the effect of publishing papers at year-end to that of publishing papers at later times (i.e., in the next year). Specifically, for example, under the *December-Year* definition, each year starts from December and ends at November of the next year. When we used this definition of year in our model estimation, thereby, the yr_end_{ijt} variable equals 1 if the paper was published in December in one year or between October and November in the next year. We used several alternative definitions of year and re-ran our benchmark model. The results (see Table 5) indicated that the current effect remained negative and significant when we compared the number of citations of papers published at year-end with that of papers published in the next year. For example, the results in Column 3 of Table 5 suggested that the average number of citations of papers published between October and December was 6.4% smaller than that of papers published between January and September in the next year.

Table 4
Model estimation results with alternative definitions of year-end.

Variables	(1) Dec	(2) Nov-Dec	(3) Sep-Dec	(4) Aug-Dec	(5) Jul-Dec
Year-end	−0.227***	−0.215***	−0.191***	−0.197***	−0.201***
	(0.033)	(0.025)	(0.019)	(0.018)	(0.017)
Control variables	YES	YES	YES	YES	YES
Journal-year fixed effects	YES	YES	YES	YES	YES
N	208,946	208,946	208,946	208,946	208,946
R^2	0.324	0.324	0.324	0.324	0.324

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. We ran our benchmark model with alternative definitions of year-end. In Column 1 year-end was defined to include December; In Column 2 year-end was defined to include November and December; In Column 3 year-end was defined to include September to December; In Column 4 year-end was defined to include August to December; In Column 5 year-end was defined to include July to December. The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5
Model estimation results with alternative definitions of year.

Variables	(1) Dec-Year	(2) Nov-Year	(3) Oct-Year	(4) Sep-Year	(5) Aug-Year	(6) Jul-Year
Year-end	−0.135***	−0.101***	−0.0638***	−0.0807***	−0.0944***	−0.101***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)
Control variables	YES	YES	YES	YES	YES	YES
Journal-year fixed effects	YES	YES	YES	YES	YES	YES
N	208,946	208,950	208,953	208,951	208,951	208,947
R^2	0.325	0.325	0.325	0.325	0.324	0.325

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. We ran our benchmark model with alternative definitions of year. In Column 1, each year was defined as starting from December and ending at November in the next year, and year-end included December in one year and October and November in the next year. In Column 2, each year was defined as starting from November and ending at December in the next year, and year-end included November and December in one year and October in the next year. In Column 3, each year was defined as starting from October and ending at September in the next year. In Column 4, each year was defined as starting from September and ending at August in the next year. In Column 5, each year was defined as starting from August and ending at July in the next year. In Column 6, each year was defined as starting from July and ending at June in the next year. In Columns 3 to 6, year-end included October to December in the earlier year. The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Furthermore, we took an alternative approach to investigate the current effect. Specifically, we compared the effect of publishing papers in January with that of publishing papers in each of the other months in the year. We created dummy variables to represent the effect of publishing in each month between February and December relative to that in January and we examined the effects under different definitions of year. The results are depicted in Table 6. For example, under the normal definition of year (i.e., starting from January and ending at December), the results (Column 1, Table 6) suggested that the number of citations of papers published between February and December decreased almost monotonically as compared to that of papers published in January. Similar patterns of results were obtained when we used other definitions of year (Columns 2 to 7, Table 6). Further, the results in Columns 2 to 7 confirmed again that papers published at the end of a year received significantly fewer citations than papers published in January of the next year. To conclude, our results confirmed that the citation trap remained significant under a variety of robustness checks and thus provided strong support to the current effect.

3.3. Evidence supporting the proposed mechanism

In this section we provide evidence that is consistent with our proposed mechanism. According to the current mechanism, we made two predictions. First, we predicted that the observed effect should be less pronounced for paper published in top-tier journals than for papers published in lower-tier journals. This is because scholars rely less on search engines for knowledge of or access to papers published in the former than those published in the latter. To test this prediction, we created a dummy variable top_j. It equals 1 if journal j was one of the top-tier journals in economics[1] and it equals 0 if

[1] The top-tier journals include *American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics, Review of Economic Studies, Economic Journal, Games and Economic Behavior, International Economic Review, Journal of Econometrics, Journal of Economic Theory, Journal of Finance,*

Table 6
Model estimation results with alternative definitions of year and dummy variables representing the effect of publishing in each month between February and December relative to that in January.

Variables	(1) Jan-Year	(2) Dec-Year	(3) Nov-Year	(4) Oct-Year	(5) Sep-Year	(6) Aug-Year	(7) Jul-Year
Feb	0.00298	−0.00161	0.0151	0.0109	0.00452	0.0159	0.0161
	(0.047)	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)
Mar	−0.0877**	−0.0813*	−0.0799*	−0.0859**	−0.0756*	−0.0744*	−0.0754*
	(0.043)	(0.043)	(0.042)	(0.043)	(0.042)	(0.042)	(0.043)
Apr	−0.0572	−0.0570	−0.0527	−0.0483	−0.0499	−0.0507	−0.0443
	(0.043)	(0.043)	(0.043)	(0.042)	(0.043)	(0.043)	(0.043)
May	−0.115**	−0.112**	−0.0983**	−0.101**	−0.107**	−0.0890**	−0.0904**
	(0.046)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Jun	−0.158***	−0.151***	−0.147***	−0.152***	−0.154***	−0.158***	−0.156***
	(0.044)	(0.043)	(0.043)	(0.043)	(0.044)	(0.043)	(0.044)
Jul	−0.194***	−0.192***	−0.188***	−0.186***	−0.184***	−0.184***	−0.0639
	(0.042)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.042)
Aug	−0.233***	−0.235***	−0.218***	−0.217***	−0.220***	−0.107**	−0.108**
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Sep	−0.276***	−0.270***	−0.266***	−0.270***	−0.137***	−0.136***	−0.136***
	(0.044)	(0.043)	(0.043)	(0.043)	(0.044)	(0.044)	(0.043)
Oct	−0.204***	−0.200***	−0.201***	−0.0690	−0.0731*	−0.0758*	−0.0652
	(0.044)	(0.044)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Nov	−0.319***	−0.319***	−0.187***	−0.185***	−0.191***	−0.185***	−0.188***
	(0.052)	(0.051)	(0.050)	(0.051)	(0.050)	(0.050)	(0.050)
Dec	−0.386***	−0.261***	−0.255***	−0.262***	−0.258***	−0.259***	−0.253***
	(0.047)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.045)
Control variables	YES	YES	YES	YES	YES	YES	YES
Journal-year fixed effects	YES	YES	YES	YES	YES	YES	YES
N	208,946	208,946	208,950	208,953	208,951	208,951	208,947
R^2	0.324	0.325	0.325	0.325	0.325	0.325	0.325

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. We compared the effect of publishing papers in January with that of publishing papers in each of the other months under alternative definitions of year. In Column 1, each year was defined normally as starting from January and ending at December. In Column 2, each year was defined as starting from December and ending at November in the next year. In Column 3, each year was defined as starting from November and ending at October in the next year. In Column 4, each year was defined as starting from October and ending at September in the next year. In Column 5, each year was defined as starting from September and ending at August in the next year. In Column 6, each year was defined as starting from August and ending at July in the next year. In Column 7, each year was defined as starting from July and ending at June in the next year. The dummy variables *Feb* to *Dec* represent the effect of publishing in each month between February and December relative to that in January, respectively. The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

otherwise. We added the top_j variable and its interaction with the yr_end_{ijt} variable into the benchmark model and ran the model again. The results are shown in Column 1, Table 7. Importantly, supporting our prediction, the interaction between the top_j and the yr_end_{ijt} variables was positive and significant, suggesting that the negative effect of publishing at year-end was significantly attenuated for papers published in top-tier journals.

Second, to the extent that the purpose of using the time window options is to narrow the returned search results, the majority of the engine users should choose to use relative short time windows in their searches. Therefore, per the current mechanism, we predicted that the citation trap should be more likely to affect papers that were published in the recent past than those that were published in the distant past. Furthermore, the moderating effect of time could also arise because papers get more citations over time, and therefore the difference in number of citations as induced by the citation trap becomes proportionally smaller in the long term. To examine the predicted effect of the length of time that has passed since the paper was published, we divided the papers in our dataset into five sub-samples according to their time of publication (between 1956 and 1970, between 1971 and 1980, between 1981 and 1990, between 1991 and 2000, and between 2001 and 2010) and we ran our benchmark model in each sub-sample. In addition, we created a variable $trend_t$ to indicate the time when the paper was published. It equals 1 for papers in the most distant sub-sample (i.e., published between 1956 and 1970) and 5 for papers in the most recent sub-sample (i.e., published between 2001 and 2010). We added the variable and its interaction with the yr_end_{ijt} variable in our benchmark model and we ran the model using the whole sample. The results are shown in Table 7. The results in Columns 2 to 6 showed that the negative year-end effect was significant in the three sub-samples with the most recent papers but became non-significant in the other two sub-samples with older papers. Further, the results in Column 7 confirmed that the interaction between the $trend_t$ and yr_end_{ijt} variables was negative and

Journal of International Economics, Journal of Labor Economics, Journal of Monetary Economics, Journal of Public Economics, Journal of the European Economic Association, Rand Journal of Economics, Review of Economics and Statistics, and *Theoretical Economics*.

Table 7
Model estimation results showing the moderating effect of journal quality and time.

Variables	(1) All	(2) 56–70	(3) 71–80	(4) 81–90	(5) 91–00	(6) 01–10	(7) All
Year-end	−0.205***	−0.0290	−0.0611	−0.157***	−0.0807**	−0.291***	0.0616
	(0.024)	(0.107)	(0.080)	(0.054)	(0.036)	(0.031)	(0.082)
Year-end × Top	0.118***						
	(0.044)						
Year-end × Trend							−0.0617***
							(0.019)
Control variables	YES	YES	YES	YES	YES	YES	YES
Journal-year fixed effects	YES	YES	YES	YES	YES	YES	YES
N	208,946	9609	15,248	33,236	60,129	90,724	208,946
R^2	0.324	0.312	0.336	0.365	0.332	0.280	0.324

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. *Year-end* is a dummy variable that equals 1 if the paper was published between October and December and equals 0 if otherwise. In Column 1, *Top* is a dummy variable that equals 1 if the paper was published in one of the top-tier journals in economics and equals 0 if otherwise. In Columns 2 to 6, we divided the papers in our dataset into five sub-samples according to their time of publication and we ran the benchmark model in each sub-sample. In Column 7, *Trend* is a variable indicating the time when the paper was published. It equals 1 for papers in the most distant sub-sample (i.e., published between 1956 and 1970) and 5 for papers in the most recent sub-sample (i.e., published between 2001 and 2010). The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

significant, indicating that the current effect was weaker for papers published in the more distant past. Together, the results provided support to our predictions and were thus consistent with the proposed mechanism.

3.4. Alternative accounts

3.4.1. Strategic submissions by high ability scholars

One alternative explanation of the current effect is that some experienced or high ability scholars might somehow be aware that papers published at year-end tend to receive fewer citations and they try to avoid publishing at year-end by strategically submitting their papers at certain times in the year (taking into account the average duration of the review process). Although we think that such strategic submission is unlikely and difficult to achieve, it is important that we rule out this possibility because it suggests that the observed difference in number of citations could be due to difference in the academic quality of the papers.

We therefore took several measures to examine the validity of this alternative explanation. First, for each paper in our dataset, we measured the ability of its author team by calculating the total number of academic papers published by all the members[2] during the last five years before the paper was published. We also measured the degree to which the author team was multidisciplinary. Specifically, we counted the number of disciplines (among the 95 disciplines as specified by *WoS*) in which an author had published at least one paper during the last five years before the paper was published. We did this for each author of the paper and we calculated the sum for the author team. We re-ran our benchmark model with these two variables added in the model (see Table 1 for the descriptive statistics of these two variables). The results are shown in Column 1, Table 8. Not surprisingly, the results showed that both ability and degree of multidiscipline of the author team positively influenced the number of citations of the papers. Importantly, however, the effect of the yr_end_{ijt} variable remained significant after author team ability and degree of multidiscipline were controlled for.

Second, we looked at papers published by an elite group of authors—the Nobel laureates in Economics (before 2019). We retrieved information for all the papers involving at least one of the laureates as a co-author and we depicted the number of papers published in each calendar month in Fig. 4. As can be seen, the number of published papers by the Nobel laureates was not substantially smaller at year-end (e.g., between October and December) than at other times in the year. Further, the results of our analysis using papers in our original dataset showed that the proportion of papers published at year-end was not significantly different between those with at least one Nobel laureate as a co-author (25%; 658/2626) and those without (26%; 53,089/206,351), $\chi^2(1) < 1$. The results therefore indicated that at least the Nobel laureates, a group of scholars with recognizably high ability and rich experience in academic publications, did not try to strategically submit their papers (or not successful in doing so) as to avoid publishing at year-end.

Finally, we investigated the prevalence rate of strategic submission by conducting an online survey among scholars. The results confirmed that strategic submission in terms of timing of publication was neither common among scholars nor was it associated with their ability or experience. Please see Appendix C for results and discussions of the survey and Appendix D for the instructions and questions used in the survey. Together, the results across different methods converged to the conclusion that strategic submission is unlikely to cause the observed effect.

[2] A pair of names that have identical surnames and first name initials are identified under one unique author.

Table 8
Model estimation results for testing of alternative accounts.

Variables	(1)	(2)	(3)
Year-end	−0.181***	−0.922***	−0.341***
	(0.021)	(0.090)	(0.037)
Author team ability	0.0136***	0.0117***	0.0117***
	(0.002)	(0.002)	(0.002)
Author team degree of multidiscipline	0.0504***	0.0294***	0.0296***
	(0.004)	(0.007)	(0.007)
Control variables	YES	YES	YES
Journal-year fixed effects	YES	YES	YES
Cragg-Donald Wald *F*		13,000	
N	208,946	69,281	69,281
R^2	0.326	0.268	0.272

Notes: The dependent variable in the models is the natural logarithm of the sum of the number of citations of the paper and the number 0.0001. Column 1 shows the results when author team ability and degree of multidiscipline were controlled for. Column 2 shows the results when the IV strategy was employed via a two-stage least square estimation. Column 3 shows the results of the OLS counterpart that corresponds to the IV estimates. As data from *Google Trends* are available after 2004, in Column 2 and Column 3 we only included data between 2004 and 2010 and the sample size of the IV analysis and its corresponding OLS counterpart was reduced to 69,281. *Year-end* is a dummy variable that equals 1 if the paper was published between October and December and equals 0 if otherwise; *Author team ability* is the total number of academic papers published by all the members in the author team of the paper during the last five years before the paper was published; *Author team degree of multidiscipline* is the sum of the number of disciplines in which each member in the author team of the paper had published at least one paper during the last five years before the paper was published. The control variables include all the seven variables described in Section 2. The standard errors in parentheses are clustered at the journal-year level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

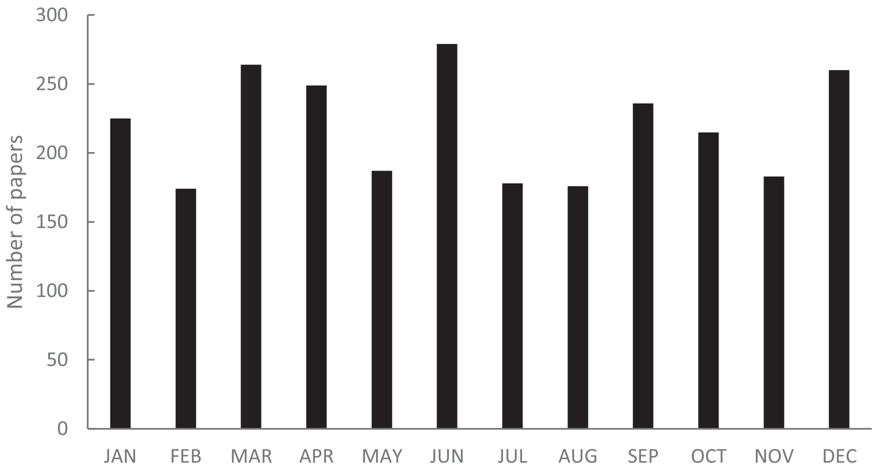

Fig. 4. Number of papers published involving at least one of the Nobel laureates in Economics (before 2019) as a co-author in each calendar month. .

3.4.2. Influences of journal editors

Another possibility is that the observed effect could arise because of possible influences of journal editors at year-end. For instance, during year-end editors may be more likely to make lenient decisions and accept papers with less rigor. Alternatively, editors might try to exploit the yearly quota for pages as imposed by publishers when approaching year-end and thereby publish more papers. These factors could possibly cause papers that are published at year-end to have fewer citations. In our benchmark model we have controlled for the effect of number of papers in the same issue of the journal and indeed we found a negative effect of this variable on the number of citations received. To further eliminate the concern that the observed effect might be due to influences of journal editors at year-end, we performed an instrumental variable (IV) analysis to tackle potential endogeneity issues arising from journal editors.

We utilized data from *Google Trends* for searches for the keyword "spring festival" (the Chinese new year) as the extra instrument (see Appendix E for a depiction of the data from *Google Trends*). The basic rationales of using the current instrument are twofold. First, the spring festival usually takes place in the early months of a year (mostly in January and February) and thus the search volumes for the keyword were negatively correlated with the yr_end_{ijt} variable, $r = -0.41$, $p < 0.001$.

Second, the spring festival is highly unlikely to have a general effect on the decisions of journal editors of the papers in our dataset.

A first stage estimation was implemented to investigate the correlation between the yr_end_{ijt} variable and all exogenous instruments. The Cragg-Donald Wald *F* statistic value was 13,000, which was greater than 10, suggesting that the relevance condition was fulfilled. The estimates of the IV analysis are presented in Column 2 of Table 8 and the results of the OLS counterpart that corresponds to the IV estimates are shown in Column 3 of Table 8. The results of the two columns showed that the coefficient of the yr_end_{ijt} variable was negative and significant with both the IV estimates and its OLS counterpart.[3]

3.4.3. The ordering of papers by the search engines

Finally, the negative effect of publishing at year-end on number of citations received could be due to the order by which papers are shown in the search results of the engines. The default setting of most search engines arranges the papers in terms of their impacts, with papers having greater numbers of citations appearing at the top. Therefore, papers published earlier in the year may initially gain greater visibility (i.e., relatively larger number of citations) than papers published later in the year, and this difference could be reinforced and enlarged by the ordering of papers by the search engines. However, our findings suggest that the current effect is unlikely to be driven by this ordering effect. First, we showed that the negative year-end effect remained robust even when we compared the effect of publishing at year-end with that of publishing in the early months in the next year (see Tables 5 and 6). Second, if it is the ordering effect that drives and reinforces the citation trap, then we should observe that the effect becomes larger as the length of time that has passed since the paper was published increases. This, however, is diametrically opposite to what we have found (see Columns 2 to 7, Table 7).

4. Conclusion

In this research we identify the citation trap: papers published at year-end receive systematically fewer citations than papers published at other months in the year. Using a large sample of more than 200,000 papers, the results of our analyses confirm that papers published between October and December get significantly fewer citations than those published in the other months in the year. To the best of our knowledge, we are among the first to investigate the relationship between the number of citations received by academic papers and their timing of publication in the year.

We argue that the current effect could potentially arise because of the time window options in online academic search engines and we provide evidence that is consistent with our proposed mechanism. Our results show that the effect is less pronounced for papers published in top-tier journals to which scholars rely much less on search engines to access. The results further show that the effect is more pronounced for papers published in the more recent years during which the use of online search engines became prevalent. In addition, we rule out several alternative explanations of the current effect. Our results suggest that the citation trap is unlikely to be driven by strategic submissions by high ability scholars, by possible influences of journal editors, or by the ordering of papers by the search engines.

The current research has important implications for academic communities. As we have mentioned, number of citations is a key determinant of many important decisions in academia because it is generally considered a fair measure of the impacts and quality of academic papers. Findings from the current research, however, suggest that the papers' timing of publication in the year could be a systematic bias that compromises the validity of citation numbers and other related indices as reliable measures of the quality of academic papers. Our research therefore reveals an overlooked factor that affects the recognition of scholars' career attainments. Further, the current mechanism suggests that the citation trap might hinder scientific advances by making papers published at year-end be less likely to be exposed to the scientific community.

A practical solution to alleviate the influences of the citation trap would be to change the pertinent setting of the time window options in online academic search engines. Specifically, the search engines should use a "recent *n* years" option such that when their users search under a time window, the engines would return papers that were published between the same date *n* years ago and the current date. For example, on July 1st, 2019, if a user searches for papers published in the "recent 5 years", the engines should return papers published on or after July 1st, 2014, rather than January 1st, 2015. By this setting, we could at least ensure that papers published at different times in the year have an equal likelihood of being exposed to the scientific community in online academic search engines.

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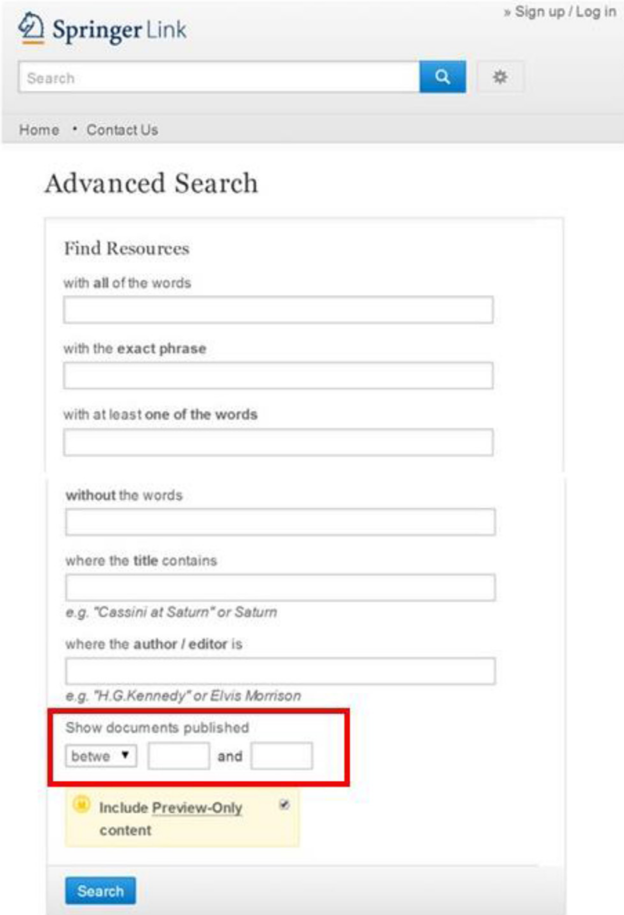
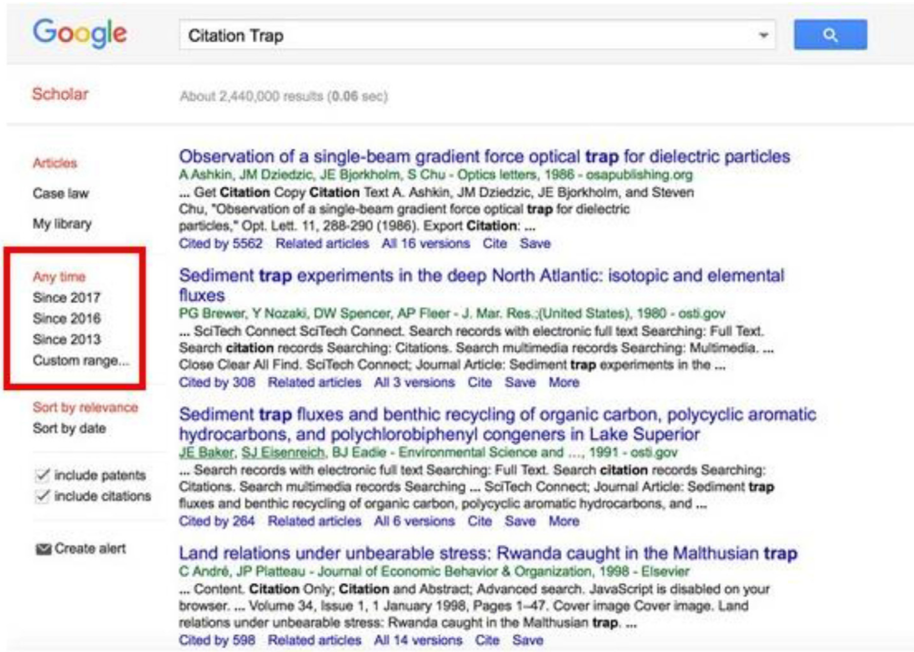
[3] Data from *Google Trends* are available after 2004. Therefore, we only included data between 2004 and 2010 and the sample size for the IV analysis and its OLS counterpart was reduced to 69,281.

Appendix A

Examples of the time window options in online academic search engines.

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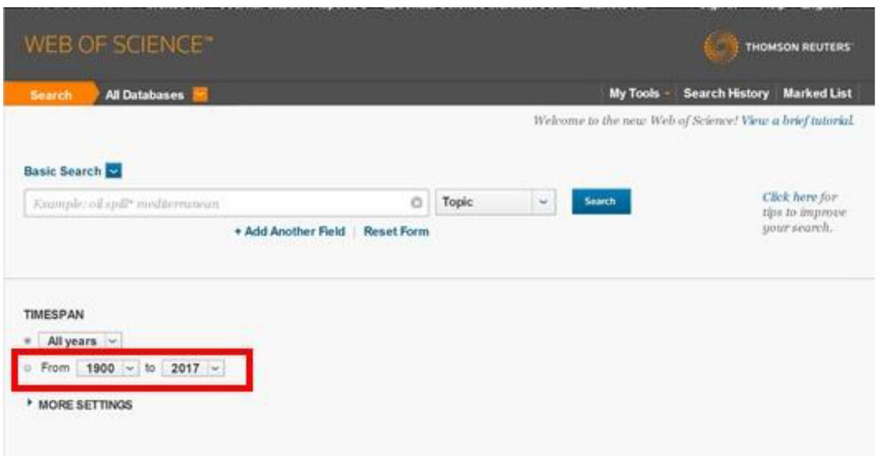
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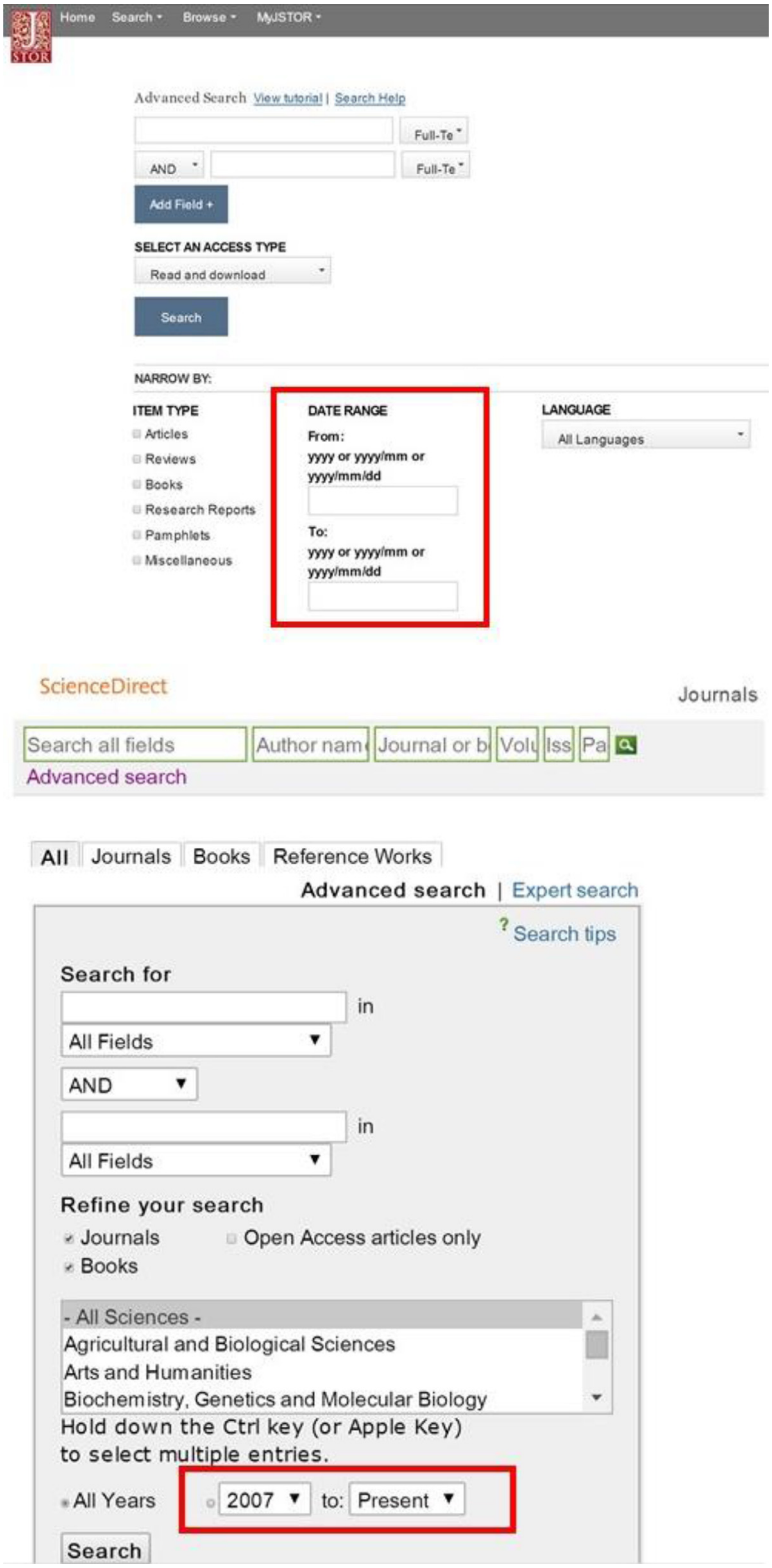
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Books
- All Sciences -
Agricultural and Biological Sciences
Arts and Humanities
Biochemistry, Genetics and Molecular Biology
Hold down the Ctrl key (or Apple Key) to select multiple entries.
All Years
2007 to: Present
Search

Table A1
Distribution of the survey respondents' location where the survey was taken.

Country	*N*
Canada	3
China	83
Colombia	1
France	2
Germany	2
Greece	1
India	1
Ireland	1
Israel	8
Italy	3
Netherland	1
Norway	2
Oman	1
Portugal	1
Singapore	1
Slovakia	2
South Korea	1
Sweden	2
Switzerland	2
Turkey	1
United Kingdom	6
United States	57

Table A2
Distribution of the survey respondents' fields of research. A survey respondent could choose more than one fields.

Field of research	*N*
Economics	82
Marketing	16
Management	20
Accounting	6
Finance	17
Psychology	52
Others	47

Table A3
The proportions of survey respondents who indicated having preferred or avoided month(s) for journal (re-)submissions in different positions and groups with different number of publications.

Position	Doctoral student	Post- doctoral research fellow	Assistant professor	Associate professor	Full professor	*p*-value from chi-square test
Proportion of respondents having preferred month(s)	4.2%	14.8%	10.6%	11.4%	16.0%	0.487
Proportion of respondents having avoided month(s)	6.3%	7.4%	10.6%	2.9%	12.0%	0.640
N	48	27	47	35	25	
Number of publications	0–2	3–5	6–10	11–20	> 20	*p*-value from chi-square test
Proportion of respondents having preferred month(s)	2.3%	8.3%	12.5%	20.6%	10.4%	0.129
Proportion of respondents having avoided month(s)	4.5%	12.5%	6.3%	8.8%	8.3%	0.813
N	44	24	32	34	48	

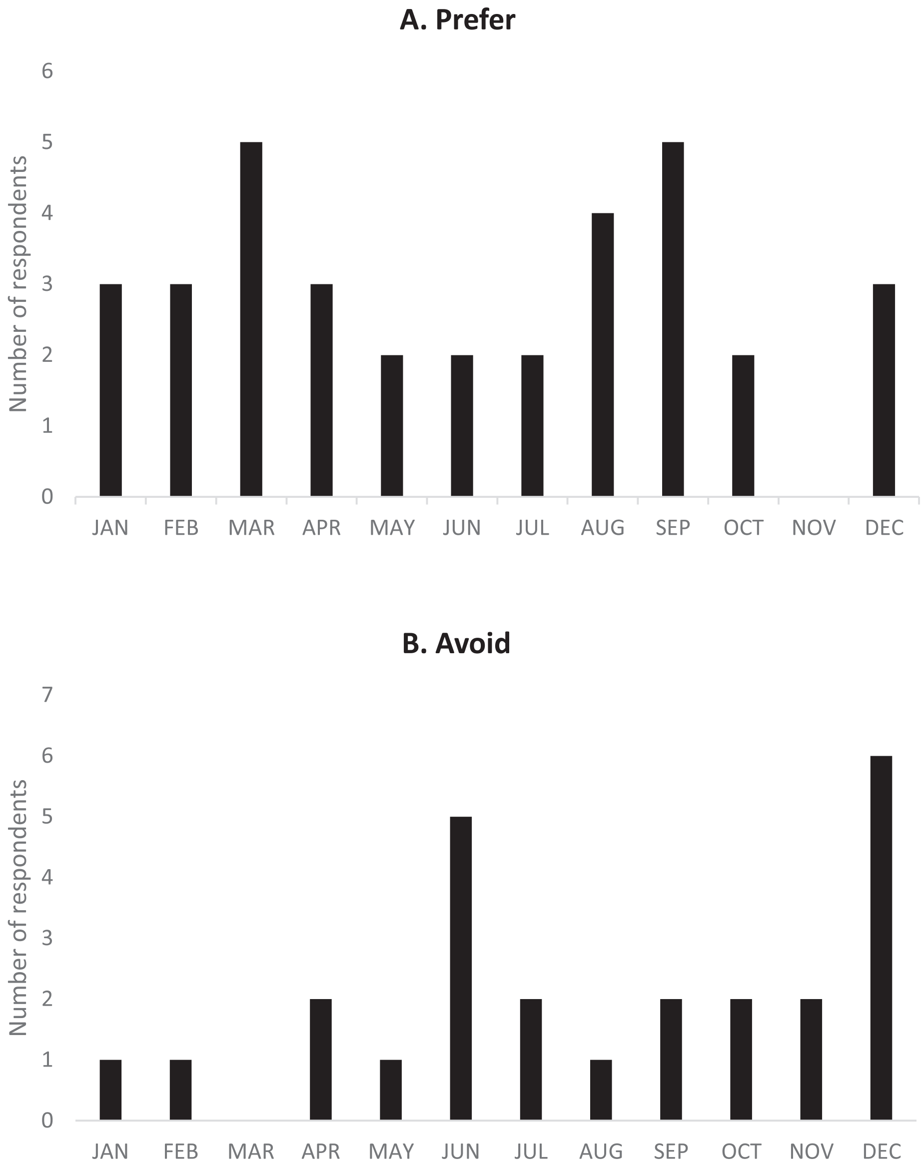
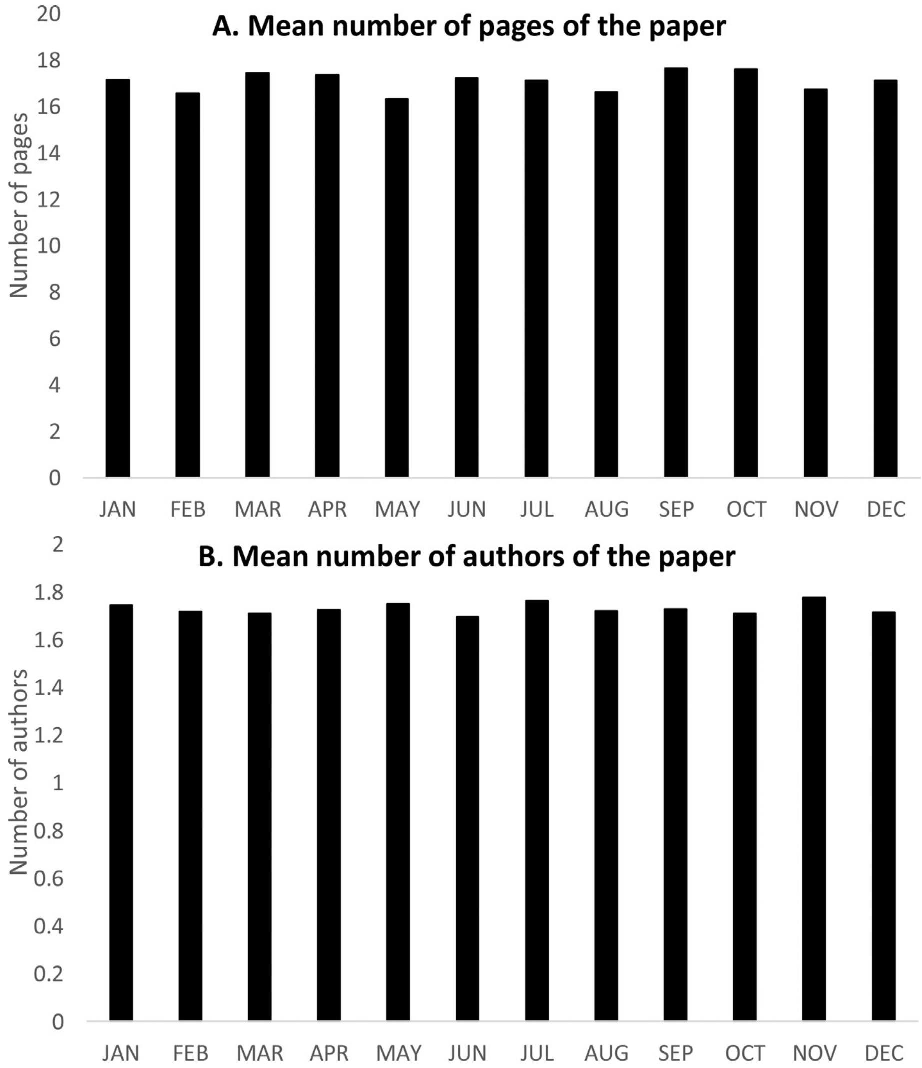
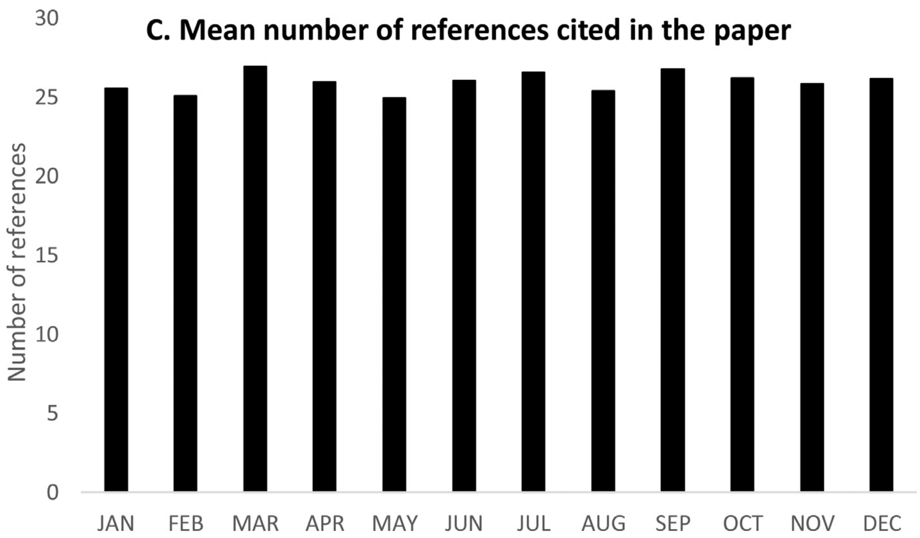


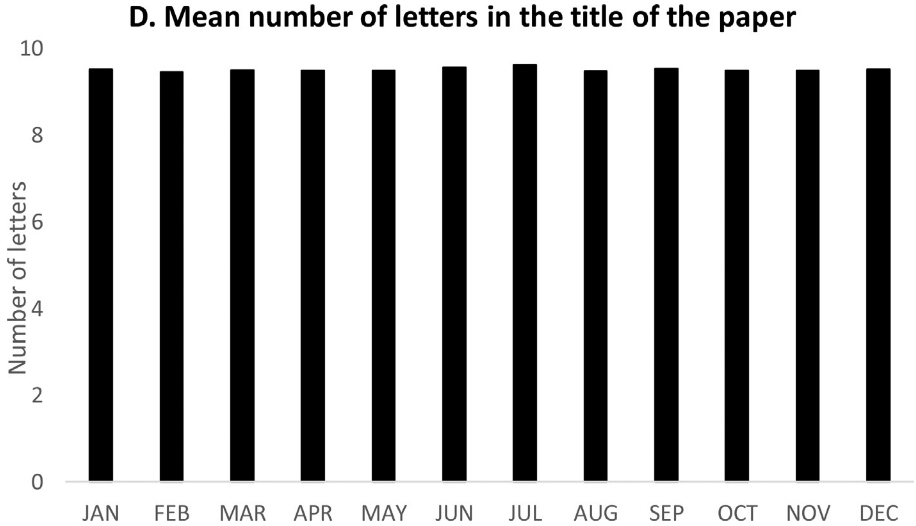
Fig. A1. Number of survey respondents who indicated that they would prefer or avoid (re-)submitting their papers to academic journals in each calendar month.

Appendix B

The mean values of number of pages of the paper, number of authors of the paper, number of references cited in the paper, and number of letters in the title of the paper for papers published in each calendar month.







Appendix C

Results and discussions of the survey

We investigated the prevalence rate of strategic submission by conducting an online survey among scholars. Invitations to take the survey were sent out in several online academic communities. These include the mailing list managed by the Society for Judgment and Decision Making, discussion groups consisting of economists from China, and members of the China Health Policy and Management Society. We had 182 completed responses. The majority of the survey respondents were from China and the United States (see Table A1). The estimated response rate of the survey is not available because we do not know the number of people in these communities. About half of our respondents were scholars in economics and related fields, and the majority of them were from fields of social sciences, including business, psychology, and others (see Table A2). Thus, the current sample was to some extent representative of authors of the papers in our dataset and also of scholars of neighboring fields.

In the survey we asked the participants to indicate whether there are certain months in the year in which they either prefer or avoid (re-)submitting their papers to academic journals. We also asked them to indicate their current position and the number of papers they had published in academic journals. Detailed instructions and questions of the survey are shown in Appendix D.

The results showed that the majority of the respondents indicated that there was not any month in the year in which they preferred (90%; 163/182) or avoided (92%; 168/182) (re-)submitting their papers. The number of respondents who indicated that they would prefer or avoid (re-)submitting their papers to academic journals in each calendar month was shown in Fig. A1. Importantly, the proportion of respondents who gave an affirmative answer to the above questions did not differ across positions or groups with different number of publications (see Table A3). Therefore, the results of our survey confirmed that strategic submission in terms of timing of publication was neither common among scholars nor was it associated with their ability or experience.

Appendix D

Instructions and questions of the survey

Dear researchers,

Thank you for taking this short survey. The survey asks a few questions about your practices in journal submissions. The information you provide in this survey will be confidential and for research use only.

When you submit/resubmit your papers to academic journals, is (are) there any month(s) of the year in which you prefer to make your submissions/resubmissions?

No, I submit/resubmit my papers as soon as they are ready
Yes, I prefer to submit/resubmit my papers in certain month(s)

(The below question was only presented to respondents who selected "yes" in the above question)
In which month(s) of the year do you prefer to make journal submissions/resubmissions?

January
February
March
April
May
June
July
August
September
October
November
December

When you submit/resubmit your papers to academic journals, is (are) there any month(s) of the year in which you avoid making your submissions/resubmissions?

No, I submit/resubmit my papers as soon as they are ready
Yes, I avoid submitting/resubmitting my papers in certain month(s)

(The below question was only presented to respondents who selected "yes" in the above question)
In which month(s) of the year do you avoid making journal submissions/resubmissions?

January
February
March
April
May
June
July
August
September
October
November
December

What is your current position?

Doctoral student
Post-doctoral research fellow
Assistant professor
Associate professor
Full professor

How many papers have you published in academic journals so far?

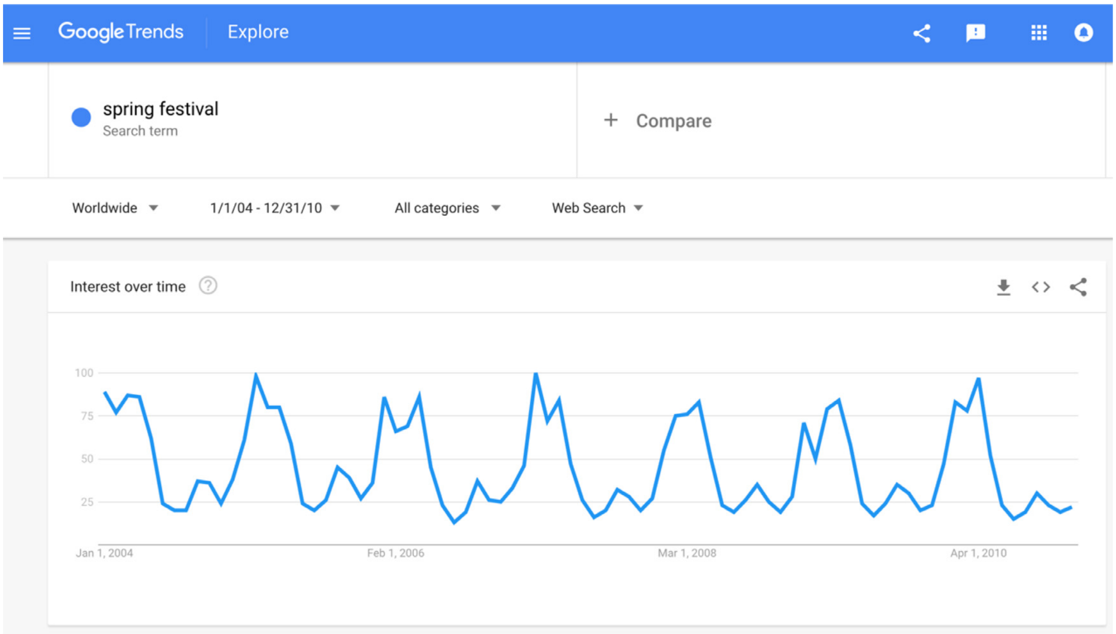
Two or below two
Three to five
Six to ten
Eleven to twenty
More than twenty

What is (are) your field(s) of research?

Economics
Marketing
Management
Accounting
Finance
Psychology
Others, please specify

Appendix E

Data from *Google Trends* for searches for the keyword "spring festival".



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