Determinants of Manuscript Submissions to Fully Open Access Journals -Elasticity to Article Processing Charges-

Determinants of Manuscript Submissions to Fully Open Access Journals: Elasticity to Article Processing Charges

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Abstract

Article processing charges that authors and research institutions pay to make articles open access are increasing. If manuscript submission is price elastic, then rising charges will cause a significant reduction in submissions, leading to decreased revenues under constant acceptance rates. Therefore, the elasticity of manuscript submission to article processing charge is one of the determinants of publishers' charges. However, several studies that investigated the determinants of article processing charges did not consider this elasticity. This study investigated the determinants of submissions, including the elasticity to article processing charge, by formulating the number of manuscript submissions to fully open access journals published by Hindawi and Elsevier in 2022. Moreover, this study formulated manuscript submissions using both list prices and charges paid to Elsevier that OpenAPC collected to compare the results. The estimation results reveal that the two publishers increase their revenues by raising the article processing charges due to the inelasticity. Moreover, these conclusions do not depend on the data set used, although the number of observations sourced from OpenAPC is small.

Keywords: article processing charge, price elasticity of submission, determinant of submission

JEL codes: L11, L86

Introduction

Open access journals allow people to read articles free of charge, removing financial barriers to acquiring academic information. However, as authors, universities, and research funders must pay article processing charges (APCs) to publish articles in APC-funded open access journals, rising APCs increase the financial burdens of authors and research institutions. Nevertheless, if manuscript submissions from authors have sensitivity to APCs, publishers cannot easily raise them, because a decrease in the number of manuscript submissions will reduce APC revenues, assuming that the acceptance rate is constant. Conversely, if manuscript submissions are insensitive to APCs, publishers could raise APCs without risking revenue reduction. Thus, the elasticity of manuscript submission to APC is a determinant of the charge. Although several studies investigated the determinants of APCs by formulating an APC equation (Asai, 2020; Budzinski et al., 2020; Schönfelder, 2020; Siler & Frenken, 2020), the elasticity of manuscript submissions to APCs has not been considered.

Several studies have investigated the factors affecting authors' journal choices through the administration of questionnaires to researchers (Jamali et al., 2014; Olusegun et al., 2015; Rowley et al., 2020; Tenopir et al., 2016). These studies found that indexing, impact factor, and fitness for journal scope were important factors in choosing a journal. Wijewickrema and Petras (2017) examined the factors affecting journal choice among open access journals using a questionnaire for researchers. However, although they questioned researchers about the choice between APC-funded and non-APC open access journals, the response to the APC level was not investigated. Olejniczak and Wilson (2020) examined the characteristics of authors who chose open access using a regression model and found that male authors and researchers who acquired federal research fundings in prestigious institutions were likely to publish open access articles in APC-funded journals. Asai (2023a) examined authors' choice between Elsevier's parent and mirror journals, suggesting that authors were more attentive to non-price factors, such as the journal citations and use of transformative agreements, when publishing an open

access article. However, Olejniczak and Wilson (2020) and Asai (2023a) also did not investigate the elasticity of manuscript submission to APC.

Khoo (2019) investigated the influence of APC changes on the number of articles published in fully open access journals and concluded that the authors were insensitive to APCs. However, the number of articles published depends on the acceptance rates; the acceptance rate of a journal varies with time. Therefore, using the number of manuscript submissions instead of the number of articles published is appropriate for investigating the APC elasticity. Although Gaston et al. (2020) analyzed the manuscript submissions to Wiley journals, the authors were Wiley's staff. As many journals neither disclose the number of manuscript submissions nor acceptance rates, it is difficult for outsiders to acquire submission data. However, Hindawi publishes data on the number of manuscript submissions for most journals on the official website; Elsevier announces the annual data for some journals. Therefore, this study examined the determinants of manuscript submissions to journals published by Hindawi and Elsevier. Although the information regarding APC elasticity of manuscript submission is essential to analyze publishers' APC setting strategies, to the best of my knowledge, this is the first study to measure the APC elasticity of manuscript submissions.

Although publishers announce their APCs on price lists, charges of leading publishers sometimes vary from the list prices, based on the agreement between publishers and research institutions to which authors belong. Budzinski et al. (2020) and Schönfelder (2020) used OpenAPC data on APCs paid for individual articles to investigate the determinants of APCs. OpenAPC, operated by Bielefeld University Library, reported the APCs paid for articles in 115 Elsevier fully open access journals in 2022 as of April 6, 2023, whereas the publisher released the APCs for 634 fully open access journals on their price list. Thus, the number of journals that OpenAPC compiled is considerably smaller than that on the publisher's APC list. Asai (2023b), who examined the characteristics of APCs paid on OpenAPC and list prices by three major publishers, found a strong positive correlation between the two prices. This study used both list prices and OpenAPC data

for Elsevier journals and compared the estimation results of submission equations.

Model and Variables

As an equation of manuscript submission has not been formulated thus far, I could not refer to variables used in previous studies. Since this study aimed to calculate the elasticity of manuscript submissions to APCs, the number of manuscript submissions to individual journals in a year was taken as a dependent variable and APC as one of the independent variables. Rowley et al. (2020) found that speed of review process, citation score, and scope of journal are important determinants of authors' selection of journal to which to submit manuscripts. Wijewickrema and Petras (2017) revealed that peer review, indexing, citation score, and review period from manuscript submission to publication are factors affecting journal choice. Therefore, in addition to APC, this study used citation score and review period as independent variables. It is essential for authors to choose a journal that fits their academic scope; therefore, authors often submit several of their manuscripts to the same journal. Moreover, Olejniczak and Wilson (2020) found that the characteristics of authors differed between open and non-open access articles. These findings suggest that authors who have previously published open access articles may choose open access again; the opposite is also true for those who have not. Therefore, this study assumed that the submissions of open access manuscripts to a journal in a year relates to the cumulative number of authors of open access articles since the journal inception. Based on this assumption, the total number of open access article authors from the journal inception to 2021 was added as an independent variable. The submission equations for Hindawi and Elsevier journals were formulated as follows:

$$Submit = \mathrm{f}\,(APC, Author, SNIP, Review, Academic\ disciplines) \quad (1)$$

The variable *APC* represents APC applicable in 2022 for the two publishers. Elsevier

announces APCs in USD, EUR, and GBP on the official website, whereas APCs for Hindawi journals are announced in USD only. Therefore, this study used APCs measured in USD. For Elsevier journals, this study used both APC list prices announced on the official website and charges paid that are available from OpenAPC. By contrast, for Hindawi journals, analysis using only list prices was conducted, because OpenAPC indexed few Hindawi journals. The variable *Author* denotes the total number of authors of open access articles from the journal inception year to 2021. This study chose Source-Normalized Impact per Paper (SNIP) among several citation indexes, such as CiteScore and impact factor. It is normalized to correct for differences in citation practices between academic fields. This study covered journals across various academic fields, therefore SNIP for 2021 was used as an independent variable. This is the latest citation score available in 2022 when submitting a manuscript. The variable *Review* is defined as the date from manuscript submission to the final editorial decision. Scopus reports the academic disciplines in accordance with the All Science Journal Classification (ASJC). This study used ASJC-based disciplines for Hindawi and Elsevier journals. Journals other than those for medicine and engineering, including computer science, were classified as "others," which accounted for 18% and 13% of Elsevier and Hindawi journals, respectively. The variable *Medicine* is set to 1 if the journal is in the field of medicine, and 0 otherwise. Similarly, the variable *Engineering* is set to 1 if the journal is in the field of engineering, and 0 otherwise. As journals in "others" are the base group when estimating submission equation, the variable *Others* disappeares in the equation. The Hindawi data for the variables *Submit*, *APC*, *Author*, and *Review* were available from Hindawi journal websites. The Elsevier data for *Submit* and *Review* were sourced from Elsevier's website for journal metrics (https://journalinsights.elsevier.com/journals/0960-9776), whereas Elsevier APCs were sourced from Elsevier price list on the official website and OpenAPC. Other data were available from Scopus.

Data

Hindawi

This study targeted 149 Hindawi journals with data for variable selection. Table 1 presents the summary statistics for the variables, excluding the binary variables representing academic disciplines, for Hindawi journals. The large differences in the mean and median of *Submit* indicate that journal size differs among the 149 fully open access journals. The skewness values for *Submit* and *Author* are 3.34 and 4.53, respectively, indicating that the distribution has a long right tail. By contrast, the variation in *APC* is relatively small, judging from the coefficient of variation. The mean and median of *SNIP* are approximately 1.0. The mean of *Review* (91) indicates that decision on manuscripts submitted to Hindawi are made in three months on average.

(Insert Table 1 here)

Table 2 reports the correlation coefficients for Hindawi journals, except for binary variables. The correlation coefficient between *Submit* and *Author* (0.914) is positive and large. The correlation between *Submit* and *APC* (0.548) is positive at the 1% significance level. By contrast, the correlation between *APC* and *SNIP* is –0.054. The null hypothesis that the value is equal to zero is not rejected at the 10% significance level. The small correlation coefficient is consistent with Asai (2021), who investigated the APCs for Hindawi journals. The negative relationship between *Submit* and *Review* (–0.381) indicates that journals with shorter review periods attract more manuscript submissions.

(Insert Table 2 here)

Elsevier

Table 3 shows the summary statistics for the variables for Elsevier journals, except for binary variables. This study compiled 68 Elsevier journals with the number of manuscript submissions and review period. The number of journals sourced from OpenAPC decreased to 20. Thus, the number of journals covered by OpenAPC is considerably small. OpenAPC collected data of individual articles. When OpenAPC collected multiple articles in a journal, this study calculated the mean of APCs paid to a journal and defined

it as the variable *APC*, because I investigated the manuscript submissions to individual journals. As OpenAPC provides APC paid in EUR only, APC in Table 3 was measured in EUR, whereas APC list prices were measured in USD to compare with Hindawi list prices. The mean and median of *APC* for the 68 Elsevier journals (1778 and 1820 USD) are higher than those for Hindawi Journals (1412 and 1025 USD), indicating that Elsevier sets higher APCs than Hindawi. The correlation between Elsevier APC list prices measured in USD and EUR is 1.0000, indicating that list prices with different currencies have an identical trend. The correlation between APC list prices in EUR and APCs paid in EUR on OpenAPC is 0.8721. The high correlation coefficient between the APC list prices and charges paid indicates that they have almost the same trend, consistent with the results of Asai (2023b). Although the number of manuscript submissions (*Submit*) varies across Elsevier journals, the coefficients of variation (126% and 114%) are smaller than that for Hindawi Journals in Table 1 (186%). The mean and median of variable *SNIP* for Elsevier are approximately 1.4, which are higher than those for Hindawi.

(Insert Table 3 here)

Table 4 reports the correlation coefficients for Elsevier journals, except for binary variables. The correlation between *Submit* and *SNIP* for Elsevier journals (0.310) is positive at the 5% significance level, whereas that for Hindawi journals (0.036) is close to zero. The relationship between *APC* and *SNIP* for Elsevier journals (0.246) is positive at the 5% significance level, which is consistent with previous APC studies for leading publishers (Asai, 2020; Björk & Solomon, 2015; Pinfield et al., 2017; Schönfelder, 2020). The correlation coefficient between *Review* and *Submit* (–0.185) is negative, but the null hypothesis that the value is equal to zero is not rejected at the 10% significance level, whereas the correlation for Hindawi journals (–0.381) is negative at the 1% significance level. This result indicates that review speed does not significantly influence the number of manuscript submissions to Elsevier journals. Thus, the relationships of *Submit* with *APC*, *SNIP*, and *Review* differ between Hindawi and Elsevier.

(Insert Table 4 here)

Results

The submission equations for the two publishers were estimated using ordinary least squares. The variables, except for the binary variables denoting academic disciplines, are natural logarithms. Table 5 reports the estimation results for 149 Hindawi journals. The coefficients of *APC* in both models are negative, and the absolute values are less than one. The findings indicate that the elasticity of manuscript submission to APC is inelastic. Therefore, Hindawi can increase APC revenues by raising APCs. The coefficients of *Author* are positive at the 1% significance level, and the values in both models are close to one. The findings reveal that journals with many open access article authors thus far received many manuscript submissions in 2022. The coefficient of *SNIP* in Model 1 is positive at the 1% significance level, whereas the null hypothesis that the coefficient in Model 2 is equal to zero is not rejected at the 10% significance level. By contrast, the coefficients of *Review* in both models are negative at the 1% significance level, indicating that journals with shorter review periods attract more manuscript submissions.

(Insert Table 5 here)

Table 6 reports the estimation results for Elsevier journals. Although the fitness of the submission equations is not good due to small samples, the conclusions from the estimations are unchanged. The absolute values of *APC* coefficients for three models are less than one, indicating inelastic submissions to APCs. The coefficients of *Author* in three estimations are close to one, which aligns with Hindawi results in Table 5. The coefficients of *SNIP* are positive, indicating that authors are likely to submit their manuscripts to journals with high citation scores. For two out of three models, the null hypothesis that the coefficients of *Review* are equal to zero is not rejected at the 10% significance level. It appears that the review period is not an important factor affecting journal choice to submit manuscripts to Elsevier. Thus, the effects of *Review* on the number of submissions differ between Hindawi and Elsevier.

(Insert Table 6 here)

Discussion and Conclusion

If manuscript submissions to individual journals were sensitive to APC changes, publishers would hesitate to raise APCs due to the risk of revenue reduction. However, this study reveals that manuscript submissions are insensitive to APCs, suggesting that publishers are able to easily raise APCs. It would be worthwhile to consider why APC would be price inelastic. Several studies found that most authors of open access articles in major journals received grants from research funders, governments, and universities (Cantrell & Swanson, 2020; Halevi & Walsh, 2021; Willinsky & Rusk, 2019). Authors who receive sufficient grants may not need to pay attention to APC levels. Previous studies on the determinants of journal choice revealed that journal prestige and impact factors were important factors in choosing a journal (Jamali et al., 2014; Olusegun et al., 2015; Tenopir et al., 2016). Moreover, empirical studies concluded that leading publishers set higher APCs for journals with higher citation scores (Asai, 2020; Budzinski et al., 2020; Schönfelder, 2020; Siler & Frenken, 2020). Considering the results of these studies, some authors who do not face economic difficulty by acquiring grants may aim to submit their manuscripts to prestigious journals even if the APCs are high. Although grants are generally essential for accomplishing research, the grant system might contribute to setting high APCs.

Journals with more authors attract more submissions in a year. These findings suggest that fully open access journals with a certain number of authors will grow, whereas other journals will find it difficult to expand their business. Although many fully open access journals have been launched since the 2000s (Crawford, 2021), some journals have already ceased publication owing to few submissions and other reasons (Shortliffe & Peleg, 2020). Although the open access journal market as a whole has expanded, competition for acquiring manuscripts is fierce among journals. This study found that authors' response to citation score and review period differ among the two publishers. Authors submitting their manuscripts to Elsevier attach more importance to high citation scores rather than a shorter review period. By contrast, authors who submit manuscripts

to Hindawi seem to prioritize shorter review periods rather than higher citation scores. Thus, authors' criteria for choosing a journal differ between publishers. The findings suggest that journals without high citation scores survive by demonstrating their advantages, such as a speedy review process.

This study investigated the determinants of manuscript submissions using list prices and OpenAPC data. The two APC data have a close relationship judging from the high correlation coefficients, and the conclusions from the estimations using the two data are unchanged. When individual research institutions have signed contracts for APCs with publishers other than transformative agreements, the conditions of the contracts are unavailable to third parties. By contrast, a few consortiums and universities that signed transformative agreements disclose their agreements on the EASC website. For example, a transformative agreement between Elsevier and the University of California stated that APCs applied to members were set by discounting list prices. A strongly positive correlation between list prices and OpenAPC data suggests that some APCs in the transformative agreements are set based on the list prices.

However, the target publishers in this study were limited to Hindawi and Elsevier owing to the limited availability of other publishers' data, such as the number of submissions or acceptance rates. Moreover, the number of journals compiled from OpenAPC was considerably reduced. Therefore, the journals compiled in this study are not representative of overall open access journals and the reliability of the results from such small data should be considered. The data, such as the number of submissions or acceptance rates, and review period are useful to authors as rationale for choosing between journals. Thus, other publishers must be encouraged to provide these data so that authors can select appropriate journals. Further information disclosure would also enable us to examine the elasticity of manuscript submissions to APCs precisely. Moreover, this study used the number of manuscript submissions in 2022 only. In future, I will use pooling data for the next few years to analyze the determinants of submissions with larger on observations.

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Table 1. Summary of statistics for Hindawi journals (N = 149)

	Submit	*APC*	*Author*	*SNIP*	*Review*
Mean	922	1412	3350	1.008	91
Median	314	1025	1100	0.933	89
SD	1717	644	7132	0.451	30
CV (%)	186	46	213	45	33

SD: standard deviation; CV: coefficient of variation

Table 2. Correlation coefficients for Hindawi journals (N = 149)

	Submit	*APC*	*Author*	*SNIP*	*Review*
Submit	1.000				
APC	0.548***	1.000			
Author	0.914***	0.521***	1.000		
SNIP	0.036	–0.054	0.061	1.000	
Review	–0.381***	–0.341***	–0.264***	0.093	1.000

***denotes 1% significance level

Table 3. Summary of statistics for Elsevier journals

	List price (N = 68)					OpenAPC (N = 20)				
	Submit	APC_{USD}	*Author*	*SNIP*	*Review*	*Submit*	APC_{EUR}	*Author*	*SNIP*	*Review*
Mean	990	1778	1671	1.424	69	1066	1799	1861	1.396	62
Median	455	1820	1249	1.402	54	484	1860	1008	1.405	54
SD	1247	818	1482	0.640	46	1217	810	1529	0.578	37
CV (%)	126	46	89	45	67	114	45	82	41	60

SD: standard deviation; CV: coefficient of variation

Table 4. Correlation coefficients for Elsevier journals (N = 68)

	Submit	*APC*	*Author*	*SNIP*	*Review*
Submit	1.000				
APC	–0.026	1.000			
Author	0.718***	0.049	1.000		
SNIP	0.310**	0.246**	0.011	1.000	
Review	–0.185	–0.134	–0.223*	0.288**	1.000

***, *denote 1% and 10% significance levels, respectively

Table 5. Estimation results for Hindawi journals

Variables	Model 1	Model 2
Constant	2.4837 (0.6852)***	2.2097 (0.6810)***
APC	–0.0973 (0.0838)	–0.2194 (0.0890)**
Author	0.9194 (0.0305)***	0.9928 (0.0331)***
SNIP	0.1654 (0.0381)***	0.0068 (0.0637)
Review	–0.5590 (0.0828)***	–0.3546 (0.0916)***
Medicine		–0.4154 (0.0935)***
Engineering		–0.1482 (0.0956)
Adjusted R^2	0.9313	0.9329

***, *denotes 1% and 10% significance levels

Standard errors are presented in parentheses.

Table 6. Estimation results for Elsevier

Variables	List price (USD)		OpenAPC (EUR)
Constant	4.0256 (2.0542)*	2.0492 (2.1663)	2.4998 (4.1572)
APC	–0.4345 (0.2126)**	–0.0921 (0.2478)	–0.2101 (0.3584)
Author	0.8958 (0.1223)***	0.9051 (0.1185)***	0.9360 (0.3157)***
SNIP	0.4373 (0.1790)**	0.2306 (0.1928)	0.3757 (0.3803)*
Review	–0.2523 (0.1593)	–0.3695 (0.1640)**	–0.3592 (0.3411)
Medicine		–0.2974 (0.2880)	
Engineering		0.5561 (0.3544)	
Adjusted R^2	0.4912	0.5227	0.2504

***, **, *denote 1%, 5%, and 10% significance levels, respectively

Standard errors are presented in parentheses.