DE GRUYTER
OPEN

Research Paper

The Roles of Female Involvement and Risk Aversion in Open Access Publishing Patterns in Vietnamese Social Sciences and Humanities

Minh-Hoang Nguyen, Huyen Thanh Thanh Nguyen, Manh-Toan Ho, Tam-Tri Le, Quan-Hoang Vuong†

Centre for Interdisciplinary Social Research, Phenikaa University, Yen Nghia Ward, Ha Dong District, Hanoi 100803, Vietnam

Citation: Minh-Hoang Nguyen, Huyen Thanh Thanh Nguyen, Manh-Toan Ho, Tam-Tri Le, Quan-Hoang Vuong (2022). The roles of female involvement and risk aversion in Open Access Publishing Patterns in Vietnamese Social Sciences And Humanities. *Journal of Data and Information Science*, 7(1), 76–96. https://doi.org/10.2478/jdis-2022-0001

Received: Jul. 22, 2021
Revised: Oct. 12, 2021
Accepted: Oct. 13, 2021

Abstract

Purpose: The open-access (OA) publishing model can help improve researchers' outreach, thanks to its accessibility and visibility to the public. Therefore, the presentation of female researchers can benefit from the OA publishing model. Despite that, little is known about how gender affects OA practices. Thus, the current study explores the effects of female involvement and risk aversion on OA publishing patterns among Vietnamese social sciences and humanities.

Design/methodology/approach: The study employed Bayesian Mindsponge Framework (BMF) on a dataset of 3,122 Vietnamese social sciences and humanities (SS&H) publications during 2008–2019. The Mindsponge mechanism was specifically used to construct theoretical models, while Bayesian inference was utilized for fitting models.

Findings: The result showed a positive association between female participation and OA publishing probability. However, the positive effect of female involvement on OA publishing probability was negated by the high ratio of female researchers in a publication. OA status was negatively associated with the JIF of the journal in which the publication was published, but the relationship was moderated by the involvement of a female researcher(s). The findings suggested that Vietnamese female researchers might be more likely to publish under the OA model in journals with high JIF for avoiding the risk of public criticism.

Research limitations: The study could only provide evidence on the association between female involvement and OA publishing probability. However, whether to publish under OA terms is often determined by the first or corresponding authors, but not necessarily gender-based.

Practical implications: Systematically coordinated actions are suggested to better support women and promote the OA movement in Vietnam.

JDIS
Journal of Data and Information Science

† Correspondence author: Quan-Hoang Vuong (E-mail: hoang.vuongquan@phenikaa-uni.edu.vn).

Originality/value: The findings show the OA publishing patterns of female researchers in Vietnamese SS&H.

Keywords Open science; Gender inequality; Risk-aversion; Vietnam; Bayesian analysis

1 Introduction with Brief Review

The new wave of female scientists in the last few decades (Ramirez & Wotipka, 2001; Q.-H. Vuong, 2019), especially their increasing enrollment in higher education (National Science Foundation, 2014), has weakened the stereotype that science is a male's club (Fralick et al., 2009; Hill, Corbett, & St Rose, 2010; Milford & Tippett, 2013). Even in a developing country like Vietnam, the growing participation of female scientists has also been witnessed over the past decades (Quy, 2021; Tran, 2020; Q.-H. Vuong, 2019). Despite that, the gender gap in science is still significant. Previous studies have investigated the gender difference favoring males in various aspects such as participation rate in scientific publishing (Bravo-Hermsdorff et al., 2019; Ho et al., 2020; Huang et al., 2020), scholarly output (Lubienski, Miller, & Saclarides, 2017), participation in disciplines (Bayer & Rouse, 2016), reputation (Sá et al., 2020), etc.

The causes and consequences of gender inequality in science have gained lots of academic attention. Bayer and Rouse (2016) argue that a huge gender participation gap in the economics-discipline career in the United States results from a systematic implicit bias and institutional practices and is found to have negative impacts on women's academic careers. Leslie, Cimpian, Meyer, and Freeland (2015) find an underrepresentation of women in fields with practitioners believing that raw and innate talents are needed to succeed. Women are stereotyped not to possess such requirements. Besides systematic bias and institutional practices, other factors, such as family affairs (e.g. having and taking care of children) (Ginther & Kahn, 2004), workplace sexual harassment (Fathima et al., 2020), are also hindrances for women who want to advance their career. The dropout rate of women is consistently higher than that of men throughout all career stages (Jadidi et al., 2017).

The current study employed Bayesian Mindsponge Framework (BMF), with the Mindsponge mechanism used to construct theoretical models and Bayesian inference utilized for fitting those models (M.-H. Nguyen et al., 2021). According to the Mindsponge mechanism—an information processing framework—individuals' decisions are driven by their cost-benefit judgments (Q.-H. Vuong, 2016; Q.-H. Vuong & Napier, 2015), so they will tend to accept and select the option with the least perceived cost or greatest perceived merits. Based on this way of cost-benefit thinking, we will explain how the current study's research questions were proposed to examine the impacts of female involvement and risk-aversion on OA publishing patterns in Vietnamese social sciences and humanities.

1.1 Open Access as a potential solution to gender difference

Given the obstacles mentioned above, research has found several strategies to help female scientists to thrive in academia. Fathima et al. (2020) find the three most common ones used by female scientists across 55 countries: self-confidence, dedication, and hard work. Also, as publications and citations are vital for academic promotion, funding proposals, and various aspects of scholars' lives, understanding how female scientists get their works published is crucial to develop and implement the right policies for women in science. One of the potential methods to improve female researchers' visibility and impact is open access (OA) publishing.

Despite its short history in science, open access has received support from major international institutions to improve accessibility to scientific knowledge, researchers, and the public. OA publishing is advocated for its ability to disseminate scientific knowledge and improve research transparency (Chan, Kirsop, & Subbiah, 2006; Shuva & Taisir, 2016). Many powerful institutions join to promote open access, including cOAliationS (Plan S), Bill and Melinda Gates Foundation, Wellcome Trust, and so on. Academic publishers seem not to miss the trend and even accelerate it. Recently, there was notable news that the publisher of *Nature*, one of the most prestigious academic publishers, has agreed to an unprecedented open access deal that permits researchers to publish in the journal and other Nature-branded titles under OA terms (Van Noorden, 2020). John Wiley & Sons, Inc. has acquired Hindawi, an OA publisher, with a total expenditure of $298 million, to show its commitment to the open access movement (Hoboken, 2021).

One benefit of OA publishing is that it makes the published research highly accessible among academia and the public. By removing paywalls, OA publishing is far more within reach than non-OA publishing (e.g. subscription-based publishing) (Gadd & Troll Covey, 2019). Piwowar et al. (2018) provide evidence about the visibility of OA publications. They find 47% of publications read by Unpaywall users are OA, mostly Bronze OA, despite OA publications are estimated to only account for 28% of scholarly literature. Moreover, as OA publications are free to spread, scientists will gain more recognition for their intellectual work (Davis et al., 2008). OA publications are also more likely to have a citation advantage than non-OA publications (Norris, Oppenheim, & Rowland, 2008; Sotudeh, Ghasempour, & Yaghtin, 2015), though this assumption remains controversial. Gaulé and Maystre (2011) find a significantly higher number of citations in OA publications than non-OA ones in the Proceedings of the National Academy of Sciences from three prolific journals (Nature, Cell, and Science). Having yet found a significant causal relationship between citation and open access, they attribute the self-selection of higher quality articles into OA, thus helping OA works gain more citations.

Apart from OA publishing in an official journal, some authors are determined to self-archive their works on academic social networks, such as ResearchGate and Academia.edu. Self-archiving on these networks might seem similar to green OA. Nonetheless, such practices are controversial since some content is illegally posted (Jamali, 2017). Moreover, ResearchGate and Academia.edu are independent for-profit companies, so their ethics and sustainability are still contentious (Fortney & Gonder, 2015). Two scholarly publishing giants, Elsevier and American Chemical Society (ACS), even filed a lawsuit in Germany against ResearchGate for violating the paywalled publications' copyright. In 2013, Elsevier also sent Academia.edu 2800 takedown notices but did not take the company to court (Chawla, 2017).

Because of the advantages of OA publishing, scientists from minority groups or with less reputation might perceive OA publishing as an effective strategy to gain more recognition in the scientific community in which readers are more favorable with well-known researchers' publications. Given the pressure that females face in academia, OA publishing, which offers greater perceived visibility and impact, could be a critical factor when female scientists consider a place to publish. For investigating this assumption, we proposed the following research question:

RQ1: Were publications with female researchers' participation more likely to be published under OA terms than those without female researchers' participation?

1.2 Barriers to open-access publishing

However, even though OA publishing might help female authors to reach a wider readership, it is also costly. In a study analyzing the experience with OA publishing of UK-based researchers, male scientists are found to be more experienced than female ones (Zhu, 2017). The cost of publishing OA might make it expensive for female researchers, who often have fewer resources than male researchers. Due to modest salary and funding (Manh, 2015; Shuva & Taisir, 2016), the article processing charge (APC) is a huge barrier that constrains researchers to publish OA. Q. H. Vuong et al (2021) find that gender inequality might have created more barriers towards OA publishing among Vietnamese female scientists. As collaboration is usually viewed as a useful cost-sharing model in Vietnam (T.-T. Vuong et al., 2020) and publications with all-female researchers or solo female researchers are least likely to be published under OA terms (H. T. T. Nguyen et al., 2021), we suspect that female researchers tend to collaborate with male colleagues to lessen OA's cost. Therefore, the second research question was proposed:

RQ2: Were female-involved publications with a higher percentage of female researchers less likely to be published under OA terms?

Although OA publishing provides various benefits to multiple parties, the incomplete OA evaluation, funding, and regulation models create opportunities for many inappropriate practices. Researchers in emerging countries tend to capitalize on low-quality predatory or junk OA journals for increasing their scientific output (Bayry, 2013). These inappropriate practices lead to negative views towards researchers publishing OA (Hien, 2020; Quyen, 2020), which, in turn, adversely affects their scientific career and increases the perceived risk of publishing OA.

Doing research is a highly competitive job; thus, not only is scientific productivity crucial, but the scientific quality is also emphasized for acquiring funding and maintaining public trust (Edwards & Roy, 2016). A researcher's ability to publish in journals with high impact factors is a common criterion to evaluate their competitiveness (Chapman et al., 2019). Despite the longstanding criticism against the use of journal impact factor (JIF) as the quality judgment of scientific papers or scientists (Alberts, 2013), this index is still frequently used in the evaluation process for grants, promotion, and even academic success (van Dijk, Manor, & Carey, 2014). In their paper, van Dijk et al. (2014) find that the impact factor of the journals in which the articles were published is a more significant predictor of an author's academic success than the number of citations divided by the impact factor.

Suppose a researcher(s) simultaneously acknowledges the advantages of the OA publishing model and the risk of public criticism on the quality of OA publishing. In that case, he/she might try to find an OA publishing approach that can prove the publications' quality to minimize the risk. This tendency might be more likely to happen among risk-averse people because their perceived demand for mitigating risk increases. Given that females are more risk-averse than males (Charness & Gneezy, 2012; Eckel & Grossman, 2008), we expect female researchers to consider journals with high JIF as a critical criterion publishing OA for reducing the risk of negative criticism from colleagues and the public. We proposed the following research questions to clarify our assumptions:

RQ3: Were OA publications more likely to be published in lower JIF than non-OA publications?
RQ4: Were OA publications that have female involvement more likely to be published in higher impact factor journals?

The above research questions are examined by analyzing 3,122 Vietnamese researchers' humanities and social sciences publications and employing the Bayesian analysis method aided by the Markov Chain Monte Carlo (MCMC) technique.

2 Method and material

2.1 Material

This paper extracted data from the Social Sciences & Humanities Peer Awards (SSHPA) database (https://sshpa.com/). The database is the result of a national project that aims to record the international scientific output of Vietnamese scientists in SS&H since 2008. It is important to note that this database covers only publications by Vietnamese researchers or about Vietnam. A publication must meet at least one of the following criteria to be recorded in the SSHPA database: (i) the author has an affiliation in Vietnam; (ii) Its topic concerns Vietnam. Further information related to the data collection, verification, and recording procedure is explained by Q.-H. Vuong et al. (2018). The dataset of 3,122 publications employed in the current study was extracted on October 24, 2020, with information related to authors (gender and nationality), title, DOI, journal, year of publication, and publisher and stored in an excel worksheet.

Since the SSHPA does not include JIF and OA status information, JIF was extracted from the 2019 Journal Citation Reports provided by Clarivate Analytics. As for OA status, Unpaywall's Simple Query Tool was employed (link: https://unpaywall.org/products/simple-query-toolle-query-tool). Some publications had no DOI and could not be searched using Unpaywall's Simple Query Tool, so manual checks were conducted by examining the journal's websites and eligible repositories that assign OA status. The procedure strictly conformed with Unpaywall's instructions and the definitions of Piwowar et al. (2018), as follow:

- Gold Access: A publication that is published in a fully open access source.
- Green Access: A publication that is not accessible on the journal homepage, but its self-archived version is available in a legitimate, open repository.
- Hybrid Access: A publication that is published in a subscription-based source but free to read under an OA license.
- Bronze Access: A publication that is open only for reading but not open for redistribution or reuse.
- Closed Access: A publication that is published in a subscription-based source and accessible only with a fee.

Data collectors conducted a cross-check after the data regarding OA status were recorded to ensure the data quality and accuracy.

2.2 Method

Bayesian analysis was employed in this research due to several reasons. First of all, the Bayesian approach, which treats all properties probabilistically (including

uncertainty or unknown parameters) (Contreras, Brown, & Ruest, 2018), might provide a better estimation for an exploratory study than using a frequentist approach. Moreover, future research could update the current study's findings when additional data are available (Wagenmakers et al., 2018) because the simulated posterior distribution of Bayesian analysis is computed based on the prior and the likelihood simultaneously. Bayesian analysis provides considerable flexibility in fitting models with various measurement scales by incorporating the Markov Chain Monte Carlo (MCMC) simulation technique (Dunson, 2001). This advantage enables the current study to examine models with high complexity constructed using the Mindsponge mechanism as a theoretical foundation. To elaborate, those models all incorporate non-linear relationships (e.g. interaction variables).

In this study, two models are constructed using four variables to examine the four hypotheses proposed above. It should be noted that we did not include green OA status for the *OpenAccess* variable because the authors' self-archiving on open repository might be free of charge. Descriptions of four variables are shown in Table 1. Model 1 was simulated to investigate Research Questions 1 and 2, whereas Model 2 was fitted to examine Research Questions 3 and 4. In Model 2, we did not include *FemaleRatio* but only *Female* and its interaction with *OpenAccess* because it would cause a cofounding effect between *Female* and *FemaleRatio*.

$$OpenAccess \sim \alpha + Female + Female * FemaleRatio \quad (1)$$

$$JIF \sim \alpha + OpenAccess + Female + OpenAccess * Female \quad (2)$$

Both models were constructed following the law of parsimony, which asserts the avoidance of complex models without necessity. We simulated them using the bayesvl R package and following the protocol suggested by Q.-H. Vuong et al. (2020) due to its ease of use and ability to generate valuable graphics (Q.-H. Vuong et al., 2020). As the current study is explorative in nature, we set all coefficients' priors as uninformative. All models are simulated using 5,000 iterations, 2,000 warm-up iterations, four cores, and four Markov chains.

Interpreting Bayesian inference's results is dissimilar from those using conventional frequentist methods. Whereas in conventional methods, researchers make a dichotomous judgment on the associations between predictor and outcome variables based on *p*-value, those associations analyzed using Bayesian inference are visually judged based on the parameters' probability distributions. The probability distribution is a normal distribution with the mean value indicating the value that has the highest possibility to happen.

Nevertheless, before assessing the parameters' probability distributions, it is essential to assess whether the simulated results meet the Markov chain central limit

theorem, which assumes that the simulated samples must be independent or not autocorrelated. In other words, the Markov chains have to be convergent. Effective sample size (n_eff) and Gelman values (Rhat) are two fundamental statistics for convergence assessment. The two Markov chains' convergence signals are the n_eff larger than 1,000 and the Rhat value equal 1. The convergence can be visually evaluated using the trace plot. If the Markov chains shown in the trace plot fluctuate around a central equilibrium, the Markov chain central limit theorem is held.

Table 1. Variable description.

Variable	Meaning	Type of variable	Value
OpenAccess	whether the publication is OA (OA status is Gold Access, Hybrid Access, Bronze Access) or not (the status is Closed Access)	binary	OA = 1 Non-OA = 0
Female	whether there is female involvement (or at least one author is female)	binary	Having at least one female author = 1 Having no female author = 0
FemaleRatio	The ratio of female authors in the publication	ratio	The ratio ranging from 0 to 1
JIF2019 [a]	Impact factor of the journal in which the publication is published	ratio	N/A

[a] Journals that have not obtained any impact factor were given 0 JIF.

3 Result

3.1 Descriptive analysis

From 2008 to 2019, we observed 3,122 publications recorded in the SSHPA database, of which 1,202 documents were OA. Among 1,202 publications, more than 60% had the involvement of female researchers (768 documents). Figure 1 illustrates the annual OA publications involving female researchers during the 2008–2019 period. It can be seen that the annual number of OA papers rose rapidly from 2012 (26 documents) to 2019 (210 documents). In the last decade, the proliferation of OA publications was mostly driven by Gold Access publications, but not much change happened to other OA types, especially Hybrid and Bronze Access. Since 2015 the number of Gold Access papers has changed radically and passed the number of Green Access papers. The highest annual number of Gold Access publications was recorded in 2019, which accounted for more than 86% of the total OA publications in 2019. These statistics hint at the fact that OA publishing, especially the Gold Access mode, was recently becoming more prevalent among female researchers.

Among the top ten journals with the highest JIF, female-involved publications tend to be published in journals with higher JIF than publications with no female involvement (see Table 2). During the 2008–2019 period, three journals with the

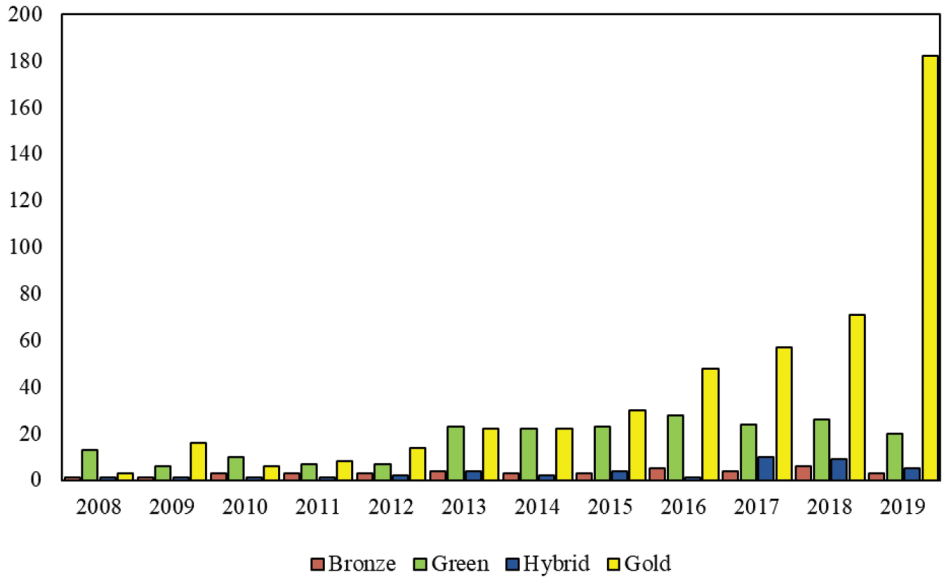

Figure 1. The annual OA publications with the participation of female authors.

highest JIF in which Vietnamese social scientists published OA were *Nature*, *Nature Human Behaviour*, and *PLOS Medicine*. Two out of them published research that had the participation of female researcher(s). Besides, the JIF of most journals in which publications were published without female researchers' involvement was lower than those with female researchers' participation. *Scientific Data* was the only journal within the top ten published two publications without female researcher's involvement. In contrast, there were three journals in the top ten publishing two or more publications that had female researchers' contribution: *Bulletin of the World Health Organization* (7 publications), *PLOS Medicine* (2 publications), and *Journal of International Business Studies* (2 publications). Even though the descriptive statistics hint that female researchers tend to publish under OA terms in high impact factor journals, this assumption still needs to be tested using inferential statistics.

3.2 Bayesian analysis

In this sub-section, we present the simulated results of Models 1 and 2 and provide interpretation for their meaning.

3.2.1 Model 1: Gender effects on OA publishing

The first model aims to test the effects of female involvement and its interaction with the female ratio against OA publishing probability. The model's simulated results are expected to answer Research Questions 1 and 2. Before interpreting the

Table 2. Top ten journals with the highest JIF in which Vietnamese social scientists published OA.

No.	Female researcher's involvement			No female researcher's involvement		
	Journal	JIF	Publication	Journal	JIF	Publication
1	*Nature*	42.779	1	*Nature Human Behaviour*	12.282	1
2	*PLOS Medicine*	10.500	2	*Bulletin of the World Health Organization*	6.96	1
3	*Journal of International Business Studies*	9.158	2	*American Sociological Review*	6.372	1
4	*Global Environmental Change*	8.086	1	*Journal of Financial Economics*	5.731	1
5	*Journal of the Academy of Marketing Science*	7.959	1	*Scientific Data*	5.541	2
6	*British Journal of Psychiatry*	7.850	1	*Journal of Marketing*	5.266	1
7	*International Journal of Epidemiology*	7.707	1	*Food Research International*	4.972	1
8	*Journal of Cleaner Production*	7.246	1	*Food Quality and Preference*	4.842	1
9	*Bulletin of the World Health Organization*	6.96	7	*Cities*	4.802	1
10	*Journal of Abnormal Psychology*	6.484	1	*Value in Health*	4.748	1

simulated posterior results, it is vital to check the model's Markov chains' convergence. Visually, the trace plots show the stationarity and adequate mixing of chains, confirming a good convergence of coefficients' Markov chains (see Figure 2). In addition to the trace plots, coefficients' effective sample size (*n_eff*) and the Gelman shrink factor (*Rhat*) are other diagnostics of the Markov chains' convergence. The effective sample size was all over 1,000, and the Gelman shrink factor of the current model's coefficients equals 1 (see Table 3), suggesting a healthy convergence of the Markov chains.

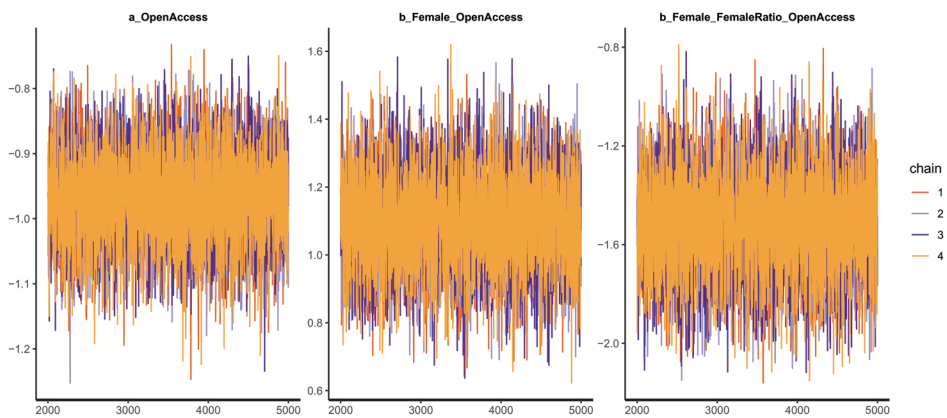

Figure 2. Model 1's trace plots of coefficients.

Table 3. Simulated posterior coefficients of Model 1.

	Mean	SD	n_eff	Rhat
Constant	-0.98	0.07	5,250	1
Female	1.10	0.13	4,320	1
*Female*FemaleRatio*	-1.52	0.19	5,180	1

Table 3 shows that the presence of a female researcher in a publication was positively associated with the decision to publish open access ($\mu_{Female\_OpenAccess} = 1.10$ and $\sigma_{Female\_OpenAccess} = 0.13$). Specifically, the *Female*'s posterior lies entirely on the x-axis's positive side (see the cyan histogram in Figure 3), indicating a robust positive relationship between the female researcher's involvement and OA publishing probability. Meanwhile, the interaction between *Female* and *FemaleRatio* posed an opposite effect on the OA publishing probability. The interaction's posterior, with $\mu_{Female*FemaleRatio\_OpenAccess} = -1.52$ and $\sigma_{Female*FemaleRatio\_OpenAccess} = 0.19$, suggests that the presence of a higher female ratio in a publication negates the impact of female

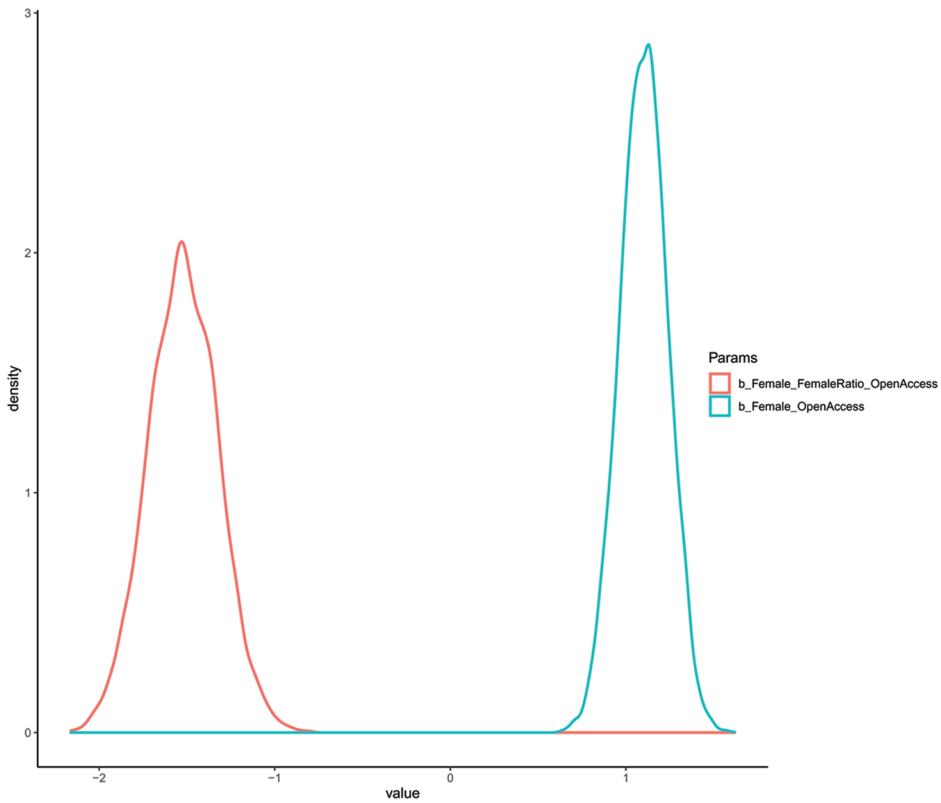

Figure 3. Coefficients' posterior distributions of Model 1.

researcher's participation on OA publishing probability. The posterior distribution is wholly located on the *x*-axis's negative side, indicating a reliable negative association between the interaction and the OA publishing likelihood.

3.2.2 Model 2: Gender and OA effects on JIF

Were OA publications more likely to be published in lower JIF than non-OA publications? Were OA publications that have female involvement more likely to be published in higher impact factor journals? Model 2's simulated results might answer these two questions. The second model examines the effects of open access status, female researcher's involvement, and their interaction on the journal's impact factor in which the publication was published.

Similar to Model 1, diagnostic statistics were checked to ensure the good convergence of Markov chains. All coefficients' effective sample size (n_eff) surpasses 1,000, and the Gelman shrink factor (Rhat) equals 1 (see Table 4), signaling robust correlations between the independent variables and the dependent variable. The stationarity and adequate mixing of chains displayed in the trace plots also confirm the Markov chains' convergence (see Figure 4).

Table 4. Simulated posterior coefficients of Model 2.

	Mean	SD	n_eff	Rhat
a_JIF	1.43	0.06	5,165	1
Constant	-0.78	0.11	5,227	1
Female	0.02	0.08	5,024	1
*OpenAccess*Female*	0.98	0.14	5,170	1

We found a negative association between the OA status and JIF, providing a "yes" answer to Research Question 3 ($\mu_{OpenAccess\_JIF2019} = –0.78$ and $\sigma_{OpenAccess\_JIF2019} = 0.11$). At the same time, the negative association between JIF2019 and the interaction of *OpenAccess* and *Female* was also observed, which underscores the impact of female researcher's participation on increasing the impact factor of journals in which the publications were published OA ($\mu_{OpenAccess*Female\_JIF2019} = 0.98$ and $\sigma_{OpenAccess*Female\_JIF2019} = 0.14$). Figure 5 illustrates the simulated posterior distribution of *OpenAccess* (x-axis) and its interaction with *Female* (y-axis) on a two-dimensional graph. The *OpenAccess*'s simulated posterior lies entirely on the axis's negative side, whereas *OpenAccess*Female*'s simulated posterior is distributed entirely on its positive side. These distributions highlight the robustness of *OpenAccess*'s and its interaction's impacts on the *JIF2019*.

Notably, the female researcher's participation was found to have no clear effect on the JIF2019. Its standard deviation was much higher than its mean, implying the high variation among simulated posteriors. Together with the above associations,

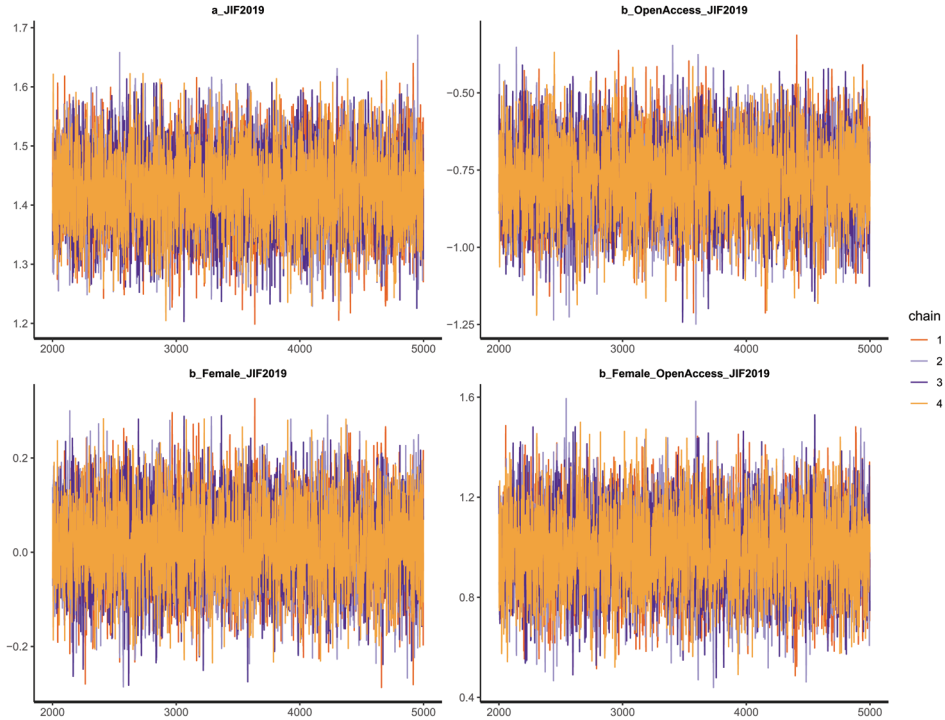

Figure 4. Model 2's trace plots of coefficients.

this finding suggests that female-involved publications were more likely to be published under OA terms in high impact factor journals than other scenarios, such as no female involvement – OA, female involvement – no OA, or no female involvement – no OA.

4 Discussion

This paper, applying the Bayesian analysis, presents two models investigating the impact of gender on OA publishing. This section discusses our results with existing literature and provides some recommendations for policymaking and further research on the topic of gender and OA.

We found that a female researcher's presence in a publication led to a higher probability that the paper was published under OA terms. Possibly, Vietnamese female researchers might perceive OA publishing as a potential method to disseminate their works to a more significant number of audiences, and thus, improve their recognition, representation, and visibility in academia (Chan, Kirsop, & Arunachalam, 2005; Davis et al., 2008; Piwowar et al., 2018).

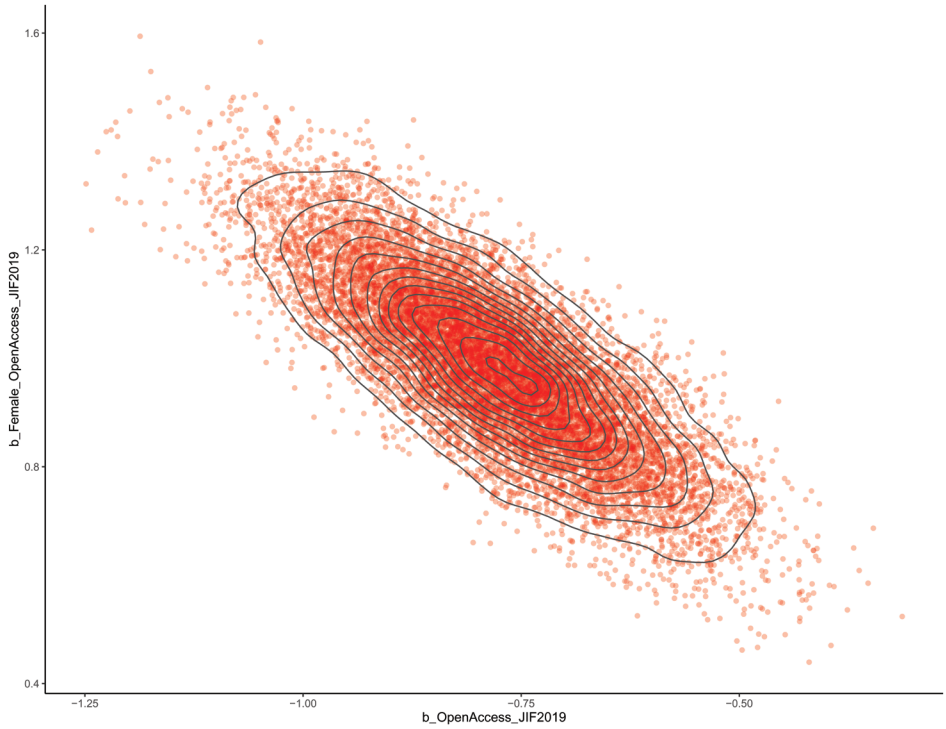

Figure 5. Coefficients' posterior distributions of Model 2 on a two-dimensional graph.

The effect of female researcher's involvement on the OA probability was lessened when considering female researchers' participation ratio in a publication. The current result was supported by the finding of Zhu (2017). Specifically, Zhu (2017) suggested the reason for female researchers' low OA experience might be induced by gender inequality in academia, so that female researchers received less knowledge of funding applications and understanding of OA policies. Thus, female researchers' resource constraints in Vietnam can be one possible explanation for our findings (Q. H. Vuong et al., 2021).

Even though the government and public institutions have taken considerable efforts to raise the Vietnamese scientific community's standards, the policy and regulation embracement of the OA movement in Vietnam is still relatively low. In particular, OA publishing in Vietnam is not explicitly funded by any institution and governmental agency. For instance, the National Foundation for Science and Technology Development (NAFOSTED) did not mention Open Access in their official decisions (NAFOSTED, 2020). Thus, the APC is usually paid by the authors or eats up a major proportion of the funding. For that reason, although Vietnamese

female researchers are maybe willing to publish OA, they might have to find support from collaborations with male colleagues to fund the APC (H. T. T. Nguyen et al., 2021) or rely on a limited number of APC-free OA journals.

Due to the establishment of the National Foundation for Science and Technology Development (NAFOSTED), which uses international publishing as part of its requirements and outcome assessment systems, and the Circular 08/2017/TT-BGDĐT in 2017, which requires doctoral candidates to publish at least two papers in international peer-reviewed journals or proceedings, with one paper published in a WoS/Scopus journal (T. T. H. Nguyen et al., 2021; Vietnam Ministry of Education and Training, 2017), the pressure of international publishing in Vietnam has been increasing considerably. This pressure might have pushed Vietnamese authors to employ OA publishing as a way to increase scientific quantity rather than quality and even become the victims of "predatory journals" (Bayry, 2013; Demir, 2018). Beall's list, one of the most frequently referred lists for predatory journals, considers "rapid publication is promised" as one of the salient features of a potential predatory journal (https://beallslist.net/how-to-recognize-predatory-journals/). For that reason, any OA journals with rapid processing speed (e.g. MDPI journals, etc.) were ascribed as "predatory journals" by the public (Hien, 2020; Quyen, 2020), which increases the perceived risk (or perceived cost) of OA publishing.

Indeed, our result shows that OA publications are negatively associated with JIF. This somehow explains why the public's prejudice towards the quality of OA articles, and the OA publishing model in general, exists. But why are female researchers willing to publish OA despite the risk of being prejudiced by the public? Another finding in our second model could explain this contradiction. It was found that although the female researcher's involvement did not have any effect on the JIF, its interaction with OA publishing results in a robustly strong positive impact on the JIF. In other words, OA publications that had female researchers' involvement were more likely to be published in journals with higher JIF than any other scenarios (e.g. all-male – OA publishing, all-male – no OA publishing, or female involvement – no OA publishing).

The findings suggested that female researchers could publish in high-impact factor OA journals to offset the public's prejudices that OA works are low quality. Nonetheless, everything has its own price tag. OA journals with high JIF often charge a higher processing fee (Budzinski et al., 2020), which leads to a higher financial burden for female researchers. Eventually, female researchers' OA publishing probability might be more subject to co-authors' economic status. This assumption is consistent with Model 1's result that a higher female participation ratio negated the OA publishing probability of female-involved publications and the

findings of H. T. T. Nguyen et al. (2021) that mixed-gender authorship structures have the highest possibility to publish under OA terms.

Our demonstrated results could benefit future policymaking and regulation of OA publishing in Vietnam and other emerging countries with similar contexts. Based on the findings, we recommend that systematically coordinated approaches are required to promote OA publishing in Vietnam. In detail, gender inequality in academia should be addressed and reduced so that female researchers can be allocated more resources. Even though the public's criticism of the OA publishing might remind researchers of scientific quality and integrity, the prolonged public's negative views towards the OA publishing might result in public distrust that will bear more cost and hinder future OA movement (Edwards & Roy, 2016; Q.-H. Vuong, 2018). Therefore, the government's regulation and institutions' provision of an OA journals evaluation system is encouraged to prevent and mitigate unethical behaviors.

5 Conclusion

The current study was one of the first analyses of female researchers' publishing patterns in Vietnam's social sciences and humanities during the 2008–2019 period. Our paper showed a positive association between female participation and OA publishing probability. However, the positive effect of female involvement on OA publishing probability was negated by the female researchers' percentage in a publication. In addition, OA status was negatively associated with the JIF in which the publication was published. Still, when female involvement and OA status concurrently occurred, the JIF was predicted to be higher. These results hint that Vietnamese female researchers were likely to publish under OA publishing terms, but their likelihood seems to be hampered by the resource constraint. Given the negative public perceptions of OA publishing, female researchers tend to publish under OA terms in high-impact factor journals to offset the risk. These findings suggest that coordinated actions are needed to mitigate the gender gap and promote Vietnam's OA movement.

The limitations of the current study are presented here for transparency (Q.-H. Vuong, 2020). The study could only provide evidence on the association between female involvement and OA publishing probability, but the first or corresponding authors often determine whether to publish under OA terms. Thus, stronger evidence is needed to confirm the assumptions that female researchers want to pursue OA publishing due to its benefits and determine to publish OA in high JIF journals to minimize the perceived risk of criticism. Moreover, Vietnamese social sciences and humanities are still in the early development stage, during which several strong

research teams greatly influence the publishing patterns (Q.-H. Vuong & Tran, 2019). As a result, our findings might be skewed towards some specific teams' patterns but not necessarily the general practice of a whole community. In this paper, we used the JIF as a proxy to indicate certain aspects of quality. Despite the controversy, JIF is still a useful metric for a quick quality judgment of scientific papers or scientists (van Dijk et al., 2014). Still, we need more evidence regarding the quality of publications to validate results and postulations shown in the current study. Finally, JIF might be inflatable over the years, so the results related to JIF should be used with more caution.

Acknowledgement

This work is supported by National Foundation for Science and Technology Development 502.01–2018.19.

Author contributions

Minh Hoang Nguyen (hoang.nguyenminh@phenikaa-uni.edu.vn): Conceptualization (Equal), Data curation (Equal), Methodology (Lead), Software (Lead), Visualization (Lead), Writing-original draft (Equal), Writing-review & editing (Equal); Huyen Thanh Thanh Nguyen (huyen.nguyenthanhthanh@phenikaa-uni.edu.vn): Conceptualization (Equal), Formal analysis (Equal), Writing-original draft (Equal); Manh-Toan Ho (toan.homanh@phenikaa-uni.edu.vn): Resources (Equal), Writing-review & editing (Equal); Tam-Tri Le (tri.letam@phenikaa-uni.edu.vn): Validation (Equal), Writing-review & editing (Equal); Quan-Hoang Vuong (hoang.vuongquan@phenikaa-uni.edu.vn): Resources (Lead), Validation (Lead), Writing-review & editing (Lead).

References

Alberts, B. (2013). Impact Factor Distortions. Science, 340(6134), 787. doi:10.1126/science.1240319

Bayer, A., & Rouse, C.E. (2016). Diversity in the Economics Profession: A New Attack on an Old Problem. Journal of Economic Perspectives, 30(4), 221–242. doi:10.1257/jep.30.4.221

Bayry, J. (2013). Open-access boom in developing nations. Nature, 497(7447), 40–40.

Bravo-Hermsdorff, G., Felso, V., Ray, E., Gunderson, L.M., Helander, M.E., Maria, J., & Niv, Y. (2019). Gender and collaboration patterns in a temporal scientific authorship network. Applied Network Science, 4(1), 112. doi:10.1007/s41109-019-0214-4

Budzinski, O., Grebel, T., Wolling, J., & Zhang, X. (2020). Drivers of article processing charges in open access. Scientometrics, 124(3), 2185–2206. doi:10.1007/s11192-020-03578-3

Chan, L., Kirsop, B., & Arunachalam, S. (2005). Open access archiving: the fast track to building research capacity in developing countries. Retrieved from https://www.scidev.net/global/features/open-access-archiving-the-fast-track-to-building-r/

Chan, L., Kirsop, B., & Subbiah, A. (2006). Open Access Archiving: The Fast Track to Building Research Capacity in Developing Countries. esocialsciences.com, Working Papers.

Chapman, C.A., Bicca-Marques, J.C., Calvignac-Spencer, S., Fan, P., Fashing, P.J., Gogarten, J., … Chr. Stenseth, N. (2019). Games academics play and their consequences: how authorship, h-index and journal impact factors are shaping the future of academia. Proceedings of the Royal Society B: Biological Sciences, 286(1916), 20192047. doi:10.1098/rspb.2019.2047

Charness, G., & Gneezy, U. (2012). Strong evidence for gender differences in risk taking. Journal of Economic Behavior and Organization, 83(1), 50–58. doi:10.1016/j.jebo.2011.06.007

Chawla, D.S. (2017). Publishers take academic networking site to court. Retrieved from https://www.sciencemag.org/news/2017/10/publishers-take-researchgate-court-alleging-massive-copyright-infringement

Contreras, L.F., Brown, E.T., & Ruest, M. (2018). Bayesian data analysis to quantify the uncertainty of intact rock strength. Journal of Rock Mechanics Geotechnical Engineering, 10(1), 11–31. doi:10.1016/j.jrmge.2017.07.008

Davis, P.M., Lewenstein, B.V., Simon, D.H., Booth, J.G., & Connolly, M.J.L. (2008). Open access publishing, article downloads, and citations: randomised controlled trial. BMJ, 337, a568. doi:10.1136/bmj.a568

Demir, S.B. (2018). Predatory journals: Who publishes in them and why? Journal of Informetrics, 12(4), 1296–1311. doi:10.1016/j.joi.2018.10.008

Dunson, D.B. (2001). Commentary: Practical Advantages of Bayesian Analysis of Epidemiologic Data. American Journal of Epidemiology, 153(12), 1222–1226. doi:10.1093/aje/153.12.1222

Eckel, C.C., & Grossman, P.J. (2008). Men, women and risk aversion: Experimental evidence. Handbook of Experimental Economics Results, 1, 1061–1073. doi:10.1016/S1574-0722(07)00113-8

Edwards, M.A., & Roy, S. (2016). Academic Research in the 21st Century: Maintaining Scientific Integrity in a Climate of Perverse Incentives and Hypercompetition. Environmental Engineering Science, 34(1), 51–61. doi:10.1089/ees.2016.0223

Fathima, F.N., Awor, P., Yen, Y.-C., Gnanaselvam, N.A., & Zakham, F. (2020). Challenges and coping strategies faced by female scientists—A multicentric cross sectional study. PLOS ONE, 15(9), e0238635. doi:10.1371/journal.pone.0238635

Fortney, K., & Gonder, J. (2015). A social networking site is not an open access repository. Retrieved from https://osc.universityofcalifornia.edu/2015/12/a-social-networking-site-is-not-an-open-access-repository/

Fralick, B., Kearn, J., Thompson, S., & Lyons, J. (2009). How middle schoolers draw engineers and scientists. Journal of Science Education Technology, 18(1), 60–73. doi:10.1007/s10956-008-9133-3

Gadd, E., & Troll Covey, D. (2019). What does 'green' open access mean? Tracking twelve years of changes to journal publisher self-archiving policies. Journal of Librarianship Information Science, 51(1), 106–122. doi:10.1177/0961000616657406

Gaulé, P., & Maystre, N. (2011). Getting cited: Does open access help? Research Policy, 40(10), 1332–1338. doi:https://doi.org/10.1016/j.respol.2011.05.025

Ginther, D.K., & Kahn, S. (2004). Women in Economics: Moving Up or Falling Off the Academic Career Ladder? Journal of Economic Perspectives. 18(3), 193–214. doi:10.1257/0895330042162386

Hien, Q. (2020). Thành tích ảo trong nghiên cứu khoa học: Chất lượng bài báo quốc tế đến đâu? [Fake scientific records: What is the quality of international articles?]. Retrieved from https://thanhnien.vn/giao-duc/thanh-tich-ao-trong-nghien-cuu-khoa-hoc-chat-luong-bai-bao-quoc-te-den-dau-1270656.html

Hill, C., Corbett, C., & St Rose, A. (2010). Why so few? Women in science, technology, engineering, and mathematics: ERIC.

Ho, M.-T., Vuong, T.-T., Pham, T.-H., Luong, A.-P., Nguyen, T.-N., & Vuong, Q.-H. (2020). The Internal Capability of Vietnam Social Sciences and Humanities: A Perspective from the 2008–2019 Dataset. Publications, 8(2). doi:10.3390/publications8020032

Hoboken, N.J. (2021). Wiley Announces the Acquisition of Hindawi. BusinessWire. Retrieved from https://www.businesswire.com/news/home/20210105005201/en/Wiley-Announces-the-Acquisition-of-Hindawi

Huang, J., Gates, A.J., Sinatra, R., & Barabási, A.-L. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. Proceedings of the National Academy of Sciences, 117(9), 4609. doi:10.1073/pnas.1914221117

Jadidi, M., Karimi, F., Lietz, H., & Wagner, C. (2017). Gender disparities in science? Dropout, productivity, collaborations and success of male and female computer scientists. Advances in Complex Systems, 21(03n04), 1750011. doi:10.1142/S0219525917500114

Jamali, H.R. (2017). Copyright compliance and infringement in ResearchGate full-text journal articles. Scientometrics, 112(1), 241–254. doi:10.1007/s11192-017-2291-4

Leslie, S.-J., Cimpian, A., Meyer, M., & Freeland, E. (2015). Expectations of brilliance underlie gender distributions across academic disciplines. Science, 347(6219), 262. doi:10.1126/science.1261375

Lubienski, S.T., Miller, E.K., & Saclarides, E.S. (2017). Sex Differences in Doctoral Student Publication Rates. Educational Researcher, 47(1), 76–81. doi:10.3102/0013189X17738746

Manh, H.D. (2015). Scientific publications in Vietnam as seen from Scopus during 1996–2013. Scientometrics, 105(1), 83–95. doi:10.1007/s11192-015-1655-x

Milford, T.M., & Tippett, C.D.J.J. o. S.T.E. (2013). Preservice teachers' images of scientists: Do prior science experiences make a difference? Journal of Science Teacher Education, 24(4), 745–762. doi:10.1007/s10972-012-9304-1.

NAFOSTED. (2020). Chương trình nghiên cứu cơ bản trong lĩnh vực Khoa Học Xã Hội và Nhân Văn. Retrieved from https://nafosted.gov.vn/chuong-trinh-tai-tro/nghien-cuu-co-ban/

Nguyen, H.T.T., Nguyen, M.-H., Le, T.-T., Ho, M.-T., & Vuong, Q.-H. (2021). Open Access Publishing Probabilities Based on Gender and Authorship Structures in Vietnam. Publications, 9(4), 45. doi:10.3390/publications9040045

Nguyen, M.-H., Le, T.-T., Ho, M.-T., Nguyen, H.T.T., & Vuong, Q.-H. (2021). Alice in Suicideland: Exploring the Suicidal Ideation Mechanism through the Sense of Connectedness and Help-Seeking Behaviors. International Journal of Environmental Research and Public Health, 18(7), 3681. doi:10.3390/ijerph18073681

Nguyen, T.T.H., Pham, H.H., Vuong, Q.H., Cao, Q.T., Dinh, V.H., & Nguyen, D.D. (2021). The adoption of international publishing within Vietnamese academia from 1986 to 2020: A review. Learned Publishing, 34(2), 175–186. doi:10.1002/leap.1340

Norris, M., Oppenheim, C., & Rowland, F. (2008). The citation advantage of open-access articles. Journal of the American Society for Information Science and Technology, 59(12), 1963–1972. doi:10.1002/asi.20898

Piwowar, H., Priem, J., Larivière, V., Alperin, J.P., Matthias, L., Norlander, B., … Haustein, S. (2018). The state of OA: a large-scale analysis of the prevalence and impact of Open Access articles. PeerJ, 6, e4375–e4375. doi:10.7717/peerj.4375

Quy, H. (2021). Những nhà khoa học nữ đầu tiên của nước VN độc lập, họ là ai? Retrieved from https://thanhnien.vn/giao-duc/nhung-nha-khoa-hoc-nu-dau-tien-cua-viet-nam-co-cong-bo-quoc-te-la-ai-1351293.html

Quyen, M. (2020). 'Thị trường ngầm' mua bán bài báo khoa học: Công bố trên tạp chí quốc tế 'dỏm' ['Underground market' of scientific articles: Publishing in international 'predatory journal']. Retrieved from https://thanhnien.vn/giao-duc/thi-truong-ngam-mua-ban-bai-bao-khoa-hoc-cong-bo-tren-tap-chi-quoc-te-dom-1265819.html

Ramirez, F.O., & Wotipka, C.M. (2001). Slowly but Surely? The Global Expansion of Women's Participation in Science and Engineering Fields of Study, 1972-92. Sociology of Education, 74(3), 231–251. doi:10.2307/2673276

Sá, C., Cowley, S., Martinez, M., Kachynska, N., & Sabzalieva, E. (2020). Gender gaps in research productivity and recognition among elite scientists in the U.S., Canada, and South Africa. PLOS ONE, 15(10), e0240903. doi:10.1371/journal.pone.0240903

Science and engineering indicators 2014 (Report No. NSB 14 – 01). (2014). Arlington, VA: National Science Foundation

Shuva, N.Z., & Taisir, R.J.I.j. (2016). Faculty members' perceptions and use of open access journals: Bangladesh perspective. IFLA Journal, 42(1), 36–48. doi:10.1177/0340035216628879

Sotudeh, H., Ghasempour, Z., & Yaghtin, M. (2015). The citation advantage of author-pays model: the case of Springer and Elsevier OA journals. Scientometrics, 104(2), 581–608. doi:10.1007/s11192-015-1607-5

Tran, N. (2020). Ba nữ khoa học người Việt lọt top 100 nhà nghiên cứu tiêu biểu châu Á. Retrieved from https://zingnews.vn/ba-nu-khoa-hoc-nguoi-viet-lot-top-100-nha-nghien-cuu-tieu-bieu-chau-a-post1096600.html

van Dijk, D., Manor, O., & Carey, L.B. (2014). Publication metrics and success on the academic job market. Current Biology, 24(11), R516–R517. doi:10.1016/j.cub.2014.04.039

Van Noorden, R. (2020). Nature journals announce first open-access agreement. Nature. Retrieved from https://www.nature.com/articles/d41586-020-02959-1

Vietnam Ministry of Education and Training. (2017). Circular 08/2017/TT-Bgdđt: Introducing Regulations on Doctoral 460 Enrolment and training. Retrieved from https://thuvienphapluat.vn/van-ban/giao-duc/Circular-08-2017-TT-BGDDTdoctoral-enrolment-and-training-347738.aspx

Vuong, Q.-H. (2016). Global Mindset as the Integration of Emerging Socio-Cultural Values Through Mindsponge Processes: A Transition Economy Perspective. In J. Kuada (Ed.), Global Mindsets: Exploration and Perspectives (109-126): Routledge.

Vuong, Q.-H. (2018). The (ir)rational consideration of the cost of science in transition economies. Nature Human Behaviour, 2, 5. doi:10.1038/s41562-017-0281-4

Vuong, Q.-H. (2019). Breaking barriers in publishing demands a proactive attitude. Nature Human Behaviour, 3, 1034. doi:10.1038/s41562-019-0667-6

Vuong, Q.-H. (2020). Reform retractions to make them more transparent. Nature, 582, 149. doi:10.1038/d41586-020-01694-x

Vuong, Q.-H., La, V.-P., Nguyen, M.-H., Ho, M.-T., Ho, M.-T., & Mantello, P. (2020). Improving Bayesian statistics understanding in the age of Big Data with the bayesvl R package. Software Impacts, 4, 100016. doi:10.1016/j.simpa.2020.100016

Vuong, Q.-H., La, V.-P., Nguyen, M.-H., Ho, M.-T., Tran, T., & Ho, M.-T. (2020). Bayesian analysis for social data: A step-by-step protocol and interpretation. MethodsX, 7, 100924. doi:10.1016/j.mex.2020.100924

Vuong, Q.-H., La, V.-P., Vuong, T.-T., Ho, M.-T., Nguyen, H.-K.T., Nguyen, V.-H., … Ho, M.-T. (2018). An open database of productivity in Vietnam's social sciences and humanities for public use. Scientific Data, 5, 180188. doi:10.1038/sdata.2018.188

Vuong, Q.-H., & Napier, N.K. (2015). Acculturation and global mindsponge: an emerging market perspective. International Journal of Intercultural Relations, 49, 354–367.

Vuong, Q.-H., & Tran, T. (2019). The Vietnamese social sciences at a fork in the road: Walter de Gruyter GmbH & Co KG.

Vuong, Q.-H., Nguyen, T.T.H., Ho, M.-T., & Nguyen, M.-H. (2021). Adopting open access in an emerging country: Is gender inequality a barrier in humanities and social sciences? Learned Publishing, 34(4), 487–498. doi: 10.1002/leap.1387

Vuong, T.-T., Ho, M.-T., Nguyen, M.-H., Nguyen, T.-H.T., Nguyen, T.-D., Nguyen, T.-L., … Vuong, Q.-H. (2020). Adopting open access in the social sciences and humanities: evidence from a developing nation. Heliyon, 6(7), e04522. doi:10.1016/j.heliyon.2020.e04522

Wagenmakers, E.-J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., Love, J., … Epskamp, S. (2018). Bayesian inference for psychology. Part I: Theoretical advantages and practical ramifications. Psychonomic bulletin review, 25(1), 35–57. doi:10.3758/s13423-017-1343-3

Zhu, Y. (2017). Who support open access publishing? Gender, discipline, seniority and other factors associated with academics' OA practice. Scientometrics, 111(2), 557–579. doi:10.1007/s11192-017-2316-z