



DOI:10.22144/ctujoisd.2025.061

Determinants of publication output: Analyzing WoS journal contributions by university lecturers in Viet Nam

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Article info.

Received 25 Aug 2024

Revised 14 Apr 2025

Accepted 28 Apr 2025

Keywords

Faculty member,
publications, scientific
research, Vietnamese
universities, WoS

ABSTRACT

This study examines the factors determining research output in Viet Nam, particularly the publication of Web of Science (WoS) listed journals, which affects the global ranking of Vietnamese universities. We analyzed the academic profiles of 2,042 faculty members from the top 12 universities, as ranked by Webometrics in 2021, using a nonlinear Poisson regression model. The analysis identified eight key factors influencing publication count: age, gender, field of study, academic degree, academic rank, professional title, administrative position, and educational background. Among them, productivity follows an inverted U-shaped pattern with age, increases with a PhD degree and foreign education, and is higher among male researchers and those in natural sciences. In contrast, administrative roles are associated with fewer publications, likely due to shifting priorities and increased non-research responsibilities. The academic rank of associate professors is related to higher research outputs, while the academic rank of full professors and professional titles shows little evidence of correlation to research outputs. The findings emphasize the diverse factors influencing academic research output. Based on these findings, we propose recommendations to boost international publication productivity in Vietnamese universities.

1. INTRODUCTION

In 2021, the inclusion of four Vietnamese universities in the Times Higher Education World University Rankings attracted considerable public attention, particularly among students, university administrators, and education researchers. Notably, 60% of the evaluation score was attributed to research output and international scientific citations, underscoring the critical role of research activities and international publications in enhancing university rankings. Institutions with high rankings enjoy greater competitiveness, an improved ability to attract talent, increased access to funding, and expanded opportunities for international collaboration.

Despite recent improvements, research activities at many Vietnamese universities remain limited in both quantity and quality. Historically, these institutions prioritized teaching over research. However, since the enactment of new higher education legislation in 2005, research has become a core responsibility of academic faculty. Although the number of faculty members and academic titles has increased, the number of universities producing internationally recognized research remains modest (Nguyen et al., 2021).

Investigating the determinants of research output is essential for optimizing productivity, improving policy decisions, and enhancing a clear understanding of these factors, which enables

institutions and governments to allocate resources efficiently, increase research impact, and strengthen global competitiveness.

Various factors have been identified as key determinants of research output. The relationship between age and productivity is complex, with mixed empirical findings. While some studies report a decline after mid-career (Levin & Stephan, 1991; Over, 1982; Kyvik, 1990), others suggest older scholars, particularly in natural sciences, may remain highly productive (Allison & Stewart, 1974; Turner et al., 2003). Gender disparities persist, with female researchers publishing less than their male counterparts, influenced by societal biases and family responsibilities (Xie & Shauman, 1998; Cole & Zuckerman, 1984). Academic degree and rank are generally correlated with higher productivity, though exceptions exist (Abramo et al., 2011; Waworuntu & Holsinger, 1989). The place of educational training also plays a significant role, with international training often leading to greater research output, while "academic inbreeding"—hiring faculty from within the same institution—negatively impacts productivity (Horta et al., 2010). Additionally, research productivity varies across disciplines, with the natural sciences typically yielding more publications than the social sciences or the arts (Sabharwal, 2013). Also, holding administrative positions or higher professional titles tends to enhance research productivity, as reflected in higher citation counts (Zaorsky et al., 2020; Eckhaus & Davidovitch, 2021).

Limited research has examined the determinants of publication in prestigious systems such as the WoS for Vietnamese researchers. A small number of studies have focused on bibliometric analyses or described the current state of international

publications from Viet Nam (Vuong et al., 2018; Ho et al., 2022), while others have investigated external influences such as policy frameworks barriers, language, or professional networks (Trinh et al., 2020). However, the internal characteristics of individual researchers, including age, gender, academic degree, administrative position, and professional title, remained largely under-explored. This gap in the literature highlights the need to investigate the individual-level determinants of international research publication among Vietnamese scholars, which this study aims to address.

Specifically, this study analyzes factors associated with WoS - indexed journal publication by faculty members at selected Vietnamese universities. It aims to (1) examine and reassess the individual determinants influencing research output., and (2) propose practical recommendations to enhance international publication productivity.

2. MATERIAL AND METHODS

2.1. Data

This study draws on two main data sources. The first is a collection of publicly available CVs from 2,042 academic staff at 12 leading Vietnamese universities, selected based on the 2021 Webometrics ranking. These CVs provide detailed information on individual characteristics such as age, gender, academic degree, and professional title. The second source is the Web of Science (WoS) database, which contains publication records from 2008 to 2021. By merging these two sources, we created a panel dataset with 28,588 observations, capturing annual information on each faculty member over the study period. The variables used in the analysis are presented in Table 1.

Table 1. Variables in the model

Variable	Category	Expect	Explanation
WoS articles (<i>wos2</i>)			The number of articles published over a two-year period
Age (<i>age</i>)		+	The age of a researcher.
Squared age (<i>age2</i>)		-	The square of age of a researcher.
Gender (<i>gender</i>)	Females		= 0 if a researcher's gender is female.
	Males	+	= 1 if a researcher's gender is male.
Field (<i>field</i>)	Social Science		= 0 if the field of study is social sciences.
	Natural Science	+	= 1 if the field of study is natural sciences.
Academic degree (<i>degree</i>)	Bachelor's		The academic degree of a researcher is a bachelor's.
	Master's	+	The academic degree of a researcher is a master's.
	PhD	+	The academic degree of a researcher is a PhD
Academic rank (<i>rank</i>)	No		A researcher does not hold an academic title.
	Assoc. professor	+	A researcher's academic title is Associate Professor.

Variable	Category	Expect	Explanation
Professional title (<i>protile</i>)	Professor	+	A researcher's academic title is Professor.
	Lecturer		A researcher is a lecturer.
	Senior lecturer	+	A researcher is a senior lecturer.
	Principal lecturer	+	A researcher is the principal lecturer.
Admin position (<i>adposition</i>)	No		= 0 if a researcher doesn't hold an admin position.
	Yes	+	= 1 if a researcher holds an administrative position.
Place of study (<i>eduplace</i>)	Domestic		= 0 if a researcher studied entirely within the country.
	Abroad	+	= 1 if a researcher has studied abroad.

2.2. Research methodology

To examine the factors influencing the number of WoS-indexed publications by faculty at selected Vietnamese universities, this study employs a nonlinear Poisson regression model. This method is appropriate for count data, particularly when the dependent variable—here, the number of WoS articles—is non-negative, highly skewed, and deviates from normality. The data also exhibit heteroskedasticity, with greater variance at higher publication counts, which can lead to biased estimates if not properly modeled. The use of Poisson regression addresses these challenges and is consistent with established approaches in prior studies (Azoulay et al., 2010; Mohnen, 2022).

The nonlinear Poisson regression is well-suited for analyzing count data and time series, providing annual indices and trend estimates. Given that the dataset consists of discrete, countable, non-negative integer values, this model effectively addresses hypotheses related to publication counts.

Using the maximum likelihood estimation (MLE), the Poisson regression can address issues such as missing values, over- and under-sampling, serial correlation, and deviations from the Poisson distribution (Cameron & Trivedi, 2013). The dataset derived from faculty CVs often includes incomplete information and missing data, making the Poisson method appropriate.

The regression model for the research study is as follows:

$$\begin{aligned}
 \text{wos2} = \exp(&\beta_0 + \beta_1 * \text{age} + \beta_2 * \text{age2} + \beta_3 \\
 &* \text{gender} + \beta_4 * \text{degree} + \beta_5 \\
 &* \text{rank} + \beta_6 * \text{protile} + \beta_7 \\
 &* \text{protile} + \beta_8 * \text{eduplace} \\
 &+ \beta_9 * \text{field}) + \varepsilon_i
 \end{aligned}$$

When converting to the logarithmic model, we have:

$$\begin{aligned}
 \ln(\text{wos2}) = &\beta_0 + \beta_1 * \text{age} + \beta_2 * \text{age2} + \beta_3 \\
 &* \text{gender} + \beta_4 * \text{degree} + \beta_5 \\
 &* \text{rank} + \beta_6 * \text{protile} + \beta_7 \\
 &* \text{protile} + \beta_8 * \text{eduplace} \\
 &+ \beta_9 * \text{field} + u_i
 \end{aligned}$$

3. RESULTS AND DISCUSSION

3.1. Main results

Table 2 shows descriptive statistics of our panel data. The dataset comprises up to 28,588 observations across variables. On average, individuals have published between 0.5 per 2 years with considerable variation. The average age is approximately 39.4 years, ranging from 19 to 76, and the squared age reflects this spread. In terms of demographics, around 59% of the sample were male, and about 51% studied domestically. The average academic degree lies between a Master's and a PhD, while academic rank, professional title, and administrative position levels are generally low, suggesting many respondents are in early career stages. Additionally, around 65% are affiliated with the field of natural sciences.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
WoS articles (wos2)	28588	.5	3.006	0	108
Age (age)	10094	39.444	8.321	19	76
Squared age (age2)	10094	1625.053	734.756	361	5776
Gender (gender)	28588	.587	.492	0	1
Place of study (eduplace)	22218	.507	.5	0	1
Academic degree (degree)	28588	2.457	.547	1	3
Academic rank (rank)	28588	1.202	.589	1	3
Professional title (protile)	28588	1.117	.454	1	3
Admin position (adposition)	28588	.183	.387	0	1
Field (field)	28588	.647	.478	0	1

The regression results as in Table 3 reveal that out of the eight variables included in the model, all are statistically significant at the 5% level, except for the "protitle" variable, which shows no significant difference in the number of WoS journal papers between groups of professional titles. More specifically, we have details as in Table 3.

Table 3. Regression model results

Variables	Coefficient	Standard error
age	0.098**	0.041
age2	-0.001**	0.000
gender	0.472***	0.105
Eduplace (<i>abroad</i>)	0.288***	0.097
1.degree (<i>bachelor</i>)	1.446***	0.406
3.degree (<i>doctor</i>)	0.514***	0.122
2.rank (<i>Assoc. Prof</i>)	1.307***	0.292
3.rank (<i>Prof.</i>)	0.215	0.142
2.protile (<i>senior</i>)	0.123	0.403
3.protile (<i>principal</i>)	-0.181	0.322
Adposition (<i>admin</i>)	-0.363***	0.115
Field (<i>natural science</i>)	0.670***	0.104

Asterisks indicate statistical significance levels, where * denotes $p < 0.10$, ** denotes $p < 0.05$, and *** denotes $p < 0.01$.

Age: The variable *age* has a positive coefficient, while *age2* has a negative coefficient. This U-shaped relationship suggests that publication productivity increases with age up to a peak and then declines. This pattern aligns with findings by Levin and Stephan (1991), and Turner et al. (2003). Early in their careers, researchers benefit from increased learning and motivation, but productivity may decline beyond a certain age due to health and motivational factors.

Gender: The positive coefficient for "gender" indicates that male researchers publish more in WoS-listed journals compared to female researchers. This supports previous studies by Cole and Zuckerman (1984), Kyvik and Teigen (1996), Xie and Shauman (1998). The gender gap can be attributed to time constraints, biological factors, and differing research focuses, with female researchers often facing interruptions due to family responsibilities and working in fields with less emphasis on research (Allison & Long, 1990).

Educational Background (eduplace): Researchers educated abroad tend to publish more WoS journal papers than those educated solely in Viet Nam. This is due to better language skills, exposure to advanced academic environments, and enhanced

research opportunities abroad, which contribute to higher research productivity. This result is in line with previous study by Shin et al. (2014), Baruffaldi & Landoni (2012).

Degree: Given that the majority of lecturers in our dataset hold a Master's degree, we use this group as the reference category for comparison. Consistent with the findings of Roach and Sauermann (2010), our results confirm a positive association between holding a PhD and higher research output. This is likely attributable to the advanced subject expertise, research training, and academic networks that typically accompany doctoral education. Conversely, we do not find a significant negative relationship between holding a degree below the Master's level and research productivity. A possible explanation is that lecturers without a Master's degree who remain employed at universities may possess exceptional abilities or potential, justifying their retention despite lower formal qualifications. Further research is needed to test this hypothesis.

Rank: Holding the position of associate professor is significantly associated with higher research output compared to non-ranked lecturers, which is similar to findings by Abramo et al. (2011) Waworuntu & Holsinger (1989). In contrast, no significant difference in research output is found between full professors and non-ranked lecturers, which may be attributed to the small number of full professors in our dataset.

Professional title (protile): Senior lecturers tend to publish more, while principal lecturers publish less than lecturers. This pattern may reflect promotion criteria that prioritize teaching experience over international research output at higher ranks, thereby reducing incentives or available time for publishing. However, the variable does not show a statistically significant effect.

Administrative Position (adposition): The negative coefficient for administrative positions suggests that while these roles demand significant achievements, the time spent on administrative tasks can detract from research activities, thereby reducing productivity.

Field: Scholars in the natural sciences tend to publish more WoS papers compared to those in the social sciences. This is likely because the natural sciences often involve extensive experimentation and technical research, resulting in more publications, whereas the social sciences typically

require more time for data analysis and may produce fewer publications.

These findings contribute to understanding the factors influencing research productivity and provide insights into how various academic and professional variables affect publication output.

3.2. Robustness check

Multicollinearity test

To ensure the reliability of the estimated results, we conducted a robustness check focusing on multicollinearity among the independent variables (except for *agesq*, which has conceptual and empirical overlap with the *age* variable). Although the primary analysis employed a random-effects Poisson regression model, the Variance Inflation Factor (VIF) was computed using an auxiliary OLS regression with the same set of predictors. The VIF results indicate that all variables had values well below the conventional threshold of 10, with a mean VIF of 1.23. This suggests that multicollinearity is not a concern in the final model specification.

Model Fit and Specification Robustness

The random-effects Poisson regression model demonstrates a good overall fit to the data. The Wald chi-square test yields a statistic of 251.72 ($df = 12$, $p < 0.001$), indicating that the explanatory variables, taken together, significantly contribute to explaining variation in the dependent variable (*wos2*).

Furthermore, the likelihood ratio (LR) test for the presence of random effects is highly significant ($\chi^2(01) = 14,000$; $p < 0.001$), rejecting the null hypothesis that the dispersion parameter alpha equals zero. This result supports the use of a

random-effects specification to account for unobserved heterogeneity across authors (*auth_id*), confirming that between-individual differences are relevant in modeling research productivity.

The log-likelihood value of the final model (-17,206.297) shows a substantial improvement compared to the null model (-24,671.125) and the initial fixed-effects Poisson model (-24,286.424), further reinforcing the appropriateness of the selected model.

In summary, the statistical evidence suggests that the random-effects Poisson model provides a valid and robust specification for analyzing the determinants of individual research productivity in the dataset.

Sensitivity check of research productivity measurement

The measurement of research productivity is inherently sensitive, as publication can vary significantly across disciplines. In some fields, the process from conceptualizing an idea to publishing an article may take more than a year. Consequently, rather than uniformly aggregating publications over a fixed two-year period, previous studies have adopted varying time spans, such as one year (Azoulay, 2012), five years (Ductor, 2015), etc. In order to avoid the bias by choosing a fix time span (2 years), we employed three different dependent variables to assess research productivity and compare the regression results across models in Table 4.

The results for all four models show consistent signs, demonstrating the robustness of the regression model across different measures of research productivity.

Table 4. Robustness check with different dependent variables

VARIABLES	Model 1	Model 2	Model 3
	<i>wos1</i>	<i>wos2</i>	<i>wos5</i>
age	0.103** (0.041)	0.098** (0.041)	0.082** (0.042)
age2	-0.001** (0.000)	-0.001** (0.000)	-0.001* (0.000)
gender	0.485*** (0.107)	0.472*** (0.105)	0.471*** (0.110)
eduplace	0.295*** (0.100)	0.288*** (0.097)	0.316*** (0.102)
1.degree (bachelor)	1.417*** (0.404)	1.446*** (0.406)	1.549*** (0.430)
3.degree (doctor)	0.525*** (0.124)	0.514*** (0.122)	0.498*** (0.128)

VARIABLES	Model 1	Model 2	Model 3
	<i>wos1</i>	<i>wos2</i>	<i>wos5</i>
2.rank (<i>Assoc. Prof</i>)	1.293*** (0.293)	1.307*** (0.292)	1.323*** (0.305)
3.rank (<i>Prof.</i>)	0.217 (0.144)	0.215 (0.142)	0.202 (0.147)
2.protitle (<i>senior</i>)	0.054 (0.408)	0.123 (0.403)	0.422 (0.420)
3.protitle (<i>principal</i>)	-0.225 (0.343)	-0.181 (0.322)	-0.403 (0.333)
adposition (<i>admin</i>)	-0.391*** (0.117)	-0.363*** (0.115)	-0.332*** (0.118)
field	0.646*** (0.107)	0.670*** (0.104)	0.862*** (0.108)
Constant <i>wos1</i>	-4.222*** (0.887)		
Constant <i>wos2</i>		-3.484*** (0.871)	
Constant <i>wos5</i>			-2.843*** (0.891)
Constant <i>lnalpha</i>	0.093* (0.056)	0.113** (0.053)	0.222*** (0.051)
Observations	9,002	9,002	9,002
Number of scholars	643	643	643

Standard errors in parentheses

*Asterisks indicate statistical significance levels, where * denotes $p < 0.10$, ** denotes $p < 0.05$, and *** denotes $p < 0.01$.*

- Model 1 uses the annual count of WoS papers recorded each year by the scholar.
- Model 2 uses the total number of WoS papers recorded every two years (as in the main analysis).
- Model 3 uses the total number of WoS papers recorded every five years.

4. CONCLUSIONS

This study examines the factors influencing research productivity, measured by the number of articles published in WoS-indexed journals. The regression results indicate that several key factors—such as age, gender, educational background, academic degree, academic rank, administrative position, and field of study—have a significant impact on research productivity.

Specifically, the relationship between age and research output follows a U-shaped curve, with productivity rising to a certain point before declining. Gender also plays a significant role, with male researchers publishing more than their female counterparts, which may reflect time constraints and

family responsibilities that disproportionately affect women. Researchers who have received education abroad, those holding doctoral degrees, and faculty members with the academic rank of associate professor tend to publish more, benefiting from advanced subject knowledge and enhanced academic networks. Conversely, holding administrative positions is associated with lower productivity, likely due to a shift in focus towards administrative duties and mentorship rather than research. Finally, scholars in the natural sciences publish more than those in the social sciences, likely due to the nature of research in these fields, which involves more technical experimentation and results in more publications.

These findings enhance our understanding of the various academic and professional factors that influence research productivity and provide a foundation for developing policies to improve international publication output at universities. Upon these results, the authors have put forth recommendations for enhancing future publication productivity in Viet Nam, as follows:

4.1. Implications for the government

First, it is imperative to establish priority policies and incentives for female staff members when engaging in scientific research. This includes measures such as gender-neutral recruitment, increasing the proportion of female participants in training and development programs, providing commendations and incentives to female staff with research projects that significantly contribute to practical production, and revising age requirements for programs and scholarships for master's and doctoral studies abroad, among others.

Second, revamping and enhancing the selection process and administrative role assignments at each position is essential. For individuals who excel in scientific research activities and meet the job position requirements, there may be a provision for their special recruitment into civil service or appointment to corresponding scientific titles.

4.2. Implications for universities

First, universities should encourage faculty and students to engage in scientific research, learning, and work abroad, possibly through short-term lecturer exchange programs, to enhance foreign language proficiency and gain access to and experience in professional academic environments.

Second, establishing and nurturing scientific research groups within the young faculty team is critical to facilitate connections, support, and professional consultations with leading experts in the field.

4.3. Implication for researchers

First, female scholars should cultivate a conscious awareness of their position and responsibilities in both the broader societal context and the specific realm of research work. Actively engaging in scientific research, akin to their male counterparts, will, to some extent, mitigate gender inequality and elevate the status of women in society.

Second, for every researcher, regardless of whether they hold academic titles or degrees, it remains essential to maintain a conscious commitment to continuous self-improvement and the enhancement of their professional knowledge. This can be achieved through participation in specialized training courses, research guidance, and engagement in research conferences, among other avenues, in order to supplement their knowledge and experience.

4.4. Limitations

In addition, while there are practical measures to improve publication productivity and research, there are still some limitations:

First, the data collection methods used by the authors have limitations. Data about researchers at universities in Viet Nam is collected from official university websites, which are not uniform, and some researchers do not publicly share their academic curricula vitae. This has made data collection challenging, resulting in a relatively small sample size.

Second, many researchers had incomplete or outdated information on their academic curriculum vitae, leading to errors in data synthesis and potentially compromising the accuracy of research results.

Given these limitations, future research in this area should diversify data collection methods, expand the research scale, and increase the number of observations to achieve the best possible results.

ACKNOWLEDGMENT

This research is funded by Foreign Trade University under research project number NTCS2022-11.

CONFLICT OF INTEREST

The authors declare that the funding source had no involvement in the study design, data collection, analysis, interpretation, or the writing of this manuscript. The authors declare no conflict of interest.

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