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Market Wage Premium and Publications of Tenured Faculty at *Universidad de Costa Rica*

Premios salariales de mercado y publicaciones del personal académico titular en la Universidad de Costa Rica

Laura C. Blanco[1]
Universidad de Costa Rica, San José, Costa Rica
lauracristina.blanco@ucr.ac.cr
https://orcid.org/0000-0002-9825-3027

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1 PhD. Politics, philosophy and economics.

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Abstract

Introduction

Current Costa Rican policies on wage erosion for the public sector threaten to weaken the services provided, including those related to academic research.

Objective

The paper analyses the association between alternative wages and wage premiums with the number of publications by academic staff.

Methodology

This paper uses administrative data on the academic publications of tenured faculty at the *Universidad de Costa Rica* to examine the Tobit regression results between academic output and the opportunity cost that different individuals face in the labour market. Opportunity costs are imputed from wage equations estimated from the National Household Surveys.

Results

The results indicate sizable differences in the wage premiums associated with the disciplines of study in the Costa Rican labour market: while physical education or nursing receive a wage penalty, careers in law or medicine report wages 40% above the average wage of other graduates. This higher labour market wage premium correlates with fewer academic publications, which suggests that people might respond to these higher opportunity costs by prioritizing alternative work opportunities. The results also confirm that the time it takes to get tenure is negatively associated with the number of publications.

Conclusions

Results highlight the potential for improving the institutional hiring policies by facilitating research activities for non-tenured faculty and the potential weakening of research activities due to wage erosion policies.

Keywords:

economics of education; labour economics; career choice; graduates; academia; tenure; human capital; publications; wages; wage premium; public universities; wage policy.

JEL Classification:

I23; J16.

Resumen

Introducción

Las políticas costarricenses actuales de erosión de salarios en el sector público amenazan con debilitar los servicios ofrecidos, incluyendo aquellos relacionados con la investigación en la academia.

Objetivo

El artículo analiza la relación entre los salarios alternativos y premios salariales con las publicaciones del personal académico.

Metodología

Se hace uso de bases de datos administrativas sobre publicaciones del personal titular de la Universidad de Costa Rica para examinar, mediante un análisis de regresión Tobit, la relación existente entre la producción académica y el costo de oportunidad que las diferentes personas enfrentan en el mercado laboral. Estos últimos se imputan a partir de ecuaciones salariales a partir de la Encuesta Nacional de Hogares.

Resultados

Se encuentran amplias diferencias en los premios que el mercado laboral les otorga a las disciplinas: castiga a disciplinas como educación física o enfermería, pero premia a carreras como derecho o medicina con salarios que superan en más de un 40% al salario promedio en otras disciplinas. Este mayor premio en el mercado laboral se relaciona con menos publicaciones, lo que sugiere que las personas responderían a esas mayores oportunidades laborales. Los resultados también muestran que el tiempo que tardan las personas en alcanzar la titularidad se asocia negativamente con la cantidad de publicaciones.

Conclusiones

Los resultados muestran potencial para mejorar las políticas de contratación al facilitar la investigación para el personal interino, así como el posible debilitamiento de la investigación a partir de las políticas de erosión salarial.

Palabras clave:

economía de la educación; economía laboral; decisión de carrera; personas graduadas; academia; titularidad; capital humano, publicaciones; salarios; premio salarial; universidades públicas; política salarial.

Clasificacion JEL:

I23; J16.

1. Introduction

This is the fifth paper in a series of publications dedicated to understanding the gender differentials in Costa Rican academia (Blanco, 2023a; 2023b; 2023c; 2024). Previous findings indicate that gender wage differentials are largely attributed to variations in human capital and publication rates. Hence, investigating the potential factors behind differences in publication rates emerged as an additional area of study from earlier results. This paper contributes to the current discussion on wage policies in public universities and their possible effect on faculty productivity by gender and discipline of study. Specifically, it questions how opportunity costs may affect academic productivity. It uses administrative datasets for tenured academics who have been evaluated by the Commission of Academic Ranking at the *Universidad de Costa Rica* (UCR) as of August 30th, 2019, to examine, using Tobit regression analysis, the relationship between the number of publications and the opportunity cost that different people face in the labour market. While the number of publications is used as a proxy for academic output, the opportunity cost is proxied by the wage premium associated with the different disciplines of study.

The results show that the number of publications is negatively and increasingly associated with the wage premium the labour market places on the person's discipline of study. There is also a negative relationship between this academic output and the time it takes for a faculty member to get tenure. Both results differ between women and men. Given that nominal wages in public institutions have been frozen since 2018, it might be strategic for those faculty members with higher opportunity costs to replace their research activities with jobs outside academia or even to give up academia altogether. Because wage premiums tend to be higher for men and male-concentrated disciplines of study, it would be expected that more men than women would resort to this strategy. Furthermore, the budget cuts that threaten to reduce tenure options might slow the pace of academic productivity, thus weakening, in the long run, our public universities.

Both the Public Finance Strengthening Law 9635, approved in December 2018, and the Public Employment Framework Law 10 159, approved in March 2022, transform public employment by eroding public wages and salaries. The former limited benefits from exclusivity contracts (Asamblea Legislativa, 2018, art. 51), standardized and converted annuities into nominal amounts (Asamblea Legislativa, 2018, art. 51), fixed salary incentives to January 2018 levels (Asamblea Legislativa, 2018, art. 54), and gave the Legislative Assembly exclusive authority over new wage incentives (Asamblea Legislativa, 2018, art. 55). It also created automatic spending ceilings when public debt, expressed as a percentage of gross domestic product, exceeds the different critical debt limits established by law (Asamblea Legislativa, 2018, art. 11 and 13). This forces institutions to freeze or cut spending, regardless of the financing source. For example, the law prevents universities from supplementing their spending with surpluses from selling services to private companies when the fiscal cap is in effect. One of the most important cost-containment measures is freezing nominal wages when the public debt reaches 60% of GDP, thereby preventing purchasing power restoration (Asamblea Legislativa, 2018, art. 13, subsection c). These measures, which are in force, evidently undermine the capacity of public institutions to attract and retain their personnel.

The latter law aims to standardise public sector salaries for equivalent positions to contain wage growth. Following periods of political support for public universities during the Chinchilla Miranda (2010–2014) and Solís Rivera (2014–2018) administrations, these institutions suffered a defunding policy under the Alvarado Quesada (2018–2022) and Chaves Robles (2022–2026) administrations. The Legislative Assembly reduced the budget for the Special Fund for Higher Education (Fondo Especial para la Educación Superior, FEES) by ten thousand million colones in 2019, and, in 2020, an additional cut of thirty-eight thousand two hundred million colones was allocated to COVID-19 pandemic relief (CONARE, 2024). This meant that the real FEES was reduced by 7% between 2018 and 2020, going

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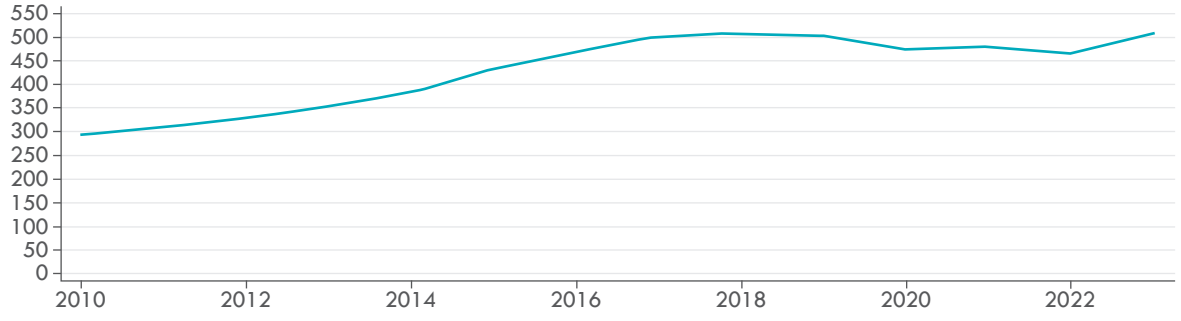
from five hundred and eight thousand million to four hundred and seventy-three thousand million real colones. Despite the universities' efforts, including legal actions to enforce the transfer of resources stipulated by the Constitution, the real amount of FEES has not returned to 2018 levels, as shown in Figure 1. This is due both to implemented policies and to accumulated inflation, which exceeded 14% between 2018 and 2023. This has significant repercussions on the operation of universities, including their wage policy.

After a reduction in faculty positions, likely related to pension reforms and staff departures not being replaced, teaching positions at the *Universidad de Costa Rica* have remained relatively stable since 2016. Despite such stability, however, the executed budget for real per capita salaries has experienced a considerable reduction of 14.4% between 2019 and 2022 (Universidad de Costa Rica, 2024a; 2024b), as shown in Figure 2. While the 2020 pandemic also lowered the average gross salary of university graduates in the labour market, this reduction was smaller (around 2%) than the 14.4% cut observed at universities. Further, the wages of graduates in the labour market showed a partial recovery in the years following the pandemic, so that the loss in purchasing power for this group by 2022 was 0.8% (INEC, 2022), *i.e.,* salaries in academia are losing relative competitiveness compared to other employment opportunities that do offer long-term wage growth.

Although during the discussion of Law 10 159, there was talk of setting public sector salaries based on a market salary, this is unlikely, not only because what has actually been implemented is a policy of reducing real salaries, but also because faculty wages are neither defined by the discipline of study nor negotiated. Instead, salaries are determined by academic rank, as regulated by the Reglamento de Régimen Académico y Servicio Docente (Universidad de Costa Rica, 2008). This poses a problem since the different disciplines face different market salaries. Since the law seeks to compress wages in the public sector, individuals with a higher opportunity cost may choose to transition, either partially or entirely, to the private sector. This may impact academic productivity indicators differently across departments. Therefore, analysing the relationship between the average market salary and academic publications could yield valuable insights. These policies can also have a differential impact on the salaries of women and men and, in the long term, could even lead to more marked gender segregation in academia. There is evidence of significant differences between the salaries received by female academics compared to their male peers (Biasi & Sarsons, 2022; Ibarra & Castellanos Llanos, 2009; MIT, 1999a; 1999b; Jabbaz et al., 2019; Toope, 2019)[2]. For example, at Cambridge University, the gender wage gap amounts to almost 20% (Toope, 2019). This

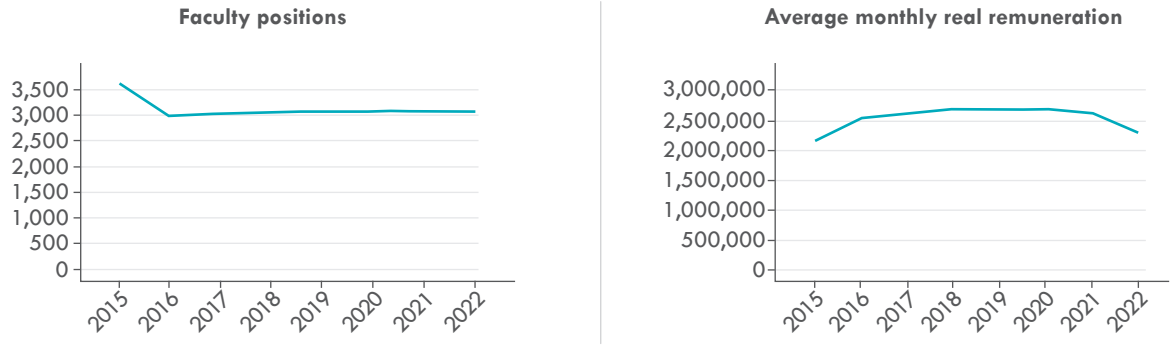
Figure 1. 2010–2023 agreed FEES budget (in thousand million 2019 real CRC)



Source: own elaboration using data from CONARE (2024).

2 For a wide literature review on the subject, see Blanco (2023a; 2024). This paragraph summarizes the main ideas of the above-mentioned literature review and therefore shares the same references as in Blanco (2023a; 2024).

Figure 2. Faculty positions and average monthly real remunerations* (in 2019 CRC) at *UCR* in 2015-2022



Note: * 2018 average monthly real remuneration was imputed, since it was unavailable.

Source: own elaboration using data from Universidad de Costa Rica (2024a; 2024b).

gap is largely explained by vertical segregation in academia (European Commission, 2017; Ginther & Kahn, 2004; Glover, 2000; McElroy, 2013). This, in turn, is explained by a slower rate of promotion for women: they are less likely than men to obtain tenure (Bagues et al., 2017; De Paola & Scoppa, 2015); more so when publishing with male co-authors (Sarsons, 2017), and they have a greater probability of remaining in temporary contracts or in low academic ranks (Ceci et al., 2014).

These promotion probabilities are also limited by their publishing rate: women publish less than men (Barbezat, 2006; Ceci et al., 2014; Ginther & Kahn, 2004) due to a series of institutional differences specific to both universities and publishers. Women report less time and fewer resources for research from universities and funding bodies (MIT, 1999a; 1999b), and greater dedication to teaching and administrative activities (Barbezat, 2006; Babcock et al., 2017). Additionally, their papers tend to have higher rejection rates by editorial boards (Hengel, 2017; Murray et al., 2019). Ironically, because women are aware of their higher rejection rate, they respond by taking more time writing and revising their manuscripts, which further slows down their publication rate without guaranteeing an improvement in the acceptance rates of their work (Hengel, 2017).

The evidence for *Universidad de Costa Rica* is consistent with this literature. Although lower than that observed in other contexts, the gender wage gap for tenured academics at this institution is significant and amounts to 7.8% (Blanco, 2023b). As expected, this is explained by a lower probability of being promoted to full professor than men. An analysis of the salary determinants indicates that the most significant gender gaps at this university refer to the accumulation of human capital and research: consistent with the world literature, female academics at the *Universidad de Costa Rica* publish considerably less than their male peers (Blanco, 2023b), and their publications are less valued than those of men (Blanco, 2023c). Likewise, men are more likely to hold a PhD degree and to have studied at leading universities worldwide, which may provide better opportunities for research training and access to academic networks that facilitate publishing and could eventually lead them to greater academic productivity (Blanco, 2023b).

At this university, gender composition and academic productivity vary widely by department. For example, while in some departments such as Physics, Mathematics, or History more than 80% of the tenured faculty hold a PhD degree, in departments like Medicine, Business Administration, Dentistry, or Topographic Engineering, less than 10% do. The differences are also significant regarding academic output: while the Arts College reports an average of 45.6 works per capita, the Faculty of Dentistry only reports 9.3 (Blanco, 2023b). It is then worth asking whether these differences between departments might be associated with different opportunity costs.

Current wage erosion policies may have two

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effects: first, based on Goldin's pollution theory (Goldin, 2002), as salaries in academia become less competitive, this would not only mean an already significant reduction in purchasing power but also a signal of lower status. Given that the gender wage gap at the university (7.8%) is smaller than that for graduates in the labour market (12.19%) (Blanco, 2023b) and given that significant wage premiums are observed for specific disciplines, those people who see their status diminished more significantly could choose to reduce their work in academia or leave altogether to take up higher-status jobs. Since both the most productive academics and men as a group are the most affected by this loss of status, one could expect a greater feminisation of the faculty. Further, according to this pollution theory, this likely increase of women in an occupation reinforces the idea of its status decline, which, in turn, would encourage a greater departure from academia. The loss of staff with higher opportunity costs could lead to lower publication rates and decreased research activity.

Secondly, changes in the salary-setting mechanism may also result in differences between women and men. For example, transitioning from a salary rules mechanism to individual negotiation may increase the gender wage differential because men are more successful in negotiating their salary (Biasi & Sarsons, 2022). This may be because women are less likely to job shop than men (Manning & Swaffield, 2008) and could therefore be less aware of their opportunity cost when negotiating; or because, in general, women are more risk-averse and tend not to negotiate for their own benefit (Bertrand, 2011). In Costa Rican universities, as the new mechanism compresses salaries without negotiation options, the amount of labour will adjust, so that contracted research time will likely decrease, to the detriment of academic productivity.

While previous findings and implemented changes in hiring and wage policies are the motivators for this paper, its objective is to analyse how academic productivity might be affected by opportunity costs. The data available does not allow for a policy evaluation, but it can still provide strong arguments on the relevance of creating efficient policies for building quality academic institutions. The following section describes the dataset and methodology used to analyse the relationship between the number of academic publications and the opportunity cost a person faces in the private sector, measured as the alternative salary that a person can obtain outside academia. Section 3 presents the results, and Section 4 concludes.

2. Data and methods

The university employs a tiered academic ranking system, in which faculty members progress based on the accumulation of points. Therefore, individuals are required to submit their qualifications and publications for evaluation to qualify for higher academic ranks. Information on productivity indicators is available for 809 tenured faculty members at the Universidad de Costa Rica as of the 30th of August 2019. The data was obtained from the Financial Administration Office and the Academic Evaluation Centre. This represents 43% of all tenured faculty. Since participation in the evaluation is optional, the sample only includes those individuals who submitted their certificates. It excludes 87% of the teaching staff (tenured and non-tenured faculty) who chose not to be evaluated and whose productivity data is unavailable. Proportion and mean tests confirmed the sample's validity. There is no evidence that the sample differs from the population, except for instructors and female tenured faculty in the Law Department, where significant data loss occurred due to lower participation. The Scientific Ethics Committee of the Universidad de Costa Rica approved the use of this dataset, in accordance with session 170 of the 22nd of April 2020, as stated in the letter CEC-199-2020.

Table 1 summarizes some characteristics of the sample, which consists of 355 women and 454 men, so that women represent 43.9% of all

3 For a more detailed description of the sample, see Blanco (2023b).

observations[3]. On average, women report 8.43 fewer publications than men, which places them at a disadvantage, since publications are the main method of promotion in academia. Both women and men require nearly 8 years to attain tenure after beginning their positions at the university, with no significant differences observed by gender. Hence, academics lack job stability for a considerable portion of their careers. Further, during this period of instability, contracts predominantly focus on teaching rather than research.

Table 1 presents four human capital variables: having a postgraduate degree, having a doctorate, the Times Higher Education (THE) index score for the university where the person received their latest academic degree, which is measured between 0 and 100, and whether the person is at least bilingual. Among academics sampled, 93.1% hold a postgraduate degree. Although the percentage of women with a postgraduate degree (95.8%) exceeds that of men (91%), men are over 10 percentage points (p.p.) more likely to have a PhD. This means that men are also more likely to graduate from higher-rated universities. Since all sampled academics are bilingual, this variable is only relevant for opportunity cost imputations. The dataset also includes five variables related to productivity: the percentage of an individual's publications appearing in journals indexed in Scopus, Latindex or UCRIndex, which is an indicator of their publication costs; the average publication score awarded by the university, ranging from 0 to 6; teaching evaluation scores ranging from 0 to 10; and the research and community work evaluations, scored from 0 to 3.

On average, half of men's publications appear in indexed journals. In contrast, most women are published in other media types, and this difference is significant at the standard level. In addition, male academics get higher publication scores: while they receive, on average, 1.15 points per publication, women are only awarded 1.02 points per publication. Men's higher publication rate and publication scores facilitate their academic rank advancement, partly explaining the observed vertical segre-

Table 1. Descriptive statistics for tenured faculty as of the 30th of August 2019

	Total	Women	Men
Observations	809	355	454
Average number of publications	21.87	17.14	25.57
Average years of working at the university before getting tenure	7.75	7.96	7.59
Percentage that is female	43.9%		
Percentage holding a graduate degree	93.1%	95.8%	91.0%
Percentage holding a PhD degree	51.8%	45.9%	56.4%
Average THE overall score of the university	44.10	43.10	44.88
Percentage who is at least bilingual	100.0%	100.0%	100.0%
Average percentage of indexed publications	47.7%	45.2%	49.7%
Average score given by publication	1.09	1.02	1.15
Average research evaluation	0.44	0.44	0.43
Average teaching evaluation	9.18	9.24	9.13
Average community service evaluation	0.44	0.56	0.35
Distribution by gender segregation of disciplines of study:			
Male-dominated	21.4%	13.0%	28.0%
Integrated	30.8%	23.7%	36.3%
Female-dominated	47.8%	63.4%	35.7%
Percentage with couples	62.3%	57.2%	66.3%

Source: own elaboration using data from the Universidad de Costa Rica (2019).

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gation (Blanco, 2023b; 2024).

Both women and men average 0.44 points for their research activity. Women score higher than men in teaching and community work. However, overall scores in research and community work are low, indicating limited engagement, despite both being considered substantive activities of academic work. In contrast, the average teaching evaluation is high for both female and male academics, exceeding a score of 9.

Following Hakim (2002), I use the gender-segregation classification for professions in Costa Rica (Blanco, 2018) to create a categorical variable indicating whether the discipline of study is predominantly male, integrated, or female. This classification considers an occupation as female-dominated when at least 60% of the workers are women. It is male-dominated when at least 60% of workers are male and integrated when women account between 40% and 60% of all workers. Almost two-thirds of the female academics in the sample belong to a female-dominated discipline. Men are more evenly distributed across categories, suggesting that segregation is mainly due to women's decisions. Moreover, the table shows that female academics are less likely (57.2%) than men (66.3%) to have a partner.

2.1 Methods

To analyse how publications relate to a person's opportunity cost, measured as the average alternative salary that a person could gain working outside of academia, I estimated Mincer's (1970) wage equations for university graduates using the National Household Survey (ENAHO) for the period 2011-2021 (INEC, 2021), which contains the COCR-2011 four-digit occupational classification codes. This dataset was obtained via an agreement between the *Instituto Nacional de Estadística y Censos* (INEC) and the *Instituto de Investigaciones en Ciencias Económicas* (IICE). Since academic disciplines do not always map directly to occupational codes, I estimated separate equations for each discipline to calculate the average labour market wage premium assigned to each one. Due to limited data, it was sometimes necessary to group disciplines. For example, occupation code 2633 corresponds to "Philosophers, historians and political scientists", who belong to departments in different colleges: the Philosophy department belongs to the Arts and Humanities College, while the History and Political Science departments belong to the Social Sciences College. Hence, each discipline was matched to the occupational codes where they are more likely to work, so that the logarithm of the real hourly wage (*ln(w)*) in 2019 colones for a specific discipline of study takes the following form:

$$\ln(w) = \alpha + \delta D + \rho Z + \varepsilon, \qquad [1]$$

where: α represents the intercept, D is a dummy variable that takes the value of 1 when the occupation is associated with the discipline in question, such that δ is the coefficient of interest and shows the wage premium or punishment assigned by the market to that occupation, and ρ is the vector of coefficients associated with the independent variables of the matrix Z. Z includes those salary determinants available both in the ENAHO dataset and the university's administrative records, thereby allowing the imputation of market wages for the observations in the university sample. The matrix Z contains seven variables that include two dummy variables associated with the accumulation of human capital: one identifying whether the person has a postgraduate degree and another identifying whether the person is bilingual. In addition, it includes the years of potential work experience and its square, also as a measure of human capital accumulated over time; a categorical variable that indicates whether the occupation is male-dominated, integrated, or female-dominated, following Hakim (2002), and two dummy variables identifying whether the person is a woman and whether she has a partner.

From these wage equations, I then impute three values to the sample of tenured academics: an opportunity cost, measured as the predicted market gross hourly wage based on their individual characteristics, a wage premium for

their discipline of study, φ, and its square. The first may reflect a person's level of productivity, given the human capital they have accumulated over time. It represents what they might earn if they leave academia, *i.e.,* it is their predicted alternative salary. The second is a more direct measure of society's value on each discipline, so that those highly valued will receive a higher wage premium and those that are not considered as important or prestigious would incur in penalties. The squared term measures whether the premium is increasing or decreasing.

With these imputed values, I estimated three Tobit models for the logarithm of the publication counts (y). The expected value of publication counts for censored observations in the Tobit model setting zero (L=0) as the lower bound will be given by (Cameron & Trivedi, 2010, p. 536):

$$E(y_i|x_i, y_i > L) = x_i' \ \beta + \sigma \frac{\phi\{x_i' \beta - L/|\sigma\}}{\Phi\{x_i' \beta - L/|\sigma\}} = x_i' \beta + \sigma\lambda_i \qquad [2]$$

The term on the left side of the equation is the expected value of y_i given that it is greater than zero; x is the matrix of individual characteristics; β is the vector of associated coefficients; σ is the standard deviation for the dependent variable; ϕ is the density, and Φ is the cumulative distribution function. Because publications are censored at zero ($L = \gamma = 0$), the term $\lambda_i = \phi/\Phi$ is estimated from a probit model for the probability that an individual has publications ($y_i^* > 0$). If d=1 when publications are observed and d=0 when publications are null, the density function for the censored model is given by (Cameron & Trivedi, 2010, p. 537):

$$f(y_i) = \left[\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2\sigma^2}(y_i - x_i' \beta)^2}\right]^{d_i} \quad [\Phi\{\gamma - x_i' \beta/|\sigma\}]^{1-d_i} \qquad [3]$$

Because the distribution of publications is not normal, the Tobit models estimate the expected logarithm of the publication counts using the *tobit* command in Stata. This command allows for the estimation considering the nonzero threshold and lognormal y. So, when using lny as the dependent variable, the censored mean is given by (Cameron & Trivedi, 2010, p. 545):

$$E(y|x) = e^{x' \beta + \sigma^2/2} \left\{1 - \Phi\left(\frac{\gamma - x_i' \beta - \sigma^2}{\sigma}\right)\right\} \qquad [4]$$

The first model estimates the logarithm of publications dependent solely on the variables of interest, namely: four continuous variables for the natural logarithm of the expected hourly wage outside academia, the market wage premium and its square, and the years at the university before tenure, as well as a dichotomous variable indicating whether the person is a woman. As explained, the first three capture the effect of the opportunity cost of working in academia, while the fourth variable reflects job instability presumably associated with teaching positions. The fifth variable allows us to establish whether there are any gender differences.

The second model adds controls for two human capital dummy variables: whether a person holds a PhD, indicating specialized research training linked to academic productivity, and the Times Higher Education index score of their last degree-awarding university, proxying the quality of research training.

The third model controls for five variables linked to publications, as identified in Blanco (2023b): the percentage of an individual's publications in journals indexed by UCRIndex, Latindex, or Scopus; the average points awarded per publication; and the research, teaching, and community service evaluations. These three models are estimated for the pooled, female, and male samples.

In all three models, matrix X includes the inverse Mills ratio to account for potential selection bias (Heckman, 1979). Since promotion requires a request for assessment, the administrative data is

Sociedad y Economía N° 57 (2026) / e-ISSN: 2389-9050 / e10114688
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only available for 43% of all tenured faculty. No information exists for the remaining 57%. The inverse Mills ratio is derived from a probit estimation of the probability of inclusion in the sample (S_i) dependent on a binary variable indicating whether the person is a woman and a categorical variable for the discipline's college - along with an error term ξ-, these being the only observed variables for those individuals without evaluation records. The latent model for the probability of being in the sample is given by:

$$S_i^* = \mu_1 woman + \mu_c college + \xi_i \quad [5]$$

The results reported are those of the best model. Robustness checks were conducted, including estimations for the Tobit model without selection bias adjustment, as well as ordinary least square and fixed effects models adjusted for selection bias.

3. Results

Table 2 reports the estimates of labour market wage premiums across different academic disciplines. As mentioned above, some of these had to be grouped to match them with the occupational codes. The humanities category consists of philology, linguistics, literature, philosophy, modern languages, political sciences, and history. The agronomy and related category comprise agronomy, animal husbandry, agricultural economics, agribusiness, and biology. The economics and administration category includes both business and public administration in addition to economics and economic sciences.

There are no wage premiums for careers in arts, humanities, agronomy, and similar fields, library science, science, geology, health technologies, public health, other health sciences, microbiology, architecture, and chemical, mechanical, and agricultural engineering compared to other professions, regardless of whether one is a woman or a man. Penalties exist for careers in physical education and sports and nursing for both sexes at a significance level of 10%. In addi-

Table 2. Costa Rican wage premium by academic discipline and sex

Discipline of study	Women		Men	
Arts	1.9%		-5.9%	
Humanities	-8.2%		-15.7%	*
Agronomy and related	3.5%		3.8%	
Law	41.8%	***	43.9%	***
Education	26.0%	***	16.4%	***
Library science	0.6%		6.1%	
Physical education and sports	-21.6%	**	-16.8%	**
Economics and administration	18.0%	***	26.7%	***
Mathematics and statistics	-20.9%	***	-6.8%	
Social sciences	28.5%	***	29.8%	***
Mass communication	21.2%	***	25.6%	***
Psychology	16.2%	***	24.6%	***
Social work	29.5%	***	29.8%	***
Geography, anthropology and sociology	39.1%	***	19.7%	**
Sciences	-7.0%		3.4%	
Physics and chemistry	-16.1%	**	-6.0%	
Geology	-20.2%		-19.5%	
Other degrees in health science	0.0%		27.3%	
Nursing	-3.5%	*	-6.9%	*
Medicine	61.1%	***	66.2%	***
Nutrition and food technology	8.4%		-32.3%	***
Health technologies	-0.5%		0.2%	
Public health	-5.0%		-7.1%	
Dentistry	15.5%		46.3%	***
Microbiology	1.7%		-9.1%	
Pharmacy	33.7%	***	27.4%	***
Engineering	15.9%	***	14.2%	***
Civil engineering	11.4%		21.5%	***
Electric engineering	26.2%	**	14.3%	***
Industrial engineering	17.4%	***	10.2%	***
Mechanic engineering	13.6%		5.8%	
Chemical engineering	15.6%		3.6%	
Architecture	1.1%		-1.6%	
Computing and information technologies	12.9%	***	29.8%	***
Agricultural engineering	-5.3%		18.5%	
Topographic engineering	22.0%		-17.0%	**

Note: * p<0.10; ** p<0.05; ***p<0.01.
Source: own elaboration using data from INEC (2021).

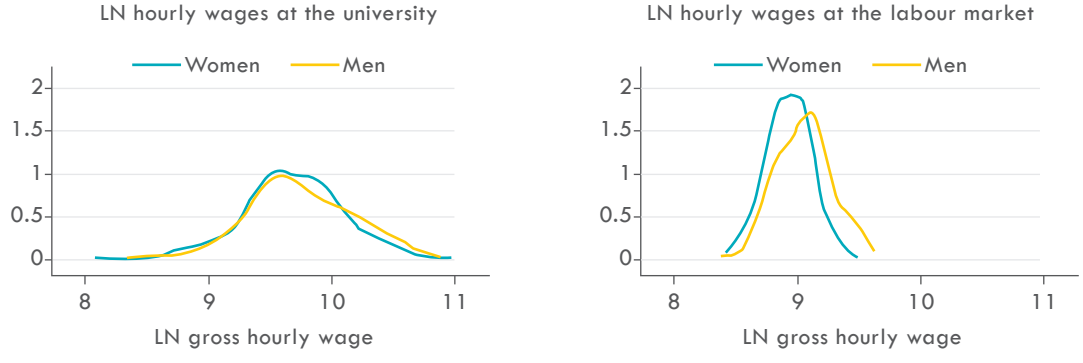
tion, women in mathematics and statistics earn, on average, 20.9% less than other female graduates, while women in physics and chemistry have a penalty of 16.1% compared to other female graduates. Still, these penalties are not observed for men. The penalization for women in these four male-dominated fields might suggest intense discrimination in traditionally male environments. Conversely, men are penalized in topographic engineering and "nutrition, and food technology" when compared to male graduates in other careers. Men in the latter might be punished for transgressing into a female-dominated discipline of study. In contrast, significant premiums are observed for men in civil engineering (21.5%) and dentistry (46.3%), but not for women.

Both women and men in law, education, economics and administration, social sciences, mass communication, psychology, social work, geography, anthropology and sociology, medicine, pharmacy, computing and information technologies, and engineering, industrial and electrical engineering receive a wage premium relative to other graduates in the labour market. However, the magnitudes of these premiums vary widely between women and men. For example, women in geography, anthropology, and sociology earn, on average, 39.1% more than other female graduates. Still, men in these careers receive only a 19.7% premium relative to the salary of other male graduates. In contrast, men in computing and information technologies earn a salary 29.8% higher than other male graduates, but the premium is only 12.9% for women in the same career. Medicine is the degree with the highest premium: female doctors earn, on average, 61.1% more than other female graduates, while male doctors earn 66.2% more than other male professionals. Overall, the average female wage premium amounts to 8.3%, while that of men is 1.4 p.p. higher, equivalent to 9.7%. All this shows that the alternative salaries to which people could aspire vary not only by discipline but also by sex.

Figure 3 compares the Kernel distributions of the natural logarithm of the gross hourly wage for academics in the sample and their imputed opportunity cost, based on their individual characteristics and the wage equations obtained using Costa Rican labour market data. In both cases, the male wage distribution shows greater positive skewness than females wages, and these are specially pronounced in the labour market, where the gender wage gap is 14% compared to 6.2% among academics. Furthermore, on average, academics continue to earn more than graduates outside academia, so wage erosion might only incentivize those with higher outside opportunity costs and lower academic salaries to leave academia, *i.e.,* highly qualified young scholars starting out at universities.

Table 3 displays the Tobit model with the Heckman correction results for the number of publications. In all three models, the F test indicates that the regression results are different from those obtained from a model with no

Figure 3. Distribution of the LN of the hourly wage for tenured academics at UCR and its opportunity cost



Source: own elaboration using data from Universidad de Costa Rica (2019).

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Table 3. Tobit estimates for LN of publications for tenured academics, with Heckman correction

	Model I			Model II			Model III		
	Pooled	Women	Men	Pooled	Women	Men	Pooled	Women	Men
LN hourly wage expected outside of academia	1.484***	1.355***	1.562***	1.391***	1.353***	1.428***	1.225***	1.145***	1.280***
	(0.197)	*(0.313)*	*(0.251)*	*(0.195)*	*(0.310)*	*(0.250)*	*(0.199)*	*(0.309)*	*(0.257)*
Wage premium	-1.869***	-1.696***	-2.101***	-1.835***	-1.589***	-2.093***	-1.959***	-1.506***	-2.330***
	(0.299)	*(0.476)*	*(0.391)*	*(0.294)*	*(0.470)*	*(0.387)*	*(0.289)*	*(0.452)*	*(0.390)*
Squared wage premium	1.728***	2.669**	1.273*	1.816***	2.598**	1.390*	2.406***	2.603**	2.373***
	(0.593)	*(1.150)*	*(0.719)*	*(0.586)*	*(1.127)*	*(0.723)*	*(0.592)*	*(1.116)*	*(0.775)*
Years at university before tenure	*-0.046****	*-0.047****	*-0.047****	*-0.043****	*-0.041****	*-0.046****	*-0.038****	*-0.037****	*-0.040****
	(0.007)	*(0.011)*	*(0.010)*	*(0.007)*	*(0.010)*	*(0.010)*	*(0.007)*	*(0.010)*	*(0.009)*
Being a woman	-0.202***			-0.163**			-0.233***		
	(0.077)			*(0.077)*			*(0.075)*		
Having a PhD				0.276***	0.303***	0.258**	0.308***	0.257**	0.360***
				(0.072)	*(0.103)*	*(0.102)*	*(0.075)*	*(0.110)*	*(0.104)*
Times Higher Education score				0.006***	0.008**	0.005*	0.006***	0.008**	0.005*
				(0.002)	*(0.004)*	*(0.003)*	*(0.002)*	*(0.004)*	*(0.003)*
Percentage of publications in UCRIndex, Latindex or Scopus							-0.758***	-0.605***	*-0.883****
							(0.137)	*(0.201)*	*(0.187)*
Average score per publications							*-0.184***	*0.067*	-0.341***
							(0.093)	*(0.160)*	*(0.110)*
Research evaluation							0.153***	0.141***	0.172***
							(0.034)	*(0.054)*	*(0.040)*
Teaching evaluation							0.083*	0.134*	0.054
							(0.049)	*(0.081)*	*(0.061)*
Community service evaluation							-0.036	-0.044	*-0.046*
							(0.040)	*(0.052)*	*(0.062)*
Inverse Mills ratio	*-0.707****	*-1.053****	*-0.315*	*-0.585****	*-0.927****	*-0.180*	*-0.674****	*-0.892****	*-0.402*
	(0.170)	*(0.230)*	*(0.257)*	*(0.165)*	*(0.221)*	*(0.251)*	*(0.161)*	*(0.216)*	(0.250)
Constant	-9.632***	-8.455***	-10.608***	-9.353***	-9.067***	-9.909***	-8.083***	-8.329***	-8.245***
	(1.779)	*(2.776)*	*(2.278)*	*(1.762)*	*(2.766)*	*(2.271)*	*(1.886)*	*(2.896)*	*(2.471)*
σ constant	0.974***	0.959***	0.978***	0.959***	0.938***	0.965***	0.916***	0.909***	0.904***
	(0.028)	*(0.044)*	*(0.037)*	*(0.028)*	*(0.043)*	*(0.036)*	*(0.028)*	*(0.045)*	*(0.036)*
Observations	809	355	*454*	809	355	*454*	809	355	*454*
F	32.38	14.10	20.86	26.43	11.66	*15.55*	26.22	10.09	17.20
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: * p<0.10; ** p<0.05; ***p<0.01.

Source: own elaboration using data from the Universidad de Costa Rica (2019).

regressors. Selection bias appears prominent for women but not men, raising future research questions about differences between female academics interested in promotion and those who are not.

The first model shows that, for the pooled, female and male samples, a higher alternative salary is related to a greater number of publications with a significance level of 1%. This is expected, as the opportunity cost variable was imputed considering characteristics associated with the accumulation of human capital, such as having a postgraduate degree, being bilingual, and work experience. Thus, a 1% increase in the female alternative salary is associated with a 1.36% rise in the number of publications, while the increase would be higher and equivalent to 1.56% for men.

In contrast, those with degrees related to higher wage premiums report fewer publications. This suggests that having a wage premium associated with the degree might indeed divert people's interest from academic research to other, better-paid activities. Further, this reward is increasing. Thus, a 1% increase in the wage premium is associated with a 1.7% decrease in the number of publications by female academics and a 2.1% decrease in male publications. As expected, the number of publications is also negatively related to how long it takes to get tenure: an additional year to tenure is associated with a 4.7% reduction in the number of publications for women and men. Furthermore, being a woman is associated with 20.2% fewer publications than men.

The second model controls for human capital. The number of publications is positively and significantly related to these variables, consistent with previous findings (Blanco, 2023b). No significant changes are observed in the coefficients associated with the variables of interest. In addition, for women, holding a PhD degree is associated with having 35.4% more publications compared to women without a PhD, while this increase is 29.4% among men. This highlights the importance of supporting training programs to develop the skills required for academia, especially for women, as this may help close the gender productivity gap. Additionally, attending a higher-ranked university is positively associated with more publications: each additional Times Higher Education ranking point increases publications by 0.6%, although this is slightly higher for women (0.8%) than for men (0.5%). These results are consistent with those previously obtained in Blanco (2023b).

Including additional control variables in the third model does not impact estimates for the variables of interest. Research evaluation scores are positively related to publication count, with each additional point increasing output by 14.1% for women and 17.2% for men. Also for men, the number of publications is negatively related to the average score obtained per publication and the proportion published in indexed journals, suggesting a compensatory trade-off between the costs of publishing and the volume of publications. This is consistent with the results previously found.

4. Discussion and conclusions

This article examines how the number of academic publications relates to the opportunity cost of working in academia versus other jobs in the labour market. The research was motivated by recent public sector wage policies that compress salaries and erode academics' purchasing power over time. The paper uses administrative datasets for the tenured academics at the Universidad de Costa Rica for whom there is information on training, experience, and publications. Further, the National Household Survey enabled estimation of Mincer wage equations to assess wage premiums for each discipline of study. The results show vast differences in how the labour market compensates the various disciplines. For example, graduates in medicine and law earn salaries over 60% and 40% higher, respectively, than those in other fields.

Regression analysis indicates that while academic salaries are higher than those in the labour market, academic productivity is positively and significantly related to potential outside salaries. Thus, it is foreseeable that those people who, due to their training and experience, face higher market wages tend also to be more productive academically. In contrast, those in high-premium fields produce less within academia. Further, this negative association between publications and the wage premium is increasing, since people will neglect or leave academia as their opportunity cost increases. This might explain why Medicine academics report considerably fewer publications than other departments with lower opportunity costs, such as the humanities. It may also explain why many Law academics do not pursue career advancements in academia, since their involvement with the university is partial and limited to teaching, rather than other substantive activities. It should also be noted that such policies affect university departments differ-

ently: disciplines with no positive wage premiums may attract more productive academics, whereas highly rewarded fields may struggle to retain talent. It is therefore important to reconsider policies that reduce public sector wages, as they might lower service quality not only in academia but in health, security, and other services provided by the central government.

Results also suggest that non-tenured academics face a publishing disadvantage, as time to tenure is negatively related to productivity. This might partly be because non-tenured academics are primarily hired for teaching rather than research or community work. However, under such circumstances, it is worth asking whether it is appropriate to have a hiring policy that results in individuals spending an average of nearly eight years on temporary employment contracts, which may hinder their ability to develop their academic careers fully. If a person works between 30 and 35 years of their life, they will spend between a fifth and a quarter of that time facing job instability and likely focusing entirely on teaching. Since research, particularly publishing, is the primary mechanism for academic advancement, it seems more sensible to develop more efficient hiring policies.

These policies should facilitate the selection of academics, ensuring that only those meeting productivity and tenure standards are retained long-term. Conversely, these policies should identify and support individuals with the necessary skills, allowing them to pursue doctorates at well-qualified universities. This would help them develop research-related skills and return to stable, research-oriented positions. Such a policy would ultimately benefit both the university and society.

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Conflict of interest

Although the author is a professor at the Universidad de Costa Rica, the development of this research respects the ethical standards of academia. The author does not benefit from the writing or publication of this article.

Ethical implications

The author has no ethical implications that should be declared in the writing and publication of this article.

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