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Who Comes First and Who Gets Cited? A 25-Year Gender Perspective on First-Author Impact in Web of Science Economics. Evidence from Romania-Affiliated Publications

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Abstract

The aim of this research is to provide a 25-year gender perspective on first-author impact in Economics articles that include at least one Romanian-affiliated author, published in Web of Science journals over 2000-2025. Drawing on 4030 papers, we map the bibliometric gender gap by examining first-author status, collaboration patterns, research topics and citation counts. The results show that the female-to-male first-author ratio for Romanian-affiliated publications is close to parity, in sharp contrast to the pronounced under-representation of women, among foreign-affiliated first authors. Using Negative Binomial models, quantile regressions, and robustness checks, we find no systematic or robust gender penalty in citations once structural and topical factors are controlled for. The initial gender gap observed largely reflects men's over-representation in higher-impact journals rather than an intrinsic bias against women's work. Team size consistently emerges as the strongest predictor of citations, and, by extension, scientific visibility. Our findings offer valuable insights into gender dynamics in a semi-peripheral scientific system, highlighting the nuanced interplay between institutional context, research practices, legislation and academic recognition.

Keywords: bibliometrics; gender-gap; first author; networks; citations

JEL Code: J16; I23

1. Introduction

Over the past three decades, collaborative authorship of scientific papers by research teams has become standard practice across academia (Wuchty et al., 2007; Ghosh and Liu, 2020), reshaping virtually every discipline, from mathematics, physics, chemistry and engineering to the social sciences and humanities. This development has boosted research productivity, fostered interdisciplinary dialogue and methodological rigour, and enhanced the visibility and replicability of scientific results. The shift from single-authored works to those produced by research teams is equally evident in Economics. Rath and Wohlrabe (2016) report a persistent rise in the mean number of authors per economics article, from 1.56 in 1991 to 2.23 in 2013. Bibliometric evidence consistently shows expanding team sizes, increasing international collaboration and a broader adoption of interdisciplinary approaches. Today, most papers published in elite economics journals are collaborative endeavours involving authors affiliated with institutions in at least two countries (Rath & Wohlrabe, 2015; Kuld & O'Hagan, 2018; Aigner et al., 2025).

The proportion of women in scientific research has risen markedly (Boekhout et al., 2021); nevertheless, they remain under-represented, especially at the highest levels, across several dimensions: productivity, collaboration patterns, first-author position and citation impact. Gender disparities in scientific productivity and first-author status were noted as early as the 1980s. Cole and Zuckerman (1984), for example, analysed a sample of 526 scholars who earned their doctorates

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between 1969 and 1970 and found that, on average, in the first twelve post-doctoral years men published 11.2 papers, compared with 6.4 for women, yielding a female-to-male ratio of 0.57; this difference is statistically significant. The result is corroborated by Long (1992), who emphasises that the productivity gap among biochemists appears very early in their careers and persists over the long term. Xie and Shauman (1998) document a similar effect across disciplines, showing that female researchers publish fewer articles than their male counterparts, not because of a direct gender effect, but because they typically have fewer resources, weaker institutional positions and smaller collaboration networks to sustain their productivity.

McDowell et al. (2007) examine the academic labour market and show that collaboration networks and institutional factors shape the likelihood of publishing as first author; although these mechanisms still favour men, gender gaps in access to collaborative networks evolve over time as women become better represented in academia and research. A gender disparity in first-author positions in top journals, again to the disadvantage of women, is likewise documented by Pico et al. (2020) for geoscience. In Economics, the number of female first authors in elite journals, and their position within collaboration networks, is markedly lower and more clustered than that of men (McDowell et al., 2007; Liu et al., 2020; Hengel and Moon, 2022).

Citations, often used as a proxy for scientific impact and visibility, should ideally reflect a paper's intrinsic quality and originality, yet recent bibliometric research reveals asymmetric gender effects. Larivière et al. (2013) show that publications with a woman as first or last author attract fewer citations than those with men in these positions. At national level the evidence is mixed. Nielsen (2016) finds no significant gender differences in citation or self-citation rates among Danish researchers, except in medical fields, while Thelwall (2018) reports no marked citation bias against women in countries with mature science systems (Spain, the United Kingdom and the United States) but pronounced disadvantages in Turkey and India; he also stresses that conclusions depend on the normalisation method used to compare disciplines. In gender-mixed teams, both male and female researchers garner more citations when they have a female co-author than when the co-author is male (Hengel and Moon, 2022). Sarsons (2017) further shows that gender-mixed co-authorship does not confer the same career benefits on women as on men: women receive lower rewards for collaborating with men, whereas men are evaluated similarly whether they publish alone or with others. This so-called *female co-author penalty* (Sarsons, 2017; Hussey et al., 2021; Gërxhani et al., 2023; Brooks et al., 2025) undermines women's visibility and the recognition of their scientific contribution. The international academic community is therefore debating whether journals should explicitly state each author's individual contribution to curb gender bias.

Maddi and Gingras (2021) show that gender-mixed teams accrue 10-20% more citations than single-gender teams. Team heterogeneity thus acts both as a driver of visibility and as a potential locus of asymmetric reward allocation, and collaboration practices vary substantially across specialties and disciplines. Moreover, Araújo and Fontainha (2017) demonstrate that gender imbalance shapes not only publication volumes but also the topology of topic networks. Similar analyses by Abramo et al. (2018) and Bravo-Hermsdorff et al. (2019) further clarify the mechanisms that generate and perpetuate gender bias in scientific research.

Bibliometric analysis has concentrated on mature science systems in the United States and Western Europe, or on broad international samples, whereas semi-peripheral research systems, such as Romania's, remain under-explored, despite transformations that may interact uniquely with gender dynamics. Since Romania's accession to the European Union in 2007, Romanian economic research has internationalised rapidly, offering an ideal setting in which to test whether patterns observed in core countries also apply in a semi-peripheral context.

Addressing this gap, the present study aims to examine: (1) whether gender disparities exist in the first-author position for Economics articles published in Web of Science journals between 2000 and 2025 that include at least one author affiliated with a Romanian institution, with nuanced analyses and sub-grouping by the local or international affiliation of the first author; (2) how first-author gender affects article visibility, measured by Web of Science citations, comparing papers led

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by women and men in the overall corpus and in five additional subsets detailed below; (3) the influence of legislative changes during this period on the gender dynamics of publications; and (4) the extent to which article topic moderates these gender differences, that is, whether particular subjects favour female first authors or, conversely, penalise them in terms of citations. Employing negative binomial models, quantile regressions and robustness checks, we seek to determine whether and why the *gender penalty* persists in both first-author roles and citation counts, and to assess how the Romanian institutional context and article topic mitigate or exacerbate these inequalities.

To the best of our knowledge, no bibliometric study of Romanian peer-reviewed economic publications spans this 25-year period. Our contribution therefore lies both in systematically charting the bibliometric gender gap across a quarter-century of Romanian economic research and in clarifying the role of gender in researchers' scientific visibility.

2. Data Gathering and Variables

The empirical analysis rests on a corpus of articles indexed in the Web of Science Core Collection (WoS), Economics category, published between 2000 and 2025 that include at least one author affiliated with a Romanian institution. The query used was "WC=(Economics) AND CU=(Romania) AND PY=(2000-2025) AND DT=(Article)", executed on 15 May 2025. The WoS export function returned 6725 records, downloaded in seven Excel files (the WoS limit is 1000 per file) and subsequently imported, concatenated and processed in SPSS 26.0 and R 4.4.3.

To obtain a homogeneous sample, the raw set underwent rigorous filtering. We retained only records marked with the letter "J" in the Publication Type field (the WoS code for journal articles, 6510 in total, 96.8% of the raw set), excluded duplicate items[1] (2) and articles that, although retrieved under "CU = Romania", had no author affiliated in Romania[2] (6). After cleaning, the analysis set comprised 6502 articles.

The initial query also retrieved 2458 articles classified as Agricultural Economics and Policy and 14 articles classified as Agricultural Economics and Policy, Food Science and Technology. These items lacked the Economics label and were assigned the research areas Agriculture or Agriculture, Food Science and Technology. Because the present study focuses on WoS Economics articles, we retained only papers carrying the Economics label, either alone or together with other economics labels, and excluded the 2472 agriculture items. The resulting data set, containing 4030 observations, includes extended bibliometric metadata (authors' full names, article title, journal name, language, keywords, keywords plus, abstract, affiliations and addresses, WoS category, citation count, open-access status and so forth).

Several additional analytical variables were derived. From Author Full Names we extracted the given name of the first author, and using the paid version of GenderAPI we assigned each name a gender label (*female* or *male*). Given names assigned with a probability below 80% were checked manually. We then reviewed and corrected missing or inaccurate information in the first author's affiliation. A binary variable, Ro_author (*True* or *False*), flags whether the first author is affiliated with a Romanian institution; the *True* category includes both Romanian scholars as well as a small number of foreign doctoral candidates enrolled at Romanian Universities, while the *False* category covers foreign scholars and Romanians affiliated abroad. One article had an empty Affiliations_first field, although the author's name is Romanian; manual inspection in WoS revealed a Romanian address, so the record was retained.

Based on the 4030 Economics-labelled articles we constructed, for robustness, another five subsets: *Economics pure* (1719 items containing only the Economics label), *Ro_author total* (3475 items), *Ro_author Economics pure* (1414 items), *Foreign_author total* (555 items) and *Foreign_author Economics*

[1] WOS:000422179700019 and WOS:000422170800044

[2] WOS:000456093800005, WOS:000306250600005, WOS:000422170800049. WOS:000758146600003, WOS:001252822700006 and WOS:000915982800001

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pure (305 items). Using WoS Categories, we defined the MultiDisc variable to capture multidisciplinarity, coded 0 for monodisciplinary articles (Economics only, 1719 items) and 1 for multidisciplinary articles (at least one additional label beyond Economics, 2311 items). We also recorded Num_authors, the total number of authors per paper, and created three dummies for open-access designation: OA_GG = 1 if the label contains gold or green, including any hybrid combination (1575 items); OA_Unknown =1 if the label is exactly "Unknown" (2300 items); Closed/Hybrid = 1 when the label contains neither gold nor green and is not 'Unknown', that is, cases labelled bronze or solely hybrid (155 items).

We underline that the unit of analysis is the individual article, each observation representing a study published in a journal indexed by WoS in the Economics category.

3. Econometric Analysis

As a first step in the econometric analysis, we examined whether the gender distribution of first authors departs significantly from the theoretical parity of 50%-50%. We applied a χ^2 goodness of fit test (df=1), under the null hypothesis that the proportions of women and men are equal. The results, namely the χ^2 and Cramer's V effect size, are presented in Table 1.

Table 1. Results of χ^2 Test.

Group	Women	Men	N	$\chi^2(1)$	p-value	Cramer's V
Total	1957	2073	4030	3.339	0.068	0.029
Economics pure	841	878	1719	0.796	0.372	0.022
Ro_author total	1782	1693	3475	2.279	0.131	0.026
Ro_author Economics pure	748	666	1414	4.755	0.029	0.058
Foreign_author total	175	380	555	75.721	0.000	0.369
Foreign_author Economics pure	93	212	305	46.430	0.000	0.390

Source: authors' calculation using SPSS 26.0 and R 4.4.3.

The $\chi^2(1)$ on the representation of women as first authors point to a nuanced pattern that varies across sub-groups. For all the dataset, the female-to-male proportion, 48.6% versus 51.4%. is only marginally significant at $p = 0.068$ (significant at the 10% level, but not at 5% level), and the effect size is very small, V = 0.0287. In the *Economics pure* subset, the distribution remains virtually equal, $\chi^2(1) = 0.796, p = 0.372, V = 0.022$. The picture changes, however, once affiliation is considered. Among articles whose first author is affiliated with a Romanian institution there is no statistically significant overall difference, yet the data show a slight over-representation of women. More strikingly, in the specific case of *Economics pure* articles with a Romanian affiliated first author the difference is statistically significant in favour of women $\chi^2(1) = 4.755, p = 0{,}029$, although the effect is small, V = 0.058. The sharpest contrast emerges for articles whose first author is affiliated outside Romania: women account for only 31.53% in the full corpus and 30.49% in *Economics pure*. These gender gaps are highly significant and associated with moderate-to-large effect sizes, V = 0.369 and V = 0.390 respectively. In conclusion, the gender imbalance observed in the overall sample stems almost entirely from the output of foreign-based authors, whereas Romanian-based economics publications remain close to parity, with only minor deviations, a noteworthy feature.

At the next stage we sought to analyse the factors that influence the number of Web of Science citations, with gender as the focal variable. We began with a Poisson model, which is appropriate for count data. The Poisson specification assumes that $Var(Y) = E(Y)$, where Y denotes the WoS citation count. We tested this assumption for overdispersion by examining the Pearson χ^2 statistic divided by the degrees of freedom and by applying the Cameron and Trivedi score test implemented in the AER package in R.

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As shown in Table 2, the dispersion coefficient φ ranges from 18.52 to 67.60 across all subsets ($p < 0.001$), signalling severe over-dispersion. Accordingly, we estimated a Negative Binomial model. The estimated dispersion parameter θ (0.47 – 0.57, values below 1) further confirms the departure from the Poisson assumption. For the full data set, ΔAIC = 43597.6 with $p < 0.001$, while for the remaining subsets ΔAIC lies between 5954.2 and 26387.5, again with $p < 0.001$ in every case. In short, the Negative Binomial specification offers a markedly better fit than the Poisson model for each analysed subset.

Table 2. Overdispersion test and comparison between the Poisson and Negative Binomial models.

Subset	Pearson χ^2	df	φ	p Pearson	z AER	p AER	θ	AIC Poiss.	AIC NB	p LRT
Total	141487.48	4 028	35.13	0.000	3.18	0.000	0.52	67 291.1	23693.5	0.000
Economics pure	43406.25	1 717	25.28	0.000	7.19	0.000	0.47	27 955.6	9 903.8	0.000
RO_author total	74837.97	3 473	21.55	0.000	5.07	0.000	0.57	45 882.3	19494.8	0.000
RO_author Economics pure	26152.38	1 412	18.52	0.000	6.03	0.000	0.52	18 052.5	7 670.2	0.000
Foreign_author total	37381.25	553	67.60	0.000	1.81	0.035	0.47	17 398.1	3 963.0	0.000
Foreign_authorEconomics pure	10851.14	303	35.81	0.000	4.53	0.000	0.48	8 089.8	2 135.6	0.000

Source: Authors' calculation using R 4.4.3.

The Negative Binomial model estimated for the complete corpus and for each of the five subsets takes the following general form:

$$\ln(E[Y_i]) = \beta_0 + \beta_1 Female_i + \beta_2 MultiDisc_i + \beta_3 lnAuthors_i + \beta_4 OA_{GG_i} + \beta_5 OA_{Unknown_i}$$

where Y_i is the number of WoS citations for article i, and Y_i follows a Negative Binomial($\mu_i . \theta$) distribution, with $\mu_i = \exp(\beta_0 + \beta_1 Female_i + \beta_2 MultiDisc_i + \beta_3 lnAuthors_i + \beta_4 OA_{GG_i} + \beta_5 OA_{Unknown_i})$. Incidence-Rate Ratios (IRR) presented in Table 3 are exp (β_j).

Table 3. Summary results of the Negative Binomial model.

Variables	**Total**	**Economics pure**	**RO_author total**	**RO_author Economics pure**	**Foreign_ author total**	**Foreign_ Author Economics pure**
Female	0.901 [0.825- 0.984]**	0.865 [0.752- 0.996]**	1.005 [0.917- 1.102]	0.917 [0.787- 1.068]	0.869 [0.669- 1.139]	1.037 [0.721- 1.514]
MultiDisc	0.980 [0.895- 1.072]	-	1.079 [0.980- 1.188]	-	1.035 [0.810- 1.323]	-
LnAuthors	1.633 [1.51 - 1.764]**	1.891 [1.67 - 2.131]**	1.300 [1.195- 1.414]**	1.572 [1.379- 1.792]**	2.069 [1.561- 2.763]**	1.446 [0.876- 2.381]
OA_GG	1.102 [0.865- 1.388]	0.892 [0.649- 1.200]	1.080 [0.825- 1.392]	0.865 [0.607- 1.201]	1.394 [0.805- 2.293]	1.149 [0.557- 2.175]
OA_Unknown	1.095 [0.860- 1.375]	0.942 [0.685- 1.268]	1.007 [0.770- 1.296]	0.870 [0.609- 1.209]	1.610 [0.935- 2.631]	1.230 [0.604- 2.284]

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Source: Authors' calculations in R 4.4.3 (MASS package); results cross-checked in IBM SPSS Statistics 26.0. ** $p < 0.05$;"-" variable constant within the subset (not included in the model).

The Negative Binomial estimates indicate that, in the full corpus, Economics papers whose first author is a woman receive, on average, 9.9 % fewer WoS citations than those whose first author is a man, a difference that is statistically significant. The gap widens in the *Economics pure* subset, reaching -13.5%. By contrast, for articles whose first author is affiliated with a Romanian institution, no statistically significant gender difference emerges; the same holds for Romanian-affiliated authors publishing in *Economics pure* journals. Hence, the citation penalty for female first authors is concentrated in the overall (and especially the *Economics pure*) international literature, while it disappears in output led from within Romania, suggesting that citation dynamics for women vary with national context and sub-field characteristics.

Multidisciplinarity has no significant effect on citation counts in any subset. Team size, however, is the strongest predictor: a one-unit increase in LnAuthors, roughly a doubling of the number of co-authors, is associated with a 63.3% rise in citation rate, a large and highly significant effect. The association is even stronger in *Economics pure* articles (+89.1%). For locally affiliated first authors the effect is positive and significant, though smaller (+30%), whereas for first authors based abroad it is largest: a one-unit rise in ln(Authors) corresponds to a +106.9% increase, again highly significant. In the first author affiliated abroad *Economics pure* subset, the coefficient remains positive but is not statistically significant.

Open-access route, Gold or Green versus Unknown versus Closed/Hybrid, does not significantly influence citation counts in any subset (confidence intervals include 1 and coefficients fail to reach the 5 per cent level). Overall, the gender citation penalty is confined to internationally produced economic papers (particularly *Economics pure*), whereas editorial practice in Romania appears neutral with respect to the first author's gender. The benefits of larger collaborations are strong and gender-neutral, and multidisciplinarity does not confer additional visibility in the analysed data.

To test whether the impact of gender on citation counts varies according to an article's interdisciplinary character, we re-estimated the baseline Negative Binomial model, adding the interaction term *Female* × *MultiDisc* and retaining the same control variables. The likelihood-ratio test showed no significant improvement in model fit ($\chi^2(1)=1.00$; $p = 0.32$ for the full set, $\chi^2(1)=2.49$; $p = 0.11$ for articles whose first author is affiliated abroad, and $\chi^2(1)=3.24$; $p = 0.07$ for articles whose first author is locally affiliated. In subsets that contain no multidisciplinary papers with a female first author the interaction cannot be estimated. Consequently, we kept the specification without interactions and conclude that any citation advantage or disadvantage associated with multidisciplinarity does not differ statistically by the gender of the first author.

After estimating the Negative Binomial models for the total corpus and the five subsets, we computed average marginal effects with the MASS, marginaleffects and estimatr packages, using HC0 robust standard errors. The average marginal effect (AME) of the *Female* variable represents the estimated difference in the expected citation count between papers whose first author is a woman and those whose first author is a man, holding all other control variables constant. The AME estimates and their 95% confidence intervals are presented in Table 5.

Table 5. AME results, values expressed in WoS citations.

Group	AME	SE	CI_low	CI_high	z	*p-value*
Total	-2.052	1.841	-5.661	1.556	-1.11	0.265
Economics pure	-0.735	0.682	-2.072	0.602	-1.08	0.281
RO_author total	0.255	0.407	-0.542	1.052	0.63	0.531
RO_author Econ pure	-0.002	0.561	-1.102	1.097	0.00	0.996
Foreign_author total	-2.088	2.664	-7.309	3.133	-0.78	0.433

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Foreign_author Economics pure	1.374	2.822	-4.157	6.906	0.49	0.626

Source: Authors' calculation using R 4.4.3; MASS package, dplyr, marginaleeffects and estimatr.

Re-estimating the Negative Binomial models and computing AMEs with robust standard errors show that *Female* has no statistically significant effect on WoS citation counts in any of the six samples. For the full corpus, the estimated difference is –2.052 citations (p = 0.265), suggesting a downward tendency but lacking statistical significance. Across the thematic and affiliation-based subsets, *Economics pure*, local affiliated authors, or abroad affiliated authors, the AMEs range from –2.088 to +1.374, and all their 95% confidence intervals include zero. Consequently, there is no robust evidence of a gender gap in citations, either for the overall body of articles or for first authors with local affiliation.

To capture the heterogeneity of the citation distribution, which features a long tail and a dense mass of poorly cited papers, we estimated quantile regressions at four representative percentiles, τ = 0.25, τ = 0.50 (the median), τ = 0.75 and τ = 0.90. Unlike mean-based models such as Negative Binomial or OLS, quantile regression yields separate coefficients for each segment of the distribution, thereby addressing the question: *what is the effect for the article that lies at percentile* τ?. Observations are ordered directly by their actual citation counts, avoiding the distortions introduced by journal-level bibliometric indicators. This approach allows us to test whether first-author gender, interdisciplinarity or team size affect impact uniformly or only for articles near the top of the ranking. The quantile regression results are summarised in Table 6.

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Table 6. Quantile regression results.

Variables	**τ = 0.25**	**τ = 0.50**	**τ = 0.75**	**τ = 0.90**
Total				
Female	0.106 [-0.024; 0.236]	0.220 [-0.084; 0.523]	0.147 [-0.664; 0.958]	-0.909 [-3.070; 1.252]
MultiDisc	0.136 [-0.004; 0.277] *	-0.073 [-0.380; 0.233]	-0.687 [-1.550; 0.176]	-1.818 [-4.129; 0.493]
LnAuthors	0.167 [0.093; 0.240] **	0.585 [0.440; 0.731] **	1.698 [1.284; 2.113] **	3.182 [2.141; 4.222] **
Economics pure				
Female	-	-	-	-
MultiDisc	-	-	-	-
LnAuthors	-	-	-	-
RO author total				
Female	0.143 [0.015; 0.271] **	0.355 [0.045; 0.665] **	0.625 [-0.125; 1.375]	1.150 [-0.619; 2.919]
MultiDisc	0.163 [0.008; 0.319] **	0.226 [-0.107; 0.558]	-0.250 [-1.068; 0.568]	-0.750 [-2.607; 1.107]
LnAuthors	0.143 [0.068; 0.218] **	0.355 [0.215; 0.495] **	1.125 [0.740; 1.510] **	1.783 [0.951; 2.615] **
RO author *Economics pure*				

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Female	-	-	-	-
MultiDisc	-	-	-	-
LnAuthors	-	-	-	-
Foreign author total				
Female	0.074 [-0.664; 0.812]	0.746 [-0.907; 2.399]	0.273 [-4.217; 4.764]	3.774 [-8.349; 15.897]
MultiDisc	0.296 [-0.443; 1.035]	0.313 [-1.145; 1.770]	-1.063 [-5.470; 3.345]	-9.283 [-21.635; 3.069]
LnAuthors	0.333 [-0.103; 0.769]	1.002 [0.153; 1.852] **	2.383 [0.624;4.141] **	3.736 [-1.963; 9.435]
Foreign author *Economics pure*				
Female	-	-	-	-
MultiDisc	-	-	-	-
LnAuthors	-	-	-	-

Source: Authors' calculations in R 4.4.3; results cross-checked in IBM SPSS Statistics 26.0; -" **" $p < 0.05$. "*" $p < 0.10$.

Quantile regressions confirm that WoS citation impact is shaped almost entirely by team size. The coefficient on LnAuthors rises steeply from +17% at the 25th percentile to +59% at the median and exceeds +300 % in the top decile; it is statistically significant in every subset where the variable varies. The effect of MultiDisc is ambivalent, showing a slight advantage for poorly cited articles (τ= 0.25, $p < 0.10$) but a negative and imprecise coefficient at the upper end of the impact scale, suggesting that interdisciplinarity does not propel papers that are already highly cited. The variable *Female* remains not significant across the entire distribution, with confidence intervals crossing zero in all subsets and quantiles, so no gender gap is detected either among low-cited or highly visible articles. The *Economics pure* and *Ro_author Economics pure* subsets provide too little variation to estimate coefficients, indicating that in these very specialised niches certain attributes, such as multidisciplinary, are virtually absent. Overall, the quantile-regression results show that team size is the principal determinant of citations across the full impact range, whereas first-author gender and multi-field orientation do not produce robust or consistent effects.

To investigate whether national promotion policies have shaped the gender distribution of publications and their scientific visibility, we split the entire 2000 to 2025 span into three-time windows that align precisely with the major regulatory changes to the promotion standards for professors and associate professors in Economic Sciences. First, 2000 to 2010, the pre-standardisation period, when the only legal framework was the Education Act 84/1995. Second, 2011 to 2016, starting with the National Education Act 1/2011, which introduced national minimum standards for academic appointments and titles. Order 6560/2012 provided the first stable, detailed set of threshold criteria for each scientific field, including economics, explicitly requiring a minimum number of Web of Science (WoS) articles and citations and publication in journals with a specified impact factor or recognised indexing. These rules substantially increased the pressure on staff to publish in prestigious international journals and accumulate citations, bringing Romanian requirements into line with international academic standards. Third period, 2017 to 2025, when Order 6129/2016 tightened the thresholds still further (for example, mandating a minimum number of WoS articles with an Article Influence Score above 0.15 and specific citation counts) and remained in force until the CNATDCU revision draft of 2025. The heightened demands intensified the drive to publish in

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high-quality journals and to generate impact, encouraging larger teams and more international collaboration.

This segmentation allows us to test directly whether the introduction of bibliometric standards in 2011 and their subsequent strengthening in 2016 amplified or reduced gender differences in scientific visibility. Such standards can influence publishing behaviour and journal placement, thereby indirectly affecting the distribution of citations across genders. For this analysis we employed the same Negative Binomial model as in the previous sections, estimating it separately for each of the three policy-defined periods: 2000 to 2010, 2011 to 2016 and 2017 to 2025. The results are presented in Table 7.

Table 7. Incidence-Rate Ratio (IRR) for the explanatory variables, across the three legislative windows.

Group	2000-2010	2011-2016	2017-2025
Female			
Total	1.258 [1.017 – 1.557] **	0.761 [0.655 – 0.884] **	0.943 [0.834 – 1.066]
Economics pure	0.967 [0.647 – 1.461]	0.802 [0.610 – 1.057]	0.896 [0.749 – 1.072]
RO author total	1.326 [1.067 – 1.650] **	0.847 [0.727 – 0.987] **	1.046 [0.915 – 1.193]
RO author Economics pure	1.089 [0.713 – 1.681]	0.867 [0.654 – 1.151]	0.927 [0.758 – 1.132]
Foreign author total	0.951 [0.349 – 2.916]	0.692 [0.391 – 1.293]	0.966 [0.717 – 1.312]
Foreign author Economics pure	0.214 [0.046 – 0.987] **	0.902 [0.390 – 2.393]	1.106 [0.735 – 1.694]
Multidisc			
Total	0.746 [0.592 – 0.935] **	1.207 [1.024 – 1.421] **	0.986 [0.871 – 1.116]
Economics pure	-	-	-
RO author total	0.749 [0.588 – 0.949] **	1.414 [1.187 – 1.681] **	1.059 [0.924 – 1.213]
RO author Economics pure	-	-	-
Foreign author total	0.958 [0.444 – 2.078]	0.963 [0.579 – 1.610]	1.032 [0.775 – 1.377]
Foreign author Economics pure	-	-	-
LnAuthors			
Total	1.529 [1.262 – 1.854] **	1.642 [1.425 – 1.892] **	1.668 [1.493 – 1.865]**
Economics pure	1.226 [0.859 – 1.756]	2.268 [1.747 – 2.950] **	2.007 [1.719 – 2.341]**
RO author total	1.422 [1.162 – 1.741]**	1.296 [1.110 – 1.512] **	1.330 [1.179 – 1.501]**
RO author Economics pure	1.051 [0.710 – 1.562]	1.698 [1.295 – 2.236] **	1.701 [1.435 – 2.016]**
Foreign author total	2.289 [0.908 – 6.250]	2.838 [1.559 – 5.509]**	2.133 [1.496 – 3.073]**
Foreign author Economics pure	5.561 [1.240 – 25.798]**	4.759 [1.115 – 22.762]**	1.581 [0.832 – 2.985]
OA_GG			
Total	0.983 [0.150 – 4.156]	1.613 [0.954 – 2.604]	1.097 [0.820 – 1.442]
Economics pure	0.226 [0.003 – 2.084]	0.805 [0.336 – 1.665]	0.934 [0.654 – 1.300]
RO author total	1.073 [0.023 – 9.740]	1.494 [0.888 – 2.410]	1.054 [0.754 – 1.439]
RO author Economics pure	0.822 [0.300 – 3.079]	0.700 [0.293 – 1.446]	0.908 [0.607 – 1.316]
Foreign author total	1.074 [0.109 – 9.013]	1.542 [0.031 – 11.581]	1.443 [0.801 – 2.450]

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Foreign author Economics pure	0.075 [0.003 – 1.846]	1.805 [0.018 – 17.795]	1.139 [0.527 – 2.232]
OA_Unknown			
Total	0.333 [0.057 – 1.060]	0.837 [0.506 – 1.314]	1.354 [1.006 – 1.793]**
Economics pure	0.198 [0.003 – 1.288]	0.609 [0.256 – 1.241]	1.074 [0.746 – 1.512]
RO author total	0.863 [0.020 – 5.944]	0.830 [0.506 – 1.296]	1.091 [0.775 – 1.503]
RO author Economics pure	-	0.553 [0.234 – 1.122]	0.925 [0.610 – 1.363]
Foreign author total	0.308 [0.047 – 1.428]	0.847 [0.017 – 6.000]	2.087 [1.155 – 3.558]**
Foreign author Economics pure	0.036 [0.002 – 0.390]**	1.121 [0.011 – 10.201]	1.415 [0.659 – 2.744]

Source: Authors' calculations in R 4.4.3; results cross-checked in IBM SPSS Statistics 26.0; "**" $p < 0.05$.

Table 7 shows that, although the gender gap fluctuated with each set of bibliometric standards, team size consistently remained the primary driver of citation visibility, whereas multidisciplinarity and open access exerted only temporary, limited effects. In the pre-standardisation period (2000–2010) the global *Female* coefficient was positive, implying about 25.8% more citations for papers whose first author was a woman, statistically significant save for a pronounced disadvantage among *Economics pure* articles by foreign affiliated authors (IRR = 0.214, $p < 0.05$). During the same interval multidisciplinary papers were penalised (IRR = 0.746, $p < 0.05$) and Gold/Green or Unknown open access had no significant impact. After the WoS thresholds were introduced (2011–2016) a significant overall penalty emerged for *Female* (IRR ≈ 0.761, $p < 0.05$), yet the gap vanished in all subsets led by local or abroad affiliated Economics pure authors; this window also brought a visibility bonus for multidisciplinarity (IRR = 1.207, $p < 0.05$) and a one-unit rise in LnAuthors lifted citations by 64.2% (IRR = 1.642, $p < 0.05$). Gold/Green open access remained non-significant, and OA_Unknown still had no effect. After the criteria were tightened (2017–2025) all *Female* IRRs reverted to roughly 1 and lost significance, multidisciplinary ceased to offer a consistent advantage and open access stayed inconclusive apart from a modest positive effect for OA_Unknown globally (IRR = 1.354, $p < 0.05$). Team size, by contrast, continued to dominate in every period a one-unit increase in LnAuthors produced between +52% and +67% more citations (all $p < 0.05$) in the full corpus and every subset. In conclusions, the gender gap surfaced only sporadically, chiefly in the international arena and immediately after 2011, while multidisciplinarity and OA failed to yield a robust visibility premium; team size, however, exerted a constant and substantial influence throughout 2000-2025.

To probe the robustness of our findings we re-estimated a Poisson model with journal fixed effects, using the fepois function in *fixest*, which absorbs all time-invariant journal characteristics, prestige, disciplinary scope and so forth. The MultiDisc variable is omitted, as the fixed effects implicitly control for journal type. Under this specification the coefficient on *Female* is not statistically significant in most samples (IRR 0.75–1.02, $p > 0.10$), apart from a marginal disadvantage, significant at $p < 0.10$, for first authors affiliated abroad. This suggests that the initial gender differences stemmed from the over-representation of men in higher-impact journals rather than from any intrinsic quality gap. Team size remains a robust predictor: doubling the number of authors raises citations by about 17.8 % in the full set and 11.5 % among locally affiliated first authors. Gold/Green open access boosts visibility by roughly 90% in the full corpus and in the Ro_author total subset, and the OA_Unknown label is likewise positive and significant in those samples. The results in Table 8 therefore reinforce the conclusion that there is no systematic citation penalty for women, save for a marginally significant disadvantage among first authors based abroad.

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Table 8. Poisson model with journal fixed effects, estimated using the *fepois* function (fixest package).

Group	N	IRR Female	Δ % citări (dublare autori)	IRR OA_GG	IRR OA_Unknown
Total	4030	0.916	+17.8%	1.896**	1.850**
Economics pure	1719	0.908	+18.1%	1.531	1.525
Ro_author total	3475	1.009	+11.5%	1.913**	1.815**
Ro_author pure	1414	1.015	+12.7 %	1.453	1.471
Foreign_author total	555	0.794*	+17.6 %	1.720	1.715
Foreign_author pure	305	0.752	+7.2%	1.209	1.479

Source: Authors' calculation using R 4.4.3; **$p < 0.05$; *$p < 0.10$; elasticity with respect to a doubling of team size is $(e^{\beta ln2} - 1) \times 100$; β= Poisson coefficient of LnAuthors.

To check whether the estimated penalty simply reflects the fact that women publish more often in recent years, years that have had less time to accumulate citations, we re-estimated every Negative Binomial model with year fixed effects (2000–2025). Once publication year and the other controls are absorbed, the *Female* coefficient remains insignificant in almost all sub-groups, showing only marginal significance in the full corpus ($p = 0.08$). By contrast, the log of team size retains a strong positive effect everywhere. The multidisciplinarity indicator generally reduces citations: in the full set IRR ≈ 0.881 (95%CI 0.808–0.961; $p < 0.001$), in *Ro_author total* IRR ≈ 1.037 ($p = 0.44$, not significant), and in *Foreign_author total* IRR ≈ 0.807 ($p = 0.06$, marginal). Articles tagged Open Access-Gold/Green (OA_GG) attract fewer citations in most sub-groups; the effect is not significant for abroad-affiliated authors. Papers with OA_Unknown status likewise show a significant negative effect in the total corpus, in *Economics pure* and in *Ro_author Economics pure*, but not among authors based abroad. Overall, once year dummies and covariates are included, *Female* is consistently non-significant, LnAuthors reliably lifts citation counts, while multidisciplinary articles and those labelled OA_GG or OA_Unknown tend to receive fewer citations, particularly among Romania-affiliated authors.

Table 9. Effect of the *Female* variable on citations after controlling for year dummies, Negative Binomial models, IRR and 95 % CI.

Group	IRR	95 % CI	*p-value*
Female			
Total	0.928	0.853-1.009	0.08*
Economics pure	0.918	0.801-1.052	0.21
RO author total	1.053	0.966-1.149	0.24
RO author Economics pure	0.965	0.834-1.116	0.63
Foreign author total	0.992	0.771-1.281	0.94
Foreign author Economics pure	1.214	0.853-1.745	0.25
Multidisc			
Total	0.881	0.808-0.961	0.00**
Economics pure	-	-	-
RO author total	1.037	0.946-1.137	0.44
RO author Economics pure	-	-	-
Foreign author total	0.807	0.634-1.027	0.06*
Foreign author Economics pure	-	-	-
LnAuthors			

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Total	1.840	1.701-1.991	0.00**
Economics pure	2.283	2.014-2.588	0.00**
RO author total	1.447	1.332-1.572	0.00**
RO author Economics pure	1.802	1.587-2.048	0.00**
Foreign author total	2.117	1.595-2.848	0.00**
Foreign author Economics pure	1.548	0.876-2.772	0.07*
OA_GG			
Total	0.746	0.586-0.941	0.01**
Economics pure	0.685	0.500-0.922	0.01**
RO author total	0.673	0.513-0.872	0.00**
RO author Economics pure	0.582	0.409-0.812	0.00**
Foreign author total	1.066	0.636-1.717	0.79
Foreign author Economics pure	0.973	0.486-1.813	0.93
OA_Unknown			
Total	0.765	0.601-0.963	0.02**
Economics pure	0.770	0.563-1.036	0.09*
RO author total	0.590	0.449-0.765	0.00**
RO author Economics pure	0.577	0.403-0.809	0.00**
Foreign author total	1.215	0.729-1.944	0.43
Foreign author Economics pure	1.040	0.526-1.912	0.90

Source: Authors' calculations in R 4.4.3; results cross-checked in IBM SPSS Statistics 26.0; **$p < 0.05$; *$p < 0.10$.

The Web of Science export provides only the aggregate indicator Citations_WoS, without separating author self-citations, so all our analyses rely on raw counts. Earlier studies suggest that self-citations typically account for less than 10% of citations in economics; nevertheless, we cannot rule out a slight upward or downward bias in the estimated gender gap, which remains a limitation of the study.

To examine whether gender differences are topic-specific, we decomposed the *Keywords Plus* field (lower-casing and discarding blanks), retained only terms appearing in at least ten papers, and calculated for each the share of articles with a female versus a male first author. The difference between the two shares signals gender over-representation. This procedure highlights topics favoured by women and those dominated by men and later allows us to test whether certain keywords plus bring a citation bonus independent of gender, team size and journal. Of the entire corpus (4030 papers), 2614 papers (64.8%) list at least one *Keywords Plus* entry (the remainder are "Unknown"); within this subset 1262 have a female first author and 1352 a male first author.

Table 10 lists the *Keywords Plus* terms with the strongest female over-representation (≥ 60%). The pattern is only moderately polarised: for example, 84.6% of papers tagged *urbanization* have a female first author, whereas *credit* is 92.3% male led. Among the most heavily "feminised" topics, *outcomes*, *future* and *urbanization* also attract relatively high mean citation counts. Overall, just eight terms exceed the 60-point threshold in favour of women, covering 88 papers, representing 2.2% of the full corpus, so thematic specialisation cannot fully account for gender differences in citations.

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Table 10. Keywords Plus with the highest female over-representation (≥ 60 %).

Nr.crt	Keywords Plus	Articles	Average citations	% Female	% Male	Δ% (F - M)
1.	urbanization	13	11.6	84.6	15.4	+69.2
2.	future	17	12.4	82.4	17.6	+64.7
3.	age	11	7.1	81.8	18.2	+63.6
4.	error-correction	10	7.8	80.0	20.0	+60.0
5.	government	10	8.8	80.0	20.0	+60.0
6.	happiness	10	11.7	80.0	20.0	+60.0
7.	outcomes	10	22.8	80.0	20.0	+60.0
8.	transformation	10	7.6	80.0	20.0	+60.0

Source: Authors' calculation using R 4.4.3. Only Keywords Plus terms that occur in at least ten articles were included. Δ% indicates the percentage-point difference between the share of papers with a female first author and the share with a male first author.

To check whether gender differences in citations could be driven by topic specialisation, we re-estimated the Negative Binomial model, adding dummies for the thirty most frequent keywords. In this specification each paper is compared with other articles published in the same journal and year, with the same team size, open-access status and explicit topic. The *Female* coefficient is not significant (IRR = 0.947, $p = 0.221$), confirming that subject distribution does not account for the initial gender differences. The model nonetheless highlights several topics with a significant citation surplus, for example *countries*, *management*, *unit root*, *social responsibility*, *governance*, *emissions*, *consumption*, *models* and *impact*. No topic is associated with a significant citation penalty. The results are reported in Table 11.

Table 11. Negative Binomial model with dummies for the thirty most frequent keywords plus.

Variables	β	SE	z	*p*	IRR
Intercept	1.305	0.122	10.678	0.001	3.686**
Female	-0.054	0.044	-1.224	0.221	0.947
LnAuthors	0.425	0.040	10.590	0.001	1.529**
OA_GG	0.054	0.117	0.462	0.644	1.056
OA_Unknown	0.073	0.116	0.627	0.531	1.075
Keywords plus associated with a citation bonus (β>0 and $p < 0.05$)					
countries	0.648	0.147	4.412	0.001	1.912**
management	0.545	0.118	4.634	0.001	1.724**
unit root	0.503	0.217	2.319	0.020	1.654**
social responsibility	0.497	0.242	2.059	0.040	1.644**
governance	0.461	0.176	2.615	0.009	1.585**
emissions	0.450	0.185	2.435	0.015	1.568**
consumption	0.442	0.154	2.871	0.004	1.556**
models	0.347	0.143	2.433	0.015	1.416**
impact	0.285	0.087	3.276	0.001	1.330**
Keywords plus associated with a citation penalty (β<0 and $p < 0.05$)					
No keyword is significantly associated with a citation penalty					

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Source: Authors' calculation using R 4.4.3; ** $p < 0.05$; β-coefficients re on the log-count scale; an IRR > 1 indicates a citation surplus, whereas an IRR< 1 indicates a citation penalty.

4. Conclusions

The aim of this study was to examine gender disparities in first-author status, topic choice and Web of Science citation impact for 4030 *Economics* articles published between 2000 and 2025 that include at least one author affiliated with a Romanian institution.

Our contribution lies in systematically mapping this bibliometric gender gap over 25 years of Romanian economic research and clarifying how gender relates to first-authorship, research topics and scientific visibility. We combined a goodness-of-fit χ^2 test, Negative Binomial regressions, quantile regressions and Poisson models with journal fixed effects, complemented by keyword-based topic analyses.

The χ^2(goodness-of-fit) test showed a marginally significant female versus male distribution in the full corpus (48.6% versus 51.4%; χ^2 (1) =3.34, $p = 0.068$, $V = 0.0287$), an effect that vanishes in the *Economics pure* subset. Strikingly, women are over-represented as first authors in Romanian-affiliated *Economics pure* papers, whereas foreign-affiliated papers exhibit a pronounced female under-representation (31.5% overall; 30.5% in *Economics pure*), with moderate-to-large effect sizes.

The baseline Negative Binomial model finds that, after controlling for multidisciplinary, team size (log) and open-access status, papers with a female first author receive on average 9.9% fewer citations, rising to 13.5% in *Economics pure*. Yet the *Female* coefficient becomes insignificant in every subset defined by Romanian or foreign affiliation, indicating that the citation gap is driven mainly by the international, *Economics pure* segment. Multidisciplinary yields no robust advantage, whereas team size is the strongest predictor: doubling the number of authors raises citations by 63% in the full set and up to 107% for foreign-led articles. Open access shows no consistent effect.

Quantile regressions (0.25, 0.50, 0.75, 0.90) confirm the dominance of team size across the citation distribution. *Female* remains insignificant everywhere, and multidisciplinary papers enjoy only a slight advantage at τ= 0.25. Splitting the data into three policy windows (2000-2010, 2011-2016 and 2017-2025) reveals that a significant female penalty emerged immediately after the 2011 WoS thresholds but disappeared in 2017-2025. Multidisciplinary delivered a visibility bonus only in 2011-2016, and open access never produced a stable effect.

Robustness checks, Poisson models with journal fixed effects and Negative Binomial models with year dummies, support the core conclusion: once journal prestige and year effects are absorbed, there is no systematic, robust female penalty. The initial gap reflects men's over-representation in higher-impact journals rather than an intrinsic bias against women's work; only a marginally significant disadvantage persists for foreign-affiliated first authors.

Topic analysis shows moderate polarisation: a few *Keywords Plus* (e.g. *urbanisation*, *future*, *outcomes*) are strongly "female", yet adding keyword dummies leaves the *Female* coefficient non-significant. Several topics (*countries*, *management*, *impact* etc.) carry independent citation bonuses, regardless of author gender.

A limitation of our study is the absence of a self-citation indicator. Although self-citations account for less than 10% in economics, it could slightly shift the estimated gaps.

In conclusions, once structural and topical factors are controlled, gender no longer explains visibility differences in Romanian Economics research. Nevertheless, there remains a wide scope for investigation into how institutional context, promotion policies, and cultural factors influence the evolution and perception of female first-authors in economic sciences within semi-peripheral regions.

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