Scientometrics
https://doi.org/10.1007/s11192-026-05623-z

National contexts and gendered research performance: a study of Armenia and Italy

Giovanni Abramo[1] · **Ciriaco Andrea D'Angelo**[2] · **Edita Gzoyan**[3] · **Shushanik Sargsyan**[3]

Received: 26 September 2025 / Accepted: 30 March 2026
© The Author(s) 2026

Abstract
Gender disparities in academic research remain a persistent concern. They are reflected in publication activity, citation impact, collaboration, and representation in senior academic positions, but the magnitude and form of these gaps vary across national contexts. This study provides an exploratory, most-different systems comparison of Armenia and Italy, two countries that differ markedly in the size, resources, and institutional organization of their research systems. Using individual-level bibliometric data from the Web of Science Core Collection (2017–2021), linked to census information on 3,617 Armenian and 27,034 Italian STEMM researchers, we compare gender differences in output, field-normalized impact, productivity, and collaboration patterns. The analysis documents substantial gender gaps in both countries, alongside cross-country differences in how these gaps are expressed (e.g., publication activity, productivity dispersion, and international collaboration). By mapping convergences and divergences with harmonized indicators, the study contributes comparative evidence on the extent to which gendered performance patterns persist across contrasting research systems, and it identifies policy-relevant areas where further, context-sensitive analysis is warranted.

Keywords Gender disparities · Research productivity · Research collaboration · Armenia · Italy

Introduction

Gender disparities in research performance and academic career advancement are central concerns in debates on equality in science and higher education (Elsevier, 2020; Larivière et al., 2013). They manifest in differences in research output, citation impact, collaboration opportunities, and representation in senior academic positions (Abramo et al., 2013a; Bendels et al., 2018; Ceci & Williams, 2011).

A preliminary version of this work was presented at the 20th International Society for Scientometrics and Informetrics Conference (ISSI 2025), held on 23-27 June 2025 in Yerevan, Armenia (Sargsyan, Gzoyan, Abramo, & D'Angelo, 2025a).

Extended author information available on the last page of the article

Although the existence of gender gaps is well documented, their magnitude and expression differ across countries and institutional settings (UNESCO, 2019). Such variation is often linked to differences in research-system resources, career structures, evaluation practices, and broader gender regimes, which shape access to funding, time, and scientific networks (van den Besselaar & Sandström, 2016).

Comparative evidence is therefore needed to clarify which features of gender inequality appear robust across contexts and which are more context-dependent, providing a basis for more evidence-informed discussions on equality in science and higher education (Huang et al., 2020).

This article examines gender differences in research performance and collaboration in STEMM[1] by comparing Armenia and Italy. The two countries are selected as most-different cases, as they differ markedly in terms of size, resources, and internationalization of their research systems, as well as in institutional organization (academy- and institute-centered versus predominantly university-based) and career structures. We use this contrast to advance an exploratory proposition: that substantial gender gaps can display convergent features across very different research systems, even if they are sustained through partly different institutional configurations.

In Armenia, a post-Soviet country undergoing socio-economic transformation, women constitute a significant share of the STEMM research workforce; however, their representation declines at higher academic ranks and in decision-making positions, indicating pronounced vertical segregation (Yeritsyan, 2019; UNDP Armenia, 2020; Sargsyan et al., 2025b). Italy, with a mature and internationally integrated university system and a more consolidated equality-policy framework in higher education, still exhibits marked gender stratification in senior academic roles and persistent gaps in several STEMM fields (Bettio & Verashchagina, 2009; Guarino & Borden, 2017; Mairesse & Pezzoni, 2015; Moscatelli et al., 2019).

Research performance and collaboration can be examined through bibliometric indicators such as publication output, field-normalized citation impact, and co-authorship patterns. While such indicators cannot directly identify the causal mechanisms that generate gender disparities, they can reveal systematic regularities in productivity and network participation that are relevant for comparative analysis (Bozeman & Corley, 2004). Prior work suggests that women, on average, publish less, receive fewer citations, and participate differently in collaboration networks, partly reflecting unequal access to resources, time, and scientific networks, as well as potential biases in evaluation and publication processes (Abramo et al., 2016, 2019a, 2019b; Caplar et al., 2017; Dworkin et al., 2020; Thelwall & Wilson, 2014; Witteman et al., 2019).

By applying harmonized micro-level indicators to two highly contrasting systems, the study contributes comparative evidence on whether gendered performance patterns are primarily context-dependent or whether they exhibit recurring features across national settings. In particular, we examine whether gaps in publication activity and productivity, as well as differential access to international collaboration, are observable in both countries, notwithstanding differences in system-level resources and institutional composition.

Our aim is not to provide a causal evaluation of specific national policies, but to map convergences and divergences in gendered research performance and collaboration and to

[1] Science, technology, engineering, mathematics, and medicine.

interpret these patterns in light of documented features of the two research systems. We focus on two related questions:

(1) To what extent do Armenia and Italy exhibit similar or different gender gaps in research output, impact, productivity, and collaboration (overall, domestic, and international)?
(2) How can the observed similarities and differences be interpreted in light of salient institutional features of the two national research systems—including their institutional composition (universities vs public research organizations), career structures, and degree of internationalization—as described in the literature?

By juxtaposing these two configurations, we explore how widely discussed gendered constraints, such as the leaky pipeline, unequal access to high-impact publication channels, and barriers to international collaboration, are expressed under different institutional environments. The intent is not to claim universal, context-free mechanisms, but to provide an empirically grounded comparison that can inform more detailed historical and policy-oriented investigations.

Methodologically, the study adopts a comparative, individual-level bibliometric approach. Using 2017–2021 data from the Web of Science Core Collection (WoS) linked to census information on researchers, we analyze 3,617 Armenian and 27,034 Italian STEMM scientists and compute indicators of publication output, field-normalized impact, productivity (Fractional Scientific Strength), and collaboration propensity. Cross-country differences are interpreted with explicit attention to dataset asymmetries and the limitations of WoS coverage, as discussed in Sect. "Comparative logic and limitations".

Literature review

Gender disparities in academia have been widely documented across multiple dimensions, including research performance, career advancement, and leadership positions. A growing body of research indicates that female researchers tend to publish fewer papers than their male counterparts, receive fewer citations, and have less access to collaborative networks, collectively impacting their academic influence and visibility (Bendels et al., 2018; Larivière et al., 2013). These disparities are typically attributed to a combination of structural, institutional, and cultural factors that hinder women's academic progression, such as unequal distribution of research funding, higher teaching or service burdens, and biases in publication and peer review processes (Ceci & Williams, 2011; Witteman et al., 2019).

Cross-national studies have increasingly highlighted that gender disparities in research performance are not universal but instead vary significantly by country, discipline, and institutional framework (Elsevier, 2020). For instance, countries with robust gender equality policies, such as those in Northern Europe, often exhibit smaller gender gaps in research output and impact compared to countries where such policies are less established (UNESCO, 2019).

This also showed during the COVID-19 pandemic. Contrary to common belief, only in the Far East did women experience a greater decrease in research output than men. In the U.S. and China, female and male scholars reduced their research output at a similar rate. In Europe, contrasting evidence emerged. In some countries (France, the Netherlands, and Switzerland), women were hurt more than men; in others (Germany and Spain), the

opposite holds true, while in such countries as Italy, Sweden, and the U.K., gender differences are hardly noticeable (Abramo et al., 2022).

These variations emphasize the importance of contextual factors in shaping academic gender disparities and underscore the need for comparative studies to deepen our understanding of how different socio-cultural and institutional contexts contribute to these disparities.

Research output, typically measured by the number of publications, remains a key metric for academic success and is often influenced by gender. Studies consistently show that, on average, female academics publish fewer papers than their male colleagues, a disparity observed across various disciplines, including STEMM fields and the social sciences (Aksnes et al., 2011; Huang et al., 2020). Various factors contribute to this gap, including differences in time allocation between research and other responsibilities such as teaching and administration, which often fall disproportionately on women (Guarino & Borden, 2017). Additionally, women in academia may face greater challenges in securing research funding, which directly affects their ability to conduct and publish high-quality research (van den Besselaar & Sandström, 2016).

Notably, recent research has examined the "leaky pipeline" phenomenon, wherein female representation in academia decreases at each successive career stage, especially in higher academic ranks (Alper & Gibbons, 2017). This effect is often pronounced in countries with traditional gender roles, where female academics may face greater cultural expectations around caregiving responsibilities, thereby limiting their time for research and collaboration. Armenia and Italy both experience significant "pipeline leakage," particularly in senior positions, though the underlying causes and extent of this trend differ between the two countries (Sargsyan et. al., 2025b; Abramo et al., 2021).

Citation-based metrics are widely used to assess research impact and visibility in the academic community. Studies show that female researchers generally receive fewer citations than their male counterparts, even after controlling for publication volume and field-specific citation rates. Typically, even after controlling for publication volume and field-specific citation rates, female researchers receive fewer citations than their male counterparts (Dworkin et al., 2020). This disparity has been attributed to various factors, including potential biases in citation practices and the gendered dynamics of academic networks, which can affect the visibility and perceived impact of women's research (Caplar et al., 2017).

Gender differences in citation impact are also influenced by the nature of the journals where female researchers publish. Women are often underrepresented in high-impact journals and may face greater challenges in accessing these prestigious publication venues due to biases in the editorial process or fewer collaborative opportunities that hinder the production of impactful research outputs (Addis & Villa, 2003). The Armenian context, where academic journal publishing is still in its early stages of development, poses additional challenges for researchers, particularly for women, who may have limited access to international platforms with high visibility. In contrast, Italian researchers benefit from more established networks and access to high-impact publication venues; however, significant gender gaps persist, particularly in STEMM disciplines and among top scientists (Abramo et al., 2009a, 2009b).

Research performance is widely acknowledged to be positively correlated with collaboration, particularly international collaboration, which enhances scientific productivity and visibility (Abramo et al., 2011; Zhang & Xu, 2021; Zhou et al., 2024). Collaboration has thus become an increasingly critical component of academic success, as researchers who engage more extensively in collaborative activities tend to publish more frequently

and achieve higher citation impact (Mairesse & Pezzoni, 2015). However, existing studies suggest that women are often less integrated into influential academic networks and may face reduced access to international and interdisciplinary collaborations (Bozeman & Corley, 2004). Such structural constraints on collaboration opportunities can limit women's research output and visibility, thereby contributing to persistent gender disparities in academic performance. Research by Thelwall and Wilson (2014) suggests that women are more likely to collaborate within their institutions and less likely to engage in international collaborations, which tend to be more productive and impactful. This trend is especially relevant in countries with limited research infrastructure, such as Armenia, where institutional and funding limitations may constrain collaborative opportunities with international peers. In Italy, despite a more internationally integrated research system overall, evidence suggests that women can remain less connected to international and interdisciplinary collaborations, especially in male-dominated fields (Abramo et al., 2013b).

The academic gender gap in Armenia reflects broader societal dynamics shaped by the country's post-Soviet transition, which has influenced both educational institutions and gender norms within professional environments. Traditional gender expectations, combined with limited institutional support for women in research, may contribute to disparities in research performance (Sargsyan et al., 2025a; Yeritsyan, 2019). Although Armenia has undertaken initial efforts to promote gender equality, these measures may not yet have fully dismantled entrenched structural and cultural norms. As a result, female researchers may still face significant barriers to academic advancement and research success (UNDP Armenia, 2020). Italy, on the other hand, is a Western European country where gender equality in academia has been increasingly recognized and addressed through various policies and initiatives. However, Italy's academic sector still reflects significant gender biases, especially in senior academic roles. Female representation decreases sharply in higher academic ranks, and Italian women researchers in science and engineering fields encounter barriers to promotion and access to research funding (Bettio & Verashchagina, 2009; Moscatelli et al., 2019). Additionally, family-oriented cultural expectations in Italy can contribute to career interruptions for female researchers, with potential consequences for research output and overall academic impact.

Taken together, prior studies suggest that gender disparities are shaped by a combination of structural constraints (resources, evaluation, time) and network dynamics, and that institutional arrangements can potentially mitigate cumulative disadvantages. Because the present study relies on bibliometric evidence and does not evaluate specific policy instruments, we draw on this literature only to identify broad policy levers commonly discussed in relation to gender gaps: transparency and accountability in recruitment, promotion, and funding; support for career continuity and caregiving; mentoring and sponsorship; and measures that widen access to domestic and international collaboration networks (Stoet & Geary, 2018).

In both Armenia and Italy, these levers are potentially relevant, but the appropriate policy mix is likely to differ because the two research systems face different structural constraints. In Armenia, where resources and international visibility are more limited, improving access to research infrastructure, competitive funding, and international networks—alongside transparent evaluation and promotion practices—may be particularly important. In Italy, where overall publication activity is high but vertical segregation persists, policies may focus more on promotion to senior roles, leadership opportunities, and reducing the career penalties associated with caregiving and mobility constraints. We return to these implications in the Conclusions, presenting them as context-sensitive applications of a shared policy logic rather than country-exclusive prescriptions.

Comparative perspective: Armenia and Italy

The literature reviewed above suggests that gender regimes, academic career structures, and national research-system characteristics simultaneously shape gender disparities in research performance. Cross-national bibliometric studies have documented substantial between-country variation in the size and form of gender gaps, even among countries with similar aggregate levels of economic development (e.g., Abramo et al., 2021; Elsevier, 2020; Huang et al., 2020). These findings support the use of comparative designs to illuminate how the same gendered mechanisms—such as unequal access to funding, mobility constraints, or biased evaluation practices—are activated and mitigated under different institutional and cultural conditions.

From this perspective, Armenia and Italy can be viewed as two contrasting institutional configurations rather than directly comparable "cases" in a quasi-experimental sense. Armenia's research system remains strongly influenced by the legacy of an academy-dominated, institute-based model inherited from the Soviet era, with the National Academy of Sciences and its affiliated research organizations playing a central role. Italy's system, by contrast, is predominantly university-based, with public research organizations accounting for a smaller share of academic research staff and output.[2] Both countries exhibit "leaky pipelines" and horizontal segregation across fields, but the position of women within these structures differs considerably in terms of numerical representation and access to senior roles.

Our comparative strategy is thus configurational and exploratory in nature. We use harmonized bibliometric indicators to map gendered performance patterns in the two systems and to identify systematic convergences and divergences between them. We do not attempt a full historical reconstruction of the evolution of gender-equality policies in either country, nor do we test specific causal hypotheses about policy interventions. Instead, we position our contribution as a comparative, micro-level complement to the existing literature on national gender-equality frameworks in science and higher education. The empirical patterns we reveal can inform future, more detailed historical and policy-oriented analyses, and help identify where policy measures might be most effective in each context.

Data and methods

The census of Armenian scientists and their publication portfolio

We conducted a census of the research staff within Armenia's national science system by collecting information on professors and researchers through three complementary sources: (i) official websites of higher education institutions and research centers affiliated with the National Academy of Sciences of the Republic of Armenia (NAS RA); (ii) official requests sent to the respective institutions asking them to provide the relevant information; and (iii) financing agreements of NAS RA research institutions available on the website of the Government of the Republic of Armenia.

[2] For a more extensive description of the two research systems see Abramo et al. (2025).

Overall, we obtained microdata for all 20 research organizations of the NAS RA and for 14 out of the 17 universities engaged in STEMM research.[3] The dataset includes personal identifiers, institutional affiliations, full names, gender, and academic rank. In the subsequent stage, we retrieved publication records from the Web of Science database by selecting publications with "Armenia" listed as the affiliation country. These records were then manually matched by (i) comparing researchers' full names with author lists and (ii) verifying official institutional affiliations against the bibliometric address information. To assess data quality, we evaluated the precision and recall of the resulting bibliometric dataset through manual verification using a randomly selected sample of records.

The resulting Armenian dataset is intended to approximate a census of research staff employed in core public research organizations and higher education institutions active in STEMM fields. It does not include researchers working exclusively in private R&D laboratories, small non-university research institutes outside the NAS RA framework, or non-STEMM units. Although these groups represent a relatively limited share of Armenia's research workforce, their exclusion implies that the dataset should be interpreted as capturing the institutional backbone of public research and STEMM higher education rather than the entire population of research-active personnel in the country.

Importantly, the Armenian dataset combines data from both research institutes and universities. These two institutional types differ in mission, governance structures, and staffing profiles, and NAS RA institutes are often highly specialized in specific disciplines. Such institutional characteristics may affect both research intensity and collaboration patterns, as well as the gender composition of research staff. We therefore return to this issue in Sect. "Comparative logic and limitations", where we discuss the implications of these differences for cross-country comparability.

The census of Italian scientists and their publication portfolio

The MUR maintains a database of university personnel. For each professor, this database provides information on their name, surname, gender, affiliation, discipline classification, and academic rank as of the close of each year.[4] A similar database does not exist for public research institutions, which forces us to restrict the Italian census to professors only. For reasons of significance, our analysis is limited to those professors who held formal faculty positions for at least three years over the 2017–2021 period. The bibliometric dataset used to assess professors' output is extracted from the Italian Observatory of Public Research (ORP), a database developed and maintained by Abramo and D'Angelo and derived under license from the Clarivate Analytics WoS. Beginning with the raw data from the WoS, we first reconcile the authors' affiliations and then apply a complex algorithm to disambiguate the true identities of the authors. In ORP, each publication is attributed to the university professors who produced it.[5]

[3] One major university, the National Polytechnic University of Armenia, as well as two other multi-profile institutions, the French University of Armenia and the European University of Armenia, were excluded from the analysis due to data unavailability. In addition, several research institutions operating outside the National Academy of Sciences framework, including the A. I. Alikhanyan National Science Laboratory (Yerevan Institute of Physics, AANL), were not covered by the present study.

[4] http://cercauniversita.cineca.it/php5/docenti/cerca.php. Last accessed on January 26, 2025.

[5] The harmonic average of precision and recall (F-measure) of authorships, as disambiguated by the algorithm, is around 97% (2% margin of error, 98% confidence interval).

In contrast to the Armenian case, the Italian dataset includes only university professors. Research staff employed in public research organizations and private research institutes are not covered, because no integrated, nation-wide personnel database exists for these institutions. The Italian dataset, therefore, corresponds to a census of academic staff in public universities, which represent the dominant component of the national research system. Still, it does not cover the full spectrum of research-active organizations. This asymmetry in institutional coverage between Armenia and Italy should be taken into account when interpreting comparative results.

Standardizing academic rank and classifying researchers by field

Since the dataset for Italy includes exclusively university professors, we will also use the term "professor" for all Armenian individuals. For this purpose, the ranks of the research staff at NAS RA institutions were matched to the equivalent academic rank as follows: Research Director = > Full Professor; Chief Researcher/Leading Researcher = > Associate Professor; Senior Researcher/Researcher = > Assistant Professor.

For benchmarking the two national systems, it is key to categorize each professor in the dataset into a specific scientific discipline. To achieve this, we utilized the WoS classification scheme and: (1) identified the WoS-indexed publications of each professor under observation; (2) assigned to each publication the SC or SCs of the hosting journal; (3) classified each professor in the most recurrent SC in their publication portfolio.

A problem arises when the portfolio is limited to one or a few publications or when one observes more than one dominant SC. For this purpose, such an analysis was carried out on an extended time window of eleven years (2010–2022). Residual cases of professors with more than one dominant SC were solved by randomly selecting one of the dominant SCs.

The final dataset

Due to the limited coverage of publications in the Arts and Humanities, for reasons of significance, we included only professors in STEMM SCs in the analyses (Aksnes & Sivertsen, 2019; Larivière et al., 2006). Moreover, after merging the datasets of the two countries, we included in the final dataset only those SCs (128 in all) with at least one Armenian and one Italian professor.

The final dataset consists of 3,617 Armenian professors (of whom 1,882, or 52%, are women) and 27,034 Italian professors (of whom 9,684, or 36%, are women). Their distribution per field[6] is shown in Table 1.

In both countries, Engineering is the most represented field, while Mathematics is the one with the fewest number of professors on staff. While the distribution by field is relatively similar between the two countries, the breakdown by academic rank is significantly different. Full professors in the Italian dataset account for 31% of the total, compared to 12.5% for Armenia. In contrast, Italian assistant professors account for 16.7% of the total, while in Armenia, they are almost 60%.

[6] SCs are grouped in fields following a pattern previously published on the website of ISI Journal Citation Reports, but no longer available on the current Clarivate portal. There are no cases in which an SC is assigned to more than one field.

Table 1 Dataset of analysis

Field	No. of SCs	No. of Armenian professors	No. of Italian professors
Biology	26	637 (17.6%)	5232 (19.4%)
Biomedical research	12	387 (10.7%)	2863 (10.6%)
Chemistry	8	332 (9.2%)	1566 (5.8%)
Clinical medicine	25	437 (12.1%)	5425 (20.1%)
Earth and space sciences	11	309 (8.5%)	2271 (8.4%)
Engineering	27	708 (19.6%)	5487 (20.3%)
Mathematics	3	250 (6.9%)	1496 (5.5%)
Physics	16	557 (15.4%)	2694 (10.0%)
Overall	128	3617	27034

Measuring research performance

The comparative evaluation of the research performance of individual professors is proxied by an output-to-input productivity indicator named Fractional Scientific Strength (FSS),[7] defined as:

$$FSS_p = \frac{1}{\left(\frac{w}{2} + k\right)} \cdot \frac{1}{t} \sum_{i=1}^{N} c_i f_i \tag{1}$$

where: w = average yearly salary of the professor (we halve labor costs, assuming that 50 percent of professors' time is allocated to activities other than research); k = average yearly capital available for research to the professor; t = number of years of work by the professor in the period under observation; N = number of publications by the professor in the period under observation; c_i = impact of publication i (weighted average of the discipline-normalized citations received by publication i and the discipline-normalized impact factor of the hosting journal)[8]; f_i = fractional contribution of professor to publication i [9]; As for the input factors (w and k), we relied on Abramo et al., (2020, Table 4).

[7] For a comprehensive explanation of the methodology, underlying theory, assumptions and limitations, as well as the input data source, we direct the reader to Abramo and D'Angelo (2014) and Abramo et al. (2020).

[8] This combination serves as the most accurate projection of future long-term citations for a publication (Abramo et al., 2019a, 2019b). Citations are adjusted to the mean of the distribution concerning all referenced publications from the same year and the Web of Science subject category (SC) of publication i. The journal's impact factor (IF), corresponding to the year of publication, is normalized relative to the average of the IF distribution of all journals in the same SC of publication i.

[9] In the field of life sciences in Italy, it is customary for authors to delineate their respective contributions to published research based on the order of names in the byline. In SCs related to these areas, we assign varying weights to each co-author depending on their position in the byline and the nature of the co-authorship (intra-mural or extra-mural). When the first and last authors are affiliated with the same university, each is attributed 40% of the citations, with the remaining 20% distributed among all other authors. If the first two and last two authors come from different universities, 30% of citations go to the first and last authors, 15% to the second and penultimate authors, and the remaining 10% is divided among all other contributors. These weighting values were determined with guidance from eminent Italian life sciences scholars and can be adjusted to align with various practices in other national contexts. In all other subject areas, fractional contribution is calculated as the inverse of the number of authors.

For each professor[10], FSS is computed in absolute value and percentile rank, by comparison with the same data referring to all professors in the same subject category in the dataset.

The analysis will also be conducted through indicators that measure the different components of FSS, and more specifically, the output (O_p), the fractional output (FO_p), and the average impact, as measured by standardized citations (AI_p) and hosting journals' standardized impact factors (JI_p). For this purpose, we will use the indicators described below.

$$O_p = \frac{N}{t} \tag{2}$$

$$FO_p = \frac{1}{t}\sum_{i=1}^{N} f_i \tag{3}$$

$$AI_p = \frac{1}{N}\sum_{i=1}^{N} cit_i \tag{4}$$

$$JI_p = \frac{1}{N}\sum_{i=1}^{N} if_i \tag{5}$$

With N = number of publications by the professor in the period under observation; f_i = fractional contribution of professor to publication i; cit_i = year- and discipline-normalized citations received by publication i; if_i = discipline-normalized impact factor of the hosting journal in the year of publication.

Measuring propensity to collaborate

Beginning with the individual academic of known gender and discipline, we will compare the average propensity to collaborate in the different disciplines for each of four forms: in general, intramural, and extramural collaborations with researchers from domestic and foreign organizations. The first form of collaboration, the propensity to collaborate in general, represents a superset of the other forms.

For this purpose, we associate each academic in the dataset (for both Italy and Armenia) with their publications (p) over the period. Since for each publication we know the number of authors and the number of domestic and foreign institutions, for each scientist we can calculate the number of publications resulting from:

- Collaborations (cp)
- Collaborations with other academics belonging to the same university (intramural—cip),
- Collaborations with scientists belonging to other domestic organizations (extramural domestic—$cedp$),

[10] As for the research staff of Armenian researchers working at NAS RA institutes, we equate the research unit leader to full professor, senior researcher to associate professor, and researcher to assistant professor.

- Collaborations with scientists from foreign organizations (extramural international—*cefp*)[11]

From these values, we can construct the indicators for the relative individual propensities to collaborate, from which we can then also obtain the average propensities per gender in each discipline:

- Propensity to collaborate, $C = \frac{cp}{p} \times 100$
- Propensity to collaborate intramurally, $CI = \frac{cip}{p} \times 100$
- Propensity to collaborate extramurally at the domestic level, $CED = \frac{cedp}{p} \times 100$
- Propensity to collaborate extramurally at the international level, $CEF = \frac{cefp}{p} \times 100$

Each of the four indicators varies between zero (if, in the observed period, the scientist under observation did not produce any publications resulting from the form of collaboration analyzed) and 1 (if the scientist produced all their publications through that form of collaboration).

Comparative logic and limitations

The construction of two national-level datasets raises important questions regarding their degree of comparability. First, as noted above, the Armenian dataset covers research staff employed in all NAS RA research organizations and in 14 (out of 17) universities active in STEMM fields. In contrast, the Italian dataset includes university professors only. The Armenian sample thus includes scientists whose primary institutional affiliation is a research institute rather than a university. Since research organizations tend to have a stronger focus on research and a different balance of teaching, service, and administrative duties, this may affect both productivity levels and collaboration patterns, as well as the distribution of academic ranks.

Second, the rank distributions differ substantially between the two datasets: in Italy, full professors constitute around one-third of the total, whereas in Armenia they represent only 12.5%, with almost 60% of staff in the equivalent rank of assistant professor. These differences partly reflect distinct career structures and demographic profiles and must not be interpreted as simple "deficits" in one system relative to the other.

Third, although the Armenian dataset aims to approximate a census of the country's core public research organizations and STEMM-oriented universities, it does not entirely align with official national statistics on the research workforce. Available evidence suggests that Armenia has a relatively high proportion of women in STEMM research compared to many other countries, particularly in specific fields of study. While our data are consistent with this general pattern, they should not be read as precise estimates of national gender representation in academia. Rather, they describe the gender composition of the specific institutional universe covered by our data.

[11] Single-authored papers with more than one affiliation are not considered as collaborations. A publication with more than two authors could present different forms of collaboration, for example intramural and extramural domestic. In this case it is counted in calculating propensity for each form of collaboration observed.

Table 2 Share of female professors, by gender, country and field

Field	Armenia		Italy	
	Share of females (%)	CI*	Share of females (%)	CI*
Biology	70.6	1.358	49.6	1.385
Biomedical research	71.3	1.371	48.4	1.351
Chemistry	60.2	1.158	44.7	1.248
Clinical medicine	60.9	1.170	35.9	1.003
Earth and space sciences	47.9	0.921	35.1	0.981
Engineering	42.9	0.825	21.8	0.608
Mathematics	30.8	0.592	36.7	1.024
Physics	28.9	0.556	19.0	0.531
Overall	52.0		35.8	

*Concentration index, given by the share of female professors of a country in a given field divided by the share of female professors of that country overall. A value of 1.2 means that in the field, females are 20% more prevalent than their expected value, as measured at the overall country level

Taken together, these considerations define the scope of our comparative design. We analyze gendered patterns of performance and collaboration within the observed populations of scientists in each country, taking into account their respective institutional configurations. We do not treat the two datasets as fully harmonized samples drawn from a single, unified population, nor do we make claims that would require such strict equivalence. Accordingly, cross-country differences are interpreted as reflecting context-specific institutional configurations and constraints. Where relevant, we explicitly note instances in which institutional composition or rank structure may plausibly contribute to the observed patterns (for example, when interpreting concentration indices or field-specific gender gaps).

Results

The incidence of women in the research staff of the two countries

A comparative view of the gender distribution within the research staff of Armenia and Italy is provided in Table 2 and Fig. 1, categorized by academic rank and field.[12] Notably, Armenia exhibits a higher overall representation of women in STEMM fields (52.0%) compared to Italy (35.8%). This trend is particularly evident in Biology and Biomedical Research, where the share of female researchers in Armenia exceeds 70%, whereas Italy reports approximately 50% female participation. Conversely, in male-dominated fields such as Engineering and Physics, both countries exhibit significantly lower female representation. In these fields, only 42.9% of Armenian researchers and 21.8% of Italian researchers are women in Engineering, and 28.9% (Armenia) and 19.0% (Italy) in Physics.

[12] Disciplines (SCs) are grouped in fields following a pattern previously published on the website of ISI Journal Citation Reports, but no longer available on the current Clarivate portal.

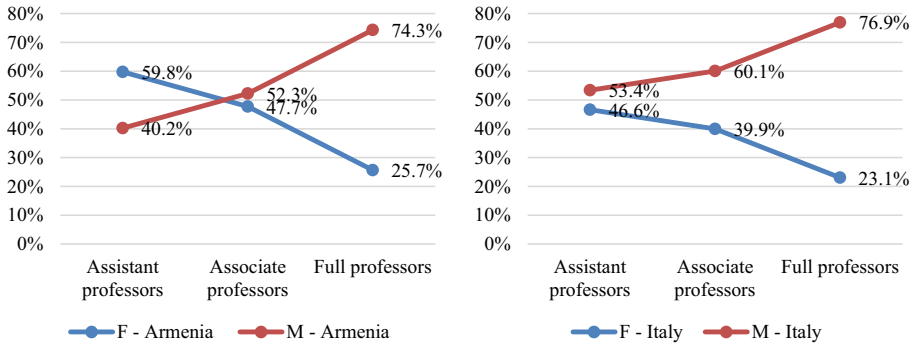


Fig. 1 Research staff of the two countries in the dataset, by gender and academic rank

Interestingly, the concentration index (CI) reveals that women in Armenia are more proportionally represented across various fields compared to the national average, while Italy shows more pronounced disparities in female representation across disciplines. These data suggest systemic differences in how gender roles manifest in academic environments, with Armenian women achieving higher numerical participation but potentially facing other structural barriers.

Output

Table 3 details the percentage of professors with at least one WoS publication during the 2017–2021 period. The data reveal stark contrasts in research output between Armenia and Italy. In Italy, the vast majority of professors (98.1%) have at least one WoS publication, with negligible gender differences across fields. In Armenia, however, the overall share is markedly lower at 28.3%, with significant variations by field and gender. For instance, while 39.1% of Armenian women in Physics have at least one publication, the percentage drops to just 15.6% in Mathematics. This pattern highlights not only a productivity gap between the two countries but also suggests the presence of field-specific constraints that disproportionately affect female researchers.

Table 3 Share of professors with at least one 2017–2021 WoS publication, by gender, country, and field

	Armenia			Italy		
Field	F (%)	M (%)	Total (%)	F (%)	M (%)	Total (%)
Biology	22.2	22.5	22.3	99.0	98.9	99.0
Biomedical research	27.2	26.1	26.9	99.3	98.9	99.1
Chemistry	33.0	43.9	37.3	99.4	99.2	99.3
Clinical medicine	27.4	31.0	28.8	98.1	98.0	98.0
Earth and space sciences	19.6	25.5	22.7	97.5	97.4	97.4
Engineering	15.1	18.6	17.1	98.0	98.1	98.1
Mathematics	15.6	35.8	29.6	93.3	95.8	94.9
Physics	39.1	50.8	47.4	95.7	97.3	97.0
Overall	24.7	32.3	28.3	98.1	98.0	98.1

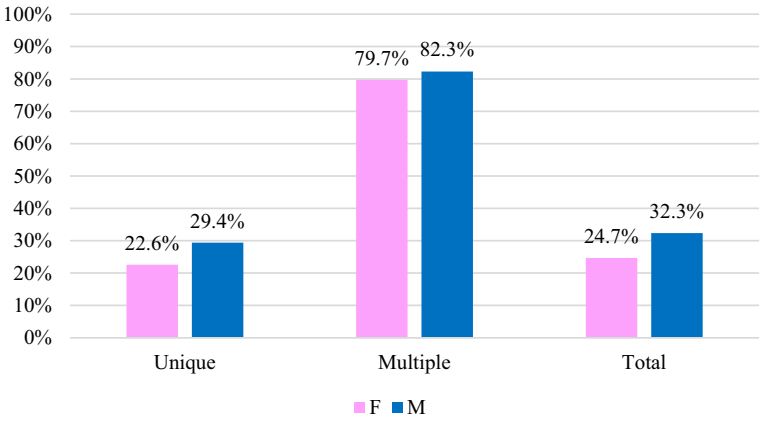


Fig. 2 Share of Armenian professors with at least one 2017–2021 WoS publication, by gender and number of affiliations

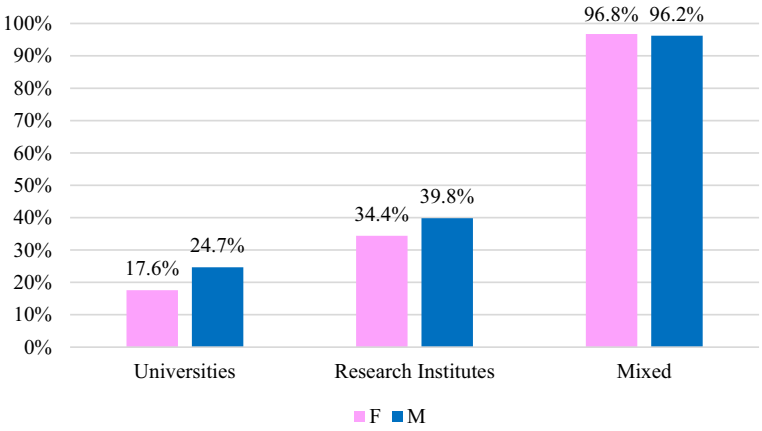


Fig. 3 Share of Armenian professors with at least one 2017–2021 WoS publication, by gender and affiliation type

The observed disparities in research output between Armenia and Italy are likely driven by a combination of factors, including limited research funding, weaker integration into international scientific networks, language barriers, institutional publication practices, and broader structural and societal inequalities.

Figures 2 and 3 further explore the Armenian context, showing how affiliation type and the number of affiliations correlate with publication activity. Women with multiple affiliations tend to exhibit higher publication rates, suggesting a potential role for collaborative opportunities in mitigating structural barriers to research output. Figure 4 underscores the disparity in publication activity by academic rank, with full professors in both countries demonstrating the highest productivity rates. However, the gender gap persists, particularly at senior levels in Armenia, suggesting entrenched structural challenges.

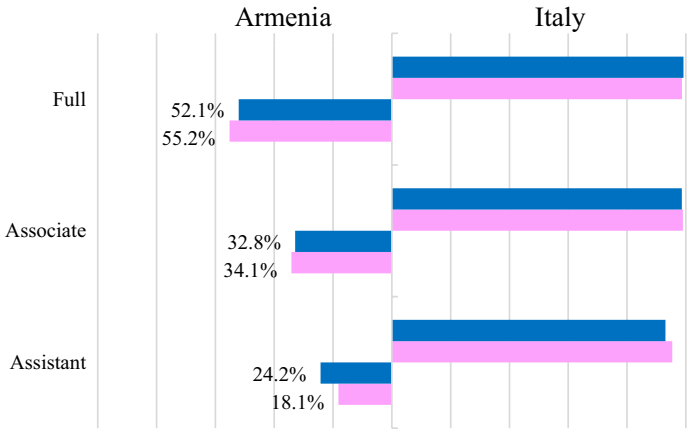


Fig. 4 Share of professors with at least one 2017–2021 WoS publication, by gender, academic rank, and country

Table 4 Yearly average 2017–2021 output of professors in the dataset, by gender, country, and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.124	0.186		3.767	4.739	
Biomedical Research	0.159	0.202		5.530	8.502	
Chemistry	0.336	0.623		4.920	5.517	
Clinical Medicine	0.162	0.192		5.529	7.764	
Earth and Space Sciences	0.200	0.183		3.139	3.781	
Engineering	0.084	0.113		4.226	5.200	
Mathematics	0.091	0.325		1.746	2.208	
Physics	0.379	0.864		12.047	11.632	

Tables 4 and 5 provide insights into the yearly average output of professors [as measured by (2)] in both countries. Table 4 examines the entire dataset, while Table 5 focuses specifically on professors with at least one WoS publication. In Table 4, Italian professors exhibit significantly higher average yearly outputs compared to their Armenian counterparts across all fields. This difference is particularly pronounced in Clinical Medicine and Engineering, where Italian professors produce more than double the output of Armenian professors. Gender differences are also apparent, with male professors generally outperforming female professors in both countries. The only exceptions occur in Earth and Space Sciences (Armenia) and Physics (Italy).

Table 5 narrows the focus to active researchers, revealing gender disparities among those with at least one publication, like those observed in the entire dataset. However, Armenia's gap between genders is lower than Italy's, in all fields but Mathematics and Physics.

Table 5 Yearly average 2017–2021 output of professors with at least one 2017–2021 WoS publication, by gender, country, and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.560	0.829		3.804	4.790	
Biomedical Research	0.584	0.772		5.570	8.595	
Chemistry	1.018	1.417		4.949	5.562	
Clinical Medicine	0.592	0.619		5.639	7.926	
Earth and Space Sciences	1.021	0.717		3.220	3.881	
Engineering	0.557	0.611		4.313	5.299	
Mathematics	0.583	0.906		1.872	2.305	
Physics	0.968	1.702		12.588	11.955	

Table 6 Yearly average 2017–2021 fractional output of professors in the dataset, by gender, country, and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.023	0.037		0.618	0.803	
Biomedical Research	0.025	0.035		0.761	1.185	
Chemistry	0.080	0.143		0.825	0.996	
Clinical Medicine	0.031	0.029		0.847	1.204	
Earth and Space Sciences	0.046	0.033		0.638	0.781	
Engineering	0.020	0.034		0.963	1.209	
Mathematics	0.046	0.199		0.656	0.897	
Physics	0.103	0.205		0.787	0.976	

Fractional output

Tables 6 and 7 refine the analysis by focusing on fractional output [as measured by (3)], which adjusts for multi-authorship. With the exceptions of Clinical Medicine and Earth and Space Sciences, Armenian women exhibit lower fractional output compared to their male counterparts, even in fields with higher female participation, such as Biology and Biomedical Research. This suggests that while Armenian women are well-represented numerically in certain fields, their roles in collaborative projects may be less prominent, potentially limiting their overall fractional contribution. In contrast, in Italy, women's fractional output is always lower than men's across all fields, and differences between the two sexes are greater in Italy than in Armenia.

Average impact

Tables 8 and 9 examine the average impact of professors' publication portfolios, measured by citation rates [as in (4)] and journal impact factors [as in (5)]. Italian researchers, regardless of gender, outperform their Armenian counterparts in both metrics, reflecting Italy's

Table 7 Yearly average 2017–2021 fractional output of professors with at least one 2017–2021 WoS publication, by gender, country and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.105	0.166		0.624	0.811	
Biomedical Research	0.092	0.136		0.767	1.198	
Chemistry	0.243	0.325		0.830	1.004	
Clinical Medicine	0.113	0.092		0.864	1.229	
Earth and Space Sciences	0.237	0.131		0.654	0.802	
Engineering	0.129	0.185		0.983	1.232	
Mathematics	0.297	0.555		0.703	0.937	
Physics	0.262	0.403		0.822	1.003	

Table 8 Average impact of professors' publication portfolio, by gender, country, and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.473	0.580		1.082	1.069	
Biomedical Research	0.326	0.651		1.084	1.093	
Chemistry	0.254	0.288		0.974	0.968	
Clinical Medicine	0.623	0.539		1.014	1.017	
Earth and Space Sciences	0.688	0.708		1.024	1.050	
Engineering	0.250	0.252		0.989	1.032	
Mathematics	0.286	0.292		0.883	0.951	
Physics	0.299	0.228		1.369	1.356	

Table 9 Average journal impact factor of professors' publication portfolio, by gender, country, and field

	Armenia			Italy		
Field	F	M	Δ(%)	F	M	Δ(%)
Biology	0.601	0.665		1.162	1.224	
Biomedical Research	0.474	0.557		1.137	1.143	
Chemistry	0.453	0.498		1.196	1.219	
Clinical Medicine	0.696	0.694		1.065	1.046	
Earth and Space Sciences	0.654	0.736		1.043	1.076	
Engineering	0.353	0.391		0.720	0.689	
Mathematics	0.405	0.386		0.947	0.944	
Physics	0.466	0.399		1.029	1.032	

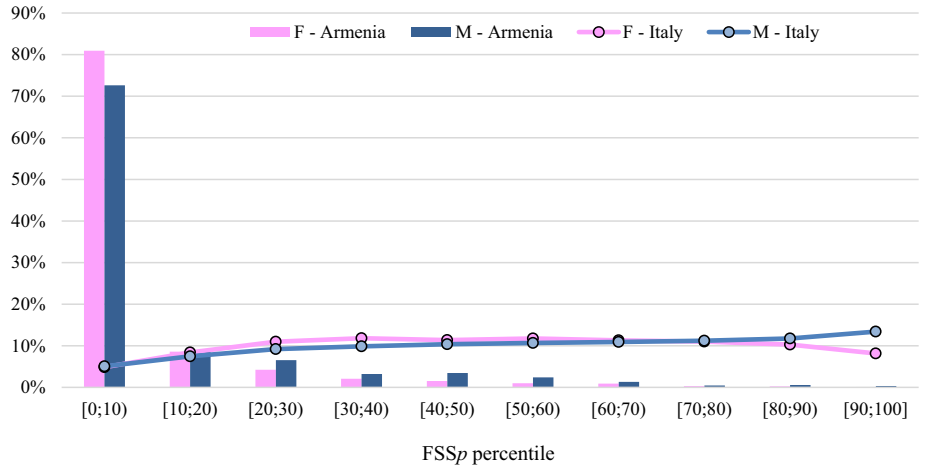


Fig. 5 Distribution of 2017–2021 research productivity percentiles of Armenian and Italian professors, by gender

more established academic infrastructure and global integration. In both countries, gender differences in average impact are field-dependent. For example, Armenian women in Clinical Medicine and Physics achieve higher average citation impacts than men, whereas their peers in Biomedical research and Biology show significantly lower averages. In contrast, Italian women in Biology, Chemistry, and Physics outnumber men. This pattern underscores the interplay between field-specific norms and the visibility of women's research.

Productivity

Figures 5 and 6 illustrate the distribution of research productivity [as measured by (1), transformed into percentiles], highlighting the disparities between Armenian and Italian professors and between genders within each country. Italian professors occupy higher productivity percentiles overall, with minimal gender differences. In Armenia, the distribution skews sharply, with a substantial proportion of women falling into lower productivity percentiles. However, among Armenian "productive" professors (those with at least one publication), the gender gap narrows slightly, suggesting that once structural barriers to productivity are overcome, women can achieve performance levels closer to those of their male counterparts.

Research collaboration

Table 10 shows the mean value and standard deviation measured for each of the four collaboration indicators, by gender and country. The U Mann–Whitney test indicates whether gender differences are statistically significant or not.

The analysis of gender differences in collaboration propensity across Italian and Armenian academics reveals a clear and consistent pattern in three of the four dimensions considered. Starting with the overall propensity to collaborate (C), women score higher than men in both countries. In Italy, the average value for women is 98.9 compared with 98.1 for men, while in Armenia the gap is wider, with female academics averaging 96.1 compared

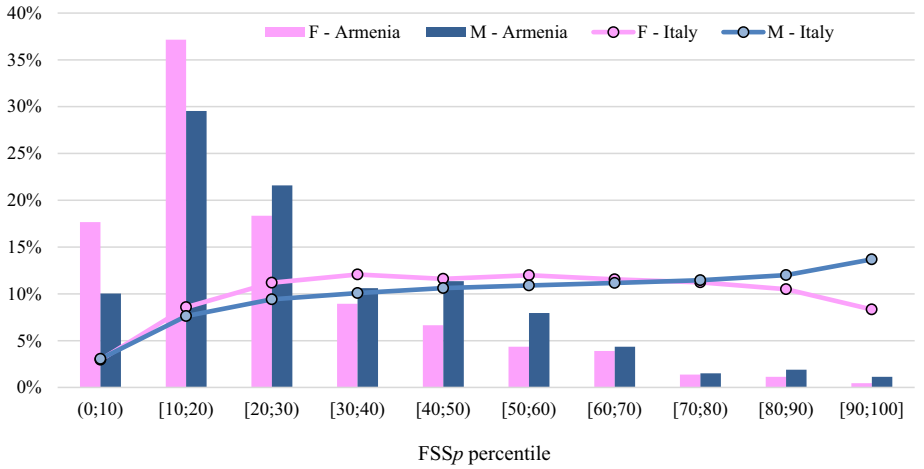


Fig. 6 Distribution of 2017–2021 research productivity percentiles of Armenian and Italian "productive" professors, by gender

with 90.2 among males. In both contexts, the differences are statistically significant at the 0.01 level, indicating that female academics are more likely to publish in co-authorship than men.

Turning to intramural collaboration (CI), that is, collaboration with colleagues within the same institution, women again show a stronger tendency to engage in intramural collaboration than men. In Italy, female academics reach an average CI of 91.0, compared with 86.6 for men. In Armenia, the difference is even more pronounced, with an average CI of 88.4 versus 77.2 for men. Both gaps are highly significant, suggesting that female researchers tend to anchor their scientific activity more strongly within their immediate institutional networks than men.

A similar gendered pattern emerges in extramural domestic collaboration (CED). In Italy, the CED averages 63.8 for women, compared to 60.6 for men. In Armenia, the CED averages 52.1, compared to 40.3. Again, all differences are statistically significant at the 0.01 level. This suggests that female academics are more active than their male

Table 10 Gender differences in propensity to collaborate, by country and collaboration type

Index	Italy					Armenia				
	Mean		St. dev			Mean		St. dev		
	F	M	F	M	Gender differences†	F	M	F	M	Gender differences†
C	98.9	98.1	6.5	9.0	+***	96.1	90.2	17.4	25.6	+***
CI	91.0	86.6	18.1	21.6	+***	88.4	77.2	27.5	35.0	+***
CED	63.8	60.6	27.6	29.4	+***	52.1	40.3	43.3	42.1	+***
CEF	35.8	39.8	25.7	27.4	−***	41.5	42.9	42.8	42.5	−

Significance level: *** = $p < 0.01$; ** = $p < 0.05$; * = $p < 0.1$

†U Mann–Whitney test

counterparts in establishing research ties across domestic institutions, reinforcing the perception of women as more network-oriented within the national scientific community.

The only indicator where the pattern is reversed is international collaboration (CEF). In Italy, men show a significantly higher propensity to collaborate internationally (39.8) compared with women (35.8), with the difference being highly significant. In Armenia, however, the averages are closer, 42.9 for men and 41.5 for women, with no statistically significant gender difference. Thus, while women generally appear more collaborative in both countries, their relative disadvantage becomes apparent in international collaboration, particularly in Italy.

These results suggest several possible interpretations. The stronger collaborative orientation of female academics within their institutions and national contexts may reflect strategies to reinforce their position in the academic system by relying on accessible and supportive networks. Conversely, the lower involvement of women in international collaborations, especially in Italy, may be linked to structural and cultural barriers, such as limited opportunities for mobility, greater family responsibilities, restricted access to international funding schemes, or weaker integration into global research networks. In the Armenian context, the absence of statistically significant gender differences in international collaboration likely reflects systemic constraints affecting Armenian researchers as a whole. Insufficient research infrastructure and equipment, limited funding, and obstacles to publishing in international journals create strong incentives for collaboration across the scientific community, irrespective of gender. In this environment, international collaboration appears to function primarily as a compensatory response to structural deficiencies in the national research system rather than as a gender-specific strategy. Accordingly, the Armenian case suggests that collaboration patterns are driven predominantly by institutional and resource-related constraints, with gender playing a secondary role. The statistics in Table 10 actually conceal a significant difference between the two countries. The distributions of collaboration propensities highlight striking differences between Italy and Armenia. For both CED (Fig. 7) and CEF (Fig. 8), the Armenian histograms exhibit a bimodal pattern, with high frequencies at the extremes (0 and 1) for both males and females. This suggests that Armenian academics are often either fully engaged or completely absent in these forms of collaboration, with limited intermediate behavior. In contrast, the Italian distributions appear more uniform, with values more evenly spread across the range, although more concentrated on the right tail for CED and on the left for CEF. This indicates a broader diversity of collaborative practices in Italy and a less polarized pattern compared with Armenia.

We now turn to deepen the analysis at the field level. The one referring to international collaborations (CEF) is certainly interesting: Table 11 provides a field-level breakdown of international collaboration propensity (CEF) by gender in Italy and Armenia.

Several statistically significant differences emerge. In Italy, women consistently exhibit lower international collaboration rates than men in several fields. Considerable gender gaps are observed in Biology (34.6 vs 39.6), Biomedical Research (33.6 vs 36.3), Chemistry (36.6 vs 41.9), Earth and Space Sciences (35.9 vs 42.2), and Engineering (32.5 vs 35.7). These results reveal a systematic pattern in which male academics are more engaged in international collaborations, suggesting barriers to women's participation across multiple scientific domains.

In Armenia, significant gender differences also appear, but with a somewhat different profile. In Biomedical Research, men show markedly higher values (57.4 vs 36.5). A significant gap is also evident in Chemistry, where men average 37.4 compared with 20.4 for women ($p < 0.001$). In the other fields, gender differences are not statistically significant. These results highlight particularly pronounced gender imbalances in fields that are highly internationalized or heavily reliant on extensive research networks.

An interesting exception to the general pattern is found in Physics. Here, gender differences are not statistically significant in either Italy or Armenia. However, the data indicate

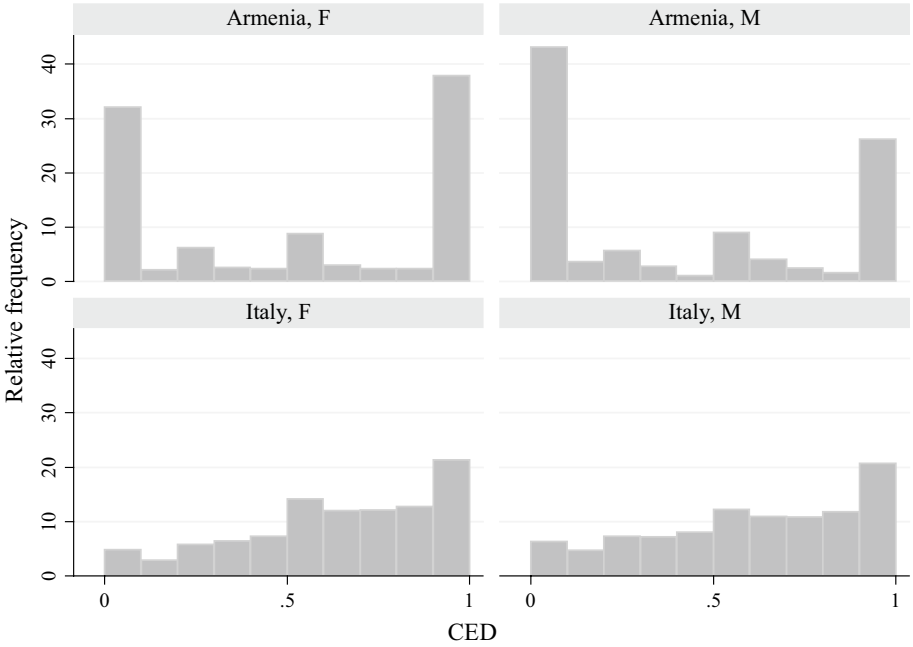


Fig. 7 Frequency distribution of the propensity to collaborate extramurally at the domestic level (CED) for male and female scientists of the two countries

that women exhibit a slightly higher average level of international collaboration than men. In Italy, female physicists have a mean CEF of 58.4, compared with 56.5 for men, while in Armenia, the averages are 41.2 versus 38.3. Although these gaps are not significant, the direction of the difference contrasts with most other fields, suggesting that Physics may represent a more gender-balanced or inclusive environment for international collaboration. For Armenia, another notable exception is Medicine. Observed gender differences would appear to favor women, but the analysis, which deserves further investigation, is not statistically significant in this case either.

Conclusions

This study has examined gender disparities in academic research performance and collaboration behavior in Armenia and Italy, using harmonized bibliometric indicators at the individual level. Rather than testing a specific causal hypothesis, we treat Armenia and Italy as two contrasting cases through which to assess whether substantial gender gaps exhibit recurring features across very different research-system configurations. The comparison is interpretive and exploratory: it aims to map convergences and divergences in gendered research performance across the two settings and to identify patterns that can inform further, more historically and policy-oriented work.

Within this framework, our findings indicate that gender gaps in research performance are substantial in both countries, but they take different forms. Italian professors, embedded in a mature and internationally integrated university system, display very high overall levels

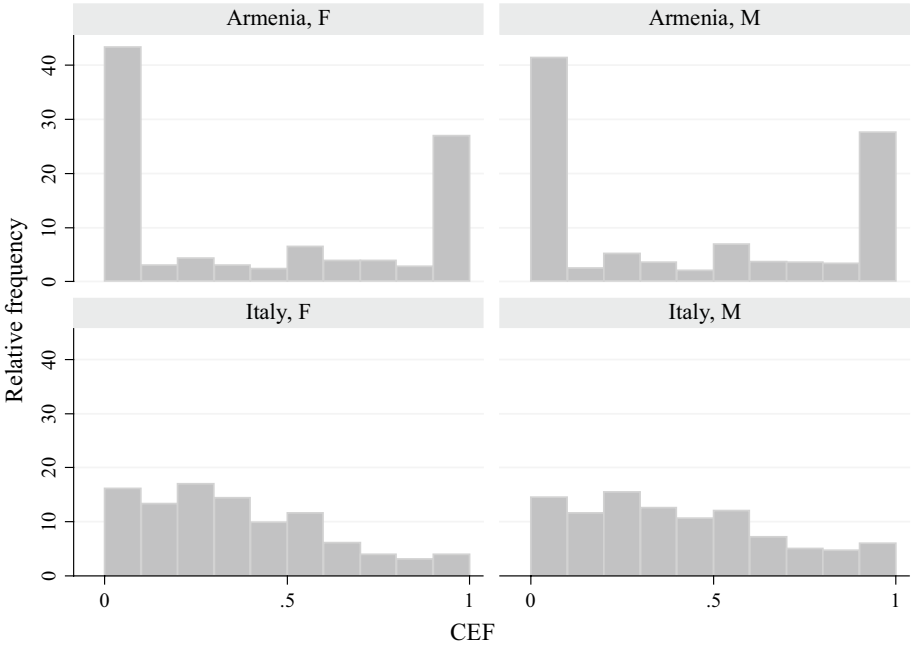


Fig. 8 Frequency distribution of the propensity to collaborate extramurally at the international level (CEF) for male and female scientists of the two countries

Table 11 Gender differences in the propensity to collaborate at the international extramural level CEF in the different fields, by country

Field	Italy			Armenia		
	Mean			Mean		
	F	M	Gender differences†	F	M	Gender differences†
Biology	34.6	39.6	−***	43.9	50.7	−
Biomedical research	33.6	36.3	−***	36.5	57.4	−**
Chemistry	36.6	41.9	−***	20.4	37.4	−***
Clinical medicine	33.4	33.6	−	57.0	52.2	+
Earth and space sciences	35.9	42.2	−***	66.7	74.0	−
Engineering	32.5	35.7	−***	40.6	41.7	−
Mathematics	41.9	43.4	−	17.5	23.7	−
Physics	58.4	56.5	+	41.2	38.3	+

Significance level: *** = $p < 0.01$; ** = $p < 0.05$; * = $p < 0.1$

†U Mann–Whitney test

of publication activity and citation impact, with limited gender differences among active researchers but persistent stratification by academic rank. Armenian scientists, working in a more resource-constrained system that combines universities and highly specialized public research organizations, exhibit much lower aggregate levels of WoS-indexed output and a

more polarized distribution of productivity and collaboration, with women numerically well represented but facing stronger obstacles in reaching higher performance percentiles.

The Armenian case illustrates that high numerical participation of women in science does not necessarily translate into equal access to senior positions. In our dataset, women constitute a substantial share of STEMM research staff, yet their representation declines sharply at higher ranks, consistent with pronounced vertical segregation. As suggested by prior work on post-Soviet and resource-constrained systems, such patterns may reflect a combination of institutional and societal factors—including limited resources, career structures, and persistent gender norms—that can cumulatively disadvantage women's advancement (van den Besselaar & Sandström, 2016; Sargsyan et al., 2025b; Yeritsyan, 2019).

Conversely, Italian researchers operate within a mature, internationally integrated university system with very high levels of publication activity. Nonetheless, gender stratification remains visible, particularly in senior ranks and in several STEMM fields, and women's publication and impact profiles differ from men's in parts of the distribution (Abramo et al., 2009a, 2009b; Guarino & Borden, 2017). This combination indicates that resource-rich environments are not sufficient, by themselves, to eliminate cumulative disadvantages.

Collaboration patterns add nuance to these findings. In both countries, women show a slightly higher propensity to collaborate overall, particularly within their institutions and across domestic organizations. This pattern may reflect differential access to resources and networks, with collaboration functioning as an important channel for participation and visibility. However, women—especially in Italy—are less engaged in international collaborations in several fields, consistent with constraints related to mobility, time, and access to global networks. In Armenia, overall gender differences in international collaboration are smaller and often not statistically significant, although gaps persist in specific fields such as Chemistry and Biomedical Research.

The bimodal distribution of collaboration propensities in Armenia further reveals that researchers tend to be either strongly engaged or absent from collaborative practices, in contrast with Italy's more uniform distribution. This suggests structural polarization in Armenian academia, where access to collaboration opportunities is unevenly distributed and often concentrated among a subset of researchers. For women, who are overrepresented numerically but underrepresented in leadership, this polarization may reinforce unequal access to the networks most critical for visibility and impact.

Although our design does not allow evaluation of the effectiveness of specific policy instruments, the observed patterns point to policy-relevant areas at both national and institutional levels.

Across both cases, the results suggest a shared set of potential policy levers—transparency and accountability in recruitment, promotion, and funding; support for career continuity; and measures that widen access to high-value collaboration networks—but with different priorities and instruments. In Armenia, where WoS-indexed publication activity is low and collaboration patterns are polarized, strengthening research infrastructure, predictable access to competitive funding, and institutional support for international collaboration may help reduce structural constraints that affect researchers overall and may facilitate women's progression into senior roles. In Italy, where publication activity is high but women remain underrepresented in senior positions and less internationally connected in several fields, institutions could examine promotion and leadership pathways, evaluation criteria, and the career penalties associated with caregiving and mobility constraints, with a view to reducing cumulative disadvantages (Borrell-Damián & Rahier, 2019; Stoet & Geary, 2018; UNESCO, 2019).

Finally, in both countries—and especially in male-dominated fields such as Engineering and Physics—initiatives that broaden access to domestic and international networks (e.g., structured mentoring and sponsorship, support for mobility and project participation, and visibility in

high-impact venues) may be relevant, given the established links between collaboration, productivity, and impact (Caplar et al., 2017; Thelwall & Wilson, 2014). We present these implications as hypotheses consistent with our bibliometric evidence and the existing literature, to be assessed through policy-specific evaluation.

While this study provides valuable insights, it is essential to reiterate the limitations of our comparative design. The Armenian and Italian datasets differ in institutional composition and rank structure, and our indicators rely on WoS-indexed publications, which under-represent some fields and local-language outlets, particularly in Armenia. For these reasons, our analysis should not be interpreted as providing precise estimates of national gender gaps or as enabling definitive statements about "which country performs better" in gender equality. Instead, it offers a systematic, micro-level mapping of gendered research performance and collaboration under two different national configurations, highlighting where structural constraints and opportunities appear to converge and where they differ.

Further investigation is needed to examine field-specific norms, citation behaviors, and collaborative practices that may contribute to the observed gender disparities. Future research should incorporate qualitative methods to capture the nuanced interplay between cultural, institutional, and individual factors that shape gender disparities in academia. Comparative studies involving additional countries and disciplines could further elucidate how national policies and practices foster or hinder gender equity in academic research.

While numerical representation is an important starting point, progress toward gender equity in research also depends on institutional arrangements that shape access to resources, networks, and advancement opportunities. By documenting convergences and divergences between two contrasting national systems, this study contributes comparative evidence that can inform future mixed-method research and more policy-specific assessments.

Funding Open access funding provided by Università degli Studi di Roma Tor Vergata within the CRUI-CARE Agreement. Giovanni Abramo acknowledges support from the National Research Council of Italy (Consiglio Nazionale delle Ricerche) under the 2023–2024 Bilateral Agreement CNR/MESRA (Armenian Ministry of Education and Science). Edita Gzoyan and Shushanik Sargsyan acknowledge that this research was supported by the Higher Education and Science Committee of MESCS RA (Research project № 23SC-CNR-5D014).

Declarations

Conflict of interest The authors declare that they have no conflicts of interest or competing interests that could have influenced the conduct of the study, its results, or their interpretation.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Abramo, G., & D'Angelo, C. A. (2014). How do you define and measure research productivity? *Scientometrics, 101*(2), 1129–1144.

Abramo, G., Aksnes, D. W., & D'Angelo, C. A. (2020). Comparison of research productivity of Italian and Norwegian professors and universities. *Journal of Informetrics, 14*(2), Article 101023.
Abramo, G., Aksnes, D. W., & D'Angelo, C. A. (2021). Gender differences in research performance within and between countries: Italy vs Norway. *Journal of Informetrics, 15*(2), Article 101144.
Abramo, G., D'Angelo, C. A., & Caprasecca, A. (2009a). Gender differences in research productivity: A bibliometric analysis of the Italian academic system. *Scientometrics, 79*(3), 517–539.
Abramo, G., D'Angelo, C. A., & Caprasecca, A. (2009b). The contribution of star scientists to overall sex differences in research productivity. *Scientometrics, 81*(1), 137–156.
Abramo, G., D'Angelo, C. A., & Di Costa, F. (2019a). A gender analysis of top scientists' collaboration behavior: Evidence from Italy. *Scientometrics, 120*(2), 405–418.
Abramo, G., D'Angelo, C. A., & Felici, G. (2019b). Predicting long-term publication impact through a combination of early citations and journal impact factor. *Journal of Informetrics, 13*(1), 32–49. https://doi.org/10.1016/j.joi.2018.11.003
Abramo, G., D'Angelo, C. A., & Mele, I. (2022). Impact of covid-19 on research output by gender across countries. *Scientometrics, 127*(12), 6811–6826.
Abramo, G., D'Angelo, C. A., & Murgia, G. (2013a). Gender differences in research collaboration. *Journal of Informetrics, 7*(4), 811–822.
Abramo, G., D'Angelo, C. A., & Murgia, G. (2013b). The collaboration behaviors of scientists in Italy: A field level analysis. *Journal of Informetrics, 7*(2), 442–454.
Abramo, G., D'Angelo, C. A., & Rosati, F. (2016). Gender bias in academic recruitment. *Scientometrics, 106*(1), 119–141.
Abramo, G., D'Angelo, C. A., & Solazzi, M. (2011). The relationship between scientists' research performance and the degree of internationalization of their research. *Scientometrics, 86*(3), 629–643.
Abramo, G., D'Angelo, C. A., Gzoyan, E., & Sargsyan, S. (2025). Benchmarking research performance in a post-soviet science system: The case of Armenia. *Scientometrics, 130*(4), 2213–2235.
Addis, E., & Villa, P. (2003). The editorial boards of Italian economics journals: A gender analysis. *Feminist Economics, 9*(1), 75–84.
Aksnes, D. W., & Sivertsen, G. (2019). A criteria-based assessment of the coverage of Scopus and web of science. *Journal of Data and Information Science, 4*(1), 1–21.
Aksnes, D. W., Rorstad, K., & Sivertsen, G. (2011). Are female researchers less cited? A large-scale study of Norwegian scientists. *Journal of the American Society for Information Science and Technology, 62*(4), 628–636.
Alper, J., & Gibbons, A. (2017). The leaky pipeline in academia: Barriers to gender equality. *National Academies Press*
Bendels, M. H. K., Müller, R., Brueggmann, D., & Groneberg, D. A. (2018). Gender disparities in high-quality research revealed by Nature Index journals. *PLoS ONE, 13*(1), Article e0189136.
Bettio, F., & Verashchagina, A. (2009). Gender segregation in the labour market: Root causes, implications, and policy responses in the EU. *European Commission's Expert Group on Gender Equality and Employment*
Borrell-Damián, L., & Rahier, M. (2019). Women in university leadership: Subtle leaks in the pipeline to the top. *European University Association.* https://www.eua.eu/our-work/expert-voices/women-in-university-leadership-subtle-leaks-in-the-pipeline-to-the-top.html. Last accessed on January 26, 2025
Bozeman, B., & Corley, E. (2004). Scientists' collaboration strategies: Implications for scientific and technical human capital. *Research Policy, 33*(4), 599–616.
Caplar, N., Tacchella, S., & Birrer, S. (2017). Quantitative evaluation of gender bias in astronomical publications from citation counts. *Nature Astronomy, 1*, Article 0141.
Ceci, S. J., & Williams, W. M. (2011). Understanding current causes of women's underrepresentation in science. *Proceedings of the National Academy of Sciences, 108*(8), 3157–3162.
Dworkin, J. D., Linn, K. A., Teich, E. G., Zurn, P., Shinohara, R. T., & Bassett, D. S. (2020). The extent and drivers of gender imbalance in neuroscience reference lists. *Nature Neuroscience, 23*(8), 918–926.
Elsevier. (2020). *The research gender gap: Research performance by gender across 15 countries.* Elsevier Gender Report
Guarino, C. M., & Borden, V. M. H. (2017). Faculty service loads and gender: Are women taking care of the academic family? *Research in Higher Education, 58*(6), 672–694.
Huang, J., Gates, A. J., Sinatra, R., & Barabási, A.-L. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. *Proceedings of the National Academy of Sciences, 117*(9), 4609–4616.
Larivière, V., Archambault, É., Gingras, Y., & Vignola-Gagné, É. (2006). The place of serials in referencing practices: Comparing natural sciences and engineering with social sciences and humanities. *Journal of the American Society for Information Science and Technology, 57*(8), 997–1004.

Larivière, V., Ni, C., Gingras, Y., Cronin, B., & Sugimoto, C. R. (2013). Bibliometrics: Global gender disparities in science. *Nature, 504*(7479), 211–213.
Mairesse, J., & Pezzoni, M. (2015). Does gender affect scientific productivity? Evidence from a large-scale French survey. *Revue Économique, 66*(1), 65–113.
Moscatelli, M., et al. (2019). Academic career progressions and gender gaps: Italy in a European context. *Gender in Management, 34*(3), 233–249.
Sargsyan, S., Gzoyan, E., Abramo, G., & D'Angelo, C.A. (2025a). Gender disparities in academic research: A comparative study of Armenia and Italy. *Proceedings of the 20th International Society of Scientometrics and Informetrics Conference - (ISSI 2025)*. June 23–27, 2025, Yerevan, Armenia
Sargsyan, S., Maisano, D. A., Shakhatuni, A., Sargsyan, H., Mirzoyan, A., Ohanyan, M., Kesoyan, G., & Gzoyan, E. (2025b). Armenian women in science: An analytical and bibliometric study of current trends. *Journal of Scientometric Research, 14*(1), 75–85.
Stoet, G., & Geary, D. C. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. *Psychological Science, 29*(4), 581–593.
Thelwall, M., & Wilson, P. (2014). Gender differences in bibliometric indicators and implications for career development. *Journal of Informetrics, 8*(2), 292–305.
UNDP Armenia. (2020). *Gender equality brief: Progress and challenges.* United Nations Development Programme Armenia
UNESCO. (2019). *Global Education Monitoring Report 2019: Gender report.* UNESCO Publishing
van den Besselaar, P., & Sandström, U. (2016). Gender differences in research performance and its impact on careers: A longitudinal case study. *Scientometrics, 106*(1), 143–162.
Witteman, H. O., Hendricks, M., Straus, S., & Tannenbaum, C. (2019). Are gender gaps due to evaluations of the applicant or the science? A natural experiment at a national funding agency. *The Lancet, 393*(10171), 531–540.
Yeritsyan, S. (2019). Gender issues in higher education: Armenia's progress and ongoing challenges. *Armenian Journal of Social Sciences, 5*(2), 97–112.
Zhang, L., & Xu, S. (2021). The relationship between collaboration and citation impact: A meta-analysis. *Scientometrics, 126*, 6497–6520.
Zhou, P., Yu, M., & Wang, X. (2024). International collaboration and citation advantage: New evidence from global science. *Journal of Informetrics, 18*(1), Article 101398.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Giovanni Abramo[1] · Ciriaco Andrea D'Angelo[2] · Edita Gzoyan[3] · Shushanik Sargsyan[3]

✉ Ciriaco Andrea D'Angelo
dangelo@dii.uniroma2.it

Giovanni Abramo
giovanni.abramo@unimercatorum.it

Edita Gzoyan
editagzoyan@gmail.com

Shushanik Sargsyan
shushaniksargsyan8@gmail.com

[1] Laboratory for Studies in Research Evaluation, Universitas Mercatorum, Piazza Mattei 10, 00186 Rome, Italy

[2] Dept of Business Engineering, University of Rome "Tor Vergata", Via del Politecnico 1, 00133 Rome, Italy

[3] Institute for Informatics and Automation Problems of NAS RA, 1 Paruyr Sevak St, 0014 Yerevan, Republic of Armenia