

Transformative agreements, publication venues and Open Access policies at the University of Milan

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Abstract: Starting from July 2020 at the University of Milan, one of the largest and most important Italian universities, the first transformative agreements with some major international scientific publishers have come into effect. These agreements allow corresponding authors to publish in open access without directly bearing the publication costs. From the perspective of corresponding authors, these agreements could increase the dissemination of their scientific output and, thereby, the impact on the scientific community. However, transformative agreements are part of a rapidly changing publishing market that already includes open access articles in both so-called ‘Diamond’ and ‘Gold’ journals. The aim of our study is to understand to what extent the positioning of journals in impact rankings, the disciplinary field of the article, together with the career stage of the corresponding author, influence the choice to publish in a journal covered by transformative agreements rather than in other open access or hybrid journals. The results of our investigation draw attention to the importance of rules in Italy governing scientific careers in different disciplinary fields and potential unforeseen effects of policies favouring open access.

INTRODUCTION

Starting from July 2020 at the University of Milan (hereafter referred to as UNIMI), one of the largest and most important Italian universities, the first transformative agreements with some major international scientific publishers have come into effect. These agreements allow corresponding authors (hereafter CAs) to publish open access. The cost of this service is covered by the agreement, with article processing charges (APCs) typically lower than those without such contracts (Schönfelde, 2020). These charges are not borne by the CA or their research funds but by the institution to which the CA belongs.

Open access publications, strongly advocated by European institutions and the open science movement, have the systemic advantage of not discriminating access to scientific knowledge

based on the economic resources available to individual countries and their institutions.¹ From the perspective of individual researchers, open access could increase the dissemination of their scientific output and thereby enhance their impact within the scientific community and their career advancement opportunities in academia (Dorta-Gonzalez & Dorta-Gonzalez, 2023; Huang et al., 2024; Langham-Putrow et al., 2021; Piwowar et al., 2018). Being able to do so, without depleting the often limited research

¹See COMMISSION RECOMMENDATION (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information (<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0790&from=HU>), <https://open-research-europe.ec.europa.eu/> and in the Italian context Piano Nazionale per la Scienza Aperta Decreto Ministeriale il 15 giugno 2022 <https://www.mur.gov.it/it/atti-e-normativa/decreto-ministeriale-n-268-del-28-02-2022>.

funds should be considered *a priori* a highly attractive opportunity for researchers and university professors. Nevertheless, the increase of publications in journals once they are included in transformative agreements cannot be taken for granted in the Italian context. As we will show, the criteria adopted in the Italian national scientific qualification for roles such as associate professor, full professor, and for participation in competition committees and doctoral faculties are various. In many disciplines the number of published articles is emphasized, with consequences on the venues of publications. Indeed, transformative agreements are part of a rapidly changing publishing market that already includes open access articles in both so-called ‘Diamond’ and ‘Gold’ journals.²

In this respect since 2020 in UNIMI APCs of articles accepted in Gold journals are co-financed by a specific fund established by the Open Science Commission. This fund had grown to €300,000 by 2023.

Moreover, almost all journals that have long allowed access via subscription also allow authors, upon payment of APCs, to make their articles freely accessible to anyone with an internet connection. These are known as hybrid journals.

This article aims to examine the preference for publishing articles in journals covered by transformative agreements with UNIMI (referred to as ‘transformative journals’) and to evaluate the impact of other publication avenues on this preference.

What encourages or discourages publication in transformative journals within the Italian context, as represented by UNIMI? Various factors, including journal impact, disciplinary affiliation, academic career stage, national qualification regulations, and university policies, may influence the decision to publish in a transformative journal rather than in other types of journals. Since less than half of the articles published in the ‘transformative journals’ by UNIMI CAs in 2022 took advantage of the agreement clauses and are open access, we have also the opportunity to test the role played (if any) by ‘openness’ in the context of transformative journals. This can be done by comparing articles published in transformative journals as open access with those published in transformative journals that are still accessible only by subscription.

The results of our investigation highlight the crucial importance of the rules governing scientific careers in Italy across different disciplinary fields and the potential unforeseen effects of policies favouring open access. When UNIMI scholars choose to publish in an open access journal, the journal’s ‘openness’ is not the only significant factor influencing their decision. Even when UNIMI authors can make their articles open access through transformative agreements, they seem to systematically prefer other publication venues, particularly if they are seeking career advancement, are women, or belong to specific scientific areas, often giving up the prestige and good reputation of the journal. In the upcoming section, we provide context on the evolution of the publishing market, transformative agreements, and Italian

²One should add pre-print publication archives that in some research areas are more and more common (see Green, 2019). For an updated and complete description of the future scenarios for the scholarly publishing system (see Van Barneveld-Biesma et al., 2020).

Key points

- This study examines the influence of journal impact factors, article disciplines, and corresponding author career stages on publication choices between transformative agreement journals and other open access or hybrid options at a leading Italian university.
- Italian academic career regulations vary by field, and may unintentionally influence scholars’ publication choices. Researchers in the so-called “bibliometric disciplines”, especially those aiming for career advancement, are frequently required to publish in order to increase their publication count and citation chances.
- Although transformative agreements can facilitate the dissemination and impact of scientific output, a multivariate analysis of 2022 publications from the University of Milano indicates a preference for specific Gold open access journals among scholars pursuing career advancement in bibliometric disciplines, particularly those who are female. These journals, which are typically less prestigious and cited than the “transformative” ones, often provide a more expedient peer review process and less rigorous selection criteria, which appeals to those aiming to increase their publication output.
- Both Italian regulations regarding scientific careers and university policies that indiscriminately favour all Gold open access journals risk promoting a significant number of scientifically irrelevant publications.

university qualification criteria. In the second section we describe the database we created for analysis, its properties and limitations. In the following section, we present an overview of publication practices at UNIMI, followed by a multivariate analysis to determine the causal factors influencing publication venue choice. The final section will discuss the prospects for the success of transformative agreements in light of UNIMI’s open access policy and national scientific qualification rules.

SCIENTIFIC PUBLISHING MARKET, TRANSFORMATIVE AGREEMENTS, AND RULES FOR OBTAINING NATIONAL SCIENTIFIC QUALIFICATION IN ITALY

Since the mid-1990s, Italy, like many other countries, transitioned to the ‘big deal’ model in the academic journal market, providing

electronic access to complete publisher catalogues. This shift raised concerns among librarians regarding high costs and under-utilization. However, usage data later revealed a growing user base and increased appreciation for comprehensive access. The 'big deal' model also facilitated the establishment and expansion of digital libraries in Italian universities. Despite these benefits, negotiations with large international publishers often disadvantaged individual institutions. To address this, a national agreement was signed in 2005 between the Conference of Italian University Rectors (CRUI) and Italian universities and research centres, establishing the CARE Group (Coordination for Access to Electronic Resources) within CRUI to centralize negotiations and improve conditions for all subscribing institutions.

The issue of who should pay, how much and for what also underlies the development of the 'open science' movement in Europe and the United States during the same period. This movement advocates for cost-free access to scientific knowledge for everyone, particularly citizens and scholars from countries and academic institutions with insufficient resources.

Harsh criticisms from the movement centre on pricing dynamics influenced by a non-competitive market and inelastic demand, lack of transparency due to confidentiality clauses in contracts, paywalls limiting access to subscribing bodies despite public funding, and the practice of double dipping.³ Additionally, publishers have been accused of imposing restrictions on access conditions by requiring authors to transfer rights to make their work openly accessible.

The viewpoint and the demands of the open science movement have been also embraced by European institutions. Starting from Horizon 2020, stringent conditions have been imposed on researchers to make their research products as accessible as possible, without cost, when benefiting from European Union funding.

While a segment of the open access movement seeks a complete overhaul of the current scientific publishing model and thus does not advocate for signing contracts with major publishers, certain demands of the movement are also supported by key stakeholders who negotiate and sign such contracts. This has led to the emergence of transformative agreements, which began appearing in 2015 in the Netherlands, 2016 in UK, 2017 in Austria, France, Germany, and Sweden, and 2019 in Finland, Greece, and Hungary.⁴ In Italy, CRUI-CARE began negotiating and proposing transformative agreements to member institutions starting

³The hybrid journals provide access to their articles through subscription fees, but they also provide individual articles as open access upon payment of the APC (article processing charge). When universities or research institutions pay the APC for articles in hybrid journals whose libraries have already subscribed, publishers receive payment twice for accessing the same content: once for closed access through subscription fees, and a second time for open access through APCs.

⁴See <https://esac-initiative.org/about/transformative-agreements/agreement-registry/>. Non-European experiences in a specific research area are analysed and compared in (Hoogendoorn & Redvers-Mutton, 2024). See also

in 2020.⁵ These transformative agreements transform the subscription model, based on paying for access to content, into a new commercial model, so-called Read and Publish. The agreed-upon price in contracts attributed to this model is a combination of a Read (for reading) and a Publish (for open access publishing) component. In practice, publishers provide a nationally pre-determined number of vouchers, sometimes unlimited, for open access publishing, mainly in previously hybrid journals, and for some contracts, also in Gold open access journals. Number of vouchers, when not unlimited, is calculated based on the articles published by the CAs of subscribing entities in previous years. In the Italian case, this includes all academic institutions and research centres subscribing to transformative agreements signed by CRUI-CARE. As already mentioned in transformative agreements, unlike simple subscription contracts, and unlike with articles accepted by Gold journals, all costs, both for access and open access publishing, are centrally covered by the institution that has signed the contract through its library system. These contractual models are considered a sort of transition towards models where the only cost for academic institutions and research centres is the APC from the outset (Pinfield et al., 2015), and all articles in the journals are solely open access.⁶

A few years after the initial subscription contracts negotiated by CRUI-CARE, with many journals transitioning to hybrid models, the Italian Parliament approved the national scientific qualification as part of a comprehensive reform of the university system. Under Article 16 of Law 240 of 2010, candidates participating in competitions at individual universities for positions as full professors or associate professors must be deemed suitable by national commissions appointed by the ministry. These commissions vary for each scientific sector in which academic activity is divided in Italy. For the first time, individuals must meet pre-determined levels of scientific productivity to be considered for evaluation by these commissions. These levels are defined differently depending on whether the scholar's scientific sector is classified as bibliometric or non-bibliometric.⁷ They mainly consist of scientific production levels equivalent to the updated median values of scientific productivity of current associate and full professors in Italy. Consequently, these levels are subject to

⁵Currently transformative contracts signed by CRUI in Italy are: American For Computing Machinery, Springer, Wiley American Chemical Society, Emerald, Cambridge University Press, Walter De Gruyter, Lippincott, IEEE, Royal Society of Chemistry, Elsevier, Institute of Physics.

⁶See https://www.coalition-s.org/wp-content/uploads/PlanS_Principles_and_Implementation_310519.pdf.

⁷The following are considered 'bibliometric' disciplines: Health Professions, Dentistry, Immunology and Microbiology, Psychology, Biochemistry, Genetics and Molecular Biology Agricultural and Biological Sciences, Physics and Astronomy, Pharmacology, Toxicology and Pharmaceutics, Veterinary, Chemical Engineering, Environmental Science, Engineering and Energy, Chemistry, Neuroscience, Medicine, Earth and Planetary Sciences, Materials Science, Nursing, Mathematics, Computer Science and Decision Sciences. The following are considered non-bibliometric disciplines: Economics, Finance, Management, Arts and Humanities, Social Sciences and Legal studies.

automatic increase over time. Every new associate professor and full professor must first have attained at least the median level of the teaching staff in their respective role and disciplinary sector before being appointed.

Therefore, the subsequent median values after their entry in the university as an associate professor or as a full professor can only be equal to or higher than the median values before their entry. In particular, for disciplines in the bibliometric sector, the number of articles in journals included in the main international databases (WSI and Scopus) published in the 10 consecutive years (5 years for the role of associate professor) preceding the evaluation, the total number of citations received for all scientific production in the last 15 years (10 for the role of associate professor), and the h-index of Hirsch calculated for the last 15 years (10 for the role of associate professor) are taken into account. In non-bibliometric sectors, individual citation indices are not taken into consideration, and the types of scientific production required to meet the specified levels are more diverse compared to those in bibliometric sectors. Specifically, they are the number of books published in the last 15 years (10 for the role of associate professor), the total number of journal articles and book chapters published in the last 10 years (5 years for candidates for the role of associate professor), and the number of articles published in journals considered internationally excellent in the last 15 years (10 years for the role of associate professor). In both sectors, any candidate that does not meet at least two out of three criteria is filtered out. With reference to the disciplines in the bibliometric sector, we notice a prevailing emphasis on the number of published articles as the 'objective function'. This is not only because it is one of the three criteria that candidates must meet but also because it can affect a second criterion, namely the candidate's number of citations. To maximize such an index, a candidate can either publish a few highly cited articles or many articles with fewer citations. If the first criterion, the number of published articles, is demanding, the most efficient way to meet the second one is by maintaining a high productivity of articles, even if they have a low number of citations.

Therefore, over the past 12 years in Italy, particularly in 'bibliometric' disciplines, the emphasis on rapidly publishing numerous articles and garnering high citations has become essential for career progression among academics. It appears plausible to presume that this new regulation regarding career paths has influenced publication decisions, in conjunction with the aforementioned shifts in the scientific publishing landscape.

THE DATABASE

The database used for our analyses consists of all articles published in scientific journals in 2022 and present in the Scopus database, where the CA is affiliated with UNIMI at the time of article acceptance. We excluded articles in which authors were affiliated with UNIMI, but none of them were the CA, except in the case of a few publications without APCs (those in so-called Diamond

journals) for which no recognizable CA existed, and at least one of them was affiliated with the UNIMI.

All possible publisher brands of the journals were mapped back to the name of the parent publishing house. For example, the editorial brand Academic Press was mapped to Elsevier, Blackwell to Wiley, and so on. Affiliation to the institution under the national 'transformative' contracts lacks clear definition.⁸ There are no specific legal rules or established practices governing affiliation, giving the institution broad discretion in evaluating individual cases. The University Library Committee at UNIMI applies an inclusive criterion, considering anyone with an active relationship with the university at the time of editorial acceptance as affiliated. This includes a range of individuals such as tenured professors, adjunct professors, researchers, research fellows, research assistants, scholarship holders, doctoral students, specialization students, undergraduates, and administrative and technical staff.

We have cross-checked and supplemented the information provided by Scopus regarding affiliation with UNIMI through UGOV (Unified Governance), the software platform utilized by Italian universities to manage various aspects of their administration and governance. Authors active in UGOV during 2022 were considered, including those who ceased their affiliation during the year due to retirement, completion of specialization, doctoral programs, or the end of a research contract.

The articles subject to analysis are those defined by Scopus as 'Original Article' or 'Review Article' since they are the articles eligible for publication in Open Access under all CRUI transformative agreements. In 2022, the transformative contracts with 'Springer', 'Wiley', 'American Chemical Society', 'Lippincott, Williams & Wilkins', and 'Walter Gruyter' were in force from the previous year, 2021, with a limited number of vouchers for publishing open access. In 2022, contracts were added with the Royal Society of Chemistry, and with an unlimited number of vouchers, Cambridge University Press and IEEE. The access period provided by the contracts corresponds to the calendar year. In transformative agreements, not all journals owned by these Publishers are included, but only those listed in the appendices to the contracts.

The decision to base our analysis on articles present in Scopus is based on the fact that Scopus is the most comprehensive archive of publications recognized internationally and is used to calculate bibliometric indices of journals and individual authors. Unlike institutional electronic archives of universities, the information comes directly from journals rather than authors, making it less prone to omissions, errors, and lack of updating.

However, we cannot ignore some important limitations of this database. Not all journals from scientific publishers are indexed in Scopus. We estimate that approximately 15% of all scientific journals are not included, particularly national journals from smaller publishers.

⁸Regarding the difficulties in identifying the CA in Scopus, see also Gray (2020).

Out of the 2,728 publications considered by Scopus as ‘Original articles’ or ‘Review Articles’ and attributed to affiliates of UNIMI, 415 articles were excluded after a more thorough examination because the CA was not affiliated or because the CA’s name was not listed in Scopus, despite the journal not being a Diamond journal.

The Scopus database of the articles published by UNIMI’s scholars cannot deliver reliable information about the utilization of vouchers provided by transformative agreements. As previously mentioned, indexed articles are those published in issues. While there is usually a delay of some weeks between the acceptance date of an article and its online publication, this delay can extend to many months when considering the publication date in an issue. Requests to use vouchers typically occur at the time of article acceptance. Although we can determine with certainty the institution to which the CA was affiliated at the time of acceptance, as this information remains consistent in the final version of the article, unfortunately, we lack precise information about the acceptance date. Many articles in the database published in issues in 2022 might have been accepted before the transformative contract signed by the journal’s publisher came into effect.⁹ Additionally, the right to publish in open access is forfeited in cases where vouchers are not unlimited, and the transformative contracts have already taken effect but the vouchers have already been exhausted. However, this latter circumstance affects a relatively small number of cases, partly because vouchers are depleted towards the end of the year, and sometimes CAs manage to negotiate with the publisher to postpone the formal acceptance date to the beginning of the next calendar year when vouchers become available again.¹⁰ Overall, one can hypothesize that the decision to publish articles in ‘transformative’ journals is influenced by the availability of open access only when the CAs have utilized the vouchers. In our dataset, this was the case for less than half of the ‘transformative’ articles.

The dataset obtained through queries of the Scopus platform was supplemented with information obtained from the following sources:

- The internal archive of the UNIMI Authors Service of the University Library Service, where validations (i.e., voucher usage) of the transformative contracts are recorded.
- The online archive of DOAJ, which allows for the identification of only open access journals and distinguishes between those that require payment (Gold) and those that are free (Diamond).

⁹In 2022, 393 articles were validated. Many of these, presumably mostly those validated in the last months of the year, would have been published in an issue and therefore indexed by Scopus only in the following year. In the same year, 2022, the articles published in an issue and validated were 285 out of a total of 599 articles published in eligible journals (i.e., included in the transformative contracts), namely less than 60%.

¹⁰In 2022, a portion of the articles formally accepted by journals covered by transformative agreements from Wiley and Springer between mid-October and December 31, 2021, may have unintentionally not benefited from the advantages of transformative agreements.

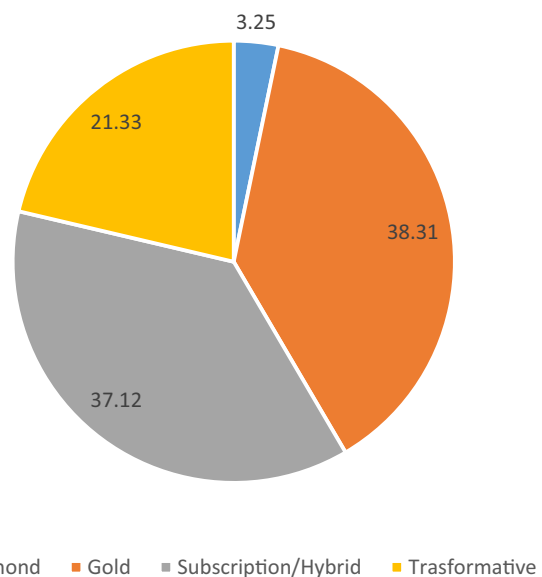


FIGURE 1 Percentage of UNIMI articles by publication mode in 2022.

- The U-GOV system for accurate affiliation checks.
- The Cineca archive on Italian university teaching and research staff, from which we obtained the qualifications of the CAs.

AN OVERVIEW

The articles published in 2022 in issues by CAs affiliated with UNIMI in journals included in transformative contracts (hereafter referred to as ‘transformative journals’) were 486; just over 20% of the total number of articles with CAs affiliated with UNIMI (Fig. 1). The articles published in ‘Subscription/Hybrid’ journals have almost an equivalent weight (37% vs. 38%) to articles published in ‘Gold’ journals. Unfortunately, we are unable to determine how many articles published in ‘Subscription/Hybrid’ journals were made accessible for free through the payment of an APC. The proportion of articles published in Diamond journals is negligible.

The initial breakdown of article production by journal type varies across different disciplinary fields.¹¹ Similarly, the overall distribution of article production is influenced by the number of researchers and professors, which differs across disciplinary areas, as well as by the publication styles prevalent in certain fields (Fig. 2). In some areas, products other than articles, such as

¹¹The disciplinary fields are defined by the Scopus database, and some marginal reaggregation is suggested due to the limited number of articles in relatively similar fields. We were unable to use the formal membership of the CA to the disciplinary sector provided for by Italian law because the data on this membership is not available for PhD students, post-doc and adjunct professors.

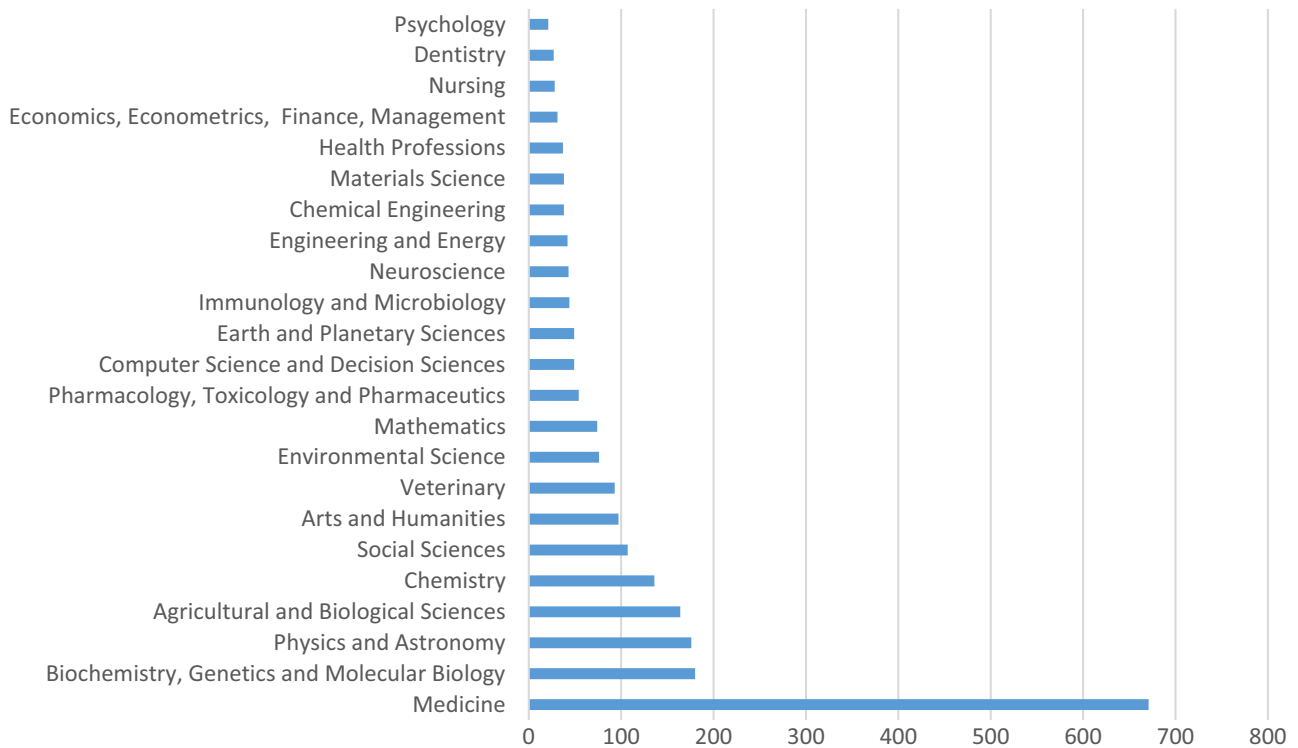


FIGURE 2 Proportion of UNIMI articles in 2022 by disciplinary field.

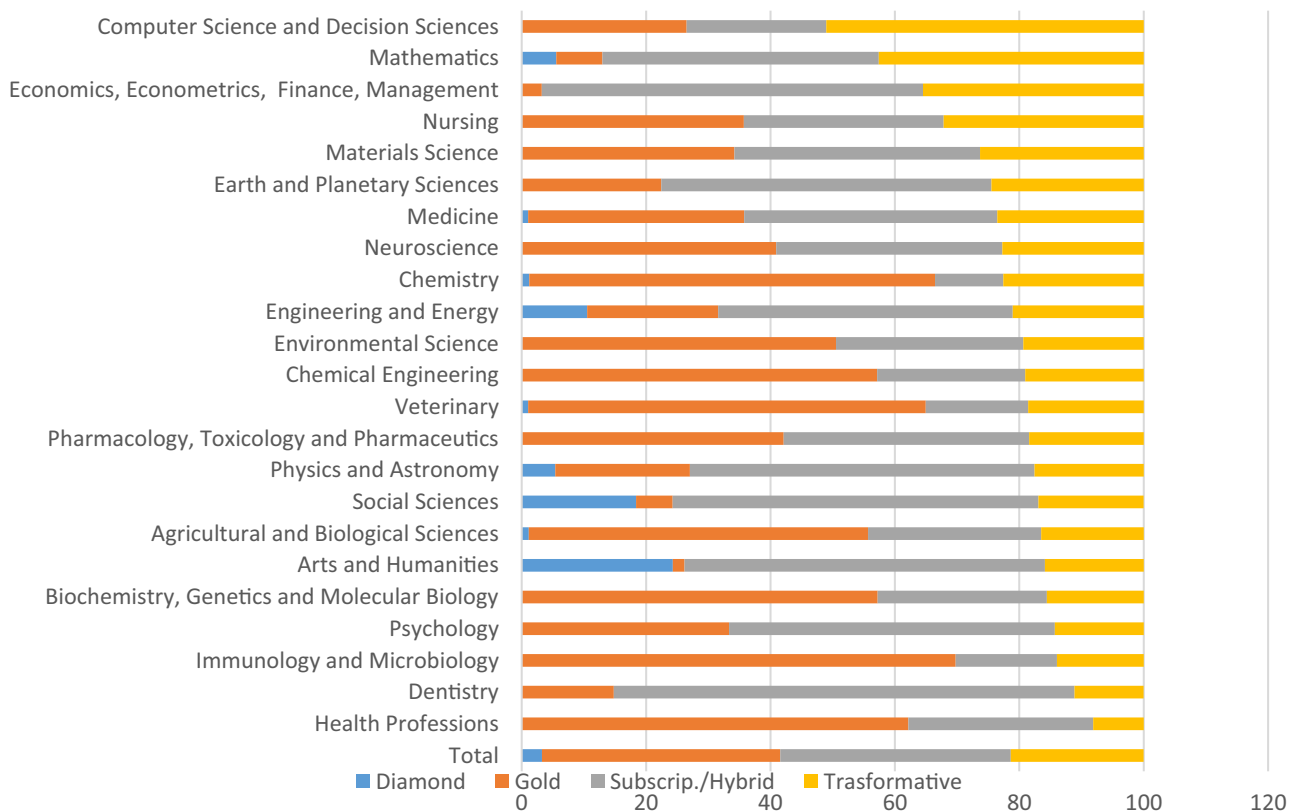


FIGURE 3 Percentage distribution of articles by publication mode and Scopus disciplinary field, UNIMI 2022.

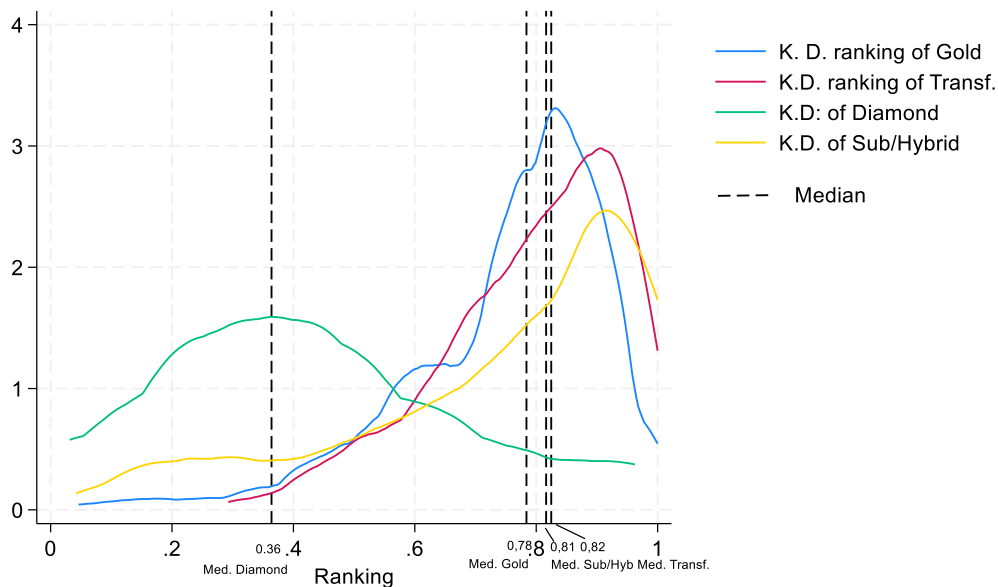


FIGURE 4 Percentage distribution of articles by publication mode and Scopus ranking position.

monographs, are more popular than in others. Additionally, certain areas exhibit lower article counts and/or fewer co-authors.

Almost 30% of all articles published at UNIMI in 2022 are attributed to the disciplinary field of ‘Medicine’ (Fig. 2). In some disciplines such as Dentistry, Immunology and Microbiology, articles published in transformative journals comprise just over 10% (Fig. 3). In contrast, in others like Decision Sciences and Computer Science, they surpass 50% of the articles. In some disciplines, the proportion of articles published in Gold journals is very high, exceeding 60%. This is the case, for example, in Veterinary, Immunology and Microbiology, and Chemistry. Subscription/Hybrid journals prevail in economic disciplines (Economics, Econometrics, Finance, Management), Social Sciences, and Arts and Humanities.

Articles in Diamond journals are primarily concentrated in the Social Sciences and Humanities, with one notable exception. The SCOAP3¹² consortium, based at CERN and in collaboration with major international publishers, particularly Springer, has transformed the main journals in the field of high-energy physics into open access publications, funded by its resources, and without cost to the authors. As a result, many scholars in the fields of ‘Physics and Astronomy’ and ‘Engineering and Energy’ publish in journals formally categorized as Diamond. However, unlike other journals of this type, these are owned by prominent international publisher.

As we have already mentioned, many ‘transformative’ articles in the 2022 database were accepted before the transformative agreement came into effect for the journal. Moreover, the ‘economic’ benefits for individual scholars introduced by transformative agreements were still relatively new and unfamiliar. Therefore, the decision to publish an article in a transformative

journal in 2022 was largely independent of the opportunity these journals offered to make one’s contribution accessible at no cost to the CA. The decision seems to have relied more on the inherent characteristics of such journals compared to other types, the nature of the disciplinary fields, and the career stage of the CA. It appears that the choice to publish in transformative journals was made without full awareness of their transformative nature.¹³

The impact of the journal where an article is published on the scientific community can be deduced from the journal’s relative position in the Scopus ranking. The derived index ranges from 0 to 1.¹⁴ Figure 4 illustrates, using Kernel graphs (continuous approximations of histograms), the percentage distributions of articles based on their positioning in the Scopus ranking, categorized by publication mode. Except for articles published in Diamond journals, which have significantly lower positioning

¹³While on the other hand the publishing houses knew perfectly well what type of journals they had included in the lists attached to the contracts.

¹⁴Other indicators besides ranking were excluded, although present in Scopus, because they covered a much smaller number of articles. The position of each journal is calculated by Scopus based on the total number of journals in disciplinary subfields (e.g., for the Social Sciences thematic area, the value of a Political Science journal is calculated for the Political Science subfield, and the value of a Sociology journal for the Sociology subfield). If a journal is present in multiple subfields, the one with the best ranking is chosen. A total of 1 is subtracted from the ranking and 1 from the total number of journals in that subfield, and the first number is divided by the second. For example, if a journal is second out of 7, the value will be $(2-1)/(7-1) = (0.167)$. This division value is always between 0 and 1. The value found is subtracted from 1 (the theoretical maximum). Therefore, the value is high for journals at the top of the ranking and low for those at the bottom. For example, in the previous example, $1-0.167 = 0.833$ (medium-high value).

¹²See <https://scoap3.org/>.

compared to all other articles, the differences among the remaining publication modes are not particularly pronounced. However, the median positioning of articles published in transformative journals and Subscription/Hybrid journals is higher (both around 0.82) compared with the median positioning of articles published in Gold journals (0.78).

For almost all academic positions of the CAs, the majority of articles are published in subscription/hybrid journals (Fig. 5). Significant exceptions are researchers and associate professors, the roles with the highest number of members and most prolific,

whose articles are more often published in Gold journals (45% and 40% respectively). The category of CAs that most frequently publishes in transformative journals is that of full professors (25% of articles).

Finally, and quite surprisingly, the distinction based on gender also appears to play a role. The proportion of articles in Gold Journals is much higher among female CAs than among male CAs. Conversely, articles published in subscription/hybrid and transformative journals are much more common among male CAs (Fig. 6).

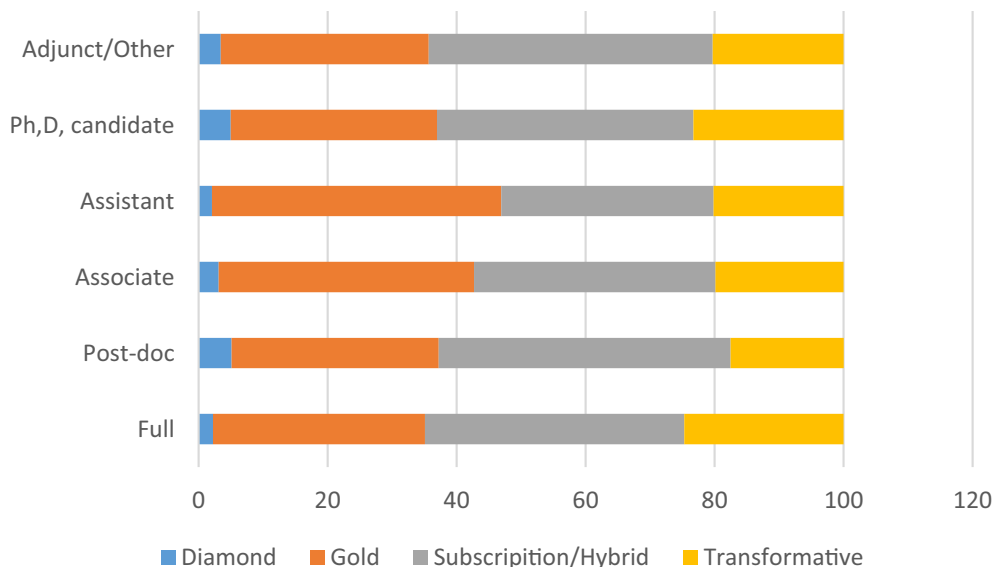


FIGURE 5 Proportion of articles by publication mode and academic position, UNIMI 2022.

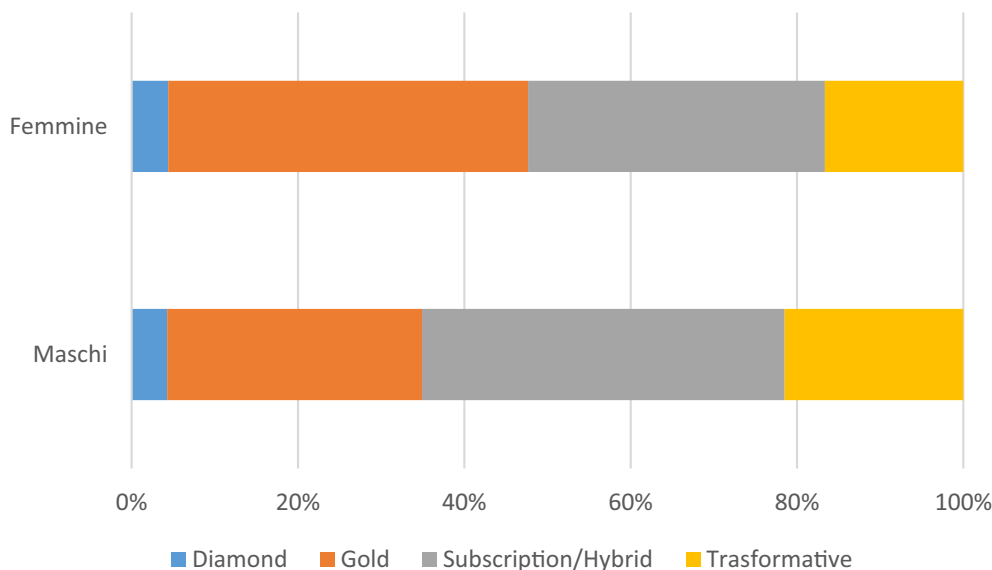


FIGURE 6 Proportion of articles by publication mode and CA gender, UNIMI 2022.

A MULTIVARIATE ANALYSIS

The information presented so far suggests that articles published in transformative journals in UNIMI aim to have a greater impact on the scientific community compared to those published in Gold or Diamond journals. Additionally, their CAs are more frequently already holding the rank of full professor, indicating less pressure to maximize the number of publications in a short period. However, these provisional results call for a more in-depth investigation for two fundamental reasons. First, each of these findings is considered separately from the others, especially considering the nature of disciplinary fields, which, as demonstrated in the previous paragraph, exhibit varied publication modes. Additionally, the apparent role played by the CAs gender could depend on an unbalanced distribution of female scholars among academic ranks and disciplinary fields. Only through a multivariate analysis considering all proposed variables simultaneously can we obtain a reliable understanding of the factors that contribute to the propensity to publish in transformative journals compared to other venues. Secondly, we cannot exclude the possibility that the profile of the CAs who had the opportunity and/or willingness to use the vouchers granted by the transformative agreements is different from that of the CAs who, despite publishing in transformative journals, did not use them and did not make their publications open access and similar to the profile of CAs who publish in Gold Journals. In the following analyses, we hypothesize the contrary: that the set of transformative articles published in 2022 that took advantage of the vouchers and consequently are open access are mostly homogeneous with the transformative articles that did not take advantage of the vouchers. In other words, we hypothesize that the 'openness' of transformative articles has not (at least yet) played an important role in choosing transformative journals as the publication venue compared to all other publication venues. This hypothesis is confirmed by a statistical analysis available in an online appendix.¹⁵

The propensity to publish in a transformative journal instead of other publication venues can be evaluated through a multinomial logistic analysis. We grouped some of the values of the variables we illustrated in the descriptive section in order to simplify and facilitate the results' interpretation. The academic positions have been grouped in two categories: on one side the positions that are not affected by the scientific production levels as they are already at the top position (full professors) or they are not on an academic career path (adjunct professor); on the other side all other positions that can feel the pressure of the rules governing scientific careers. The disciplinary fields have been subsumed in

¹⁵We checked the validity of this hypothesis through a binary logistic regression where the dependent variable is the presence or absence of voucher utilization. In Natural Sciences and Economics and Social Sciences, there is a higher propensity to use the vouchers compared to Health Sciences. The rest of the coefficient variables are not significant. Therefore, we can infer from these results that there is no substantial difference between the two types of transformative articles with respect to the academic position and gender of the CAs and the ranking of the journals.

seven large scientific areas: Health Sciences, Natural Sciences, Mathematics Physics and Astronomy, Engineering and Chemistry Science, Computer and Decision Sciences, Economics and Social Sciences, Arts and Humanities.

In multinomial logistic analysis, a reference event is selected, which, in our case, is the publication of the article in a transformative journal. The role of selected variables is assessed in relation to an alternative 'event', such as, for instance, publication in a Gold journal. If the coefficient of a variable is positive and statistically significant, it indicates that the variable favours the event of 'publication in a Gold journal' over the reference event of 'publication in a transformative journal'. If negative, the opposite holds, of course. The coefficients are logarithms. To understand their real significance, they need to be transformed into relative risks or percentages of increase or decrease for the chosen event compared to the reference one. When variables are categorical and not numerical, such as academic position, the coefficients are expressed relative to a category of the variable chosen as the reference category. For example, if we choose 'Full/Adjunct professor' as the reference category for the 'University qualification' variable, the value of 0.28 for the coefficient of 'other academic positions' in the analysis dedicated to the event 'publication in Gold journals' tells us that not being a Full or Adjunct professor rather than a Full or Adjunct professor increases the probability of publishing in Gold journals by about 1.32 times compared to publishing in transformative journals. The results of our analyses confirm the impressions obtained from the simpler cross-tabulations of the previous graphs (Fig. 7).

The impact of journal ranking is consistently significant in every comparison. As the ranking increases, the probability of publishing in a Gold journal compared to publishing in a transformative journal is only about 23%, the probability of publishing in a Subscription/Hybrid journal is 29% (Fig. 7), not to mention the Diamond journals for which this probability is little more than 1%.

In other words, the choice not to publish in transformative journals, all else being equal, is negatively influenced by the selectivity of these journals and/or, probably, by longer review times that is usually correlated with selectivity.

Moreover, the propensity to publish in transformative journals is low and inconsistent across different scientific areas. Taking 'Health Sciences' as the reference discipline, no other scientific area, except for 'Computer Sciences and Decision Sciences', consistently shows a higher or equal propensity to publish in transformative journals compared to other alternatives. Specifically, in Natural Sciences and Engineering and Chemistry, Gold journals are chosen 1.7 and 1.3 times more, respectively, compared to transformative journals. In Economics and Social Sciences, and in Arts and Humanities, both Diamond and Hybrid/Subscription journals are by far the preferred choices. Scholars in Math, Physics, and Astronomy prefer Diamond Journals, which however, as previously noted, have a peculiar nature (Fig. 7).

The scientific areas that most strongly reject Gold Journals, namely Economics and Social Sciences, and Arts and Humanities, belong to sectors considered non-bibliometric by the current



FIGURE 7 Journal type. Multinomial logistic analysis with scientific areas. Reference mode: 'Transformative' (coefficients of non-significant variables are omitted; Risk ratio values are provided in brackets).

regulations in Italy regarding national scientific qualification. As explained earlier, in non-bibliometric fields, the necessary (though not sufficient) criteria to obtain national qualification for roles like associate professor and full professor are not centred on the total number of scientific articles and individual citations.

When we categorize scientific areas into 'bibliometric' and 'non-bibliometric' sectors (Fig. 8), it becomes evident that those within bibliometric fields tend to prefer publishing in Gold journals over transformative journals. The probability in this scenario is almost seven times higher than the probability of publishing in transformative journals (Fig. 8). These are the areas of knowledge in Italy where there's a pressing need to publish extensively and promptly, prioritizing Gold journals even at the potential expense of the articles' reputation and impact within the scientific community. As mentioned in the previous section, in these scientific areas the 'objective function' for scholars seeking career advancement is the maximization of the number of published articles. By publishing many articles in Gold Journals, UNIMI scholars can also try to maximize the number of individual citations in a less risky way compared to attempting to publish fewer articles in more prestigious, highly-cited, but also more selective transformative journals.

The importance of the thresholds set by the National Evaluation Agency (ANVUR) to participate in the national scientific qualification process in influencing the choice to publish in Gold journals rather than transformative journals is indirectly confirmed by other important results of our analyses. CAs still

seeking academic advancement, especially assistant professors and associate professors, show a greater propensity than full professors and adjunct professors to publish in Gold journals, more than 1.30 times the probability of publishing in transformative journals. Additionally, the high propensity of female CAs compared to male CAs to publish in Gold Journals, between 1.7 and 1.9 times the probability of publishing in transformative journals, can be explained in the same terms. We hypothesize that young female scholars, still a minority in Italian universities, facing greater difficulties in balancing life and career requirements, perceive a greater urgency to publish as much as possible compared with male scholars.

IMPLICATIONS

The findings of our analysis reveal that when assessing the potential of various publication types within a specific academic context, one must consider the regulations governing the career trajectories of the authors of those publications. Initiatives aimed at promoting specific types of open access publications, when coupled with these regulations, can yield unforeseen and not always favourable outcomes. It is conceivable that even Gold journals, much like transformative journals, were initially selected by scholars at UNIMI for reasons scarcely related to the author's economic convenience, particularly following the introduction of transformative contracts in academic publishing. What drew

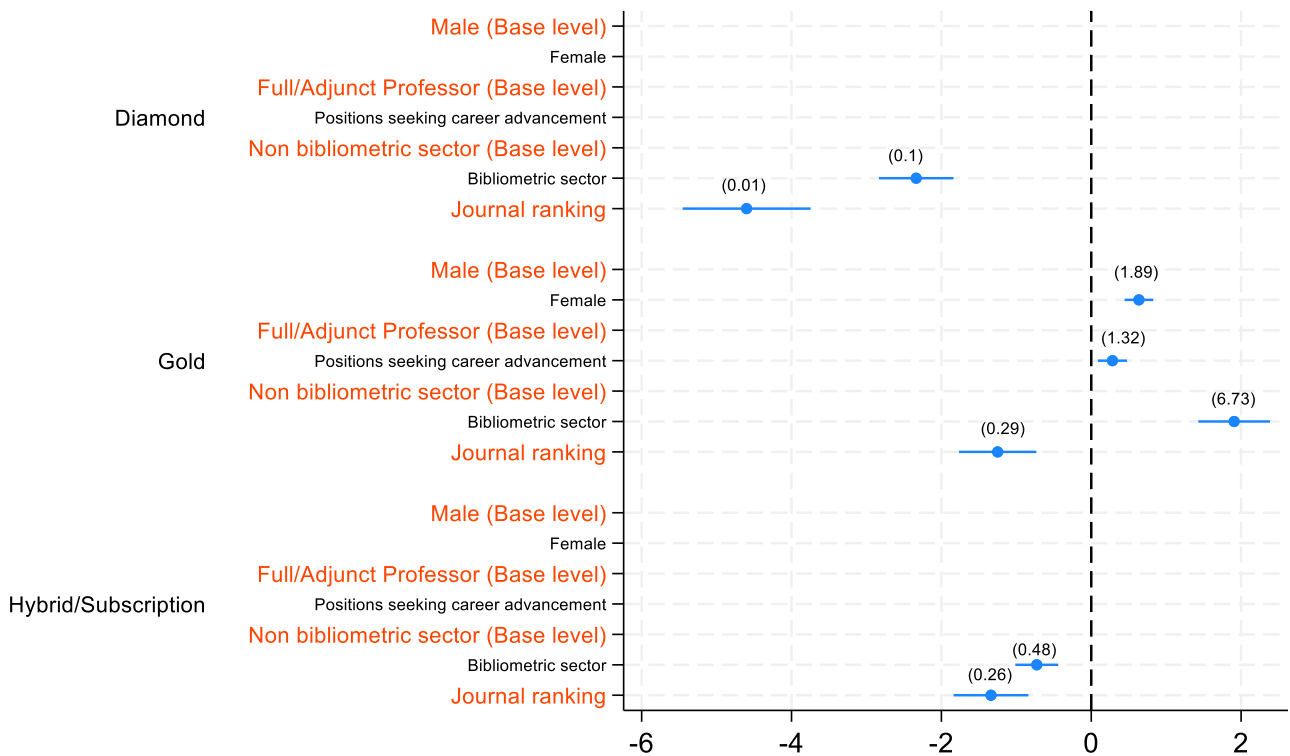


FIGURE 8 Journal type. Multinomial logistic analysis with bibliometric sector. Reference mode: ‘Transformative’ (coefficients of non-significant variables are omitted; Risk ratio values are provided in brackets).

many scholars to these journals was their generally less stringent selection process and quicker peer review, qualities usually correlated with inferior prestige and reputation but particularly valued by scholars with a greater need to boost their publication output (and individual citations). Therefore, we believe that the success of these journals at UNIMI cannot be attributed to a shared commitment among scholars to the objectives of the open access movement, which might lead them to prefer these journals over transformative or hybrid ones. Instead, this success can be viewed as an effect of the regulations governing the national scientific qualification process.

For individual scholars seeking career advancement, publishing quickly and being cited becomes increasingly urgent, and it seems even more urgent for female scholars. To be cited, one must publish, and publishing many articles open access increases the likelihood of being cited, perhaps by scholars who otherwise would not have access to the publication. However, accessibility is not everything. You also need to be quick in publishing many articles. Prestigious, highly cited, but also selective and ‘slow’ journals—such as transformative journals on average—are not very attractive for scholars seeking career advancement, even when they use vouchers to make their articles open access. In other words, the rules for national qualifications already favour publishing in Gold journals.

Of course, if we had data on the attempts individual scholars make in the article submission process, we could obtain incontrovertible proof of this sort of downward adjustment in the publication choices of many of those seeking academic career

advancement in bibliometric fields. However, it also seems plausible to imagine that the choice in favour of Gold journals is a sort of equilibrium strategy shared within the peer community, one that does not always require personal failures to be adopted.

As previously mentioned, Gold open access journals hosting articles by UNIMI’s CAs are positioned lower in terms of impact ranking compared to transformative and subscription/hybrid journals. Some Gold journals are excellent and rank in the highest tier. Often, these are journals from major international publishers that were not included in transformative contracts in 2022. However, the vast majority of articles published in Gold journals in 2022 (70%) were concentrated in journals owned by two new publishers (Frontiers and MDPI¹⁶) that only publish Gold journals. Compared to the Scopus ranking index, the median value of articles published in journals from these two publishers is 0.78, compared to 0.83 for all other Gold journals.

The analysis of the UNIMI case suggests that the danger facing the national research system in Italy is therefore that of promoting an academic overproduction largely scientifically irrelevant.¹⁷ This danger risks being further unintentionally reinforced by a policy indiscriminately favourable to publications

¹⁶For an informed opinion piece on MDPI see Crosetto (2021).

¹⁷There are several scientific and opinion pieces discussing the perverse effects of incentives that favour the overproduction of low-quality science. See, among others, Ioannidis et al. (2018); Conroy (2024); Ioannidis et al. (2024);

in Gold journals. At UNIMI, publishing in Gold journals has been co-funded since 2020. A funding pool has been established to promote open access to articles on the condition that the publishers are not the same ones with which subscription contracts are also in effect (and which require APCs), to avoid so-called double dipping. Since the existence of this fund has been known to researchers and professors at UNIMI for some time now, we cannot exclude that if confirmed in the future, it will influence their choices regarding the venue for submitting articles.

From the perspective of the individual scholar striving to meet the thresholds necessary for qualification as an associate or full professor, the existence of this university fund is desirable. However, is it also desirable from a systemic standpoint, especially for those who value not only open science but also the quality and overall impact of scientific output from each university and the research system as a whole? In the presence of APCs, scholars, and potentially the research teams they are part of, may face a choice: submit their article to a less prestigious and lower-impact journal, which may offer faster and less selective refereeing processes but require direct payment or through research funds of APCs, or opt for a transformative journal, which may offer greater prestige and impact but come with higher selectivity and more uncertain and prolonged refereeing times, all, however, without direct payment or through research funds.

Completely or partially eliminating APC costs indiscriminately for articles published in any Gold journal, making even lower-reputation journals attractive, can further, albeit marginally, promote in the future the overproduction of scientifically irrelevant articles and perhaps reduce the propensity to publish in transformative journals, which are on average more prestigious and have greater impact, and for which the individual university has already entered into expensive contracts.

Indiscriminate financial support for publishing articles in Gold journals can exacerbate the asymmetry between disciplinary fields in Italian universities regarding the dissemination of open-access publications. This asymmetry is partly attributed, once again, to the regulations of national qualification. In non-bibliometric fields such as Social Sciences, Humanities, and Economics, the pressure to publish numerous articles is alleviated by rules for national scientific qualification, which also consider alternative modes of scientific production.¹⁸ It is unsurprising that the proportion of articles published in Gold journals is low in these fields. Moreover, there are few articles published by publishers who have entered into transformative agreements, as some major publishers specializing in these fields have not yet reached an agreement with CRUI-CARE. Since publishing open access books and book chapters usually involves high costs, especially with major publishers, the alternative for open access publishing in non-bibliometric

¹⁸Even in non-bibliometric fields, distortions in publishing styles induced by qualification thresholds are significant and serious. A very fragile barrier to the overproduction of articles is represented by the threshold of the so-called excellence-tier journals, which currently seems to lead to a greater increase in other forms of scientific communication such as chapters in collective books and monographs.

disciplinary fields mainly entails publishing paid articles in subscription/hybrid journals at UNIMI, without the opportunity for co-funding, or resorting to Diamond journals with lower dissemination, prestige, and impact compared to other publication types. Consequently, achieving open access to scientific production at UNIMI and potentially in many other Italian universities proves much more challenging in certain scientific fields than in others. Furthermore, as observed, in the fields where it is more feasible, it often takes place at the expense of scientific relevance.

AUTHOR CONTRIBUTIONS

The article's overall design and the development of its research hypotheses were the result of a joint effort. The data set was created by Laura Berni, who also wrote the section on open access and contractual models. Francesco Zucchini analysed the data and identified implications derived from the results.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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