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Social determinants of citations: An empirical analysis of UK economists

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Abstract

We investigate to what extent personal proximity and similarity in professional and political attributes, besides scientific factors, help explaining citations between economists. We do so by using a unique dataset of all academic economists based in the United Kingdom, created specifically for this study by merging RePEc data on works published in the past four decades with information collected by manually processing their curriculum vitae (CVs). We investigate directed citations within each pair of authors active in a same year, finding that social factors play an important role as predictors of citations. An author is systematically more likely to cite another economist not only if they work on similar topics, but most relevantly if they have been co-authors, faculty colleagues, alumni of the same Alma Mater, and even if they express similar political views. The implication is that citations do not signal the intrinsic quality of research outputs only, but they also capture social and professional connections. When citation counts are used to reward academics, economists have an incentive to join many and large professional communities as doing so would increase their predicted citations.

1 | INTRODUCTION

As succinctly put by Klemer and van Dalen (2002), academic researchers have mainly two objectives: to get published and to be cited. Having a work published is a necessary condition for researchers to contribute to scientific knowledge, but it is not sufficient for their contribution to have an impact. Their work needs to be known, which is often measured by the fact of it being cited by other scholars. It is known that citation counts are highly skewed (Aksnes & Sivertsen, 2004; Hamermesh, 2018); that is, most articles receive few or no citations while few receive many citations, and researchers are aware that they participate in what has been called an 'attention game' where the pay-off is positively correlated with said skewness (Klemer & van Dalen, 2002). Besides the elevated aim to contribute to the advancement of science and hence society, researchers also have material goals that in many countries are impacted by the number of citations received, such as being hired, appointed or promoted; being given tenure; having salary increases; winning awards and fund allocations (Ellison, 2013; Hamermesh, 2018; Faria & Mixon, 2021; see also the studies cited by Coupé, 2004).

In the case of economics, journal rankings (or even just lists of 'top journals') are arguably more influential in many countries than individual-level citations (see, e.g., Heckman & Moktan, 2020). These rankings, however, are typically based directly or indirectly on journal-level citation counts, such as the Journal Impact Factor™ or similar indexes developed by competing database providers. According to their supporters, the main benefit of employing indexes or rankings based on citation counts is the recognition of researchers' merits on the basis of supposedly objective indicators, avoiding 'the side effects of nepotism that prevails in the "old boys"-network' (Van Dalen & Klamer, 2005). However, specialised literature in the fields of library and information sciences and the consolidating field of scientometrics (the 'science of science') has highlighted that citations correlate with many factors that apparently do not regard scientific merit (D'Ippoliti, 2021). To mention just a few, citations are found to correlate with the number of authors, the year, language, and kind of publication, and the reputation of the journal (Laband, 2013); and at the author level, with academic seniority, field and degree of specialisation, and gender (Grossbard et al., 2020; Hengel & Moon, 2020). Yet, differently from other social scientists, economists often see citations as a measure of scientific *quality*: a rough proxy, perhaps, but generally an unbiased one (see Hamermesh, 2018; Zacchia, 2021).[1] This assumption reflects a historical attitude in the natural sciences that, however, is increasingly challenged. For example, in a joint declaration, the Académie des Sciences, Leopoldina, and Royal Society (2018) warn that 'the misuse of metrics has become a cause for serious concern' (p. 2), noting that

> undue emphasis on bibliometric indicators will not only fail to reflect correctly the quality of research, but may also hinder the appreciation of the work of excellent scientists outside the mainstream; it will also tend to promote those who follow current or fashionable research trends, rather than those whose work is highly novel and which might produce completely new directions of scientific research. Moreover, over-reliance on citations as a measure of quality may encourage the formation of aggregates of researchers (or 'citation clubs') who boost each others [sic] citation metrics by mutual citation. (p. 2)

In this work, we consider the case of economics in the United Kingdom[2] to investigate how such 'citation clubs' may arise from economists' citation behaviour. The focus on a specific country is made necessary by the very large number of possible pairs between each two authors and by the considerable time and effort necessary to manually gather and process data from individuals' CVs. The case of the United Kingdom seems especially relevant for in the scientometrics and in the economics literature as it is considered a test-bed for the worldwide problems of research evaluation and of allocation of resources to scientific research (Oswald, 2007).

It is relevant to note that citation clubs do not necessarily arise from bad faith on the side of any specific individual or group of individuals. Rather, in the face of a burgeoning scientific literature that makes it impossible to read

[1]There are, of course, exceptions: for a survey, see D'Ippoliti (2020). Notably, a special session on the curse of the top 5 journals, organised by the AEA at the 2016 ASSA meetings, attracted a lot of attention; James Heckman's contribution to it was later published as Heckman and Moktan (2020).

[2]According to the largest bibliometric database in the field of economics (RePEc), which we use in this work, the United Kingdom ranks first in the ranking by citations for the authors affiliated in a certain country or state. The ranking of 'Top Countries and States' has been retrieved on the RePEc website (https://ideas.repec.org/top/top.country.all.html) as of May 2023. For more information about our database see Section 3 and the Appendix S1, for information on the index, see Zimmermann (2012).

and cite every colleague working on similar topics or employing similar methods to one's own, economists generally cite the works of colleagues that they personally know. As a result, while impactful works are obviously more cited than works of lower quality, however defined, economists with more social ties to their colleagues tend to be cited more often. And as these connections may be scientific or personal, individuals' accrued citation counts (and the associated bibliometric indexes) cannot be interpreted as unbiased proxies of the quality of their publications.

We do not claim here that citations do not depend on the quality of a scientist's publications. However, in this work, we document that they depend on the social structure of the profession too, and they do so in a way that produces systematic correlations between citation counts and several variables unrelated to research quality, thus making the interpretation of citation counts, and consequently their use in research evaluation, not straightforward.

At the aggregate level, large groups or communities of economists will accumulate more citations than small groups; in some cases, this may reflect an average difference in the quality of their research, in others it may not. For example, if one could argue that economists who are active in a certain country are on average 'better scholars' than those based elsewhere, it seems more puzzling to assume that works in a certain subfield of the discipline are of better quality than works on other topics.

At the individual level, economists may vary in ways that affect their ability to attract citations due to both individual characteristics, such as one's demographic background or their skills as researchers, and in terms of their relations with other colleagues. To control for both kinds of factors, we analyse each possible pair of authors (each dyad) for all UK-based economists who have been active in a same year, for the four decades since 1980. Through dyadic regression analysis, we consider past scientific and social ties between the citer and the cited author as determinants of the number of citations between them.

Using the terminology proposed in the seminal work by Lazarsfeld and Merton (1954), we denote by 'homophily' the tendency of individuals with similar characteristics to more likely, or more often, associate with each other than with people with different characteristics (see also Cialdini & Goldstein, 2004).[3] Taking citations within each pair of authors (dyadic citations) in a certain year as our measure of connection, we analyse how such homophily may correlate with both *similarity in terms of their status* in ascribed characteristics (e.g., sex and age) and/or acquired characteristics (e.g., professional experience and scientific impact)—thus highlighting 'status homophily' in Lazarsfeld and Merton's terminology and *similarity of scientific and political opinions* (e.g., working on the same topic[s] or methods, or expressing the same political preferences) denoted by those authors as 'value homophily'.

As shown in what follows, we find that economists' citing behaviour is affected by both status homophily and value homophily; that is, economists tend to cite more often their colleagues with similar characteristics and similar opinions. This individual behaviour implies that larger and more connected communities—such as countries with more active economists, or papers on more widely studied topics—are more cited on average.

Consequently, there is strength in numbers: both in the sense that larger communities accrue more citations and that citation indexes can be shape the incentives for individual scientists. As recent research has shown that academics do respond to incentives (De Philippis, 2020), research evaluation practices that heavily rely on citation metrics are in need of closer scrutiny in terms of their impact on the direction of future economics research.

Our paper contributes to the literature on publishing, citation behaviours and networks in economics in two ways. First, we consider both status and value homophily, operationalised through a rich set of connections among economists, whereas extant literature typically focuses on one set of links at a time. Second, while extant literature mostly focuses on coauthorship networks (or at most citation networks among journals), we focus on dyadic citations among authors, a currently understudied topic in economics, despite the economists' obsession with rankings and the use of citations to supposedly quantify excellence (Zacchia, 2021).

[3]For a recent example of how this could happen without implying any bad faith, see for example Brancaccio (2022).

The rest of the paper is organised as follows: Section 2 summarises the literature on academic networks in economics; Section 3 presents the data and method used for the empirical analysis; Section 4 documents the main results; and Section 5 draws some conclusions.

2 | THE LITERATURE ON CITATION NETWORKS

Several scholars have studied citation behaviour among social scientists with ethnographic or anthropological methods (for the case of economics, see White & Wang, 1997); their main conclusion has been that there are both scientific reasons for an author's decision to cite somebody, such as recognition of intellectual debt, reference to further results or data, and social reasons, such as pleasing possible anticipated referees, gaming the evaluation systems or adjusting to academic and professional power (for a review, see D'Ippoliti, 2021). If one could assume that professional power only accrues to those who deserve it on grounds of scientific merit alone, then the distinction between the former set of motivations (scientific citations) and the latter (perfunctory citations) would not be empirically relevant (Moed, 2005). However, many works have questioned the assumption that scientific merit is the only way to obtain professional power in the case of economics (e.g., Fourcade et al., 2015; or Heckman & Moktan, 2020).

Beside authors' subjective reasons, there is at least one objective factor that may affect citation behaviour: the existence of a maximum number of references that can be included in a paper. While such maximum may vary by discipline and subfields, and according to the editorial guidelines of the publication outlets (journals, publishing houses etc.), it seems reasonable to assume, following Camacho-Miñano and Núñez-Nickel (2009), that a researcher first collects all studies she considers relevant, which she uses while writing a text, and then she picks from this pool the references to actually include in the paper, at this stage necessarily selecting to some extent in a discretionary way.

Due to this ambiguity, whereby citations may partly reflect scientific debates and partly other concerns among authors, they are increasingly used in quantitative studies to map social and scientific communities within a discipline. These studies often employ social network analysis, a methodology that involves the study of relationships between social actors, how these relationships occur, and the implications that can be drawn (Jackson, 2008; Wasserman & Faust, 1994). Starting from the seminal work of Goyal et al. (2006), several lines of research have applied network analysis to economics (Besancenot et al., 2016; Cainelli et al., 2012; D'Ippoliti, 2021; Ductor et al., 2014, 2020; Fafchamps et al., 2010; Molina et al., 2016). These contributions typically focus on co-authorship networks, as has been the case for the investigation of other scientific communities such as those of mathematicians or physicists (Hoffman, 1998; Newman, 2001a, 2001b; Redner, 2005). However, attention is being increasingly devoted to citations too, and occasionally to other links among economists, such as shared institutional affiliations (Flickenschild & Afonso, 2018) and scholarly acknowledgments (Baccini & Petrovich, 2021).

Goyal et al. (2006) investigated the evolution of social distance among economists over 30 years and found an inverse relationship between the growth in the number of connected economists and their average distance within the co-authorship network. According to the authors, this is due to the existence of a subset of economists, whom they call 'stars', characterised by a very high number of connections with other economists. These, in turn, only display few connections with others. Subsequent works have developed mostly into two streams of literature: Some works used network analysis to identify and describe communities of influential academics and/or specific issues or schools of thought; others considered the relevance of network connections to explain individual economists' performance, for example, in terms of productivity or citations. Within the first mentioned stream, Galofré-Vilà (2020) analyses the community of economic historians, Georg and Rose (2016) financial economists, Glötzl and Aigner (2018) the economists based at the Universities of Vienna and Helgadóttir (2016) the 'Bocconi boys'. In several cases, citation networks in this stream of literature have been analysed not among individual economists but rather at the journal level (e.g., by Cronin, 2008; or Baccini et al., 2020), institution level (Önder & Terviö, 2015) or paper level (e.g., by Seabrooke et al., 2015).

In a historical reconstruction of the organisation of the economics profession, Collier (2018) noticed that, ideally, a community of scholars should be inclusive, meritocratic, self-critical and team spirited. Although he did not employ an empirical analysis based on economists' network, it is nonetheless interesting to note that he claims that, in contrast to such ideal state, in academic economics there are both ‘clubs’ and ‘clans’.[4] Collier defines clubs as exclusive communities, in which access is not easy and not necessarily meritocratic, and that risk resulting in narrow debates and lower intellectual innovation—clubs are thus defined based on the possibility and easiness to joining them. Clans, on the other hand, are tight academic communities in which loyalty can de facto become more important than merit and self-criticism—the defining element is thus the behaviour of inner members (using terminology from the social capital literature, we could say that clans are communities that favour binding over bonding behaviour).[5] This distinction could be redefined in network terms, by noticing that status homophily leads to *clans*, communities whose members are more likely to connect among themselves (e.g., due to personal or professional characteristics, such as being affiliated to the same institutions); while value homophily could lead to *clubs* when, instead of new connections being established based on scientific proximity only, such proximity is made exclusive, for example, when certain subfields ignore contributions from other subfields, or when proximity is defined as agreeing on a certain theoretical or political issue. Homophily, in fact, is considered a powerful force in cultural dynamics, being one of the primary mechanisms for understanding how different cultural groups can form and cluster over time towards a stable configuration of a global monoculture (Axelrod, 1997; Centola et al., 2007). The psychological process that let us feel justified in our opinions when we are surrounded by others who share the same beliefs (value homophily) and when we interact with others who share similar backgrounds (status homophily) is usually used by historians and sociologists of science to describe the processes that drive away from cultural diversity toward cultural convergence (Keating et al., 2007; Klemm, 2005; Klemm et al., 2003). In principle, scientific connections between economists more likely pertain to value homophily (e.g., working on the same topics), and personal connections might more likely pertain to status homophily (e.g., belonging to the same age cohort). However, there is no one-to-one correspondence between each kind of connection and its possible classification: For example, a personal connection such as being employed in or having graduated from the same institution might underlie scientific proximity too, and therefore, citations being correlated with such kind of connection might denote value homophily. For people whose occupation implies working with and on ideas, the distinction between personal and ideational connections might be blurred. In what follows, we classify connection kinds on the basis of their most prominent character, without denying that alternative interpretations might be possible.

Empirically, an increasing number of works have used network analysis to highlight possible negative aspects, or externalities, of social connections among economists. For example, Henriksen et al. (2017) focused on ‘Chicago School’ economists, finding that they are more likely to cite each other and thus to concentrate on an internal, closed debate (the reciprocity index in citations is higher among them than in other communities). Similarly, analysing the curricula of all authors and editors of the top 4 general interest (US-based) economics journals, Colussi (2018) found that journal editors favour authors with whom they have personal connections, such as current or former PhD students or faculty colleagues, by being more likely to publish their works and by accepting from them longer articles on average. Ductor et al. (2020) analysed board membership and authorship data for 106 economics and finance journals, finding that co-authors of journal editors publish more articles in their journals and that these articles are not of higher impact (measured by citation counts) than the other articles. They are, however, reluctant to infer that this is necessarily a sign of favouritism, because the number of submissions from these authors (required to compute acceptance rates) is unknown.

[4]As is well known, the first economist to talk about clans within our discipline was Leijonhufvud (1973). For a recent discussion of his thought, see e.g. Ferlito (2022).

[5]Similar claims have been raised by several other historians of economic thought (see, e.g., Roncaglia, 2020), and the notion of ‘clans’ in economics can be traced back at least to Leijonhufvud (1973), who ironically employs the term to denounce exclusivity and sterility of the academic debate in economics. The lecture by Collier is highlighted here for its distinction between exclusivity of communities (clubs) and their inner-looking behavior (clans).

These works echo the findings of a larger literature, not based on network analysis, which highlights institutional concentration in economics (Hodgson & Rothman, 1999), that most, and sometimes virtually all, editorial board members of the so-called top journals graduated and work in a handful of economics departments in the United States; that these editors tend to stay in the role for very long, with possibly negative impact on the production and publication of innovative research (Heckman & Moktan, 2020); and more in general, the highly hierarchical and possibly oligopolistic nature of economics (Fourcade et al., 2015), and the widespread diffusion of scientific misbehaviour and professional malpractice (Le Maux et al., 2019) as well as discrimination (Corsi et al., 2019a, 2019b) in academic economics as well as among students.

In this work, we do not wish to deny that favouritism, misbehaviour and discrimination exist in the economics profession, but rather, we focus on highlighting how common, 'regular' behaviour, such as being more likely to cite somebody one personally knows or somebody with a similar political orientation, can produce relevant consequences in the aggregate, such as a correlation between citation counts and variables that should not, in principle, concern the quality of research.

Within this stream of literature, earlier works focused on co-authorship networks and productivity, measuring the latter by the number of publications (e.g., Cainelli et al., 2012; Ductor et al., 2014). Closer to our focus here on citation networks, later redefinitions of productivity in terms of bibliometric indexes of visibility, such as the *h*-index or the *g*-index,[6] paved the way to analyses of citations and the associated indexes (Besancenot et al., 2016; Kim et al., 2009). However, studies on author-level citation networks for the community of economists have been rare so far, regarding the analyses on other scientific communities, especially in the natural sciences (Abbasi et al., 2014; Baldi, 1998; Mählck & Persson, 2000; Uddin et al., 2013; Wallace et al., 2012; White et al., 2004; Yan & Ding, 2009).

These studies have typically followed one of two research strategies: On the one hand, analyses of dyadic connections looked at every possible pair of authors within a certain sample or population, in order to study the determinants of pair-specific links (this is the approach taken in the present study); on the other hand, more aggregate analyses have looked into how an author's position within a social network can affect her overall performance and/or the topology of the whole network itself.

Concerning dyadic analyses, Baldi (1998) analysed data on all possible pairs of astrophysicists who have dealt with celestial masers using dyadic logistic regression. He found that the content of the cited paper and its impact, measured by the accumulated sum of citations (excluding self-citations), are good predictors of dyadic citations between two authors. Furthermore, he did not find any effect of social ties between citing and cited authors. Similarly, White et al. (2004) studied the flow of information within an interdisciplinary research unit, finding that proximity in the content of written documents is a more reliable predictor of future citations than personal knowledge between research team members. By contrast, Mählck and Persson (2000) arrive at an opposite result, detecting a significant overlap between the co-authorship and the citation networks of two biology departments.

A plausible explanation of such conflicting results can be attributed to heterogeneity between scientific disciplines. As noted by Wallace et al. (2012), different communities are characterised by different behaviours and customs regarding citation and co-authorship. The authors note that the number of citations between previous co-authors tends to be lower in the social sciences than in the natural sciences; this may be attributable to several factors, the most relevant of which seems to be the average number of co-authors per paper.

In the first study of a citation network among economists (as opposed to networks of journals or institutions, mentioned above), D'Ippoliti (2021) found that, among all Italy-based economists in the 2011–2015 period, both scientific and personal proximities are relevant predictors of dyadic citations as reported in the Clarivate Analytics Web of Science™ database. The present work extends that analysis by considering both a larger sample of authors and a

[6]The *h* index (Hirsch, 2005) measures the number of an author's publications, *h*, that have received at least *h* citations. The index thus ignores all the other publications by the author, which have received fewer than *h* citations, as well as all citations to her publications, in excess of *h*. Therefore, the *h* index favours those authors who regularly publish papers of a certain given impact, and penalises those who occasionally publish much cited papers along with many papers that attract few citations. To reduce this effect, Egghe (2006) developed the *g* index, indicating the highest number of papers, *g*, which all together have received at least g^2 citations.

different country, that is, all research-active economists based in the United Kingdom, and a longer time span on a more comprehensive data source, that is, the whole RePEc database for the years 1980–2019.

3 | DATA AND METHODS

We base our analysis on two datasets: the RePEc database, arguably the most comprehensive database of publications in economics,[7] and a manually compiled collection of CVs of all UK-based academic economists. In this section, we give an overview on how we built the final dataset, while the details of the procedure used in the identification process and on the different steps of data collection and cleaning are given in Appendix S1.

We first collected a list of 2639 academics who declare economics to be among their research interests by browsing all UK universities' websites. To link these authors to works in the RePEc database, we used the RePEc Application Programming Interface service, obtaining their unique RePEc identifier (handle). This way, we identified 55% of the authors in the initial list (1447 individuals; the others are likely scholars in other disciplines, such as sociology or political science, which are not covered in RePEc, or sometimes economists mostly active in teaching rather than research). Additional authors were added by including those who declared on their RePEc author page to be affiliated with at least one UK research centre. As these self-declarations may be outdated or wrong, we searched online for these authors and verified that 1998 of them were indeed affiliated with an institution in the United Kingdom at the time of data collection (March 2020). Accordingly, our final sample—which arguably encompasses almost the whole population of research-active UK-based academic economists—contains information on 3445 individuals.

In order to consider research-active professional economists with consolidated citation practices, and given the extremely large coverage of RePEc, which sometimes include works from scholars of other disciplines, we limited the analysis to the 2764 authors with at least five publications in RePEc.[8] We manually processed the CVs of these individuals to understand if, where and when they obtained a PhD in economics and their affiliation(s) during the period 1980–2019. We included multiple affiliations for authors, for example, at think-tanks or extended visiting positions, when they were declared on the author's CV and unless they concerned very short periods of time (few days).

Additionally, we collected information on authors' sex and political leaning. We inferred authors' sex from their first name(s) by using the *genderize.io* Application Programming Interface. To account for possible name ambiguities, we kept only name-sex associations for which the reported probability was higher than 70%; the remaining cases were assigned by visual inspection of photos obtained through web search.

Concerning authors' political leaning, we gathered the weblinks shared on Twitter by 735 authors in our sample who have an active account on that platform (more details are available in Appendix S1). We assigned a political orientation to the link sources (a procedure adopted, e.g., by Stefanov et al., 2020), based on the categorisation provided by the 'Media Bias Fact Check' website. The initial set of links shared by the 735 economists contains 243,881 sources, obtained from 231,826 different tweets published between August 2010 and July 2020. We could

[7]As described in their website (http://repec.org/), 'RePEc (Research Papers in Economics) is a collaborative effort of hundreds of volunteers in 102 countries to enhance the dissemination of research in economics and related sciences. The heart of the project is a decentralised bibliographic database of working papers, journal articles, books, book chapters and software components, all maintained by volunteers. The collected data are then used in various services that serve the collected metadata to users or enhance it'. As of November 2020, the database lists over 57,000 authors and contains over 3 million research works from more than 3500 journals and 5000 working papers series.

[8]The exclusion list contains 681 individuals, 40 of whom are registered on RePEc but have no listed works; for 55% of the remaining authors the difference between the first and the last publication is of at least 6 years, implying either that they have published very infrequently or that the outlets where they publish are not well covered by RePEc (e.g., journals of social sciences other than economics and books; see Appendix S1). Some of the remaining 304 authors may be early career researchers such as PhD students (we recall that the five publications could be working papers and pre-prints). We deemed it appropriate to exclude these scholars too, because they may have less consolidated or specific citation strategies, which would warrant separate analysis beyond the scope of this paper.

match a political categorisation for 52,320 of these links (20.4%), for 649 users: 8.3% of all links that we could label with a political category were considered to be left-wing, 78.3% centre-left, 10.1% centre-right and 3.3% right-wing.

These four categories were synthesised both in a directed and an undirected measure of political distance between each pair economists. The undirected measure was obtained by computing the Euclidean distance, that is, the sum of the squared differences between the shares of tweets in each category for the two authors—so the index ranges between 0 (complete similarity of views) and 1 (completely different views). For the directed measure of distance between two authors, we employed a fuzzy-set approach (Alcantud et al., 2018): First, we defined an economist's (fuzzy) positioning along a right-to-left scale, and then for each pair of economists, we computed the difference between their political leaning. In the first step, each author's views shared on Twitter were synthetised by the weighted average of right-wing and centre-right links she shared, minus the weighted average of left-wing and centre-left links.[9] The resulting index is a continuous variable and ranges between -1 (only left-wing links shared) and $+1$ (only right-wing links), and it measures an author's relative positioning with respect to the other economists in the sample. In the second step, our directed measure of political distance for each pair of economists was obtained by the simple difference between their political positioning, and it measures how much an author is to the political right of another one. As a robustness check, in separate estimations, we also included the difference between the two authors' shares of tweets in one or more specific categories.

Finally, concerning bibliometric data, we mirrored the complete RePEc database as of March 2020, keeping works labelled as ‘pre-print’ (i.e., working papers) or ‘article’, which represent 96.5% of the initial dataset, with a publication date between 1900 and 2019. We merged different work versions (e.g., a manuscript that appears in different working paper series, and/or a working paper that is then published in a journal) in a single ‘main version’. Because the metadata available in different versions of the same work are not necessarily the same (e.g., JEL codes could be missing in a working paper series but present in the journal article version), we assigned the information not available in a work's main version from what we could retrieve from the other versions. Evidently, we only kept works of which at least one author is in our list of UK-based academic economists. The final dataset comprises 56,678 citing and 44,162 cited works.

3.1 | Estimation method

We estimate the determinants of citations between any two authors in the sample (‘dyadic citations’) through dyadic regression analysis, that is, estimation on all possible pairs of individuals within a certain sample. In our case, we only consider combinations of authors who are both research-active in a certain year (i.e., they are in any year between their first publication and their last publication) because, by definition, authors cannot cite any colleague after their last publication.

Inference about count data, such as the number of citations, is typically attempted by maximum likelihood estimation of a Poisson or a negative binomial distribution (as is well known, the latter is a generalisation of the Poisson that includes an overdispersion parameter, α). However, as it is typical for all citation distributions, in our sample, both the total accumulated citations per author and dyadic citations exhibit strong skewness, with heavy tails denoting a large share of authors who are never cited, and a tiny minority of authors who receive a disproportionate share of citations, as shown in Figure 1.

For this reason, in the literature, the most common empirical models of the determinants of citation counts are the zero-inflated Poisson regression, and the zero-inflated negative binomial regression. In the following analysis, we present results for the latter, because the citation distribution in our sample exhibits overdispersion (indeed, as

[9]The categories of ‘left’ and ‘right’ were assigned weight 1, denoting fully defined positions, whereas ‘centre-left’ and ‘centre-right’ were attributed a weight equal to the share of economists who tweeted or retweeted links labelled in the respective category. For an introduction to applications of fuzzy set theory to economics, see Chen et al. (1983).

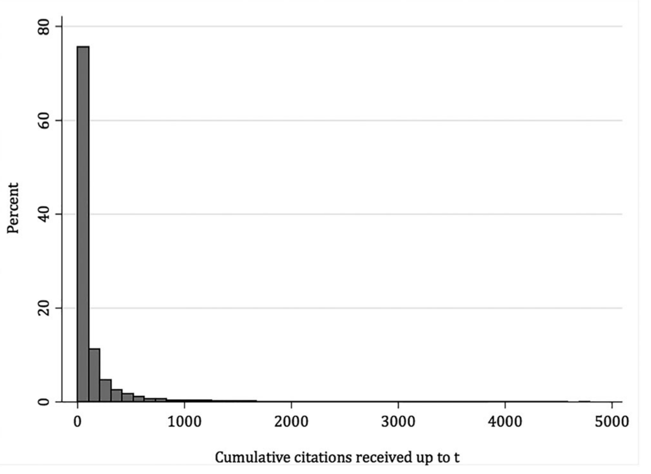

FIGURE 1 Total citations on RePEc received by UK-based economists 1980–2019.

shown in Tables 1 and 2, the overdispersion parameter is consistently different from zero in all specifications).[10] Zero-inflated models assume a mixture of two underlying stochastic processes: one determining how many citations an author receives (the count model, assumed here to follow a negative binomial distribution) and one determining if the author is not cited at all, that is, a probability distribution for 'excess zeroes', modelled here with a logistic regression. A theoretical justification for assuming a process determining if an economist *i* is ever cited by a colleague *j*, different from the process determining how many times *j* cites *i*, may be found in the observation by Camacho-Miñano and Núñez-Nickel (2009) mentioned in Section 2, that authors face an upper limit to the number of references they can include in their papers, thus having to select the works and authors they will cite among a larger pool of 'citable' sources. In other words, we assume that when writing a paper, an author *j* collects all works possibly relevant to her analysis: These are the works that she might cite at least once, and the logit component in our model determines if some other author *i*'s works are among them, depending on several variables. Among these citable works, *j* picks those that she will actually cite and decides how many times to cite each of them—this being the count component of the model. Notice that the two processes are simultaneous and not sequential, because we do not observe authors in the process of writing and then choosing whom to cite, but only their final decisions; and that the count component too may indicate that an author is not cited in a certain year if the predicted value is zero (thence the denomination of 'excess' zeroes for the zero-inflation component).

Building on this conceptualisation, it seems appropriate to assume that the zero-inflation component of the model mostly contains variables of intellectual proximity between two authors, while the count component may include measures of social and professional proximities too (in all specifications, variables denoting connections are taken with a 1-year lag to prevent possible endogeneity issues). Accordingly, in the zero-inflation component, we include

- Three measures of intellectual and scientific proximity between the two authors (*value homophily*): how many one-digit JEL codes authors *i* and *j* have both used in their publications up to the previous year ($t - 1$); the number of common references that the two authors have used in their publications up to $t - 1$ (which is a widely used measure of scientific/intellectual proximity, since the seminal work by Small, 1973); and the number of papers they have written in the same journals or working papers series up to $t - 1$.[11]

[10] Results for the zero-inflated Poisson specifications are not qualitatively different from those shown in the text and are available upon request from the authors.

[11] For a discussion on journal networks in economics and their possible role in shaping scientific and professional communities, see Baccini et al. (2020).

TABLE 1 Determinants of dyadic citations, pooled zero-inflated negative binomial regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Count component (number of dyadic citations)									
Citation in $t-1$	1.284***	1.220***	1.264***	1.222***	1.200***	1.243***	1.236***	1.218***	1.264***
	[0.019]	[0.018]	[0.018]	[0.017]	[0.017]	[0.017]	[0.018]	[0.018]	[0.017]
Cited author has at least a 'top 5' article	0.488***	0.504***	0.499***	0.513***	0.519***	0.513***	0.495***	0.503***	0.498***
	[0.013]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]
Coauthors in $t-1$	1.637***	0.840***		1.264***	0.778***		1.236***	0.826***	
	[0.031]	[0.035]		[0.027]	[0.030]		[0.029]	[0.032]	
No. of years in which coauthors up to $t-1$			0.535***			0.441***			0.483***
			[0.013]			[0.012]			[0.013]
No. of common affiliations in $t-1$	0.620***		0.507***	0.581***		0.514***	0.519***		0.491***
	[0.022]		[0.021]	[0.020]		[0.020]	[0.021]		[0.021]
No. of years in common affiliations up to $t-1$		0.455***			0.367***			0.382***	
		[0.012]			[0.012]			[0.013]	
Value homophily									
No. of common JEL codes in $t-1$	0.002***	0.001***	0.001***						
	[0.000]	[0.000]	[0.000]						
No. of common references up to $t-1$				0.002***	0.001***	0.001***			
				[0.000]	[0.000]	[0.000]			
No. of papers in the same series up to $t-1$							0.039***	0.017***	0.013***
							[0.002]	[0.002]	[0.002]
Same Alma Mater	0.350***	0.302***	0.285***	0.324***	0.301***	0.286***	0.298***	0.289***	0.277***
	[0.029]	[0.025]	[0.025]	[0.024]	[0.024]	[0.024]	[0.026]	[0.025]	[0.025]

TABLE 1 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Status homophily									
Difference in accumulated citations up to $t-1$	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Same 5-year graduation period	−0.077***	−0.072***	−0.073***	−0.101***	−0.091***	−0.094***	−0.087***	−0.076***	−0.076***
	[0.014]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]	[0.013]
Male citer, female cited	0.089***	0.085***	0.079***	0.084***	0.082***	0.076***	0.085***	0.084***	0.078***
	[0.018]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]
Female citer, female cited	0.337***	0.346***	0.339***	0.365***	0.368***	0.359***	0.346***	0.348***	0.340***
	[0.033]	[0.033]	[0.033]	[0.033]	[0.032]	[0.033]	[0.033]	[0.033]	[0.033]
Female citer, male cited	0.162***	0.171***	0.168***	0.188***	0.189***	0.184***	0.176***	0.176***	0.171***
	[0.016]	[0.016]	[0.016]	[0.015]	[0.015]	[0.015]	[0.015]	[0.016]	[0.016]
Zero inflation component (logit for excess zeroes)									
Value homophily									
No. of common JEL codes in $t-1$	0.005***	0.004***	0.003***	0.001***	0.001***	0.001***	0.002***	0.003***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No. of common references up to $t-1$	−0.024***	−0.025***	−0.026***	−0.025***	−0.026***	−0.026***	−0.026***	−0.026***	−0.026***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No. of papers in the same series up to $t-1$	−0.149***	−0.156***	−0.155***	−0.178***	−0.178***	−0.175***	−0.092***	−0.132***	−0.136***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]

(Continues)

TABLE 1 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Status homophily									
Difference in specialization (JEL codes)	−0.034***	−0.034***	−0.034***	−0.036***	−0.036***	−0.035***	−0.035***	−0.034***	−0.034***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Difference in academic age	−0.041***	−0.041***	−0.041***	−0.045***	−0.044***	−0.044***	−0.042***	−0.041***	−0.041***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Ln (α)	1.291***	1.268***	1.284***	1.403***	1.373***	1.382***	1.312***	1.288***	1.298***
	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.017]	[0.016]	[0.017]	[0.017]
Observations	9,903,966	9,903,966	9,903,966	9,903,966	9,903,966	9,903,966	9,903,966	9,903,966	9,903,966
Log-likelihood (null)	−576,354.4	−576,354.4	−576,354.4	−576,354.4	−576,354.4	−576,354.4	−576,354.4	−576,354.4	−576,354.4
Log-likelihood (model, $df = 23$)	−541,012.4	−538,138.4	−537,538.3	−537,619.8	−536,582.1	−536,138.7	−538,927.6	−537,856.5	−537,389.6
AIC	1,082,071	1,076,323	1,075,123	1,075,286	1,073,210	1,072,323	1,077,901	1,075,759	1,074,825
BIC	1,082,395	1,076,647	1,075,447	1,075,610	1,073,535	1,072,648	1,078,226	1,076,084	1,075,150

Note: Cluster-robust standard errors in brackets. Control variables in the count component include time (linear form), and a constant term; and in the inflation component: a constant term. All specifications were estimated on 9,903,966 observations (104,060 non-zero) and 2,062,555 pairs (std. err. clusters).
*$p < .05$, and **$p < .01$.

TABLE 2 The relevance of political distance: years 2010–2019, zero-inflated negative binomial regression.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Count component (number of dyadic citations)									
Cited author has at least a 'top 5' article	0.571***	0.559***	0.558***	0.569***	0.558***	0.557***	0.567***	0.555***	0.554***
	[0.050]	[0.050]	[0.050]	[0.049]	[0.050]	[0.050]	[0.049]	[0.050]	[0.050]
Coauthors in $t-1$	1.236***	0.797***		1.242***	0.808***		1.246***	0.813***	
	[0.122]	[0.112]		[0.121]	[0.113]		[0.121]	[0.113]	
No. of years in which coauthors up to $t-1$			0.433***			0.434***			0.433***
			[0.043]			[0.043]			[0.043]
No. of common affiliations in $t-1$	0.543***		0.495***	0.545***		0.496***	0.544***		0.494***
	[0.062]		[0.062]	[0.062]		[0.062]	[0.062]		[0.062]
No. of years in common affiliations up to $t-1$		0.330***			0.330***			0.328***	
		[0.036]			[0.036]			[0.036]	
Value homophily									
Undirected political distance: Euclidean	0.091	0.085	0.093						
	[0.085]	[0.085]	[0.086]						
Directed political distance: Fuzzy right–left index				−0.282***	−0.266***	−0.259***			
				[0.078]	[0.078]	[0.079]			
Political distance: Diff. in right-wing tweets							0.812***	0.815***	0.812***
							[0.245]	[0.242]	[0.233]
Political distance: Diff. in centre-right tweets							0.539***	0.508***	0.487**
							[0.193]	[0.194]	[0.196]
Political distance: Diff. in centre-left tweets							0.798***	0.762***	0.741***
							[0.175]	[0.174]	[0.174]
No. of common references up to $t-1$	0.002***	0.001***	0.001***	0.002***	0.001***	0.001***	0.002***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Same Alma Mater	0.225***	0.186**	0.178**	0.225***	0.187**	0.178**	0.226***	0.188**	0.179**
	[0.080]	[0.079]	[0.079]	[0.080]	[0.078]	[0.079]	[0.080]	[0.078]	[0.079]

(Continues)

TABLE 2 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Status homophily									
Male citer, female cited	0.142**	0.143**	0.132**	0.118*	0.120*	0.110*	0.131**	0.132**	0.121*
	[0.065]	[0.066]	[0.065]	[0.065]	[0.065]	[0.065]	[0.065]	[0.066]	[0.065]
Female citer, female cited	0.470***	0.411***	0.384***	0.464***	0.406***	0.378***	0.469***	0.410***	0.382***
	[0.128]	[0.120]	[0.118]	[0.127]	[0.118]	[0.116]	[0.126]	[0.117]	[0.115]
Female citer, male cited	0.196***	0.193***	0.171***	0.220***	0.215***	0.194***	0.219***	0.216***	0.195***
	[0.059]	[0.060]	[0.058]	[0.060]	[0.061]	[0.058]	[0.059]	[0.061]	[0.058]
Zero inflation component (logit for excess zeroes)									
Value homophily									
No. of common JEL codes in $t-1$	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003**	0.003***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
No. of common references up to $t-1$	−0.023***	−0.024***	−0.024***	−0.023***	−0.024***	−0.024***	−0.023***	−0.024***	−0.024***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
No. of papers in the same series up to $t-1$	−0.126***	−0.130***	−0.124***	−0.125***	−0.130***	−0.124***	−0.125***	−0.130***	−0.124***
	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Ln (α)	1.329***	1.308***	1.308***	1.328***	1.309***	1.309***	1.325***	1.305***	1.306***
	[0.062]	[0.063]	[0.063]	[0.061]	[0.063]	[0.063]	[0.061]	[0.063]	[0.063]
Observations	409,590	409,590	409,590	409,590	409,590	409,590	409,590	409,590	409,590
Log-likelihood (null)	−29,361	−29,361	−29,361	−29,361	−29,361	−29,361	−29,361	−29,361	−29,361
Log-likelihood (model)	−27,705	−27,668	−27,634	−27,695	−27,660	−27,626	−27,689	−27,653	−27,620
AIC	55,456	55,383	55,314	55,437	55,365	55,298	55,424	55,353	55,286
BIC	55,707	55,634	55,565	55,688	55,616	55,549	55,675	55,604	55,537

Note: Heteroskedasticity-robust standard errors in brackets. Control variables in the count component: a dummy variable denoting if the authors exchanged citations in the previous year; a dummy denoting if the authors graduated in the same 5-year period; the difference in each author's impact up to $t-1$; time (linear form); the number of publications by the citing author in t; the number of publications by the cited author up to t; and a constant term; and in the inflation component: a dummy variable denoting if the authors exchanged citations in the previous year; the difference in specialization; the difference in academic age; and a constant term. All specifications were estimated on 409,590 observations (5563 non-zero) and 100,879 pairs (std. err. clusters).

*$p < .05$, and **$p < .01$.

- Two measures of profile similarity (*status homophily*): the difference between the cited author's and the citing author's academic age, defined as the years since their respective first publication; and the difference in their degree of specialisation, defined as the number of different JEL codes each of them ever used up to that year.

In the count component of the model, we include some measures of personal and professional proximities:

- a dummy variable denoting if *i* and *j* have been co-authors in the year before or alternatively the number of years in which they have been co-authors; and
- the number of common institutional affiliations in the previous year or alternatively the number of years in which they shared common affiliations.

Furthermore, to investigate *value homophily*, we include

- the same three measures of intellectual proximity defined above (in terms of cumulative JEL codes, co-citations, and common journals and series, all up to $t-1$), included alternatively due to multicollinearity;
- a measure of similarity in cultural backgrounds: a dummy variable denoting if *i* and *j* obtained a PhD in economics from the same institution[12];

And to analyse *status homophily*:

- a dummy variable denoting if the authors graduated in the same cohort, defined as a rolling 5-year period;
- the difference between the cited author's and the citing author's citation impact up to the previous year, measured by their total accumulated number of citations up to $t-1$, to capture a possible Matthew effect, that already highly cited authors are more likely to be further cited;
- three dummy variables denoting the interaction of the citing and cited authors' sex: male to female, female to female, and female to male pairs, all three capturing the respective difference with respect to the male-to-male baseline case.

Both sets of variables—those denoting status homophily and those denoting value homophily—express links within pairs of authors, and therefore, they can be thought of as forming several social networks among economists. Sometimes, these networks are compact; namely, they exhibit a giant component of connected nodes (see Figure S1). But authors may be connected by other, unobserved links, such as further variables of background similarity, or other characteristics of their personal or professional relation. To account for such unobserved heterogeneity across pairs of authors, both in the count component and in the zero-inflation component, we included a dummy variable denoting if the authors exchanged at least one citation in the previous year, and we computed all standard errors robust to clustering by author pair.[13]

All specifications include time as a control variable. Furthermore, each year an author *j* is more likely to cite another author *I*, the more papers *j* writes in *t*, and the more papers *i* has written until *t*. The former could indeed be considered as a measure of exposure (i.e., including the variable with the coefficient constrained to one, would imply estimating the rate of citations per paper), but to allow for dyadic citations to be potentially independent from authors' productivity, we included in the count component the natural logarithm of these two variables in all specifications without constraining the respective coefficient.

[12]This variable to some extent may capture both commonality in terms of ideology or political orientation, as highlighted by Fourcade et al. (2015), Henriksen et al. (2017) and Helgadóttir (2016), and common training and cultural background(s).

[13]As a robustness check, we further estimated various panel (random effects) Poisson regressions, considering author pairs as the panel unit; results are available in Table S3.

Finally, although it is not related to homophily, in the count component, we include as a control variable a dummy denoting if the cited author has published at least one article in a 'top 5 journal' (as defined by Heckman & Moktan, 2020). Arguably, in economics, writing in one of these journals could be perceived even more as a signal of 'quality' than the cumulative citation impact (included in the count component). Therefore, if citations were mainly driven by actual or perceived quality of the publications, these two variables should be (next to proximity of topics) the main predictors of citation counts.

In the estimates, we dropped all dyadic observations (pairs of *i* and *j*) for years in which *j* has not written at least one article in that year, and/or *i* has not written an article until that year, because they would correspond to zero citations for reasons different from author's *j* choice (which is what we seek to understand). Descriptive statistics are shown in Tables S1 and S2.

4 | MAIN RESULTS

In the RePEc dataset, it is quite evident that, at the aggregate level, large groups of economists tend to accumulate more citations than small groups. For example, the left-hand panel of Figure 2 reports the aggregate number of citations (excluding self-citations) to each country's economists, plotted against the number of research-active authors in the country (as declared on RePEc). Unsurprisingly, a strong correlation emerges between the aggregate number of citations to all economists who work in a certain country and how many these authors are. Such correlation between total citations and community size is robust across dimensions, or the nature of the groups and communities considered.[14] For example, considering all publications authored by economists based in a certain country—the United Kingdom, on which we focus in this work—and defining scientific communities based on research topics (identified here by single-digit JEL codes), we similarly find a strong correlation between community size and total citations, as shown in the right-hand panel of Figure 2. A positive correlation between community size and citations, though with much more variability, emerges at the micro level too: In these two examples, between the number of authors and citations per capita in a certain country, or between average citations per work and how many works use the same JEL code(s) (these are respectively reported on the left-hand panel and right-hand panel of Figure S2).

At the individual level, evidence on citation counts is less straightforward, because individuals vary by personal characteristics and typically belong to more than one community (e.g., in terms of institutional affiliation, topics of interest and Alma Mater). To account for this heterogeneity, we run dyadic negative binomial regressions on all possible pairs of authors who were both research-active in a same year.

As shown in Table 1, in the various specifications, all variables denoting (lagged) personal or professional ties, value homophily and status homophily turn out to be statistically significant at the 1% level, and they exhibit the expected sign; that is, all kinds of connections are positively correlated with citations.[15] However, given the very large sample size, statistical significance does not necessarily imply substantial relevance. Indeed, as shown in Figure 3, the variables denoting personal and professional connections between authors seem to have a stronger correlation with predicted citations than those denoting scientific proximity do.

Considering value homophily, the estimated coefficients associated with how many JEL codes two authors have in common, and that on how many references they both have ever cited (in both cases, up to the previous year) appear to be rather small in absolute value. In the count component, both variables have coefficients slightly greater

[14]In other disciplines, this correlation has led some authors (e.g., Abramo et al., 2015) to argue for the normalisation of citation counts across fields, disciplines and even sex, when one is to compare citation counts across heterogeneous populations.

[15]Among the control variables, we find that very productive authors are less likely to be cited in a given year—perhaps unsurprisingly, given a possible trade-off between the quantity and quality of publications (D'Ippoliti, 2020)—while, as predicted, the more an author writes in a certain year, the more she is likely to cite somebody else in that year. The dummy variable denoting if there were any citations in the previous year always has a large and statistically significant coefficient, highlighting that also other factors, not explicitly accounted for in our model, may play a relevant role in economists' citing behaviour.

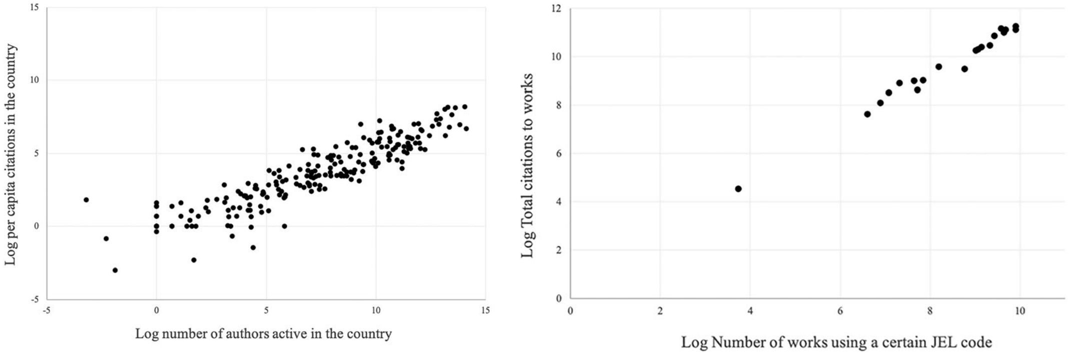

FIGURE 2 Total citations, citations per capita, and number of economists in RePEc. *Note*: Authors can be affiliated to several institutions, in which case they have been allocated to each institution and country based on self-declared percentages of affiliation on RePEc; works present more than once in the database (such as working papers published in more than one version or series, or published as articles too) are counted only once. On the right-hand panel, only papers authored by UK-based economists are considered.

than 0.001, and in both cases, a one-standard deviation change in the independent variable would increase the predicted dyadic yearly citations by slightly more than 0.1.[16]

While small in the absolute, such magnitude is not negligible in relative terms, given the very large share of zeroes in the citation distribution. Let us recall that we consider all possible pairs of research-active economists in a certain year, but authors typically cite only a tiny fraction of their colleagues (in our sample, the average predicted number of dyadic citations per year is 0.01: see Table S1). In terms of incidence rate ratio (IRR), each additional JEL code two authors have both used and each additional reference they have both cited in the past increase predicted citations by 0.2% on average.

In the zero-inflation component, the significance of having used the same JEL codes in the past is roughly zero: Indeed, it is even slightly positive, implying that scientific proximity measured in this way marginally increases the probability that predicted citations will be (excess) zero. This finding, however, could be due to the inability of JEL codes to correctly capture scientific proximity between authors (Marcuzzo & Zacchia, 2016). Indeed, co-citations are found to exert a consistently positive correlation with the decision to cite (i.e., a negative coefficient in the inflation component for the excess zeroes): In terms of odds ratio, each reference that two authors have both used in their previous works reduces the odds of excess zero citations (i.e., it increases the odds of non-zero citations) by around 2.5%.[17]

Our third measure of value homophily, the number of articles written in the same journals or series, exhibits larger coefficients, lowering the odds of excess zeroes by between 10% and 19% for each work two authors have published in the same series, and increasing the predicted number of yearly dyadic citations by between 0.01 and 0.04. However, authors are less likely to write in the same journals than they are of using the same JEL codes or citing a same reference, so that a one standard deviation change in the former variable is only associated with a predicted change in yearly dyadic citations of 0.07. Moreover, considering the above-mentioned results by Carrell et al. (2022), Colussi (2018) and Ductor et al. (2020), on the role of personal connections among editors and authors

[16]Because the zero-inflated negative binomial is a non-linear model, and given the extreme skewness of both the dependent and several explanatory variables, these comparisons are only provided to convey an idea of the rough order of magnitude of the estimated associations between variables. More precise analysis of the predicted citation counts as a function of selected explanatory variables is provided in Figure 3. Additional results are available from the authors upon request.

[17]In the robustness checks shown in Table S3, showing the results of random effects Poisson regressions, similar results are found (the coefficient for the common references is slightly smaller than in the zero-inflated negative binomial regressions, and that on common JEL codes slightly larger, in absolute terms).

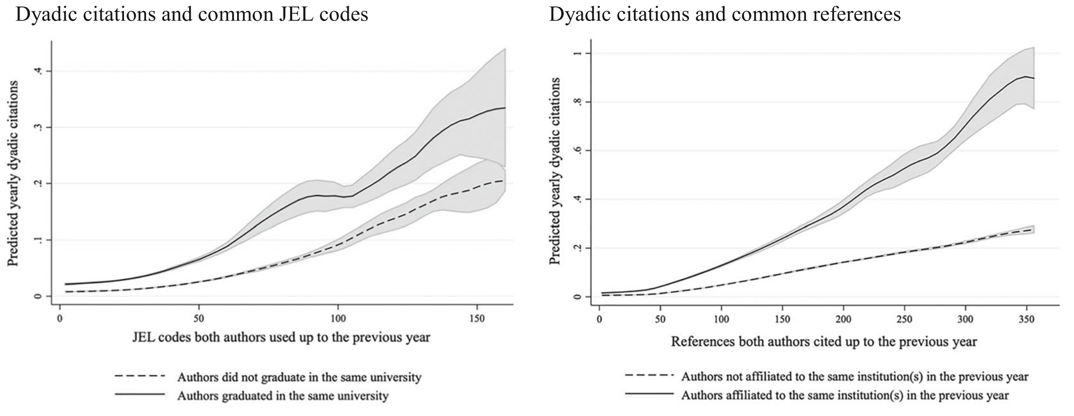

FIGURE 3 Dyadic citations: predicted yearly citations as a function of past co-citations and common past JEL codes. *Note*: In the sample, 99% of pairs of authors share fewer than 256 references and fewer than 130 JEL codes. For visual clarity, the top 0.5% of observations corresponding to pairs of authors respectively sharing more than 160 JEL codes, and more than 356 citations, are not shown in the figures. Predicted citations obtained from the specifications respectively shown in columns 3 and 6 of Table 1 (the preferred specifications according to the information criteria).

in facilitating publication in some journals, this variable should probably not be interpreted as denoting scientific proximity only.

Conversely, we find that personal and professional relations within each pair of authors are highly correlated with predicted citations between them. Having been co-authors in the previous year is found to increase the predicted number of yearly dyadic citations by between 0.8 and 1.6, and each year in which the authors have written together in the past increases the predicted number of citations by roughly 0.5. In terms of IRR, depending on the specification, co-authors in the previous year receive between 300% and 450% the number of citations of non-coauthors, and each year of co-authorship increases predicted citations by a factor between 150% and 170%. Similarly, each common affiliation in the previous year increases the predicted number of citations by between 0.5 and 0.6 (IRR between 160% and 190%, depending on the specification).

Concerning the indicators of status homophily, having graduated in the same university is estimated to increase predicted dyadic citations each year by around 0.3 (IRR around 140%). Furthermore, we find that authors tend to cite more the more specialised, more impactful and older colleagues, and less frequently those who graduated in their own cohort. For these variables too, however, the magnitude of the estimated coefficients is rather small. This is especially true of the difference between the two authors' accumulated past citations, which, if one assumed that citations were a measure of scientific quality, would imply that at the micro level authors of 'better' publications in the past are not much more likely to be cited, ceteris paribus.

Evidently, personal ties among economists are rarer than the impersonal scientific connections among them: Every year, two authors are much more likely to write on the same topics than to write a paper together. Therefore, our model predicts that one of the reasons for the severe skewness of aggregate citation distributions (a consolidated finding in the scientometrics literature, reported in Figure 1 for our sample) is the strong correlation between citations and some very unevenly distributed variables, that is to say, communities of economists are relevant, but the reach of each economist's network is small. In this sense, it is significant that the correlation between citations and having been co-authors (a dummy variable) is of an order of magnitude larger than a one standard deviation change in the variables denoting scientific proximity. To exemplify the relative size of the estimated coefficients, Figure 3 shows two relevant examples. Authors not based in the same institutions need to share more than double the number of common past references (right-hand panel) to have the same number of predicted citations of authors who shared at least one institutional affiliation in the previous year. Similarly, authors who do not share the same Alma Mater need to double the number of common JEL codes to have the same number of predicted citations of authors who graduated in the same institution (left-hand panel in the figure). In both cases, unconnected authors must have an extraordinarily stronger scientific proximity in order for them to exchange the same number of (predicted) citations as connected authors.

It is significant that personal connections, and both the scientific and the less scientific dimensions of (value and status) homophily are all found to correlate with predicted citations even after controlling for measures of actual or perceived quality of the cited author's work, such as cumulative citation impact and having articles in top 5 journals. The latter variable has indeed a large coefficient (around 0.5 in most estimates) if one considers that the citation network is not very dense. However, such estimated coefficient is only between one half and one third that of personal connections such as having been coauthors or having shared a same affiliation in the previous year. Therefore, although we find evidence of a Matthew effect in economics, this does not seem to be the prime cause of the extreme skewness of the distribution of citations—being the network structure of personal and scientific connections a more likely candidate explanation, as discussed in Section 4.2.

4.1 | Differences in political orientation

Concerning value homophily, evidence on the relevance of proximity in terms of political orientation is more mixed, though it has been proved that sexual characteristics shape views of policy, political and social questions among European economists (May et al., 2018). van Dalen (2019) shows that economists' personal values matter in shaping the economists' methodological and theoretical premises. It would thus be not too surprising if it emerged that—beside and in addition to the impact of scientific proximity—an economist's political views mattered in her citing behaviour too. To investigate this issue, as mentioned above, we considered both an undirected measure, the Euclidean distance between the shares of tweets in the four political categories tweeted by the two authors (right, centre-right, centre-left and left), and a directed measure, obtained by means of fuzzy-set logic. The former variable does not change depending on which direction an author differs from another one; the latter measures how much the cited author can be seen (on Twitter) as standing to the right of the citing author in relative terms. Consideration of these variables required separate estimations because we only have data for a subset of economists active on Twitter and only for the last decade.[18]

As shown in Table 2, the coefficients of all other variables included in the baseline regressions do not significantly change, and the undirected measure of political distance exhibits a small coefficient, not statistically different from zero. It would thus seem that the *difference* in terms of one's political outlook does not affect how many times an author cites another economist with different views. However, the directed measure of political distance appears to be negatively associated with dyadic citations, with a large (in absolute terms) and statistically significant coefficient. This highlights that, when we consider distance along a significant axis rather than mere difference per se, authors cite considerably less often the economists whom they perceive to stand to their political right.

However, to contextualise this result, we recall that 78% of all links in our sample were labelled as centre-left, which is clearly the mainstream political position among the UK-based economists active on Twitter.[19] It is possible that any deviation from this position is associated with fewer citations, including deviations to the ('radical') left—only this does not appear in the single index of directed distance because deviations to the right of the mainstream

[18]We show in Table 2 only results including past co-citations as a measure of scientific proximity because it is the preferred measure according to the information criteria and the one most often employed in the literature. Results including the other two measures of scientific proximity shown in Table 1 are not qualitatively different and are available from the authors upon request.

[19]Incidentally, we note that a generally progressive outlook within the profession, at least relative to the general population even if not relative to faculty of other disciplines, was found among economists based in other countries too, such as the United States (Cardiff & Klein, 2005; Davis et al., 2011; Horowitz & Hughes, 2018) or Italy (De Benedictis & Di Maio, 2016).

are more frequent. To investigate this possibility, we separately included in the estimation the difference in the economists' shares of tweets labelled with the single political categories except the radical left (our benchmark in columns 7 to 9). We find that relative to the difference in the share of left-wing tweets, all other variables measuring the differences in shares of politically connoted tweets exhibit a positive sign, with the difference in centre-left tweets and radical right tweets especially large (with an estimated coefficient around 0.8). Therefore, although the general directed distance index implies that economists tend to cite more often those who share Tweets closer to their own political positioning, the single distances in terms of the four categories implies that with respect to the more left-wing colleagues, economists tend to cite more often the economists of all other political orientations.

Overall, our findings imply that the mere difference in political orientation is not, on average, associated with differences in dyadic citations; however, economists active on Twitter are heavily concentrated on the centre-left of the political distribution, and they appear to cite less often the economists who are relatively to their right as well as the (fewer) ones who are to their left.

4.2 | Robustness checks

Although we do not employ here causal analysis of the quasi-experimental kind, in this section, we document that the estimated correlations between current citations and past or extant connections among economists is very robust. Beside the use of alternative estimation strategies (see Appendix S2, Table S3), we run the same regressions shown in Table 1 on a number of subsamples: of 'highly visible' authors; by sex; and on a specific topic.

First, we considered those cited authors only, who have published at least one article in a top 5 journal up to *t* (Table 3); the same economists as citing authors (Table 4); or the network composed of these authors only (both as citers and cited: Table 5). As shown in Table 3, we find that the same variables associated with citations to the whole sample are also associated with citations to the highly visible authors too and with very similar estimated coefficients. All kind of connections—personal, professional and scientific—seem to determine the behaviour of these authors as citers too, but as shown in Tables 4 and 5, in this subsample, we find generally lower (but still large and statistically significant) coefficients for the variables denoting personal relations, such as having been coauthors, working in the same institutions, and having graduated in the same place, and generally larger coefficients for the variables denoting scientific proximity, such as having used the same JEL codes or having a substantially overlap in the references cited up to *t*. These differences are sometimes large in relative terms (e.g., for JEL codes), but still they are very minor in absolute value, so that even among these highly visible authors (or authors of papers of higher quality, if one were to consider citations and rankings as valid proxies of scientific quality, contrary to what we claim here), personal connections appear to be more correlated with citations than scientific proximity (value homophily).

Looking at status homophily in terms of gender-based homophily in citations is especially interesting because it exemplifies our point forcefully. In all specifications, we find that women tend to cite other colleagues more often than men, and in particular, they cite other women more often, but men too, ceteris paribus, cite women more often than they cite other men (the coefficients of both the female-to-female and the male-to-female dummy variables are consistently positive across specifications). However, in our sample, women are on average less cited than men, with 0.007 yearly dyadic citations, as opposed to men's 0.011 (see Appendix S2). We find that such sex citation gap can entirely be explained by personal characteristics and dyadic connections between authors, so that when observable differences in men's and women's social and professional networks are taken into account in the various estimates, we find that there is actually an unexplained component in women's favour.

Besides being relatively younger and less specialised, women have graduated from and are based in smaller institutions on average, and they have fewer past citations in common with other colleagues, fewer common JEL codes, and fewer papers in the same journals or series (see Table S2). This could at least partly be explained by differences in research preferences: For example, while both men and women economists write a considerable share of papers in microeconomics and on quantitative methods, women specialise relatively more than men in labour and

TABLE 3 Determinants of dyadic citations, pooled zero-inflated negative binomial regressions: subsample of cited authors with at least a 'top 5' article.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Count component (number of dyadic citations)									
Citation in $t-1$	1.149***	1.097***	1.113***	1.090***	1.075***	1.095***	1.119***	1.097***	1.114***
	[0.023]	[0.022]	[0.021]	[0.021]	[0.021]	[0.020]	[0.022]	[0.022]	[0.021]
Coauthors in $t-1$	1.425***	0.585***		1.026***	0.576***		1.037***	0.577***	
	[0.042]	[0.043]		[0.039]	[0.043]		[0.040]	[0.042]	
No. of years in which coauthors up to $t-1$			0.440***			0.331***			0.388***
			[0.017]			[0.017]			[0.018]
No. of common affiliations in $t-1$	0.484***		0.385***	0.436***		0.386***	0.407***		0.371***
	[0.029]		[0.027]	[0.026]		[0.026]	[0.027]		[0.027]
No. of years in common affiliations up to $t-1$		0.394***			0.285***			0.331***	
		[0.017]			[0.017]			[0.018]	
Value homophily									
No. of common JEL codes in $t-1$	0.002***	0.001***	0.001***						
	[0.000]	[0.000]	[0.000]						
No. of common references up to $t-1$				0.002***	0.002***	0.002***			
				[0.000]	[0.000]	[0.000]			
No. of papers in the same series up to $t-1$							0.036***	0.016***	0.014***
							[0.002]	[0.002]	[0.002]
Same Alma Mater	0.250***	0.198***	0.182***	0.211***	0.195***	0.184***	0.188***	0.181***	0.172***
	[0.040]	[0.033]	[0.032]	[0.030]	[0.030]	[0.030]	[0.033]	[0.032]	[0.031]
Status homophily									
Difference in accumulated citations up to $t-1$	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Same 5-year graduation period	−0.045**	−0.053***	−0.056***	−0.073***	−0.073***	−0.076***	−0.064***	−0.056***	−0.057***
	[0.019]	[0.018]	[0.018]	[0.017]	[0.017]	[0.017]	[0.018]	[0.018]	[0.018]
Male citer, female cited	0.053**	0.059**	0.059**	0.038	0.046*	0.046*	0.055**	0.059**	0.059**
	[0.027]	[0.027]	[0.028]	[0.025]	[0.026]	[0.026]	[0.027]	[0.027]	[0.027]

(Continues)

TABLE 3 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female citer, female cited	0.337***	0.360***	0.360***	0.369***	0.381***	0.378***	0.356***	0.362***	0.361***
	[0.050]	[0.049]	[0.049]	[0.049]	[0.049]	[0.049]	[0.050]	[0.049]	[0.049]
Female citer, male cited	0.112***	0.121***	0.115***	0.136***	0.139***	0.135***	0.124***	0.123***	0.117***
	[0.020]	[0.020]	[0.020]	[0.020]	[0.020]	[0.020]	[0.020]	[0.020]	[0.020]
Zero inflation component (logit for excess zeroes)									
Value homophily									
No. of common JEL codes in $t-1$	0.005***	0.004***	0.004***	0.001***	0.001***	0.001***	0.002***	0.002***	0.003***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
No. of common references up to $t-1$	−0.024***	−0.024***	−0.024***	−0.025***	−0.025***	−0.025***	−0.025***	−0.025***	−0.025***
	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
No. of papers in the same series up to $t-1$	−0.068***	−0.072***	−0.071***	−0.084***	−0.085***	−0.082***	−0.010**	−0.047***	−0.050***
	[0.004]	[0.004]	[0.004]	[0.005]	[0.004]	[0.004]	[0.004]	[0.006]	[0.006]
Status homophily									
Difference in specialization (JEL codes)	−0.034***	−0.034***	−0.033***	−0.037***	−0.036***	−0.036***	−0.034***	−0.034***	−0.033***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Difference in academic age	−0.034***	−0.034***	−0.034***	−0.038***	−0.037***	−0.037***	−0.034***	−0.034***	−0.034***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Ln (α)	1.123***	1.093***	1.099***	1.254***	1.222***	1.223***	1.129***	1.101***	1.103***
	[0.022]	[0.021]	[0.021]	[0.022]	[0.022]	[0.022]	[0.022]	[0.022]	[0.021]
Observations	3,082,674	3,082,674	3,082,674	3,082,674	3,082,674	3,082,674	3,082,674	3,082,674	3,082,674
Log-likelihood (null)	−317,667	−317,667	−317,667	−317,667	−317,667	−317,667	−317,667	−317,667	−317,667
Log-likelihood (model, $df = 22$)	−301,443.8	−300,150.2	−299,913.7	−299,497.1	−299,152.5	−299,010.5	−300,522.7	−300,009.4	−299,825.8
AIC	602,931.5	600,344.4	599,871.5	599,038.1	598,349	598,065	601,089.5	600,062.8	599,695.7
BIC	603,216.2	600,629.1	600,156.2	599,322.8	598,633.7	598,349.7	601,374.2	600,347.5	599,980.4

Note: Cluster-robust standard errors in brackets. Control variables in the count component include time (linear form), and a constant term; and in the inflation component: a constant term. All specifications were estimated on 3,082,674 observations (61,570 non-zero) and 585,561 pairs (std. err. clusters).
$^{*}p < .05$, and $^{**}p < .01$.

TABLE 4 Determinants of dyadic citations, pooled zero-inflated negative binomial regressions: subsample of citing authors with at least a 'top 5' article.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Count component (number of dyadic citations)									
Citation in $t-1$	1.149***	1.049***	1.074***	1.062***	1.025***	1.054***	1.106***	1.051***	1.077***
	[0.033]	[0.030]	[0.028]	[0.028]	[0.028]	[0.027]	[0.031]	[0.030]	[0.028]
Cited author has at least a 'top 5' article	0.802***	0.806***	0.799***	0.821***	0.825***	0.815***	0.798***	0.806***	0.799***
	[0.024]	[0.023]	[0.022]	[0.022]	[0.022]	[0.021]	[0.023]	[0.023]	[0.022]
Coauthors in $t-1$	1.476***	0.562***		1.039***	0.528***		1.114***	0.542***	
	[0.051]	[0.049]		[0.048]	[0.049]		[0.050]	[0.048]	
No. of years in which coauthors up to $t-1$			0.476***			0.359***			0.430***
			[0.021]			[0.020]			[0.021]
No. of common affiliations in $t-1$	0.586***		0.472***	0.541***		0.480***	0.517***		0.460***
	[0.035]		[0.034]	[0.033]		[0.034]	[0.035]		[0.035]
No. of years in common affiliations up to $t-1$		0.436***			0.324***			0.384***	
		[0.020]			[0.020]			[0.021]	
Value homophily									
No. of common JEL codes in $t-1$	0.004***	0.003***	0.003***						
	[0.000]	[0.000]	[0.000]						
No. of common references up to $t-1$				0.002***	0.002***	0.002***			
				[0.000]	[0.000]	[0.000]			
No. of papers in the same series up to $t-1$							0.038***	0.016***	0.014***
							[0.003]	[0.002]	[0.002]
Same Alma Mater	0.248***	0.192***	0.162***	0.217***	0.203***	0.182***	0.191***	0.181***	0.161***
	[0.051]	[0.041]	[0.041]	[0.038]	[0.038]	[0.038]	[0.043]	[0.041]	[0.041]
Status homophily									
Difference in accumulated citations up to $t-1$	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Same 5-year graduation period	−0.065***	−0.073***	−0.074***	−0.054**	−0.059***	−0.062***	−0.076***	−0.068***	−0.068***
	[0.023]	[0.022]	[0.022]	[0.021]	[0.021]	[0.022]	[0.022]	[0.022]	[0.022]
Male citer, female cited	0.035	0.041	0.029	0.016	0.027	0.017	0.039	0.041	0.030

(Continues)

TABLE 4 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	[0.032]	[0.031]	[0.031]	[0.030]	[0.030]	[0.030]	[0.031]	[0.031]	[0.031]
Female citer, female cited	0.263***	0.299***	0.289***	0.294***	0.315***	0.301***	0.283***	0.297***	0.286***
	[0.071]	[0.069]	[0.068]	[0.070]	[0.068]	[0.068]	[0.071]	[0.069]	[0.068]
Female citer, male cited	0.099***	0.111***	0.101***	0.106***	0.115***	0.104***	0.116***	0.112***	0.100***
	[0.031]	[0.032]	[0.032]	[0.031]	[0.031]	[0.031]	[0.032]	[0.032]	[0.032]
Zero inflation component (logit for excess zeroes)									
Value homophily									
No. of common JEL codes in $t-1$	0.006***	0.005***	0.005***	0.000	0.001	0.001	0.002***	0.002***	0.002***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]
No. of common references up to $t-1$	−0.022***	−0.023***	−0.023***	−0.023***	−0.023***	−0.023***	−0.024***	−0.023***	−0.024***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
No. of papers in the same series up to $t-1$	−0.120***	−0.124***	−0.123***	−0.146***	−0.144***	−0.141***	−0.057***	−0.098***	−0.100***
	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.012]	[0.006]	[0.006]
Status homophily									
Difference in specialization (JEL codes)	−0.024***	−0.024***	−0.024***	−0.026***	−0.025***	−0.025***	−0.024***	−0.023***	−0.023***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Difference in academic age	−0.032***	−0.032***	−0.032***	−0.034***	−0.033***	−0.033***	−0.032***	−0.031***	−0.031***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Ln (α)	1.227***	1.190***	1.203***	1.337***	1.298***	1.302***	1.244***	1.184***	1.190***
	[0.030]	[0.030]	[0.029]	[0.030]	[0.030]	[0.030]	[0.030]	[0.030]	[0.030]
Observations	3,263,049	3,263,049	3,263,049	3,263,049	3,263,049	3,263,049	3,263,049	3,263,049	3,263,049
Log-likelihood (null)	−182,674.5	−182,674.5	−182,674.5	−182,674.5	−182,674.5	−182,674.5	−182,674.5	−182,674.5	−182,674.5
Log-likelihood (model, $df = 23$)	−170,390.4	−169,096.9	−168,833	−168,751	−168,382.3	−168,198.6	−169,757.2	−169,116.6	−168,896.4
AIC	340,826.8	338,239.7	337,711.9	337,548	336,810.7	336,443.2	339,560.4	338,279.2	337,838.8
BIC	341,125.7	338,538.7	338,010.9	337,846.9	337,109.6	336,742.2	339,859.4	338,578.2	338,137.7

Note: Cluster-robust standard errors in brackets. Control variables in the count component include time (linear form), and a constant term; and in the inflation component: a constant term. All specifications were estimated on 3,263,049 observations (33,162 non-zero) and 598,305 pairs (std. err. clusters).
$^{*}p < .05$, and $^{**}p < .01$.

TABLE 5 Determinants of dyadic citations, pooled zero-inflated negative binomial regressions: network of authors with at least a 'top 5' article.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Count component (number of dyadic citations)									
Citation in $t-1$	0.999***	0.915***	0.922***	0.918***	0.894***	0.907***	0.955***	0.914***	0.923***
	[0.039]	[0.033]	[0.031]	[0.031]	[0.031]	[0.030]	[0.034]	[0.032]	[0.031]
Coauthors in $t-1$	1.285***	0.335***		0.808***	0.342***		0.893***	0.319***	
	[0.062]	[0.058]		[0.062]	[0.058]		[0.059]	[0.056]	
No. of years in which coauthors up to $t-1$			0.361***			0.249***			0.323***
			[0.020]			[0.018]			[0.021]
No. of common affiliations in $t-1$	0.481***		0.383***	0.445***		0.395***	0.420***		0.374***
	[0.040]		[0.038]	[0.036]		[0.037]	[0.040]		[0.039]
No. of years in common affiliations up to $t-1$		0.347***			0.234***			0.304***	
		[0.021]			[0.019]			[0.022]	
Value homophily									
No. of common JEL codes in $t-1$	0.004***	0.002***	0.002***						
	[0.000]	[0.000]	[0.000]						
No. of common references up to $t-1$				0.002***	0.002***	0.002***			
				[0.000]	[0.000]	[0.000]			
No. of papers in the same series up to $t-1$							0.033***	0.014***	0.013***
							[0.002]	[0.003]	[0.003]
Same Alma Mater	0.225***	0.171***	0.138***	0.174***	0.168***	0.148***	0.153***	0.153***	0.129***
	[0.068]	[0.050]	[0.048]	[0.046]	[0.045]	[0.045]	[0.054]	[0.049]	[0.047]
Status homophily									
Difference in accumulated citations up to $t-1$	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Same 5-year graduation period	0.013	−0.005	−0.009	0.015	0.007	0.003	−0.002	0.001	−0.002
	[0.027]	[0.026]	[0.026]	[0.025]	[0.025]	[0.025]	[0.026]	[0.026]	[0.026]
Male citer, female cited	−0.041	−0.030	−0.035	−0.071*	−0.053	−0.056	−0.027	−0.024	−0.029
	[0.043]	[0.042]	[0.043]	[0.039]	[0.040]	[0.040]	[0.044]	[0.043]	[0.044]

(Continues)

TABLE 5 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female citer, female cited	0.306***	0.347***	0.358***	0.346***	0.366***	0.368***	0.328***	0.342***	0.350***
	[0.101]	[0.099]	[0.100]	[0.100]	[0.098]	[0.099]	[0.102]	[0.099]	[0.100]
Female citer, male cited	0.113***	0.128***	0.118***	0.122***	0.131***	0.123***	0.131***	0.128***	0.117***
	[0.037]	[0.038]	[0.038]	[0.037]	[0.037]	[0.037]	[0.037]	[0.038]	[0.038]
Zero inflation component (logit for excess zeroes)									
Value homophily									
No. of common JEL codes in $t-1$	0.007***	0.006***	0.006***	0.002***	0.002***	0.002***	0.003***	0.003***	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
No. of common references up to $t-1$	−0.021***	−0.021***	−0.021***	−0.022***	−0.022***	−0.022***	−0.022***	−0.022***	−0.022***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
No. of papers in the same series up to $t-1$	−0.061***	−0.063***	−0.062***	−0.075***	−0.074***	−0.072***	−0.006	−0.035**	−0.038***
	[0.005]	[0.005]	[0.005]	[0.006]	[0.005]	[0.005]	[0.004]	[0.015]	[0.012]
Status homophily									
Difference in specialization (JEL codes)	−0.022***	−0.022***	−0.022***	−0.025***	−0.024***	−0.023***	−0.023***	−0.021***	−0.021***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Difference in academic age	−0.027***	−0.027***	−0.027***	−0.030***	−0.029***	−0.029***	−0.027***	−0.026***	−0.026***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Ln (α)	1.032***	0.980***	0.985***	1.149***	1.102***	1.100***	1.024***	0.968***	0.968***
	[0.037]	[0.036]	[0.036]	[0.037]	[0.037]	[0.037]	[0.036]	[0.036]	[0.036]
Observations	1,050,160	1,050,160	1,050,160	1,050,160	1,050,160	1,050,160	1,050,160	1,050,160	1,050,160
Log-likelihood (null)	−116,161.2	−116,161.2	−116,161.2	−116,161.2	−116,161.2	−116,161.2	−116,161.2	−116,161.2	−116,161.2
Log-likelihood (model, $df = 22$)	−109,944.9	−109,204.5	−109,072.2	−108,911.3	−108,768.9	−108,673.8	−109,559.1	−109,218.3	−109,110
AIC	219,933.8	218,453	218,188.3	217,866.7	217,581.8	217,391.7	219,162.1	218,480.6	218,263.9
BIC	220,194.9	218,714.1	218,449.4	218,127.7	217,842.9	217,652.7	219,423.1	218,741.6	218,524.9

Note: Cluster-robust standard errors in brackets. Control variables in the count component include time (linear form), and a constant term; and in the inflation component: a constant term. All specifications were estimated on 1,050,160 observations (22,863 non-zero) and 173,185 pairs (std. err. clusters).
*$p < .05$, and **$p < .01$.

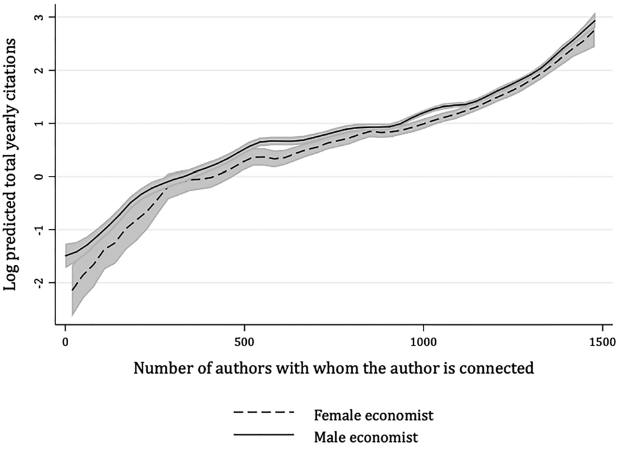

FIGURE 4 Total individual citations: log predicted yearly citations as a function of individual economists' network reach. *Note*: Individual total predicted citations obtained by aggregation of the predicted dyadic citations obtained from the specification shown in column 6 of Table 1 (the preferred specification according to the information criteria).

demographic economics (JEL code J); economic development and growth (JEL code O); and health, education and welfare (JEL code I), whereas men specialise relatively more in macroeconomics and monetary economics (JEL code E). As men represent most of the population of research-active economists, men's preferences in terms of methods and topics carry a citation premium because of each individual's scientific proximity with a larger set of authors.

However, when running separate regressions on the male and female subsamples (reported in Tables S4 and S5, respectively), we also find small differences in the relevant coefficients, implying that female economists in the United Kingdom also benefit less from their connections, in terms of citations, than their male colleagues. As a consequence, as shown in Figure 4, for both male and female economists, there is a strong association between the reach of their network—measured by how many economists they have personal or scientific connections with—and their total citation counts (the confidence intervals of the two predictions actually overlap in several areas). In this sense, all economists have an incentive to try to connect to as many colleagues as possible.

Finally, in order to investigate whether some communities of economists exhibit specific characteristics, in a further robustness check (documented in Appendix S3), we run the same dyadic zero-inflated negative binomial regressions presented here on a subsample of economists who, to some extent, specialise in macroeconomics. Both considering a relatively stricter and a looser definition of who are the ‘macroeconomists’, we found results similar to those documented here. Dyadic connections are confirmed to exert a relevant role in predicted dyadic citations, with a slightly greater role for personal ties and lower role for scientific proximity in the smaller sample of economists who have written at least 25% of their publications using a macroeconomics-related JEL code. Overall, in contrast with Önder and Terviö (2015), the case study of macroeconomists does not suggest that there may be relevant differences between subfields of economics.

5 | CONCLUSIONS

Citations—directly or indirectly due to their influence on journals' and departments' prestige and rankings—are the currency in the ‘marketplace for ideas’ in economics. Yet our analysis shows that the acceptance of this currency leads us astray from a level playing field; in this peculiar market, the rewards (and therefore, ex ante, the incentives) seem to depend on many things beside individual effort and individual merit.

Our analysis of citation behaviour among UK-based economists highlights that both scientific and social proximities play an important role in shaping authors' decisions on what citations they include in their works. We find that similarity of topics (evidenced by having used the same JEL codes in the past, having cited the same references, or having published in the same journals and series) is a statistically significant predictor of dyadic citations, but it is not the only or even the main factor at play. Social links, in terms of past co-authorship, shared past affiliations, or having graduated in the same Alma Mater, matter as well.

Beyond these finer distinctions, it emerges that the citation network of UK-based economists is determined both by status homophily and by value homophily; that is, individuals are more likely to cite other economists with which they share personal or professional characteristic. To some extent, professional connections may denote scientific proximity too: For example, a co-author or someone based in the same department is more likely to be familiar with the contents of a colleague's work than someone who is not connected with them at all. However, because these variables are found to correlate with citations even after controlling for various measures of scientific proximity, in the context of our study, they should be interpreted to a large extent as measures of personal ties.

Indeed, personal and professional ties, though of course less densely distributed and wide-ranging than scientific proximity, are found to have even a higher correlation with the predicted number of citations than measures of scientific proximity. This raises doubts on the frequent assumption that citations only reflect the scientific quality of publications (D'Ippoliti, 2020). Because other variables, unrelated with quality, are found to be important predictors of citations, the latter should be at least understood as biased proxies of scientific quality, if at all.

Our findings imply that, depending among other things on the professional standing and their position within the network of personal connections among economists, some authors are systematically more likely to be heard than others—those better able to leverage the strength of their community size. We find that, beyond the obvious aggregate evidence, at the micro level too, individual economists enjoy a 'comparative advantage' in terms of citations, from belonging to more and larger communities than their peers—what we call strength in numbers. These network economies imply that systematic differences between categories of economists emerge, that we could characterise as systematic bias, due to the structure of the scientific debate and professional patterns within the discipline, and even if there were no desire to discriminate or to game the system on the side of the single citing authors.

These findings have two main implications. First, they imply that citations do not measure scientific quality alone, but they depend on an author's professional and social standing too, as well as their choices, for example, in terms of which topics to study. Therefore, in particular, the use of citations as a metric for research evaluation, so pervasive in many countries, should be reconsidered. For example, it is not clear why research carried out on more masculinised topics (as measured by the share of men of use certain JEL codes) should be considered to be of superior quality than research carried out on other topics, even though higher average citation counts would suggest so to some.

And second, to the extent that citations determine incentives for authors, there are structural tendencies within economics to choose research methods and topics cultivated by the larger groups of researchers, and more in general, to try and join as many and as large communities as possible (e.g., to graduate in and then to be affiliated with the larger departments, and even to take the most popular political opinions, or at least not to share their own in the social networks, if these differed from the mainstream). These incentives imply a risk of stifling diversity and innovation in the scientific debate in economics. This does not imply that citation counts are meaningless constructs. They can be of interest, for example, for sociologists and historians of science, providing an understanding of the network structure of scientific fields and the social connections among researchers, answering questions like who collaborates with whom, what are the intellectual foundations of a certain field of research or school of thought, or how certain ideas have spread among certain communities (Aistleitner et al., 2019). What how our analysis shows, is that they cannot be interpreted as unbiased proxies of scientific merit alone.

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DATA AVAILABILITY STATEMENT

Replication files are too large to be shared on the journal or the authors' websites, due to the size of the final dataset (2.8 GB). The authors are available to share the final dataset in an anonymised form and all Stata scripts upon request. The single component datasets (e.g., data on individuals' CV) cannot be shared due to privacy concerns.

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