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Analysis

Environmental and ecological economics in the 21st century: An age adjusted citation analysis of the influential articles, journals, authors and institutions

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ABSTRACT

We investigate the influence of articles, authors, journals and institutions in the field of environmental and ecological economics. We depart from studies that investigated the literature until 2001 and include a time period that has witnessed an enormous increase of importance in the field. We adjust for the age effect given the huge impact of the year of an article's publication on its influence and we show that this adjustment does make a substantial difference — especially for disaggregated units of analysis with diverse age characteristics such as articles or authors. We analyse 6597 studies on environmental and ecological economics published between 2000 and 2009. We provide rankings of the influential articles, authors, journals and institutions and find that Ecological Economics, Energy Economics and the Journal of Environmental Economics and Management have the most influential articles, they publish very influential authors and their articles are cited most. The University of Maryland, Resources for the Future, the University of East Anglia and the World Bank appear to be the most influential institutions in the field of environmental and ecological economics.

1. Introduction

We investigate the influence of articles, authors, journals and institutions in the field of environmental and ecological economics on the basis of citation analysis. Increasingly, performance measurement and impact analysis have come to play a role in research and education policy and in the assessment of departments and faculty. A lot of research is done on the assessment of the impact of journals and there is a lot of debate going on (see Harzing, 2010). It appears that in the classic journal impact factor, article age adjustment is missing. The conventional two and five year impact factors furthermore have the problem that they only use a two year and five year after publication window for papers to receive citations. We do not pursue this classic journal impact analysis but will rely on citation analysis. This type of analysis puts the article itself in the spotlight and not the journal. We think it is the article that makes the difference as the article is communicating the research. We are well aware of the fact that citations have their limitations too (see Costanza et al. (2004: 262)). For example, the influence of a paper need not be restricted to an academic audience, there is a bias to the journals that are in the database, and it takes time for citations to appear in the literature. However, authors such as Costanza et al. (2004) and Kim et al. (2006) are confident of the virtues of citation analysis to base their study on. We apply citation analysis to environmental and ecological economics, which has become an increasingly important field in both research and policy in the 21st century due to climate change, globalization, and the rapid advance of renewable energy.

Citation analyses within environmental and ecological economics were first published in the 21st century, even though they mainly analysed 20th century publications due to the time required for citation and publication. Kohlstad (2000: 294) identifies "the most 'useful' (i.e. cited)" articles published in two sub-areas of environmental and ecological economics (energy economics and exhaustible resources economics) over five 5-year periods from 1974 to 1998. To define his sample, he searches for area specific keywords in 34 (general) economics journals. Kohlstad finds an age effect, as he observes older papers to receive more citations than younger peers with the exception of Perron's (1989) seminal econometric paper on oil price

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shocks. This result implies that citation counts might need to be annualized in some form when comparing journal articles. Kohlstad also lists the five journals with the highest number of citations per article in each sub-area during each decade in his sample and finds a noticeable degree of inconsistency among the top journals of each decade. This implies that journal rankings need to be updated regularly to reflect changes in journal impact.

Furthermore, Smith (2000) reviews research on the non-market valuation of environmental resources published in the Journal of Environmental Economics and Management (JEEM) over the period 1978–1998. His review includes a list of all JEEM papers in this subarea which have been cited more than 50 times by 1998. The list is dominated by older studies. This, again, implies that age can have an impact: the age effect, which we define as a significant positive relationship between the age of a study and its number of total citations.

Ma and Stern (2006) analyse the overlap between JEEM and Ecological Economics (EcE) based on articles published between 1994 and 2003. They find high correlations between the journals citing JEEM and EcE as well as those journals referenced in JEEM and EcE, which implies a significant overlap between the two journals in specific areas and in the areas of environmental and ecological economics in general. Ma and Stern (2006) also list 30 articles which received the highest number of total citations in each journal. However, since they use total citations as their measure of influence, the youngest article in both lists is published in 1999, while the oldest appeared in 1931. Recently, two citation studies focus on evaluating journals in the field of environmental and ecological economics (Aufhammer, 2009; Rousseau et al., 2009). However, both are fully exposed to the age effect discussed above and, in case of Aufhammer (2009), also to the biases associated with Google Scholar data (see, for instance, Jacsó, 2005, 2006a, 2006b, 2008; Shultz, 2007).

To the best of our knowledge, the only age adjustment in citation analysis of environmental and ecological economics to date has been conducted by Costanza et al. (2004). They examine the influence of 251 individual publications related to EcE which are published between 1920 and 2001. They assess articles nominated for their quality by the EcE Editorial board, highly cited articles published in EcE or articles and books published elsewhere that were highly cited by EcE articles. While Costanza et al. (2004: 264) mainly analyse total citations, they explicitly acknowledge that total citations as a measure of influence is biased towards older publications, which simply had more time to be cited. Hence, they do not only employ total citation as a measure of total influence but also calculate the "*average number of citations per year … [as] 'predictor' of ultimate influence that can better compare older and younger articles*". This adjusted measure, for instance, aids the comparison of two of the most influential publications in their sample: Costanza et al.'s (1997) 'Value of the world's ecosystems and natural capital' and Hardin's (1968) 'Tragedy of the Commons'. While the latter has more than five times more citations than the former (499 to 2525), since it is 29 years older, the former received marginally more citations per year (71.3 to 70.1) in Costanza et al.'s (2004) citation analysis.

To sum up, the previous studies make substantial contributions to the understanding of influence and citation patterns in the increasingly important field of environmental and ecological economics. However, they do not assess the influence of individual authors or institutions and are, with the exception of Costanza et al. (2004), exposed to a substantial age effect. Costanza et al. (2004) implement their age adjustment only for individual articles published up to 2001, and no age adjusted ranking of articles published subsequently has been published to date. Similarly, no ranking of journals in the field of environmental and ecological economics has been published that adjusts for the age of a journal's most cited articles. If the article age effect is not controlled for in the journal rankings, the journals are virtually assessed on their performance in the earlier years of the data sample and improvements over time are inappropriately considered. Furthermore, journals vary the number of articles over time. Hence, journals which increased (decreased) their number of published articles during a sample period are disadvantaged (advantaged) due to the age effect which favours older over younger articles

These gaps in the citation analysis literature of environmental and ecological economics provide us with the opportunity to employ an age effect adjusted citation analysis approach and a 21st century data sample. Therefore, we ask the following four research questions which are original in the context of our study:

(1) Which are the influential *articles* published in environmental and ecological economics journals?
(2) Which are the influential *journals* focused on publishing articles in environmental and ecological economics?
(3) Which are the influential *authors*, who published in environmental and ecological economics journals?
(4) Which are the influential *institutions*, whose affiliates published in environmental and ecological economics journals?

In summary, this paper builds on previous citation analyses in the field of environmental and ecological economics or its sub-areas (Costanza et al., 2004; Kohlstad, 2000; Ma and Stern, 2006; Smith, 2000). We extend their scope substantially by pursuing – to the best of our knowledge – a citation analysis of the field of environmental and ecological economics, which makes the following four contributions. First, we conduct the first analysis of the influential authors in the field. Second, we pursue the first investigation of the influential institutions in the area. Third, we conduct the first rating of journals in the field of environmental and ecological economics in the 21st century which is not exposed to age effect. Fourth, we compile the first list of the influential papers in the area published in this century, in which the importance of at least some areas of environmental and ecological economics dramatically increased (e.g. climate change, renewable energy).

Our paper is structured in three further sections. In the following (second) section, we discuss our data set. Section 3 discusses our analysis and results with regard to each individual research question, before we conclude in the last section.

2. Data Sample

We follow an increasing literature that frequently employs citations for their virtues as non-subjective, reasonably comprehensive measure of study influence (e.g. Alexander and Mabry, 1994; Borokhovich et al., 1994; 2000; Costanza et al., 2004; Kim et al., 2006; Ma and Stern, 2006). Employing a standard approach to sample selection in citation analysis, we define our research field based on academic journals specialising in it (e.g. Coupé, 2003; Kim et al., 2006; Pieters and Baumgartner, 2002). Insofar, we follow Ma and Stern (2006), who use publications in JEEM and EcE as approximations for the field of environmental and ecological economics respectively (thus, we describe the research area of environmental and resource economics short as environmental economics). We extend Ma and Stern's sample by adding the economics journals which are heavily cited in JEEM or EcE or heavily cite JEEM or EcE and focus on environmental and ecological economics.

Hereby we define four relevant concepts as follows: First, we define any journal as an economics journal if it includes the term Economic(s) in its title or if it is indexed in the subject category Economics of Thomson Reuter's Web of Knowledge (WoK) database, which represents the quasi standard in citation research (Archambault et al., 2006) (this database was formerly provided by the Institute for Scientific Information and is still well known under this name). Since our analysis is based on citation data from the WoK database, which has a large coverage in Economics, we do not restrict the sample by employing its subject category Economics. Second, we define journals heavily cited in JEEM or EcE as