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Inventorship and authorship as attribution rights: An enquiry into the economics of scientific credit☆

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ABSTRACT

Authorship and inventorship are "attribution rights" upon which individual scientists build their reputation and career. Social and legal norms concerning their distribution within research teams are currently criticized for failing to inform third parties on individual contributions. We examine the case of teams engaged in the "double disclosure" of their research results through both publications and patents, and model the negotiation process taking place between junior or female team members and the senior (male) ones. We suggest that the former may give up inventorship in order to secure authorship, even when entitled to the both. Based on a sample of 680 "patent–publication pairs" (related sets of patents and publications) we show that, very frequently, one or more authors of a publication do not appear as inventors of a related patent. This is less likely to happen for first and last authors, which is in accordance both with our model and the prevailing legal norms on inventorship. However, the probability of exclusion from inventorship also declines with seniority, and increases for women, which is compatible with our model only.

"Why does your name even appear on the paper?"

"I am the one who suggested the problem [. . .] I prepared the grant application to the NIH. [. . .] Without such support [my student] could do nothing. I'm not just talking about the fellowship. [. . .] There's both a teacher-apprentice relationship and collegiality."
(Djerassi C., *Cantor's Dilemma*, Penguin Books, 1989; pp. 50–51).

"I think there's rarely more than one inventor. I mean, if you wake up and you have an idea, that's the invention. And then there's all this work around it, of course . . . [The postdoctoral researchers] contributed to the work, but they

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didn't do any really innovative work [. . .] They don't have time to think as much, they have a lot of manual labour to do"
(McSherry C., *Who Owns Academic Work?*, Harvard Univ. Press; 2003; p. 84)

1. Introduction

Understanding how scientific knowledge is produced and reduced to practice is a central theme of today's economic research. Both the sociology and the economics of science pay a great deal of attention to the system of incentives affecting academics' choice of research topics and transfer tools, with special emphasis on the role played by personal reputation and intellectual property (Dasgupta and David, 1994; Stephan, 2010). We contribute to this line of enquiry by studying the distribution of reputation among scientists working in teams and engaged in the "simultaneous disclosure" of scientific and commercial knowledge, by means, respectively, of publications and patents (Gans et al., 2011). In particular, we show that the distribution of authorship (of publications) and inventorship (of patents) among members of a research team reflects not only the individual contributions to the research effort, but also the relative bargaining power and incentives of team members.

We describe both authorship and inventorship as 'attribution rights', a form of intellectual property recognized both by the social norms of science (Merton, 1957) and by international conventions on "moral rights" of authors and performers (art. 11 in UNESCO, 2001; and art. 6 in WIPO, 2008). Such rights provide signals to participants to knowledge markets, where problems of asymmetric information are particularly acute. Indeed, a scientist's record as author and/or inventor is used by funding agencies or business companies to find the best researcher to sponsor, or the most-suited collaborator or consultant.

Assigning attribution rights is however difficult when the relevant activities are performed by teams, rather than individuals, as it is increasingly the case with science and technology (Katz and Martin, 1997; Jones et al., 2008; Wuchty et al., 2007; Jones, 2009). This is because the existing social and legal norms defining attribution rights leave room to contrasts and negotiations among team members (Fernandenz-Molina and Pais, 2001; Fisk, 2006). We argue that such negotiations, while possibly resolving in an optimal way the internal disputes, may mis-inform third parties on each team member's actual contribution to the research and inventive efforts, thus possibly generating negative information externalities. As already discussed in other contexts (e.g. Aghion and Bolton, 1987, on exclusive-dealing contracts; Hansmann and Santilli, 1997, on visual artists' rights), such externalities may affect negatively the efficiency of private agreements, as stated by the Coase theorem (Coase, 1960; Hermalin et al., 2007).

With the help of a stylized theoretical model we identify a number of conditions under which inventorship may be attributed more sparingly than authorship, so that not all the co-authors of a scientific publication end up being included in the list of inventors of the related patents. In particular, we argue that junior and female co-authors can be convinced to give up inventorship, other things being equal, due their lower incentives to reclaim this type of attribution right, as opposed to authorship.

We then test our propositions by using patent publication pairs (PPPs). A patent and a paper form a pair when they disclose the same research result, and at least one author and one inventor are the same person. Using text mining techniques we build an original sample of 680 PPPs produced by 308 Italian academic inventors between 1975 and 2002, in the fields of Chemical Engineering, Electronic Engineering and Telecommunications, Pharmacology, and Biology. We complement these data with related bibliometric and gender information on the selected academic inventors and their co-authors. We estimate that the risk of an author's exclusion from a related patent is higher for junior and female scientists.

The paper is structured as follows. In Section 2, we recall the increasing importance of teams in publishing and patenting and discuss the concepts of inventorship and authorship. In Section 3, we develop a formal model and the related proposition (full analysis in Additional Material). In Section 4, we describe our methodology for the identification of PPPs, the econometric model and the main variables. In Section 5, we describe the data and estimate the probability for the co-author of a publication to be excluded from the related patent, as a function of her contribution to the publication, seniority, gender, and experience. We also perform robustness checks and discuss the implications and limitations of our analysis. Section 6 concludes and discusses the relevance of our findings for the domain of the economics of science, and beyond.

2. Research teams and problems of attribution

2.1. The increasing importance of teams in publishing and patenting

The average number of authors per publication and inventors per patent has been increasing over time. By considering all scientific publications listed by the ISI Web of Science database, Wuchty et al. (2007) estimate that the average number of authors per paper moved from 1.9 in 1955 to 3.5 in 2000. For patents at the US Patent & Trademark Office (USPTO), the same authors estimate an increase from 1.7 inventors per patent in 1975 to 2.3 in 2000.[1] According to Jones (2009), the scientific work is increasingly specialized and therefore requires teams of increasing size. In addition, the growing need of

[1] Our own elaborations over data from the European Patent Office suggest an increase from 1.95 inventors per patent in 1980 to 2.46 in 1999; when considering only patents in a science-based fields such as organic chemistry, the figures are respectively 2.76 and 3.88 (data available on request).