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Contemporaneous peer effects, career age and the industry involvement of academics in biotechnology

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ABSTRACT

This study explores the role of contemporaneous peer effects in driving an academic's involvement with industry. Specifically, we examine the influence of workplace peers and personal collaborators and how these effects are moderated by the career age of the scientist. Moreover, we look at situations in which both types of social influence are incongruent and the academic is faced with "dissonance". Based on survey data of 355 German academics in the field of biotechnology and publication data from the Science Citation Index Expanded (SCIE), we find that the scientist's involvement with industry increases with the orientation of the scientist's department toward industry ("localized peer effect"). This effect turns out to be moderated by the scientist's age, such that the localized peer effect decreases with age and finally turns negative for very senior scientists. Moreover, we find that a scientist's involvement increases with the industry orientation of the scientist's co-authors ("personal peer effect"), irrespective of the scientist's age. In case both types of social influence are incongruent, younger scientists will revert to localized norms while more experienced scientists will orient themselves more toward their personal collaborators.

1. Introduction

How does social interaction influence an academic's decision to become entrepreneurial and to collaborate with industry? How is the academic's behavior influenced by intersecting types of social interaction? Does the academic's age attenuate or amplify these effects? A growing body of literature has begun to study questions on the effects of individuals in the environment of an academic in shaping his or her engagement in commercial activities (e.g., Louis et al., 1989; Stuart and Ding, 2006; Bercovitz and Feldman, 2008; Kacperczyk, 2013). One reason for such peer effects to occur has been described as "imprinting", defined as a process in which, during a certain period of time, an individual develops persistent characteristics that mirror central features of the environment (Marquis and Tilcsik, 2013). The environment, in turn, "is not a homogeneous setting but a varied, *n*-dimensional space in which a set of economic, technological, and institutional conditions, as well as the influence of particular individuals, coexist and jointly constitute the stamp of the period" (Marquis and Tilcsik, 2013, p. 227).

Several prior studies have addressed the role of workplace peers in imprinting an academic's behavior. Among them, Stuart and Ding (2006) find that scientists with co-authors who have become academic entrepreneurs are more likely to become commercially active themselves. Similarly, Kacperczyk (2013) shows that past entrepreneurial activity of university peers influences individual rates of entrepreneurship. Bercovitz and Feldman (2008) show that scientists are more likely to disclose their inventions if they observe technology transfer activities among their local peers. Azoulay et al. (2009) find early career experiences to have a substantial impact on academics' careers. One line of argument suggests that such effects are due to better information or resources that the scientist's social environment might provide (e.g., Sorensen and Audia, 2000). Another line of argument focuses on reference groups and social norms to explain individual behavior (e.g., Louis et al., 1989; Kenney and Goe, 2004; Bercovitz and Feldman, 2008). In a Mertonian view, universities are seen as repositories for the norms of open science, characterized as communalism, universalism, disinterestedness, and organized skepticism (Merton, 1973). Producing and diffusing scientifically valuable knowledge to realize an economic return thus implies a departure from the traditional mission and priority of academia (Dasgupta and David, 1994). In this regard, workplace peers may influence the informational and normative environment that exerts an effect on the decision to become commercially active.

Despite these insights, relatively little empirical attention has been devoted to multiple coexisting peer effects (Marquis and Tilcsik, 2013). Bercovitz and Feldman (2008) find that an academic's training norms may be incongruent with the localized social norms in the current work environment in which case the individual will

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conform to the local norms. However, it is unclear how different *contemporaneous* imprints interact in shaping an academic's involvement with industry. Moreover, we know little about the breadth and prevalence of different ways to get involved with industry as a result of peer effects. Prior literature is largely confined to studying invention disclosures or academic entrepreneurship (e.g., Stuart and Ding, 2006; Bercovitz and Feldman, 2008), although industry–science interaction may be multifaceted (D'Este and Patel, 2007).

In this paper, we draw a distinction between "localized" and "personal" peer effects on academics' involvement with industry to shed light on two different types of contemporaneous peer effects in a university environment. We suggest that a scientist's involvement with industry will increase with the orientation of the scientist's department toward industry, which we call a localized peer effect. Moreover, we expect a scientist's involvement with industry to increase with the industry orientation of his or her personal collaborators, an effect we call a personal peer effect. Besides our interest in whether these effects take the same or different directions, we seek to study their interaction and specifically a situation in which they are incongruent and hence "dissonant". Prior literature has also widely acknowledged the importance of age on an individual's susceptibility to imprinting (Marquis and Tilcsik, 2013). We expect both the localized and the personal peer effect to be stronger the more recent the vintage of the scientist's PhD, suggesting that imprinting takes place in the early stages of a scientist's academic career. Moreover, we hypothesize that the effects of dissonance will be different between young and experienced scientists. With respect to the dependent variable, we follow Bozeman and Gaughan (2007) and consider a broader set of industry–science interactions by using an industry involvement index that comprises five different channels of knowledge and technology exchange.

Our empirical analysis is based on a sample of 355 academic scientists working in the field of biotechnology in Germany who were surveyed in 2010. In fact, one of the industries that is particularly knowledge-driven and close to scientific research is the biotechnology industry. Technology for new products, methods and services frequently emerges from scientific institutions or in collaboration between firms and such institutions (e.g., Audretsch and Stephan, 1996; Zucker et al., 2002). Involving researchers from academia tends to be more important in biotechnology than in other sectors (Higgins et al., 2008). Germany has a lively and growing biotechnology scene, involving about 540 dedicated biotech companies as well as about 200 universities and public research institutions that carry out biotechnological research (BIOCOM, 2011).

We aim to contribute to the literature in three ways. First, we extend existing studies in the field by focusing on different contemporaneous peer effects while accounting for other environmental conditions and individual characteristics that may explain an academic's industry involvement. We distinguish between the effects that stem from localized and personal peers, allowing us to examine the relative impact of both as well as their interaction. Specifically, we shed light on congruent versus dissonant peer effects, an understudied, yet important area of research on peer effects in industry–science interaction. Second, we identify the researcher's career age as an important boundary condition for a researcher's susceptibility to imprinting. While the career age may directly influence the strength of peer effects, it is important to understand its role when peer effects are congruent or dissonant in order to derive implications for the management of science organizations and to extend existing models of imprinting through social interaction (Marquis and Tilcsik, 2013). Third, we extend prior literature on peer effects and industry involvement that has limited the researcher's commercial activity to a specific type such as the disclosure of an invention or patenting. University faculty may engage in a wide variety of interactions with industry of which patenting may only be one channel. D'Este and Patel (2007) have argued that accounting for the variety of industry–science interaction is a crucial complement to more traditional measures used in prior literature. In that respect, our research is positioned to further contribute to the body of literature that investigates the factors driving academics to depart from the traditional mission of the university and to engage with industry (e.g., Meyer-Krahmer and Schmoch, 1998; Link et al., 2007).

The remainder of the paper is organized as follows. The next section provides a literature background on academic involvement with industry and derives hypotheses. The data, variables and estimation methods are discussed in Section 3. Section 4 presents the results and several robustness tests. A discussion and concluding remarks appear in Section 5.

2. Peer effects and academics' involvement with industry

2.1. Literature background

While research on peer effects motivating academics to engage with industry is a relatively small but growing area of interest, there is a rich body of literature investigating the nexus between public science and industry. Hence, the purpose of this section is to position our research in the broader context of the literature on industry–science interaction and to outline those strands in the literature particularly relevant for our research. In fact, it has almost become conventional wisdom that knowledge produced in the public sector constitutes an important ingredient of economic growth and technological progress (Jaffe, 1989; Adams, 1990). Close links to academic research have been shown to be beneficial for the innovation performance of firms (Cockburn and Henderson, 1998; Belderbos et al., 2004; Arvanitis et al., 2008) because of the novelty and sophistication of the knowledge that universities create (Link et al., 2007). Moreover, universities offer access to basic research, talented people and complementary resources and allow the firm to explore new technological opportunities (Dasgupta and David, 1994; Sorensen and Fleming, 2004). Scientific knowledge does not, however, automatically spill over to industry. Knowledge and technology transfer relies on the engagement of the individual academic (Louis et al., 1989; Bercovitz and Feldman, 2007) and is thus dependent on the individual's decision to actively participate in industry–science activities through a variety of channels that can be either formal or informal. Formal involvement is typically based on a patent to be sold or licensed out (Bozeman, 2000; Thursby and Thursby, 2002) or collaboration in R&D (Laursen et al., 2011), while informal channels of interaction might involve industrial consulting (Jensen et al., 2010), joint publication of research results with industry personnel or informal contacts (Link et al., 2007; Grimpe and Fier, 2010).

The complexity that comes with the exchange of novel and sophisticated knowledge between academia and industry suggests several factors besides peer effects to play a role in motivating academics to engage with industry. In the following, we will therefore revert to the general model of imprinting developed by Marquis and Tilcsik (2013) that we believe is helpful in structuring and assessing the different factors influencing industry–science interaction. The model focuses on individuals as the entities bearing the imprint and explains a focal entity's reflection of certain characteristics as imprints from the environment and other entities during a sensitive period. It suggests that the entity bearing the imprint may move through periods during which it may not be sensitive to those imprints and that it may itself become a source of "second-hand" imprints on other entities. A key assumption of the model is a certain level of persistence of the imprint over time that allows the imprint to be actually identified and traced back to its source. As a result of the model, the characteristics an entity shows may