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Breaking the Ivory Tower: Academic Entrepreneurship in the Life Sciences in UK and Germany

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ABSTRACT

We examine engagement in commercial activities (consulting, patenting, and founding) among more than 2200 German and UK life scientists. We test hypotheses that include attributes of individuals, their material and social resources, and perceptions about values and reputation. We find that characteristics reflecting professional security, advantage and productivity are strong predictors for a greater breadth of participation in academic entrepreneurship, but not for all forms of technology transfer that we are able to test. For such academics, science and commerce go hand in hand, as they are best poised to straddle the boundary between industry and academy. We find strong support, however, that scientists perceive the value of patenting differently, and the level of reputational importance placed on scientific compared to commercial achievements matters in shaping commercial involvement.

1. Introduction

For decades, OECD countries have made concerted efforts to strengthen linkages between public research and private industry to improve national economic performance. Under the logic of facilitating innovation and increasing knowledge flows to companies, public initiatives have turned to formal technology transfer (TT), largely targeting intellectual property (IP) and faculty participation in commerce (Mowery and Sampat, 2004; Geuna and Nesta, 2006). National policies have become remarkably similar in their focus on patents, adapting many US models, such as university IP ownership of government-funded research and pecuniary incentives to inventors (Gulbrandsen and Etzkowitz, 1999; Powell et al., 2007). As a result, TT participation among life science faculty, termed academic entrepreneurship by some, is now widely accepted, and highly encouraged in most developed economies.

As a consequence, universities and public research organizations (PRO's) are subject to new metrics of performance, such as the number of patents produced or start-up companies formed (DLA Piper and Hayes-Curran, 2007). In 2006, the European Commission (EC) sponsored a study on TT regimes and their use as part of their Sixth Framework for R&D. In the same year, the Association of European Technology Transfer Professionals began surveying universities and PRO's on TT performance, including patents, new start-ups, licenses and income (Arundel and Bordoy, 2008). Many argue that these benchmarking efforts provide crude, often distorted measures of the impact of research on the economy (Nelson, 2009). Notably, scientists' formal TT participation is highly skewed (Agrawal and Henderson, 2002; Giuri et al., 2007). For example, Meyer (2006) demonstrates that individuals who patent in the UK, Germany, and Belgium account for 2% or less of the nano-science publishing communities. A focus solely on patents or spin-outs misses the numerous channels of TT (Murray, 2004; Sampat, 2006; Shapin, 2008).

We contend that only 'counting productivity' strips practices from the settings in which scientists produce knowledge, and overlooks important demographic, career, and normative characteristics that identify the loci of commercial activity (Stephan et al., 2007; Colyvas and Powell, 2009). We argue that the proclivity of scientists to engage in TT is conditioned by their positions in the social structure of science and outlooks on their careers. More established and productive scientists have less to lose in terms of tenure and reputation, have more resources, and are better situated to mobilize their material and social capital for commercial gain (Stephan and Levin, 1992; Casper and Murray, 2005; Stuart and Ding, 2006). Furthermore, the social acceptance of IP plays an important role in participation, although few have measured the reputational value that scientists place on property versus esteem from scientific

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achievement. Even at highly entrepreneurial universities, scientists differ greatly in their emphasis on industry engagement—ranging from those who see synergies between industry and academic science, to those who view them in opposition (Owen-Smith and Powell, 2001). We claim that commercializing science has much to do with academics' perceptions about reputation and achievement.

1.1. Technology transfer in the academy

Technology transfer reflects how scientific results move from one organization to another for further development and commercialization (AUTM, 2009).[1] The distinction between public and private science, which emphasizes the social organization of knowledge production, provides a useful contrast in understanding changes in TT. Dasgupta and David (1994) suggest structural differences between academic and commercial science in terms of the goals accepted as legitimate; features of the reward system; and norms regarding knowledge disclosure. In public science, the primary legitimate goal is priority of discovery, which is rewarded through peer review and codified through publication, citation, and professional awards. In proprietary science, legitimate goals are oriented toward market share, which is rewarded through excludability and profit, making patents the primary currency for disclosure. Government initiatives and local incentives to integrate commercial efforts into universities and PRO's mark a strong departure from the normative aspects that have traditionally distinguished academic from industry science. Scholars assert that these once separate regimes have become more integrated whereby science has moved from a "binary system. . . to . . . arrangements that combine elements of both" (Owen-Smith, 2003; Rhoten and Powell, 2007, p. 346).

Claims of blurred boundaries between public and proprietary science are not without debate, particularly how this amalgamated regime actually reflects changes in practices. Some argue that this view of science as open and communal is exaggerated and the production of knowledge in public settings has always been highly secretive, exclusionary, and often intended for practical application (Vallas and Kleinman, 2008). Therefore, a move toward engagement in commercializing science does not actually reflect a strong normative departure, and rather is more a product of a shifting knowledge economy. Others emphasize that in many countries, academic ties to industry have a long legacy, has taken multiple forms, and both sectors share many substantive similarities in the nature of the research (Shapin, 2008). In Germany, for example, specialized agencies as early as the 1970s were created within academic institutions to make research more visible to industry (Lange and Krücken, 2008). The proactive focus on IP rights for research as a primary way of disseminating findings is, however, new. For scientists, industry engagement means navigating dual, often conflicting public and proprietary systems (Vallas and Kleinman, 2001; Haeussler, forthcoming).

Indeed, numerous aspects of these two systems are contradictory. Whereas publication provides open access to knowledge, IP confers the ability to exclude others from using it. Publication success depends on peer review, while patents rely on legal criteria of novelty, non-obviousness, and use (Eisenberg, 1987, 1996). For scientists, the time and work required for successful commercialization does not necessarily support, and even undermines, advance in academic science: the kind of effort involved in publication success is different from that necessary to secure a patent (Packer and Webster, 1996). Formal TT may also preclude access to scientists' work, create conflict of interest, or divert attention and resources away from scientific recognition (Krimsky, 2006; Murray and Stern, 2007). As a result, scientists' responses to national and local incentives may be mediated by the trade-offs they face in their professions and everyday work.

1.2. Antecedents and effects

We follow research that posits ways in which proprietary practices may generate a new "fault line" for scientists—reproducing the existing social system of science, advantaging some who are better poised to harness the dual objectives of scientific advance and commercial rewards, and perhaps isolating those who remain 'pure' (Owen-Smith and Powell, 2001). We focus on individual predictors that profile the loci and normative orientation of those who engage in TT, and reveal how science and commerce have intermingled or not in academia. Academics' participation in such practices thus raises an important puzzle: Does engagement in academic entrepreneurship reproduce the existing social structure of science, in which case those with resources and professional security are more able to parlay science into commerce? Or, does entrepreneurial activity reveal opportunities to circumvent the established social order of science? The former is an enduring concern about stratification in scientific production and careers. The latter reflects the hope of many local and government policies.

To address these questions, we utilize a survey-based dataset of 2294 German and UK life scientists' commercial practices, enabling us to examine three forms of TT – consulting, patenting, and founding – that also reflect distinctive ways scientists engage with industry (Shane, 2004).[2] The life sciences are a strategic context since industrial advance relies heavily on public and basic research, yet proprietary science is newer to this field compared to engineering and physical sciences. Germany and UK provide apt settings due to their high quality science, established life science industries, and concerted governmental attempts to facilitate TT (Casper and Whitley, 2004).

Our contribution is empirical and theoretical. Most individual-level studies focus on the US and separate forms of commercial engagement, although these activities often go hand in hand (Murray, 2004). Notable exceptions highlight consulting, which is often overlooked due to the unavailability of data (Porter et al., 2005; Jensen et al., 2008; Ding and Choi, 2008). We examine three forms of TT in the same sample. Furthermore, many analyses emphasize the social and normative structure of science such as career status or productivity, yet few capture differences toward reputation and rewards. We tease out attitudinal differences and demonstrate their distinctiveness from demographic and resource attributes. We thus capture whether and how commercial practices integrate into public science through legitimate goals and rewards.

2. Determinants of commercial engagement

We present one set of hypotheses, addressing each determinant in terms of "breadth" and "degree" of involvement with industry, which we test first as a summative index of patenting, consulting, and founding (i.e., breadth), and second, separately for each (i.e., degree). We examine scientists' demographic attributes, followed by material, human, and social resources, as well as the reputational associations scientists credit to commercial and scientific achievement.

[1] TT is broader than entrepreneurship that emphasizes scientist engagement in commercializing findings, or proprietary science that emphasizes disclosing knowledge through patents (Owen-Smith and Powell, 2001).

[2] These do not reflect all TT, notably conference presentations and graduate hires are also important.