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Positions and rewards: The allocation of resources within a science-based entrepreneurial firm

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ARTICLE INFO

Article history:

Received 31 March 2013

Accepted 31 January 2014

Available online 19 May 2014

Keywords:

Biotechnology

Publication strategy

Compensation

Organizational structure incentives

Intraorganizational authority

ABSTRACT

We study the link between resource allocation and employee publication in the open science in a quantitative case study of one science-based, entrepreneurial firm. We bridge the literature on incentives with that on authority structures to argue that a positive relationship between rewards and productivity will be strongest for individuals in positions of scientific leadership within the firm. In a novel dataset, we find that prolific publishers receive greater year-end bonuses and are allocated additional direct reports, but this relationship only holds for individuals in scientific leadership roles. These results contribute to our understanding of resource allocation processes and reward structures in science-based firms.

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1. Introduction

The role of incentive structures in promoting knowledge creation and other forms of entrepreneurial activity within science-based firms has received considerable attention in the literature. To date, scholars have examined hiring policies in science-based firms (Stern, 2004) and the proclivities of university-trained scientists to work in private firms (e.g., Roach and Sauermann, 2010; Lacetera and Zirulia, 2012; Sauermann and Stephan, 2013). For a limited set of pharmaceutical firms, Henderson and Cockburn (1994) have linked pro-publication policies to innovative productivity. In a quantitative case study, Bhaskarabhatia and Hegde (2012) examine the effect of IBM's decision to adopt a pro-patent incentive regime.

Despite the deepening of our understanding of the link between human resource practices, publishing, and patenting, scholars have devoted much less attention to the inventive context *within* firms, including the potential interrelationships among a range of factors such as resource allocation practices, corporate culture, incentive plans, and the distinct positions and roles that knowledge workers hold within organizations (Murray, 2004 is a notable exception). This dearth stems not from a lack of interest (for example, see Audretsch et al., 2007; Grimaldi et al., 2011), but in the obstacles associated with collecting data on the activities of scientists

and the management systems in place in R&D organizations within for-profit firms.

In this paper, we provide quantitative evidence of the link between publication and rewards in a large—but still entrepreneurial—firm, which we label “BTCO” to preserve anonymity. We argue that the reward structure for these activities may not be uniform across BTCO's knowledge workers. Specifically, although it is not a written policy, we hypothesize that the organization's incentive system will be targeted to most generously reward knowledge-generating activities for those individuals in more senior, scientific leadership roles in the company. To examine these issues, we investigate a longitudinal dataset that span the years 2001–2008. As we follow individual scientists over time, we can study the effects of year-to-year variation in each individual's publication success. We link this measure of knowledge production to two outcomes within the organization: the amount of discretionary compensation earned, and changes in the individual's span of control (i.e., number of direct reports allocated to them). Consistent with Henderson and Cockburn (1994), we equate the allocation of rewards as a tangible indicator of senior management's priorities (e.g., the incentive structure) within this entrepreneurial firm. Moreover, we measure the *allocation* of rewards, rather than the *promise* of rewards because this is a more easily observable outcome within the organization.

Surprisingly, we find that this organization, which espouses organization-wide support for publication activities, does *not* reward the median, publishing individual. However, when we condition our regressions on specific organizational roles, we then find

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that those employees who are in positions of authority within the organization are rewarded for publishing, but not the technicians who populate these leaders' laboratories. Specifically, laboratory heads that publish receive greater monetary compensation, as evidenced by the size of their year-end bonuses, and a greater share of organizational resources, as proxied by an individual's number of direct reports.

The paper proceeds as follows. Section 2 reviews the literature on scientific production within for-profit firms, and the motivations underpinning these activities. In Section 3, we develop two interrelated hypotheses with regards to the contingent incentive structure underlying scientific activities. Section 4 describes our setting, data collection, and measures, and Section 5 presents our findings. A final section concludes and discusses some implications for future research.

2. Publishing and incentives in the private sector

The question of how to induce employees to behave in an entrepreneurial manner is a seemingly permanent element in the set of challenges facing leaders of large, established companies. In fact, certain theories suggest that as organizations age they invariably must be designed in ways that lead to the reinforcement of their existing activity sets, which implies that inertia is inevitable (Sorenson and Stuart, 2000). Particularly for companies in fast-paced environments, however, many scholars argue that entrepreneurial activities are essential for rejuvenation of the firm's capabilities (e.g., Henderson and Clark, 1990). Our question is not why established firms engage in entrepreneurial activities or even whether they will succeed in these endeavors. Rather, we ask: how does a focal decision, to engage in one type of knowledge-generating activity, permeate the intra-organizational context of the firm and the allocation of organizational resources?

Our trace of entrepreneurial activity is an employee's participation in the external ecosystem within which the scientific discovery process is embedded: the publication of scientific results in academic journals. At first glance, there is little motivation for for-profit firms to participate in open Science, given the associated costs. No doubt many academics can empathize with the time and effort that is required to craft the right turn of phrase, to adjust figures and graphs to be just so, and to attend to the minutiae that is part and parcel of the publication process. In fact, given the sizeable time costs of writing and revising research papers, BTCO's current management has recently introduced policies to reduce the number of submissions to second- and third-tier academic journals. BTCO management emphasized that they were not discouraging public disclosure of scientific findings. They continue to authorize conference submissions and to sanction presentations in a variety of venues, but they actively discourage the submission of these results to low quality journals. They simply perceive little value in the production of non-momentous papers.

Second, publication is disclosure. Although it is possible to time the submission of publications so that they do not interfere with patent filings, firms that publish unavoidably disclose a great deal of information about the focus of their research endeavors (Gans and Stern, 2003). In contrast to patenting activity, a central role of publishing is to allow the reproduction and independent corroboration of a scientist's findings (Merton, 1957). If a scientific finding is not replicable, the validity of the result is questionable. In consequence, a byproduct of the publication process is to facilitate the advancement of potential competitors to a similar point in the scientific production frontier (Dasgupta and David, 1994). By contrast, patents are much less explicit: they are often written as broadly as possible to encompass an array of commercialization strategies. Because Science is an integral component of a firm's capabilities in

industries such as biomedicine, open publication is tantamount to a revelation of strategic intent.

Lastly, publication contributes to the conversion of firm-specific human capital to its general form. When firms permit researchers to publish, they not only endow specific individuals with the credit for their discoveries; they also divulge this information to the public. It then becomes possible for external parties to link a firm's technical developments to the specific individuals who contributed most to its creation. Publishing allows the public observation of a firm's productive workers, and efforts by competitors to poach talent may be an inevitable result. Internally, publishing may increase employee mobility and bargaining power.

What, then, are the compensatory benefits that offset these costs, and what do they imply for how the organization behaves? In our interviews at BTCO, interviewees underscored a number of points. First, publishing allows BTCO's researchers to be more embedded in the external ecosystem, within which entrepreneurial activities are embedded (Liu and Stuart, 2011). Publishers, as active participants in the invisible colleges of the scientific community, acquire access to unpublished results. Over time, the organization hopes to utilize this privileged access to accelerate their future, for-profit endeavors (Cockburn and Henderson, 1998).

Second, pegging rewards to publications potentially helps firms to resolve a perennial dilemma: how to evaluate and reward researchers who work on very long-term and highly uncertain projects, the vast majority of which will fail to deliver revenues for the firm (and none will do so in the proximate future)? Under these circumstances, peer-reviewed publications provide a semi-objective method of evaluating performance to allocate discretionary compensation in a context in which the quality of research is difficult to assess, and effort is challenging to measure. Moreover, in our interviews as well as reported elsewhere (e.g., Cockburn and Henderson, 1998) managers emphasized the belief that, while costly, publishing raised the quality of the research itself, pushing BTCO employees to think harder and more creatively about their problems at hand.

Lastly, and this was a point repeatedly underscored by BTCO management, a permissive publication policy is an essential component of any strategy to recruit and retain the highest quality researchers, especially individuals who hold doctoral degrees. If potential employees, the vast majority of whom have spent many years in academia, do not perceive the ability to engage in open science activities, they may look for employment elsewhere. A record of publication success by BTCO scientists, especially in prominent journals, is a tangible illustration of the organization's commitment to fostering a pro-scientific environment.

Recently, there has been both theoretical (Lacetera and Zirulia, 2012) and empirical (Stern, 2004; Roach and Sauerermann, 2010) interest in the relationship between a for-profit firm's decision to engage in (or refrain from) scientific publishing, and the implications of this decision on the firm's recruitment strategies in the scientific labor market. Broadly, the conclusion is that scientists will accept lower wages in exchange for employment in a firm that embraces scientific publishing (Stern, 2004), although the willingness to accept this differential varies across individual members within the scientific community (Sauerermann and Cohen, 2010). We extend this literature by examining not BTCO's employment strategies, but rather the varied tributaries through which a pro-publication orientation permeates the entirety of the organization.

3. Organizational context and incentives to publish

The motivating concerns of this paper are two-fold. First, we seek to provide a descriptive account of how BTCO's decision to encourage publishing influences resource allocation and a variety

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