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The role of relative performance in inter-firm mobility of inventors

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ABSTRACT

Prior research has emphasized the influence of inter-firm mobility on knowledge flows and innovation, yet we have an incomplete picture of the antecedents of inventor mobility. Building on theoretical traditions related to decision-making based on limited, asymmetric, bounded information, and economic and other incentives, our paper suggests that after controlling for individual performance and other variables previously shown to affect inter-organizational mobility, an inventor's performance relative to his co-patenting group alters his likelihood of mobility. Our analysis of 2648 inventors in the pharmaceutical industry shows that for those performing above their reference group (of past and current co-inventors in patenting), an increase in relative performance decreases the likelihood of mobility, and for those performing below the reference group, a decrease in relative performance decreases the likelihood of mobility. We also find that when inventors have more external scientific collaborations, their likelihood of mobility increases and this variable moderates the relationship between the performance gap and mobility, but only for those performing above their peers.

1. Introduction

In technology and science intensive industries, knowledge is a strategic asset critical to the competitiveness of firms (Coff, 1997). According to the knowledge-based view of the firm, knowledge is embedded in individuals (Grant, 1996) and is combined within organizations through routines in order to apply it to useful ends (Kogut and Zander, 1992; Nelson and Winter, 1982). Since individuals are the repositories of useful knowledge within organizations, to be successful, firms need to protect their knowledge through employee retention and also access external knowledge through hiring knowledgeable employees. Scholars have shed some light on the relationship between mobility and firm performance showing that the mobility of professionals, including engineers and scientists, has implications for the flow of knowledge across organizations (Campbell et al., 2012b; Corredoira and Rosenkopf, 2010; Rosenkopf and Almeida, 2003; Singh and Agrawal, 2010; Somaya et al., 2008), entrepreneurial dynamics (Agrawal et al., 2006; Almeida et al., 2003) and individual and firm innovative output (Cirillo et al., 2013; Cruz-Castro and Sanz-Menéndez, 2010; Groysberg et al., 2008a; Hoisl, 2007; Singh and Agrawal, 2011; Slavova et al., 2015).

While this previous research has increased our understanding of the individual and organizational implications of inter-firm mobility (for a review see Mawdsley and Somaya, 2016), it has been recognized that the effects of mobility depend, in part, on who moves and under what conditions. Along with firm incentives (Gambardella et al., 2015, 2010; Jovanovic, 1979; Lazear, 2000; Marx et al., 2009; Zenger, 1992) and external labor market factors (e.g. Palomeras and Melero, 2010), individual performance has been proposed as a strong predictor of inter-organizational mobility (Campbell et al., 2012b; Carnahan et al., 2012; Hoisl, 2007). Previous studies consistently find that high performers are less likely to be mobile compared to low performers. While prior research compared performance of innovators within a firm and across firms, our paper suggests that, in addition, *relative performance* within groups affects mobility decisions. We build on theoretical traditions suggesting that individuals and organizations make decisions based on limited and bounded information (Arrow, 1962; March and Simon, 1958), and so decision makers need reference points to interpret information (Cyert and March, 1963; Festinger, 1954; Kahneman and Tversky, 1979). Our paper explores how individuals and firms use reference groups for assessing and interpreting innovative performance, how this assessment influences the likelihood of inter-organizational mobility. Also, building on previous research on the role of collaborations as information channels on job opportunities (Granovetter, 1973; Nakajima et al., 2010), we examine how an inventor's ties with external organizations directly affect the likelihood of moving and how they moderate the relationship between relative performance and mobility.

Using data on inventors in the pharmaceutical industry from 1975 to 2006, our analysis reveals that i) for inventors performing above their reference group (of past and current co-patenters), an increase in

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relative performance decreases the likelihood of mobility, and ii) for those performing below the reference group, a decrease in relative performance decreases the likelihood of mobility iii) for an inventor performing above his peers, external professional collaborations decrease his likelihood of remaining within the current firm.

Our paper builds in important ways on the important research by Carnahan et al. (2012). While both papers focus on explaining the likelihood of employee mobility and show a relationship between mobility and performance, Carnahan et al. (2012) show how differences in compensation between a current employer and that of another firm in the same state affect the likelihood of employees' mobility. In contrast, our study examines how relative performance within groups (regardless of whether they are high or low performers at the firm level) matters to the likelihood of inter-organizational mobility. We incorporate insights from previous research (not related to mobility) that shows that relative performance is an important construct, and firms and individuals use this construct to make decisions (e.g. Bromiley and Harris, 2014; Cyert and March, 1963; Greve, 1998; Kahneman and Tversky, 1979). Further, the literature on peer effects (e.g. Bercovitz and Feldman, 2007; De Jong et al., 2014; Kram and Isabella, 1985; Tartari et al., 2014) suggests that relative performance among innovators affects firm incentives and inventor behavior. It is worth noting that *relative* individual performance (within groups) has not been previously studied with respect to the effect on individual mobility. In this study, even though we control for performance and other accepted antecedents of mobility, we find effects for the influence of relative (group) performance on mobility. This finding is central to the novelty and contribution of the paper.

2. Theory

2.1. Inventor performance as an antecedent of inter-organizational mobility

Several existing streams of research relate individual performance to inter-organizational mobility. One set of papers studies internal labor market dynamics and focuses mainly on the design of optimal contracts for talented people. This research suggests that mobility is mainly driven by a mismatch of employee incentives, wages, and expectations (Jovanovic, 1979; Lazear, 2000; Zenger, 1992) and proposes a mix of monetary and non-monetary incentives in employment contracts (Aghion et al., 2008; Stephan, 1996; Stern, 2004; Toivanen and Väänänen, 2012) to help retain employees (Gambardella et al., 2015, 2010; Marx et al., 2015, 2009). Another set of research papers relates to external labor markets and highlights the idea of fit between hiring firms and inventors. For instance, Palomeras and Melero (2010) look at how the matching of the inventor's knowledge and the recipient firm's knowledge stimulates mobility, and Nakajima et al. (2010) argue that an inventor's research collaboration networks reduces the uncertainty that firms have about inventors prior to hiring.

Related to the internal and external labor market perspectives, individual performance is seen as an influence on the likelihood of mobility, since it affects the internal bargaining with a current employer and provides a signal to the external market (e.g. Campbell et al., 2012b; Groysberg et al., 2008; Hoisl, 2007; Singh and Agrawal, 2011). Individual performance is considered a strong indicator of an individual's ability to capture rents in the form of salary or career opportunities (Campbell et al., 2012b; Carnahan et al., 2012; Toivanen and Väänänen, 2012). This prior research has emphasized that there is a systematic difference in the likelihood of mobility among individuals depending on their position on the performance distribution and find that high performers are less likely to be mobile compared to low performers. Firms use contractual or managerial instruments to increase the chances of retaining valued employees (Gambardella et al., 2015, 2010). Employers have an informational advantage vis-a-vis other firms, so that the relationship between individual performance and the likelihood of mobility has been systematically found to be negative.

2.2. Relative performance

Since individuals and organizations make decisions based on asymmetric and bounded information (Arrow, 1962; March and Simon, 1958), reference points can be a useful device to interpret this information (Cyert and March, 1963; Kahneman and Tversky, 1979). Based on this idea, an stream of empirical research has developed around the role of performance relative to reference points for strategic decision making of individuals (e.g. Audia and Brion, 2007; Greve, 2002) and organizations (e.g. Bromiley and Harris, 2014; Greve, 2003a, 1998).

An assumption of some prior research on individual performance and inter-organizational mobility has been that information about potentially mobile employees is freely available to both individuals and firms (Campbell et al., 2012a; Coff and Raffiee, 2015). However, we know that individual and organizational decision-making is a process based on limited information, and that comparative mechanisms are established in order to better interpret performance and subsequent actions (Arrow, 1962; March and Simon, 1958). Empirical evidence on the performance-mobility relationship implies that differentiating between low and high performers is useful (Carnahan et al., 2012; Zenger, 1992) while studying the relationship between performance and mobility. While individual (absolute) performance is indeed a valid indicator of the overall value of an individual's value, we believe that individuals and organizations develop and use reference points to assess their own performance and make decisions based on this assessment.

2.3. Co-workers in innovation activities as a reference point

Social comparison theory postulates that individuals have an intrinsic tendency to self-evaluate, and that such self-evaluation is often informed by comparison with others whom they consider as having similar attitudes or abilities (Festinger, 1954). Building on this theory, studies have explored the role of peers in team-based jobs and its effect on individual performance and career development (De Jong et al., 2014; Kram and Isabella, 1985; Lepine and Dyne, 2001; Loughry and Tosi, 2008). In science and innovation-related contexts, we know that an individual's immediate work colleagues significantly influence the individual's proclivity to startup a new venture (Nanda and Sørensen, 2010), engage in collaborations (Bercovitz and Feldman, 2007; Tartari et al., 2014) and compete for jobs (Stephan, 1996).

In considering how innovation activities are carried out in pharmaceutical firms, co-workers in R & D groups are also often co-patenters. In our field research, we conducted semi-structured interviews with scientists and R & D managers/directors/inventors in leading pharmaceutical firms to provide some clarity on the appropriateness of co-inventors as the referral groups when evaluating performance. When asked about the role of co-inventors, one of the interviewees responded, "*R & D groups are fundamental. In biotech, pharmaceutical and medical research the group of co-scientists is the source of stimulus to do better. …the crazy scientist doing everything by herself does not exist anymore in pharma-biotech research.*" Other scientists suggested, "*My peers are considered by program, project, patenting or those in the same level in the hierarchy*" and "*(my) peers are those having the same title, working group, tech category, or patenting team*". These observations suggest that the co-inventors on a patent are the ideal reference group for measuring performance (Reagans and Zuckerman, 2001).

2.4. Hypotheses development

In the following section we develop a set of hypotheses on how individual relative performance relates to the likelihood inter-organizational mobility of inventors in knowledge-based industries such as pharmaceuticals. We follow the logic stream supported by previous research that relative performance is used by firms and individuals to