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How stars matter: Recruiting and peer effects in evolutionary biology☆

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ABSTRACT

The peer-effects literature highlights several distinct channels through which colleagues may affect individual and organizational performance. Building on this, we examine the relative contributions of different channels by decomposing the productivity effect of a star's arrival on (1) incumbents and (2) new recruits. Using longitudinal, university-level data, we report that hiring a star does not increase overall incumbent productivity, although this aggregate effect hides offsetting effects on related (positive) versus unrelated (negative) colleagues. However, the primary impact comes from an increase in the average quality of subsequent recruits, an effect that is most pronounced at non-highly-ranked institutions. We discuss the implications of our results for star-focused strategies to improve organizational performance.

1. Introduction

One of the most prominent and persistent features of the production of scientific knowledge is the role of superstars. The highly skewed distribution of output per individual is well documented. Almost a century ago, Lotka (1926) observed that 6% of physicists produced more than 50% of all papers. Since then, the relative importance of scientists in the right tail of the output distribution – stars – has endured (Rosen, 1981; Narin and Breitzman, 1995; Ernst et al., 2000).

How do stars affect the productivity of their organization? Although stars themselves have been carefully examined, their effect on the organizations they join is less well studied. We examine two channels: incumbents and joiners. These channels are not mutually exclusive. Stars may increase the productivity of incumbents – scientists already present at the organization when the star arrives – by raising the standards, collaborating, or by sharing their knowledge, for instance. Stars may also increase the productivity of the average worker at their organization by enhancing the quality of subsequent recruits ("joiners") due to their reputation. We find evidence in support of both channels, but the effect on joiners dominates the effect on incumbents.

We base our empirics on a sample of 140 evolutionary biology departments that published 149,947 articles over the 29-year period 1980–2008. We employ a difference-in-differences estimation, comparing the productivity of "treated" versus "control" departments before versus after the arrival of a star, to estimate the impact of a star hire on department productivity, where treatment refers to the recruitment of a star.

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We report three main results. First, the arrival of a star is highly correlated with a subsequent increase in the productivity of the group. Specifically, we estimate that a department's productivity (output per scientist) increases by 46% after the arrival of a star. Second, productivity gains are primarily due to an increase in the quality of subsequent recruits who join after the arrival of the star, as opposed to an increase in the productivity of incumbents who were already in the group prior to the star's arrival. The mean quality of joining scientists increases by more than 64% after the arrival of a star. Third, the "no net effect on incumbent" result obscures a subtler effect that stars do seem to enhance the productivity of incumbents who work in areas related to the star, but they also diminish the relative productivity of incumbents who work in areas unrelated to the star, perhaps due to crowding out resources that would have otherwise gone to the unrelated areas.

We interpret our results as causal – that the arrival of a star scientist causes an increase in the subsequent productivity of their department – with caution. Stars may move to departments that are on the rise (reverse causality). In addition, an omitted variable, such as a positive shock to department resources (e.g., philanthropic gifts, sharp increases in government funding, the construction of a new building), may cause the department to both hire a star and increase its overall productivity in terms of incumbent productivity and the quality of subsequent recruits. Our difference-in-differences estimation method partially addresses these concerns by controlling for general productivity trends (time fixed effects) and department-specific attributes (department fixed effects). However, a concern remains that time-specific department-level shocks could lead to a misidentification of causal effects. Thus, we conduct three additional tests; they all produce results consistent with a causal interpretation. Still, we view the causal interpretation of our results with caution due to the possible endogeneity of the arrival of a star at a department.

This star-effect-on-recruiting finding is important because it has a direct bearing on strategy and policy. From a strategy perspective, organizations with capacity for further hiring will enjoy higher returns from recruiting a star than will otherwise similar organizations. This would not be the case if the benefits were instead due to enhancing incumbent productivity. In addition, from a policy perspective, our findings, while not conclusive, are more consistent with a zero-sum, splitting-the-pie interpretation rather than a growing-the-pie interpretation. Given the main effect of star arrival is enhancing the quality of subsequent recruits rather than increasing the productivity of incumbents, the focal department's gain comes at the expense of other departments' loss. Our results do not offer an obvious case for intervention by the central planner with respect to allocating stars across organizations to optimize welfare.

Overall, this paper offers three primary contributions to the literature. First, we introduce a theoretical model that generates testable predictions for the implications of star arrivals on the productivity of related versus unrelated incumbents and the quality of related versus unrelated joiners. Second, we link the literatures on direct peer effects (e.g., via collaboration) and indirect peer effects (e.g., enhanced recruiting), and report that the latter dominates the former, at least in our empirical setting. Finally, we report evidence that collaboration may be an important mechanism through which stars enhance incumbent productivity, although only for those working in related areas.

The paper proceeds as follows. We review the related literature in Section 2 and then present our theoretical framework in Section 3. We describe our data in Section 4 and our empirical strategy in Section 5. We report results in Section 6 and, in Section 7, provide further evidence that supports a causal interpretation. We discuss the implications of our findings in Section 8.

2. Related literature

Evidence is mixed concerning the effect of stars on peer productivity. Using unexpected star scientist deaths as an exogenous source of variation in peer groups, Azoulay et al. (2010) find a lasting impact on the quality-adjusted publication output of co-authors. Also using star deaths as an exogenous source of variation, Oettl (2012) finds evidence that co-authors of highly helpful scientists that pass away experience a decrease in the quality but not the quantity of output. In contrast, Waldinger (2012), who uses the natural experiment of the dismissal of distinguished scientists in Nazi Germany to measure the effect on colleagues left behind, does not find evidence of adverse effects on former peers within the dismissed scientists' department. One explanation for the difference in these findings may be that the Waldinger study is based on data from an earlier period and the role of teams in the production of science has become significantly more important (Wuchty et al., 2007; Jones, 2009; Conti and Liu, 2015; Bercovitz and Feldman, 2011).[1]

Evidence of peer effects has also been found in other domains. In the context of a retail firm, Mas and Moretti (2009) find evidence of productivity spillovers when a high productivity worker arrives, but the benefit is limited to those who see the star in their daily work and is stronger when there are more frequent interactions with the new arrival. Using data on the performance of randomly assigned college roommates, Sacerdote (2001) finds that peers have an impact on grade point averages and decisions to join social groups.[2]

[1] An important question addressed in the literature is how the relationship with the arriving star mediates the impact on incumbents. Conceptualizing knowledge development as a process of search and recombination, Grigoriou and Rothaermel (2014) develop the idea of a "relational star." They argue that a focus on individual productivity presents an under-socialized view of inventor capacity, and instead emphasize the importance of the star's position in intraorganizational knowledge networks. In this regard there is growing evidence that having a cadre of incumbents with skills that complement an arriving star matters for the productivity enhancing effect of the star's arrival. In a study of security analysts, Groysberg et al. (2008) find that a star's own productivity drops significantly on arrival, but that this effect is attenuated when they move to firms with better capabilities or when they move together with prior team members. This suggests difficulties in effective matching with new colleagues where incumbent capabilities are unrelated to the star. In a related study, Groysberg and Lee (2009) find that star security analysts who join firms to initiate new activities ("exploration") suffer long-run performance declines while those who join to reinforce existing activities ("exploitation") suffer only short-term declines. Kehoe and Tzabbar (2015) find that the positive effect of a star on incumbent productivity is greatest where the star has broad expertise and collaborates frequently. (See also Kehoe et al., 2016.) In a study of translational research in medicine, Ali and Gittelman (2016) find evidence of a licensing penalty for teams that comprise MDs and PhDs, suggesting the challenges of combining expertise that bridge different knowledge domains and thus the limited benefits of star arrivals for unrelated incumbents.

[2] Collaboration is one mechanism through which star arrivals could affect incumbent productivity, especially where the incumbent works in areas related to the star. The benefit could be influenced by the "Matthew effect," made famous by Merton (1968) in a study of Nobel laureates. Azoulay et al. (2013) provide evidence that status-conferring prizes lead to increased citations to prior work, especially where there is uncertainty about the quality of the article. Such citation boosts will also positively impact co-authors, even though there may be a retrospective reallocation of credit when prizes are awarded. There is also direct evidence that collaboration with stars can increase the probability of publication independent of the quality of the work. Simcoe and Waguespack (2011) exploit a natural experiment where new submissions to the Internet Engineering Task Force were announced with the first author followed by "et al." The importance of status is identified by variation in whether a high-status name is obscured or not in the announcement of the submission. They find name-based signals significantly affect publication rates and attention on electronic discussion boards, indicating a publication advantage from collaboration with a star. Lu et al. (2013) provide intriguing evidence of the citation implications of the Matthew effect in reverse–where an article has to be retracted and blame attributed. They find that retractions impose little citation penalty on the star, but non-star co-authors face substantial declines in citations to prior work. Hohberger (2016) examines the effects of a star on non-star inventors in biotechnology. He finds that having a star directly involved in building on