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Knowledge, Proximity and R&D Exodus

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ABSTRACT

We explore not only how technological leaders and laggards react to agglomeration, but within an agglomeration we look at how the relative presence of other leaders, laggards and foreign firms affects these firms. Existing literature argues that technological leaders experience net knowledge outflows and are therefore losers in agglomerations. However, we do not know if they avoid locations with laggards more so than locations with leaders or vice versa, thus we examine how the relative presence of each affects leaders' location decisions. For technologically lagging firms, we argue they will prefer locations with leaders over locations with laggards. We further posit that an increasing presence of foreign firms will have a particularly detrimental effect on technologically leading domestic firms, as these lose out in the contest for talent. Contextualized in an emerging market with weak intellectual property rights protection, we examine whether these concerns about knowledge spillovers and competition for talent prompt firms to close their R&D facilities or remain open. Using 5798 observations of R&D laboratories in India during 2003–2011, we find that while technologically leading firms are more likely to close their R&D facilities as the presence of other domestic labs increases, laggards are less likely to do so. These findings suggest concerns over knowledge spillovers are present, especially on the part of technologically leading firms. Moreover, leaders are more concerned by the presence of other leaders. Technologically lagging firms, by contrast, are less likely to close R&D facilities in the face of these concerns and will prefer staying near leaders over laggards. Finally, we find evidence of foreign firms crowding out domestic technological leaders but not laggards in the competition for talent.

1. Introduction

Scholars and policy makers have long promoted the benefits of agglomeration (Marshall, 1898); more recently researchers have begun to take into account firm heterogeneity in examining location decisions. Drawing on the concept of absorptive capacity, these researchers have divided firms into technological leaders and laggards in examining how agglomeration influences location choices (Alcácer and Chung, 2007). But while researchers have studied heterogeneity among focal firms, what has been less explored is heterogeneity of the agglomeration. Although we know that technologically leading firms avoid locations with many competitors to prevent knowledge spillovers (Alcácer and Chung, 2007; Narula and Santangelo, 2009; Shaver and Flyer, 2000), we do not know if this is because those competitors are primarily other laggards or leading firms. In this paper we explore how the presence of leaders or laggards influences the location decisions of other leaders and laggards. For example, does the presence of technological laggards cause leaders to leave a location? Conversely, does the presence of leaders cause laggards to stay? We explore how the heterogeneity of the agglomeration has a differential impact on focal firms, depending on whether they are technologically leading or laggard firms. In other words, we simultaneously examine the heterogeneity of the agglomeration and of the focal firm.

In addition, we focus on a third important component of an agglomeration – the presence of foreign firms. The effect that foreign firms have on domestic firms has generated considerable debate, especially in emerging economies (Meyer and Sinani, 2009; Narula and Kodiyat, 2013). On the one hand, foreign firms have advanced technology and know-how, which is expected to diffuse to domestic firms and subsequently lead to product and manufacturing improvement. However, in emerging markets, multinational corporations (MNCs) closely guard their technology (Zhao, 2006), limit their activities (Kumar and Aggarwal, 2005; Perri et al., 2013), or do not transfer their best technology (Mansfield and Romeo, 1980) in an effort to make imitation difficult for local competitors. Thus, even policy makers admit that "the net effect of MNC R&D investments is hard to discern" (World Bank, 2007, p.53). But, foreign firms do increase competition for talent, often "poach[ing] the best workers from domestic firms" (Barry et al., 2005, p.68).

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As a result, foreign firms may crowd out domestic competitors, especially those with whom they compete for skilled labor. Furthermore, research examining knowledge spillovers from foreign firms often assumes homogeneity among domestic firms and does not account for their technological differences. On the other hand, research that does consider the characteristics of domestic firms often ignores the geographic location of foreign firms within a country. To address these gaps, we examine whether the presence of foreign firms affects domestic technological leaders differently than laggards, accounting for their geographic proximity.

We look at an activity where knowledge spillovers are expected to occur and are particularly important and where location plays critical role – R&D activities of domestic firms in an emerging economy, India. While studies have focused on firm entry decisions (Chung and Alcácer, 2002; Dossani and Kenney, 2007; Lamin and Livanis, 2013), we focus on *R&D lab closure*, partly because recent work has failed to find a positive effect of agglomeration on firm innovation (Furman et al., 2005) and partly because the focus on firm entry may obscure another effect of agglomeration – exit. If the benefits of agglomeration are elusive, firms engaged in R&D may elect to leave cities where they risk leaking proprietary knowledge to competitors since spillovers from rivals lead to more imitation not innovation (Cappelli et al., 2014). These concerns take on greater importance in emerging economies with weak intellectual property rights (IPR) protection (Zhao, 2006) as a weak IPR regime can translate into faster diffusion of technological knowledge, quickly raising the capabilities of rivals.

We link research on agglomeration economies, specifically the literature on location strategies, knowledge spillovers and firm heterogeneity, with the capabilities perspective and argue that not all firms will be motivated to leave a location in the presence of other firms (Iammarino and McCann, 2006). The effects will play out differently for technological leaders vs. laggards. As technological leaders experience net knowledge outflows, we expect that their likelihood to leave or close their R&D facilities rises in highly agglomerated locations. Conversely, we expect that agglomeration will incentivize technological laggards to stay as they receive net knowledge inflows. Importantly, we examine whether technological leaders respond more strongly to the presence of other leaders or laggards in a location. Similarly for laggards, we examine if they respond more strongly to the presence of leaders over laggards. Finally, we explore whether foreign firms disproportionately affect technological leaders in a location by increasing the competition for talent and thus influence leaders' decisions to close their R&D facilities. As prior work has not accounted for the presence of leaders vs. laggards within a location, our contribution lies in exploring how the heterogeneity of the agglomeration affects different firms. We test our arguments using 5798 observations of Indian R&D laboratories from 2003 to 2011, where we distinguish technologically leading firms from technologically lagging firms and identify when firms close an R&D laboratory.

We proceed as follows. In the next section, we look at the interplay of the heterogeneity of an agglomeration with firm characteristics and how it gives rise to differences in firms' propensity to close their R&D facilities. Next, we explain our data, methods and results. Finally, we highlight our findings and discuss implications for firm strategy.

2. Heterogeneity of an agglomeration

2.1. Technological leaders with laggards

Research shows that firms' technological capabilities influence the calculation of a location's overall net benefit or cost. Specifically, it is argued that technologically advanced firms have more to lose than to gain from agglomeration (Shaver and Flyer, 2000) as these firms have greater knowledge stocks, which in turn "increase the potential for and amount of spillovers" (Alcácer and Chung, 2007, p. 763). Although technologically advanced firms are likely to receive spillovers as well, the benefit they receive is less than the benefit they provide to less advanced competitors (Narula and Santangelo, 2009). These arguments are similar to the anchor tenant hypothesis in the sense that R&D performed by larger or leading firms appears to boost the local innovation activity (Agrawal and Cockburn, 2003) and that small firms are key beneficiaries (Agrawal et al., 2014; Clarysse et al., 2014). On the other hand, less advanced competitors have the opportunity to upgrade their capabilities from the presence of technology leaders. Even the anchor tenant literature acknowledges that small innovative firms are "in direct competition with the lead firms for key inputs, including... information on intellectual property" (Christopherson and Clark, 2007, p. 1228). But technology leaders, by virtue of already being in a leading position, have less opportunity to upgrade their capabilities. Thus, leading firms are more likely to be net losers in agglomerations. Shaver and Flyer (2000, p.1177) argue that agglomerations disproportionately aid firms with less advanced capabilities: "The spillover of technology greatly enhances the competitiveness of the 'poor' technology firm yet does not (or only marginally) enhances the competitiveness of the 'good' technology firm". Although not formally addressed, this argument implies that even though leaders can gain from other leaders, their gain will only be marginal but their loss to laggards will be substantial. In analyzing the location choices of foreign entrants into the U.S., Shaver and Flyer (2000) find that technologically leading firms avoid states with higher proportions of same-industry firms. Alcácer and Chung (2007) also examine the location decisions of new entrants into the U.S. and find that leading firms avoid locations with higher industry patenting activity. Focusing on a sample of 64 U.S. firms in three R&D intensive industries, Fung (2005) finds that laggards can eventually catch-up to leaders "because the former tend to be the ones that receive knowledge spillovers from the latter" (p. 302). These findings support the idea that technologically leading firms are net losers in agglomerations. Although they also suggest that it is the presence of laggards that is particularly harmful to leading firms, this has not been directly examined. In other words, while prior work points to the presence of laggards as the main culprit driving leaders away from agglomerations, it has not directly looked at the composition of the agglomeration in terms of the type of competitors present.[1] Specifically, are laggards in a location more strongly affecting the location choices of leading firms than the presence of other leaders in a location? We use this idea – that laggards are damaging to leaders – as our starting point for exploring how different elements within a cluster may impact leaders differently than laggards.

Furthermore, the idea that technological leaders suffer a net loss in terms of knowledge spillovers, suggests that firms may choose to leave locations where there are many competitors. Using a formal model, Belderbos et al. (2008) show that technological leaders will decrease their R&D resources "when appropriation gets more difficult because this will allow the laggard to benefit more from knowledge spillovers" (p. 772). While the idea to cease R&D activities in a location may seem impractical in developed economies (Alcácer and Zhao, 2012), it can be a rational response in emerging economies with weak IPR protection. In these environments, unauthorized copying of innovation may not be preventable as patent protection is weak, the legal system is

[1] Alcácer and Chung (2007) do examine the composition of an agglomeration in terms of academic, government and industry knowledge stock, but they do not separate industry knowledge into that which belongs to leaders vs. laggards.