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Does director interlock impact corporate R&D investment?

Jie Han [a], Indranil Bose [b,*], Nan Hu [c], Baolei Qi [a], Gaoliang Tian [a]

[a] Xi'an Jiaotong University China
[b] Indian Institute of Management Calcutta, India
[c] Stevens Institute of Technology, United States

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ABSTRACT

This paper investigates the effect of director interlock on corporate research & development (R&D) investment from the perspective of inter-organizational imitation. We argue that managers will imitate the R&D investment intensity of their interlocked-firms when deciding how much to spend in R&D for their own firm. Following prior literature, we further argue that under different types of interlocking director and industry characteristics, the impact of director interlock on corporate R&D spending is different. Using a sample of public firms listed in Chinese Shanghai and Shenzhen Stock Exchanges, our empirical results show that managers imitate the prior R&D investment intensity of their interlock partners, and the impact of director interlock on corporate R&D intensity is stronger when the interlocking director is an inside director in the focal firm or when the focal firm and interlock firm belong to the same industry. Our results still hold when we account for the potential sample selection bias, firm similarity, and the confounding factors that can contribute through unobserved industry characteristics.

1. Introduction

As the primary source of firm innovation, investment in research & development (R&D) enables firms to maintain sustainable competitiveness and development [6,27,44]. Investment in R&D is the driving force of future competitive capacity and profitability [16,42], and it is expected to enhance shareholder wealth in the long run. However, it also adversely impacts short-term performance owing to its high uncertainty and high cost [1,12]. Therefore, how much to spend on R&D is one of the most sophisticated investment decisions faced by firm managers [2,14]. In fact, to a certain extent, it represents a trade-off between short-term performance and long-term performance [14]. Given the key role of R&D investment in firm development and its complexity in decision-making, scholars often investigate what factors affect corporate investment in R&D [2]. Minnick and Noga [33] suggest that board of directors play integral roles in choosing firm strategy as they have the fiduciary duty to participate in all major firm decisions and increase firm performance and shareholder wealth. According to the 'upper-echelons' theory firms' economic outcomes are a reflection of their top managers' cognition and values [19]. Differences in managers' characteristics, which are composed of human capital and relational capital such as director interlock [11], lead to differences in the estimation of decision-making environments and eventually result in different firm decisions [19,40].

From the perspective of 'upper-echelons' theory, directors' human capital characteristics, such as age, tenure, education background, affect firms' investment in R&D [2,10,27]. From the perspective of resource dependency theory, directors' relational capital can serve as a key conduit for linked firms to important information and essential resources that are crucial to firm decisions [39]. According to social embeddedness theory [17] firms' economic action is closely embedded in networks of social relations. As one of the most important social relations of firms, director interlock acts as a mechanism for the diffusion of information about major practices and structures among linked firms [17,46], and plays a direct and significant role in firms' economic decisions and outcomes.

Prior studies document that imitation does occur through director interlocks. For example, Davis [13] shows that interlocking with other firms that have already adopted a poison pill will increase the possibility of a focal firm[1] also to adopt poison pill. Haunschild [21] suggests that managers are exposed to other firms' acquisition activities through director interlocks, and such acquisition activities become the role model for the managers to imitate. Regarding the relationship between interlock and R&D, previous research (e.g., [6,11]) focuses on studying whether the interlock to other firms influences its own R&D spending.

* Corresponding author at: Indian Institute of Management Calcutta, Diamond Harbor Road, Joka, Kolkata 700104, India. Tel.: +91 33 2467 8300.
E-mail address: bose@iimcal.ac.in (I. Bose).

[1] In our study, the focal firm and the interlock firm are a pair of related concepts. When there is director interlocking relationship between two firms, the firm we concentrate on is the focal firm, and the other is the interlock firm.

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For example, Dalziel et al. [11] find that firms with the interlock ties to high-technology firms tend to have a higher R&D spending than firms with the interlock ties to low-technology firms. Chen et al. [6] find that director's relational capital, measured by the total number of board directorships the board members hold at other firms, has a moderate effect on the relationship between CEO tenure/education level and R&D investment. In this study, we investigate whether the R&D spending of firm pairs connected with interlock is more similar than that of firm pairs without such a connection.

China provides us an ideal environment setting to study this research question. Firstly, as an institutional transition economy, the decision cost and risk for firms in China are higher than those in Western countries due to the unstable and imperfect institutions [38]. The poor economic environment leads to more sophisticated R&D investment decisions for firms. As argued by Lieberman and Asaba [30], imitation is a matter of frequent occurrence for firms, and imitation is more likely to occur in the environments characterized by uncertainty or ambiguity. Secondly, prior literature suggests that director interlock is an alternative mechanism to weak institution and may play an essential role for firms in developing countries [38]. As a result, managers are very likely to imitate other firms' R&D investments when they decide their own R&D intensity.

Our results indicate that R&D investment decision does diffuse across the corporate interlock network and the focal firm's R&D intensity is significantly and positively related to its interlock firm's previous R&D intensity. Additionally, we find that this relationship can be moderated by industry homogeneity and the types of interlocking directors (inside director or independent director) that are present in focal firms.

The rest of the paper proceeds as follows. In Section 2, we review the related literature and then develop our hypotheses. In Section 3 we introduce our research design. This is followed by the discussion of our empirical results in Section 4. Section 5 concludes our paper with some directions for future research.

2. Literature review and hypotheses development

2.1. Imitation based on director interlock

Haunschild and Miner [23] have defined inter-organizational imitation as "when one or more organizations' use of a practice increases the likelihood of that practice being used by other organizations". Imitation is a common form of behavior in various business practices. Imitation occurs among firms in the introduction of new products or new technologies, in the adoption of organizational structures and managerial styles, and in the timing of corporate investments [30]. Additionally, imitation plays an essential role in several organizational theories. Strategic choice theory, for example, argues that imitation is a strategic response to the actions of competitors because second-movers realize that the risk related to product development has been absorbed by the first-movers [31]. Organizational learning theory specifies that organizations observe and copy other organizations' practices especially when facing major environmental changes [28]. Institutional isomorphism theory suggests that organizations are very similar and they copy each others' practices, structures and routines in an effort to keep legitimacy [15]. Hence, given the importance of imitation in organizational theories and practices, researchers often investigate the conditions necessary for the occurrence of inter-organizational imitation. One of the important prerequisites for imitation is information conduit, which ensures that certain practices of the model firm can be diffused to the imitating firm.

Prior literature suggests that director interlock is a crucial information transmission channel, and it has a direct effect on the diffusion of practices among organizations [4,22]. For example, Davis [13] argues that when a firm adopts a poison pill, the likelihood of its director-interlocked firm adopting the same poison pill will increase. Palmer et al. [36] specify that firms are more likely to adopt the multi-divisional structure if their interlock partners have also adopted it. Haunschild [20,21] finds that the acquisition activities of the interlock firms serve as models to be imitated by the focal firms. And Chen and Lu [7] find that managerial ties lead to imitation in corporate acquisition premium decision, and such a decision follows the laws of imitation put forward by Tarde [43], especially 'the logical laws' and 'from the inner to the outer laws'. Finally interlock also influences the stock option policy [4] as well as corporate disclosure [5] of a focal firm. To summarize, as the conduits of private information among firms, board interlocks can impact firms' strategic decision choice through inter-organizational imitation. We present the findings of previous studies regarding how corporate strategy or practice diffuses over interlock network in Table 1.

Table 1
Imitation of corporate strategy over interlock network.

Reference	Contribution
Davis [13]	The adoption of poison pill can diffuse when firms are linked through interlock
Palmer et al. [36]	Director interlock enables the diffusion of organizational structure, e.g., the multi-divisional form, across firms
Haunschild [20,21]	Managerial ties lead to imitation in corporate acquisition activities, e.g., decision on acquisition premium
Chen and Lu [7]	
Bizjak et al. [4]	Stock option backdating can diffuse across firms through director interlock
Cai et al. [5]	Firm disclosure policy can diffuse across firms through director interlock

2.2. Director interlock and R&D investment

The occurrence of inter-organizational imitation relies on imitation motivation and information conduit. Decision-making theory suggests that environmental uncertainty or ambiguity is the driving force behind inter-organizational imitation, and imitating others is an efficient way to economize on search costs [9]. Any decisions made by managers are based on the estimation of expected returns under possible future states of the environment. To begin with, the majority of decisions are made under risks, and it is difficult to predict future states of the environment. The environmental changes are relevant to macro-economic policies, political issues and institutional reforms. Managers may lack adequate information to precisely predict the probabilities of various future states of environment. In addition, even if the probability of future environment states can be estimated, the actual benefit is still uncertain [26]. Hence, environmental uncertainty makes it difficult for managers to estimate the results of a specific decision (e.g., R&D investment). In order to reduce risks due to environmental ambiguity, managers are more inclined to imitate other firms' similar decisions [30,32]. As an information conduit, director interlock can ensure the interlock firms' essential information relevant to decision-making be transferred to the focal firms.

R&D investment[2] is essential for firms to acquire innovation and competitive capacity [35]. However, R&D investment is associated with great risk and complexity owing to its uncertain outcomes [6], and deciding how much to invest in an R&D project is a difficult decision for managers. R&D investment needs to sacrifice short-term profits to acquire long-term gains. In addition, owing to its great risk, its future outcomes are usually unclear. R&D investment may fail because of their fast market cycles or tedious processes. Furthermore, as an institutional transition economy, China's imperfect and immature institutions, such as its weak legal system, and poor information disclosure system [38], may lead to an even more difficult decision-making environment

[2] In this paper, we concentrate on the R&D investment intensity, not the specific R&D projects or specific patents. In our opinion, when managers decide how much to invest in a specific R&D project, imitation may occur. The innovation of R&D project is not the focus of this study.