



The effect of institutional proximity in non-local university–industry collaborations: An analysis based on Chinese patent data

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ABSTRACT

Based on Chinese patent data from 1985 to 2004, this study aims to provide a comprehensive analysis of formal university–industry collaborations in China, with a specific focus on the compound effect of geographic distance and other predictors. The results show that geographic distance is indeed an obstructive factor in achieving university–industry collaborations, as many previous studies have shown. However, proximities in other dimensions could intervene to attenuate that negative effect. The most salient finding is that central Ministries and local governments are two sources of institutional force that could impose or encourage university–industry collaborations without considering the geographic distance between them. The vertical and horizontal institutional proximities engendered by subordination to the same administrative unit significantly enhance the probability of collaboration, and those effects are more significant when the distance increases. Social proximity and university prestige, as verified by previous studies, could also help bring non-local academic and industrial partners together. However, when confronting with institutional interference that is of overarching importance in the Chinese context, these effects could decrease.

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1. Introduction

Knowledge produced by the public sector has been traditionally viewed as a public good contributing to economic growth (Arrow, 1962; Nelson, 1959). A large number of studies have verified the effect of academic research on industry innovation. (Adams, 1990; Mansfield, 1991; Rosenberg and Nelson, 1994). As a major source of new knowledge, research universities play a key role in promoting technological innovation. In the past 30 years, governments of many Western countries adopted an innovation-oriented science policy, with an emphasis on promoting university–industry linkages (e.g., Ballesteros and Rico, 2001; Beesley, 2003; Liu and White, 2001). Though not opening her doors until the late 1970s, the Chinese government has been advocating an application-oriented science policy since the 1950s, encouraging universities to engage in down-stream work to improve industrial capabilities. With the beginning of economic reforms and its WTO ascension in 2001, China has been increasingly involved in international competition. In the eyes of the state, universities and research institutes are thus expected to conduct cutting-edge research and effectively

transfer knowledge to Chinese industry in order to enhance its competitiveness.

Nonetheless, various studies (e.g., Hicks et al., 2001; Jaffe, 1989; Jaffe et al., 1993; Zucker et al., 1998a) conducted in the US have found that knowledge transfers from universities to industry are to a large extent confined to the local area, suggesting that broadening the impact of university research on industry may require special measures. A large body of literature ensued to study whether geographic distance is a detrimental factor in university–industry collaborations and whether other factors might be complementary to geographic proximity (e.g. Adams, 2005; Broström, 2010; D'Este and Iammarino, 2010; Laursen et al., 2011). Specifically, the French School of Proximity Dynamics introduces multiple dimensions of proximity and argues that these proximities are no less important than geographic proximity in promoting interactive learning and innovation (e.g. Kirat and Lung, 1999; Torre and Gilly, 2000). Boschma (2005) further elaborates this work by discussing the proper level of various proximities and whether cognitive, social, organisational, and institutional proximities can be complementary to geographic proximity. While these discussions on proximities shed new light on our understanding of collective learning, most of the claims have not been verified by empirical study. Moreover, the interaction effect between institutional and geographic proximities has not been clearly specified. That is probably because institutional proximity has been treated as a vague and abstract term functioning at the macro level. It is therefore

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difficult to either find a measuring variable for it or analyse how it interacts with geographic distance.

Based on interviews conducted with Chinese academics and technology transfer officials in the summer of 2004, the contribution of Chinese publications and conferences to industry innovativeness is trivial. University–industry collaborations, encouraged by the government since the 1950s, and pursued by more and more companies due to China's economic reform, is one of the key mechanisms for transferring knowledge from university to industry. Using patent co-applications by universities and firms as an indicator for university–industry collaboration, this study empirically examines the effect of organisational, institutional, and social proximities on university–industry collaborations in China from 1985 to 2004 and specifically tests the interaction effects between these proximities and geographic distance.

The most salient finding from this study is that the vertical and horizontal institutional proximities engendered by subordination to the same administrative unit significantly enhance the probability of collaboration, and these effects are more significant when the distance increases. Stories from interviewees further suggest that other major predictors (i.e. prior collaboration experience and university prestige) might lose their effects when confronting with institutional interference that is of overarching importance in the Chinese context. The results not only show a key mechanism connecting universities and industry in China, but also empirically test propositions long held in this field. The unique Chinese context in which many universities and firms are administered by various units constitutes the bases of our research. It enables the specific expression of institutional proximity as a socialist legacy, as well as facilitates comparative investigations in other institutional settings.

The paper is organised into five sections. The following section reviews the literature from multiple disciplines and proposes five hypotheses. The third section introduces the data and methods used. The fourth section presents the results and specifically shows the interaction effects between organisational, institutional and social proximities and geographic distance. The fifth section offers conclusions based on our analysis.

2. Theoretical background

The literature on inter-organisational relationships has found the importance of geographic proximity in building inter-organisational ties (Green, 1983; Harrison, 1994; Kono et al., 1998; Molotch, 1976; Perrucci and Pilisuk, 1970; Scott, 1988). Green (1983) has shown that distance reduces the level of interlocking between firms in different North American cities. Allen found that local interlocking was more likely to happen because of the operational difficulty involved in long-distance interlocking (1974) or firms' dependence on local resources (1978). Kono et al. (1998) further argued that geographic distance was an important intervening variable in predicting interlocking ties between corporations, which had been neglected in many previous studies.

Given the importance of university knowledge to industry innovativeness, social scientists and policy makers have been concerned that whether the channels connecting universities and industry are confined to the local area. Various studies have shown that university research enhances local industry innovativeness at the state level (Audretsch and Feldman, 1996; Branstetter, 2000; Jaffe, 1989) and the sub-state level (Anselin et al., 1997), suggesting that knowledge externalities are geographically constrained. Treating patent citations as paths of knowledge flow, Jaffe and his colleagues (Henderson et al., 1998; Jaffe and Trajtenberg, 1996, 1999; Jaffe et al., 1993) have revealed that knowledge spillovers are localised, especially in early years when the knowledge was

created. Based on the same methodology, Hicks et al. (2001) found that corporate patents cited more locally produced academic papers, indicating that publication, as a channel transferring knowledge from academia to industry, is subject to geographic constraints. Zucker, Darby and their colleagues (Zucker and Darby, 1996; Zucker et al., 1998a,b) also emphasised that localised ties with star scientists were important for firm performance. Some firms even purposely located themselves near star scientists.

One major reason why geographic proximity is important is that much knowledge used in actual production is tacit, requiring face to face interaction to transfer (Polanyi, 1967). Various studies have shown that distance impedes the flow of knowledge and technology (Acs et al., 1994; Polanyi, 1967; Scott, 1988; Tyre and Von Hippel, 1997) and reduces communication efficiency even within the same organisation (Hough, 1972; Tomlin, 1981). Feldman and Lichtenberg (1997) observed geographically concentrated organisations when knowledge transferred among them was tacit. Audretsch and Stephan (1996) also found that the costs of transferring tacit knowledge increased with distance. Economic geographers have been arguing that tacit knowledge accumulated through close interactions within specialised industrial clusters is a key component in constructing learning regions and that the difficulty in transferring this form of tacit knowledge constitutes the competitive advantage of these successful regions (Cooke and Morgan, 1998; Morgan, 1997; Storper, 1997).

However, some other studies conducted in the U.S., Japan, and Europe have found that geographic proximity does not necessarily facilitate university–industry interactions (Beise and Stahl, 1999; Bercovitz and Feldman, 2011; Schartinger et al., 2002; Zucker and Darby, 2001). The French School of Proximity Dynamics also claims that geographic proximity is just one dimension of multiple forms of proximities to consider in collective learning (Kirat and Lung, 1999; Torre and Gilly, 2000). Boschma (2005) further theorises five types of proximity and proposes that they can be complementary assets to geographic proximity. His theoretical discussion raises questions of the relationship between institutional and geographic proximity which can be clarified through empirical study.

Having seen these unexplored aspects of previous studies, and corresponding to the call for systematic studies of the contingent effect of geographic distance (Broström, 2010), this paper is intended to offer a comprehensive analysis by empirically testing the interaction effect between geographic distance and organisational proximity, institutional proximity, social proximity and university prestige.

2.1. Organisational proximity

Boschma (2005) has drawn extensively on transaction cost theory to develop the concept of organisational proximity. Williamson (1975, 1985) outlines two ideal types of organizing – the market and hierarchy – representing buying a product from the market and producing it within an organisation, respectively. The decision to buy or to make is determined by the specificity of the product and in turn determined by the transaction cost involved (Williamson, 1981). According to Boschma (2005), therefore, organisational proximity is a continuous variable measuring to what extent two organisations share the same organisational regulation, with the low extreme representing arm-length market relationships in a market and the high extreme being hierarchical control within an organisation. While admitting the importance of geographic proximity in knowledge transfers, Boschma (2005) has argued that organisational proximity can to some extent substitute geographic proximity.

Learning from Soviet Union, the Chinese government developed a highly centralised governmental structure. Below the State Planning Commission (SPC) that has ultimate control over economic

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