Conflicting motivations and knowledge spill-overs: Dynamics of the market across space

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Abstract

Despite market-mediated technology becoming a key source for a region's innovation and growth, the literature on spill-over across geographical space has not discerned between compensated technology transfer from pure knowledge spill-over. Drawing on the conflicting motivations between the technology supplier (licensor) and the demander (licensee) in the licensing market transaction, this critical review highlights the contrary preference for geographical proximity, separating market-mediated technology spill-overs from knowledge spill-overs. This paper argues that licensing firms might shun co-located licensees to avoid potential dissipation risk, while the purchaser prefers vicinity partners to avert opportunistic behaviour. Micro-level mechanisms of transferring compensated technology are of particular significance in enhancing the efficiency of the regional innovation system, providing an insight into why some geographical clusters are not efficient.

1. Introduction

In the past few decades, the advent of knowledge-based economies and open innovation paradigms have extended the scope of exploring connections to the external sources (Chesbrough, 2003; Ernst & Kim, 2002). The contribution of exogenous knowledge, as a propelling determinant to innovation-based regional growth, is more widely recognised, leading to the upsurge of technology transfer across geographical boundaries (Chesbrough, 2003; Cooke & Leydesdorff, 2006; Foray & Lundvall, 1998; Morgan, 2004). According to WIPO (2017), the licensing market size in the world reached $372 billion in 2016 from $75 billion (US dollars) in 2000. Despite the emerging presence of compensated technology acquired through market mechanisms, the empirical studies on spatial knowledge diffusion have not clearly distinguished between market-mediated technology and knowledge spill-overs (Asheim & Isaksen, 2002; Audretsch & Feldman, 1996; Breschi & Lissoni, 2001; Moreno et al., 2006; Mowery & Ziedonis, 2015).

The role of geographical proximity in knowledge spill-overs in supporting innovative contexts, industrial districts or regional innovation systems has been highlighted by many economic geographers (Asheim & Isaksen, 2002; Malmberg & Maskell, 2002; Maskell &

Malmberg, 1999; Piore & Sabel, 1984; Schmidt, 2015). The spatial closeness between the knowledge source and the beneficiary promotes interactions between actors that have established the basis for innovation and learning, thus, enhancing a region's innovative activity for development (Capello, 1999; Cooke, 2004; Moreno et al., 2006). While not diminishing the importance of spatial proximity, the empirical literature on examining the existence of knowledge spill-overs has mostly focused on paper trails originating from universities without pecuniary compensation (Hu & Jaffe, 2003; Schmidt, 2015; Verspagen, 1999). What they presume is that knowledge produced by universities is a 'local public good', leaving the knowledge as non-compensated but beneficial for economic activity.

This review raises doubts on the prevailing assumption that these heterogeneous types of spill-overs are equally treated in establishing the regional capacity. For instance, the embryonic ideas from research papers and the acquired technology purchased in the market for commercialisation have no homogeneous impact on the production and innovation activities constituting the local externality (Breschi & Lissoni, 2001). With the aim of exploring fundamental motivations of a technology provider and purchaser, this critical review is expected to reveal the geographical incidence of market-mediated technology. The next section discusses the spatial proximity in the presence of the technology market, focusing on whether it alleviates the transmission of technology. Section three argues how risk and risk- aversion activities of market participants have an impact on the preference of geographical proximity and section four provides a conclusion.

2. The technology market and geographical incidence of spill-overs

Technology transfer through markets entails complex procedures in identifying potential partners, negotiating contracts, determining price, transmitting detailed technical knowledge and monitoring the licensee's utilisation of the technology (Bidault, 1989). Compared with pure knowledge spill-overs, it is clear that the process is involved in the costs and uncertainties shared by both parties. Moreover, the license contract involves conflicting interests between the patent owner and purchaser. The fundamental motivation of the licensor is to maximise the revenue by allowing a licensee to utilise right-of-use, while the licensee party is willing to not only minimise the license loyalty cost but also leverage the economic value of acquired technology. Despite conflicting motivations, empirical studies on regional externality do not seem to disentangle market-mediated technology from pure knowledge spill-overs that recognise knowledge as a non-rival and non-compensated input asset (Arora et al., 2001; Breschi & Lissoni, 2001; Krugman, 1991).

Mowery and Ziedonis (2015) argue that knowledge spill-overs described as non-compensated regional externalities are basically rooted in the transactions through the markets. For instance, the typical local knowledge spillover denoted as MAR (Marshall-Arrow-Romer) externality presumes that economies of specialisation and the labour market constitute the source of local externality. However, they occur through the market mechanism. Arora et al. (2004) also argue that some apparent spill-overs, underpinning the region's economic performance, might in fact be involved with market-mediated transfers. The blurred distinction makes it difficult to evaluate the region's structural changes of innovative outcomes, causing the biased overestimation of pure knowledge spillover (Breschi & Lissoni, 2001; Geroski, 1995; Griliches, 1992).

The presence of a well-functioning technology market mechanism confers more opportunities for participants to find more potential partners (thick market) and reveal the preferences

without the risk of undermining their bargaining power (safe market) (De Marco et al., 2017). The technology market, from the perspective of geographical incidence, alleviates the geographical distances between the licensors and licensees. The patent system provides codified and structured technology information of knowledge channels, all of which mitigate the asymmetry of technology information (Gambardella, 2002; Azagra-Caro et al., 2017). Thus, Audretsch and Stephan (1996) argue that spatial closeness between licensors and licensees is not necessary for the transmission under the market- mediated technology transfer, mainly due to the codified characteristics of patents information.

The empirical results on spatial diffusion, however, have not supported the idea that the presence of the technology market fosters transactions between further partners. Mowery and Ziedonis (2015) examine pure and market-mediated outflows of universities' research outcome by comparing the regional incidence of pure knowledge (citations to university patents) with market-mediated technology (license). They count the citation frequencies of 911 patents of three universities (Columbia University, Stanford University, and the University of California) as a proxy of pure knowledge, while licensing contract agreements as for market-mediated technology. Their analysis supports the notion that market-mediated technology (patent licensing) tends to be more sensitive to the distance from a university campus than does citation. The primary reason for such a different local proximity, they argue, lies in the tacit nature of knowledge that establishes intimate interactive relationships with the patent inventor, which is more likely to be promoted by spatial proximity. Thus, even if the legal right-of-use of technology is acquired in the market, it is found that the closer geographic proximity still matters for transmitting the tacit know-how of technology.

The recent study by Azagra-Caro et al. (2017) addressing a top-level patent also finds that market-mediated licensing is more geographically clustered than are general knowledge activities reflected in publications. The average distance of a licensing firm from the technology source is 1,880 miles, while for a publishing firm is 2,832 miles. From the U.S. licensing database, Drivas and Economidou (2015) also find the localisation of patent transactions, implying that regional borderlines tend to be more geographically bounded. In sum, the geographical proximity matters even in market-mediated technology diffusion. This is partly because the tacit knowledge (know-how) tends to be imperfectly codified so that the licensee still invests time and resources in order to acquire relevant information for successful commercialisation (Agrawal, 2006).

Previous empirical research disentangles market-mediated technology externality from two types of regional externality and assumes that transmission of technology is a reciprocal activity for all the parties or at least no-risk to the technology inventor. Empirical studies reporting on technology spill-overs mainly rely on the unidirectional linkage from university to industry. Thus, the conflicting interest and motivation of the technology inventor and purchaser, embedded in the pecuniary technology transfer agreement transaction, is not fully reflected in their cases. What current research emphasises is the exploration of uncertainties embedded in the market-mediated technology transfer.

3. Uncertainties of market transactions and conflicting preferences of geographical proximity

This research argues that market risk and risk-aversion motivations lie at the heart of determining the geographical proximity of technology transfer. Even though compensated

technology transfer occurs through the market mechanism, less attention has been paid to market risk embedded in market participants as a supplier (licensor) and a demander (licensee) (Azagra-Caro et al., 2017). The motivation of patent licensors involves two effects: (1) the licensor's profit from license payment and (2) the profit dissipation effect caused by potential competition in the market (Arora & Fosfuri, 2003). According to Fosfuri (2006), one of the key motivations for a licensor is the presence of a potential threat of an entrant in the market. Thus, the technology transfer decision is determined by the strategic trade-off between the increase in royalty revenues and the potential risks of decreasing the market share within an overlapping market. Considering the primary risks of profit dissipation effects, the licensors are highly likely to reduce potential risk by selecting partners in the geographically distant markets (Fosfuri, 2006). In this case, the licensors have incentives to impose limitations on the use of technology in order to inhibit possible opportunistic behaviour by the potential licensees, on the basis of a legal contract including the geographical scope (Bidault & Fischer, 1994). More specifically, the licensor should consider market conditions that may threaten its own profits. Such risks of the licensor become more likely when it is from the private sector (e.g. firms rather than university) and the licensee originates from geographically close and highly competitive locations. In such settings, it is less likely to expect the licensors to make a license contract with partners in the vicinity.

While technology transfer via a licensing agreement consists of the explicitly codified type of knowledge with legal rights, the licensee still has market risks in acquiring the technology. First, the licensee firm might be involved in the partner's opportunistic behaviour or lack of candour and honesty in the transaction (Bathelt & Henn, 2014). The literature is full of accounts about companies that suffer from a lemon problem due to asymmetric information about the quality of the technology, or dear price (Mayer & Salomon, 2006). As a decision maker for a commercialising firm, it is particularly difficult for a licensee firm to assess the future potential value of the technology in the market.

Given the uncertainty, one of the strategic decisions of a licensee is to seek the partners within its own trust-based local networks and to monitor the licensor's reputations through different informal channels (Gertler, 2003). This action also involves risks related to preventing opportunistic behaviours among partners (Bidault & Fischer, 1994).

Second, technology license agreements cover not only explicit legal rights but also tacit knowledge (Horwitz, 2007). Technology licensing is rather a process of establishing the network, not a one-off transaction in the market (Nelson, 2009). The non-codifiable information including future non-patentable inventions for the improvements, trade secrets, methods of manufacture, or other proprietary or non-proprietary information, all of which are hardly documented, might be transmitted to the licensors in the form of training, regular meetings and informal contacts (Wang et al., 2013). A license agreement builds up the relationship, which acts as a vehicle to convey tacit knowledge from a licensor firm to a licensee firm, in exchange for the monitoring enforcement to the licensee (Hagedoorn, 1993). Such kinds of interactive contacts, as the most reliable manner of delivering and acquiring the tacit knowledge that the licensor has, might be through communications, which in turn are promoted by geographical proximity (Bathelt & Turi, 2011; Maskell & Malmberg, 1999).

4. Conclusion

This review contributes to understanding the mechanism of technology diffusion by discerning the market-mediated technology transfer from pure knowledge spill-overs and the

conflicting preference of the geographical proximity. The presence of the technology market is expected to mitigate the spatial constraints of knowledge spill-overs; however, several empirical works corroborate that the compensated technology is even geographically bounded. This critical review argues that the spatial distance is determined by the interactive and conflicting motivations between the market participants.

Given the technology licensor's strategy in the market, the primary criterion for the decision is to avert profit dissipation effects within the local market. The licensor firms are motivated to avoid potential risk by selecting partners in a distant market (Fosfuri, 2006). In contrast, the purchaser tends to prefer local providers not just to avoid the opportunistic behaviour of the provider but also to acquire the intangible know-how by securing a trust- built network, which is likely to be in the local network. The uncertainties of a technology provider act as a counter force to the agglomeration effect within the geographical cluster. Thus, the geographical proximity between technology source and acquirer, which was portrayed as a prototypical externality to the development of innovative activities, needs different approaches depending on the motivation of spill-overs.

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