

A fairly large body of literature, employing primarily patent citations data, has argued that geographic distance constraints knowledge spillovers (Jaffe 1989, Verspagen & Schoenmakers, 2004, Singh & Marx 2013). This stream of work emphasises the tacit dimension of knowledge— a property that makes knowledge sticky and rather immobile. Knowledge acquisition therefore requires, the argument goes, close personal interaction. These interactions can often be informal and are thus best facilitated by physical proximity between parties.

Others, however, have questioned this line of reasoning, proposing that knowledge spillovers arise from the social network of scientists and inventors. They suggest that because most close-knit social networks display a localized character, knowledge spillovers in such networks get, mistakenly, attributed to proximity. They in fact demonstrated that when social networks are accounted for properly, the effect of geographical proximity disappears (Zucker, et al, 1998; Breschi & Lissoni 2009). Studies have also shown that formal collaborations can generate spillovers that span regions and even countries, thus strengthening the argument on the role of social networks of inventors and scientists as an important medium of knowledge transmission (Zucker and Darby, 1997; Zucker, et al, 1998; Cockburn and Henderson, 1997; Ponds et al, 2009).

In this paper, we take this argument one step further and explore the importance of communities of inventors in generating knowledge spillovers. Similar to many other networks, social networks of inventors exhibit a “small-world” modular structure consisting of tightly-knit communities only sparsely connected with each other (e.g. Lissoni et al. 2013). Within a densely connected community there are multiple ways through which information from one member of the community can reach another member. Inventors in such communities share a common knowledge base, common approaches to solving technical problems, and often a consensus view on the directions of future development of technology. While such a “cognitive proximity” between members of a community may hinder cross-community knowledge flows, it promotes the generation and the diffusion of knowledge within each community. A starting point of our study is an examination of the extent to which community affiliation spans geographic distance and social distance (social distance between two inventors represents the number of intermediaries connecting them in the inventor network). We propose that being part of a community can mitigate the potential negative effects of social distance and geographic distance.

We test our hypotheses on a data set of patents granted by the European Patent Office (EPO) with at least one inventor with a French address in each patent. The data cover a period from 1978 to 2004. We adopt a regression framework in which the unit of analysis is a citing-cited pair of patents. The dependent variable takes the value 1 for the cited-realized citing patents pair and 0 for the cited-unrealized citing patents pair. A realized citing patent is one that cites the cited patent in question and an unrealized citing patent is one that does not cite the cited patent but share the same technology classification and the priority year as the realized citing patent. The key explanatory variables are the variable capturing community membership (calculated using the label-propagation algorithm for community detection); path length (capturing social distance) between inventors in the citing-cited patent pair; and the geographic distance between the locations of inventors in the citing-cited patent pair. We use interaction terms between community membership and the distance variables for examining the extent to which community membership mitigates the effect of both social and geographic distances. Our sample of cited patents is for the period 1978-1999, allowing for potential citations for a minimum of five years.

We link our patent data with the OECD HAN database to identify if citing and cited patents belong to the same company or not, and with the OECD REGPAT database to identify the locations of inventors in the citing and cited patents. We deploy a number of controls such as dummy variables for the same state or region and year.

## References:

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