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KNOWLEDGE CREATION IN EUROPE ALONG TIME: INDIRECT IMPACT OF HIGH-SKILLED WORKERS MOBILITY AND RESEARCH NETWORKS

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OBJECTIVE

The aim of this paper is to investigate the relative contribution of different features of the local labour market for inventors on regional patenting, both direct and indirectly. In a first part of the paper we assess whether local labour mobility of inventors, as well as their collaborative research networks, correlate with innovation outcomes. In the second part of the paper, we extend the analysis to the role of inventors' mobility and research networks allowing for higher returns of knowledge endowments on regional innovation, what we consider to be an indirect impact of these highly-skilled labour mobility and their research networks on patenting activity.

MAIN RESULTS AND POLICY IMPLICATIONS

With respect to the direct impact of inventors' mobility and research networks, we obtain that both variables are highly significant and their impact on patenting activity is positive. Thus, we can conclude that collaborative research networks of inventors boost regional knowledge capability and that the mobility of inventors within the local labour market of a region enhances knowledge intensity. In addition, network density shows a significant negative impact on knowledge intensity, which bestows

credibility to Granovetter's arguments about weak ties and knowledge. In other words, it seems that in the European case, strong personal ties hamper knowledge once the information flowing becomes redundant. Finally, we must say that the results are robust to the inclusion of a large number of time-variant controls.

In relation with the indirect impact of research networks, we do obtain that regions with higher number of individuals connected within a research network (measured through the average degree centrality measure) may obtain higher returns to R&D investments and to the stock of human capital, probably due to the fact that their inventors are more prone to learn from each other, with faster access to new and complement knowledge. In fact, as it is commonplace in the related literature, close network links seem to prove more useful in transferring complex knowledge, especially that with a high component of 'tacitness'. Similarly, individuals connected within a collaborative framework are more willing to learn from each other than is the case of isolated inventors. Additionally, participating in networks reduces the degree of uncertainty and provides fast access to different kinds of knowledge. All this would signal to the fact that belonging to a research network may imply higher returns of knowledge endowments, such as R&D and human capital investments, on regional innovation, as we obtain in this paper.

However, the parameter for the cross-effect between R&D or human capital and labour mobility is not significant. We have not obtained evidence in favour of the idea that in regions with high levels of mobile workers, the investment made in R&D or in human capital is more profitable than in those with lower levels of labour mobility. It seems that the idea that mobility may favour knowledge diffusion is not confirmed.

In short, we find that both mobility and networks explain a sizeable part of the spatial heterogeneity of innovation rates. From a policy perspective, these results illustrate that, not only R&D and human capital efforts are important to generate innovations, but also the *embeddedness* of agents in their local networks of alliances and mobility, as well as their degree of *connectedness* with the outside world. Further, it is precisely the concepts of *embeddedness* and *connectedness* which are in the core of the *smart specialisation* strategy recently launched by the European Commission.

In practical terms, the results encountered in this paper provide additional evidence on the role that socioeconomic conditions play to enhance regional innovation rates. Thus, policies aimed to increase the polarisation and concentration of innovation activities in the space in order to benefit from economies of scale may fail to achieve satisfactory results if the specific economic tissue of regions is not properly taken into consideration. In other words, we should take into account that there are ways of diffusing knowledge, such as through collaboration in research networks, which make investments in R&D and human capital more profitable in economic terms. To sum up, if governments want to obtain the highest returns from each euro invested in R&D and in education, it is advisable from a policy perspective, to promote the participation of high-skilled workers in networks of research.