

Regional technological diversification and global R&D connectedness: evidence from European regions

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Research issue: The advent of the so-called Industry 4.0 entails a digital transformation that is revealing a strong territorial and geographical characterization (Buarque et al., 2020; Capello and Lenzi, 2020;). Not only are the key enabling technologies of the new industrial paradigm, like Artificial Intelligence, unevenly distributed across space (Cicerone et al., 2020), but uneven is also the regions' capacity to renew their knowledge base in order to master the same technologies (Laffi and Boschma, 2020). Indeed, the digital transformation does not appear ubiquitous and crucially depends on the extent to which regions are capable to diversify in technological terms. While a substantial amount of academic literature has been already dedicated to the topic, representing a vigorous stream of research on the geography of innovation, the determinants of regional technological diversification are not fully acknowledged yet. The so-called "relatedness approach" to the issue (Balland, 2016) has shown that such a diversification is crucially affected by the extent to which the new technologies that entry in the region, like the enabling ones of the Industry 4.0, are cognitively proximate to those already present in the regional knowledge base: such a relatedness would in fact allow regions to smartly exploit the opportunities of recombining existing ideas into new but related knowledge domains. However, an as much consistent body of research has been showing that technological diversification does rely on other factors than the regional embeddedness of the new technologies, and that these factors can either complement or substitute the role of relatedness for what is called "regional technological branching": for example, the regional endowment of key enabling technologies can make the role of relatedness less binding and allow regions more explorative patterns of diversification (Montresor and Quatraro, 2019). Among the relatedness interacting factors on which the literature has focused, an important role is played by the "degree of openness" of diversifying regions, generally meant as their capacity of acquiring and absorb external knowledge across their boundaries. In a nutshell, the main argument is that the regions' capacity to diversify their technologies could be helped, but also constrained by their internal knowledge base, and that incoming external knowledge could plug new ideas in the region by attenuating its constraints to diversify in an explorative manner. In the extant literature, such a degree of openness has been addressed by looking at the different channels through which external knowledge can be conveyed in the region, like international flows of trade, foreign direct investments, interregional flows of labour and entrepreneurs, and inventors' partnerships (for a review,

see Santoalha, 2019). Quite interestingly, although conditionally on different circumstances, among which the cognitive relatedness of the incoming flows to the extant knowledge-base, these channels actually seem to increase the regional capacity to diversify in technological terms. Being involved in international and/or interregional flows of commodities, capital (physical and human) and ideas does for sure expose regions to important opportunities of acquiring external knowledge, which as we said is important for their technological diversification. However, as much important for that to happen does also appear the production structure of the focal regions and the extent to which its constitutive industries can facilitate the exchange of innovative knowledge with other regions and countries in a global setting. Indeed, progressively more with the advent of the digital transformation, the upsurge of international fragmentation and of global value chains is creating a set of global networks, in which industries exchange commodities and (embodied and disembodied) knowledge flows among them, within and across countries, revealing different degrees of importance (centrality) and in different respects within them.

Objective: The present paper focuses on one of these networks, namely the global network of embodied R&D intersectoral flows: a network that maps the innovative knowledge that industries (arguably) obtain by investing in R&D and that they exchange with other industries through its embodiment in the commodities they acquire and sell to them. Looking at the properties of such a network and at the implications it has for the diffusion of innovative knowledge, we argue that the extent to which the structure of regional production reflects the centrality that industries have in the global R&D network, affects the degree to which the local knowledge-base can be contaminated and enriched by external knowledge. In turn, we expect that this could, on the one hand, increase the regional capacity to diversify in technological terms, on the other hand, moderate the role that relatedness has in favoring the same diversification process.

Methodology: We test for these hypotheses by looking at the technological branching of EU28 regions, which we measured in terms of new revealed patent-based technological advantages, by drawing on the OECD-Regpat Dataset. We the account for regional technological diversification through an “augmented” relatedness model (Montresor and Quatraro, 2017). In particular, after having built up the density of the cognitive proximities that the newly acquired regional technology shows with respect to pre-existing ones, we estimate: a benchmark model, where relatedness is the focal regressor along with standard regional controls; an augmented model, where we insert different measurements of the extent to which regional economies are exposed to central industries in the global network of embodied R&D flows, and their interaction with relatedness. In augmenting the model, we draw on a brand-new paper (Fusillo et al., 2020) that, by combining the World Input-

Output Dataset (WIDO) with the OECD dataset of Analytical Business Enterprise R&D (ANBERD), build up the R&D network of as many as 24 industries per 35 countries, that is, a network of 840 sector-country nodes over the period 2009-2013. In particular, we refer to a battery of network indicators that the authors have calculated for the same network and, on their basis, we identify the centrality indices and distributions with respect to which then calculate the exposure of regional economies.

Results: Expected results can have important research and policy implications. In extending the analysis of regional technological diversification to the role of the regional industrial structures and their exposure to globally central industries in R&D diffusion, we aim at obtaining insights that regional policy makers can use to upgrade their smart specialisation policies in the era of Industry 4.0: in particular, by integrating the role of embeddedness and of relatedness, with that of openness and of interregional relationships.

References

Balland, P. A. (2016). "Relatedness and the geography of innovation". In Handbook on the Geographies of Innovation. Edward Elgar Publishing.

Buarque, B. S., Davies, R. B., Hynes, R. M., and Kogler, D. F. (2020). "OK Computer: the creation and integration of AI in Europe". Cambridge Journal of Regions, Economy and Society, 13(1), 175- 192.

Capello, R. and Lenzi, C. (2020). "Regional patterns of 4.0 technological transformations: conceptual reflections and empirical evidence from European regions", paper presented at the 2020 ERSA Conference.

Cicerone, G., Faggian, A., Montresor, S. and Rentocchini, F. (2020). "Regional artificial intelligence and the geography of environmental technologies: Does the digital transformation meet the green transition?" Paper prepared for the 2020 RSA of the Italian Economists Society (SIE).

Fusillo, F., Montresor, S. and Vittucci Marzetti, G. (2020). "The global network of embodied R&D flows: central industries and clusters in the intersectoral, international diffusion of innovation", mimeo.

Laffi, M. and Boschma, R. (2020). "The role of the local knowledge base in the development of 4.0 technologies. Evidence from the European regions", paper presented at the

2020ERSA conference.

Montresor, S. and Quatraro, F. (2017). Regional Branching and Key Enabling Technologies: Evidence from European Patent Data, *Economic Geography*, 93(4), 367-396.

Santoalha, A. (2019). "Technological Diversification in European Regions: Literature Review", PhD Thesis, TIK Centre for Technology, Innovation and Culture, Faculty of Social Sciences, University of Oslo.