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Technological catching up among European regions. Lessons from Data Envelopment Analysis

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OBJECTIVE

The main aim of this paper is to assess, by means of DEA, the degree of efficiency with which European regions use internal and external inputs for the production of new knowledge and ideas. DEA allows to compute for the first time a regional ranking of the innovative performance within the EU in the first years of the current century. The evolution of such rankings is also evaluated thanks to the Malmquist productivity index (Coelli et al., 1998) in order to assess the relative importance of different factors. Most importantly, this decomposition allows to focus on the differences between those countries which are rich and industrialized and form the so called "Old Europe" and those which are relatively poor and have entered the European Union quite recently. This distinction is particularly informative with respect to the prospective potential evolution of European Neighbouring Countries which can be assimilated to the past dynamics of Eastern European regions. All in all, this decomposition may offer useful hints for designing a new innovation policy, as advocated by Camagni and Capello (2013), which replaces the "one size fits all approach" with a strategy built on the smart specialization of R&D activities in different regions (Foray, 2009).

MAIN RESULTS

DEA results provide evidence of a dualistic (centre vs. periphery) pattern in the regional innovation activities, with the most efficient territories located in the most central or economically strategic areas of the continent. Conversely, the lowest efficiency scores are shown by regions located in European peripheral areas, especially in the new accession countries. Further, the application of the Malmquist productivity index, in the second part of the analysis, shows that productivity dynamics has been extremely differentiated across regions in terms of both magnitude and intrinsic features. We, again, observe important differences between the core and periphery of Europe and specifically between the countries which are rich and industrialized and form the so called "Old Europe" and those which are relatively

poor and have entered the European Union quite recently. The former regions are those who create most innovations whilst the latter regions are those which lag behind and can eventually exploit the diffusion of such innovations.
As a matter of fact, results show that there has been a process of knowledge productivity convergence, albeit slow, and that such a convergence is mostly attributable to a closing up of the technology gap and to an significant enhancement in pure efficiency. On the contrary, the efficiency component due to the scale dimension has been decreasing for all regions in Europe and in particular in new entrant countries.

POLICY IMPLICATIONS

Results show that there has been a process of knowledge productivity convergence, albeit slow, and that such a convergence is mostly attributable to a closing up of the technology gap and to an significant enhancement in pure efficiency. On the contrary, the efficiency component due to the scale dimension has been decreasing for all regions in Europe and in particular in new entrant countries. For the future, however, we expect that potential gains due to reductions of the technology gap and inefficiencies are going to be limited, due to the fact that, from now on, backward regions are going to be closer to the frontier. This reasoning should lead to a future strategy which abandons the idea of R&D expenditure and human capital as the only way to boost innovation processes and productivity enhancement. The differentiated specialization models along diverse stages in the development process suggest a very heterogeneous pattern in the exploitation of technological externalities both at the regional and at the interregional level (as shown in Brülhart and Mathys (2008), Foster and Stehrer (2009) and Marrocu et al., 2012). At the same time, the diverse phases of the innovation process also show varying performances, making the pathway to technological progress and economic growth specific to local and contextual characteristics (Capello and Lenzi, 2012).
In conclusion, the analytical scenario together with the empirical analysis offered in this study suggest a strategy which recognizes different regional specializations in specific knowledge production chains. This is instrumental to overcome the current catching up model, based on the technological gap, and opt for a development model more associated to economies of scale, which have been so far neglected. Economies of scale are crucial to allow each region to exploit the increasing returns to R&D due to the presence of high fixed costs in the innovation process (Foray, 2009). Europe 2020 and the Smart specialization strategy seems to provide (European Commission, 2010) interventions which attribute to each region its original innovation strategy in light of a specific specialization model, development stage and set of comparative advantages.
As for the European Neighbouring Countries, we expect that regions in these countries are going to be able in the near future to exploit the same advantage of backward regions in Eastern countries. These regions have, in other words, a potential for catching up which is mainly due to the fact that they are far away from the technological frontier. This process can not, however, been taken for granted since the economies of ENC needs the necessary absorptive capacity to effectively use the knowledge and the technology already developed and applied in Western regions. These implies that these countries have to invest, first of all, in human capital.