



POLICY NOTE OF THE WORKING PAPER 4/03

A country-level knowledge production analysis with parametric and non parametric methods

Barbara Dettori, Elisa Gagliardini, Stefano Usai

University of Cagliari, CRENoS

1. OBJECTIVES

The main purpose of this analysis is to investigate the functioning of the knowledge economy at the country level in Europe and in its Neighbouring countries. In particular, we assess, by means of econometric techniques, the impact of intangible assets such as research and development activities on inventive performance measured by patent applications at either EPO or PCT. We also evaluate whether this impact is significantly different among countries in particular with respect to three areas: Old Europe, which includes the fifteen more developed Western economies, the New Europe, with the twelve countries which have entered the European Union in more recent times, and finally European Neighboring Countries. Moreover, we apply Data Envelopment Analysis as a benchmarking methodology which permits to identify the best performing countries within Europe and beyond. Since, in general, the two methods provide different indications on the same object of analysis, we employ both of them in a complementary guise in order to gain wider and different insights for the comparison of European Union and European Neighbouring countries innovative performance.

2. SCIENTIFIC METHOD

The analysis is based on regression models and on Data Envelopment Analysis (DEA). While regression models are particularly suitable to measure central tendencies of a given phenomenon, DEA is more adequate for benchmarking analysis as it permits to identify the best performing units within a given set of entities. The DEA approach will allow us to single out the specific characteristics of each region and to determine how far they are in relative terms from the most efficient areas, so that we will provide an assessment of the potential productive gains not yet accrued by inefficient regions. Since, in general, the two methods provide different indications on the same object of analysis, we employ both of them in a complementary guise in order to gain wider and different insights for the comparison of European Union and European Neighbouring countries innovative performance.

The first part of the analysis, is, therefore, devoted to the investigation of the impact of intangible assets on the innovative capacity of a region. We present results for a standard knowledge production function (Griliches, 1979) with the R&D as the main input. The analysis is mainly speculative because the absence of information of some potentially important phenomena, such as human capital, may hinder our results and conclusions. Nevertheless, main results are robust and confirm previous analysis at the country and regional level. Moreover, they also add some original finding about the potential for catching up of European Neighbouring Countries. The second part of the paper is devoted to the application of DEA in order to assess the relative innovative performance of countries with respect to the technological frontier. Despite some drawbacks, again due to the quality of the dataset, results are particularly interesting since efficiency and inefficiency scores are not necessarily attributable to EU and ENC respectively.

3. MAIN RESULTS

The econometric analysis shows that the returns of R&D expenditures on country innovative capacity are significant and positive, as expected. Results are robust. Most importantly the distinction between different groups of countries, that is EU15, NMS12 and ENC allow to draw some interesting further result. The role of R&D is, as a matter of fact, much stronger in EU15 countries whilst ENCs are less effective in transforming R&D into patents. There is, in other words, a potential gain coming from an efficiency improvement.

Differences in efficiency are the main and direct object of analysis of the application of non parametric techniques. They allow to identify countries on the frontier and to show that there is, again, a dualistic pattern in the regional innovation activities. The highest efficient territories are located in EU15 and the lowest efficiency scores in European peripheral areas, which involve both new accession countries and European Neighboring Countries.

4. POLICY VALUE-ADDED

We are aware that the analysis provided in this paper is mainly exploratory and comments have to be considered with cautious, as tentative conclusions. Policy value added is even more difficult to extract and therefore no more than tentative.

It is confirmed that ENC can be likened in many respect to new member states and that therefore they have a great potential for catching up process in the near future. In light of the results of Marrocu, Paci and Usai and Foddi and Usai in these same report, we therefore expect that single regions, more than the whole 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 and, secondly, in scientific expertise to enhance their efficiency in transforming these inputs in to technological output: inventions, innovations and, most importantly, adopted technologies.