Tailoring innovation: An analysis for the European regions

There is a wide research stream which found clear evidence that the impact of research and development spending's differs greatly between territories. Therefore, starting from the assumption that there is regional heterogeneity not only in terms of socioeconomic characteristics but also, and more importantly, in terms of "absorptive capacity", we intend to analyze which is the effect of investment in research and development for each specific territory. To this aim, we will resort to the Geographically Weighted Regression approach because of its power to estimate specific parameters for each geographical unit. This analysis will be carried out for European regions at the NUTS2 level of spatial disaggregation. In addition to observing the links between investment in research and development and economic growth, control variables representing the regional socioeconomic context will be considered, using data mostly from the European Statistical Office. Being aware that investment research and development does not generate immediate effects (in the same period in which it happened), a complementary analysis is used to select the time lags corresponding to investment in research and development. The results will allow us to confirm, first, if the research and development spending effect is heterogeneous throughout the territories, and if it is true, analyze if there exist a spatial pattern or common characteristics of those places who most benefit from this kind of investment. Second, we will analyze if this effect varies depending on the kind of innovation model proposed in each territory.

Conte et al. (2009) bring up two main reasons supporting the interest of European governments on increasing investment in research and development. First, research and development could be an important driver of long-term economic prosperity as the main objective of these activities is to create new products/processes that can be turned into revenues. Second, private research and development investment entails risks, which limits the engagement of firms, hence the government's role in research and development investing is key, especially during economic crises. Taking into account the socio-strategic character of this kind of activities, it becomes of primary importance to assess the capability of each region to transform investment into growth, while trying to understand the clustering pattern generated by territorial advantages and/or knowledge diffusion. Previous studies suggest that economically lagging-behind regions are in a worst position to turn investment into benefit, posing once again the challenge of achieving convergence in a multi-layered and complex reality, since pouring resources without considering the specific regional environment may lead to disappointing outcomes.

It is understood that in a context like the one depicted above, the main premise for the analysis should be that the estimated effects of a variable can vary greatly across territories depending on the temporal or the spatial framework chosen (Shearmur and Polèse, 2005; Shearmur et al., 2007; Glaeser et al., 2014). Given the existence of spatial heterogeneity, the question is whether a single estimate can properly explain regional phenomena. Spatial non-stationarity takes place when the responses to particular variables change across space, and these differences might be caused by the interrelationships between neighboring regions. Adopting a global regression approach might lead to deceptive estimates if those are extrapolated to the local environment. The conclusions regarding, for instance, the level of investment in research and development or the economic growth associated with it derived from global estimations can mask

significant local variation. Thus, a standard overall estimate may point to a certain effect of one factor whereas this factor could be stimulating growth in some areas but negatively affecting it in others, showing an average effect which is not representative at the local level due to its high regional variability. This compensation effect is especially problematic when the average impact is close to zero, as it might be deemed to be non-significant and disregarded as an element of the analysis or as a policy instrument.

The simplest approach proposed in the literature to address spatial non-stationarity is the fixed-effect model, where dummy variables are introduced to capture site-specific characteristics (Anselin, 1998; Brunsdon et al., 1998; Greene, 2000). To correct for spatial dependence, Anselin (1988) suggested a spatial error model (SEM) and a spatial lag model (SLM). Both models take into account the problems mentioned above but parametric heterogeneity is not accomplished, so an important source of regional information is lost. The Geographically Weighted Regression is a non-parametric approach that represents an alternative to deal with both issues (Brunsdon et al., 1996 and 1998). The GWR method can be easily implemented, hypothesis testing is akin to that of standard methods and results can reveal interesting spatial regularities undetected by more traditional methods (McMillen and Redfearn, 2010). This methodology captures spatial variations in the regression coefficients by introducing a weighting matrix in the estimation process and estimating a locally-varying sample for each location, generating a separate group of regression parameters which reflects the sample heterogeneity by estimating different responses to an explanatory variable across space.

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