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Les défis de développement pour les villes et les régions dans une Europe en mutation

## A heterogeneous coefficient approach to the knowledge production function

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### Référence à la session / reference to the session

### Résumé / Summary

Research conducted on regional innovation systems points to regional disparities in both their ability to turn their knowledge inputs into innovation and to access external knowledge. However, the knowledge production function model used in the literature does not account for these regional differences. To fill this gap, we apply a heterogeneous coefficients spatial autoregressive panel model capable of producing estimates of knowledge production function parameters for each region in the sample. Past literature has used conventional spatial autoregressive panel data models to relate patent production output to knowledge production inputs. These models summarize the relationship involving  $N$  regions over  $T$  time periods by restricting coefficients to be homogeneous across regions and time periods. Of course, we can allow for region-specific and time-specific fixed effects in an attempt to ameliorate the fact that we rely on homogeneous coefficients in the model. Introducing these allows for region- and time-specific differences in the model intercept.

A heterogeneous coefficients spatial autoregressive (HSAR) panel model specification allows for variation in the level of spatial dependence/interaction as well as knowledge production function coefficients, intercepts and noise variances across each region. In many contexts (including our case of 94 French NUTS3 regions) a small group of regions within a country account for the majority of innovation activity. Some regions might exhibit knowledge production output that is sensitive to private R&D inputs, while others involve relationships where the knowledge base or public inputs are more important. Some regions might benefit from spillover

impacts of neighbors, while others do not. From an econometric viewpoint, it would be desirable to have estimates of the knowledge production function at the regional level that allow for differences in the level of interaction/spatial dependence between regions

as well as knowledge production function coefficients, intercepts and disturbance variances. This type of model would allow inference regarding how knowledge output of each region responds to changing levels of own- and neighboring-region knowledge inputs, and how knowledge production is influenced by neighboring region production as well as time-invariant region-specific factors.

We estimate region-specific knowledge production functions for 94 NUTS3 regions in France using a panel covering 21 years from 1988 to 2008 and 4 high-technology industries: chemistry, pharmaceutical, mechanics and materials. A great deal of regional heterogeneity in the knowledge production function relationship exists across regions, providing new insights regarding spatial spillover and spillover effects between regions.

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