

Technological and structural change in European regions through scenarios of improved productivity and regional catch-up

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Technological change and productive transformation are central drivers of long-term growth, competitiveness, and territorial cohesion in Europe. Persistent disparities in productivity and economic performance across European regions highlight the need for policies that foster convergence while respecting regional specificities. In this context, European cohesion policy plays a crucial role by promoting technological upgrading, structural change, and the diffusion of more efficient production models, particularly in lagging and border regions. Improving regional catch-up through productivity gains is essential not only for regional development but also for the overall cohesion and resilience of the European economy.

This paper contributes to this debate by developing an analytical framework to evaluate the economic effects of technological and structural change in regional economies through economically consistent and realistic catch-up scenarios. The analysis builds on input-output methodology and focuses on the modification of regional production structures through the adoption of more productive technologies observed in comparable European regions. Technological change is modelled through changes in the matrix of technical coefficients (A matrix), together with coherent adjustments in value added, imports, and taxes, ensuring that model closure conditions are preserved.

Our catch-up scenarios are defined as processes of convergence of selected regional production chains moving towards higher levels of productivity, efficiency, or internal sourcing of inputs. For each selected sector, regions with higher productivity levels and sufficient structural similarity are selected to explore the adoptability and convergence to the technological frontier.

As a case study, we apply this methodology to the Spanish region of Aragon, using its 2022 input-output table and comparative information from a multi-regional European framework. We also use economic and geographical information with a higher level of detail to downscale the results. Based on the strategic relevance of key activities, several sectoral scenarios of catch-up are developed, including: (1) Agri-food block; (2) Metal block; (3) Automotive sector; (4) Energy sector; and (5) Transport and logistics block.

The results indicate that technological upgrading can generate substantial gains in regional value added and employment, although both the magnitude and spatial distribution of these effects vary notably across sectors and geographical areas. Specifically, our estimations suggest that the largest increase in value added in Aragon is achieved with an upgrading in the automotive scenario, moving to a more integrated supply chain, as observed in some Swiss regions. This structural change would result in an increase of 3.52% of the regional value added, and would generate above 14,000 equivalent jobs. Employment would increase most in the agri-food scenario, with more than 20,000 equivalent jobs generated. Our findings also show that employment would increase in all scenarios except the energy one, which is also relevant, given the important deployment of this sector in the last decades. The sub-regional disaggregation of the results reveals that some scenarios generate more territorially balanced outcomes than others. Transport and logistics scenario is very important, especially since no sub-regional territory loses out, highlighting the importance of evaluating shocks at territorial level. To maximize positive impacts across the entire region would also be possible by combining policies.

Overall, the paper offers a novel and flexible approach to assessing technology-driven convergence processes at the regional level, replicable to other technologies and regional structures. The results provide useful insights for the design of cohesion policies aimed at fostering productivity growth, reducing regional disparities, and promoting more balanced and integrated European economic

structures.