Energy transition and regional distribution in Europe: A new MRIO modelling approach

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Cohesion policy as part of the European Unionâ€™s (EUâ€™s) regional policy is the EUâ€™s main investment policy. The goals of the EUâ€™s cohesion policy are job creation, improved business competitiveness, economic growth, improved quality of life and sustainable development on top of the reduction of disparities between regions. Since 2001, the EUâ€™s cohesion policy supported economic growth in less developed regions. Especially, eastern regions have been catching up with the rest of the EU and the gap of the GDP per capita has decreased substantially. Despite this convergence, several middle-income and less developed regions, mostly located in the southern EU, struggle to recover from the economic and financial crisis in 2008 and face stagnating or even declining economic developments. Overall, capital metropolitan regions outperform other, more rural regions.

In the future, the clean energy transition will have substantial impacts on the EUâ€™s economic growth. As stated in the European Green Deal, the EUâ€™s greenhouse gas emissions should be reduced by 55% by 2030 and carbon neutrality is the EUâ€™s goal for 2050. To reach carbon neutrality the transition to renewable energy (RE) technologies as main energy sources is inevitable. However, an EU-wide clean energy transition is challenged by the disparities between and within the 27 member states. Therefore, the new EU cohesion policy supports the transformation of the economy through investments in key sectors like RE, recycling, renovation, and ecosystem services. Yet, the uneven regional distribution of these key sectors might manifest or widen regional disparities. In addition, heavy industries need to reduce their emissions and the regions in which they are located might be adversely affected by the clean energy transition. Thus, the social impact of the transition will differ between regions and is likely higher in less developed areas.

In a recent study, Maucorps et al. (2022) examined general growth potentials and regional readiness for the digital and green transition of the EUâ€™s NUTS-2 regions based on a scoring approach applied to five key factors of economic growth (human capital, innovation, investment, institutions and infrastructure). The authors find that the EU faces a danger of rising imbalances and increasing disparities, since especially urban regions located mostly in the European centre show high growth potential and high levels of readiness, whereas rural, agricultural, and mining regions show low levels of digital and green readiness combined with a low growth potential. The investments necessary to support the transition to a carbon neutrality are an opportunity for economic growth while at the same time the necessary structural changes impose risks for new regional disparities.

To our knowledge, the potential effects of investments in RE technologies and their operation on cohesion in the EU have not been thoroughly examined yet. Previous studies have concentrated on the regional impacts of the energy transition in single member states of the EU. Ulrich et al. (2022), for example, compare the macroeconomic developments in ten scenarios of energy system transformation in Germany and find that especially in northern and eastern German states, where wind and PV capacities are high, the energy transition is expected to enhance economic growth. The dependence on employment in the coal industry varies greatly across the EU. The employment vulnerability is higher in Central European countries like Poland, Bulgaria and Czech Republic than in Western Europe, and thus these countries face much higher costs associated with a transition to RE. An analysis based on the RHOMOLO-IO modelling framework concludes that 215,000 jobs in

the EU can potentially be affected by the shift away from coal (Mandras et al. 2019; Kochanek 2021).

To fill these knowledge gaps, we analyse the impact of the clean energy transition on EU cohesion based on a multiregional input-output (MRIO) modelling approach that takes various impact channels of investments in RE technologies, their regional distribution, the economic structural differences of the NUTS-2 regions and their interrelations through local-to-global value chains into account. We develop a new database that consists of two components: firstly, the economic structure of the EUâ€™s NUTS2 regions, and interregional as well as international trade dependencies are mapped by MRIO tables from the EUREGIO database. Secondly, since the sectoral resolution of the MRIO tables is low, especially in the energy sector, we combine them with detailed survey based cost structures of the production and operation of eight of the most important RE technologies (wind, hydropower, PV, CSP, biomass, biogas and geothermal). Overall, we shed light on possible synergies and trade-offs between the clean energy transition and cohesion amongst and within the regions of the 27 EU member states.