COMPARING THE EFFECT OF TARGETED RESEARCH AND INNOVATION MEASURES ON LOCAL BIOECONOMY EMPLOYMENT IN RURAL AND NON-RURAL AREAS

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Introduction

The bioeconomy involves all economic sectors and systems linked to biological resources and their functions and principles (EC, 2018). By supporting the bioeconomy, policymakers aim to promote the development of rural areas, among other goals. Rural areas in many European countries are left behind compared to other regions in their development. Rural EU regions have a higher risk of poverty or social exclusion, fewer highly educated people, and worse infrastructure than non-rural regions (Abreu et al., 2019). The 2018 EU Bioeconomy Strategy Update states that "the deployment of a sustainable European bioeconomy would lead to the creation of jobs, particularly in coastal and rural areas through the growing participation of primary producers in their local bioeconomies" (EC, 2018, p.5). This statement suggests that European policymakers promote the bioeconomy to achieve more than increasing and improving primary production. An essential objective is to offer more and higher value possibilities for biomass processing while involving primary producers. The strategy further states that "the bioeconomy offers important opportunities for new jobs, regional economic development, and improved territorial cohesion, also in remote or peripheral areas" (EC, 2018, p. 10). To conclude, the bioeconomy is partly seen as a means to decrease the disparity in the context of growing inequality.

Sizable bioeconomy development happens in the European regions at the sub-national level through bioeconomy projects and initiatives promoted by regional and local public authorities, private companies, universities, research centres or other actors (Haarich et al., 2017). A way of promoting the deployment of local bioeconomies is to implement regional bioeconomy strategies addressing research and innovation (R&I). The European Commission (EC) developed an innovation strategy as part of the Europe 2020 strategy, which introduced the concept of smart specialization. The EU Member States and regions are supposed to design national or regional research and innovation strategies for smart specialization to deliver more targeted Structural Fund support and a strategic and integrated approach to development in all regions. The EU Structural and Investment Funds include the European Regional Development Fund, which aims to increase cohesion between EU regions. Smart Specialization Strategies (RIS3) are defined as "[…] integrated, place-based economic transformation agendas […]" (Foray et al., 2012). The RIS3 conditionality in the Structural Funds regulations for 2014-2020 means that every region must have a well-developed strategy before receiving EU financial support through the Structural Funds for their planned innovation measures (Foray et al., 2012). Whether these strategies have the desired effect regarding developing the bioeconomy and increasing job opportunities for skilled workers remains an open question. Innovative and high-value production generally takes place mainly in non-rural areas. Therefore, comparing the development in rural and non-rural regions is critical to assess whether this gap between these types of regions is closing.

The objective of this paper is to investigate whether research and innovation strategies and measures targeted at the bioeconomy have led to increased employment compensation in rural areas compared to non-rural areas. Haarich et al. (2017) developed a bioeconomy R&I maturity index based on an analysis of smart specialization strategies of 210 EU regions and countries. Two hundred seven out of them include bioeconomy-related aspects in their 2014-2020 R&I priorities and plans. The bioeconomy R&I maturity index considers the overall innovation capacity of a region, the existence of

specific bioeconomy features such as strategies or clusters and the perceived intensity of bioeconomy R&I activity. The index indicates high, middle, or low bioeconomy maturity.

Research questions

We focus on the following three main research questions (RQs): What are the determinants of an EU region's high bioeconomy R&I maturity? (RQ1); What is the effect of a high bioeconomy R&I maturity index on growth in bioeconomy employment compensation in EU regions? (RQ2); What is the difference in the effect of a bioeconomy high R&I maturity index on bioeconomy employment compensation between rural and non-rural regions? (RQ3).

Data and research methodology

We use the panel data from Eurostat's 'Regional statistics by NUTS classification' ranging from 2008 to 2019 for 261 NUTS 2 regions. To cover the range of bioeconomy sectors defined following the Statistical Classification of Economic Activities in the European Community (NACE) (Kardung et al., 2021), we use Compensation of employees by NUTS 2 (1-digit) regions for agriculture, forestry and fishing and Structural Business Statistics (SBS) data by NUTS 2 regions and NACE Rev. 2 (2-digit) for the manufacturing sectors. The data for the baseline characteristics for the Propensity Score Matching include the 'Regional gross domestic product', 'Primary income of private households', 'Tertiary educational attainment', 'Intramural R&D expenditure', 'Unemployment rate', 'Households that have internet access at home', 'Utilized agricultural area', and 'Standard output by farms'.

Our empirical strategy consists of the Propensity Score Matching (PSM) method combined with Difference-in-Differences (DID) to estimate the impact of a high bioeconomy R&I maturity index on bioeconomy employment compensation in the NUTS2 regions. Matched DID allows reducing the risk of bias in the estimation (Gertler et al., 2016). Various studies have used this approach to analyze the impacts of, for example, agricultural land preservations policies (Liu and Lynch, 2011), a rural road policy (Mu and Van de Walle, 2011), or large-scale housing improvement policies (Cattaneo et al., 2009). Figure 1 depicts our empirical strategy, which consists of four main steps. First, we separate predominantly rural NUTS 2 regions from intermediate and predominantly urban NUTS 2 regions following de Beer et al.'s (2014) classification. We do the following steps separately for rural and non-rural regions because we want to compare the effect of a high bioeconomy R&I maturity on the different types of regions. In the second step, we perform the PSM based on the selected baseline characteristics from 2008 to 2013. We use the baseline characteristics to predict the probability of having a high R&I maturity index, the propensity score, using a logit model. This propensity score is used to match regions with high R&I index with regions with low and middle R&I index. Third, we use the DID method to estimate the effect on bioeconomy employment compensation between two periods. The Smart Specialisation Strategies (RIS3) were relevant for 2014 to 2020, when R&I priorities and plans were implemented. Therefore, we compute the difference in bioeconomy employment compensation mean values between the 1st Period (2008 – 2013) and the 2nd Period (2014 – 2019) for each NUTS 2 region with a high bioeconomy R&I maturity index. Next, we compute the difference in employment between the two periods for this region's matched comparison with middle or low bioeconomy R&I maturity index. We subtract the second difference from the first difference and average out these double differences (Gertler et al., 2016). Forth, having done the previous steps for rural and non-rural NUTS2 regions, we compare the double differences between the two types of regions.

Expected results

Our analysis aims to empirically assess the effect of bioeconomy research and innovation strategies and measures on employment compensation in EU regions. We expect to get results on the determinants of a high level of bioeconomy adoption and support in a region. Subsequently, we anticipate finding an effect of a high level of bioeconomy R&I maturity on bioeconomy employment. Lastly, this effect is likely different for rural and non-rural regions, given the importance of the bioeconomy for rural areas. This assessment might support regional policymakers in steering their regional development. The deployment of local bioeconomies might be a helpful policy instrument to ensure skilled jobs in rural

regions and decrease disparities with non-rural regions. Our results might also be used for developing national and supranational bioeconomy research and innovation strategies because estimating the effect of these strategies and measures on a national or higher is unfeasible.

Essential references

Abreu, I., Nunes, J. M., & Mesias, F. J. (2019). Can Rural Development Be Measured? Design and Application of a Synthetic Index to Portuguese Municipalities. *Social Indicators Research*, 145(3), 1107–1123. https://doi.org/10.1007/S11205-019-02124-W/TABLES/5

Beer, J. De, Gaag, N. Van Der, & Erf, R. Van Der. (2014). New classification of urban and rural NUTS 2 regions in Europe. Netherlands Interdisciplinary Demographic Institute. Working Paper (No. 3; 2014).

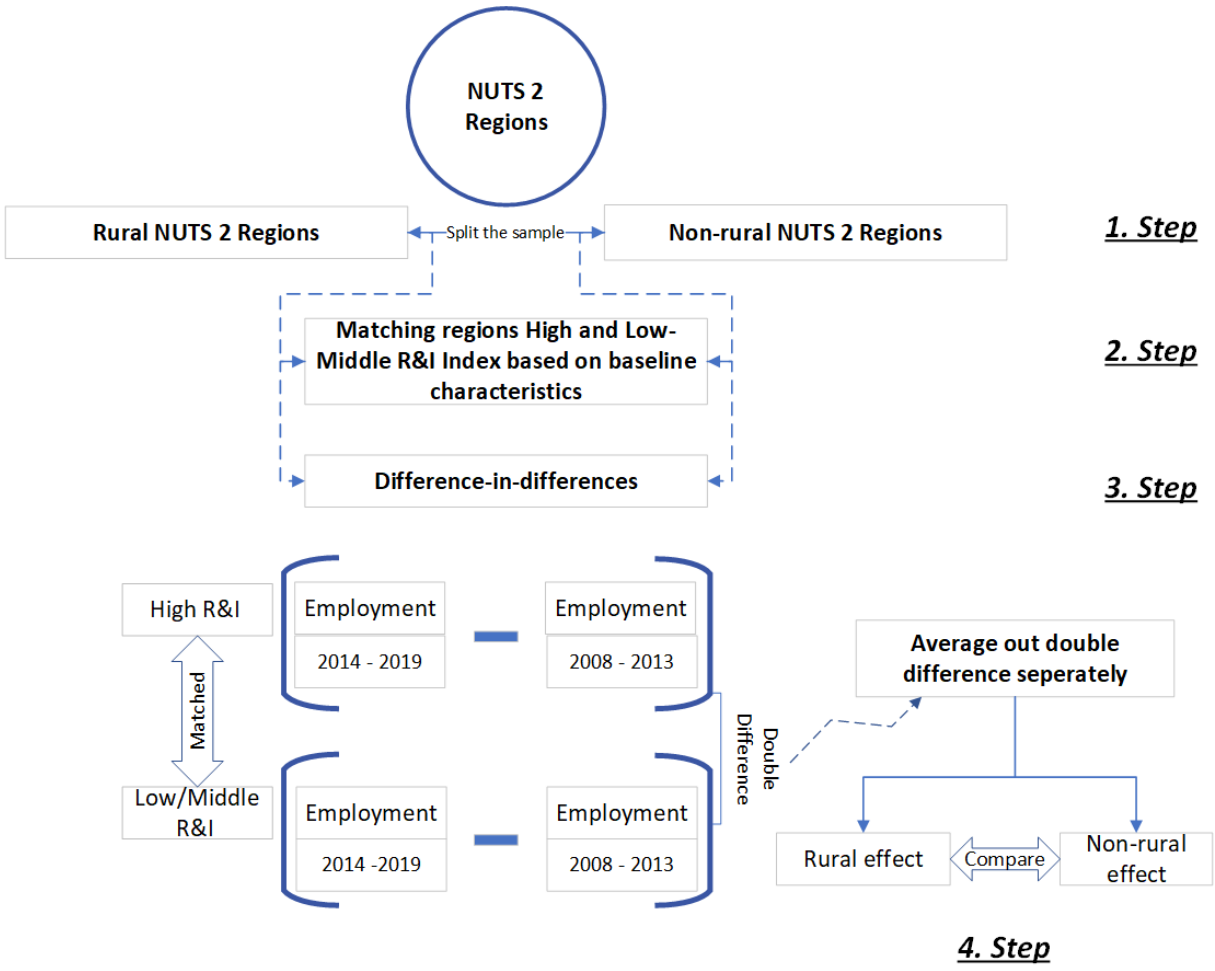
Cattaneo, M. D., Galiani, S., Gertler, P. J., Martinez, S., & Titiunik, R. (2009). Housing, Health, and Happiness. *American Economic Journal: Economic Policy*, 1(1), 75–105. https://doi.org/10.1257/POL.1.1.75

European Commission. (2018). A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment. Updated Bioeconomy Strategy. https://doi.org/10.2777/478385

Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., Nauwelaers, C., & Ortega-Argilés, R. (2012). Guide to Research and Innovation Strategies for Smart Specialization (RIS3). March 2012, 114. https://doi.org/10.2776/65746

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. J. (2016). Impact Evaluation in Practice, Second Edition. In Impact Evaluation in Practice, Second Edition (Vol. 35, Issue

FIGURE 1: EMPIRICAL STRATEGY



17). Washington, DC: Inter-American Development Bank and World Bank. https://doi.org/10.1596/978-1-4648-0779-4

Haarich, S. (2018). Bioeconomy development in EU regions: mapping of EU Member States' / regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on bioeconomy: final report, Publications Office. European Commission, Directorate-General for Research and Innovation. https://data.europa.eu/doi/10.2777/84684

Kardung, M., Cingiz, K., Costenoble, O., Delahaye, R., Heijman, W., Lovrić, M., van Leeuwen, M., M'Barek, R., van Meijl, H., Piotrowski, S., Ronzon, T., Sauer, J., Verhoog, D., Verkerk, P. J., Vrachioli, M., Wesseler, J. H. H., & Zhu, B. X. (2021). Development of the Circular Bioeconomy: Drivers and Indicators. *Sustainability*, 13(1), 413. https://doi.org/10.3390/su13010413

Liu, X., & Lynch, L. (2011). Do agricultural land preservation programs reduce farmland loss? Evidence from a propensity score matching estimator. *Land Economics*, 87(2), 183–201. https://doi.org/10.3368/le.87.2.183

Mu, R., & van de Walle, D. (2011). Rural Roads and Local Market Development in Vietnam. *Journal of Development Studies*, 47(5), 709–734. https://doi.org/10.1080/00220381003599436