

Ph.D. in Data Analytics and Decision Science:

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“The impact of regional development policies on socio-economic development and sustainability transition”

Abstract

This dissertation investigates the impact of regional development policies, constituting regulatory frameworks aiming to promote local socio-economic development. In particular, I focus on the study of the European Cohesion Policy, as it represents a cornerstone among place-based policies implemented at European Union (EU) level. Although it was originally conceived as a fiscal equalization instrument, pointing to activate economic convergence through a catching up mechanism between more advanced and less developed regions, the EU Cohesion Policy has recently undergone through relevant reforms that have progressively enlarged its scope. For instance, the available budget has significantly increased, more than tripling between the timeframe 1994-1999 and the most recent programming period (2014- 2020). Furthermore, new programmes of financial supports have been introduced to properly address additional development axes including climate change, competitiveness of small medium enterprises, digitalization and social inclusion. Due to this profound transformation, new empirical evidence on the effect recently generated by the EU Cohesion Policy is required to support policy makers to better understand the impact of this renewed regulatory framework, and carefully design corrective actions, further contributing to local development. Against this background, my thesis is composed by three research papers that aim to assess the impact of the EU Cohesion Policy across different priority investment areas. Through the integration of heterogeneous sources of data and the application of state of the art statistical analyses, this work contributes to show the effect of EU Cohesion policy at the intersection of the social, economic, environmental and innovation dimensions. More specifically in Paper I, I analyse the socio-economic impact of Structural and Cohesion Funds (SCFs) that represent the main financial instrument employed by the EU Cohesion Policy to boost local development across EU regions. In particular, I investigate the short and medium-long term effect generated by these funds across the different sectors in which they are allocated. In this way, I aim to fill a relevant gap of extant literature that have mainly focused on the aggregate amount of SCFs, without deploying their impact across the recipient sectors. Through the application of a generalized propensity score matching model with a continuous treatment and spatial panel models based on geographical and technological proximity matrices over the time frame 2007-2014, I show that the energy, research and development and transportation sectors significantly contribute to economic growth with persistent effects in a medium-long term perspective. Conversely, competing behaviours arise for the environment sector, where SCFs have a slightly negative immediate impact on GDP per capita, complemented by positive effects at different time lags. Furthermore, I show that the transportation sector, that accounts for the largest portion of the EU budget over the analysed time frame, produces the highest spillovers, thus contributing to the local growth also of close regions from a geographical and technological perspective. Since SCFs in the human resources sector raise GDP per capita

and activate positive spillovers, policy makers may consider to increase the size of funds devoted to this sector, as it received only 1% of the overall EU capital. As a final step, I discuss the geographical distribution of SCFs spillovers across EU regions to support policy makers in the identification of areas mostly contributing to cross fertilisation of other member states economies. Overall, I show that the highest spillovers are generated by provinces in Belgium, while at national level, Belgium, Germany, the Netherlands and UK produce the highest aggregate spillovers. When I consider the portion of spillovers cross cutting national boundaries, I show that UK retains the largest portion of positive spillovers within country (almost 90%). On the other hand, Austria, Belgium, France, Germany and the Netherlands generate large spillovers absorbed by NUTS-2 in other countries, with only a percentage between 13% and 38% that is confined within national boundaries. Paper II analyses some limitations of the current criterion implemented by the European Commission (EC) to allocate the largest portion of SCFs, devoted to the so-called "less developed regions", that are territories with a GDP per capita below the 75% of EU average. In particular, I focus on two potential pitfalls of the mechanism through which EU regions receive SCFs, investigating whether the current approach may lead to a delayed entrance into or a premature exit from the less developed status. More specifically, I first study whether the current SCFs allocation criterion risks to not promptly identify territories with a fragile economy, thus preventing a timely access to the less developed status for regions that require additional financial support. Second, I analyse whether this criterion risks to phase out from the less developed status, regions that have not activated a mechanism of endogenous self-sustaining growth, yet. I address this research objective analysing the consequences on SCFs allocation associated with the EU major enlargement occurred as of 1st May 2004, when 10 countries joined the EU as new member states. Due to the economic backwardness of new member states characterized by a GDP per capita ranging between 25% and 75% of EU average, such event represented an exogenous shock in the treatment assignment with respect to the local development level. In particular, I identify two different groups of regions potentially penalized in terms of received SCFs as a consequence of the EU enlargement. The former (Not treated again (NTA) regions) encompasses EU-15 regions that were not classified in the group of less developed regions both in the programming period 2007-2013 and 2014- 2020, but that would have been likely to receive the less developed status in absence of the EU enlargement (based on the pre-enlargement benchmark represented by the 75% of EU-15 average GDP per capita). The latter (Lost treatment (LT) regions) includes NUTS-2 that lost the status of less developed regions for the timeframe 2014- 2020, but that would have been likely to receive the less developed status in absence of the EU enlargement (based on the pre-enlargement benchmark represented by the 75% of EU-15 average GDP per capita). The application of state of the art Synthetic Control Methods and Difference in Differences approaches at different levels of geographical scale provides evidence of a strong economic penalization of NTA regions subject to a significantly lower GDP per capita growth between -10.5% and -5.7%. Conversely, LT regions did not experience significantly lower economic growth. This might be due to the fact that such regions received a "safety net", a financial cushion that guaranteed them to obtain at least two-thirds of the budget received in the previous programming period. Paper III studies the impact of different combinations of policy instruments adopted at EU level in order to foster the sustainability transition. In particular, I consider SCFs and H2020 funds as main examples of technology push policies, since they represent the most relevant instruments adopted by the EC to tackle climate change. Furthermore, I take into account the European Union Emissions Trading System (EU ETS) as an example of demand pull policy instrument, since it covers more than 45% of overall GHG emissions at EU level. Through the application of a dynamic two ways fixed effects (TWFE) panel event study, I show that the EU ETS has a positive impact on innovation performances of firms in the manufacturing sector, contributing to raise patents applications between 0.4% and 0.5% during the period 2013-2020 (Phase III). Conversely, the effect generated by this demand pull policy instrument is not significant over the previous two phases (2005-2007 and 2008-2012) and when I consider either the

energy sector, or firms across all economic sectors. Such empirical evidence suggests that the effectiveness of demand pull policy instruments depends both on policy stringency and on market conditions that may affect the extent to which firms can avoid to fully internalize the carbon price in their investment decisions. Indeed, the effect of EU ETS is stronger during Phase III, characterized by a higher carbon price, auctioned rather than free allocated allowances and stronger environmental certificates withdrawal, thus providing more intense signals and incentives in favour of the decarbonization process. Furthermore, the impact is significant only for the manufacturing sector, that cannot easily implement the cost-pass through mechanism, differently from the energy sector. On the other hand, when I consider the policy mix, SCFs and H2020 allocated to environmental innovation projects do not automatically imply better green innovation performances, as such funds contribute to generate additional benefits with respect to the EU ETS policy only for the energy sector. In particular, SCFs and H2020 increase patents applications in the energy sector between 1.4% and 2.1%, with a reduction of CO₂ emissions in the range 0.7%-0.8%. This result points to the fact that in case firms can adopt alternative strategies to reduce the impact of the carbon price in their business activities, technology push instruments represent effective complementary measures with respect to demand pull policies, improving the environmental performances of the underlying firms. This may be due to the fact that such firms perceive the commitment of relevant international institutions on the environmental transition, becoming more willing to invest in clean technologies to show their commitment towards community and stakeholders expectations. Finally, I analyse the mechanism explaining why a properly designed policy mix based on the combination of demand pull and technology push instruments may generate additional environmental innovation at firm level. In this direction, I show that SCFs and H2020 do not crowd out investors, but catalyze capital, activating additional research and development activities, contributing to raise patents applications and decrease CO₂ emissions. Overall, this thesis contributes to the debate on the effectiveness of the EU Cohesion Policy, providing robust empirical evidence with respect to several significant aspects of this regulatory framework. First, disentangling the impact of SCFs across different sectors and showing the geographical distribution of associated spillovers, I support policy makers in the identification of a more effective allocation of the EU budget across sectors and territories, in order to maximize the potential local development. Understanding the economic multiplier associated with investments targeting different sectors is of utmost relevance in the current policy agenda, considering that the main strategy implemented by national and international governments to deal with the economic and financial crisis triggered by the COVID-19 pandemic relies on the design of different packages of financial support and fiscal stimulus. Second, I quantify the impact of receiving an amount of SCFs not aligned with respect to the local development of EU regions. In this way, I empirically show some of the pitfalls of the current criterion used to allocate the largest portion of SCFs. Such evidence may fuel the discussion about the need to carefully refine this indicator that should provide a more representative and accurate overview of territories characterized by a fragile economy. Adjustments and improvements in a correct identification of the less developed regions may significantly improve the process of economic convergence that still constitutes one of the main pillars of the EU Cohesion Policy. Third, I highlight how alternative policy instruments contribute to environmental innovation, filling a significant gap in the literature on the policy mix, mainly characterized by theoretical contributions or empirical analyses focusing on single policy interventions. In this way, I support policy makers to identify market conditions that may affect the impact of specific regulatory instruments and that may require more complex combinations of policy measures to produce the desired outcome. Such evidence can be used by regulators to further refine and fine tune extant policy frameworks in order to achieve the established environmental targets, limiting wastes in the usage of available resources. Although my strongest effort to implement methodologically grounded research, some limitations still affect my work and may open future research opportunities and discussion. First, I mainly focus on the complete ex-post assessment of

the analysed regional development policies. Despite the usefulness of robust empirical evidence on the main effects generated by policy measures to design timely corrective actions, policy makers are currently interested also in ex-ante evaluations of the impact of their decisions. As a consequence, state of the art machine learning and deep learning techniques may be used in future research works to forecast the effects of alternative policy measures and design interventions minimizing the misuse of resources. Second, the majority of my analyses is conducted at EU level and considers heterogeneous sectors. More vertical analyses on specific countries or sectors may provide additional insight on the factors that may influence the impact of the EU Cohesion Policy in a specific context or sector. Properly addressing such limitations in future research studies, may allow to generate additional value and empirical evidence in support of a proper design and implementation of regional development policies.