EXTENDED ABSTRACT

Title: Regional general equilibrium modelling with forward-looking agents: an application to the 2014-2020 European structural regional investments

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Subject area: Governance and Impact of Territorial Policies

Abstract:
Cohesion policy is the second largest item in the budget of the European Union (EU). The bulk of the policy, about 75% of the funds (almost €260 billion), are channelled through the European Regional Development Fund (ERDF) and the Cohesion Fund (CF), which aim to reduce the disparities in the levels of development between regions (European-Commission (2021)). The CF concentrates on the 15 Member States whose per capita Gross National Income is below 90% of the EU average, and focuses on transport networks and projects falling under EU environmental priorities. In this paper, we investigate the macroeconomic effects of the 2014-2020 structural regional investments related to the European cohesion policy. We use a general equilibrium model calibrated on all the NUTS 1 regions of the EU with forward-looking agents in

order to take into account expectations and policy credibility. We show that the almost €260 billion of investments lead the European GDP to be 0.3% higher in 2020 than it would be in the absence of the policy. Interestingly, this effect is lower than what a model with myopic agents would suggest. The regional distribution of the differences in the GDP impacts between the two alternatives settings indicates that the largest deviations are recorded for the net contributor regions, with interesting implications with respect to policy credibility, the nature of the policy interventions and their duration.

Over time, the literature attempting to assess the impact of cohesion policy has been considerably growing, adopting a wide variety of techniques including econometric analysis, partial and general equilibrium modelling, and counterfactual impact evaluations.

The empirical literature has employed a number of econometric tools to estimate the impact of cohesion policy on EU regions and countries, resulting in conflicting evidence depending on the data and methods used. For instance, Cappelen et al. (2003) find a positive impact of regional policy on growth and convergence, while Dall'Erba and Le Gallo (2008) suggest that the policy effects on economic growth may be negative, if existing at all. A further strand of econometric studies finds that the evidence on the effects of cohesion policy depends on the investigation of specific factors which could affect the relationship between the policy and economic growth, such as the quality of institutions, the regional absorptive capacity, and capital endowments. The lack of consensus over the econometric assessment of cohesion policy may be partially due to the approach adopted by most studies on the subject, with Berkowitz et al. (2019) criticising the use of growth regressions which may suffer from potential endogeneity issues. This would be due to the cohesion investments mostly targeting the least developed regions of the EU, and therefore possibly being inversely related to economic growth by policy design. However, regression discontinuity analyses lack the amount of granularity needed in order to account for the nature of the policy interventions and the economic mechanisms they are likely to trigger. Over all, the existing empirical evidence at the time had provided mixed, if not contradictory, results.

The literature based on macroeconomic models offers more consistent results on the impact of the European regional policy.

However, despite the appeal of modelling-based policy impact assessments, the existing contributions are not numerous. Moreover, macroeconomic models integrating geography elements could be a suitable tool to produce credible estimates of the impact

of cohesion policy, but building up a regional general equilibrium model is challenging, mainly due to data availability and computational complexity. That is why most of the existing contributions are based on models which are defined at best at the national level such QUEST (Varga and in't Veld (2011)). This limits the possibilities to fully understand the impact of a regional policy such as cohesion policy.

Varga and in't Veld (2011) use the New-Keynesian micro-founded Dynamic Stochastic General Equilibrium (DSGE) model called QUEST, to simulate cohesion investments for the programming period 2000–06. The main shortcoming of this analysis lies in the territorial aggregation of the model, as it is defined and calibrated at the level of EU member states (or groups of member states), making it a less than ideal tool for a regional investigation.

The regional dimension of any analysis on cohesion policy is of paramount importance. Even within the same country, EU regions are characterized by high degree of heterogeneity in terms of economic conditions, institutions, and geographical characteristics. Furthermore, there is significant within-country heterogeneity in the distribution of cohesion investments, especially in countries like Italy, Spain or France, which are characterised by varying levels of economic development. Obviously, this is reflected in the actual distribution of the cohesion investments: most of the projects financed by the ERDF and CF take place in the less developed regions of the EU, irrespective of the countries they are in. For these reasons, assessing the impact of cohesion policy by assuming homogeneity at the country level may lead to misleading results. Only a regional model calibrated with adequately disaggregated data would be able to take into account both the existing regional heterogeneity, and all the economic mechanisms that are likely to be triggered by place-based interventions such as those of cohesion policy.

As for the existing evidence based on models defined at the regional level, the literature mostly offers case studies and single region analyses.

An exception is constituted by Crucitti et al. (2022), who use the RHOMOLO model to assess the impact of the 2014-2020 cohesion policy programmes on all the EU NUTS 2 regions. Their findings suggest a positive impact on the aggregate EU GDP for the entire programming period and beyond, with evidence of long-lasting effects.

One important limitation of that model lies in its assumption of myopic agents, in contrast with the forward-looking behaviour of DSGE models such as the aforementioned QUEST. The models is dynamic, as the simulation periods are linked via capital accumulation through investments, but a myopic behaviour of both firms and

households is assumed so that the models are solved recursively, mainly due to the computational complexity which would be implied by employing forward-looking agents capable of forming expectations on the future states of the economy. According to Partridge and Rickman (2010), assuming myopic agents could be considered as a serious shortcoming when analysing the potential impact of a multi-annual development policy due to the fact that that key assumptions significantly affects the agents' expectations with consequences in terms of consumption smoothing and investments decisions in reaction to the policy implementation.

There are reasons to expect the results obtained with a regional model with forward-looking agents to differ substantially from those obtained with a model featuring myopic agents. For example, Lecca et al. (2013) used a stylized computational macroeconomic model applicable to a regional context to demonstrate that the assumption of myopic vs forward-looking agents yields differences in the dynamics generated by a shock perturbing the initial steady state, even though the alternative paths lead to the same long-run equilibrium.[1]

In this paper, we show the importance of accounting for alternative types of agents' expectations when evaluating the impact of regional policies. We use a spatial dynamic computable general equilibrium model (defined over more than 80 NUTS 1 regions of the EU) to analyse the macroeconomic impact of the regional investments, deployed over the 2014-2020 period through the ERDF and the CF. We present results obtained with the model with forward-looking agents, who are capable of forming expectations over the future realisations of the economy, as well as with an alternative model version, in which agents are myopic and form expectations solely based on current and past states of the economy. The model also features endogenous total factor productivity that changes in relations to the capital stock, depending on the regional research and development intensity of the various regions, thus increasing the role of factor endowments in explaining regional income dispersion.

To the best of our knowledge, this analysis constitutes the first attempt at evaluating cohesion policy in an intertemporal spatial general equilibrium-modelling framework of this type. The features of the multi-annual cohesion policy are such that the economic agents can credibly anticipate the interventions, and hence using a model with rational expectations is better suited to analyse the macroeconomic impact of the policy than

[1] These results might be driven by the assumption about the households saving decisions of the model. Though agents are fully forward-looking expectation and total saving is endogenous, the households saving rate is exogenous in both specifications of the model

models with myopic agents. Nevertheless, constructing a regional model with forward-looking agents is computationally intensive, and this paper is an attempt to verify whether investing in such development is worthwhile in terms of quality of the results.

The results of the modelling simulations suggest that, given a monetary injection of €260 billion of investments spread across EU regions, the European GDP would be about 0.3% higher in 2022 than it would be in the absence of the policy. Interestingly, this effect is lower than what a model with myopic agents would suggest, unless the intertemporal elasticity of substitution assumes unrealistically high values. The regional distribution of the differences in the results between the two versions of the model suggests that assuming myopic agents lead to higher impacts of the policy in the territories, which are net contributors to the policy, while differences are smaller in the main beneficiary regions.

The main reason for this finding seems to be related to the different perception of the time persistency of the shock. Myopic agents would expect the policy to be permanent, rather than temporary, therefore their responses are larger than those of the forward-looking agents that start disinvesting, or invest less, especially in the regions, which carry the burden of the policy financing. This suggests interesting implications in terms of policy credibility and on the effects of announcements about the nature of the policy interventions and their duration. Investigating the various types of shocks used to simulate the full policy package yields additional insights on the reaction of the forward-looking agents to demand-side versus supply-side interventions.

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Keywords: general equilibrium modelling, forward-looking behaviour, regional economics, cohesion policy.

JEL codes: C68, D58, R13