

## Rhomolo and other methodologies to assess The European Cohesion Policy

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**ABSTRACT:** The funds committed to cohesion policy are the second highest category of expenditure in the European Union budget and this policy is among the most evaluated. There are different tools and methodologies to carry out the evaluation each of them with their own merits and also their flaws and biases. This special issue explores the three main types of approaches, theory-based evaluation, counterfactual (econometrics) and macroeconomic models, to assess cohesion policy by presenting a set of contributions within these methodologies. The first set of contributions focus on the assessment of cohesion policy by means of macro models putting a special emphasis on the European Commission newly developed model RHOMOLO. The second set of contributions is linked to the econometric evaluations of different aspects of cohesion policy and finally a theory-based evaluation exercise closes this special issue.

**JEL Classification:** R11; R13; C54; C68.

**Keywords:** European Union; Cohesion Policy; regional development; macroeconomic models.

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## Rhomolo y otras metodologías para evaluar la Política de Cohesión Europea

**RESUMEN:** La política de cohesión es la segunda más importante en el presupuesto de la Unión Europea y es una de las políticas más evaluadas. Existen diferentes herramientas y metodologías para realizar esta evaluación, cada una de ellas con sus propios méritos pero también con sus sesgos y fallos. Este número especial explora las tres aproximaciones más importantes para evaluar la política de cohesión, evaluación fundamentada en la teoría, análisis *counterfactual* (econometría) y modelos macroeconómicos, presentando un conjunto de contribuciones dentro de cada una de estas metodologías. El primer conjunto de contribuciones se centra en la evaluación de la política de cohesión a través de modelos macroeconómicos con una dedicación especial al nuevo modelo desarrollado por la Comisión Europea llamado RHOMOLO. El segundo conjunto de contribuciones se basa en evaluaciones econométricas de diferentes aspectos de la política de cohesión, y finalmente el monográfico se cierra con un ejercicio de evaluación fundamentada en la teoría.

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**Palabras clave:** Unión Europea; política de cohesión; desarrollo regional; modelos macroeconómicos.

### 1. Introduction

The European Cohesion Policy (ECP) is one of the major investment tools in the European Union (EU). Roughly a third of the EU budget is assigned to this policy domain with the objective of supporting job creation, enhancing competitiveness and economic growth and improving quality of life and sustainable development (EU Commission, 2010). The cohesion policy is one of the most evaluated policies, however capturing both ex-ante and ex-post macroeconomic impacts of ECP is intrinsically a very complex exercise.

A variety of different tools and methodologies have been developed and used by scholars and institutions to carry out such evaluations, each of them with their own merits but also with their flaws and biases. The three main approaches to assess the effect of EU financial transfers on the key magnitudes of growth, investment and employment are the theory-based evaluation (see for recent contributions Bachtler *et al.*, 2013; Faña *et al.*, 2013a, 2013b), the counterfactual analysis including the econometric exercises (Cancelo *et al.*, 2009; Dall’erba *et al.*, 2009, Rodríguez-Pose and Fratesi, 2004 and Villaverde and Maza, 2010) and the use of macroeconomic models (Bradley *et al.*, 1995; Cardenete *et al.*, 2013, Márquez *et al.*, 2010; Sosvilla, 2009, Varga and in ‘t Veld, 2011).

This special issue brings together the three main approaches to the analysis of the impact assessment of European cohesion policy by presenting some of the most recent contributions within these methodologies. The first set of contributions focus

on the assessment of cohesion policy by means of macro models putting a special emphasis on the European Commission newly developed model RHOMOLO. The second set of contributions is linked to the econometric evaluations of different aspects of cohesion policy and finally a theory-based evaluation exercise closes this special issue. The interest of this issue is to prompt new reflections and debate among the academic community and public policy makers on the techniques used for measuring the economic impact of EU funds. Taking into account that this evaluation is a complex process a particular attention to the techniques used to carry out the evaluation should be taken. The need to ensure the existence of enough available data to carry out the exercises and prompting the collaboration with research institutes and universities should also be considered among the top priorities for achieving the success in this important task.

The rest of the paper is structured as follows: section 2 briefly summarizes the main contributions to the monograph which are based on the use of the RHOMOLO model, section 3 does the same for the contributions based on other macro models, and econometric exercises and finally section 4 comments on the theory-based evaluation exercise.

## **2. The Rhomolo model as a tool to assess the impact of the European Cohesion Policy**

The evaluation of the Cohesion Policy by the European Commission (DG Regio) has been largely based on two macroeconomic models: HERMIN (Bradley *et al.*, 1995) and QUEST (Varga *et al.*, 2011, Varga and in 't Veld, 2011 ). These models have different theoretical underpinnings and sector coverage. QUEST belongs to the class of Dynamic Stochastic General Equilibrium (DSGE) models and has only one sector producing intermediate inputs, whereas HERMIN is a system of macroeconomic models which offer much higher level of disaggregation. However, these models are applied at the level of EU Member States (MS) and cannot be employed to analyse economic developments at regional level, according to the European Nomenclature of Territorial Units for Statistics (Eurostat, 2006). One important shortcoming when using these macroeconomic models for the evaluation of cohesion policy is that they lack the ability to produce results at regional level. This shortcoming was pointed out in a special report made by the European Commission Court of Auditors in 2006 (Special Report No 10/2006) on the ex post evaluations of the former objectives 1 and 3 programmes 1994 to 1999. It became even more pressing with the Barca 2009 report emphasizing the place-based nature of European cohesion policy. The RHOMOLO model developed by the DG REGIO with the collaboration of JRC-IPTS fulfils the shortcoming previously mentioned since it is a general equilibrium model which produces results at the level of EU NUTS2 regions.

The lead article of this special issue by Brandsma *et al.* uses the RHOMOLO model to estimate the ex-ante impact of the cohesion policy over the period 2014-2020 on GDP in the 267 NUTS 2 regions of EU27. After a brief overview of the

2014-2020 ECP financial envelope, the paper outlines the main building blocks of the RHOMOLO model. Then it describes the four scenarios which represent the main channels over which the structural funds flow: increase human capital through investment in training and other related policies, provide public funding assistance to the private and public sectors via R&D and Non-R&D subsidies thus increasing factor productivity and increase investment in order to improve the physical infrastructure as a basis for stimulating private sector productive activity. These financial expenditures are assumed to affect a set of parameters including factor productivity and transport costs that determine the model outcomes. The results of the simulations show that the overall effect of the four set of investments can clearly be expected to be positive, especially for most of the regions in the Member States which joined in the past decade. This fact is correlated with the distribution of Cohesion Policy support which is much higher for less developed regions.

Di Comite and Potter's investigation proposes one extension of the RHOMOLO model devoted to the study of knowledge creation, investment decisions and economic growth by capturing the interactions between researchers, investors and final good producers. The starting point for the design of their knowledge production block and its integration with the rest of the economy comes from the formulation in Romer (1990). This formulation was later implemented in QUEST III a macroeconomic DSGE model for the Eurozone (Varga and in 't Veld 2010). The future updates of RHOMOLO and its simulation results will greatly benefit from this theoretical piece of research since full endogenous knowledge production and investment decisions at the regional level could be incorporated to the current model's structure. However as the authors clearly point out, some challenges could arise at the implementation phases due to data constraints and the model's large dimensions (267 EU regions and 6 sectors).

RHOMOLO would fall short of a full-fledged equilibrium model without a well-modelled labour market. Regional labour markets serve as important adjustment channels to macro-economic shocks. In the third contribution of this special issue, Persyn *et al.* address this concern by describing the functioning of RHOMOLO's labour market. In a standard labour market setting, regional demand shocks are translated into changes in local employment. Local employment changes can in turn be decomposed into three components: changes in labour force participation, changes in unemployment and changes in migration. The authors elaborate on how each of these channels are modelled. First, RHOMOLO incorporates the participation decision of workers, both at the extensive and the intensive margin. Second, regional unemployment is pragmatically modelled by means of wage curve, which inversely relates wage to unemployment. Finally, interregional migration decisions are based on a discrete-choice framework, in which the migration elasticities are estimate econometrically. The paper additionally discusses possible paths for future development.

The evaluation of the macro-economic impacts of innovation activities induced by R&D is by now well established in the CGE and DSGE frameworks (Bye *et*

*al.*, 2006, Křístková, 2013, Varga *et al.*, 2011). However innovation can take place through activities which do not require R&D *senso stricto* such as the purchase of licenses, patents and software. Diukanova and López-Rodríguez's investigation deals with the analysis of the impact of the ECP 2014-2020 financial investments allotted to innovation activities other than R&D (non-R&D) in the EU regions using the RHOMOLO model. Assuming that these innovation activities increase total factor productivity and that the RHOMOLO model requires externally elasticities to be supplied from other specific studies, they use López-Rodríguez and Martínez (2014) elasticity estimations to perform their simulations. The main results show that the biggest impact of the funds is reached in the regions belonging to the Central and Eastern European countries.

### 3. Other macro models and econometric studies to assess the European Cohesion Policy

De Miguel *et al.*'s paper focus their analysis of the impact of the European cohesion policy on the specific case of the Extremadura region. Specifically the paper aims to evaluate the effects that an increase of public final demand financed with the European funds may have in the economy of Extremadura. These effects are measured using a SAM (Social Accounting Matrix) model, which is an extension of Input-Output models and uses a SAM as database. The database is the SAM for Extremadura in 2000 (SAMEXT2000) elaborated by de Ramajo *et al.* (2009). After presenting an overview of two macro variables, GDP (Gross Domestic Product) and employment, and the evolution of population in the region in 2000-13, they evaluate the effects of raising investment demand. The main conclusions are that agriculture and market services are the most affected sectors, especially the former, in line with the main source of European funding. Regarding employment, Market services capture the biggest effects. According to their results, every million euros invested in Extremadura with European funds in the period 2007-13 generated around 67 new jobs in the region.

Álvarez-Martínez manuscript reviews a rather small set of literature that has examined the response of Spanish regions to European Structural Funds. It does so by first laying out the priority objectives of the funds and then pointing to regions in Spain that have received them (and how much). In doing the latter, it discusses why some regions have phased into and out of receiving the funds over time.

From this base, the paper moves to a discussion of the general equilibrium effects of the Structural Funds and immediately identifies the four papers that have used regional CGE models. The analyses are all recent and are limited to Madrid and Andalusia. Interestingly the author finds that the existing studies strictly examine the short-run effects of the investment spending of the Structural Funds. That is, all four papers fail to examine the true purpose of the structural funds, which is to improve long-run productivity by investing in human capital and key elements of public infrastructure. As the present author notes «we do not build roads... for their impacts

on construction jobs but rather because they enable the delivery of products and people at lower cost... we do not fund [education and training] programs to enhance universities and schools, but rather to improve the capabilities... of workers».

Subsequently, the author cleverly uses the misguided analysis of the reviewed studies as a springboard to discuss new official Spanish databases on gross fixed capital formation.

The Maza *et al.*'s paper studies the impact of R&D investment, measured by the number of patents per million inhabitants, in Spanish growth and convergence at the level of NUTS3 regions (Spanish provinces). After a review of the theoretical and empirical literature on the topic, the authors started their econometric exercise by estimating an absolute beta-convergence equation for the Spanish provinces over the period 1996-2009 which was used as a benchmark for the subsequent estimations. Then, this equation is modified in subsequent stages to incorporate the effect of patents on the income growth in the Spanish provinces and also several control variables in order to test for the robustness of the results. The authors also report results using spatial econometric techniques to control for the existence of spatial dependence in their beta-convergence estimations. The results of this investigation show that first, patents have acted as a growth driver in the Spanish economy over the period 1996-2009. Second, no presence of spatial spillovers for the period under analysis is found. And, third, the effect of patents on growth seems to be higher for developed than for less developed provinces. These results can be used as a lesson for the design of future cohesion policy programmes since a big share of the ECP financial investments go to finance innovation related activities in the European regions. In view of the authors' findings, major efforts should be devoted to promote a cohesion policy focused on R&D investment in the less developed territories.

It is well known that a great heterogeneity exists regarding the endowment of public and private, material and immaterial assets across EU regions. Within this context, Fratessi and Perucca's paper assesses the role of these specific territorial endowments labelled as «territorial capital»<sup>1</sup> on the efficient implementation of Cohesion policies in Central and Eastern European NUTS3 regions. The authors overall results postulate that regions more endowed with territorial capital are more able to benefit from the policy support of structural funds investment and that for a substantial number of territorial capital assets, increasing returns are present and therefore regions more endowed with specific types of territorial capital are more able to gain from policy investment in related fields. These results, as the authors state, pose a trade-off between the effectiveness of the European cohesion policy and the convergence and catching up stimulus they can achieve, i.e., investing cohesion funds in regions with more «territorial capital» leads to greater returns than investing them in poorer regions. The authors' suggested way out of this dilemma is to use the structural funds to build this type of capital which eventually will end up in enhancing the long run growth of the poorest regions.

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<sup>1</sup> See Camagni (2008) for a taxonomy on the types of territorial capital.

Disparities in the levels of regional development are a well-established feature of the European economies. These disparities are largest within Central and Eastern European countries when comparing capital and non-capital city regions. Foreign direct investment could be an off-setting factor for regional disparities if it is channelled towards second tier city regions. The Dogaru *et al.*'s paper analyses the locational choices of multinational corporations (MNCs) in Central and Eastern Europe (CEE) between 2003 and 2010 focusing particularly on the location choices of capital city regions versus second tier city regions in the networks of foreign direct investments. The econometric exercise carried out by the authors (conditional logit regression) found that the most important location factors for FDI are market accessibility, strategic assets, institutional quality and agglomeration. These factors, at the present stage, cannot be offered simultaneously in CEE second-tier city regions and consequently competitiveness opportunities are difficult to obtain. The paper emphasizes the need for more European involvement in redirecting financing towards secondary city regions. According to the authors' view cohesion policy should partly shift its support from offsetting deficient regional growth to encouraging secondary growth centres. EU guidelines should recognize the importance of more decentralized regional development.

#### **4. Theory-based evaluations on the European Cohesion Policy: The case of Andalucía**

Romero and Fernández-Serrano's investigation closes this special issue by discussing the significance, trends and achievements of entrepreneurship promotion in Andalusia within the framework of the European cohesion policy financial investments carried out in the regions since the launching of the first programming period, the Delors I package (1989-1993) until the recently finished one (2007-2013). After a thorough discussion of the European Union cohesion policy and ERDF initiatives regarding to entrepreneurship in Andalucía in sections two and three, the authors move on to present an evaluation of the impact of these initiatives. This evaluation is made using several regional indicators such as business density, demography and total entrepreneurship activity, among others. The analysis of the experience of Andalusia allows the authors to draw some lessons and make recommendations for a more effective and efficient design of cohesion policy in support of entrepreneurship, which go beyond the particular case under study. Some of these recommendations are already incorporated in the current design of the ECP programmes. Among them it is important to underline *a)* the need of having a productive system with enough absorption capacity for an efficient use of the European Structural and Cohesion instruments, *b)* the need of a long run view for this type of policy actions since it is not possible to substantially change the entrepreneurial culture in a region with structural deficiencies in the short or medium run, *c)* the need of taking demand considerations into account and to apply a bottom-up approach granting an important role to private and intermediate agents, *a)* the need of moving away from a «subsidy» culture and potential rent-seeking behaviour by using other type of instruments such as reimbursable funds, credit guaranties or loans.

## 5. Conclusions

The interest of this issue was to prompt new reflections and debate among the academic community and public policy makers on the techniques used for measuring the economic impact of EU funds. The evaluation of the European Cohesion policy is a complex process and we believe that this special issue of *Investigaciones Regionales* contributes to its general understanding. It provides an overview of the progress that has been accomplished over the past decades, and highlights present day state-of-the-art techniques that are currently used in the evaluation process. The different contributions stress the need to keep the academic debate alive, since many hurdles are still to be overcome. It is our hope that this special issue paves the way for new collaborations between research institutes and universities, which should be considered to be a top priority for future progress on the subject.

## 6. References

- Bachtler, J.; Begg, I.; Polverari, L., and Charles, D. (2013): «Evaluation of the Main Achievements of Cohesion Policy Programmes and Projects over the Longer Term in 15 Selected Regions (from 1989-1993 Programme Period to the Present (2011.CE.16.B.AT.015), Final Report to the European Commission (DG Regio)», *European Policies Research Centre*, University of Strathclyde (Glasgow) and London School of Economics.
- Barca, F. (2009): *An Agenda for A Reformed Cohesion Policy: A Place-Based Approach to Meeting European Union Challenges and Expectations*, Independent Report, Prepared at the Request of the European Commissioner for Regional Policy, Danuta Hübner, European Commission, Brussels.
- Bradley, J.; Hecce, J. A., and Modesto, L. (1995): «The macroeconomic effects of the CSF 1994-99 in the EU periphery: An analysis based on the HERMIN Model», *Economic Modelling*, 12(3), 323-333.
- Brandsma, A.; Kancs, D.; Monfort, P., and Rillaers, A. (2013): RHOMOLO: «A Regional-based Spatial General Equilibrium Model for Assessing the Impact of Cohesion Policy», *JRC-IPTS Working Paper Series JRC81133*, European Commission, DG Joint Research Centre.
- Bye, B.; Heggedal, T.-R.; Fæhn, T., and Strøm, B. (2006): A CGE model of induced technological change: A detailed model description, Statistics Norway, [http://www.ssb.no/a/english/publikasjoner/pdf/doc\\_200611\\_en/doc\\_200611\\_en.pdf](http://www.ssb.no/a/english/publikasjoner/pdf/doc_200611_en/doc_200611_en.pdf).
- Cancelo, J. R.; Faiña, A., and López-Rodríguez, J. (2009): «Measuring the permanent impact of European structural funds on peripheral objective 1 regions: The case of Galicia», *European Planning Studies*, 17, pp. 1535-1558.
- Camagni, R. (2008): «Regional Competitiveness: Towards a Concept of territorial capital», in Capello, R.; Camagni, R.; Chizzolini, B., and Fratesi, U. (eds.), *Modelling Regional Scenarios for the Enlarged Europe: European Competitiveness and Global Strategies*, 33-48, Springer Verlag, Berlin.
- Cardenete, M. A.; Delgado, M. C., and Lima, C. (2013): «The Structural Funds in Andalusia for the Programming Period 2014-2020: Time for Tightening belts», *European Planning Studies*, DOI:10.1080/09654313.2013.771622.
- Dall'Erba, S.; Guillain, R., and Le Gallo, J. (2009): «Impact Of Structural Funds On Regional Growth: How To Reconsider A 9 Year-Old Black Box», *Region et Développement*, Region et Développement, LEAD, Université du Sud - Toulon Var, vol. 30, pages 77-100.

- De Miguel, F. J.; Cardenete, M. A., and Pérez, J. (2009): «Effects of the tax on retail sales of some fuels on a regional economy: a computable general equilibrium approach», *Annals of Regional Science*, 43 (3), 781-806.
- European Commission (2010): *Europea 2020 Strategy*, <http://ec.europa.eu/europe2020/indexen.htm>.
- (2014): *Investment for jobs and growth. Promoting development and good governance in EU regions and cities. Sixth report on economic, social and territorial cohesion*, Publication Office of the European Union.
- Faiña, A.; López-Rodríguez, J.; Romero, I.; Fernández-Serrano, J., and Montes-Solla, P. (2013a): *Evaluation of the main achievements of cohesion policy programmes and projects over the longer term in 15 selected regions (from 1989-1993 programming period to the present). Case Study Galicia*, University of A Coruña, University of Seville, London School of Economics and European Policies Research Centre of the University of Strathclyde.
- (2013b): *Evaluation of the main achievements of cohesion policy programmes and projects over the longer term in 15 selected regions (from 1989-1993 programming period to the present). Case Study Andalucía*, University of A Coruña, University of Seville, London School of Economics and European Policies Research Centre of the University of Strathclyde.
- Křístková, Z. (2013): «Analysis of private R&D effects in a CGE model with capital varieties: the case of the Czech republic», the *Czech journal of economics and finance*, vol. 63, issue 3, pp: 262-287.
- Márquez, M. A.; Ramajo, J., and De Miguel, F. J. (2010): «Evaluación de los efectos económicos de los fondos estructurales del periodo 2000-2006 sobre Extremadura», *Papeles de Economía Española*, 123, pp. 191-205.
- Rodríguez-Pose, A., and Fratesi, U. (2004): «Between Development and Social Policies: The Impact of European Structural Funds in Objective 1 Regions», *Regional Studies*, 38.1, pp. 97-113.
- Romer, P. (1990): *Endogenous technological change. Journal of political Economy*, S71-S102.
- Romero, I., and Fernández-Serrano, J. (2007): «Un Análisis de la Heterogeneidad Empresarial en la Unión Europea: Implicaciones para la Política Europea de Fomento Empresarial», *Ekonomiaz*, 66, 350-371.
- Solow, R. M. (1956): «A contribution to the theory of economic growth», *The quarterly journal of economics*, 70(1): 65-94.
- Sosvilla, S. (2009): «El impacto de los Fondos Europeos en la economía andaluza: 1989-2013», *Revista de Estudios Regionales*, 85, 97-118.
- Varga, J., and in 't Veld, J. (2011): «A model-based analysis of the impact of Cohesion Policy expenditure 2000-06: Simulations with the QUEST III endogenous R&D model», *Economic Modelling*, Elsevier, vol. 28(1-2), pp. 647-663, January.
- Varga A.; Járosi P., and Sebestyén, T. (2011): *Modeling the economic impacts of regional R&D subsidies: The GMR-Europe model and its application for EU Framework Program policy impact simulations*, [http://dimetic.dime-eu.org/dimetic\\_files/Vargaetal2011.pdf](http://dimetic.dime-eu.org/dimetic_files/Vargaetal2011.pdf).
- Villaverde, J., and Maza, A. J. (2010): «Los fondos estructurales europeos y la convergencia de las regiones españolas: 2000-2006», *Papeles de Economía Española*, 123, 2-15.